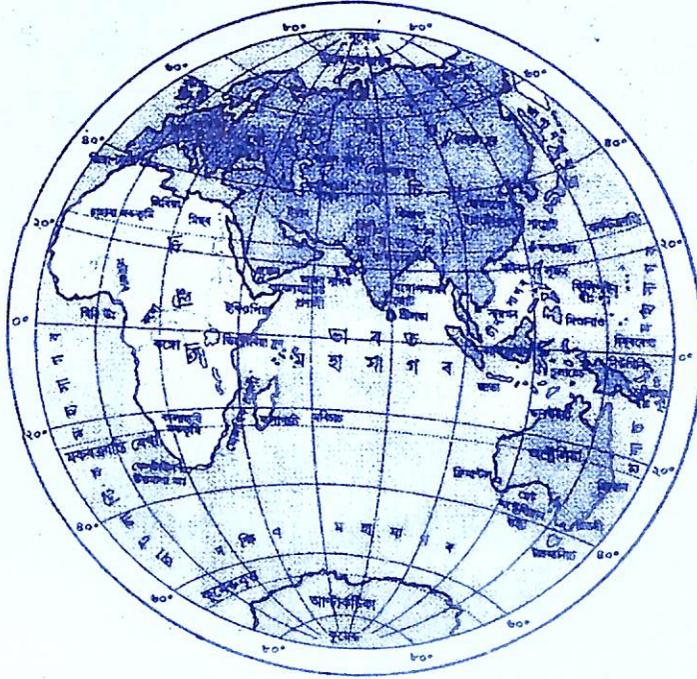




ধৰিত্ৰী [THE EARTH]

বহুৰেকীয়া দ্বি-ভাষিক ভৌগোলিক আলোচনী
Annual Bilingual Geographical Magazine

নৱম সংখ্যা, ২০১৮ :: Volume, 9, 2018



DEPARTMENT OF GEOGRAPHY
D.H.S.K. COLLEGE
DIBRUGARH

ধৰিত্ৰী

[THE EARTH]

বহুৰেৰেকীয়া দ্বি-ভাষিক ভৌগোলিক আলোচনী
Annual Bilingual Geographical Magazine

নৱম সংখ্যা, ২০১৮ :: Volume, 9, 2018



DEPARTMENT OF GEOGRAPHY
D.H.S.K. COLLEGE
DIBRUGARH

Editor
Dr. Meetal Chaliha



DHARITRI [The Earth] Annual Bilingual
Geographical Magazine published by Dr. Meetali Chaliha,
on behalf of the Dept. of Geography, D.H.S.K. College,
Dibrugarh-786001, Assam, India

© all rights reserved by the Editorial Board

Editorial Board :

Advisor : Dr. Sashi Kanta Saikia
Principal, DHSK College

Editor : Dr. Meetali Chaliha
Dept. of Geography

Members : Mr. Narendra Mahela
Mr. Hemanta Timsina, HoD.
Mrs. Krishnakhi Saikia

Price : ₹ 50.00/- (Fifty Rupees only)

Printed at Kaustubh Printers, Dibrugarh

NB. : The views expressed in the articles are the author's own and the editor is
in no way responsible for the same.



Editorial Board

Left to right : **K. Saikia**(Member), **H. Timsina**(HOD), **Dr. S.K. Saikia**(Principal),
N. Mahela(Vice-Principal), **Dr. M. Chaliha**(Editor).

Editorial



It is a matter of immense pleasure to present before you the 9th volume of the annual bilingual Magazine of the Department of Geography, D.H.S.K College. In our changing earth nothing changes more than Geography. Through this publication we are intending to present before the readers the issues being faced by the present day world from a geographical perspective.

'The study of Geography is more than just memorizing places on a map. It's about understanding the complexity of our world, appreciating the diversity of cultures that exists across continents. And in the end it's about using all that knowledge to help bridge divides and bring people together'—Barack Obama

This noble venture aims to encompass all sectors of the discipline. The topics range from the basics in Geography to the use of high level techniques in the study of the subject. The importance of the subject and its scientific study have also been emphasized in the writings. Articles in this issue have also highlighted the career options after a geography degree. Some basic physical geographical aspects have also been focused. Major current environmental issues plaguing our planet and the importance of sustainability have been stressed in the articles. A research paper on the world's most productive environment i.e. wetlands has also been incorporated. Besides some articles have also drawn attention on current political geographical issues. Furthermore an attempt is made to present an up to date

information of the Department in a nutshell.

I would now like to take the opportunity to express my thankfulness and gratitude to each one of the authors who have contributed their time and expertise to this magazine. I also wish to acknowledge the constant support and guidance of the Head of the Department, Mr. H. Timsina and other members of the Editorial Board without whose persistent help this work would not have been possible. I am indebted to Dr. S.K. Saikia, Principal, D.H.S.K College who has always been encouraging and supportive in such academic pursuits. I would like to include a special note of thanks to Dr B. Dutta and Mrs. S. Bhattacharjee (Fomer editors of this magazine) for their encouragement and inspiration to start the work. And last but not the least I express my thanks to Kaustubh Prakashan & Printers for their commitment and painstaking effort in publishing this magazine within a very short period.

Dibrugarh
5 September, 2018

Dr. Meetali Chaliha
Editor, Dharitri(The Earth)

Contents

- ভূগোল অধ্যয়ন কিয় আৰু কাৰ বাবে? ৯
 ✍ ড° শশীকান্ত শইকীয়া
- শৈক্ষিক বিষয় হিচাপে ভূগোলৰ গুৰুত্ব ১২
 ✍ ড° ভাৰতী দত্ত
- Morphometric analysis of Drainage Basin ১৫
 ✍ **Smriti Bhattacharjee**
- Geography and Statistical Methods ২১
 ✍ **S. K. Kar**
- The Study of the Status of the Wetlands and Low Lying Areas of Dibrugarh District ২৪
 ✍ **Ms. Sultana Hazarika**
- The Science of Geography ৩৫
 ✍ **Hemanta Timsina**
- ভূ-মণ্ডলীয় প্ৰতিৰক্ষাজনিত আৰ্হি (Global Strategic Models) ৪২
 ✍ ড° বাজীৰ হাজৰিকা
- El Nino and its Affect on Indian Monsoons ৫০
 ✍ **Dr. Meetali Chaliha**
- Basics of Geography ৫৩
 ✍ **Dr. K. Kalita & Dr. (Mrs) M. Gogoi**
- Jatropha Biodiesel as a Future Sustainable Fuel ৬২
 ✍ **Krishnakhi Saikia**

○ India's Geo-economic Position in Asia and the World	৬৮
✍ Lonkham Boruah	
○ Remote Sensing Sensors	৭৬
✍ Mouchumi Saikia	
○ Petroleum Industries and Ocean Water Pollution	৭৮
✍ Debanjan Timsina	
○ Ozone Depletion	৮০
✍ Gurpreet Kaur Virdhi	
○ Sustainability : Living with reduced human footprints	৮৫
✍ Sainon Jenny Wangsa	
○ Solstices and Equinoxes	৮৭
✍ Arpita Chakraborty	
○ Global Wildlife Population	৮৮
✍ Parishmita Gogoi	
○ Eclipses	৯০
✍ Rosme Sonowal	
○ Maguri Beel : The hidden treasure of Dibru Saikhowa	৯১
✍ Protyush Protim Gogoi	
○ Influence of Geography on Indian History	৯৩
✍ Achinta Mugdha Bokal	
○ Quotes on Geography– Collected by Gurpreet Kaur Virdhi	৯১
○ Geographic Facts– Compiled by Dhan Rai	৮৬
○ Geographic Facts– Compiled by Tulika Baruah	৯২
○ Departmental Profile	৯৫

ভূগোল অধ্যয়ন কিয় আৰু কাৰ বাবে ?

ড° শশীকান্ত শইকীয়া

অধ্যক্ষ,

ডিব্ৰুগড় হনুমানবল্ল সুৰজমল কানৈ মহাবিদ্যালয়

“Without geography you are nowhere” —সঁচাকৈ ভূগোল অবিহনে মানুহৰ কোনো অস্তিত্বই নাই। ভূগোলৰ প্ৰয়োজনীয়তা কি, কিয় সেই বিষয়ে অনুভৱ কৰিবলৈ হ'লে মানৱ সমাজৰ অস্তিত্ব সম্পৰ্কেও গভীৰভাৱে অনুধাৱন কৰিব লাগিব। পৃথিৱীৰ ভূ-পৃষ্ঠৰ পৰিৱৰ্তনৰ লগে লগে ভূগোল অধ্যয়নৰ গুৰুত্বও দিনক দিনে বৃদ্ধি পাইছে। ভূগোল হ'ল এনে এটা বিষয় য'ত পৃথিৱীৰ উপৰি ভাগৰ লগতে প্ৰাকৃতিক সম্পদ আৰু মানুহৰ জীৱন ধাৰণ পদ্ধতি আৰু অৱস্থিতি সম্পৰ্কে অধ্যয়ন কৰা হয়। ভূগোল অধ্যয়নে ভৱিষ্যত মানৱ সমাজৰ জীৱন ধাৰণ পদ্ধতি আৰু মানুহৰ চিন্তন প্ৰক্ৰিয়া জাগ্ৰতিক ৰূপত সহায় কৰে। অতীজৰ পৰা ভূগোল শিক্ষাৰ ওপৰত গুৰুত্ব দি অহা হৈছে। ভূগোল অধ্যয়নে পৃথিৱীৰ ওপৰিও বিশ্বব্ৰহ্মাণ্ডৰ সৃষ্টি ৰহস্য সম্পৰ্কে জনা আৰু বুজাত সহায় কৰে। প্ৰাচীন কালত পৃথিৱী সম্পৰ্কে অধিক ৰহস্য সৃষ্টি হৈছিল। চন্দ্ৰ, সূৰ্যৰ লগতে অন্যান্য গ্ৰহ, নক্ষত্ৰসমূহে কেনেদৰে বিশ্বব্ৰহ্মাণ্ডত বিচৰণ কৰি আছে সেয়া অলৌকিক বুলি ধাৰণা কৰা হৈছিল। মানুহৰ চিন্তাবোধ ক্ৰমে পৰিৱৰ্তীত হৈ যেতিয়া জ্ঞান-বিজ্ঞানৰ দিশে ধাবিত হ'ব ধৰিলে তেতিয়াই ভূগোলৰ প্ৰয়োজনীয়তা জনাত মানৱ সমাজ আগ্ৰহী হ'ল। খ্ৰীঃ পূঃ ২৭৬-১৯৪ সময়ছোৱাত ভূগোলৰ ওপৰত মানুহৰ আগ্ৰহ বৃদ্ধি পাবলৈ ধৰিলে। প্ৰাচীন গ্ৰীচত ভূগোলক বিজ্ঞানৰ শাৰীলৈ উত্তৰণ ঘটোৱা হয়। গ্ৰীক ভাষাত ভূগোলক 'জিঅগ্ৰাফীয়া' বুলি কোৱা হৈছিল। ইয়াৰ অৰ্থ আছিল পৃথিৱীৰ সম্পৰ্কে অধ্যয়ন বিশ্লেষণ কৰা। মাটি, পানী আৰু বায়ুৰ পৰিঘটনাসমূহ অধ্যয়ন কৰাৰ প্ৰয়াস কৰা হৈছিল সৌ তেতিয়াই। ভূগোল শব্দটোৰ উদ্ভাৱক আছিল ইৰাটোওচ্থেনচ্। ভূগোলৰ বিৱৰ্তন আৰু পৰিঘটনাই বিভিন্ন খেপ অতিক্ৰম কৰি আজিৰ অৱস্থালৈ আহি উপনীত হৈছেহি। ভূগোলৰ আধুনিক ৰূপ আৰু পৰিৱৰ্তনে মানৱ সমাজক পৃথিৱীৰ সম্পৰ্কে জনা আৰু বুজাত সহায় কৰিছে। কিয় পৰিৱেশৰ পৰিৱৰ্তন হৈছে বা কিয় আৰ্কটিক আৰু এণ্টাৰটিকাত বৰফ গলিবলৈ আৰম্ভ কৰিছে নতুবা কিয় এই সুন্দৰ ধৰণীৰ পৰা জীৱ-জন্তু, কীট-পতংগ বিলুপ্ত হৈছে সেই বিষয়ে জানিবলৈ হ'লে ভূগোল অধ্যয়নৰ বিকল্প নাই। ভূগোল কেৱল বৃত্তি বা মনোৰঞ্জনৰ বাবে অধ্যয়ন কৰিলে নহ'ব। ভূগোল অধ্যয়ন কৰিব লাগিব- পৃথিৱীক জানিবলৈ, মানুহক জানিবলৈ বা ভৱিষ্যতৰ

সমাজ জানিবলৈ। কেৱল পাঠ্যক্রমৰ বিষয় অধ্যয়ন কৰি প্ৰমাণ-পত্ৰ লাভ কৰিলে ভূগোল শিক্ষা গ্ৰহণ কৰাটো নুবুজায়। ভূগোল অধ্যয়ন কৰি মানুহৰ সমাজখন কেনেদৰে যুগজয়ী কৰিব পাৰি সেই চিন্তা মন আৰু মগজুত লৈ ফুৰাটোহে ভূগোল অধ্যয়নৰ মূল উদ্দেশ্য। পৰিৱেশ বিনষ্ট কৰা সকলক কেনেদৰে পৰিৱেশ সুৰক্ষাৰ ওপৰত সজাগ আৰু সচেতন কৰি তুলিব পাৰি সেই সম্পৰ্কে ভূগোল অধ্যয়নকাৰীসকলে চেষ্টা চলোৱা উচিত।

সাধাৰণতে দেখা যায় ভূগোল অধ্যয়ন কৰা গৰিষ্ঠ সংখ্যক ছাত্ৰ-ছাত্ৰীয়ে ভূগোল অধ্যয়নৰ মাদকতা বা ৰস অনুভৱ কৰিব নোৱাৰে। কেৱল শিক্ষা সমাপ্ত কৰি প্ৰমাণ-পত্ৰ লাভ কৰাটোৱে ভূগোল অধ্যয়নৰ মূল ছাবিকাঠি বুলি বিবেচনা কৰা হয়। যেতিয়ালৈকে হৃদয়ত ভূগোলক প্ৰকৃত অৰ্থত স্থান দিব নোৱাৰে তেতিয়ালৈকে সঁচা অৰ্থত ভূগোল অধ্যয়নৰ আচল ৰহস্যও উদ্ধাৰ কৰিব নোৱাৰে। সমগ্ৰ বিশ্বব্ৰহ্মাণ্ডৰ বিষয়ে অধ্যয়ন কৰা কম সহজনে? বিষয়টোৱেই আচলতে আমোদজনক। প্ৰতিটো বিষয়ৰ ওপৰত অধ্যয়ন কৰি তাৰ পৰা লাভ কৰা সোপান সমাজক বিলাই দিব পৰাটো কম কথানে? ভূগোলে কেতিয়াও মানৱ সমাজক প্ৰভাৱিত নকৰে, যদিহে ভূগোলক 'ভূগোল' হিচাপে অধ্যয়ন কৰা হয়। ভূগোল যিমানে জনপ্ৰিয় হ'ব সিমানে মানৱ সমাজৰ উত্তৰণ ঘটিব। ২১ শতিকাত ভূগোলৰ দক্ষতা বৃদ্ধিৰ বাবে গৱেষকসকলে বহু দিশ নিৰ্দেশনা প্ৰস্তুত কৰিছে। গৱেষকসকলে মত প্ৰকাশ কৰিছে যে ২১ শতিকাৰ সময়ছোৱা হ'ব পৰিৱেশ পৰিৱৰ্তনৰ আটাইতকৈ জটিল সময়। এনে সন্ধিক্ষণত ইজনে সিজনৰ ওপৰত নিৰ্ভৰ কৰি আশুৱাই নগাইলে, পৃথিৱীৰ বিভিন্ন প্ৰান্তৰ সাংস্কৃতিক সম্পদ, বিশ্বাস আৰু পৰম্পৰা, জীৱন ধাৰণ পদ্ধতি, জীয়াই ৰখাটো সম্ভৱ নহ'ব। সমগ্ৰ বিশ্ব এতিয়া গোলকীকৰণৰ বিষয়ৰ ওপৰত নিৰ্ভৰ কৰিছে। ভূগোল অধ্যয়নে ছাত্ৰ-ছাত্ৰীৰ লগতে অন্যান্য সাধাৰণ লোকক পৃথিৱীৰ উপৰিভাগৰ পৰিৱৰ্তনৰ ৰূপ জনাত সহায় কৰিব। সৃষ্টিশীল আৰু উদ্ভাৱনী শক্তিৰ দক্ষতা, জটিল সমস্যাৰ সমাধান সূত্ৰ আৱিষ্কাৰৰ দক্ষতা আৰু যোগাযোগ, সহযোগিতাৰ কৌশলৰ দক্ষতা আয়ত্ব কৰিব নোৱাৰিলে পৰিৱেশৰ ওপৰত পৰা প্ৰভাৱ কেতিয়াও লাঘৱ কৰিব নোৱাৰে। বিশেষকৈ সাম্প্ৰতিক সময়ত সমস্যা সমাধানৰ কৌশল আটাইতকৈ গুৰুত্বপূৰ্ণ বুলি বিবেচনা কৰা হয়। পৃথিৱীৰ জন্মকালৰ পৰা কেনেকৈ বহু জীৱ-জন্তু, কীট-পতংগ, প্ৰাণী বিলুপ্ত হ'বলৈ পালে? ডাইনোসৰৰ দৰে প্ৰকাণ্ড প্ৰাণী পৃথিৱীৰ পৰা কেনেকৈ নোহোৱা হৈ গ'ল? এই বিষয়বোৰেই একো একোটা নতুন সমস্যাৰ উদ্ৰেক কৰিছে। পৃথিৱীৰ উষ্ণতা পৰিৱৰ্তনৰ ফলত এনে পৰিৱৰ্তন সম্ভৱ হৈছে। উষ্ণতা বৃদ্ধিৰ কাৰকবোৰনো কি? ইয়াৰ বাবে জগৰীয়া কোন? ভূগোল অধ্যয়নে এই বিষয়ে জনা আৰু বুজাত স্পষ্টভাৱে সহায় কৰে। সেয়ে ভূগোল অধ্যয়নৰ প্ৰয়োজনীয়তা আজিৰ প্ৰেক্ষাপটত কোনেও নুই কৰিব নোৱাৰে। তথ্য প্ৰযুক্তিৰ উত্তৰণে ভূগোল বিষয়ৰ অধ্যয়নৰ ক্ষেত্ৰখন অধিক সহজ কৰি তুলিছে। ভূগোলৰ পৰিসৰ ক্ৰমে বৃদ্ধি পাইছে। উৰাজাহাজৰ গতিপথ, নিৰ্ধাৰিত স্থান বিচাৰি উলিওৱাত ভূগোল অধ্যয়নে অধিক সহজ কৰি তুলিছে।

ভূগোল অধ্যয়নৰ শাখাৰ পৰিসৰ সলনি হৈছে। পূৰ্বতে ভূগোল অধ্যয়ন মানে কেৱল 'ফিজিকেল', 'হিউমেন' আৰু 'কালচাৰেল' ভূগোলক সামৰি লোৱা হৈছিল। বৰ্তমান ভূগোলৰ পৰিসৰ

বৃদ্ধি হোৱা ফলত, ভূগোলৰ কেতবোৰ আধুনিক শাখা সৃষ্টি হৈছে। ভূগোলৰ স'তে বিজ্ঞানৰ নিকট সম্পৰ্ক গঢ় লৈ উঠাত ভূগোলৰ প্ৰযুক্তিও বৃদ্ধি পাইছে। 'বিহেভিয়াৰেল', 'ফেমিনিষ্ট', 'জিওছফি', 'জিওমেট্ৰিক' আদি ভূগোলৰ ন-ন শাখা সৃষ্টি হৈছে। যিমানৈ পৃথিৱীৰ পৰিৱৰ্তন হৈছে সিমানৈ ভূগোল অধ্যয়নৰ পৰিসৰো দৈনিক বৃদ্ধি পাইছে। অতীজৰ বহু শিক্ষণ পদ্ধতি যেনেদৰে অচল হৈ পৰিছে, সেইদৰে বিজ্ঞানৰ প্ৰগতিৰ ফলত ভূগোল অধ্যয়নৰ ক্ষেত্ৰত বহু আধুনিক সামগ্ৰী তৈয়াৰ হৈছে আৰু তাৰ চাহিদাও বৃদ্ধি পাইছে। পেচা হিচাপে ভূগোল সমগ্ৰ বিশ্বতে জনপ্ৰিয় হৈছে। বিশেষকৈ ভূগোল অধ্যয়নৰ ফলত 'কাৰ্টগ্ৰাফাৰ', 'পৰিৱেশ বিশেষজ্ঞ' বা 'পৰামৰ্শদাতা', 'জিওগ্ৰাফিকেল ইনফৰ্মেচন চিষ্টেম অফিচাৰ', 'কনজাৰভেচন অফিচাৰ', 'ৰিচাইক্লিং অফিচাৰ', 'লেণ্ড্‌ কেপ আৰ্কিটেক্ট', 'গ্ৰেচিওলজিষ্ট', 'জিওচফিষ্ট', 'কমাৰ্চিয়েল চাৰ্ভেয়ৰ', 'প্লেনিং এণ্ড দেভলপমেন্ট চাৰ্ভেয়ৰ', 'লজিষ্টিক এণ্ড ডিষ্ট্ৰিবিউচন মেনেজাৰ', 'মাৰ্কেট ৰিচাৰ্চাৰ', 'চাষ্টেনিবিলাটি কম্পালটেণ্ট', 'ট্যুৰিজম অফিচাৰ', 'ট্ৰান্সপোর্ট প্লেইনাৰ', 'টাওন প্লেইনাৰ' 'মেষ্ট্ৰলজিষ্ট', আদিকে ধৰি বহু ন-ন পদত ভূগোল অধ্যয়ন কৰা ছাত্ৰ-ছাত্ৰীয়ে নিযুক্তি লাভৰ সন্ভাৱনা বৃদ্ধি পাইছে। ভূগোল অধ্যয়ন কৰা ছাত্ৰ-ছাত্ৰীসকলৰ বাবে এইটো এটা সৌভাগ্যৰ কথা যে তেওঁলোকৰ বাবে প্ৰতিদিনে নতুন নতুন চিন্তা আৰু গৱেষণাৰ ক্ষেত্ৰ সৃষ্টি হৈছে। উন্নত দেশসমূহত ভূগোল অধ্যয়ন কৰা সকলক সন্মানীয় ব্যক্তিসকলৰ ভিতৰত আগস্থান দিয়া হয়। আমেৰিকাৰ দৰে দেশত একো একোজন ভৌগলিক বিদে বাৰ্ষিক ৭৪২৬০ আমেৰিকান ডলাৰ আয় কৰে। ২০১৬ চনত আমেৰিকাত পৃথকভাৱে ১৫০০ জন লোকক ভূগোল অধ্যয়নৰ বাবে নিযুক্ত কৰা হৈছিল আৰু সকলোৱে জানি সুখী হ'ব যে এই ব্যক্তিসকলৰ বাবে পাৰিশ্ৰমিক হিচাপে বুজন পৰিমাণৰ ধন ব্যয় কৰা হৈছে। ভূগোল অধ্যয়ন কৰা ছাত্ৰ-ছাত্ৰীসকলৰ কোনো দিনে সংস্থাপনৰ সমস্যা সৃষ্টি নহয় কাৰণ পৃথিৱী থকালৈকে ভূগোলৰ অধ্যয়ন চলি থাকিব আৰু নিত্য নতুন সংস্থাপনৰ বাট মুকলি হ'ব। আন নহ'লেও ভূগোল বিষয়ৰ সজাগতা সৃষ্টিৰ বাবে স্বচ্ছসেৱী সংগঠন গঢ়ি তুলি নিজাববীয়াকৈ ধন আয় কৰিব পাৰে। বিদ্যালয়, মহাবিদ্যালয় বা শিক্ষানুষ্ঠানসমূহত শিক্ষকৰ চাকৰি সংস্থাপনৰ প্ৰচুৰ সন্ভাৱনা আছে। ভূগোল অধ্যয়নৰ ফলত যিদৰে মানৱ সমাজক বুজিব পাৰে সেইদৰে আন বিষয়ৰ অধ্যয়নত তেনে মাদকতা পোৱা নাযায়। ভূগোলৰ বিভিন্ন বিষয়সমূহত সদায় নতুন নতুন সোৱাদ পোৱা যায়। ■

শৈক্ষিক বিষয় হিচাপে ভূগোলৰ গুৰুত্ব

ড° ভাৰতী দত্ত

অৱসপ্ৰাপ্ত সহযোগী অধ্যাপিকা

ভূগোল বিভাগ,

ডিব্ৰুগড় হনুমানবল্ল সুৰজমল কানৈ মহাবিদ্যালয়

‘ভূগোল’, ইংৰাজীত কোৱা হয় Geography। এই Geography শব্দটো গ্ৰীক ভাষাৰ ‘geo’ অৰ্থাৎ earth (পৃথিৱী) আৰু graphein অৰ্থাৎ to write (লিখা)ৰ পৰা সৃষ্টি হৈছে আৰু গ্ৰীক পণ্ডিত এৰাটোষ্টেনিছে (Eratosthenes) এই নামটো দিছিল। মানুহৰ বাসভূমি হিচাপে পৃথিৱীৰ অধ্যয়নকেই ভূগোল বুলি তেওঁ কৈছিল। ভূগোল এক শৈক্ষিক বিষয় আৰু এই বিষয়টিৰ উল্লিখিত সংজ্ঞাৰ পাছতো বিভিন্ন সময়ত বিভিন্ন পণ্ডিতে ইয়াৰ নানা সংজ্ঞা আগবঢ়াইছিল। অৱশেষত পূৰ্বে উল্লিখিত সংজ্ঞাটোকেই গ্ৰহণ কৰা হয়। ইংৰাজীত এই সংজ্ঞা হ’ল—Geography is the discipline which studies the earth as the habitation of human being।

বিগত দুই শতিকা জুৰি ভূগোল বিষয়টিৰ যথেষ্ট উন্নতি সাধন হৈছে। ন-ন বিষয় ইয়াৰ স’তে সংযোজিত হৈছে। সময়ৰ পৰিৱৰ্তনৰ স’তে খাপ খুৱাই ইয়াকো নৱ ৰূপ দিয়া হৈছে। নতুন নতুন যিবোৰ পঠনীয় উপভাগ ভূগোল বিষয়ত সংযোজিত কৰা হৈছে তাৰ ফলত বিষয়টিয়ে সমৃদ্ধ হোৱা নাই শৈক্ষিক দিশত ইয়াৰ উপযোগিতাও বৃদ্ধি পাইছে। ভূগোলৰ প্ৰধান দুটা ভাগ বুলি ক’লে—প্ৰাকৃতিক ভূগোল (Physical Geography) আৰু মানৱ ভূগোল (Human Geography)ক বুজোৱা হয়। প্ৰাকৃতিক ভূগোলে ভূভাগৰ বিভিন্ন অৱয়বক সামৰি অধ্যয়ন কৰাৰ বিপৰীতে মানৱ ভূগোলত মানৱ সম্পৰ্কীয় বিভিন্ন দিশ সামৰা হয়; মানৱৰ ক্ৰিয়া-কলাপ অধ্যয়ন কৰা হয়। কৰ্তা আৰু উপভোক্তা হিচাপে যিহেতু মানৱৰ ভূমিকা অধিক সেয়েহে মানৱ অধ্যয়নে বিশেষ গুৰুত্ব পোৱাৰ কথাটো অনুধাৱন কৰিয়েই ‘জনসংখ্যা ভূগোল’ (Population Geography) নামৰ বিষয়ৰ অন্তৰ্ভুক্তি ঘটিল আৰু এইক্ষেত্ৰত মনত পেলাবলগীয়া প্ৰথম নামটো হ’ল—Glen. T. Trewartha। ১৯৫৩ খ্ৰীঃ ৰয় এই বিশেষ চনটোতেই ব্ৰেৰাৰ্থাই এমেৰিকান এছোছিয়েচন অৱ জিঅ’গ্ৰাফাৰছ (American Association of Geographers)ৰ সন্মিলনত দিয়া সভাপতিৰ অভিভাষণত জনসংখ্যা ভূগোলৰ প্ৰসংগটো উত্থাপন কৰিছিল। সেইয়াই আৰম্ভণি।

