"Qualitative and Quantitative Water Scarcity Issues in Bihar, India"

ASHOK GHOSH DEPARTMENT OF ENVIRONMENT & WATER MANAGEMENT A.N.COLLEGE, PATNA

Water Quality and Quantity



"Water quality and quantity is going to be the biggest challenge in coming years to human beings on planet Earth.....Many persons have survived without love, but none without water"

Our Life Style ???















If everyone on Earth continue our current life style, it would take more than 7 Earths to support human population by the end of this century. THE ONLY ONE WE KNOW OF...

...TO DATE !





Gangotri Glacier

- Receding since
 1870 when data
 gathering began
- 1,147 meters
 melted away
 during the 61 years
 between 1936 and
 1996 (19 meters
 per year)
- Receded 850
 meters during the
 25 years between
 1975 and 1999 (34
 meters per year)

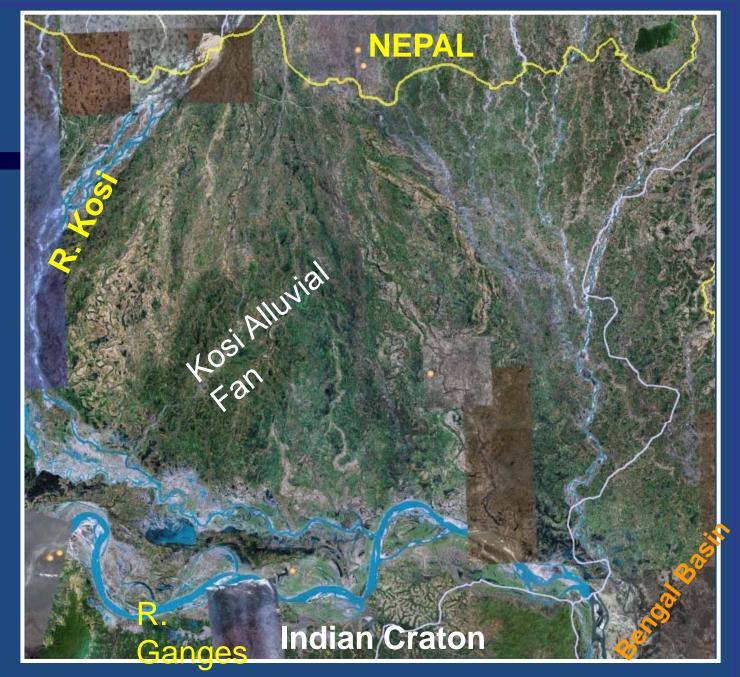
Bihar- A Water Resource Hub

• Playground of perennial Himalayan and seasonal Peninsular Streams

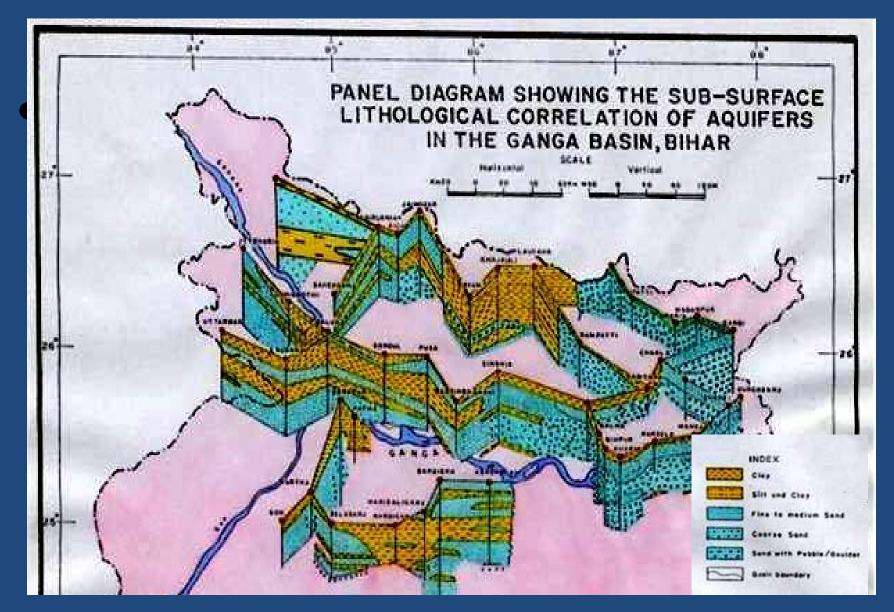
• Abundance of aquifers at all levels



Satellite view of East Bihar Plains



Aquifers of Bihar

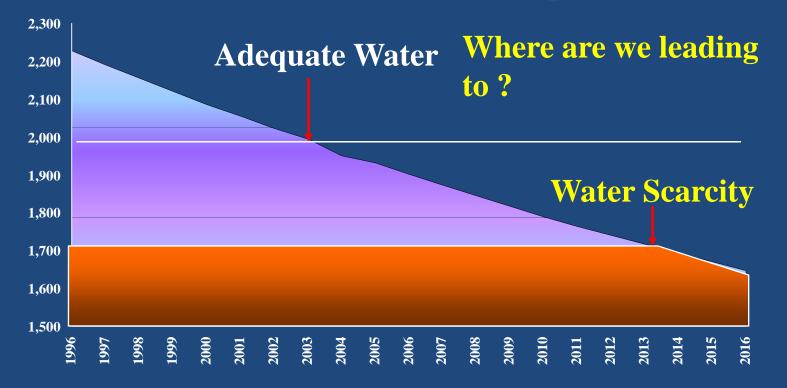


GANGA-MEGHNA-BRAMHAPUTRA RIVER BASINS



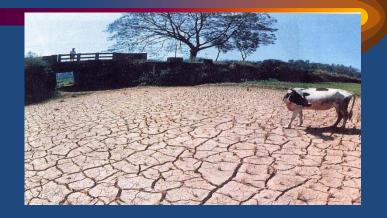
Annual Per Capita Availability of Water in the Eastern Plains of India

Precipitation : 4,000 km³



WATER RESOURCE THE - CURRENT SITUTATION

- High dependence on ground water (85%)
- Over extraction of ground water for irrigation
- Uncontrolled deforestation
- Neglect of traditional practices and systems, including rain water harvesting
- Inadequate integrated water management and watershed development
- Emerging water quality problems





