GEOMORPHOLOGICAL KNOWLEDGE IN MANAGEMENT OF DAMS AND BARRAGES: SPECIAL REFFERENCE TO FARAKKA BARRAGE IN WEST BENGAL

Pompa Mondal

Bansdroni Chakdah Vidyamandir (H.S)

ABSTRACT

The present study is concerned with the geomorphological knowledge in management of dams and barrages special reference to Farakka barrage in West Bengal. Dam is the barrier constructed across a stream or river to impound water and raise its level. A barrier of concrete or earth built across a river to create a body of water as for domestic water supply. A reservoir of water creates by such a barrier. A barrage is a construction across a water course to increase the depth of water to assist navigation and irrigation. Both of these are build up for the purpose of equal water distribution, irrigation, proper navigation, reduce flood level, generation of hydroelectricity, decreasing siltation in the lower coarse of the river etc. So management of dams and barrages is also essential. In this case geomorphological knowledge as a management tool plays important role like Remote Sensing and GIS. Because the geomorphological knowledge help to overcome the different problems created by the construction of dams and barrages. Farakka Barrage is a barrage across the Ganges River, located in the Indian state of West Bengal, roughly 10 kilometres (6.2 mi) from the border with Bangladesh near Chapai Nawabganj District. So the over says problems shows in West Bengal and surroundings as a result of construction of Farakka barrage. Geomorphological knowledge like idea of soil, geology, hydrology etc. as management tool of dams and barrage is very significant.

INTRODUCTION:

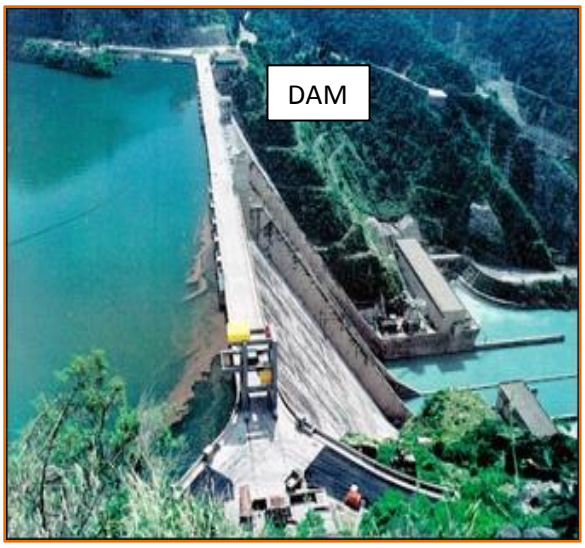
The present study is concerned with the geomorphological knowledge in management of dams and barrages special reference to Farakka barrage in West Bengal. Siltation in the lower coarse of river is one of the most important problem in West Bengal as well as India, World. For this reason flooding, unequal water distribution, coarse change of river, poor port system occur

continuously. Dams and barrages help to overcome these problem. So management of these dams and barrages also require. Like GIS and Remote Sensing geomorphological knowledge is the important tool to management of the dams and barrages. Farakka Barrage is a barrage across the Ganges River, located in the Indian state of West Bengal, roughly 10 kilometres (6.2 mi) from the border with Bangladesh near Chapai Nawabganj District. Construction was started in 1960 and completed in 1974. The barrage was built to divert the Ganges River water into the Hooghly River during the dry season, from January to June, in order to flush out the accumulating silt which in the 1950s and 1960s was a problem at the major port of Kolkata on the Hooghly River. One of the important things to note here is that the river divides Murshidabad and Malda districts of West Bengal. So for minimization or overcome these problem geomorphological knowledge as a tool of management of dams and barrages is very much important.

OBJECTIVES OF THE STUDY: The main objectives of the study are

- To know the difference between dam and barrage.
- To identify the reasons behind building of the barrage.
- To mark the impacts of the barrages on environment.
- Management of the barrage in West Bengal.

What is dam? Dam is the barrier constructed across a stream or river to impound water and raise its level. A barrier of concrete or earth built across a river to create a body of water as for domestic water supply. A reservoir of water creates by such a barrier.



WHAT IS A BARRAGE?