ইতিহাসৰ পৃষ্ঠা লুটিয়ালে পোৱা যায় যে খ্ৰীঃপূঃ ২৫০ৰ পৰা ১৮০০ খ্ৰীঃলৈকে ভূগোল অধ্যয়নৰ গুৰুত্ব পোৱা একমাত্ৰ বিষয়টো আছিল কোনো ঠাইৰ অৱস্থিতিৰ বৰ্ণনা। অৰ্থাৎ ঠাইখন ক’ত (Where)

অৱস্থিত সেই কথাটোৰ প্ৰতিহে মনোযোগ দিয়া হৈছিল। 'Where' অৰ্থাৎ 'ক'ত' এই প্ৰশ্নটোৰ উত্তৰৰ অধ্যয়ন কেইবাবছৰ ধৰি চলি আছিল। তাৰপাছত ১৮০০ খ্ৰীঃৰ পাছতহে ভূগোলৰ প্ৰকৃতিৰ পৰিৱৰ্তন হ'বলৈ ধৰিলে। ভূগোলবিদসকলে ঠাইৰ অৱস্থিতিৰ উপৰিও প্ৰাকৃতিক আৰু সামাজিক কাৰক সম্পৰ্কেও চিন্তা-চৰ্চা কৰিবলৈ আৰম্ভ কৰিলে অৰ্থাৎ ভূগোলত এই দুটা কথাও অন্তৰ্ভুক্ত হৈ পৰিল। লাহে লাহে শৈক্ষিক বিষয় হিচাপে ভূগোলৰ গুৰুত্ব বৃদ্ধি পাবলৈ ধৰিলে।

পৰৱৰ্তী সময়ত মানুহ ক'ত বাস কৰে (Where do the people live) এই বিষয়টোৱে ভূগোলবিদসকলৰ দৃষ্টি আকৰ্ষণ কৰিলে। পূৰ্বৰ 'Where' আৰু এই পিছৰ 'Where'ৰ মাজত এটা পাৰ্থক্য আছে। পূৰ্বৰ ক'ত বা 'Where' ত এখন ঠাইৰ অৱস্থিতিৰ কথাটো ধৰা হৈছিল; কিন্তু পাছৰ 'Where' বা ক'ত শব্দই মানুহে বসবাসৰ বাবে কোন ঠাই পছন্দ কৰে এইধৰণৰ কথাটোত দৃষ্টি দিয়া হ'ল।

প্ৰাকৃতিক দুৰ্যোগ আৰু মানৱৰ ক্ৰিয়া-কলাপ উভয়েই প্ৰাকৃতিক পৰিৱেশলৈ পৰিৱৰ্তন আনে। এই বিষয়ে ভূগোলত অধ্যয়ন কৰা আৰম্ভ হ'ল। ক'বলৈ গ'লে ভূগোলৰ জ্ঞান অবিহনে পৃথিৱী সম্পৰ্কীয় জ্ঞানেই অপূৰ্ণ হৈ ৰয়। প্ৰাকৃতিক দুৰ্যোগ যেনে বানপানী, ভূমিকম্প অথবা ধুমুহা-বতাহ—এই সকলোবোৰে ভূপৃষ্ঠৰ চিত্ৰৰ যি ৰূপান্তৰ ঘটায় সেইসমূহৰ সংঘটিত হোৱাৰ কাৰণ সম্পৰ্কে ভূগোলত ব্যাখ্যা আগবঢ়োৱা হয়। সেয়ে সমাজ বিজ্ঞানীসকলৰ বাবেও ভূগোলৰ জ্ঞানৰ প্ৰয়োজন আছে। সাধাৰণ লোকৰ বাবেও ভূগোলৰ জ্ঞানৰ প্ৰয়োজন আছে অন্ততঃ নিজৰ আবাসভূমিৰ সামগ্ৰিক প্ৰাকৃতিক অৱস্থাৰ বুজ পাবলৈকে হ'লেও।

মানুহ আৰু পৰিৱেশৰ মাজৰ সহসম্বন্ধৰ বিষয়ে ভূগোলত অধ্যয়নৰ অৱকাশ আছে। মানুহৰ স'তে পৰিৱেশৰ পাৰস্পৰিক সম্বন্ধৰ অধ্যয়নৰ জৰিয়তে ভূপৃষ্ঠৰ পৰিৱেশৰ পৰিৱৰ্তনৰ কাৰণ সম্বন্ধেও জানিব পৰা যায়।

ভূগোলৰ স'তে অন্যান্য কেতবোৰ শৈক্ষিক বিষয় যেনে—ভূতত্ত্ব, পদাৰ্থবিজ্ঞান, জ্যোতিৰ্বিজ্ঞান, উদ্ভিদ বিজ্ঞান, বুৰঞ্জী, নৃতত্ত্ব, সমাজবিজ্ঞান, অৰ্থনীতি আদিৰ সম্বন্ধ আছে। এইখিনিতে ভূগোল আৰু উল্লিখিত বিষয়সমূহৰ ক্ষেত্ৰত থকা এটা পাৰ্থক্যৰ কথা প্ৰসংগক্ৰমে উল্লেখ কৰিছোঁ আৰু সেইয়া হ'ল অন্যান্য বিষয়সমূহে নিজৰ নিজৰ বিষয়ৰ ওপৰতহে অধ্যয়ন কৰে; বিভিন্ন পৰিঘটনাৰ পাৰস্পৰিক সম্বন্ধৰ সামগ্ৰিক চিত্ৰখন পোৱা নাযায়। ফলস্বৰূপে উদ্ভিদ বিজ্ঞানেই হওক বা পদাৰ্থবিজ্ঞানেই হওক বা অন্যান্য বিষয়সমূহেই হওক এইসমূহৰ জৰিয়তে এখন ঠাইৰ একো একোটা নিৰ্দিষ্ট বিষয়ৰ চিত্ৰখনিহে পোৱা যায়। সৰল ভাষাত ক'বলৈ গ'লে উদ্ভিদ বিজ্ঞানে ঠাইখনৰ উদ্ভিদ সম্বন্ধীয় দিশটোহে উন্মোচিত কৰিব অথবা পদাৰ্থ বিজ্ঞানে বায়ুমণ্ডল সম্বন্ধীয় পৰিঘটনাৰ কিছু দিশ উন্মোচিত কৰিব পাৰে। বিভিন্ন কাৰকৰ পাৰস্পৰিক সম্বন্ধৰ জৰিয়তে এখন ঠাই বা এটা অঞ্চল (region)ৰ সামগ্ৰিক ছবিখনি ভূগোল অধ্যয়নৰ জৰিয়তেহে পাব পাৰি। এইখিনিতে ভূগোল অধ্যয়ন বা আঞ্চলিক ভূগোল (regional geography) অধ্যয়নৰ গুৰুত্ব নিহিত হৈ আছে।

পূৰ্বতে উল্লেখ কৰিছোঁ যে ১৮০০ খ্ৰীঃৰ পাছৰ পৰা ভূগোল বিষয়টিৰ প্ৰকৃতি সলনি হ'বলৈ ধৰিলে যেতিয়া ভূগোলবিদসকলে ঠাইৰ অৱস্থিতিৰ লগতে প্ৰাকৃতিক আৰু সামাজিক দিশসমূহো বিষয়টিত অন্তৰ্ভুক্ত কৰিবলৈ আৰম্ভ কৰিলে। তেওঁলোকে একে ধৰণৰ গুণসম্পূৰ্ণ ঠাইসমূহৰ একোটা গ্ৰুপত ভাগ কৰিবলৈ ল'লে আৰু এয়াই আছিল আঞ্চলিক ভূগোলৰ (Regional Geography) আৰম্ভণি। বিখ্যাত জাৰ্মান

ভূগোলবিদ কাৰ্লৰিটাৰে (Karl Ritter) আঞ্চলিক ভূগোলৰ ভেটি সুদৃঢ় কৰাত বিশেষ অৱদান আগবঢ়াইছিল। জাৰ্মানীৰে আলোকজেশ্বৰ ভন হামবল্ড (Alexander Von Humboldt)ৰ সমসাময়িক কাৰ্ল ৰিটাৰকো হামবল্ডৰ দৰেই আধুনিক ভূগোলৰ পিতৃ বুলি কোৱা হয়। বাৰ্লিন বিশ্ববিদ্যালয়ৰ প্ৰথমগৰাকী ভূগোলৰ প্ৰাধ্যাপক ৰিটাৰেই বাৰ্লিন জিঅ'গ্ৰাফিকেল ছ'চাইটি (Berlin Geographical Society)ৰ স্থাপনা কৰে। তেৱেঁই প্ৰথমে ভূগোল বিষয়ক 'Erdkunde' বা earth science বুলি ঘোষণা কৰিছিল।

ভূগোল বিষয়ৰ গুৰুত্ব বুজাবলৈ প্ৰচলিত এটি আখ্যাই যথেষ্ট আৰু সেইয়া হ'ল ভূগোল হ'ল মাতৃস্বৰূপ (mother discipline)। বতৰবিজ্ঞান (metereology), মৃত্তিকা বিজ্ঞান (soil sciences), উদ্ভিদ পৰিস্থিতি বিজ্ঞান (plant ecology)ৰ দৰে বিভিন্ন শৈক্ষিক বিষয় ইয়াৰ পৰাই উদ্ভৱ হৈছে।

ভূগোলত যিহেতু পৃথিৱীখন মানুহৰ আবাসভূমি হিচাপে অধ্যয়ন কৰা হয় গতিকে স্বাভাৱিকতে বিষয়টিত মানৱৰ গুৰুত্ব আছে আৰু সেয়েহে এক নতুন উপ বিষয় এটি ইয়াত সন্নিৱিষ্ট কৰা হৈছে। Welfare Geography এই বিষয়টি হ'ল মানৱ ভূগোলৰ এটি ভাগ। মানৱ কল্যাণৰ ওপৰত গুৰুত্ব দিয়াৰ ফলশ্ৰুতি হ'ল Welfare geography।

মানুহৰ সামাজিক কল্যাণ সাধনৰ উদ্দেশ্যে Welfare Geographyৰ মানৱ ভূগোলৰ এক ভাগ হিচাপে ১৯৭০ খ্ৰীঃত সন্নিৱিষ্ট হয় আৰু এইক্ষেত্ৰত প্ৰথমেই নাম ল'ব লাগিব ডি. এম. স্মিথ আৰু পি. এল. নক্সৰ (P.L. Kmox)। স্থান বিশেষে মানুহৰ জীৱন ধাৰণৰ সামাজিক বৈষম্যৰ মেপ প্ৰস্তুত কৰাটো ভূগোল বিদৰ দায়িত্ব বুলি ভবা হ'ল। কেৱল GNP আৰু ৰাষ্ট্ৰীয় আয়ৰ দ্বাৰাই মানুহৰ জীৱনৰ মানদণ্ড জুখিব পৰা নাযায়। স্থানিক বৈষম্যৰ কাৰণ জানিলেহে শুদ্ধৰূপত সামাজিক কল্যাণ সাধনৰ পৰিকল্পনা কৰিব পৰা যাব। ভূগোলবিদৰ ইয়াতো কৰণীয় আছে। ভোক, দৰিদ্ৰতা, সামাজিক বৈষম্য, অপৰাধমূলক কাৰ্য, স্বাস্থ্যসম্পৰ্কীয় সুবিধা, গোষ্ঠীগত সামাজিক চাপ আদি বিষয়ৰ অধ্যয়ন অপৰিহাৰ্য মানৱৰ সামাজিক কল্যাণসাধনৰ ক্ষেত্ৰত। একে আধাৰতে ক'বলৈ গ'লে—The basis of the welfare geography is on who gets what, where and how। কোনে কি, ক'ত, কেনেকৈ পাইছে—এই তথ্য আহৰণৰ পাছতহে শুদ্ধভাৱে কল্যাণকামী পৰিকল্পনা সম্ভৱ। মানৱ মংগলৰ কথাই যিহেতু সম্প্ৰতি ভূগোল বিষয়টোত গুৰুত্ব লাভ কৰিছে সেয়ে বিষয়টিৰো গুৰুত্ব স্বাভাৱিকভাৱেই বৃদ্ধি পাইছে। quantitative geographyৰ বিষয়টোও ভূগোলৰ এক এবাব নোৱাৰা অংগ হৈ পৰিছে। তথ্যৰ বিশ্লেষণাত্মক অধ্যয়নত ইয়াৰ গুৰুত্ব অপৰিসীম। পৰিৱেশ ভূগোল (environmental geography), সাংস্কৃতিক ভূগোল (cultural geography), চিকিৎসা ভূগোল (medical geography), পৰিবহন ভূগোল (transport geography) ইত্যাদি অনেক বিষয়ৰ অন্তৰ্ভুক্তিৰে ভূগোলৰ অধ্যয়নৰ পৰিসৰ বিশাল হৈ পৰিল। মেপ বা মানচিত্ৰ অধ্যয়ন অবিহনে ভূগোল অধ্যয়ন সম্পূৰ্ণ হ'বই নোৱাৰে। Cartography বা মেপ অংকনৰ বিজ্ঞানৰ এই বিষয়টোৰ গুৰুত্ব ভূগোলত অপৰিসীম। Remote Sensing বা দূৰ সংবেদন, GIS (Geographic Information System), GPS (Global Positioning System) আদি আধুনিক প্ৰযুক্তিগত পাঠ্যক্ৰমৰ অন্তৰ্ভুক্তিয়ে ভূগোল বিষয়ৰ গুৰুত্ব সাম্প্ৰতিক কালত আৰু অধিক বৃদ্ধি কৰিছে। বিবিধ বিষয়ৰ অন্তৰ্ভুক্তিয়ে ভূগোলৰ ক্ষেত্ৰখনৰ পৰিসৰ বৃদ্ধি কৰাৰ সমান্তৰালভাৱে কৰ্মক্ষেত্ৰৰ পৰিসৰ প্ৰসাৰ কৰাতো সুপ্ৰভাৱ পেলাইছে।■

Morphometric analysis of Drainage Basin

Smriti Bhattacharjee

Retd. Associate Professor

Dept. of Geography

D.H.S.K. College, Dibrugarh

Geomorphology is the significant branch of Physical Geography. The Greek words 'Ge' means Earth, 'Morph' means Form and 'logos' means discourse. Therefore Geomorphology is the science of various landforms of the Earth. The term Geomorphology in its present sense was used by Keith in 1894. In Europe the term 'Physiography' was applied to interpret the study of landforms. In America, Geomorphology was the term used for this. Landforms and process are the major subject matter of Geomorphology. The quantitative approach to study the landform was developed in U.S.A. in 1940's and thereafter became popular throughout the world. An American Engineer R.E. Horton (1932-1945) brought quantitative revolution in the field of Geomorphology.

Horton analysed the fluvially originated drainage basin quantitatively for the first time. In India morphometric analysis of terrain characteristics based on topographical maps was initiated by R.L. Singh in his Presidential address of Indian Science Congress held in the year 1967.

In Geomorphology, morphometry may be defined as the measurement and mathematical analysis of the configuration of the earth's surface, shape and dimensions of its landforms. (J.I. Clarke 1970). Morphometry includes quantitative study of the area, altitude, volume, slope, profiles of the land surface and drainage basin characteristics of the area. There are two branches of morphometry-(i) relief morphometry (ii) fluvial morphometry. Relief morphometry is related with the analysis of terrain characteristics through hypsometric curves, height slope relationship curve i.e. climograph curve, altimetric frequency histogram and curves, superimposed, projected composite profiles etc. Fluvial morphometry includes Linear, Areal and Relief aspects of a fluvially originated drainage basin. Linear aspects are hierarchical orders of streams, numbers and length of the stream

segments and their relationship. Areal aspects includes analysis of basin perimeters, basin shape, basin area, stream frequency drainage density and drainage texture. Relief aspect includes hypsometric, Climographic, altimetric analysis and absolute and relative relief ratios, average slope etc.

Morphometric methods were generally applied for the analysis of relief and terrain characteristics since the beginning of 20th century. But the application was mainly started from 1945 after the publication of research paper by R.E. Horton, an American Engineer.

The application of morphometric method has passed through three stages. (i) Macro-morphometry : In the first phase i.e. in 19th Century it was only confined to the study of small-scale map where height and volumes of landforms were analysed. (ii) In the second phase i.e. in 20th century large scale topographic maps were studied and erosional surface, slopes, valleys were analysed. (iii) Micro-morphometry : In the third phase with the introduction of R.E. Horton's "Morphometric System" intensive study of small morphological units i.e. drainage basin was started. Advanced statistical and mathematical method have been applied to study the drainage basin. Now areal photography and satellite imageries have also been used for morphometric analysis.

The morphometric analysis of the drainage basin comprises of (a) morphometry of drainage channels and (b) morphometry of drainage basins. These two play a vital role for understanding the geo-hydrological behaviour of drainage basin and also expresses the prevailing climate, geology geomorphology and structural condition of the channel area.

One of the main aim of Geomorphologists is to study an ideal areal unit for the analysis of erosional land forms. Physiographic regions and drainage basins have been selected for this purpose. The main aim was to collect, process, organize and interpret the data of the landforms particularly of erosional region. Fluvially originated drainage basin has gained importance as a "geomorphic unit" because of its topographic, hydraulic and hydrological unity.

P. Perrault (1674) was the first scholar who visualized the significance of drainage basin. Phillippe Busche was the first to outline the concept of general topographical unity of the drainage basin. John Playfair (1802) appreciated the significance of drainage basin. T.J. Taylor (1851) emphasized that the discharge of river water would depend upon the area of drainage basin. W.M. Davis (1899) visualized the significance of rivers and presented the concept of the span of drainage basin.

C.B. Fawcett (1917) divided England into "Provinces" on the basis of drainage basin. J. Brunhes (1920) selected one criteria i.e. the drainage basin for major division of France. R.E. Horton first described the characteristics of drainage basin in 1932 and in 1945 acknowledged the drainage basin as a morphometric system. After that a large number of Geomorphologists accepted the drainage network and basin as a dynamic unit.

The ground surface which supplies rain and melting water to a particular stream and its tributaries which drain the area is called drainage basin which is demarketed by a well defined perimeter on the basis of water divides. A drainage basin is an open system into which and from which ecology and matter flows. Most of the landscapes are drained by the river and therefore drainage basins are a fundamental unit of geomorphic analysis.

The drainage basin receives energy from two sources (i) from the atmosphere in the form of precipitation and (ii) from the earth where endogenetic forces are related with upliftment, warping, folding, faulting etc. Provide energy to the erosional process. On the otherhand drainage basin loses energy (i) through evaporation, transpiration (from the vegetation of the concerned basin) and (ii) outflow of water and sediments through its mouth.

Total network of master stream and the tributary streams of a particular drainage basin is collectively known as Drainage network which includes all types of streams-permanent, seasonal ephemeral etc. Not only these, rills and fingertip channels are also included in drainage network.

The basin morphometry or fluvial morphometry includes linear, area and relief aspects of a drainage basin.

Most commonly used linear aspects of basin are :

1. Stream ordering : It is defined as a measure of the position of a stream in the hierarchy of tributaries.
- (i) Gravelius made the first attempt in 1914 to determine the orders of stream network. He first identified the 1st order of stream on the basis of greatest width discharge, headward branching and junction angles. By applying the same procedure he designated 2nd order of stream which joined the 1st order and then 3rd order of streams which joins 2nd order and the finger tip tributaries were designated as highest order.
- (ii) Horton's Scheme : R.E. Horton formulated a system of ordering the streams of a drainage basin in the hierarchical order. According to this scheme a stream without any tributary is a 1st order stream. Two 1st order join to

form a 2nd order, two 2nd order join to form a 3rd order and so on. He then extended the highest value of order towards the head i.e. the largest one. Thus a renumbering of streams in order as well as loss of lower order of streams takes place.

(iii) Strahler's Method : According to A.N. Strahler (1969) each fingertip channel is designated as a segment of 1st order.

At the junction of any two 1st order segments, a 2nd order channel is produced and extends down to the point where it joins with another 2nd order segment. Two 2nd order segments results in 3rd order and so on. The order does not increase if a lower order stream meets a stream segment of higher order.

Strahler's scheme is popularly known as stream segment method.

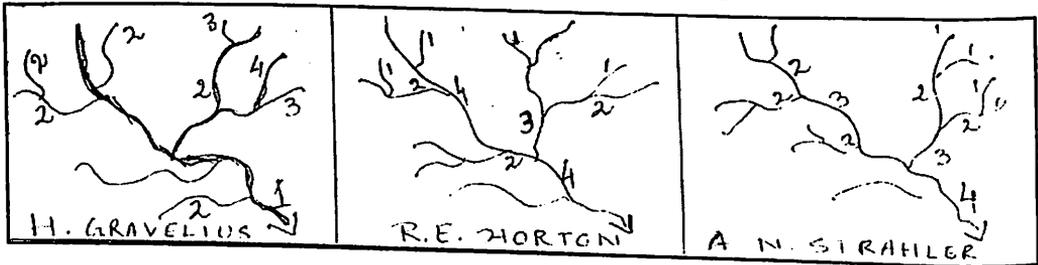


Fig 1.

2. Bi-furcation Ratio (R_b) Bi-furcation Ratio is defined as the ratio of the number of stream segments of any order (N_u) to the number of stream segments of the next higher order (N_{u+1}) It is expressed in terms of the following equation

$$R_b = \frac{N_u}{N_{u+1}}$$

Where N_u = number of streams of a given order

N_{u+1} = number stream of next higher order

Bi-furcation ratio is a dimensionless property of the drainage basin and supposed to be controlled by drainage density, lithological characteristics, basin areas etc. R_b is 2.0 when streams of a given order combine only with another stream of the same order i.e. a flat basin. In natural and otherwise uncontrolled drainage basin it varies from 2-5. It is well above 5 depending on lithology and climatic variation.

3. Sinuosity indices : Sinuosity of a stream denotes the degree of deviation of its actual path from expected theoretical straight path as there are many factors which force the stream to deviate from the straight path. These factors may be geological, hydrological etc. The degree of sinuosity may give a picture of the

stage of the river as well as landform evolution.

(i) S.A. Schumm's Model—(1963)

$$\text{Channel Sinuosity} = O_L/E_L$$

Where O_L = Observed / Actual path of the stream

E_L = Expected path of the stream.

On the basis of this equation Schumm described the channel into 5 categories.

(a) Straight—when sinuosity is 1.0

(b) Transitional, Regular, Irregular, Tortuous. When Sinuosity index is more than 20.

(ii) J.E. Muller Model (1968)

Sinuosity Index - Measurement of Channel length (CL), Valley length (VL) and the Shortest distance between the source and mouth of the river (Air L)

$$SSI = \frac{CL}{VL} \text{ Where SSI = Standard Sinuosity Index}$$

CL = Channel length

V_L = Valley length.

The index gives magnitude of meandering. If the SSI is 1.0, it indicates straight river course. If the value ranges between 1 and 1.5 the river is sinuous. And if the value exceeds 1.5 it represents meandering course.

Other Linear aspects are Length Ratio, Length of the overland flow, meander properties etc.

Areal aspects : Area of the basin is a very important morphometric attribute which is related with stream frequency drainage density, slope, relative relief etc.

(i) Stream frequency—Stream frequency or drainage frequency is the measure of the number of stream per unit area (sq. mt/sq. km and so on). To analyse the stream frequency the basin is conveniently divided in grid squares depending on the scale of the map and areal coverage of the basin. The number of stream in each grid is counted, tabulated and quantified. The analysed data of stream frequency are classified into certain categories depending upon the nature of data. The spatial pattern of stream frequency are gradually studied through isopleth or choropleth maps.

The generally categories of stream frequencies are (i) Very poor (SF_{vp}) ii) Poor (SF_p) iii) Moderate (SF_M) iv) High (SF_H) and v) Very high (SF_{vH}).

Drainage density : Drainage density refers to total stream length per unit area. According to R.E. Horton (1945) drainage density can be derived with the following formula.

$$D_d = \frac{LK}{AK} \text{ Where } LK = \text{Total stream length of the basin area}$$

AK = total area of the basin.

It gives only one value (D_d) for the entire basin. Another method derived by Savindra Singh (1978) to calculate drainage density on a regional scale is to divide the basin into grid squares of one sq. kilometers each. In the next step measurement of total stream length of each grid by Rotmeter/thread and group the derived data into drainage density categories i.e. (i) very low (Dd_{VL}) (ii) Low (Dd_L), (iii) moderate (Dd_M) (iv) high (Dd_H) and (v) very high (Dd_{VH}) and in the last step preparation of Isopleth for the study of spatial distributional pattern.

Other methods to derive the areal aspects of basin are Area Ratio (R_a), Law of basin area, Law of Allometric growth, Drainage texture etc.

Relief aspects : Relief aspects of the drainage basin are related with area, volume and altitude i.e. three dimensional features of the basins. These aspects includes:

- (i) Hypsometric analysis : Area height relationship.
- (ii) Clinographic analysis : Analysis of average slope between successive contours.
- (iii) Altimetric analysis : Numerical frequency of the high lands i.e. spot height, Benchmark etc.
- (iv) Average slope : Analysis of angular inclination.
- (v) Relative relief : Showing differences between highest and lowest height.
- (vi) Profile analysis : Analysis of serial, superimposed, Longitudinal and Transverse profile related with a drainage basin.

The quantitative approach is the basis of morphometric analysis which is related with drainage basin analysis. Through Linear, areal and relief aspects Drainage basin have been recognised as an ideal geomorphic unit which is adynamic unit rather than a static one. Detailed data can be collected from topographical maps of different scales. Therefore the results derived through morphometric analysis may be erroneous in some cases. But now a days mass data derived through satellite imageries, air photographs enabled the geomorpho logists to monitor the changes of the basin and have a proper knowledge about the basin.