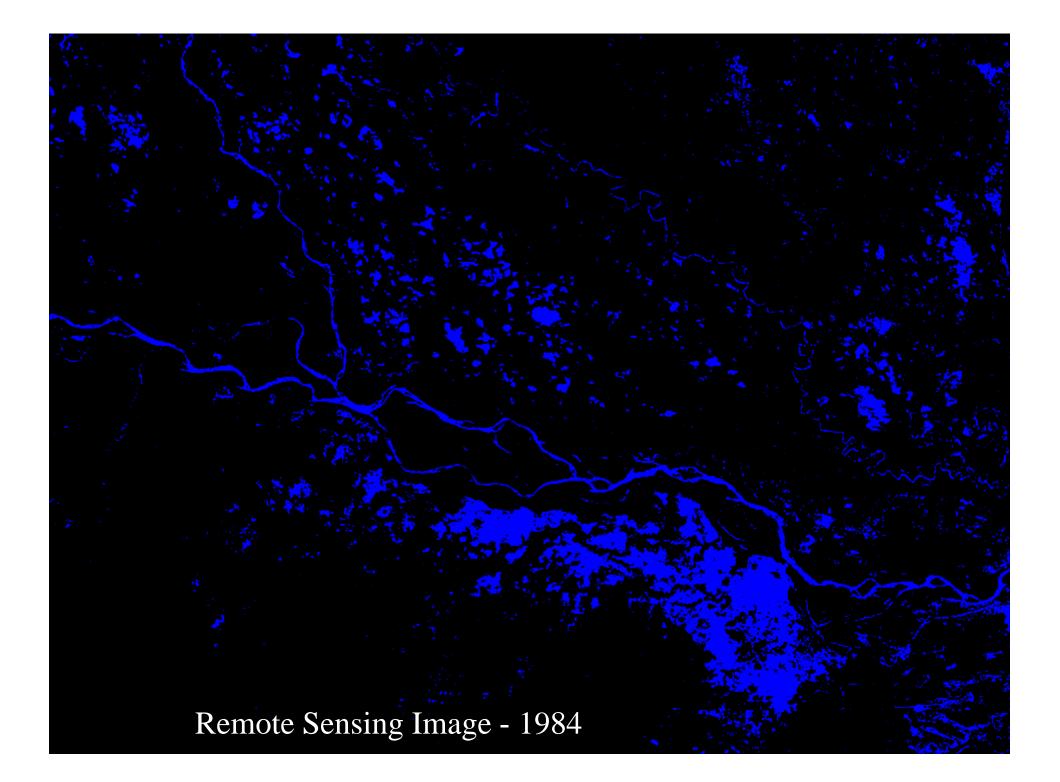
WATER QUANTITY

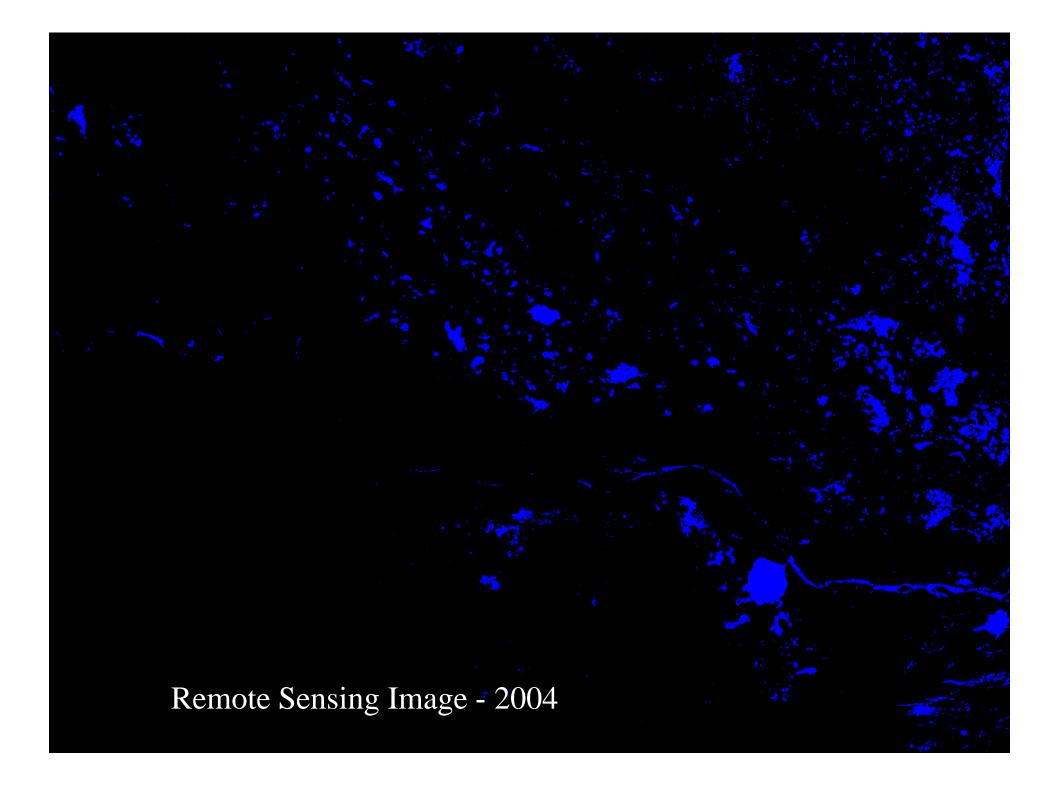
Shrinking Wetlands of Bihar- Current Climatic and Tectonic Changes? (Ghosh et al,2004)

Projection of Climate Change on Water Availability

The gross per capita water availability in Bihar will decline from about 1,950 m³/yr in 2001 to as low as about 1,170 m³/yr in 2050

 Bihar will reach a state of water stress before 2020 when the availability of clean water falls below 1000 m³ per capita





Current Status of "Surplus River Water" State – Bihar

- Surface water coverage in Ghagra-Gandak & Gandak-Kosi Zones decreased by 43.4% and 37.8% respectively
- Massive sedimentation leading to near obliteration of water bodies, including channel flows
- Increase in surface water area in Kosi Fan by 7.65%
- Eastward shift in mid-section of the Kosi.