A barrage is a construction across a water course to increase the depth of water to assist navigation and irrigation.

DISTINGUISH BETWEEN DAMS AND BARRAGES:

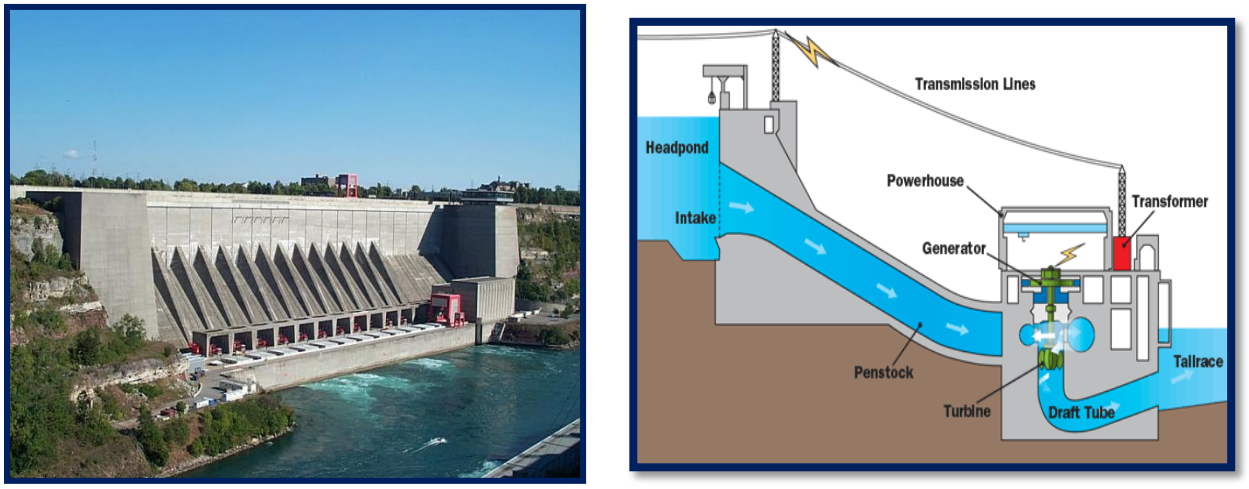
Both the dam and barrage are barriers constructed across a river or natural water course for diverting water into a canal mainly for purposes of irrigation, water supply etc. or into a channel or a tunnel for generation of power.
In case of a barrage, its entire length across the river i.e. between the banks is provided with gates having their bottom sill near the river bed level. Thus, the storage behind the barrage is solely created by the height of the gates.
The dam on the other hand has spillway gates almost near its top level and the storage behind the dam is mainly due to the height of concrete structure and partially due to the gate height.
In both the cases, however, the number and size of gates is adequate to pass the design flood during monsoons.

REASION TO BUILD A DAM

- Generation Of Hydroelectricity

- Irrigation. These are often diversion dams, which stop a river's natural course so that water can be sent off to a different place.
- Control of flooding. These are called detention dams, which are constructed to either stop or slow the amount of water in a river.

According to Patrick McCully, campaigns director of the International Rivers Network, over 800,000 dams have been constructed worldwide for drinking water, flood control, hydropower, irrigation, navigation, and water storage. But since the 1950s, the peak of the big dam era, perceptions of dams and dam building have changed. Once symbols of development, dams today symbolize, as shown in this website, not progress but environmental and social devastation.



GENERATION OF HYDROELECTRICITY

IMPACTS OF BUILDING THE DAM AND BARRAGE:

Number of impacts are there in building of dams and barrages. These are

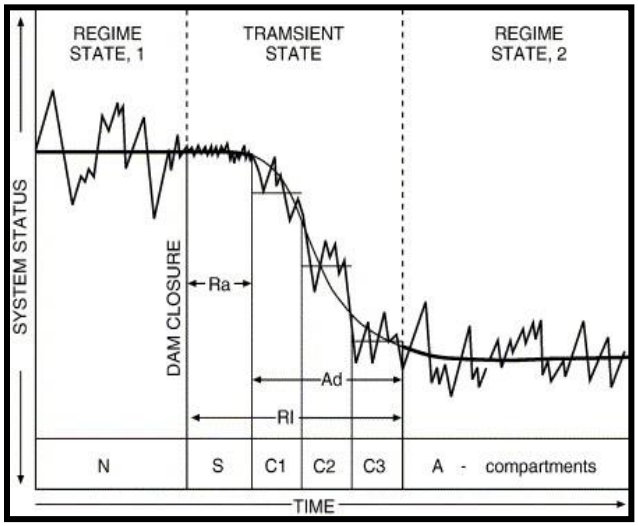
1.impacts of flow regime 2. Impacts of sedimentation 3.Impacts of primary production

4. impacts on thermal regime 5. Impacts on stable water quality 6.impacts on biodiversity

7.impacts on birds and animals 8.impacts on fish

DAMS AND BARRAGE : A GEOMORPHOLOGICAL OVERVIEW:

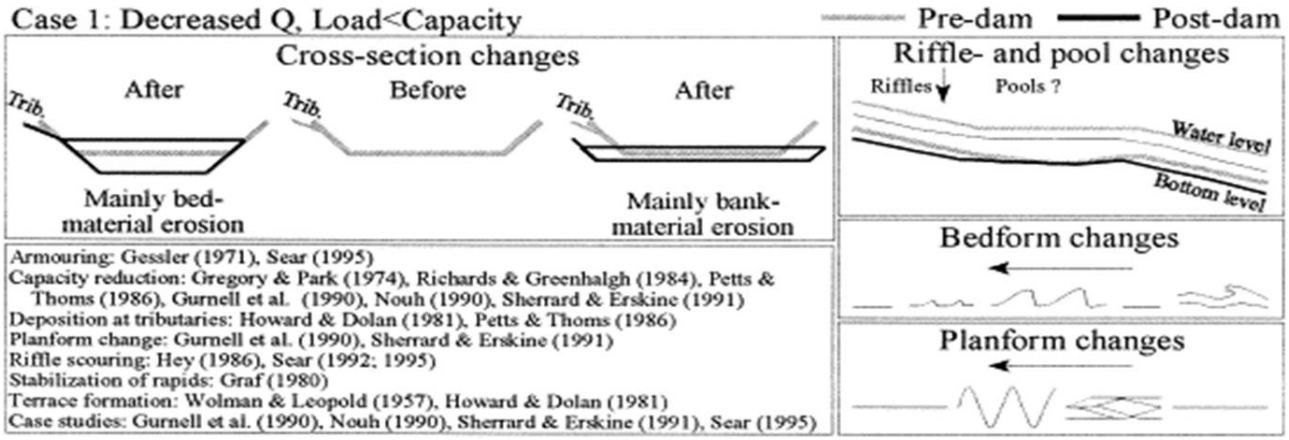
Dams impose changes of flow and sediment transfer that drive changes of channel form along the downstream regulated river. These changes have been described for more than 50 years but process-form relationships have only been advanced with the establishment of a conceptual framework during the 1970s, and then the extension of monitoring data and advancement of remote sensing technologies, particularly over the past 20 years. This paper reviews these developments and identifies three influential themes: (i) channel dynamics, (ii) the role of riparian vegetation, and (iii) channel change as the driver of ecological change. Changes can be rapid in semi-arid regions but elsewhere relaxation periods may extend to millenia. In these latter cases regime or steady-state models should be replaced by models of transient states applied to the reach scale in order to respond to the needs of river managers over decadal timescales.