References :

- Basu Partha and Saha P. Kanti - Advance Practical Geography.
 Gautam Alka, 2009 Geomorphology
 Singh Savindra, 1999 Geomorphology
 Thornbury William D. Principles of Geomorphology

Geography and Statistical Methods

S. K. Kar

Retd. Associate Professor
and HoD Geography
Dept. of Geography
Darrang College, Tezpur

Scientific Basis of Geographical Studies : Geography is the study of the variable character of the earth's surface. For long time it was concerned with the description and interpretation of various phenomena of the earth especially the physical earth. This approach could not make the subject at par with the fundamental disciplines like Physics or Chemistry and Economics or Biology. The subject of Geography even suffered from dualism and dichotomy viz physical versus human geography, Regional versus Systematic Geography, Idiographic versus Nomothetic Geography etc. Due to inherent weakness in the discipline i.e. description and explanation, the subject could not make much contributions towards theory and model building. Some theories and models postulated by early geographers were far below the level of fundamental disciplines. Finally, the neo geographers of 1950's introduced Quantitative and Statistical Methods in Geography in order to provide an scientific orientation to the field. In the words of Yeates, Geography can be regarded as a science concerned with the rational analysis and testing of theories that explain and predict the spatial distributions and location of various characteristic features of the earth's surface. In order to achieve this objective and to obtain the real picture of a region, geographers began to use and apply quantitative tools and techniques.

The shift in the focus of geographical studies during the mid 50's and the early 60's inevitably involved a major change i.e. a revolution in geographical studies. It was clear that the new concept of geography as the science of spatial analysis of phenomena on the earth's surface with Pronounced contributions to theory needed a new set of methodologies for analysis and interpretation. Ackerman (1958) in his essay on—"Geography as a fundamental discipline categorically

stated about the need of application of complex statistical methods. He emphasised on application of quantitative methods to make the geographical studies more accurate and precise. Quantification was definitely the key to radical transformation of spirit and purpose of Geography during mid fifties to early sixties.

Quantitative and Statistical Methods : Quantitative Methods involve collection, presentation, analysis and interpretation of numerical data concerned with various phenomena of the earth's surface. These methods have assumed great importance in Geography during mid fifties to early sixties. Advances in technology and scientific surveys including remote sensing techniques have provided more accurate data and information about physical, economic and cultural elements. Quantitative Methods help us in explaining the facts and understanding the interrelationship between various elements of the earth's surface. The objectives were to make the subject matter of Geography more useful and applied in nature.

Statistical data are collected and compiled by individual researchers and govt and international agencies. Such data provides information on area, population, natural resources, energy, minerals, agriculture, industry, transport, communication etc. The data thus obtained are compiled on the basis of administrative units such as village town, revenue circle and then aggregated to the levels of police station, subdivision, district, state and the nation. Geographers prepare maps by using these organised data. Statistical tables support the analysis of the pattern and variation. It must be remembered that the statistical data are in absolute numbers when they are compiled and have to be processed further in the form of ratio, percentage, density etc. The data are aggregated into smaller groups and their values are arranged in ascending or descending order in the tables. The mean, median or modal values are obtained when the distribution of some elements were presented in tables or maps. These values show the average pattern of a distribution. The distribution of some elements show that there is some kind of variation from the central value (i.e. mean median or modal value). Apart from those mentioned above, different elements of earth's surface show some kind of relationship among them. Often the relationship between the elements needs further evaluation as a combined effect of a number of factors or variables; such problems can be easily tackled by applying advanced quantitative techniques like multifactor or principal component analysis.

Any statistical analysis depends upon the type of quantitative information available in the data under consideration. For example, the study of cropping pattern of a region requires information on location, area, relief, cultivable area, irrigated area, use of fertilizers and farming equipments and tools, area under

different crops etc. Similarly a study of urbanisation will require figures regarding total population, urban population, population of migrants and occupation of people. In addition, we require information regarding density of population, wages of workers, transport and communication facilities, various other infrastructure facilities, number of industrial units along with other related elements.

The Quantification as well as application of qualitative and statistical methods is essentially a well designed exercise and follows a definite sequence as stated below—

i) Setting up of hypotheses on the basis of objective of a study.

ii) Setting objectives and methodologies of study

iii) Use of suitable sampling techniques

iv) Application of probability theories.

v) Collection of data using both primary and secondary sources.

vi) Data processing, computation, simplification, classification.

vii) Application of graphic measures.

viii) Application of various statistical measures to derive conclusion theory and model building—

a) Application of measures of Central Tendency.

b) Application of measures of dispersion and relative dispersion.

c) Application of measures of skewness and inequity

d) Application of measures of disparities

e) Analysis of variance.

f) Application of correlation and regression

g) Combinational analysis

h) Network analysis.

i) Multifactor and multivariate analysis

j) Principal component analysis.

k) Test of significance (use of and test, T-test, Chi-square test etc.)

The foregoing discussion points out the inherent weakness of the discipline of geography due to application of methodology like description and interpretation. Only recently i.e. after 1950, the geographers started using quantitative and statistical methods in order to make the subject more analytical and scientific. There has been large scale application of various structuralist methods, which helped the neo geographers to synthesise the geographic analysis of various problem concerned with the earth's surface. The sequence of statistical methods mentioned in the foregoing discussion can be suitably arranged and additional techniques can be incorporate to handle various geographical data. ■

The study of the status of the wetlands And Low Lying Areas of Dibrugarh District

Ms. Sultana Hazarika
Associate proff and HoD, Deptt. of Zoology,
D.H.S.K. College, Dibrugarh. Assam.
E-mail : sultana_h@rediffmail.com

INTRODUCTION:

The value of wetlands was actually realized after the Rio Conference 1992, Regina Conference (1987) and Ramsar Convention (1971). "The wise use of wetlands is sustainable utilization of the resources for the benefit of human kind in a way compatible with the maintenance of the natural properties of the ecosystem. The natural properties of the ecosystem were defined as "those physical, biological or chemical components, such as soil, water, plants animals and nutrients and the interactions between them"

Natural water bodies are a part of vast aquatic ecosystem that plays a vital role in the biogeochemical cycle of the entire earth that effect the composition of the atmosphere, the climate and hydrological cycle. Though the most important aquatic ecosystem on global biogeochemical interactions is the oceans yet the inland water site on earth cannot be underestimated. Without these the earth would be devoid of all terrestrial and fresh-water species including man. These aquatic ecosystems are in continuous state of change, with fluctuations following a daily and seasonal cycle on climate factors of rainfall and changing temperature. When hydrobiological characters of these water bodies are disturbed even minutely due temperature change there causes elimination of some macrophytes and biodiversity. These water bodies harbour various resources like fish, amphibians, birds, reptiles,

zooplankton and phyto-plankton, benthic biota, bottom organisms, physico-chemical properties of water and soil.

The wetlands and flood plain areas are subject to seasonal flooding permanent or semi-permanent areas of standing water may be locked in ox-bow lakes and other depressions after the flood water has receded. They sustain a heavy population of livestock.

The chemical properties of water together with temperature control the types of the species of animals and plants that live in different fresh-water areas.

The ox-bow lakes are relatively narrow long and have straight or bent shaped. They formed from isolated loops of meandering rivers or streams. These crescent shaped basins are usually deeper, because they occupy old segments of the rivers. They may also have connection with the parent river through the channel and during high floods with the neighbouring catchment areas. These floodplain lakes retain the continuity with the river through connecting channels either throughout the year or at least during monsoon season. They are termed as live or open beel. The others which are completely cut-off from the parent river are called dead or closed beel. Most of the beels present in the Dibrugarh district are either closed or open beel. Some others are formed as a result of earthquake of 1897 and 1960 as tectonic lakes.

A large number of wetlands are present in varying sizes. These beels or wetlands are very important in restoring the biodiversity of the region. Most of these wetlands are small sized. In spite of the small size the slight variation in climate topography, physico-chemical parameters enhances and encourage the wide range of species diversity in these wetlands and swamps.

Among the different wetlands of India, beels occupy the most conspicuous position both in terms of area and production. They cover 2,02,213 hectare water area which is 12.6% of the total freshwater resources of the country. These nutrient rich and biologically diverse ecosystems generally possess high potential in-situ fish production and are such that all the fish from its catchments gets collected here.

The average annual fish production from beels in India is in the range of 100-200 kg/hectare, though their potential is estimated to be about 1000 kg/hectare (*Jhingran and Pathak, 1987*). Latest scientific results from West Bengal have

indicated that true potential fish production from beel is still higher (*Sugunan et al, 2000*).

But over-exploitation of resources mainly fish from these wetlands coupled with large amount of water withdrawal or conversion of low-lying land for agricultural purposes have already posed serious threats to these wetland habitats. As a result the wetlands have been disappearing at an alarming rate. Out of the main problems associated with the maintenance of beels has been lack of proper integration of wetland values in the planning process for these flood prone areas. Lack of fisheries management and widespread illegal fishing is causing great concern to Beel Fisheries of the country. Though some developmental programmes have been undertaken but no attempts have been made to formulate post developmental management strategies for beels to enhance their value to local communities.

STUDY AREA:

Dibrugarh District - 27° 5'38"N to 27°42' 30"N latitude and 94° 33'46"E to 95° 29' 8"E Longitude.

METHODOLOGY:

The survey is done by visiting different wetlands of Dibrugarh district as far as possible. One vehicle (Jeep), measuring tape, compass, GPS, etc were used. Visits were done with the help of District Fishery department, Dibrugarh.

DISCUSSION:

In the wetland ecosystem energy is derived by the fixation of solar energy through photosynthesis. In this process CO₂ and water are converted to carbohydrate and other food by green plants using solar energy. In beel ecosystem, unlike other aquatic ecosystems where algae are the chief primary producers, microphytes are more efficient converters of energy in macrophytes to algae (*CIFRI, 1992*). In the beels of Assam, similar trend was observed by different workers (*Yadav 1987*), *Jhingran and Pathak (1987)*, *Acharjee (1997)*.

It is apparent that each stage from producers to consumers, considerable energy is used up or lost. Most of the wetlands receive monsoon runoff from the catchment area for which the aquatic food web is greatly influenced by the ecological conditions by the surrounding territory of these water bodies. Again fishing activities by removing macrophytic plants alter the ecological condition of beel especially during heavy fishing seasons (November to March).

Beels or wetlands perform numerous valuable functions such as recycling of nutrients, purify water, recharge ground water, serve in providing drinking water, fish, fodder, fuel, medicine, wildlife habitat, buffer shoreline against erosion etc. ecologically they may be received as complex hydrological and bio-geochemical system endowed with specific structural and functional attributes and performing major ecological role in biosphere. The riverine connection of the beels regulates pH, CO₂ and O₂ content of the water and also the clarify macrophytes during the monsoon period. So it is important to continue the link channel between the beel and the river. Beels are the breeding ground for most of the riverine species. But some beels have lost their feeding channel due to siltation, flood activities, weed infestations and anthropogenic activities. It is considered to be a major problem for the conservation of biodiversity and need proper planning and programme from the authority as well as from the villagers too.

LIST OF REGISTERED WETLANDS OF DIBRUGARH DISTRICT

1	Dibrujan Beel	Bordung G.P	Panitola Dev.Block
2	Kerua Lika Beel	Deodharia mirigaon	Panitola Dev.Block
3	Hakoi Beel	Numdung forest, Leng	Khowang Dev.Block
4	Khowang Borbeel	Nagar Gaon	Khowang Dev.Block
5	Chapara Beel	Jamirah	Borboruah Dev.Block
6	Larua Beel	Charai Habi Gaon	Borboruah Dev.Block
7	Meer Lagana Khana	Sessamukh Gazai Gaon	Borboruah Dev.Block
8	Kalakhowa Borbeel	Kalakhowa Chariali	Borboruah Dev.Block
9	Chajan Beel	Jamirah	Borboruah Dev.Block
10	Garudharia Beel	Garudharia gaon	Borboruah Dev.Block
11	Gela desaoi Beel	Rohmoriam	Lahual Dev.Block
12	Romai	Romai	Lahual Dev.Block
13	Maijan Beel	Moderkhat	Lahual Dev.Block
14	Kheremia Beel	Tingrai Kharamia	Tengakhat Dev.Block
15	Disamjan Beel	Sassoni	Joypur Dev.Block
16	Demow Beel	Khowang	Khowang Dev.Block
17	Kawaimari Dighali Beel	Sassoni	Joypur Dev.Block
18	Singhimari Beel	Romai	Lahual Dev.Block
19	Hatibondha Beel	Tengakhat	Tengakhat Dev.Block

LIST OF UNREGISTERED WETLANDS OF DIBRUGARH DISTRICT

SL. No.	Name of the Beel	Area in hectare	Location	Dev. Block
1	Bheraki Beel	4.0 hect.	Balijan Gaon	Tengakhat
2	Gutung Beel	4.1 hect	Dighalia gaon	Tengakhat
3	Nalani Beel	3.5 hect.	Hatibandha gaon	Tengakhat
4	Bali Beel	1.5 hect.	Hatibandha gaon	Tengakhat
5	Parasuti beel	6.67 hect.	Khoromia gaon	Tengakhat
6	Gereki Beel	11.5 hect.	Tingrai	Tengakhat
7	Meer Beel	97.0 hect.	Kathalguri Khoromia	Tengakhat
8	Gudha Beel	20.0 hect.	Sassani	Joypur Dev.Block
9	Singi Beel	30.0 hect.	Sassani	Joypur Dev.Block
10	Lakhutiputa Beel	8.0 hect.	Kalipani	Joypur Dev.Block
11	Naojan beel	8.0 hect.	Dhaman	Joypur Dev.Block
12	Dighali Beel	10.0 hect.	Sassani	Joypur Dev.Block
13	Longhori Beel	10.0 hect.	Sassani	Joypur Dev.Block
14	Chenemari beel	16 hect.	Kutuha	Khawang Dev.Block
15	Meer Beel	90.0 hect.	Bharalibari	Khawang Dev.Block
16	Morisuti Beel	4.0 hect.	Bhagamur	Borboruah Dev.Block
17	Bouga Beel Grant	3.2 hect.	Ghronia	Borboruah Dev.Block
18	Kotoha Borbeel	19.0 hect.	Kutuha	Borboruah Dev.Block
19	Mahmara Beel	3.3 hect.	Dillibari	Tingkhong Dev.Block
20	Gerekoni Beel	7.0 hect.	Khromea	Tengakhat Dev.Block

STATEMENT SHOWING "THE LOW LYING AREAS" UNDER DIBRUGARH DISTRICT

Sl. No.	Name of Low Lying Area	Name of the Mouza	Area of the Low Lying Area	Remarks
KHOWANG DEVELOPMENTAL BLOCK				
1	Chenimari Beel, Chenimari Block gaon	Lengari	122 B- 10 L	Under Moran Circle
2	Tinthengia Beel, Chenimari Block gaon	Lengari	39 B- 8 L	Under Moran Circle
3	Padumoni gaon, Padumoni gaon	Lengari	19 B- 3 K- 1 L	Under Moran Circle
4	Ikarani Beel Nalanikur gaon	Khawang	324 B-3 K-90 L	Under Moran Circle
5	Bor-beel Block gaon	Khawang	324 B-3 K-90 L	Under Moran Circle
6	Bor-beel, No.3 Burhi Khawang	Lengari	39 B- 3 L	Under Moran Circle
7	Graging Chrania Pathar, Padumoni gaon	Lengari	572 B - 19 L	Under Moran Circle

TINGKHONG DEV. BLOCK

1	Pani beel pukhari, No.1 Keseruguri	Tingkhong	2 B- 3 K	Tingkhong
2	Pani Beel, No.1 Keseruguri	Tingkhong	45 B-3 K-14 L	Tingkhong
3	Bamun pukhori, Gharbauli	Tingkhong	1 B. 10. L	Tingkhong
4	Bherbheri Beel	Tingkhong	10 B. 2 K. 18 L	Tingkhong
5	Gharbandi Borpathar Beel	Tingkhong	3 B. 1 K	Tingkhong
6	Borbeel Dishang.	Tingkhong	35 B. 10 L	Tingkhong
7	Natun Borbeel	Tingkhong	63 B. 3 K.5 L	Tingkhong
8	Singi Beel. No.3. Nolani, Kapahua	Tingkhong	45 B. 3 K.5 L	Tingkhong
9	Beel Gela Disang	Tingkhong	42 B. 17 L	Tingkhong
10	Ting-thengia Beel, Tingthengia	Tingkhong	33 B	Tingkhong

JOYPUR DEV. BLOCK

1	Daiang Beel, Anguri gaon	Joypur	146 B-29 L	Naharkatia Circle
2	Singi beel, Man Kapahua	Joypur	29 B	Naharkatia Circle
3	Long hai beel, Rongali Pathar	Joypur	12 B- 7 L	Naharkatia Circle
4	Kaliapani beel Nirmalia	Joypur	16 B- 6 L	Naharkatia Circle
5	Bherekoni beel, Dhadumia	Joypur	1 B. 5 L	Naharkatia Circle
6	Takow Beel No.2.Tokow beel	Joypur	278 B- 4 L	Naharkatia Circle
7	Gudha beel, Gudha beel gaon	Joypur	142 B. 3 K	Naharkatia Circle
8	Hangchara beel, No.2 Delamori	Joypur	15 B - 3 K. 9 L	Naharkatia Circle
9	Singi beel, No.2. Deodhai gaon	Joypur	41 B- 15 L	Naharkatia Circle
10	Meer beel, Meer beel Graging	Joypur	56 B- 2K-2 L	Naharkatia Circle
11	Nagahulla beel, Chaike gaon	Joypur	7 B- 12 L	Naharkatia Circle
12	Lakhutiputa beel, Tairai	Joypur	11 B- 3 K- 10 L	Naharkatia Circle
13	Ghagara par, No. 2 Sukani	Joypur	12 B- 12 L	Naharkatia Circle
14	Hangahara beel, No.2 Disang	Joypur	96 B- 18 L	Naharkatia Circle
15	Bamuni beel, No.1 bamuni gaon	Joypur	56 B-2 K-2 B	Naharkatia Circle
16	Jamuna beel, Takaw beel,gaon	Joypur	11 B- 8 L	Naharkatia Circle
17	Dighali beel, dighalibeel gaon	Joypur	552 B	Naharkatia Circle

LAHOAL DEV.BLOCK

1	Ranaijan, Ranai gaon	Lahowal	12 B-1 L	Dibrugarh East Circle
2	Cheni beel, Ramai gaon & Ramai Bengali gaon	Lahowal	9 B-2 K-10 L 3 B-3 K-8 L	Dibrugarh East Circle
3	Maijan Beel, Maijan Grant, Mathala Grant, Miri Pathar Grant	Lahowal	18 B- 2 K- 9 L 1 B-2 L 15 B-3 L	Dibrugarh East Circle
4	Ramai gaon low lying area	Lahowal	15 B-1 K.4 L	Dibrugarh East Circle

TENGAKHAT DEV.BLOCK

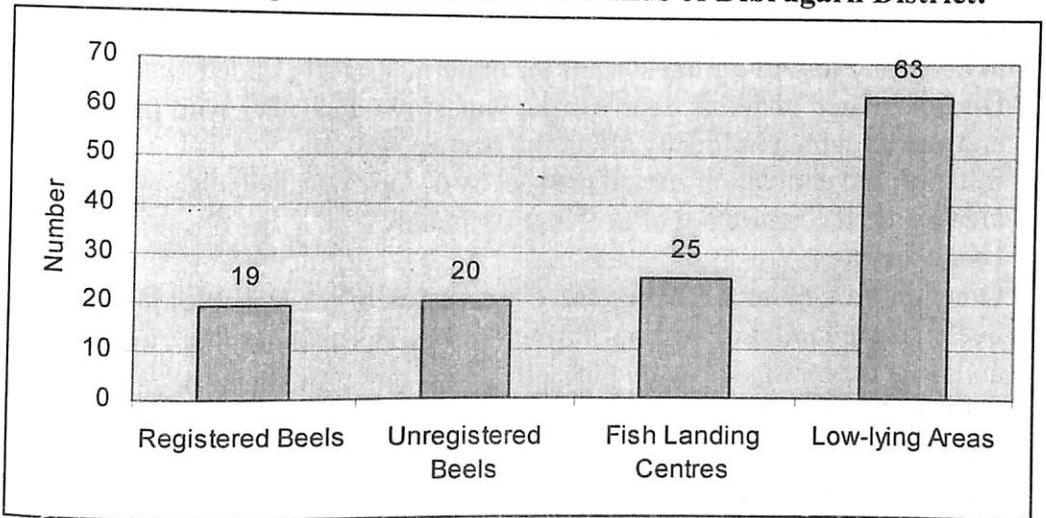
1	Bhereki beel, Mulai bam gaon	Tengakhat	79 B-2 K-4 L	Tengakhat Circle
2	Bali beel, Tikrabali gaon	Tengakhat	10 B-3 K-19 L	Tengakhat Circle
3	Bali beel, Bhagamuria	Tengakhat	69 B	Tengakhat Circle
4	Borbeel, Khangia gaon	Tengakhat	1 B-3 K-2 L	Tengakhat Circle
5	Bhereki beel, Tamulkhat	Tengakhat	30 B	Tengakhat Circle
6	Meer beel Majuli, No.1 Meer beel Majuli gaon, No.2 Meer beel Majuli gaon,	Kheremia	675 B-5L 212 B-18 L 51 B	Tengakhat Circle
7	Pachsuti Borbeel	Kheremia	49 B-2 K-15 L	Tengakhat Circle
8	Meer beel ,Prabhajan	Kheremia	71 B-3 K-15L	Tengakhat Circle
9	Gerekoni beel, Gerekoni gaon	Kheremia	63 B-3 K	Tengakhat Circle
10	Jalduba	Kheremia	8 B- 2K-10 L 12 B-3 K-10 L	Tengakhat Circle
11	Jalduba, Erasuti, Dehing, Erasuti	Kheremia	58 B-3 K-12 L 9 B-3 K-12 L	Tengakhat Circle
12	Beel Tingrai Bum gaon	Kheremia	51 B-2 K-5 L 50 B-3 K	Tengakhat Circle
13	Deo beel No.2 Chapatali	Topling	45 B-2 K-10 L	Tengakhat Circle

BORBORUAH DEV. BLOCK

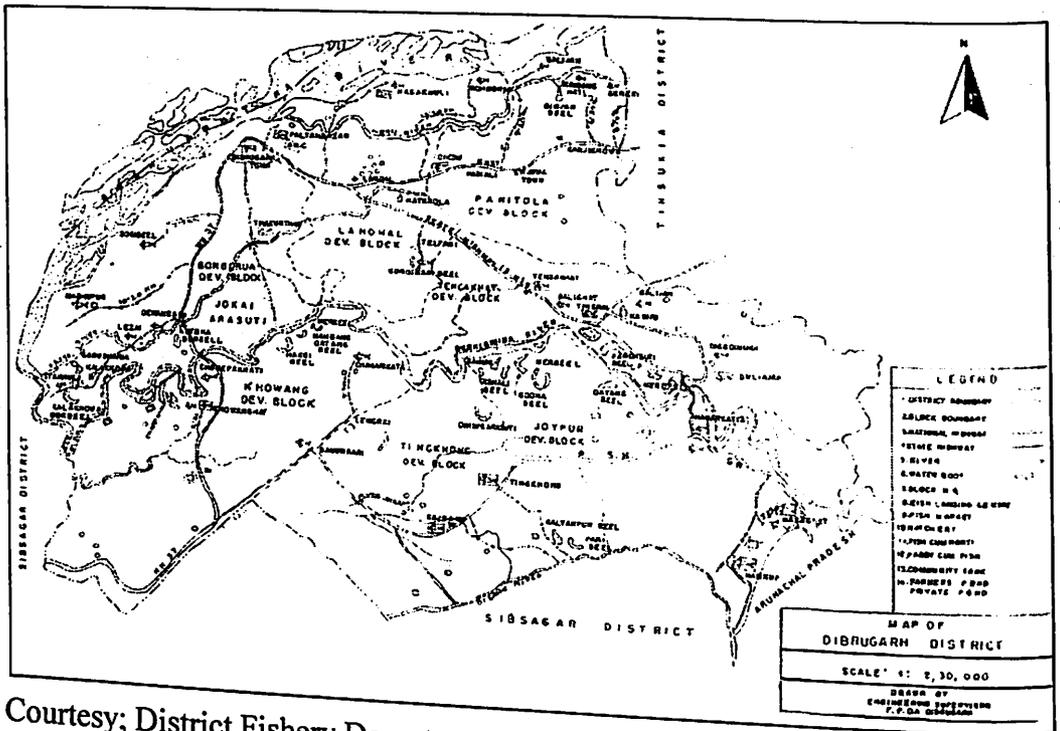
1	Padum beel, Bhurbhuri No.2 gaon	Mdneetta	34 B-3 K-7 L	Dibrugarh West Circle
2	Kath beel, Bhurbhuri No.2 gaon	Mdneetta	184 B-3K-17L	Dibrugarh West Circle
3	Montree beel, Lakai gaon	Mdneetta, Khanikar	13 B-4K-4 L	Dibrugarh West Circle
4	Cheaya beel		50 B	Dibrugarh West Circle
5	Karai beel		20 B	Dibrugarh West Circle
6	Dighali beel		100 B	Dibrugarh West Circle
7	Changpata Beel		100 B	Dibrugarh West Circle
8	Kachumari beel		25 B	Dibrugarh West Circle
9	Khalihamari pitoni, Kalalua Deori gaon		10 B	Dibrugarh West Circle
10	Gargari beel		40 B	Dibrugarh West Circle
11	Bahagua Pukhori, Betoni gaon		7 B	Dibrugarh West Circle
12	Erasuti Na-Pam Than gaon		100 B	Dibrugarh West Circle

Courtesy; District Fishery Department, Dibrugarh.

Graph showing different status of wetlands of Dibrugarh District:



Map of some important wetlands of Dibrugarh District:



Courtesy; District Fishery Department, Dibrugarh.

Major impacts of human activities on beel ecosystem:

1. Removal of vegetation cover from the catchment area of beels produces ecological problems, such as reduction of allochthonous materials available to beels and loss of a filter system for material and suspended material.
2. Disappearance of forest deprives the waterfowl and other wild life of food and shelter which indirectly affect the beel ecosystem.
3. Siltation and cultivation around the beel by occupying and damaging the shore area resulted constriction of beel and ultimately lead to the disappearance of beel ecosystem.
4. Other anthropogenic activities and construction of roads and bridge over the beel and wetland area without further and proper planning by Government authority is becoming a major problem now-a-days. And in this regard Kotoha Borbeel is a good example.
5. Introduction of some particular type of harmful fish species (exotic), Big head/ Tilapia etc without proper discussion with the experts is another cause of the

threat to the local species and degradation of beel ecosystem.

So our first challenge is to ensure that significant areas of the lakes or beels are protected from further degradation. There are a number of key steps in the design of reserve system. The first is:

- i) Identification of core areas and buffer zone.
- ii) Design of reserve network to ensure that the protected areas represent entire landscape.
- iii) Management plans are needed for each site and for the system as a whole.

Management of any wetlands must be determined in consideration of its significance for conservation, on which basis the management priorities and objectives needs to be clearly spelled out. There are some steps. These are:

1. A detailed survey of the lakes for their social and ethical values.
2. Scientific studies by the experts should be done for collecting up-to-date information on the water quality and functions of the beel.
3. Adequate fund should be allotted for basic ecological research in the beel ecosystem.
4. Training programmes should be organized to develop management and technical skills among managers, local people and scientists and students for beel maintenance. If such collaborations brought into existence can be very successful to manage beel ecosystem throughout the state.