Impact on ground water recharge

- Impact on fish culture and "makhana" cultivation
- Shrinkage and disappearance of wetland ecology
- Shrinking Kabar Tal is a proposed Ramsar Site. It covered 6786.05 hectares in 1984, but in 2004 revealed shrinkage to 5043.825 hectares.
- Seismotectonic changes were indicated by our studies in North Bihar

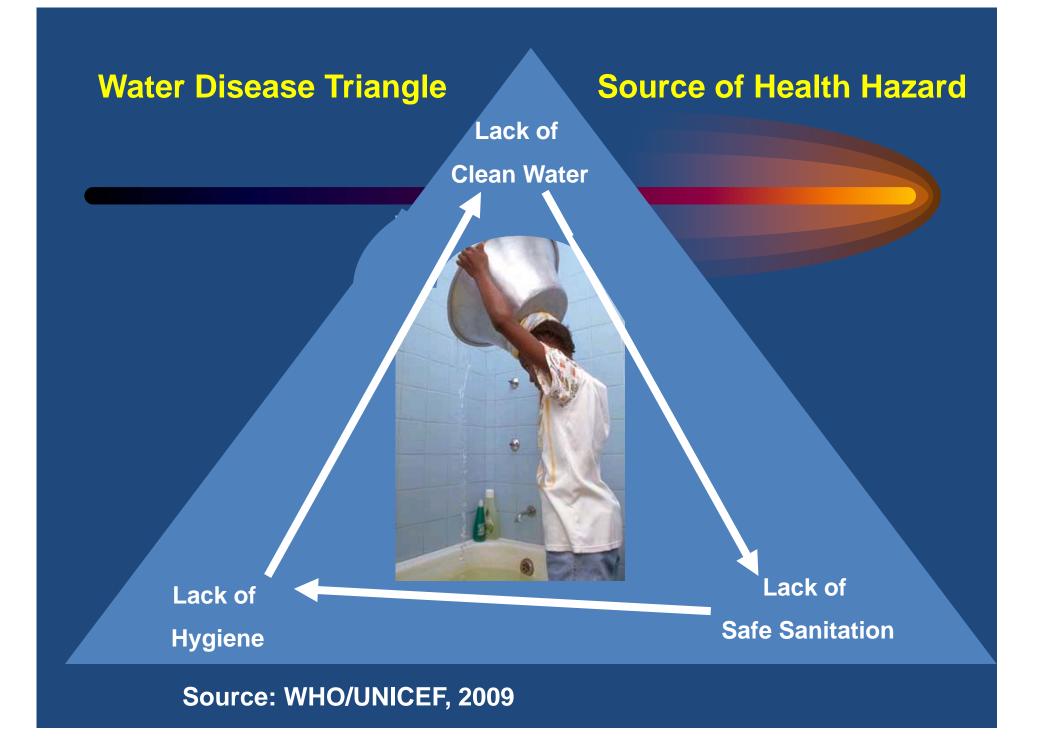
CHANGES IN MAJOR LAND USE CATEGORIES IN BIHAR

[Based on 1984 & 2004 remote sensing images]

Land use types	1984 [Fig. in Hectares]	2004 [Fig. in Hectares]	Change [in %]
Wetlands	4023.91	2409.86	-40.11
Forests, including plantations	4812.63	5773.54	19.96
Cropped Area	27148.52	24764.96	-8.78
Fallow	18653.12	20956.63	12.35
Sand and Cloud cover/Haze	978.53	1373.12	40.32
Unclassified land	521.52	860.12	64.93
TOTAL	56138.23	56138.23	-

Seasonal availability of surface water declined by 43% for the state of Bihar as a whole. Therefore lesser availability of surface water accounted for decline in the seasonal cropped area in west Bihar. Conversely in the middle plains, shrinking wetlands gave way to new arable land in their outer confines. The eastern segment is subject to rising water tables and swamping of the arable lands