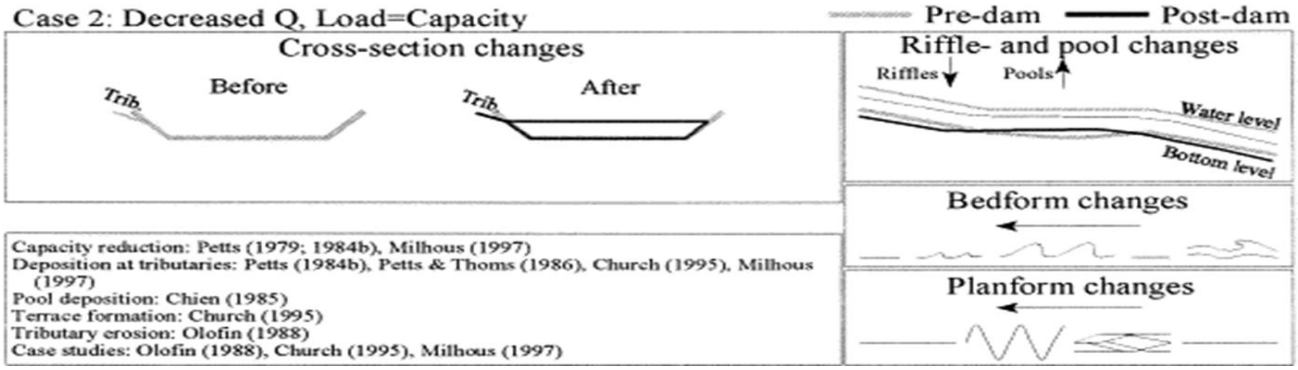


The hypothetical trajectory of fluvial metamorphosis following dam closure. Change from the natural regime state (N) to the adjusted regime state (A) passes through the relaxation period (Rl) comprising a reaction phase (Ra) and an adjustment phase (Ad). The relaxation period comprises a sequence of transient states. These include an accommodation state (S), in which regulated flows are accommodated within the inherited channel form, and changed channel states (here, C1–3) adjusted to the regulated flow and changing sediment loads as the adjustment process conveys sediments through the downstream

The sequence of changes in channel form and habitat diversity associated with benthic invertebrates within one reach below a tributary confluence on the regulated River Rheidol, UK developed from field surveys of the reach and location-for-time substitution based on other reaches along the river (after Greenwood et al., 1999). Four transient states are recognised within

the relaxation period. Following slow progressive change from S to C1, major changes were associated with a few major floods yielding gravels from the unregulated tributary.





MANAGEMENT OF DAM AND BARRAGE

1 Measures upstream and within the reservoir,dam and barrage to mitigate.

2 Measures downstream and within the reservoir,dam and barrage to mitigate.

1.MEASURES UPSTREAM OF DAM AND BARRAGE:

A/ Changes to inlet structure configuration.

B/ Artificial mixing by mechanical mixer or compressed air.

C/ Thermal regime

D/ Flushing to reduce residence times.

O/ Sedimentation

P/ Dredging

Q/ Mechanical cutting

R/ Chemical control

E/ Catchment management.
F/ Pre-impoundment clearing of reservoir.
G/ Reservoir re-aeration.
H/ treatment of reservoir inflows.
I/ Water quality
J/ Construction of small "pre-reservoirs"
K/ Debris dams.
L/ Shoreline erosion control.
M/ Sediment flushing
N/ Utilization of sediment density currents.
S/ Bio-manipulation
T/ Weeds
U/ Man made spawning areas
V/ Removal of sand bars across tributary mouths
W /Construction of shallow water habitat
X/ Wildlife rescue
Y/ Terrestrial

2.MEASURES DOWNSTRAM AND WITHIN THE RESERVOIR , DAM AND BARRAGE TO MITIGATE:

A/ Flow regime Managed flow releases.
B/ Thermal regime Multi-level outlet works.
C/ Outlet works aeration.
D/Multi-level outlet works.
E/Water quality
F/ Turbine venting.
G / Addition of sediment to rivers.
H/ Managed flow releases.
I/ Shoreline stabilisation.
J/ Sedimentation
K/Pumping offshore sediment to estuaries.
L/ Chemical control
M/ Biological control
N/ Weeds/ algal
O/ Flushing
P/ Freshet to stimulate fish migration
Q/ Improved design of turbine, Spillways and overflows
R/ Artificial spawning areas
S/ Hatches and fish stocking
T/ Mechanical cutting
U/ Fish passes

MANAGEMENT OF DAM AND BARRAGE :GEOMORPHOLOGICALKNOWLEDGE

Management of dams and barrages from any geomorphological direction is very difficult to analyze. Although it has some method of analysis to manage the dams and barrages. As given below of some specific geomorphologic points that's are relevant so