CONCLUSION:

There are 19 registered beels, 20 unregistered beels, 25 fish landing centre of river Brahmaputra, Dihing, Dibru and Sessa and 63 low-lying areas of Dibrugarh district. The low-lying areas include .in Khowang developmental block – 7 nos, Tingkhong developmental block- 10 nos, Joypur developmental block – 17 nos, Lahoal developmental block- 4 nos, Tengakhat developmental block – 13 nos and Borbaruah developmental block - 12.nos. There are 10 orders, 22 families and 87 species of fish found.

For proper functioning of a wetlands ecosystem, there should be an efficient flow of matter and energy in it. If the system fails to function, the consequences can be often unpleasant, expansive and irreversible. So any management programme should only be undertaken with a specific goal in mind, and with an understanding of the known quantitative linkage that allow one to forecast the result of the manipulation. Emphasis should be taken that all management should

have a clearly articulated goal and steps must be taken to gain better insight into the functioning of such kind of unique ecosystem and conserve them for future generation.

The survey was done in the year 2014 .The present status has changed much more.■

ACKNOWLEDGEMENT:

The financial assistance provided by DST in the form of Major Research Project to the author is gratefully acknowledged. The author is also thankful to the District Fishery Department, Dibrugarh for their help and co-operation.

References:

1. Talwar, P.K. and Jhingran, A. 1991. *Inland Fishes of India and Adjacent Countries*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2 Volumes: xix +1158.
2. Jayaram, K.C. *The Fresh water Fishes of the Indian Region*. Narendra Publishing House. Delhi
3. Jhingran, V.G. 1991. *Fish and Fisheries of India*, 3rd edition, Hindustan Publishing Corporation (India), Delhi. 727 pp.
4. National Research Council (1992). *Restoration of Aquatic Ecosystems*. National Academic Press, Washington D.C.
5. Yadava *et al.*, 1987. Studies on the Limnology and productivity of an Ox-bow lake in Assam (India) pH.D Thesis, Gauhati University (Assam).

Geographical Facts

Compiled by : **Tulika Baruah**

B.A. 1st Semester

1. Australia's diameter is 600 km wider than the moon.
2. Nauru an Island country in Micronesia is the only nation that has no official capital.
3. Russia is so large that it spreads over 11 different time zones. When one side of Russia has morning breakfast at 7 a.m., the other side enjoys evening snacks at 6 p.m.
4. Indian in USA has a city named Santa Claus.
5. Canada is an Indian word meaning Big Village.
6. On the 18th of February 1979 it was snowing in the Sahara.

Source : Internet

The Science of Geography

Hemanta Timsina

Head of the Department

Dept. of Geography, D.H.S.K. College

The basic nature of any science is a set of problems and methods for solving them in a perfect way. The subject geography is dual in nature. It studies both physical and social aspects of any phenomena. Hence its scope is more wider than any other discipline. There is dualism in Geography. It is an interdisciplinary subject. Here. questions are asked through space to solve problems. What, where,

when, how, why and who are the questions which may arise from any event which occurs on the surface of the earth in every moment. Some events may enter into our perception and some may not. The important events are perceived by us. Once it enters to the field of perception than it moves towards the field of conception. That is why concepts are necessary to describe various events. Concepts are necessary to explain the experiences. Number help us to answer the 'what' question. Number and

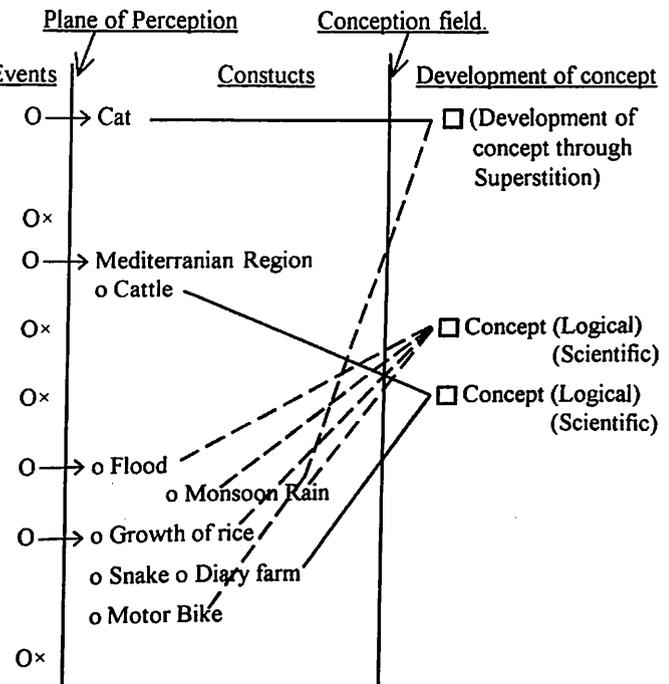


fig-(1) Development of concept

relationship help us to answer where, when, and who questions. Interrelationship of construct help us to answer why and how questions. Concept is the production of knowledge, understanding and comprehension.

In fig(1) it is seen that various events enter our perception. These events lead towards experiences. These experiences are known as constructs. These constructs enter to the field of conception through our knowledge, understanding and comprehension. Than the actual concept is developed. These concepts may be scientific or not (Superstitions).

Different sciences often describe the same events with completely different purposes in mind. A riot will have different implications for a sociologist, a geographer, an economist, a philosopher, a political scientist or a historian. If we consider an urban riot than each axis (fig-2) which intersect the construct in the centre of the drawing represent a context within which we may validly view that construct. The spatio temporal dimensions of a particular event like riot and their relevance definitely gives interest to a historian or a geographer. Moreover the social, political, psychological, economic or cultural context of this type of event are also important. Each of these give rise to a distinct science and perform the analytical study from their own view-points—

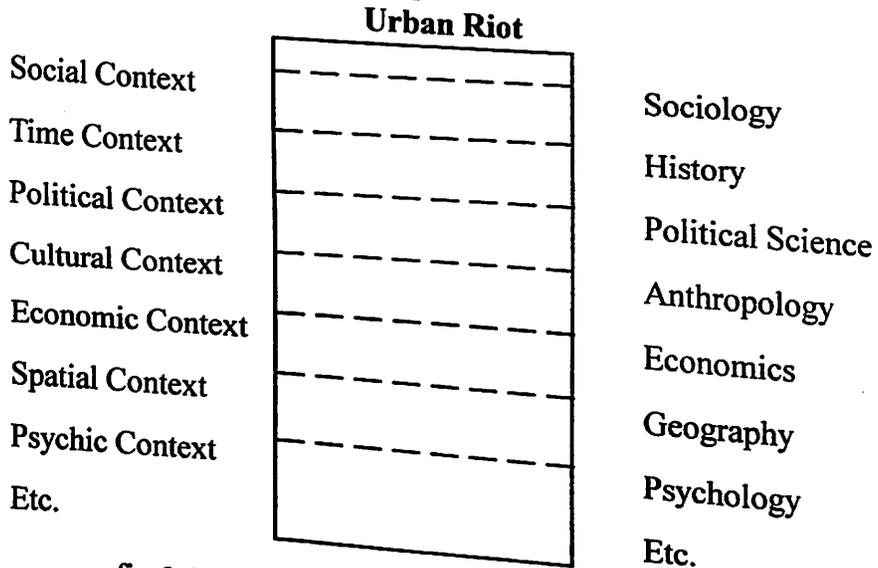


fig-2 Some constructs, context and related science.

A construct maybe interconnected to other constructs, because several sciences produce relationship among themselves. Poor police protection, high

crime rates, and minority group riots are all interconnected by different theories, Laws and hypotheses in political science and sociology as like in geography. Therefore we can say that same Law may form a part of the theoretical structure of more than one science.

It is the questions that is consistently asked by a particular science which distinguish it most clearly from other sciences. Locational and spatial questions are always asked in geographical science. The distinct geographical question is "why are spatial distribution structured the way they are?" This basic question is the foundation of our science. Because spatial distributions are basic in geography. We can talk about distribution from 1 to N-dimensional spaces. Geographers are mostly interested in the frequency with which things occur in terrestrial space. As X and Y axis of a scatter diagram define a numerical space, in the same way latitude and longitude define the terrestrial space. Spatial distributions may be composed of like or unlike things, it may be ubiquitous or localized. When it is observed that the densities of occurrence vary, in the moment we begin to ask ourselves why this variations occur. This type of question creates contemporary geography. An important aspect of spatial distribution question implies a 'where' question concerning the location of that distribution. Eratosthenes, as a geographer, first provided the science with a method which enabled it to answer 'where' questions satisfactorily. Eratosthenes devised a solution which look crude to us, but it is the foundation of the more sophisticated locational systems we use today. He devised a crude locative grid system. Both Eratosthenes measurement of the earth and his map illustrate the interest of the ancient geographers in accurate measurements and description of locations. At the same time different techniques were being developed to provide satisfactory answers to 'where' questions and geographers began to ask 'what is where' questions. Such questions are certainly evident in the proto-scientific works of Homer and Herodotus. Geographers always ask 'where' question about all events but they do not provide the same answer always. Because 'where' may be asked and answered in absolute or relative way. Absolute location position in relation to a conventional grid system which is only for locative purposes. Latitude and longitude are the most common way of describing absolute location. Dibrugarh is located at 27.4°N latitude and 95°E longitude. This location of Dibrugarh will never change. This is an absolute location. On the other hand relative location is positioned with respect to other locations. It can be described in different ways, like Dibrugarh is 45 km east of Moran or 50 km west of Tinsukia, or Dibrugarh is 1 hour distance from Moran or

1½ hour distance from Tinsukia etc. So we can express relative location in values other than the usual distance unit. The relative location of two places may change radically but absolute location remain constant.

Geographers are interested more often in the internal organization of a distribution. They are concerned about 'Pattern' of a distribution using the term Like-dense, sparse, agglomerated, dispersed, and linear. Contemporary geographers pay attention to spatial structures of different kinds. They are aware of distributions than of the processes which produce them. Structure is a determinant of process as much as process is also a determinant of structure. Spatial structure is a concept applicable to both static distributions and to processes which appear to us to be dynamic. Human movement in vehicles and on foot result in spatial structure of object i.e. road, railways, airports etc. over the surface of the earth. On the other hand human choices of agricultural, industrial and commercial activities produce economic spatial structure. Structure varies from place to place and time to time. As a result of these variations the ultimate pattern is also varied. This is the task of modern geography and for which modern geography differs from that of medieval and classical geography. That is why modern geography have to answer the questions 'why', 'what', 'where', 'how' and 'when'. But the question of traditional geography is 'what is where' only. Thus traditional geography studies about what is the phenomena or things and where it is found and so on. But the modern geography deals with the study of facts by answering 'why' and 'how' questions mainly. But it does not neglect traditional questions like 'what', 'where' questions etc. The study of traditional geographical questions is done in new spatial context. Although the growing importance of relative space is realised, traditional questions like 'where' and 'what is where' have not been altogether abandoned. However their answers and treatment are not the same. Man is increasingly feeding around with space adjusting techniques. We must constantly repeat locational observations in relative spaces, because places do change location in those context. We must be constantly alert to identify these locational changes and measure their extent and effects if we wish to produce expectable explanations of spatial structure and processes.

A concept developed by Donald G. Janelle to monitor locational changes in relative space is 'time-space convergence'. We can monitor the shrinking world by measuring the rates at which places on the surface of the earth approach one another in time distance. Let us take an example for 'where' question in relative

space, say i.e., 'where is Dibrugarh'?

To answer this question we can take the help of a formula put forwarded by Janelle. the formula is—

$$\frac{TT_1 - TT_2}{Y_2 - Y_1}$$

Where T_1 and T_2 are two places and Y_1 and Y_2 are two points of time.

Here,

$T_1 =$ Tezpur

$T_2 =$ Dibrugarh

$Y_2 =$ 2015

$Y_1 =$ 2000

TT_1

TT_2

Travel time taken
between the two places
in two points of time

In Y_1 year time taken to travel from T_1 to $T_2 = 10$ hrs.

In Y_2 year time taken to travel from T_1 to $T_2 = 7$ hrs.

$$\begin{aligned} \therefore \text{time-space convergence} &= \frac{(10-7)\text{hrs.}}{(2015-2000)\text{yrs.}} \\ &= \frac{3\text{hrs.}}{15\text{yrs.}} \\ &= \frac{180\text{min.}}{15\text{yrs.}} \\ &= 12\text{min/yr.} \end{aligned}$$

This means Dibrugarh is converging to Tezpur @ 12min/yr. The question is answered in the language of time-space convergence. The building of modern highways has produced times space convergence in many parts of the world. A peculiarity of time-space convergence is that distant places converge on each

other at a greater rate than the closer places. Janelle illustrates it with a hypothetical example—

Suppose A, B, C, D, E and F are 10 km apart like in the chart (fig.-3)

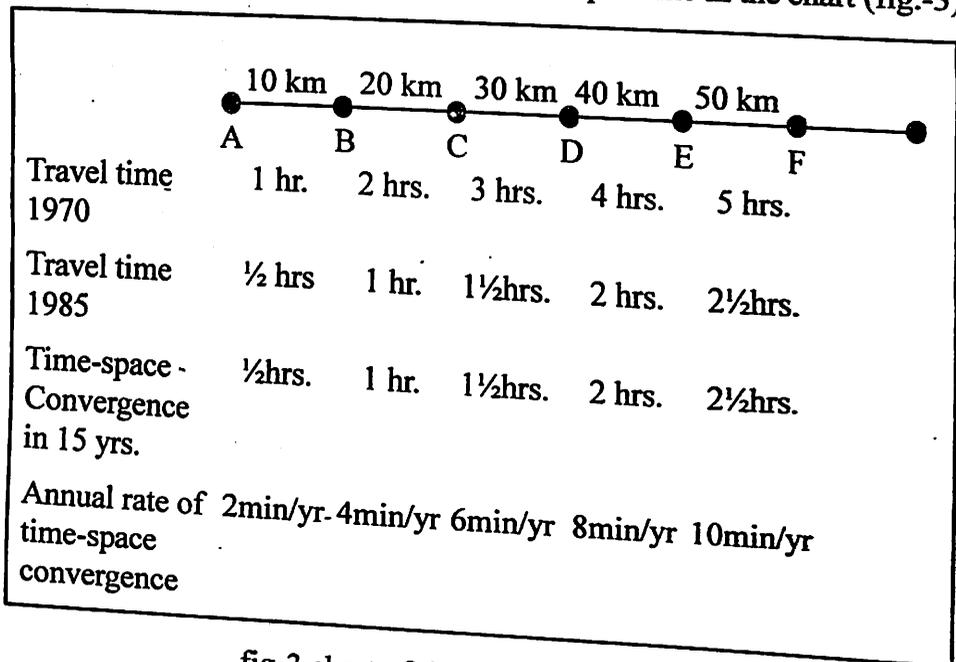


fig-3 chart of time-space convergence

It is clear from the chart that as distance increases the time space convergence is also higher. This time-space convergence gives an opportunity to people for a greater selection of any extra activity by the surplus amount of time in their hands. It is obvious that we must also be concerned with cost-space convergence, 'social-space convergence' and all the ways places are approaching one another as we continue to adjust spaces.

Our interest in distribution is always focused on their spatial structure and the processes. Movements of various phenomena in space creates movement systems. But movement systems favour some areas at the cost of others. Therefore, the relationship between movements (process) and transportation systems (structure) is not one way, but is reflexive and circularly causal. In the same way movement system or space adjusting techniques are very powerful determinants of the location of human activities. At the same time places which are nodal and have already attracted intense human activity exert powerful influence over the

structure of transportation and communication systems. Through these relationship man invents spatial organization. The interaction between structure and process is the main aspect of locational problem, whether we are trying to explain the distribution of neolithic agricultural sites or whether we are trying to decide where to locate a number of hospitals to serve a spatial distribution of people and through which we can break the problem down into term of process, structure and their interaction. We can explain human spatial behavior as the product of relative spaces which man himself creates by his space adjusting activities. Finally, the contemporary questions "Why are the spatial distributions structured the way they are?" is a handy shorthand which represent all the questions for geographers which have to be answered in order to provide satisfactory explanations of spatial process and structure and of the relationship between them.

Source :

* Spatial Organization : The Geographers View of the world, Ronald Abler, John S. Adams, Peter Gould

* Internet. etc.

Quotes on Geography

Collected by : **Gurpreet Kaur Virdhi**
B.A. 5th Semester
Geography Department

1. Geography is about maps, but biography is about Chaps.
— ERIC BENTLEY
2. There is an internal landscape, a Geography of the Soul; we search for its outlines all our lives
— JOSEPHINE HART
3. Our world is evolving without consideration, and the result is a loss of biodiversity, energy issues, congestion in cities. But geography, if used correctly, can be used to redesign sustainable and more livable Cities.
— JACK DANGERMOND

ভূ-মণ্ডলীয় প্রতিৰক্ষাজনিত আৰ্হি Global Strategic Models

ড° ৰাজীৱ হাজৰিকা

সহযোগী অধ্যাপক

ভূগোল বিভাগ, মৰাণ মহাবিদ্যালয়

Strategy শব্দটোৱে ৰাজনৈতিক ভূগোলত শক্তি ব্যৱহাৰৰ কৌশলক বুজোৱা হয়। “ভূমণ্ডলীয় প্রতিৰক্ষাজনিত খণ্ডৰ আৰ্হি বুলি ক’লে প্রতিৰক্ষা জনিত ধাৰণাৰ ভৌগলিক নিৰ্দেশক (Pattern) বুজা যায়। ভূগোল আৰু ৰাজনৈতিক সম্পৰ্কক লৈ চিন্তা-চৰ্চা গ্ৰীকসকলৰ যুগৰ পৰাই চলি আহিছে যদিও সাম্ৰাজ্যবাদৰ সময়ৰ পৰা ইয়াৰ প্ৰৱণতা বেছি হয়। ১৯ শতিকাৰ মাজ ভাগৰ পৰা বিশ্বৰ ৰাজনৈতিক গঠন তথা বিশ্ব শক্তিবোৰৰ বৰ্ণনা দিবলৈ বিভিন্ন জনে কেইবাটাও আৰ্হি আগবঢ়াইছিল। দাৰ্শনিক এৰিষ্টটল আৰু অন্যান্য বহুতে বিশ্বৰ ৰাজনৈতিক গঠনবোৰ ভূ-প্ৰাকৃতিক পৰিৱেশৰ স্থানিক পাৰ্থক্যৰ দ্বাৰা হৈছিল বুলি বৰ্ণনা কৰিছিল। আনহাতে ১৯ শতিকাৰ বিশ্ব শক্তিৰ স্থানিক আৰ্হি (Spatral model) তথা মতবাদবোৰ বিভিন্ন কাৰকৰ ওপৰত নিৰ্ভৰ কৰি আগবঢ়োৱা হৈছিল সেই কাৰক বোৰ হ’ল—বুৰঞ্জীৰ ধাৰাবাহিকতা (historical Continuity) স্থানান্তৰিত ৰাজনৈতিক শক্তিৰ সমতা (Shifting balances of power) ৰাজনৈতিক ধ্যান-ধাৰণাৰ পৰিৱৰ্তন আৰু যোগাযোগ ব্যৱস্থাৰ উন্নতি আৰু অস্ত্ৰৰ আৱিষ্কাৰ আদি এই মতবাদ তথা আৰ্হিবোৰ যুদ্ধৰ দিশৰ পৰা যথেষ্ট গুৰুত্বপূৰ্ণ যদিও বাস্তৱত এইবোৰ ভুল বুলি প্ৰমাণিত হৈছিল। বিশ্বশক্তিৰ বিষয়ে মতবাদ আগবঢ়োৱা সকলৰ ভিতৰত Mahan, Mackinder আৰু Spykman উল্লেখযোগ্য।

এই পাঠৰ পৰৱৰ্তী অংশত তেওঁলোকৰ আৰ্হিবোৰৰ বিষয়ে বৰ্ণনা কৰা হ’ল।

মহানৰ সমুদ্ৰ শক্তিৰ ধাৰণা (Mahan's sea power concept) : ভূ-মণ্ডলীয় প্রতিৰক্ষাজনিত আৰ্হিৰ আগবঢ়োৱা সকলৰ প্ৰথম হ’ল Alfred Thayer Mahan (1840-1914)। তেওঁ আমেৰিকা যুক্তৰাষ্ট্ৰৰ নৌবাহিনীৰ এজন বিষয়া আছিল। পিছত Newport's থকা Naval War College ৰ প্ৰেচিডেণ্ট হয় (1986)। মহানে নৌ শক্তি বিষয়ক কেইবাখনো কিতাপ লিখিছিল। সেইবোৰ হ’ল, The influence of sea power upon History 1660-1783 (1890); The influence of sea power upon the French Revolution and Europe, 1793-1832 (1892); The Life of Nelson (1897)।

The Interest of America in sea power, and the Problem of Asia (1910)। ওপৰত উল্লেখিত কোনো এখন কিতাপতেই তেওঁৰ বিশ্বশক্তিৰ আৰ্হিৰ বিষয়ে সম্পূৰ্ণকৈ পোৱা নাযায় যদিও বিভিন্ন উক্তিৰেই সেইবোৰতেই সিঁচৰতি হৈ আছে। মাহানৰ লিখনিবোৰৰ পৰা বুজা যায় যে বিশ্বৰ শক্তিশালী দেশবোৰৰ মাজত স্থান পাবলৈ হ'লে দেশ এখনৰ সমুদ্ৰৰ ওপৰত ফলদায়ক প্ৰভাৱ থাকিব লাগিব। তেওঁৰ মতে বিশ্বৰ প্ৰধান দেশবোৰৰ মাজত প্ৰাধান্য বিস্তাৰৰ বাবে হোৱা প্ৰতিযোগিতাত সমুদ্ৰ শক্তিৰ প্ৰভাৱ সকলোৰে ওপৰত।

মাহানতত্ত্বৰ আধাৰ :

গোলকীয় ৰাজনীতিত সমুদ্ৰশক্তিৰ ভূমিকাত প্ৰভাৱ পেলোৱা চাৰিটা স্থানিক ৰাজনৈতিক কাৰকেই আছিল মাহানৰ মতবাদৰ মূল আধাৰ। এই কেইটা হ'ল।

১। ভূ-পৃষ্ঠত মহাসাগৰ আৰু সাগৰবোৰ অবিচ্ছিন্ন ভাৱে লগ লগা আৰু ই সামুদ্ৰিক যোগাযোগৰ এক প্ৰণালীৰ সৃষ্টি কৰিছে।

২। পৃথিৱীত এখন বৃহৎ আন্তঃ মহাদেশীয় আৰু প্ৰায় সম্পূৰ্ণ ভূমিৰে আগুৰা (Land locked) দেশ আছে। এইখন হ'ল ৰুছ সাম্ৰাজ্য যিখনৰ বিস্তৃতি উত্তৰ মেৰুৰ পৰা দক্ষিণৰ উষ্ণ মেৰু ভূমি আৰু পাৰ্বত্য অঞ্চললৈ আৰু পশ্চিমে পূব ইউৰোপৰ পৰা এছিয়া মহাদেশৰ পূবলৈকে বিস্তৃত।

৩। আন্তঃ মহাদেশীয় ৰুছ সাম্ৰাজ্যৰ চাৰিওফালে সমুদ্ৰৱৰ্তী ইউৰোপীয় দেশ আৰু দক্ষিণ আৰু পূব এছিয়াৰ সমুদ্ৰৱৰ্তী দেশবোৰে আগুৰি আছে।

৪। তিনিখন দ্বীপৰাষ্ট্ৰ গ্ৰেট ব্ৰিটেইন, জাপান আৰু আমেৰিকা যুক্তৰাষ্ট্ৰ ইউৰেছিয়ান মূল ভূ-খণ্ডৰ পৰা বিচ্ছিন্ন হৈ আছে।

অভিধাৰণা :

মাহানৰ মতে সমুদ্ৰ হ'ল প্ৰধান পথ, যি পথেদি যিকোনো দিশতে যাব পাৰি। বাণিজ্য নিৰ্ভৰ সমসাময়িক বিশ্বত সেয়ে সুগম সামুদ্ৰিক অৱস্থা ৰাজনৈতিক, অৰ্থনৈতিক দিশত লাভজনক/সুবিধাজনক হয়। আনহাতে মহাদেশীয় তথা ভূমিৰে আগুৰা অৱস্থা অসুবিধাজনক হয়।

তত্ত্ব :

মাহানৰ তত্ত্বটো হ'ল যিখন দেশৰ সূচল তথা লাগতিয়াল উপকূল ৰেখা আছে আৰু সামৰিক তথা প্ৰতিৰক্ষাজনিত উপনিবেশ আছে সেইখন দেশেই শক্তিশালী সমুদ্ৰ শক্তি হিচাপে থিয় দিব পাৰিব।

মাহানে স্থল আধাৰিত সমুদ্ৰ শক্তিৰ ওপৰত বেছি গুৰুত্ব দিছিল। বৃটিছৰ সামুদ্ৰিক শক্তি আৰু বুৰঞ্জী বিশ্লেষণ কৰি মাহানে সমুদ্ৰ শক্তিৰ ছয়টা প্ৰধান কাৰকক চিনাক্ত কৰিছিল। সেইকেইটা হ'ল—

১। (Geographical Location of the State) দেশ এখনৰ ভৌগোলিক অৱস্থান : দেশখনৰ কেইখন সাগৰৰ লগত সীমা আছে। যদি আছে সাগৰবোৰ পৰস্পৰ সংযুক্ত হয়নে আৰু সহজ যোগাযোগ ব্যৱস্থা আছেনে। দ্বিতীয়তে দেশখনৰ ভূমি সীমাৰ বিস্তৃতি। তাৰোপৰি দেশখনে প্ৰধান বাণিজ্য পথবোৰৰ ওপৰত নিজৰ ক্ষমতা জাহিৰ কৰিব পৰা অৱস্থাত আছেনে নাই তথা সাম্ভাব্য শত্ৰু দেশক ভয় খুৱাব পৰাকৈ জাহাজৰ ব্যৱস্থা আছেনে নাই।

২। দেশখনৰ আকৃতি (তট ৰেখাৰ আকৃতি প্রকৃতি (The Physical conformation of the State (configuration of its coastline) : দেশ এখনৰ তট ৰেখাত প্ৰাকৃতিক হাৰবাৰ (পোতাশ্ৰয়) মোহনা, প্ৰৱেশ পথ আৰু নিগম পথৰ (in lets and outlets) আছেনে নাই। মাহানৰ মতে দেশ এখনৰ পোতাশ্ৰয়বোৰ দ আৰু জাহাজ চলাচল কৰিব পৰা নদীৰ নিৰ্গম পথ হ'লে দেশখন সম্পদশালী আৰু শক্তিশালী হয়। কিয়নো ই দেশখনৰ আন্তঃ বাণিজ্যিক সুচল কৰি তোলে। কিন্তু এইবোৰৰ বেছি প্ৰৱেশ্যতা (accessibility) দুৰ্বলতাৰ উৎস (যুদ্ধৰ সময়ত) যদিহে ভালদৰে সুৰক্ষিত কৰা নহয়।

৩। দেশখনৰ ভূখণ্ডৰ বিস্তৃতি (Extent of territory of the state) : দেশ এখনৰ উপকূল ৰেখাৰ দৈৰ্ঘ্য আৰু বাহিৰা শত্ৰুৰ আক্ৰমণৰ বিৰুদ্ধে প্ৰতিৰক্ষাৰ সক্ষমতা।

৪। জনসংখ্যাৰ আকাৰ (The size of the population of the state) : জাতি গঠন আৰু নৌ বাহিনীৰ কাৰণে বৃহৎ জনসংখ্যাৰ প্ৰয়োজন। বেছি জনসংখ্যা যুক্ত দেশে সমুদ্ৰৰ সিপাৰৰ আধাৰ আৰু উপনিৱেশবোৰ প্ৰতিপালন কৰিব পাৰে যিহেতু ইয়াত যথেষ্ট সংখ্যক সৈন্য আৰু প্ৰশাসনীয় লোকৰ প্ৰয়োজন। কম জনসংখ্যাৰ দেশৰ কাৰণে এইবোৰ অসম্ভৱ।

৫। ৰাষ্ট্ৰীয় চৰিত্ৰ (National Character) : ইয়াৰ দ্বাৰা মাহানে দেশখনৰ বাসিন্দাসকলৰ সামূহিক অভিয়ান আৰু বাণিজ্যৰ প্ৰতি থকা ৰাপৰ বিষয়ে বুজাইছে।

৬। চৰকাৰৰ চৰিত্ৰ আৰু নীতি (The Character of Government and its policy) : মাহানৰ মতে দুৰদৰ্শী চৰকাৰ এখন আৰু এটা সাহসী প্ৰশাসনিক নীতিৰ প্ৰয়োজন। কাৰণ ই প্ৰাকৃতিক অৱস্থান আৰু বৃহৎ তথা উদ্যমী জনসাধাৰণে আগবঢ়োৱা সুচলতাক এনেকুৱা চৰকাৰ আৰু প্ৰশাসনিক নীতিয়েহে ভালদৰে ব্যৱহাৰ কৰিব পাৰিব। মাহানে ৰাছিয়া, গ্ৰেট ব্ৰিটেইন আৰু আমেৰিকা যুক্তৰাষ্ট্ৰৰ শক্তি আৰু দুৰ্বলতাবোৰৰ তুলনামূলক অধ্যয়ন কৰিছিল। তেওঁৰ মতে ৰুছ সাম্ৰাজ্যৰ বিশালতা, ভূ-প্ৰাকৃতিক বাধা, দুৰত্ব আৰু অনগ্ৰসৰ আন্তঃ যোগাযোগে অৰ্দ্ধদেশীয় একতাক বাধাগ্ৰস্ত কৰে। তাৰোপৰি মহাদেশীয় (Land locked) অৱস্থানৰ ফলত সাগৰীয় শক্তিয়ে দেশখনক ধ্বংস কৰিব নোৱাৰিলেও বান্ধি ৰাখিব পাৰিব।

আনহাতে ইয়াৰ সম্পূৰ্ণ বিপৰীত গ্ৰেট ব্ৰিটেইনৰ ভৌগলিক অৱস্থান। ক্ষুদ্ৰ প্ৰকৃতিৰ হ'লেও দেশখনৰ বিশ্বব্যাপী সাম্ৰাজ্য আছে। দেশখনৰ সুচল সামুদ্ৰিক অৱস্থানে দেশখনক শক্তিশালী সমুদ্ৰ শক্তি তথা অগ্ৰণী বিশ্বশক্তিত পৰিণত কৰিছে। সেয়ে এইখন দেশে সাগৰীয় শক্তি আৰু বিশ্বব্যাপী থকা আধাৰৰ (base) যোগেদি ৰুছিয়াক সহজে বাধা দিব আৰু গতিবিহীন কৰিব পাৰিব। তেওঁ গ্ৰেটব্ৰিটেইনৰ বিশ্বব্যাপী থকা সমুদ্ৰ শক্তিৰ অধ্যয়ন তথা বিশ্লেষণ কৰিছিল। দেশখনৰ দ্বীপীয় অৱস্থানৰ ফলত বহিঃ শত্ৰুৰ আক্ৰমণৰ পৰা সুৰক্ষিত হৈ থাকিব পাৰে। সেইয়ে প্ৰতিৰক্ষাত বৃহৎ বিনিয়োগ নকৰিলেও চলে ইয়াৰ ফলত বাহি হোৱা মানৱ শক্তি আৰু অৰ্থ নৌ শক্তিত বিনিয়োগ কৰিব পাৰে। তাৰোপৰি দেশখনৰ (উত্তৰ ইউৰোপ আৰু আটলাণ্টিকৰ মাজত) ভৌগলিক অৱস্থাৰ ফলত বাণিজ্যৰ ক্ষেত্ৰতো প্ৰাধান্য বিস্তাৰ কৰিছিল। আকৌ ইউৰোপীয়ান দেশবোৰৰ জাহাজবোৰ ইংলিচ চেনেলেৰে পাৰ হৈ যাব লাগিছিল। ব্ৰিটিছ নৌ বাহিনীয়ে সেয়ে উত্তৰ আৰু পশ্চিম ইউৰোপীয় দেশবোৰৰ সমুদ্ৰ বাণিজ্যক বাধা দিব পাৰিব। সামুদ্ৰিক অৱস্থানৰ

Who rules east Europe, commands the Heartland,
 Who rules the Heartland, commands the world Island,
 Who rules the world Island, Commands the world,

মেকিণ্ডাৰে তেওঁৰ তন্ত্ৰটোত গোলকী ভূ-ৰাজনৈতিক সংৰচনাৰ আৰ্হি এটা কল্পনা কৰি লৈছিল। তেওঁৰ মতে এখন গোলকীয় মহাসাগৰৰ মাজত এটা ভূমণ্ডলীয় দ্বীপ আছে যিটো দ্বীপ ইউৰোপ এছিয়া আৰু আফ্ৰিকা মহাদেশক লৈ গঠিত। ব্ৰিটিছ দ্বীপপুঞ্জ আৰু জাপান দ্বীপপুঞ্জক উপকূলীয় দ্বীপ হিচাপে আৰু আমেৰিকা (দুয়োখন) আৰু অষ্ট্ৰেলিয়াক বহিঃদ্বীপ হিচাপে অভিহিত কৰিছিল। মেকিণ্ডাৰে লক্ষ্য কৰিছিল ভূমণ্ডলীয় দ্বীপটোৱে ভূ-পৃষ্ঠৰ দুই তৃতীয়াংশ ঠাই আশুৰি আছে আৰু পৃথিৱীৰ মুঠ জনসংখ্যাৰ ৯০ শতাংশ ইয়াত বাস কৰে। আনহাতে বহিঃদ্বীপে আশুৰা এক তৃতীয়াংশ ঠাইত ছয়ভাগৰ দুই শতাংশ জনসংখ্যা ধাৰণ কৰি আছে।

অন্তঃস্থল (Heart Land) :

মেকিণ্ডাৰে ভূ-পৃষ্ঠৰ ভূ-খণ্ড তথা দেশবোৰক তিনিটা অঞ্চলত ভাগ কৰিছিল। ইয়াৰ প্ৰথম অঞ্চলটো হ'ল সম্পূৰ্ণ মহাদেশীয় শাহ অঞ্চল (Pivot area) অথবা অন্তঃস্থল (Heart Land)। এইটো ইউৰেছিয়াৰ বৃহৎ অঞ্চল। এই অঞ্চলটো পশ্চিমৰ ভগ্না নদীৰ পৰা পূবৰ চাইবেৰিয়া লৈ আৰু হিমালয়ৰ পৰা উত্তৰ মহাসাগৰলৈকে প্ৰায় ৯ নিযুত বৰ্গমাইল আশুৰি আছে (ইউৰোপ মহাদেশৰ ই প্ৰায় দুগুণ) অঞ্চলটোৰ বিশেষত্ব হ'ল এই যে ইয়াৰ তিনিটা দিশ পৰ্বতেৰে আৰু চতুৰ্থদিশ বৰফ যুক্ত সাগৰেৰে আশুৰি আছে। ফলত এই অঞ্চলটো সাগৰীয় জাহাজৰ সমুদ্ৰ শক্তিৰ কাৰণে অগম্য। (Pivot area) শাহ অঞ্চলত ছয় খন বিখ্যাত নদী আছে। ইয়াৰে ভগ্না, অক্সাচ (Oxus) আৰু Jaxarteo নলীয়া বৈ গৈছে আৰু Obi, Yenesei আৰু Lena উত্তৰৰ বৰফযুক্ত সাগৰলৈ বৈ গৈছে।

নৈবোৰ স্থলেৰে আশুৰা সাগৰ আৰু হুদলৈ বৈ গৈছে নাইবা উত্তৰ মহাসাগৰলৈ বৈ গৈছে যিখন গোটেই বছৰ বৰফেৰে আশুৰি থাকে।

১৯০৪ চনত মেকিণ্ডাৰে আগবঢ়োৱা 'Pivot area' ই পূব ইউৰোপৰ ৰুছিয়াৰ কিছু অংশ আৰু এছিয়া মহাদেশৰ ৰুছিয়াৰ বাদেও পশ্চিম, চীন, মংগোলীয় আফগানিস্থান, বালছিস্থান আৰু ইৰাণৰ কিছু কিছু অংশক লৈ গঠিত আছিল। কিন্তু পৰিৱৰ্তিত ৰাজনৈতিক আৰু অৰ্থনৈতিক পৰিৱেশৰ ফলত মেকিণ্ডাৰে ১৯১৯ চনত পুনৰ শাহ অঞ্চলৰ পৰিসীমাৰ পৰিৱৰ্তন ঘটায়। পশ্চিমলৈ বিস্তৃতি ঘটে। ইউৰোপৰ সম্পূৰ্ণ ৰুছিয়াক সামৰি লয়। বুল্টিচ সাগৰ, নৌ পৰিবাহী ডানিয়ুবৰ মধ্য আৰু নামনি অঞ্চল, কৃষ্ণ সাগৰ, এছিয়া মাইনৰ, অৰ্মেনিয়া, পাৰ্চিয়া, তিব্বত আৰু মঙ্গোলিয়া আদিক সামৰি লয়।

১৯৪৩ চনত মেকিণ্ডাৰে পুনৰ অন্তঃস্থলৰ ভৌগলিক বিস্তৃতিৰ পৰিৱৰ্তন ঘটাই, য'ত তেওঁ চাইবেৰিয়াৰ পূব অংশক বাদ দিয়ে অৰ্থাৎ Lena land ক বাদ দিয়া হয়।

অন্তঃ অৰ্ধ চন্দ্ৰাকৃতি অঞ্চল অথবা পাৰ্শ্বঅৰ্ধ চন্দ্ৰাকৃতি অঞ্চল (Inner or Marginal Crescent) :

শাহ অঞ্চলক আশুৰি থকা ইউৰেছিয়াৰ পাৰ্শ্বৱৰ্তী অঞ্চলটোক অন্তঃ অৰ্ধ চন্দ্ৰাকৃতি অঞ্চল বুলি কোৱা হয়। বুজোৱা হয়। ইউৰোপীয় উপকূলীয় অঞ্চল স্কেন্দিনেভিয়াৰ পৰা এছিয়াৰ মঞ্চোৰিয়ালৈকে এই অঞ্চলটোৱে বৃত্তাকাৰ ভাঁজলৈ বিস্তৃতি আছে। ৰুছিয়াৰ বাদে সম্পূৰ্ণ ইউৰোপৰ দেশবোৰ, উত্তৰ, মধ্য

প্ৰাচ্যৰ বেছি অঞ্চল আৰু এছিয়া মৌচুমী জলবায়ুৰ দেশ যেনে ভাৰত, দক্ষিণ-পশ্চিম এছিয়া আৰু পূব এছিয়াক লৈ এই অঞ্চল গঠিত।

অস্তঃস্থল/শাহ অঞ্চলৰ বিপৰীত এই অঞ্চলটো সমুদ্ৰ প্ৰবাহী আৰু জাহাজ চলাচল কৰিব পৰা নদী আছে। সেয়ে এই অঞ্চলটো সমুদ্ৰ শক্তিৰ বাবে প্ৰৱেশ্য। তাৰোপৰি মেকিণ্ডাৰে পৰ্যবেক্ষণ কৰিছিল যে পৃথিৱীৰ প্ৰধান ধৰ্ম কেইটাৰ অঞ্চল বোৰো ইয়াৰ ভিতৰতে পৰে।

বহিঃ অৰ্ধ চন্দ্ৰাকৃতি অঞ্চল (Outer or Insular Crescent) বা দ্বীপীয় অৰ্ধঃ চন্দ্ৰাকৃতি অঞ্চল :

অস্তঃস্থলৰ পাশ্বৰতী অৰ্ধঃ চন্দ্ৰাকৃতি অঞ্চলৰ বাহিৰত ভূ-মণ্ডলীয় মহাসাগৰ আৰু দুৰে দুৰে অৱস্থিত স্থল ভাগ বহিঃ অৰ্ধ চন্দ্ৰাকৃতি অঞ্চলটোৰ সৃষ্টি কৰিছে। এই অঞ্চলটো উত্তৰ আমেৰিকা আৰু অষ্ট্ৰেলিয়া, ব্ৰিটিছ দ্বীপপুঞ্জ, জাপান দ্বীপপুঞ্জ, আফ্ৰিকা (চাহাৰাৰ দক্ষিণ) মহাদেশক লৈ গঠিত।

অস্তঃস্থলৰ গুৰুত্ব (Importance of Heart Land) :

মেকিণ্ডাৰে অস্তঃ অথবা বহিঃ অৰ্ধচন্দ্ৰাকৃতি অঞ্চলতকৈ শাহ অথবা অস্তঃ স্থলৰ ওপৰত বেছি গুৰুত্ব দিছিল। তেওঁৰ মতে শাহ অঞ্চল হ'ল বৃহৎ অঞ্চল য'ত আৰ্কটিক আৰু অস্তঃস্থল প্ৰবাহী নৈ আছে আৰু চাৰিওফালে পৰ্বতেৰে আগুৰি আছে। (পশ্চিম দিশৰ বাদে) যি এই অঞ্চলটোক বাহিৰা আক্ৰমণৰ পৰা সুৰক্ষা প্ৰদান কৰে। অস্তঃস্থলৰ গুৰুত্ব ইয়াৰ বিশালতা, কেন্দ্ৰীয় অৱস্থান আৰু অগম্যতাই নিৰ্ধাৰণ কৰিছে। বিশাল অঞ্চল হ'ল শক্তিৰ উৎস আৰু ই আতি প্ৰয়োজনীয় খাদ্য আৰু কেঁচা মালৰ যোগান ধৰে। আনহাতে কেন্দ্ৰীয় অৱস্থান আৰু অগম্যতাই প্ৰতিৰক্ষাৰ সুবিধা বৃদ্ধি কৰে। মেকিণ্ডাৰে আশা কৰিছিল যে (Heart land) অস্তঃস্থলত ৰেল যোগাযোগৰ প্ৰসাৰ ঘটিব যি চলিত পৰিবহন ব্যৱস্থাক (ঘোঁৰা আৰু উট নিৰ্ভৰ) অপসাৰিত কৰিব।

পূৰ্বানুমান (The Predictions) :

মেকিণ্ডাৰে বিশ্বাস কৰিছিল যে অস্তঃস্থলৰ পৰা এটা বৃহৎ স্থল শক্তিৰ উত্থান ঘটিব। এই শক্তিৰ বিস্তাৰ প্ৰথমে ইউৰোপ এছিয়াৰ পাশ্বৰতী অঞ্চলত আৰু তাৰ পৰা বিশ্বৰ অন্য প্ৰান্তলৈ ঘটিব। ১৯০৪ চনত তেওঁ শাহ অঞ্চলৰ দেশ ৰাছিয়াৰ উত্থানত ইমান গুৰুত্ব দিয়া নাছিল। বৰঞ্চ জাৰ্মানীয়ে শাহ অঞ্চলক নিজৰ আওতালৈ আনিবলৈ চেষ্টা কৰিব পাৰে আৰু অৱলীলা ক্ৰমে গোলকীয় দ্বীপৰ শাসনকৰ্তা তথা বিশ্বৰ শাসনকৰ্তা হ'ব বুলি ভৱিষ্যতবাণী কৰিছিল। তেওঁ এইটোও দেখুৱাইছিল যে উত্তৰ ইউৰোপীয় সমভূমিয়েদি হাৰ্টলেণ্ডত বহিঃশক্তিয়ে প্ৰৱেশ কৰিব পাৰিব। তেওঁৰ মতে পিভট ৰাজ্য ইউৰেছিয়াৰ উপকূলীয় অঞ্চললৈ হোৱা প্ৰসাৰণৰ ফলত স্থলভাগৰ বিশাল সম্পদবোৰ জাহাজ বনোৱাত ব্যৱহৃত হ'ব আৰু ইয়াৰ পৰিণতিত সাম্ৰাজ্যখন নিজৰ নজৰত থাকিব। এইটো সম্ভৱ হ'ব যদিহে জাৰ্মানীয়ে ৰাছিয়াৰ সৈতে মিত্ৰতা কৰে।

১৯৪৩ চনত মেকিণ্ডাৰে তেওঁৰ তত্ত্বটোৰ পুনৰ সংশোধন কৰিছিল। দ্বিতীয় বিশ্বযুদ্ধত আমেৰিকা যুক্তৰাষ্ট্ৰ আৰু ইউ. এচ. এচ. আৰ. ছোভিয়েট ৰাছিয়াই তেওঁলোকৰ সামৰিক শক্তি আৰু ৰাজনৈতিক গুৰুত্ব প্ৰদৰ্শন কৰিছিল। সেয়ে মেকিণ্ডাৰে অনুধাৱন কৰিছিল যে বিশ্ব শাসন কৰিব পৰাৰ বিপদ আহিব পাৰে মাথো 'Pivot' দেশ ছোভিয়েট ৰাষ্ট্ৰৰ পৰা। কিয়নো ইতিমধ্যে জাৰ্মানীয়ে ৰাছিয়া আক্ৰমণ কৰি জয় কৰাত অসফল হৈছিল। যদিহে ছোভিয়েট সংঘই জাৰ্মানীক দমন কৰিব পাৰে তেতিয়া ই বৃহৎ স্থল শক্তিত পৰিণত হ'ব। তাৰোপৰি ছোভিয়েট দেশ প্ৰতিৰক্ষা দিশৰ পৰা শক্তিশালী দেশ হিচাপে পৰিগণিত হ'ব। তেওঁ মন্তব্য

আগবঢ়াইছিল যে যোৱা ৩০, ৪০ বছৰৰ আগৰ অৱস্থাতকৈ হাৰ্টলেণ্ড তত্ত্বটো সেই সময়ত (দ্বিতীয় বিশ্বযুদ্ধৰ সময়ত) বেছি যুক্তিসংগত আৰু ব্যৱহাৰ উপযোগী।

সমালোচনা (Criticism of Heart Land Theory) :

মেকিণ্ডাৰৰ সমসাময়িক বিদ্বানসকলে হাৰ্টলেণ্ড তত্ত্বৰ নাৰ্যতাৰ বিষয়ে কোনো ধৰণৰ প্রশ্ন উত্থাপন কৰা নাছিল যদিও যথেষ্ট আলোচিত হৈছিল। বহুকেইজন লেখকে মেকিণ্ডাৰ তত্ত্বৰ অশুদ্ধতাৰ বিষয়ে সমালোচনা কৰিছিল। তেওঁলোকৰ ভিতৰত Nicholas J. Spykman, Donald W. Meining, David J. M. Hooson, Arthur R. Hall, Norman Pounds and W.G. East আদি। তথাপি তত্ত্বটো ৰাজনীতিৰ ভূগোলৰ প্ৰধান অংগ হিচাপে পৰিগণিত হৈছে। বহুতে মেকিণ্ডাৰক প্ৰশংসাও কৰিছিল। বিশেষকৈ দ্বিতীয় বিশ্বযুদ্ধৰ পিছত ইয়াৰ সমালোচনা হৈছিল।

ছোভিয়েট ইউনিয়নে পূব ইউৰোপত প্ৰাধান্য লাভ কৰাৰ বাবে মেকিণ্ডাৰৰ পূৰ্বানুমান সত্য হোৱা নাছিল। তেওঁৰ সমালোচকসকলে মেকিণ্ডাৰক বিশ্বব্ৰহ্মাণ্ডৰ পৰিৱৰ্তনশীল প্ৰযুক্তিৰ বিবেচনা কৰিব নোৱাৰাটোক প্ৰবলভাৱে আক্ৰমণ কৰিছিল। হাৰ্টলেণ্ডৰ ক্ষমতা আৰু প্ৰতিৰক্ষাৰ ওপৰত শক্তিৰ বেছি প্ৰাধান্য দিয়াৰ বাবেও তত্ত্বটো সমালোচিত হৈছিল। এইটো সত্য যে উত্তৰ মহাসাগৰ আৰু ইয়ালৈ প্ৰবাহিত হোৱা নদীবোৰত জাহাজ চলাচল কৰাতো অসুবিধা জনক সেয়ে উত্তৰ দিশৰ পৰা ইয়াত প্ৰৱেশ কৰাতো অসম্ভৱ। তাৰোপৰি মেকিণ্ডাৰে দেখুওৱা পৃথিৱীৰ মেপ 'Mercator projection'ত অঙ্কন কৰিছিল য'ত বৰফযুক্ত উত্তৰ মহাসাগৰক বহুত ডাঙৰকৈ দেখা যায়, যি হাৰ্টলেণ্ডৰ উত্তৰ দিশত বিশাল বৰফ ক্ষেত্ৰ আছে বুলি ভুল ধাৰণা জন্মায়। আনহাতে বৰ্তমানৰ প্ৰযুক্তি যেনে আনৱিক বৰফ কটা মেচিনৰ প্ৰয়োগৰ ফলত খৰচী হ'লেও চাইবেৰিয়াৰ নদীবোৰলৈ জাহাজ চলাচল কৰিব পৰা যায়।

মেকিণ্ডাৰে হাৰ্টলেণ্ড তত্ত্বটো স্থল আৰু সমুদ্ৰ শক্তিৰ গইনা লৈ বিশ্লেষণ কৰিছিল। তেওঁ যদিও মহাকাশ যুগৰ প্ৰাৰম্ভণীত এই তত্ত্বটো আগবঢ়াইছিল তথাপি তেওঁ বায়ুশক্তিক অনুধাৱন কৰিব পৰা নাছিল। আনকি ১৯৪৩ চনতো তেওঁ বায়ু শক্তিয়ে যে নৌ আৰু স্থল সেনাক পিছ পেলাব তাত পতিয়ন যোৱা নাছিল। 'Hooson'ৰ মতে বায়ু শক্তিৰ উদ্ভাৱন আৰু মহাদেশৰ পৰা মহাদেশলৈ মাৰিব পৰা মিছাইল আৰু Hydrogen bombৰ আৱিষ্কাৰে মেকিণ্ডাৰৰ হাৰ্টলেণ্ডৰ বহু ভিতৰলৈ সোমাব পাৰিব যিটো সমুদ্ৰ শক্তিৰ বাবে অসম্ভৱ।

'Alexander de Seversky' (1950) ৰ মতে বৃহৎ বায়ু শক্তিৰ ওচৰত স্থল আৰু সমুদ্ৰ শক্তিয়ে বশ্যতা স্বীকাৰ কৰিব। তাৰোপৰি বৃহৎ শক্তিবোৰৰ নিজ দেশৰ এলেকা আনখন দেশৰ বায়ু শক্তিৰ লক্ষ্যৰ ভিতৰত থাকিব। এইটো হ'ল হাৰ্টলেণ্ড তত্ত্বৰ প্ৰধান দুৰ্বলতা।

John Slessor (1955) মতে আকাশ মাৰ্গেৰে মাৰিব পৰা আনৱিক যুদ্ধাস্ত্ৰই হাৰ্টলেণ্ড তত্ত্বৰ প্ৰাসংগিকতা নাইকিয়া কৰিব। সেয়ে হাৰ্টলেণ্ডৰ আকৃতি, কেন্দ্ৰীয়তা আৰু অগম্যতাই অসুবিধাৰ সৃষ্টি কৰিব। জাৰ্মানী, জাপান দ্বিতীয় বিশ্বযুদ্ধত পৰাজয় আৰু ব্ৰিটেইন আৰু ফ্ৰান্সৰ অৱনতিয়ে বিশ্বত ছোভিয়েট দেশক প্ৰধান শক্তি হিচাপে প্ৰক্ষেপ কৰে যদিও 'Hall' ৰ মতে ৰাছিয়াৰ উত্থানে মেকিণ্ডাৰৰ ভৱিষ্যত বাণীক প্ৰতিফলিত নকৰে। মেকিণ্ডাৰে অন্য এটা হাৰ্টলেণ্ড (North America)ৰ ওপৰত গুৰুত্ব দিয়া নাছিল, যি

El Nino and its Affect on Indian Monsoons

Dr. Meetalī Chaliha

Associate Prof.

Dept. of Geography, DHSK College

El Nino is a disruption along the equatorial Pacific, mainly at a distance of 180 km from the Peruvian coast of South America. It is a sub surface warm current which flows from north to south between 3°S and 36°S latitudes. The term 'El Nino' refers to 'the little boy' in American Spanish. 'El Nino de Navidad' is the original name which had its origin centuries back. The Peruvian fisherman named the weather phenomenon in reference to newborn Christ as the pool of warm water in the Pacific near South America is often at its warmest around Christmas. 'El Nino' which is related to the increase of temperature of East Pacific Ocean bring heavy rainfall in the dry coastal lands of Peru.

The first written record of this significant weather phenomena was found in 1525. It was Francisco Pizarro who for the first time noted that occurrence of rainfall in the deserts of Peru is the impact of El Nino. There is a belief that the Inca Empire which is a part of modern Peru sacrificed humans to prevent rains associated with El Nino which led to four to six times more rainfall than normal. It has been found through modern research that since 1900 atleast twenty six El Nino events have occurred with the strongest occurring on 1982-83, 1997-98 and 2014-16.

This climatic abnormality occurs at irregular intervals of two to seven years and lasts for nine months to two years. When the length of the El Nino extends for a period of seven to nine months it is termed as 'El Nino conditions' and if its duration is longer it is known as an 'El Nino Episode.'

Due to strong El Nino the tropical eastern Pacific receives many times more

rainfall than normal but in the tropical western Pacific drought condition prevails. The low level surface trade winds which normally blows from east to west along the equator either weakens or changes its direction. As El Nino represents large atmospheric perturbations to which the ocean responds with warmer or colder surface temperatures it leads to extreme events such as droughts, floods and poor monsoons.

Thus El Nino has a significant affect on the Indian Monsoons. El Nino, a narrow warm current which is a temporary replacement of cold Peru current off the coast of Peru in December increases the surface water temperature of the tropical Pacific. This in turn affects the global pressure and wind systems including the monsoon winds in the Indian Ocean.

The first Director General of Indian Meteorological service, Gilbert Walker was the first to trace the El Nino impact in 1924. He detected a 'see saw' pattern of meteorological change with high pressure on the Pacific Ocean accompanied by low pressure in the Indian ocean and vice versa, which he termed as 'Southern Oscillation'. J. Bjerknes, a Dutch meteorologist after about four decades established the intimate link between the Southern Oscillation and the El Nino and at present it has become an established fact that Indian Monsoon is directly related to Southern Oscillation and El Nino. It was Charles Todd who for the first time tried to establish a relationship between El Nino and droughts in India.