- GEOLOGICAL STRUCTURE AND STATIAGRAPHI ANALYSIS
- HYDROGRAPHIC ANALYSIS
- FLOW VELOCITY ANALYSIS
- SEDIMENT ANALYSIS
- SEISMIC ANALYSIS
- ANALYSIS OF LONGITUDINAL PROFILE OF THE CONCERNED RIVER
- ANALYSIS OF RELATIVE HARDNESS OF ROCK
- CATCHMENT AREA ANALYSIS
- PALEO CHANNEL STUDY

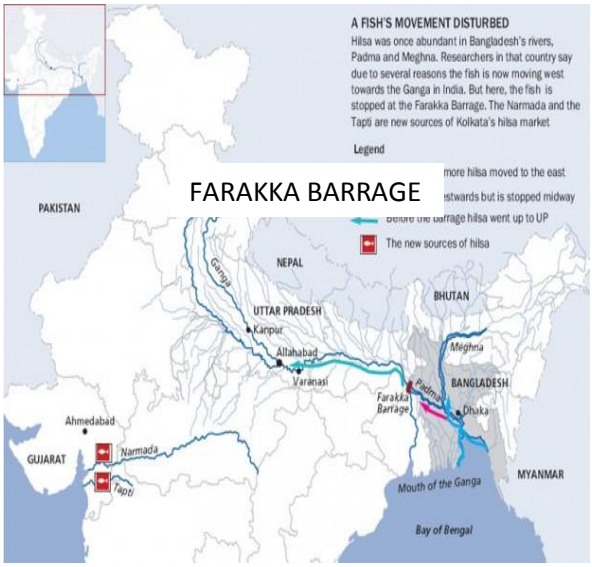
DAM & BARRAGE: WITH SPECIAL EMPHASIS TO FARAKKA BARRAGE

OVERVIEW: The Farakka Barrage was the built in 1975 on the River Ganga, at Farakka, India, 155 miles north of the Indian port city of Kolkata, and 11 miles from the Indian border with Bangladesh. It was built by the Indian government for the stated purpose of flushing the silted Hooghly tributary of the Ganga, which runs through Kolkata. Although the dam has been successful in keeping the Hooghly navigable, it has had a significant economic and ecological impact on the Bangladeshi side of the border, depriving Bangladeshi farmers of water and silt and leaving a serious threat to the Sundarban wetlands.Farakka has been a thorn in the side of Indian-Bangladeshi (and, pre-1971, Indian-Pakistani) relations for over 50 years now. Bangladesh has made claims that India has unfairly and unilaterally diverted more than its share of water during the dry season, when the flow of the Ganga is low. There have also been complaints that India did not give due warning to Bangladesh before opening the dam during the monsoon season. India, of course, has repeatedly denied the allegations.

In spite of Bangladesh's ministrations to do so, India has firmly avoided entering any multilateral talks about the issue, and fastidiously tried to keep it off the SAARC (South Asian Association for Regional Cooperation) agenda, of which both Bangladesh and India are member states. The first water-sharing agreement signed by both states was in 1977. Since then there have

been two Memorandums of Understanding, in 1982 and 1984, respectively. In December 1996, the two countries signed the thirty-year Ganges Water Treaty.

LOCATION OF FARAKKA BARRAGE IN WEST BENGAL



Farakka Barrage is a barrage across the Ganges River, located in the Indian state of West Bengal, roughly 10 kilometres (6.2 mi) from the border with Bangladesh near Chapai Nawabganj District. Construction was started in 1960 and completed in 1974. The barrage was built to divert the Ganges River water into the Hooghly River during the dry season, from January to June, in order to flush out the accumulating silt which in the 1950s and 1960s was a problem at the major port of Kolkata on the Hooghly River. One of the important thing to note here is that the river divides Murshidabad and Malda districts of West

Bangladesh and India have had many debates about how the Farakka Barrage cuts off Bangladesh's water supply. Also in Bangladesh, the diversion has raised salinity levels,

contaminated fisheries, hindered navigation, and posed a threat to water quality and public health. Lower levels of soil moisture along with increased salinity have also led to desertification.