Pressure and rainfall are inversely related. During winter, low pressure prevails over the Indian Ocean and hence there are chances of good monsoon rains. Southern Oscillation Index (SOI) is a standardized inde based on observed sea level pressure differences and it is one of the key indices for gauging the strength of the El Nino. The large scale fluctuations in air pressure occurring between the western and eastern tropical Pacific during the El Nino episodes can be measured through it. Prolonged periods of negative SOI values are related with abnormally warm ocean water across the eastern tropical Pacific. This negative SOI is closely related with the occurrence of the El Nino which is called the El Nino Southern Oscillation (ENSO). This leads to a higher pressure over north Indian Ocean and a poor or indifferent monsoon.

Thus the El Nino is associated with negative SOI or warm phase of the Pacific. When this phase occurs, trade winds weaken or even cease and warm water from the western Pacific oscillate back towards the east thus slowing or entirely stopping the cooler water along the eastern Pacific.

Meteorological observation show that two gigantic cells dominate the

circulation of air over the tropics. The first is the Hadley cell, which is a global scale tropical atmospheric circulation where air rises near the equator and flows poleward at 10-15 km above the surface descending in the subtropics and then returning equatorward near the surface. This circulation is responsible for the creation of trade winds. This cell which is oriented in the north south direction has its ascending limb over the plateau of Tibet. The ascending air from Tibet moves southward as tropical easterly jet and descends over the Indian Ocean. The second cell is the Walker Cell where the circulation of air is longitudinal. High pressure areas are formed over cooler eastern Pacific waters and areas of low pressure are formed over the warmer eastern Pacific. As winds move from high to low pressure they cross the Pacific from east to west forming trade winds. The ascending limbs of air cool the sea surface and descending limbs increase the sea surface temperature. During El Nino larger areas of India becomes a zone of descent which leads to poor monsoon and drought conditions.

So Indian Monsoon which is the seasonal change in atmospheric circulation accompanied by corresponding changes in precipitation has an inverse relationship with the El Nino. Due to the warming of the Pacific Ocean during the summer season the trade winds moving westward towards Asia from South America weakens. This results in the reduction of heat and moisture content in the atmosphere. The South West monsoon winds being devoid of moisture content cannot cause rainfall and thus drought conditions prevail over the Indian sub-continent.

The tendency for poor monsoons to be associated with El Nino has been proved by an analysis of meteorological data for three decades from 1972-73 to 2013-14. Within this period there were 14 drought years out of which 9 had been El Nino years. So El Nino may be regarded as one of the factors which influences the Indian monsoon circulation.

References :

1. Gautam, A : Geography of India
2. Khullar, D R : India a comprehensive Geography.
3. Lal, D S : Climatology.
4. Twiari, R C : A comprehensive Geography of India.

Basics of Geography

Dr. K. Kalita

Department of Geography
Tinsukia College, Assam &

Dr. (Mrs) M. Gogoi

Department of Geography
Moran College, Assam

The planet earth is the home of millions and millions of lives in different forms. Every life form has specific arrangement of their survival mechanism. Other form of life except man always maintains a proper balance with nature for their healthy growth and endurance. Man is the most active and integral part of nature. Man with his cognitive and intellectual caliber can alter his site, situation, setting and surrounding to a considerable extent. Further, he can create a congenial environment to live harmoniously and cordially with his surroundings. However, due to the increase of population and the unprecedented pressure on the nature there has been arising imbalance situation in different parts of the present day world. As the study of relationship between man and his surroundings is the central theme of geographical knowledge, hence geographical knowledge is more relevant for the present society to erase all ills from our surroundings.

What is Geography?

The word *geography* was derived from Greek word '*geographid*, which means description of the earth. The term was coined by Greek scholar, Eratosthenes. It seeks to understand the human and physical features through an understanding of place and location. It may be said that geography is the mother of all sciences, which connects people, places and the earth. The relationship between man and his environment is the focal theme of geography.

It is the study of cause and effect relationship and also is a spatiotemporal analysis of phenomena on the earth. Since its beginning, many scholars especially from Greece, Rome, Germany, France, Arabian, China, America, Poland, England and India etc countries defined geography in many ways. Besides, geographers study several types of phenomena on the earth; surface and these phenomena are dealt with by other subjects also. For example, the difference between geomorphology and geology is often confusing. Geographers tend to study the different features of the earth, landscapes, location and the man-environment relation. On the other hand, geologists enquire deeper into the interior of the earth, rocks, internal processes and also the geological time span. Hence, it is sometimes difficult to define what geography is. Further, the concept of geography has also been changing with time and circumstances. Therefore, it is not easy to define geography by a single definition. However, a few definitions given by some famous geographers since its beginning are given below.

The purpose of geography is to provide a view of the whole earth by mapping the location of places- **Ptolemy**

The geographers are the persons who attempts to describe parts of the earth- **Strabo**

Synoptic discipline synthesizing findings of other sciences through the concept of *Raum* area or space - **Immanuel Kant**

Synthesizing discipline to connect the general with the special through arrangement, mapping and a regional emphasis- **Alexander von Humboldt**

Geography is the science of places- **Paul Vidal-de la- Blache**

Geography is the study of landscape and relationship between man and the natural environment- **F. Ratzel**

Geography is the study of interaction between man and his environment- **H. J. Mackinder**

Geography is the study of human ecology, adjustment of the man to natural surroundings- **Harland Barrows**

Geography is fundamentally regional and chorological science- **R. E. Dickinson**

Geography is the study of accurate, orderly, and rational description and interpretation of the variable character on the surface- **R. Hartshorne**

Geography is the study of how environment controls human behaviour- **Miss Ellen Semple**

The science concerned with the formulation of the laws governing the

spatial distribution of certain features on the surface of the earth- **Schaefer**
Geography is both arts and science- **H. C. Darby**

Geography is the study of earth as the home of people- **Yi-Fu Tuan**

From the above definitions it is observed that different scholars have defined geography in different ways. However, most of them have described it as the study of man and the environment. It is also true that common people think that geography is a study of maps only. It is partially correct. Again, many people think that geography is only the location of places. But, geography is more than that. It is the study of place and space and their characteristics and the relationships with each other. It helps to understand better the people, places and environment. The spatial distributions of human and natural phenomena are described in geography. Besides, it develops an understanding of patterns, processes and systems of the earth which are affecting the people and other biotic elements of the earth. A glance of nature of geography reveals that geography recognizes several epistemological approaches. Some geographers understand geography as a science aiming at comprehending the world; for others geography aims at describing and measuring the world; some geographers consider the world itself to be the object of the physical geography, whereas others think that geography concerns the relationship between human and space (human geography). Geography is concerned with human-environment interactions in the context of specific places and locations. Its special characteristics are its breadth of study, its span of methodology, its synthesis of work from other disciplines including the physical sciences and the humanities, and its interest in the future management of people-environment interrelationships. However, geography may be defined as the study of nature and human constructed phenomena relative to a spatial dimension. Geographers often ask and enquire some basic questions-What, which, Where, How, When and Why. They have been emphasizing on the location and spatial variations, people-environment relations and regional analysis. Rod-Gerber mentioned that geography has been derived from the four traditions:

1. The spatial tradition is that concerned with the geometry of spatial relationships and with movement.
2. The area studies tradition that is concerned with the study of the essential characteristics of a place or a region.
3. The man-land tradition that is concerned with the interaction of people and their environment; and

4. The earth science tradition that is concerned with the description and explanation of the natural features of the earth's surface.

In short, it may be said that geography provides a holistic idea and understanding of our planet, earth.

Elements of Geography

There are six major elements of geography. This are—

1. **The World in Spatial Terms:** the world in spatial term includes the Absolute and Relative locations. Absolute location is the exact location of place and built phenomena on the earth where exactly is it. It is determined with the help of geographical coordinates i.e. longitude and latitude. On the other hand, relative location is explained with reference to the location of something already known. For example, she lives near the Dibrugarh University.
2. **Places and Regions:** places and region involves the areas of the earth surface that are often grouped, which has one or more common characteristics. It is a part of natural and human environment and varies in local, national, regional and global scale. For example, natural region, climatic region, soil region, agricultural region, economic region and political region etc.
3. **Physical System:** It involves the physical processes that shape the earth's surface. It includes the spatial distribution of the ecosystem also. For example, fluvial system, volcanism, earthquake etc.
4. **Human System:** Human system involves the growth, distribution, migration, patterns, processes and functions of human population on the earth's surface. It also includes the different forces, interdependences, co-operations and conflicts of human population.
5. **Environment and Society:** It involves the relationship between man and environment. The effect of environment on man and man's capability to modify his surroundings and the distribution and uses of resources is also included in this element.
6. **Geography and Its Uses:** It involves the interpretation of past geography and uses the geographic knowledge in the present day world. Further, it incorporates the geographic knowledge for the betterment of the future generation also.

Major Themes and Concepts of Geography

There are five major themes of geography which have been recognized by most of the geographers.

1. **Location:** About the absolute and relative location.
2. **Place:** Area on the surface of the earth.
3. **Man-Environment Interaction:** The effect of environment on man and how they respond and interact.
4. **Movement:** why and how people move from one place to another.
5. **Region:** Area or group of places which has some common characteristics and traits.

Besides these five themes, there are few important concepts in geography.

These are—

1. **Distance:** It can be defined as the length of the space between two points on the earth's surface. There are two types distance-absolute and relative. The absolute or linear distance can be measured with meters or kilometers. On the other hand, the relative distance is distance measured in relative terms as length of time, cost or convenience of the journey etc.
2. **Scale:** Map scale refers to the relationship or ratio between distance on a map and the corresponding distance on the ground. For example- 1:500000, which imply 1 unit on the map is equal to 5 km on the ground. Besides, it can be seen as area or region of the earth's surface also. Generally, there are three types of scale in geography-Statement Scale, Linear or Graphical Scale and Representative Fraction.
3. **Population:** All the inhabitants of a particular place, area or region. It may be human, animals or plants.
4. **Distribution:** It means the spread of phenomena on the earth's surface. It is the arrangement of the phenomena in different patterns and orders.
5. **Spatial Association:** It is an arrangement of similar distribution of things or phenomena over space. A strong spatial association means almost similar distribution, where as a weak distribution means less similar phenomena. Again, no association occurs when the things are totally dissimilar.
6. **Spatial Interaction:** It is the relationship between phenomena and places in the environment and the degree to which they influence or interact with each other over time and space.

7. **Spatial Change over Time:** It implies the change of geographic characteristics, features and patterns of use over period of time. It occurs at varying rate, degree and scale.

Branches of Geography

Geographers mainly studies physical and human characteristics of people, places and their surrounding environments. Hence, geography has two main branches-

1. **Physical Geography:** Physical geography is one of the two main branches of Geography and Earth Sciences. It mainly deals with the explanation of spatial characteristics of various natural phenomena associated with the lithosphere, hydrosphere, atmosphere and biosphere. The five elements of natural environment i.e. - land, water, air, plants and animals are the main themes of study of physical geography. There are a number of branches of physical geography.
 - a) **Geomorphology:** Geomorphology is the study of origin, evolution and distribution of different landforms on the planet earth. However, it now also has expanded its scope to the study of other planets. For example. - Loner geomorphology.
 - b) **Hydrology:** It is the study of occurrence, movements, quantity; quality, properties and distribution of surface and ground water of earth and other planets. Oceanography also includes hydrological study. However, oceanography is now a branch of separate study.
 - c) **Climatology:** Climatology is the study of weather and climate of the world as a whole or part thereof. Modern climatologists study the atmospheric sciences, oceanography and biochemistry also.
 - d) **Soil geography or Pedology:** Soil geography or Pedology is the branch of physical geography which deals with all aspects of soils, including the physical and chemical properties, origin, evolution, distribution and decay of soil of the earth.
 - e) **Biogeography:** Biogeography is the study of animals and plants kingdom on the surface of the earth. It deals with the origin, evolution, distribution and demise of species and ecosystem in a geographic space and through geological time.
2. **Human Geography:** Human geography is another main branch of geography which deals with the study of man and his activities on the earth's surface. How man has been responding to different environment

is studied in human geography. It is emphasizing the relationship between man and his surrounding environment. Generally, man does three types of the activities on the planet earth viz. - man lives in the surface of the earth, man makes a living and man makes design for living. There are numbers of sub-branches of human geography.

- a) **Economic Geography:** Economic geography is the study of economic activities of man on the planet earth. The different types of economic activities viz.-primary, secondary and tertiary are studies in economic geography. Economic geography looks man as economic man. The studies of the production and utilization of resources in the different regions of the earth are discussed in economic geography. The production, distribution and consumption of goods and services and the niches of markets are also studied in economic geography. There are a numbers of sub-branches of economic geography.
- i) Resource Geography
 - ii) Agricultural Geography
 - iii) Transport Geography
 - iv) Industrial Geography etc.
- b) **Social Geography:** Social geography mainly deals with the social theory and sociology. It is the study of social phenomena and its spatial components. The study of spatial arrangement of social phenomena in relation to the total environment is studied in social geography. The sub-fields of social geography are-
- i) Population Geography
 - ii) Settlement & rural Geography
 - iii) Urban Geography
 - iv) Medical Geography and
 - v) Military Geography
- c) **Cultural Geography:** Cultural geography deals with the distribution of different ethnicity and their cultures in different regions on the earth. The relation constructs and conflicts etc of cultural groups are also studied in cultural geography. Religions, languages, tools, technologies, social organizations, behaviours, are studied in cultural geography. The sub-branches of cultural geography are-
- i) Religion Geography
 - ii) Tourism Geography

- iii) Feminist Geography
- iv) Music geography and
- v) Sexuality and Space Geography etc.

Besides, the above branches few important branches and studies related to geography are-

- a) **Historical Geography:** As the name implies historical geography studies about the past geography. Both physical and historical aspects of geography are studied in historical geography. Historical geography enquires how geographical phenomena have been evolving with the time. Historical geography seeks to determine the cultural relation of man with their surrounding environment.
- b) **Mathematical Geography:** Mathematical geography studies and examines physical and human activities on the surface of the earth using mathematical and statistical models. It includes the studies of patterns and processes which are responsible for creation, modification and demolition of different physical and human phenomena and activities.
- c) **Applied Geography:** The application of geographical tools, technologies, skills and knowledge in the betterment of society are studied in applied geography. Applied geographers use geographical knowledge to solve the problems faced by society in everyday life.
- d) **Cartography:** Cartography is the science of map making. It is a complex subject which deals mainly with the conception, production and its representation of maps. The discipline has been changing with time. The teaching-learning processes and research and extension have also been done in cartography. Modern cartography is very much related to computer base learning.
- e) **Remote Sensing & GIS:** Remote Sensing is an emerging branch of study very much related to geography. It is an art and science of acquiring information, data and making measurements of the various phenomena on the earth through the sensors of different platforms without touching the objects. It is mentionable that the satellite remote sensing is widely used now in different purposes. On the other hand, Geographic Information System (GIS) is a computer based tool and technique of

analyzing and representing the various features of the earth and other planet. Remotely sensed data are often analyzed and integrated in GIS environment.

There are two basic approaches of study of geography. Based on the methods and approaches of study, geography may again be divided into two branches.

1. **Systematic Geography:** Systematic geography studies the geographical phenomenon in large scale and global perspectives. For example- world climate, rainfall distribution and patterns, soil distribution and patterns etc. It focuses on the individual phenomena that are studied on a worldwide basis. This approach is applied in almost all branches of geographical studies.
2. **Regional Geography:** Regional geography studies the area or region wise occurrences of various physical and human phenomena on the earth surface. It deals with the characteristics of the area and region and its relations and differentiation with other surrounding areas. Generally, the phenomena of the earth are studied in regional geography in meso, macro and micro levels.

The Ideographic and Nomothetic are the two other approaches of studies of geography. Nomothetic as Kant described as the tendency to generalize and is typical for natural science. It seeks to understand and derive laws that explain objective phenomena in general. It is a qualitative approach and narrative in nature. On the other hand, ideographic is a tendency to specify and is typical for the humanities. It describes the efforts to understand the meaning of contingent, unique and often subjective phenomena. It describes the study of classes or cohorts of individuals. It is a quantitative approach.

Geography is important for every citizen as it helps us to understand the world. ■

References: Open source e-resources.

Jatropha Biodiesel as a Future Sustainable Fuel

Krishnakhi Saikia

Assistant Professor
DHSK College, Dibrugarh

Introduction : Fast depletion of fossil fuels demands an immediate and urgent need for extensive research so that some viable alternative is obtained and sustainable energy demand with less environmental impact is met. Since the combustion of fossil fuels is known to increase greenhouse gas concentrations in the atmosphere, these fuels are likely sources of global warming. Another concern is advocated by the peak oil theory which predicts a rising cost of fossil fuels caused by a severe shortage of petroleum reserves underground during an era of growing energy consumption. An alternative fuel, also known as a nonconventional fuel, is any material or substance that can be used as a fuel other than conventional fuels. Conventional fuels include fossil fuels (petroleum oil, coal, propane, and natural gas) and also nuclear fuels such as uranium in some instances. A host of alternative fuels have already been identified, and these include biodiesel, bio-alcohol (methanol, ethanol, and butanol), hydrogen, non-fossil methane, non-fossil natural gas, vegetable oils, and other fuels derived from biomass sources. Among all those alternative fuels, biodiesel is the most promising and popular in the transport sector and other CI engine applications.

Oil provides more than 95% of the energy required for India's transportation sector while only 22% of future projected demand can be met by domestic supplies (Planning Commission of India 2003). In 2003, the Planning Commission of India established the Committee on Development of Bio-Fuels to explore how India can use ethanol and biodiesel blended with motor spirit (gasoline) and diesel, respectively, to reduce vehicle emissions and to decrease the country's reliance on

petroleum-based fuels. Based on its ability to thrive in a variety of agro-climatic conditions, a low gestation period, and high seed yield relative to other plants with oil-bearing seeds, *Jatropha* was selected as the most suitable for the production of biodiesel in India. *Jatropha curcas*, a shrub of 3-4 m in height, belongs to the family of Euphorbiaceae. The oil content of *jatropha* varies from 35-40% of the seed mass. It requires very few nutrients to survive and, therefore, can be grown on less fertile land. Its cultivation, seed collection, oil extraction, and biodiesel production can generate large-scale employment

Figure 1 shows the preferred regions in India for *Jatropha* growth. Zone areas are most likely to be targeted for *Jatropha* cultivation.

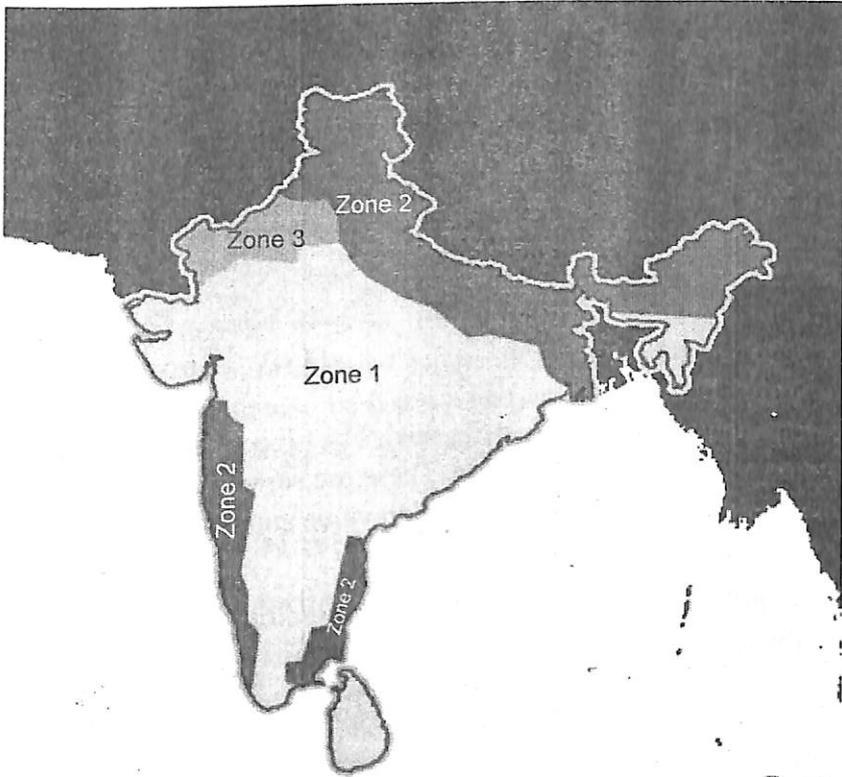


Figure 1. **Jatropha cultivation zones.** Zone 1 indicate good *Jatropha* cultivation potential in India; Zone 2 are fertile agricultural lands unlikely to be used for *Jatropha* cultivation; Zone 3 are deserts with poor growing conditions.

Source of *jatropha* Oil: The plant that is generally cultivated for the purpose of extracting *jatropha* oil is *Jatropha curcas*. The seeds are the primary source

from which the oil is extracted. Owing to the toxicity of jatropha seeds, they are not used by humans. The major goal of jatropha cultivation, therefore, is performed for the sake of extracting jatropha oil.

Analysis of jatropha curcas seed shows the following chemical compositions.

Moisture: 6.20%

Protein: 18.00%

Fat: 38.00%

Carbohydrates: 17.00%

Fiber: 15.50%

Ash: 5.30%

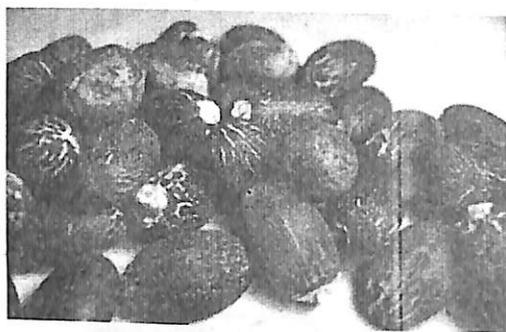


Fig-2 Jatropha curcas seed



Fig-3 Jatropha curcas plant

The oil content is 35-40% in the seed. The oil contains 21% saturated fatty acids and 79% unsaturated fatty acids. These are some of the chemical elements in the seed. Oil has very high saponification value and being extensively used for making soap in some countries.

It is significant to point out that, the non-edible vegetable oil of jatropha curcas has the requisite potential providing a promising and commercially viable alternative to diesel oil since it has desirable physical chemical and performance characteristics comparable to diesel. Cars could be run with jatropha curcas without requiring much change in design.

Jatropha oil expelled from seeds and filtered through filter press can replace kerosene or oil lamp. It will also be used in big Diesel engine based electricity generating sets, pump sets, heavy farm machinery etc. The seeds of jatropha contain (50% by weight) viscous oil which can be used for manufacture of candles and soap, in the cosmetic industry, for cooking and lighting by itself or as a Diesel /

paraffin substitute or extender. The latter use has important implications for meeting the demand for rural energy services and also exploring practical substitute for fossil fuels to counter greenhouse gas accumulation in the atmosphere.

Jatropha curcus as an energy source :

Oil from jatropha curcus: There are a variety of jatrophas and best among these are jatropha curcus. Jatropha oil is an important product from the plant for meeting the cooking and lighting needs of the rural population, boiler fuel for industrial purpose or as a viable substitute for Diesel. About one- third of the energy in the fruit of jatropha can be extracted as oil that has a similar energy value to Diesel fuel. Jatropha oil can be used directly in Diesel engines added to Diesel fuel as an extender or to a bio-diesel fuel.

Other products of Jatropha curcus: The jatropha oil can be used for soap production and cosmetics production in rural areas. The oil is a strong purgative, widely used as an antiseptic for cough, skin diseases and as a pain reliever from rheumatism. Jatropha oil has been used commercially as a raw material for soap manufacture for decades, both by large and small industrial producers.

When jatropha seeds are crushed, the resulting jatropha oil can be processed to produce a high quality biodiesel that can be used in a standard diesel car, while the residue (press cake) can also be processed and used as biomass feedstock to power electricity plants or used as fertilizer (it contains nitrogen, phosphorous and potassium).

Sustainability Analysis of Jatropha

For an assessment of the future prospect of jatropha biodiesel in the Indian subcontinent, a sustainability analysis of the abovementioned fuel is needed in terms of its strength, weakness, opportunities, and challenges. In Indian perspective, we need to put our attention to the regular use of biodiesel for commercial purpose. This analysis may give a clear vision of the future of jatropha biodiesel as a fuel in the Indian subcontinent and other countries, from the standpoint of both economic and environmental aspects.

Strength and Weakness

The jatropha biodiesel in India has definitely some strengths and advantages. Jatropha is a renewable biological crop, and it maintains a closed carbon cycle.

This explains its eco-friendly nature as a fuel. A plantation of jatropha also promotes the use of otherwise barren lands and controls soil erosion. It has high yield potential of more than 2 tons of oil per hectare per year. Straight vegetable oil (SVO) of jatropha can also be used directly in small scale diesel generators, oil lamps, and stoves. As India imports a huge amount of fossil-based crude oil to fulfil its normal demand, jatropha-based biodiesel may decrease its dependence on imported petroleum. But this fact should not be overemphasized, as the percentage of the country's fuel supply that can be replaced with biodiesel will not be too high. However, an additional source of fuel can have a surprising impact on the stability of fuel prices under fluctuating global petroleum market conditions. On the other hand, jatropha oil and its biodiesel suffer from some inherent drawbacks. First, jatropha is still a wild species, and its cultivation as an oil crop has not yet been standardized.

Its payback period is more than two years. The byproducts produced during oil extraction in the form of cake is unsuitable as animal food due to its toxic nature. India is yet to form a standard protocol for biodiesel use. Biodiesel production technologies are not firmly established for commercial purposes in India. The production cost of jatropha biodiesel is still prohibitively high due to small-scale production.

Opportunities and Challenges

In spite of some of its weaknesses, as pointed out by different researchers, jatropha biodiesel still has opportunities to be used as a partial replacement for diesel fuel. The cultivation of oil seeds, production of oil, conversion to biodiesel, and its marketing can generate employment and improve the economic condition of a country such as India. Jatropha biodiesel also reduces health hazards as the toxic pollutant emission is lower compared to that for existing fossil fuels. It is expected that jatropha biodiesel blending (10-20%) with petro-diesel may be made mandatory in the future, and this will definitely promote the production and use of biodiesel in India. Biodiesel production may also increase due to the expected incentives and subsidies from the government of India. Jatropha biodiesel is facing some challenges. This includes the deficiency in domestic knowledge, as the localized technology is not yet standardized. The lack of actual field results is also responsible for the non-popularization of jatropha oil among farmers and users. Considering the "food vs. fuel" debate, people are showing more interest for crops that can either yield fuel along with food annually or can be cultivated

in rotation with food crops. Another challenge jatropha biodiesel may face is the tough competition with algae-based biodiesel (third generation biofuels), since the oil content per unit mass of algae is much higher than that of jatropha. The minimum selling cost of biodiesel should be fixed at a certain level by the appropriate authority so that it can compete with the cost of fossil-derived fuels.

Conclusion :

India as well as other oil-importing countries needs alternative fuels to replace petroleum-based fossil fuels for several reasons. Biodiesel from jatropha is popular in India because the wasteland can be used for its cultivation. Jatropha biodiesel, obtained from jatropha oil through the transesterification process. Although jatropha biodiesel has enormous scope, it does not yet show popularity in India from a commercial point of view. The experimentation with jatropha and the implementation of the biofuel policy related to jatropha are limited to research and development in laboratories and some major automobile companies only. The high cost of production and lack of firm government policy regarding the use of biodiesel are the two key barriers for its successful implementation in the fuel sector. Third-generation biofuels, particularly algal biodiesel, may put a challenge to jatropha-based biodiesel. Since India is an agro economic country, if the cultivation of jatropha is carried out more scientifically, jatropha may turn out to be more economical than algae. Formation of a definite biodiesel policy and its proper implementation by the government of India may improve the situation in the near future. ■

References :

1. Gubitz G.M. et al edition, Biofuels and Industrial products from jatropha curcas, proceedings from a symposium held in Mamagua, Nicaragua, Technical University of Graz, Uhlandgasse, Austria (1997)
2. Henning R., The Jatropha project in Mali, Rothkreuz 11, D-88138, weissens-berg, Germany.
3. Kumar S, Chaube A, Jain SK (2008a) Jatropha biodiesel a promising C.I. engine alternate fuel in India. Indian J Appl Life Sci 4:1-5
4. Kumar S, Chaube A, Jain SK (2008b) Jatropha biodiesel: a prominent renewable biofuel in India. Indian J Appl Life Sci 4:14-19

India's Geo-economic Position in Asia and the World

Lonkham Boruah

Assistant Professor Dept. of Geography
Bajali College, Pathsala, Barpeta

The term geo-economics first came into prominence after the end of the cold war. It denotes interconnectivity of the economic and commercial opportunities, broader political and international relations, and pursuit by a country of its strategic interests, including military capabilities. This approach is rooted in the growing importance of economic factors in international relations. The geo-economic approach thus emphasizes the importance of integrating India's economic diplomacy in its multi-faceted relations with different countries and regions in the context of a rapidly changing world order.

After Narendra Modi's rise to power in 2014, India started a more active foreign policy focusing on the geo-economic purposes of the country. In the past four years of this government, they could have registered significant successes in this area; however, the geopolitical factors hinder the successful implementation of the Modi Government's geo-economic strategy. Narendra Modi's rise to power led to considerable changes in India's foreign policy as the new Prime Minister deemed the economic reformation of the country and the promotion of development as the basis for the new foreign relations trend. In order to implement his geo-economic ideas, Modi has launched plenty of initiatives and projects over the past four years, which by all means deserves attention. Since the Government has already served out a half of their term, it is worth taking a closer look at the geo-economic strategy of the Modi Administration, their results and deficiencies, as well as the geopolitical factors that considerably influence the process.

Foreign policy and geo-economy

Since 1947 India's foreign policy has aimed to consolidate political stability both in regional and global terms, promote economic development and avoid joining the formal alliances. At the turn of the 20th and 21st centuries, the economic aspect of foreign policy has continued strengthening and the geo-economic interests have come to the fore.

The term *geo-economics* includes the market-based economic developmental strategies that also promote transnational state-building. Therefore, India is interested in the establishment of partnerships under which certain countries can step on the path of economic integration, adapting to the market conditions. Unlike the geopolitical purposes, the geopolitical strategy focuses on the global economic competitiveness instead of political alliances, territorial expansion and the protection of national borders. Nevertheless, the implementation of the geo-economic ideas can hardly be successful without a definite geopolitical strategy, therefore, governments should aim to combine and balance these two.

Modi's Geo-economic Objectives

The Indian foreign policy does not tend to stiffly adhere to strategies, although the Governments have sometimes tried to lay down clear foreign political strategies. Modi's foreign policy was not always proactive; however, it was successfully built around a coherent geopolitical vision step by step, with details to be identified as follows. Modi primarily aims to transform India's economy and consolidate its emerging great power status. For this purpose, in September 2014 he launched the Make in India Program to transform the country into a manufacturing centre through foreign investments. Besides, energy safety, infrastructure developments and the expansion of trading also received priority attention. In general, the realization of the geo-economic plans rests upon 3 pillars.

1. For the emerging India, it is a precondition to take the leading role in South Asia. This is expressed in the Neighborhood First Policy.
2. Modi's other objective is to consolidate the cooperation with the countries in East and South-east Asia, which is hallmarked by the Act East Policy.
3. India as a naval power received far more emphasis than before, and the development of the Indian Ocean Region also gained importance.

The neighborhood first policy

Modi realized that the first step for India to become a global power is to take the regional leading role. One of the most spectacular elements of this process was the invitation of the Heads of the Member States to the South-Asian Association for Regional Cooperation (SAARC) to the inauguration ceremony in May 2014. After the bilateral negotiations, on 5th May the Indian Space Research Authority put the South Asia Satellite into orbit in order to develop the communication of the South-Asian countries. The satellite, which also supported scientific and economic cooperation, was disinterestedly offered to the surrounding countries by India, which also suggested its regional leading role. Except for Pakistan, the neighboring countries welcomed the Indian initiative, which founded the consolidation of the role of SAARC.

After he came to power, Modi paid several visits to the neighboring countries – starting with Bhutan –, during which he aimed to consolidate/restore the friendly relations and tighten the economic cooperation. As for Bhutan, Nepal and Bangladesh, the increasing of Indian investments and the improvement of regional connectivity were also important objectives. The duties of the Bangladesh, Bhutan, India and Nepal (BBIN) four-power sub-regional initiative include the development of trading and the establishment of the North-South directional communication channels, while the Motor Vehicles Agreement concluded in June 2015 takes a great step primarily in the elimination of factors hindering transportation. According to this, the movement of motor-vehicles is regulated by an electronic tracking system, and the motor vehicles receive an online access permit to the territory of the Member States; therefore, the customs clearance will only be implemented upon the arrival at the destination, which significantly reduces the period of delivery. The Indian Government allocated more than 1 billion dollars for the construction and development of the 558 km road network connecting Bangladesh, Bhutan and Nepal, 50% of which is funded by the Asian Development Bank.

Beyond the neighboring countries, India endeavors to a closer economic partnership with Iran and Afghanistan, too. As the relationship between Pakistan and India kept deteriorating under Modi's reign, Delhi has primarily become interested in isolating its North-western neighbour, reducing its own defenselessness against Islamabad. In May 2016 Iran, India and Afghanistan agreed that the Indian commodities could enter into Afghan territory through Iran, and in

this process the Port of Chaba Bar also fulfils a key role. Chaba Bar is situated only 72 km away from the Port of Gwadar in Pakistan, which was a considerable agent in the Chinese New Silk Road initiative. Besides the restoration of the existing ports, in May 2016 India assumed to construct a port facility suitable for the reception of large container ships to the amount of 500 million dollars. According to the plans, this would increase the annual reception capacity of the port which would increase from 2.5 million tons to 8 million tons. The construction of the Chaba Bar-Zahedan railway is another important element of the project having a total cost of 1.6 billion dollars provided by India-entirely.

Iran plays a decisive role in the International North-South Transport Corridor (INSTC) project, which primarily aims to connect Russia, Iran and India through Central Asia. On Modi's trip to Moscow in June 2017, the Indian and the Russian party declared that they aimed to increase the commercial turnover of the two countries to 30 billion dollars in 10 years' time. The establishment of the INSTC would make it possible since, according to India, the distance would become 40% shorter as compared to the currently used commercial routes, which would result in 30% cost decrease.

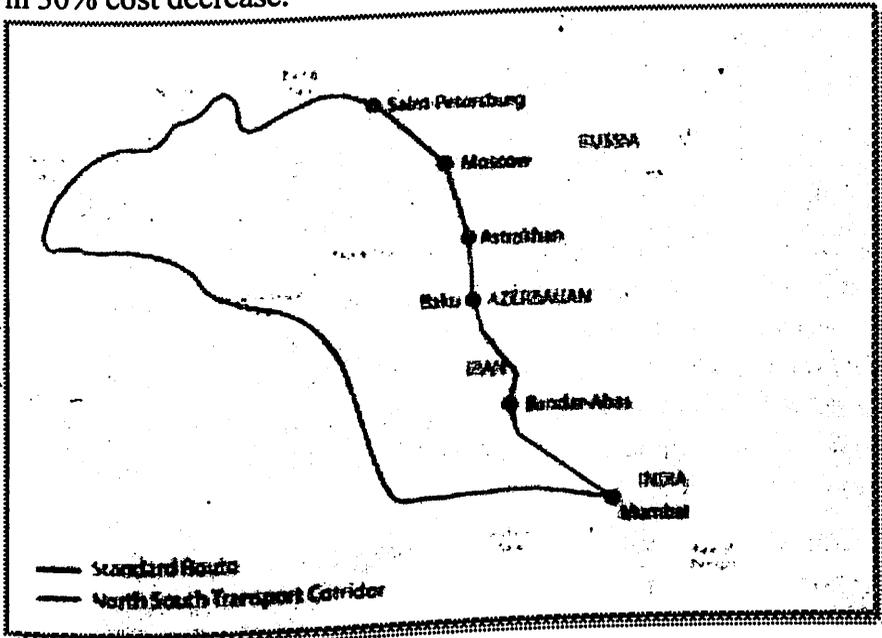


Fig.1: North-South Transport Corridor

Source: <https://cdn.rbth.com/980x-/web/in-rbth/images/2016-11/top/north-south-transport-corridor.jpg>

Today, the establishment of the Green Corridor between India and Russia and India's accession to the TIR Convention already facilitates customs clearance, and further simplification can be expected in the future.

The “Act East” Policy

It was announced by the Narasimha Rao Government in 1991 and the subsequent Administrations have always endeavored to implement it. The essence of this concept is that India needs to establish consolidated partnership relations with the south-eastern countries in both strategic and economic terms and counterbalance the rising China in the region. In November 2014 the Modi Government strengthened their commitment towards tighter cooperation with the ASEAN countries and, emphasizing proactive action, named the earlier terminology “Act East.”

India's relationship with Myanmar – supplementing the Neighbourhood First Policy – is of major importance since in economic respect it means the Gate to Southeast Asia for Delhi. For this reason, the Indian Government has aimed to improve connectivity from the beginnings since the lack of appropriate roads and railways considerably restricted the trading to Southeast Asia, too. Therefore, the India-Myanmar-Thailand Trilateral Highway is still being constructed and would be extended under the name East-West Economic Corridor towards Laos, Cambodia and Vietnam. Another significant initiative is the Kaladan Project, which would connect Kolkata with Sittwe on the sea, then Sittwe with Lashio through the Kaladan River, and finally Lashio with Mizoram on public road.

Singapore is one of the largest foreign investors for India; therefore, the economic cooperation dominated the relationship between the two countries. However, in 2016 the two parties signed an agreement concerning the establishment of a “strategic relationship,” allowing for considerable opportunities for political, defence and military cooperation. Singapore was the first ASEAN country to sign the Comprehensive Economic Partnership with India.

As for Vietnam, besides the political and defence cooperation, India is interested in the carbon-hydrogen sources on the South China Sea. The expansion of the Indian capital at the Vietnamese market is also a common interest of the two parties, while the continuously increasing bilateral trading turnover may reach 15 billion dollars by 2020.

The opening to the East Asian countries mainly focused on South Korea

and Japan. During Modi's visit to Seoul in May 2015 the parties agreed to develop their cooperation to the level of special strategic relations. Under the Make in India Program the two Governments also agreed to build warships to a total value of 2 billion dollars in the spring of 2017.

Modi's visit to Tokyo in 2014 further deepened the cooperation with Japan. After the parties had signed the Agreement on Special Strategic and Global Partnership, the economic relations started to revive. Japan plans to make investments in India to the value of 35 billion dollars over the next 5 years, including the Smart City Projects and the Delhi-Mumbai Industrial Corridor. In December 2015 Modi confirmed that he aims to build the Mumbai-Ahmedabad High-Speed Rail with Japanese contribution, applying Shinkansen technology.

After his accession to office, Modi took a stand on closer commercial and economic cooperation with China. As a result, Chinese President Xi Jinping paid a visit to India in the autumn of 2014. Besides decreasing the trading deficit, Delhi was interested in the Chinese infrastructure investments too as China envisaged the launching of high-speed rail and other projects to the value of nearly 100 billion dollars.

India as naval power

In economic terms, the global significance of the Indian Ocean is decisive in several aspects since it connects strategic trading routes. 64% of the global petroleum trading flows across its territory annually, this corresponds to 36 million barrels a day. Beyond this, the Indian Ocean Coast provides a home for nearly 2 billion people and offers the basis for the economic growth of the region. One should not forget about the natural resources either: 40% of the global coastline oil extraction can be connected to the region, while 15% of fishing is realized in the region. The exploitation of rare minerals located under the sea (manganese, zinc, copper, silver, gold) is especially important for India.

In March 2015, the Indian Cabinet introduced the Sagar Mala Project with the aim of developing the Indian ports and coastline to the value of approx. 120 billion dollars. The timeliness of the idea is supported by the fact that at present 95% of the country's trade is carried out on sea. In total, the program consists of 415 projects on the development of 12 harbours and 1208 islands and the establishment of 6 mega harbours. Besides the harbours, the industrialisation and infrastructure development of the cast areas also comprises part of the plans to be realised by 2035.

India's regional commitment is proved by the fact that in January 2016 the Department of Indian Ocean Region was set up within the Ministry of Foreign Affairs to facilitate the cooperation with other nations within the region. In this aspect, considerable attention is paid to Sri Lanka, Mauritius, the Seychelles and the Maldives. The Mausam Project, initiated by India, also emphasises tight togetherness, aiming to revive the old cultural relations in the region and found new partnerships in the Indian Ocean Region between India and the neighbouring countries. The spreading of the Indian soft power has been proved by the assistance in humanitarian and disaster relief fields recently, primarily in the case of Sri Lanka.

The geopolitical factors

During the realization of the geoeconomic purposes, we have to keep an eye on the geopolitical interests of the given country, too, which means that the appropriate harmonization of the two countries is the token of India's success. According to some opinions, the Modi Cabinet has not established a clearly-cut geopolitical vision up to present, and in the lack of this his foreign policy highlighting the geoeconomic purposes may not be successful in the long run. China, with its aggressive foreign policy, is a big challenge for India since, beyond the border debate, the 'One Belt One Road' Initiative, representing Beijing's own global geoeconomic purposes, also causes a considerable dilemma. The Modi Government would vindicate China's Indian and regional infrastructure investments in solely economic terms; however, owing to geopolitical considerations India is not willing to take part in the megaproject, although it can hinder the realisation of ideas such as the Bangladesh-China-India-Myanmar Economic Corridor. The China-Pakistan Economic Corridor, which would pass through Kashmir claimed by India and controlled by Pakistan, has also met with India's opposition. The conflict between India and Pakistan continued to escalate under the Modi Government and the danger of war remained following the events in 2016, which would cause severe damage to India in economic regards. Therefore, the cooperation with Iran and the neighbouring countries aims to isolate Pakistan and decrease the infrastructure dependence related to Islamabad. India's relationship with the United States has improved considerably recently; however, Donald Trump's policy, the US-Russia relations and the changes in the relationship between China and the US can largely affect India's geopolitical objectives in the future.

On the whole, it can be stated that the foreign policy and the geoeconomic

strategy of the Modi government has brought numerous promising results over the past 4 years; however, the unsolved geopolitical problems of the country can reverse this positive process in the long term, in the lack of a careful balancing policy. ■

References:

Chacko, P. (2015), "The New Geo-Economics of a "Rising" India: State Transformation and the Recasting of Foreign Policy," *Journal of Contemporary Asia*, Routledge, Vol. 45 (2): 326–344.

Menon, S. (2011), "Closing Remarks at the 13th Asian Security Conference," IDSA, February 18. Accessed 27th July, 2018, http://www.idsa.in/keyspeeches/AmbShivshankarMenon_13ASC.

Menon, S. (2011), "India and the Global Scene: Prem Bhatia Memorial Lecture, 11 August 2011," National Maritime Foundation, Accessed 3rd August, 2018 <http://maritimeindia.org/article/india-and-global-scene>.

Mohan, C. (2010), "Rising India: Partner in Shaping the Global Commons?," *Washington Quarterly*, Vol. 33 (3): 133–148.

Patnaik, P. 2007, "The Indian Economy under 'Structural Adjustment'," *India's Economic Transition: The Politics of Reforms*, edited by R. Mukherji, 52–86. New Delhi: Oxford University Press.

Sparke, M. (1998) "From Geopolitics to Geo-economics: Transnational State Effects in the Borderlands." *Geopolitics*, Vol. 3 (2): 62–98.

Remote Sensing Sensors

Moushumi Saikia

Contractual Teacher

Dept. of Geography, D.H.S.K. College

One of the most spectacular development and achievement in the twentieth century human society is the expedition to space and to use it for the benefit of man kind.

Remote sensing is the science of acquiring information about the earth's surface without actually being in contact with it. This is done by sensing and recording reflected or emitted energy and processing, analysing and applying that information. Detection and recording of the radiant energy reflected or emitted by phenomena or object of the earth's surface with some artificial sensors is the main principle of remote sensing.

The remote sensing model is camposed of same sets of components. It has

four components. These components are—

- i) Source of radiation (Sun or RADAR)
- ii) Objects / targets/ Surface phenomena
- iii) Sensors / Detectors/ Recording devices.
- iv) Transmission Path.

Sensors transform the reflected energy into electronic signals and transmit to the ground

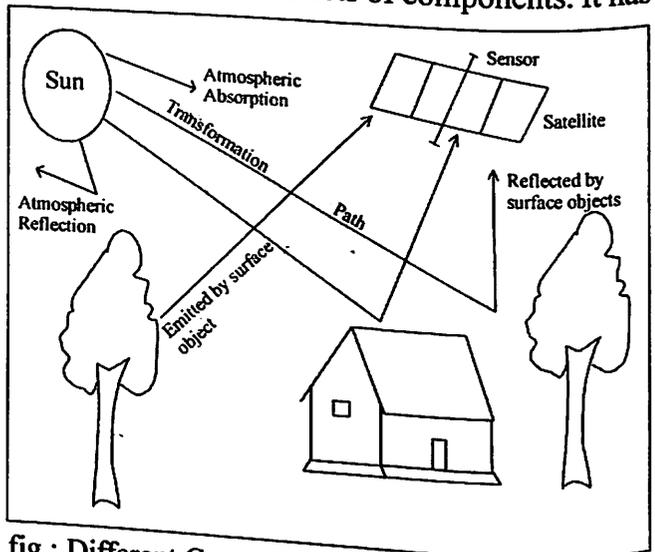


fig : Different Components and Principle of Remote Sensing

receiving centre where it is recorded and transformed into data i.e.—imagery, Digital image etc. Sensors are devices used to take observations. A sensor is a device comprising of optical components or system and a detector at the focal plane with electronic circuitry. Sensors are characterized by spatial, spectral and radiometric performance. They are available in a variety of forms and combination nowadays. There are a wide variety of sensors developed by modern science and technology. Few of such sensors are Multiband camera, Multi band video camera, Return Beam Vidicon (RBV), LISS, TM, MSS, HRV-1, HRV-2, PAN, WIFS, CCD etc. The sensors are of two types photographic and Non photographic (Digital thermal sensors, micro wave etc.) depending upon the form of data output.

According to the source of energy they may be active or passive.

Active sensors have its own source of light or illumination. In particular, it actively sends a wave and measures that backscatter reflected back to it. Active remote sensing sensor has been used for a variety of security applications including Marine and Arctic monitoring. Examples of active sensors include—RADARSAT-1, RADARSAT-2 etc.

The key advantages of active remote sensing sensors are—

- i) The capability to collect imagery at night and day.
- ii) It is unfazed by clouds and poor weather.

On the other hand passive sensors record the energy reflected from matters due to radiation of energy from the sun and incident upon these. Some examples of passive sensors are—Landsat, SPOT, EROS etc. A major advantage of passive microwave remote sensing is that microwave radiation can penetrate through cloud cover, rain, dust. It can also acquire data during the day or the night. A major disadvantage of passive microwave sensors is that the energy level being emitted is quite low. Passive remote sensing within the optical region can only take place during the time when the sun is illuminating the earth, because the sun is the natural source of energy. There is no reflected energy available from the Sun at night.

Both the Active and Passive sensors are further divided into scanning and non scanning. In scanning mode, a small area is captured at an instant and thus through multiple instants the whole area is imaged and in non scanning mode entire area is scanned simultaneously. ■

Petroleum Industries and Ocean Water Pollution

Debanjan Timsina

M.A. IIIrd Semester

J.B. College, Jorhat

Ocean water pollution has become one of the biggest menaces of the modern civilized world. Direct or indirect release of matter of energy in ocean by man which is detrimental to the aquatic life along with qualitative degradation of ocean water is termed as Ocean water or Marine pollution. Constant addition of harmful effluents from industry like petrochemical is causing an irreparable damage to marine environment. Millions of tons of highly stable industrial toxic chemical waste, contaminated water and other waste gets drained into oceans everyday. Many petroleum industries, widen the continuous transportation by ships and oil tankers etc which are the main factors responsible for marine pollution.

The intensity of Pollution caused by Petroleum Industries is remarkable. There is a great effect of Ocean Water pollution on Marine Eco System. Petroleum is an inflammable mixture of hydrocarbon with very complex chemical constitution. No other commodity of the present day has so close relation with the eco political affairs of the world than petroleum and its by-products. The rapid expanding production of petroleum and its evergreen importance in the sphere of industrial world can simply be attributed to a number of factors—

- * Petroleum occurs in large quantities
- * It is easily obtained
- * It has the widest range of domestic as well as industrial uses
- * It can be cheaply distributed via pipelines

In this modern world, petroleum industry has much more impact in ocean water pollution. The principal sources of ocean water pollution resulting from

petroleum exploration and production operations are—

- * Drilling fluids.
- * Spills and leakages etc.

Volume of wastes produced depend on the stage of the exploration and production process. Oil based drilling fluids and cutting on the other hand have an increased effect due to its toxicity. Oil based mud and cuttings affect benthic organisms.

- * Oil spill means the leakage of petroleum on to the surface of a large body of water. Oceanic oil spills became a major environmental problem in the 1960's, chiefly due to intensified petroleum exploration on the continental shelf and the use of super tankers capable of transporting more than 500000 tons of oil. Oil in ocean surface is harmful to aquatic life because it prevents sufficient amount of sunlight and also reduces the level of dissolved oxygen.
- * Moreover crude oil renders feathers and gills ineffective, so that birds, fish may die from direct contact with the oil itself. While accident to super tankers and to underwater wells and pipelines are the cause of major oil spills. Combined with natural seepage from the ocean floor these sources add oil to the worlds waterways at the rate of 3900000-6600000 tons a year.
- * Ocean water is polluted by a huge quantity of pollutant dumped into ocean, especially by the developed countries. However oil spilling in ocean is a major global problem. The world's ocean ecosystem has been subjected to 9149 cases of oil spills between 1970 and 2000. A total of 5322000 tonnes of oil has been split into ocean in the above period. Out of 9149 cases of oil spills 4855 were reported as spills due to operational factors. This type of spills takes place at oil terminals and ports.

Pictures of Damaging Coastal Ecosystem

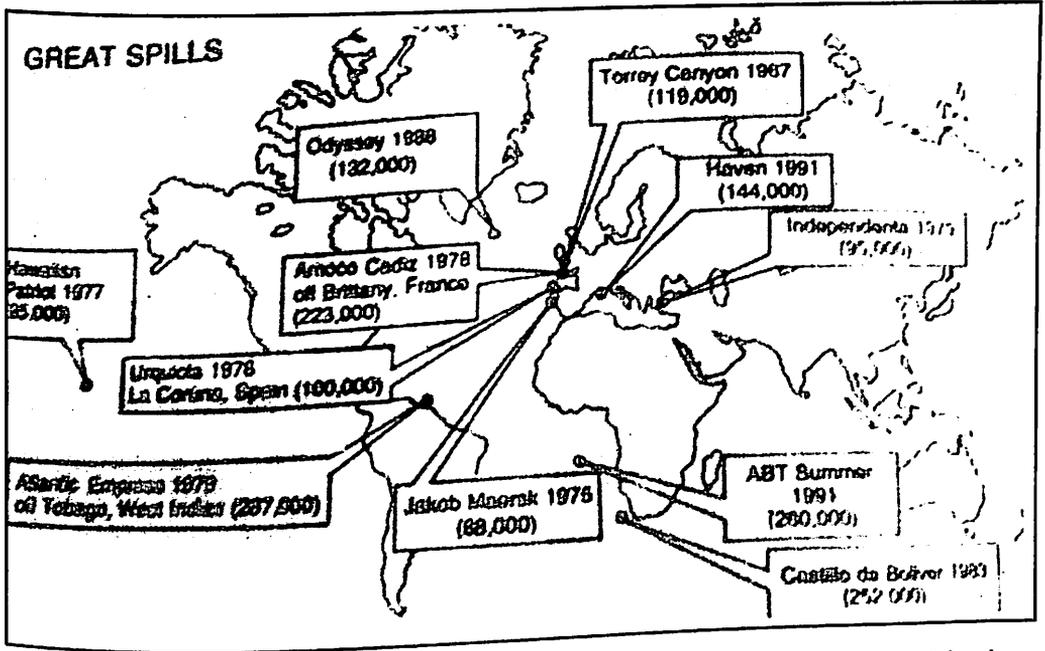


Table of Great Oil Spills (1970-2002)

Year	Vessel	Location	Spill (in tonnes)
1967	Torrey Canyon	Scilly Isles, UK	119,000
1975	Jakob maesk	Opporto, portugal	88000
1976	Urquiola	La coruna, Spain	1,00,000
1977	Hawaiion patriot	300 nautical miles off honolulu	95,000
1978	Amoco cadiz	Off Brittany, france	223,000
1979	Atlantic empress	Off tobago west indies	287,000
1983	Castillode	Off Saldanha bay, south africa	252,000
1991	Haven	Genoa, Italy	144,000
1991	ABT summer	700 nautical miles off angola	260,00
1992	Aegian sea	La coruna	80,000
1996	Sea empress	Milford haven off wales, UK	72,000
2002	Prestige	Off spanish coast	70,000

Major oils spills include Lakeview gusher, gulf war oil spill, and the deepwater horizon oil spill in 2002. The 26 year old oil tanker prestige sailing under a Bahamas flag, laden with more than 70,000 tonnes of fuel oil spilled oil when it was hit off the Spanish coast by a storm. It look an estimated 60,000 tonnes to the ocean floor and left behind 280 km of oil slick. The slick blankened and the coastline of Galacia threw 1000 Spanish fisherman out of work and coated sea birds. It proved disastrous for Europe's rishest fisheries, including goose barnacles, mussels, octopuses, and crabs. the toxic chemicals in the oil caused physical damage to marine life.

Major Oil Spills of The World



Oceans are polluted by oil on a daily basis from oil spills, routine shipping, run offs and dumping—

- * Oil spills make up about 12% of the oil that enters the oceans. The rest come from shipping travel, drains and dumping.
- * An oil spill from a tanker is a severe problem because there is such a huge quantity of oil being split into one place.
- * Oil spills cause a very localised problem but can be catastrophic to local marine wildlife such as fish, birds and sea otters.
- * Oil cannot dissolve in water and forms a thick sludge in the water, this suffocates fish, gets caught in the feathers of marine birds stopping them from flying and blocks light from photosynthetic aquatic plants.
- * Petroleum is highly toxic. Oil is absolutely lethal to fish, so the various oil spills that occur frequently cause harm to the ocean. Human beings are also badly affected by the side affect of crude oil as it can be highly carcinogenic. In crude oil we find benzene, which is a substance known to cause leukaemia. Thus ocean-water pollution by petroleum industry causes a great damage to the marine ecosystem, food resources and is a great threat to biodiversity.