This is the longest barrage in the world[citation and has recently been entered into the Guinness Book of World Records. The barrage was constructed by the Hindustan Construction Company Limited. It has 123 gates and it serves water to the Farakka super thermal power station.

IMPACT OF FARAKKA BARRAGE:

On the Gorai : Experts claim that the flow of the Ganga River in Bangladesh has decreased by 50%-73% during the dry season. The subsequent increase in salinity has had negative effects on the quality of both ground and surface water. The diversion of water at Farakka has also caused severe damage to the breeding and raising grounds for 109 species of Gangetic fishes and other aquatic species and amphibians, according to one study. In addition, siltation of th e Gorai River has been shown to have significantly increased, causing the Gorai to be close to dry during a portion of the year.

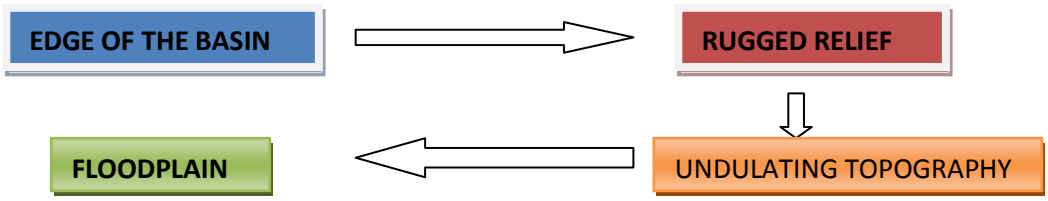
On the Hooghly: The increased flushing of the Hooghly, allowed by the construction of the Farakka Barrage, has brought about a considerable increase in the freshwater supply in the Hooghly estuary. This has, of course, affected the entire river ecology, particularly its fishery resources, fishing patterns and fish production. According to a study done by the Central Inland Capture Fisheries Research Institute in West Bengal, the freshwater zone of the river "now extends to the mouth of the estuary," the true estuarine zone "has moved seaward," and the marine zone has "now been restricted to the area near the mouth of the estuary." According to the study, these changes has led to a sharp decline in marine and neritic fish species in the upper estuary, but a marked increase in the fish Tenualosa ilisha,as well as a doubling of average annual fish landings from the estuary as a whole.

On the Bangladesh:

The ecological impact of Farakka Barrage has an inevitable socio-economic one for a country as directly tied to its land and water resources as Bangladesh. The drastic change in the quality and availability of water, as well as the related changes in soil has affected both the fish and the agricultural industry. More importantly, many farmers who lived in the areas affected by the drying river have been dislocated. Others find themselves out of means to a livelihood. It is

possible to connect the automigration of many poor farmers across the border into India in search of better circumstances to the destabilizing effect the Farakka Barrage has meant for certain regions of Bangladesh

Characterization of the geomorphological compartments identified:



CONCLUSION: Through this study it shows that geomorphological knowledge is the important technique for management of dams and barrages. Hydrological, geological, soil etc. idea are significantly apply at the time of dams and barrage construction. But geomorphological knowledge like geological structure and statiagraphic analysis, hydrographic analysis, flow velocity, sediment analysis, seismic analysis etc. are not use properly in this field . So, to solve the previous problems of dams and barrages management geomorphological knowledge should be utilize in proper way. The mean concern of the authorities, planners and Government should be look after the application of geomorphological knowledge in management of dams and barrages.

REFERENCE:

Beyer.P.J : " Dams in Geomorphology"

Brandt. A :" Prediction of Downsream Geomorphological Changes after Dam Construction"

Chudhary. S.K: "Geotextile in Road Construction Maintenance and Erosion"

Gupta avijit " Large rivers: Geomorphology and Management"

Hayat.K and Ansari J.K : "Managing Dams and Barrages Safety"

Mukhopadhayay.S.C :Hints on role of Tectonic Geomorphology of the Hindukush Himalaya India and surroundings.

Sinha. M : Farakka Barrage and its impact on the Hydrology and Fishery of Hooghly Estuary.