Some measures to control the ocean water pollution may be listed as follows—

- * Utmost care should be taken to prevent oil spill.
- * It should be made sure that vehicles and boats do not leak oil because ultimately it finds its way into the ocean.
- * Implementation of renewable energy sources such as wind or solar power, to limit off shore drilling.
- * Organise and assist agencies to clean up existing pollution.
- * Stricter government regulations on petroleum industry is one large scale solution.

It is hard to know where to start when detailing the negative effects the petroleum industry has on the oceanic environment, because the entire planet has suffered such degradation as a result of humanity's over use of fossil fuels. It is actually toxic to all forms of life. The Great Barrier Reef and other magnificent coral reefs are slowly dying, affected by the increasing acidity in the oceans. Oil spills usually cause outrage and elicit many pictures of the affected and dying animals. The clean up of these spills is very difficult and can take years to complete. However impact on marine life, animals and human health cannot easily be reversed. On the whole everybody should stand unitedly throughout the planet, so that the pitiable plight of suffering oceans might be pushed back. ■

Source :

- * Gautam, Dr. Alka : Environmental Geography.
- * Singh Savindra : Environmental Geography.
- * Agarwal, LN : Environmental Studies.
- * Internet Resources.

Ozone Depletion and Global Warming

Gurpreet Kaur Virdhi

B.A. 5th Semester

Geography Department

Increase in the concentration of Greenhouse gases and acidification has initiated the process of environmental change. Human activities have caused changes in the ozone layer in the stratosphere and increasing concentrations of atmospheric uad. Acid rain emerged as a concern in the 1960s with observation of dying lakes and forest damage in Northern Europe, United States and Canada. Both of these have significant implications for human health as well as for the earth's ecosystem.

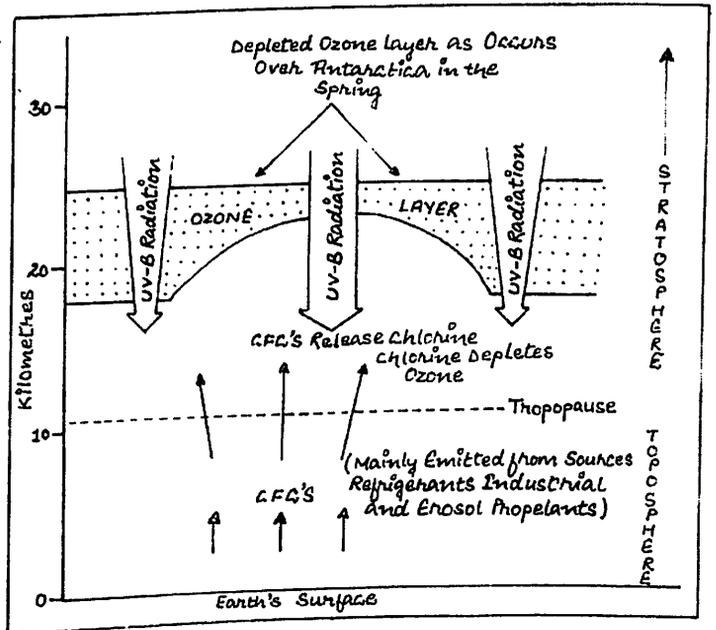
The position of ozone in the stratosphere and the processes of its depletion

have been shown in the following figure.

The presence of ozone in the atmosphere is particularly important because it filters our incoming ultraviolet (UV) radiation and thus acts as a screen against ultraviolet B(UV-B) radiation that can increase the occurrence of some forms of skin cancer, cataracts and other diseases of eyes.

The UV-B rays also suppress body defence mechanism

OZONE DEPLETION



which increases vulnerability to a variety of infectious diseases.

The problem of ozone depletion was first identified in 1970s due to the advent of supersonic aircraft which fly in the lower stratosphere and which emit nitrogen oxides. Subsequently it was established that the major cause of ozone depletion is the freons of CFC's. These compounds are non-toxic, non-flammable and chemically inert gases. These properties makes them useful for a wide range of applications including aerosol propellants, refrigerants, cleansers for electronic components fine retardant, solvents and in the production of foamed plastics. The CFC gases do not rapidly degrade and passing through the troposphere they eventually enter into the stratosphere, where they are subject to intense ultraviolet radiation—the same radiation is absorbed by ozone. Chlorine destroys ozone. In a chain reaction of oxygen destruction each of the chlorine atoms released can destroy over 10,000 ozone molecules. It has been estimated that even if the emission of CFC gases in the atmosphere is stopped, the ozone layer will continue to be damaged as these gases have long residence time and their molecules do not dissolve even after hundred years.

The first significant data about the depletion of ozone layer was presented by Farman, the leader of the British Antarctic Survey, who established that an ozone 'hole' has occurred in the stratospheric ozone layer over Antarctica each spring since 1977. Subsequently, Kerr reported that ozone layer is being depleted over the Arctic atmosphere. This is of special significance because ozone depletion in the northern hemisphere which is more densely populated than the southern hemisphere may lead to major increase in skin Cancer and Cataract problems.

The enhanced greenhouse effect, acidification and ozone depletion are all examples of atmospheric pollution that have occurred mainly after industrialization, urbanization and deforestation. The heavy metals like lead, mercury, zinc cadmium and arsenic are also creating the serious problems of environmental pollution. All these heavy metals are harmful to human health. The enhancement of these metals in the atmosphere shows some serious adverse effects on human health.

A question arises as to why the 'hole' in the ozone layer first appear so prominently over Antarctica? In most parts of the world, horizontal winds tend to mix chemicals in the air. But circulation patterns are such that the freezing whirlpool of air over the south polar continent in winter is not penetrated by air currents from the warmer earth regions. In the absence of sunlight and atmospheric mixing, the CFC's work to destroy the ozone. During summer, sunlight works to replenish it. ■

References:

1. Hussain M. : Human Geography Rawat publications.
2. Internet.

Sustainability : Living with reduced human footprints

Sainon Jenny Wangsa
B.A. 5th Semester

The first thing that hits our opinion when we hear the word sustainability is, 'to maintain'. But apparently, that doesnot explain everything. There is more to the word 'sustainability' or more precisely, 'sustainable development'.

So what does sustainability mean?

It means to live our life in such a way so that we can enjoy everything that nature has bestowed upon us and at the same time, being cautious about preserving it for our future generations by having less impact on the environment.

Today, some of the key factors hampering sustainable growth are pollution, global warming, over-population and depletion of natural resources. And sadly, all these factors are created by man directly or indirectly. Traditionally, the country had a culture of 'need based consumption', but increased urbanization and influences of westernization are influencing consumer behaviour, leading to unsustainable levels of consumption. Consequently, unsustainable levels of production and consumption are putting enormtous pressure on the carrying capacity of the natural resource system, as well as the ability of the environment to absorb the waste by products. Moreover, population explosion in developing countries like India, is giving rise to poverty and straining the already scarce resources.

If humans continue moving forward in such a harmful way towards the future, then there will be no future to consider. There is concern looming everywhere over food security, air and water pollution affecting the quality of life and land shortage and degradation affecting both agriculture and biodiversity.

Imagine a day, when we're explaining to our children about how tiny the sparrows were and how black were the crows; or how a pair of mynahs depicted good luck and the pegions peace, but the children never getting the sight of these?

Well! These are just some examples of the results that unsustainability has caused and can give birth to in near future. Therefore, as individuals, it is our responsibility to raise awareness in our local community and within our families about these issues. By doing so, we can help contribute to a more invironmentally conscious and friendly place for us to live.

Although it is true that we cannot physically stop our ozone layer from thinning, there are still so many things we can do to try and put a dent in what we already know. If we do not act now, we will be delayed to reverse the impact. We have a responsibility to leave for our future generation, a planet that is healthy and habitable by all species. And hence, we need to realize that development is more than economic and sustainable development is a collective responsibility. ■

Geographic Facts

Compiled by : **Dhan Rai**
B.A. 5th Semester

Here are some incredible, Geographic facts about this planet we call Earth.

1. Continents shift at about the same rate as our fingernails grow.
2. Mt. Thor on Baffin Island, Canada, has earth's greatest sheer vertical drop (4,101 feet.)
3. Ninety percent of Earth's population lives in the Northern hemisphere.
4. California has more people than all of Canada.
5. In the Philippines, there's an Island that is within a lake.
6. The Dead Sea is currently 429 metres below sea level and Sinking about 1 meter a year.
7. At certain times of the year we can walk from the United States to Russia because of two Islands known as Big (Russia) and Little (U.S.) Diomede.
8. Mount Everest, the World's tallest mountain can fit inside the Mariana Trench, the deepest part of the Ocean.
9. Africa is the only continent that covers four hemispheres.

Source : Internet

Solstices and Equinoxes

Arpita Chakraborty
B. Sc. IIIrd Semester

A solstice is an event occurring when the Sun appears to reach its most northerly or southerly excursion relative to the celestial equator on the celestial sphere. Two Solstices occur annually, around June 21st and December 21st. The Seasons of the year are determined with reference to both the Solstices and the equinoxes.

In the Summer, days are longer because the Sun rises earlier in the morning and sets later at night. When the North Pole of the Earth is tilted towards the Sun, we in the northern hemisphere receive more sunlight and it is Summer. As the Earth moves in its orbit, the tilt of the North Pole changes. When it is tilted away from the Sun, it is winter in the northern hemisphere. In between we have autumn and Spring. The day when the Earth's North Pole is tilted closest to the sun is called the Summer Solstice. This is the longest day of the year for people living in the northern hemisphere. It is also the day when the sun reaches its highest point in the sky. The winter solstice, or the shortest day of the year happens when the Earth's North Pole is tilted farthest from the Sun.

In between, there are two times when the tilt of the Earth is Zero, meaning that the tilt is neither away from the Sun nor towards the Sun. These are the vernal equinox—the first day of spring—and the autumnal equinox—the first day of autumn. Equinox means “equal”. During these times, the hours of daylight and night are equal. Both are 12 hours long. At the June Solstice the subsolar point is further north than any other time : at latitude $23\frac{1}{2}^{\circ}$ north, known as the Tropic of Cancer. Similarly at the December Solstice the subsolar point is further south than any other time : at latitude $23\frac{1}{2}^{\circ}$ South, known as the Tropic of Capricorn. ■

Global Wildlife Population

Parishmita Gogoi

B. A. III Semester

Dept. of Geography

Wildlife population refers to the varying kinds of animals or vertebrates on a global or world basis. Mammals, fishes, reptiles and many more can be included in this specific category of 'Global Wildlife Population.' The most significant thing noticed, about the wildlife population of the world, is its 'rate of declination' from several decades. It has been tremendously decreasing from the year 1970. Animals living in different regions of the world are decreasing at a rapid rate. This is mainly due to the behaviour of human beings, treating and considering the world to be a 'throw away'. Reports from World Wildlife Fund (WWF), have also proved it through several valid evidences.

Human activities are proving to be a great threat, not only towards the existence of the wildlife population, but also their self existence on this planet earth. Due to the accelerating rate of growth of human population, the origin of such threatful activities of the human beings are generated. The human population and demand for food supply goes parallel and are interrelated to each other. As the human population increases, the demand for food supply also increases. And to fulfill the basic necessities of food supply demand, agriculture is the primary concern for which the humans occupy huge areas of land for the purpose of agricultural activities. Such areas of land basically comprises of the forested and river lands of the world, which ultimately results in the extinction of animals from those particular areas. About 70 percent of the world's land area is occupied by agriculture. Moreover, lands are also occupied for the constructions of industries, roads and bridges. Global warming and pollution are also the main concern of habitat loss. All these collectively

contribute towards the over exploitation of wildlife. No doubt, such activities fulfill certain humanistic needs, but most importantly the fact that it is resulting in the loss of habitat of the world, can be put under prime consideration.

The path towards the extinction of human as well as wildlife population has already taken its way several decades ago. If no preventive measures are taken the population of wildlife may fall to two-third its present by the year 2020. Moreover, if we think before consuming and producing anything and consider 'sustainable development' to be the main concern from now, there is no doubt that a healthy environment will develop to live in. This strong environment will erase not only the declination of wildlife population of the world, but various problems like economic, social, political, health and mainly poverty, will undoubtedly vanish from this entire world. Materialistic progress of the country in particular and the world in general is not at all relevant, until spiritual progress arises within the people.

The future of the global wildlife population is only in the hands of human beings and they need to realize it as soon as possible. Every individual have to keep in mind that, we should not create a world that needs protection every single day, but in contrast, we should create a world that does not require any protection at all.

(With help taken from Internet)

Eclipses

Rosme Sonowal
IIIrd Semester

An eclipse takes place when a celestial body is temporarily obscured by another celestial body or by its shadow.

Two main types of eclipses can be observed from Earth—i) Solar and ii) Lunar

SOLAR : A solar eclipse occurs when a new moon moves between the earth and the sun blocking the sun's rays either partially or completely from reaching the earth and hence sun is not visible from the earth. The distance between the sun and earth is 93 million miles and the distance between the moon and earth is 239000 miles.

When the moon comes between the earth and sun there appears two types of shadows on earth. The bigger and light shadow is 'Penumbra' and the smaller and darker shadow is 'Umbra'.

There are four types of solar eclipses.

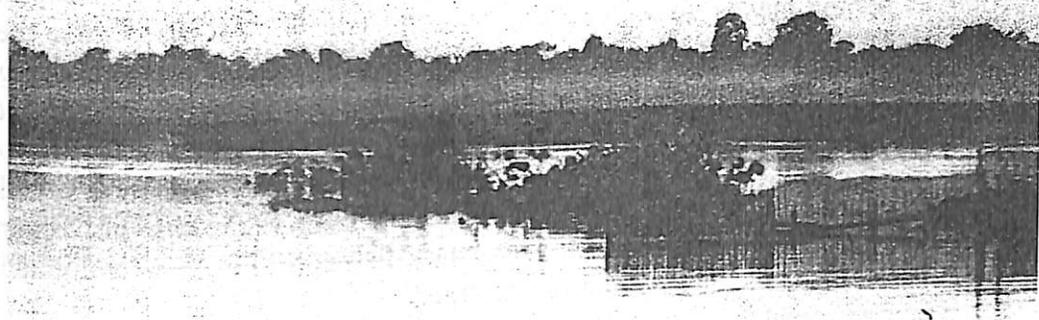
1. Total eclipse : This eclipse occurs when the moon completely covers the sun and this eclipse can only be seen when one is standing at the umbra shadow.

2. Partial eclipse : This happens when the moon partially covers the sun's disk.

3. Annular eclipse : It occurs when the moon covers the sun's centre and the visible other edges of the sun forms a 'ring of fire'.

4. Hybrid eclipse : In this the sun, moon and earth are finally balanced. It changes its appearance as the Moon's shadow moves across the earth's surface. It is a rare phenomenon.

LUNAR : It occurs when the earth comes between the sun and moon and block the sun rays from reaching the moon and thus the moon turns black. It occurs only on full moon (Purnima) days. When the shadow of the earth fully covers the moon then it is termed as total lunar eclipses and also this eclipse doesn't happen for a long time because moon itself revolves around the Earth. Partial eclipse occurs when the Earth moves between the sun and the moon but they are not precisely alligned and only part of the Moon's visible surface moves into the dark part of the Earth's shadow.■



Maguri Beel : The hidden treasure of Dibru Saikhowa

Protyush Protim Gogoi

B.A. III Semester

Dept. of Geography

Maguri beel, a large wetland located beside the Dibru river, situated at a distance of 3.8 km from Guijan ghat is considered among one of the hotspots of bird ecology in India and is a paradise for bird lovers. A total of about 525 species of local and migratory birds have been recorded till date. This beel becomes even more diverse during the winter season as hundreds of species of birds migrate to this place and this is considered as one of the best times to visit the place.

This place can be divided into two regions the grass land and the wetland. The grassland is the home to various birds like tits, nightingales, babblers etc. Some of the worth mentioning species are the rare Bush Babbler, Pied Harrier, White breasted wagtail etc. The wetland is even more diverse than the grassland as it is a home to a wide range of water birds form Asian open billed stork, egret, Barn shallow, Ruddy shelduck, Garganey, Gadwall etc. to the rarest Falcated duck and Baers pochard.

Now, a question arises from these as why inspite of such a diverse ecology

this place is a hidden treasure and is not a part of Dibru Saikhowa National Park. Well the greatest secret behind the beauty of the beel lies in the question. The beel is enjoying such a diversity due to the large scale fishing done there by the local people as fishing makes the water muddy and the nutritious algae found at the bottom of the beel goes up which acts as the food for the birds. Moreover fishing makes the beel clear and free from wet plants that creates an ideal environment for the birds. But if it were considered to be a part of the park then according to the forest act human activities would have been prohibited that would have turned the beel to a mere water body filled with water plants as in the case of Deepor beel as after making deepor beel a bird sanctuary, fishing activity was prohibited as a result of which the bird population declined.

The real credit for the fantastic management of Maguri beel goes to the local people and nature loving organizations. Long ago people used to hunt the birds for food but thanks to some educated and nature loving people who have put an effort to educate the local people who are now engaged in conservation and tourism programmes and are earning a good sum of money and is a good way of earning a living. Really it is hard to believe that it is the people who make it happen.

There are continuous threats coming from oil drilling nearby the beel, but still efforts are being made to settle the confusion.

Many people from India and outside India have come to visit the place and have returned satisfied always. Maguri beel is clearly an example of peoples bond with nature as they protect nature which gives them a way for earning.

Let us all praise the devotion of the local people in protecting a great treasure of nature which if visited once will give us an unforgettable experience. ■



Influence of Geography on Indian History

Achinta Mugdha Bokal

B. A. 1st Semester

To form a holistic image of India, an attempt to understand and appreciate the role of Geography and Ecology in moulding the character and psyche of Indians is necessary. Further we notice that the physical characteristics of the subcontinent facilitating the coexistence of different levels of cultures in different regions is due to ecological and geographical conditions.

And there is not any uniform pattern of culture in India. We come across the phenomenon of very complex cultures coexisting with others in different parts of India, all through its history, depending on their ecological set-up. Based on the physical features of the subcontinent and the communication system, it is to be noted that the main river basins constituted the areas of attraction.

The India subcontinent is divided into :

(a) Himalaya Uplands, (b) Indo-Gangetic Plains, (c) Peninsular region.

The Himalayas supply water to Indus, Ganga and Brahmaputra and provide a large quantity of alluvium to its plains spreading over an area of 2.5 million km². Indus plains witness the beginning of the first civilization of the subcontinent. The Gangetic plains play an important role in sustaining and nurturing urban life.

The Aravalli hills in Rajasthan separate the Indus plains from the Peninsular. This zone comprises the Vindhyan, Satpura ranges and the Chota Nagpur plateau. Peninsular region from the southern edge of central India.

Four major rivers, Mahanadi, Godavari, Krishna and Kaveri flow into the Bay of Bengal. These rivers created nuclear areas in plains and deltas that continuously sustained cultural growth throughout the course of history.

The rivers, Narmada and Tapti flow to west and join the Arabian sea in Gujarat. The Deccan plateau starts here and extends from the Vindhyas in the north to the southern parts of Karnataka. The black soil of Maharashtra is suitable for plough agriculture.

Despite inadequate rainfall and irrigation facilities, early farming began in the Chalcolithic period in the Deccan plateau.

The eastern coastal plains are wider than the western coastal plains. The basic peninsular offshoots of the Eastern ghats are the Nilgiris and the Cardamom hills. These geographical divisions are roughly coterminous with the present days linguistic regions.

It is no wonder that Indian character and attitude are influenced by the vagaries of nature. It is such an accepted fact that the pattern of the development of material cultures are highly influenced by geographical and ecological factors due to geographical location of the subcontinent. As the Indian subcontinent is peripheral to the Orient, the oriental influences are clearly visible in the pattern of development of culture.

People inhabiting in different parts of India are choosing their way of living according to how and what resources the particular environment is providing them since the earlier periods. The main economic source of India is its agricultural sectors which is because of the river basins. Since earlier periods people are living and developing their living standard through a mutual inter-relationship with nature. ■

(Some data are collected from Wikipedia)

Departmental Profile

1. **Name of the Department** : **Geography**
2. **Year of Establishment** : **1953**
3. **Year of Introducing Honours/Major Course** : **1972**
4. **Faculty Members Since 1953**

Name	Date of Joining	Date of Retirement
i) Sri Kalyan Kr. Baruah	7/7/1953	31/12/1989
ii) Sri Narendra Kr. Verma	6/7/1959	31/10/1995
iii) Sri Prafulla Ch. Chakarvorty	24/8/1964	28/2/1989
iv) Sri Vijay Kr. Verma	17/11/1971	30/4/2006
v) Sri Narendra Mahela	1/9/1985	
vi) Mrs. Smrity Bhattacharjee	2/5/1986	31/12/2017
vii) Dr. Bharati Dutta	22/6/1987	1/2/2016
viii) Sri Hemanta Timsina	15/9/1989	
ix) Dr. Meetali Chaliha	30/11/1996	
x) Mrs. Krishnakhi Saikia	16/3/2018	

5. Profile of the Existing Faculties / Staff

Name	Designation	Qualification	Specialization
i) Sri Narendra Mahela	Associate Prof.	M.Sc.	Cartography
ii) Sri Hemanta Timsima	Associate Prof. HoD	M.A.	Cartography
iii) Dr. Meetali Chaliha	Associate Prof.	MA. Phd.	Regional Planning
iv) Mrs. Krishnakhi Saikia	Asstt. Prof.	M.A. M.Phil	Population Studies
v) Miss Mouchumi Saikia	Contractual Teacher	M.A	Remote Sensint & GIS
vi) Mr. Babul Dihingia	Laboratory Bearer		

6. Student Enrolment (2018)

Class	No. of Students
HS 1st Yr.	79
H.S. 2nd Yr.	68
TDC 1st Semester (Major)	30 (Arts) + 7 (Science) = 37
TDC 1st Semester (Core)	56 (Arts) + 3 (Science) = 59
TDC 3rd Semester (Major)	25 (Arts) + 4 (Science) = 29
TDC 3rd Semester (Core)	35 (Arts)
TDC 5th Semester (Major)	26 (Arts) + 4 (Science) = 30
TDC 5th Semester (Core)	3 (Arts) + 5 (Science) = 8

7. Departmental Infrastructure

- Library : There is a departmental library with 375 number of subject related books which is issued to the students for a period of seven days.
- Laboratory : The Departmental laboratory is equipped with various instruments, maps and charts which facilitates the requirement of the students.
- One of the classrooms of the Department is provided with the facility of power point as an ICT tool for effective learning.

8. Results of 2018

Students securing letter marks in Geography in the HSSLC examination.

- Venisha Buragohain
- Reetashri Choudhury
- Amrita Sharma
- Biplab Tamang.

Students securing First Class in Degree Final Examination.

(Arts Stream)

- Jinti Barman
- Twinkle Gogoi
- Vishal Dey
- Vishal Paul
- Dhruba Jyoti Baruah
- Kalpita Nalung
- Rima Changmai
- Dipa Taduk
- Himaloy Barik
- Sankar Sajya Das

(Science Stream)

- Mayuri Chetia
- Khil Bahadur Newar
- Nggunya Wangsa
- Arunav Dutta

- xi) Sobha Sonar
- xii) Manisha Irow
- xiii) Priyanka Malakar
- xiv) Usha Gupta
- xv) Apsara Borgohain
- xvi) Dibya Lohar
- xvii) Saquib Ahmed
- xviii) Chandan Thakur
- xix) Niharika Hazarika

**Students Securing Second Class in Degree Final Examination
(Arts Stream)**

- i) Puja Borgohain
- ii) Mriganka Hazarika
- iii) Madhurjya Dutta
- iv) Lucky Nath
- v) Nilotpol Pritom Deori
- vi) Nirab Nayan Neog

9. **Guest Lectures :** With the motive of enriching the students with the latest updates three guest lectures were arranged during this period.

- i) Mr. Rituraj Neog, lecturer, Centre for Studies in Geography Dibrugarh University delivered lectures on 'Remote Sensing and GIS' on the 17th, 23rd and 31st of March, 2018.
- ii) Dr. Bharati Dutta, Retd. Associate Prof., DHSK College delivered a lecture on 'Climatic Conditions of India' on 23rd August, 2018.
- iii) Mrs. Smrity Bhattacharjee, Retd. Associate Prof., DHSK College delivered a lecture on 'The concept of Land Use' on 27th August, 2018.

10. Activities

- i) Publication and release of the 8th Volume of DHARITRI—The Earth (Departmental Magazine) on the 5th of September, 2017.
- ii) Inauguration of the Departmental wall magazine 'Basundhara' on the 5th of September, 2017 which displays the writings and artistic skills of the students.
- iii) Teacher's Day celebration in the Department on the 5th of September, '17
- iv) The teachers and students of the Department bade on affectionate farewell to Mrs. Smrity Bhattacharjee, a senior faculty of the Department on the 12th of February, 2018 who retired from service on the 31st of December, 2017.
- v) The students of IVth Semester, Major were taken for an educational excursion to Kaziranga, Tezpur, Singri and Sivasagar on the 3rd, 4th and 5th of March,

2018. They were accompanied by Mrs. Hemanta Timsina and Dr. Meetal Chaliha as teachers-in-charge.

- vi) Mrs. Krishnakhee Saikia guided the VIth Semester, core students in preparing a project on 'Garbage Disposal of Dibrugarh Town' in the month of March.
- vii) Departmental Seminars were organised and each Major student of IIInd, IVth and VIth semesters made power point presentations on subject related topics.
- viii) A farewell party was arranged for the VIth semester students on the 11th of April, 2018.

11. Achievements :

- i) The students of the Department secured the 3rd prize in the Inter Departmental Cultural Rally Competition of the College Week held in January, 2018. The theme of the rally was 'Floods in Assam'.
- ii) Hemangshri Gour, a Vth Semester student secured the 2nd prize in power lifting competition in the College Week held in Jan., 2018
- iii) Trishna Borah, a IIIrd Semester student won the 2nd prize in the Solo Dance Competition held in the Annual College Week of 2018. She also bagged the 1st Runners up Award and the Best Figure Award in the 'Miss Kanoi' Contest.
- iv) Puja Borgohain, a VIth Semester student was the recipient of the 2nd Runner's up Award in the 'Miss Kanoi' Contest held in the Annual College Week, 2018.
- v) Jenifa Gogoi, a VIth Semester student has participated in several Beauty Pageants and was crowned as Miss Luitporia, North East, 2017 in the month of November and Miss Phoenix 2018 in the month of March in Jorhat Engineering College. She has also been selected for Miss India International, 2019.
- vi) Sainon Jenny Wangsa a Vth Semester student participated in the All India Essay Writing Competition organised by Sri Ram Krishna Mission in the month of February, 2018. She secured the 5th position in the State level.
- vii) Achinta Mugdha Bokal, a Ist Semester student secured the 3rd position in the State Level Inter-College Etempore Speech Competition organised on the occasion of 'International Youth Day' on August, 2018
- viii) Ritashree Choudhury, a student of Ist Semester has been selected for the grand finale in the 'All Assam Group Dance Competition organised by a Gauhati based organisation 'Show Your Moves' in the month of August.