WATER QUALITY

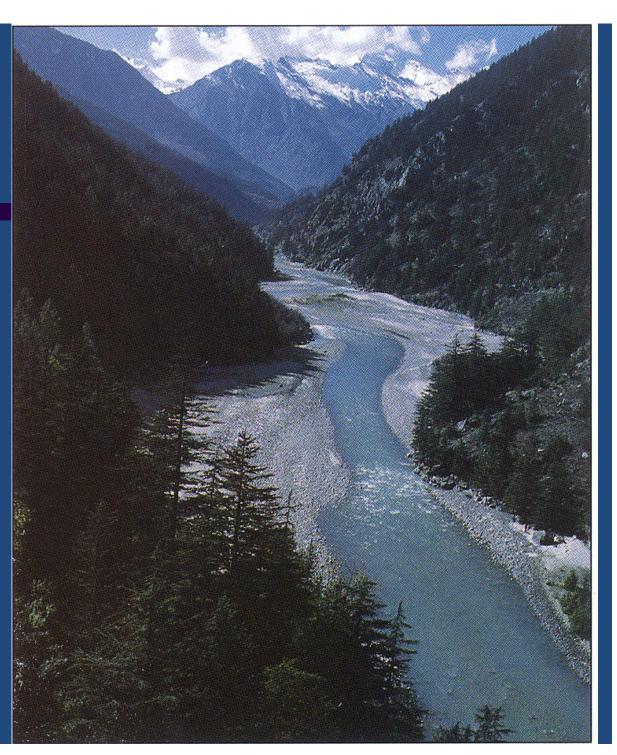


Surface Water Deterioration Due to Climatic changes and Anthropogenic activities

Status of Water Quality in Bihar

- Surface water pollution Bacteriological and Chemical
- Ground water contamination Iron, Arsenic, Fluoride and Nitrate.....

The Ganges is the longest river in South Asia. With a total length of 2,640 km



Ganga at Gomukh



Ganga at Gangotri



Ganga in UP





Ganga at Patna Bihar

Ganga at Patna



...and also, a morgue...

Ganga at Patna

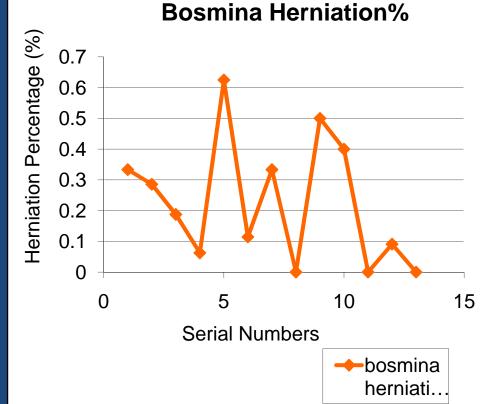


Herniation in Zooplanktons

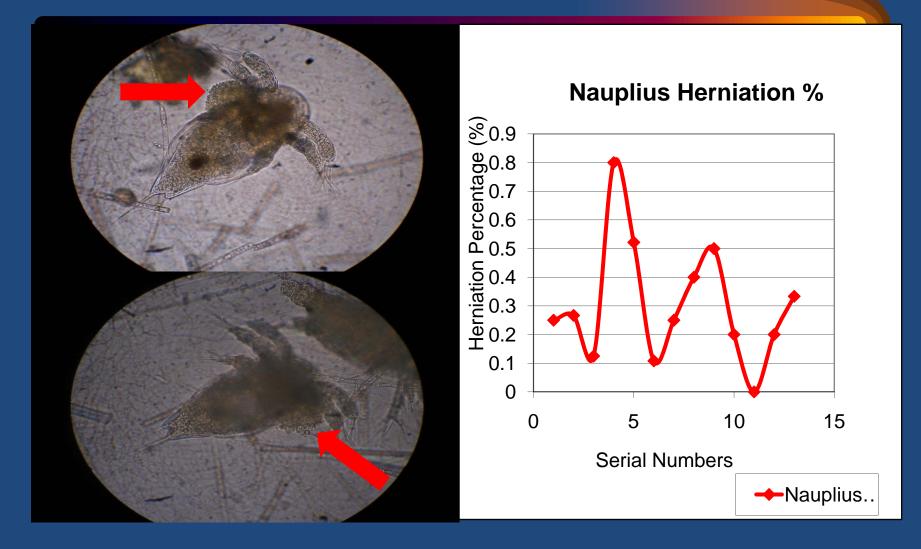
- The Ganga water has become highly polluted with very high bacterial contamination
- the growing urbanization and industrialization have increased the pollution load discharged into the River Ganga resulting in loss of the river's assimilative capacity.
- Very high rate of herniation has been detected in Ganga Water in Bihar

Herniation: Cladocera Bosmina



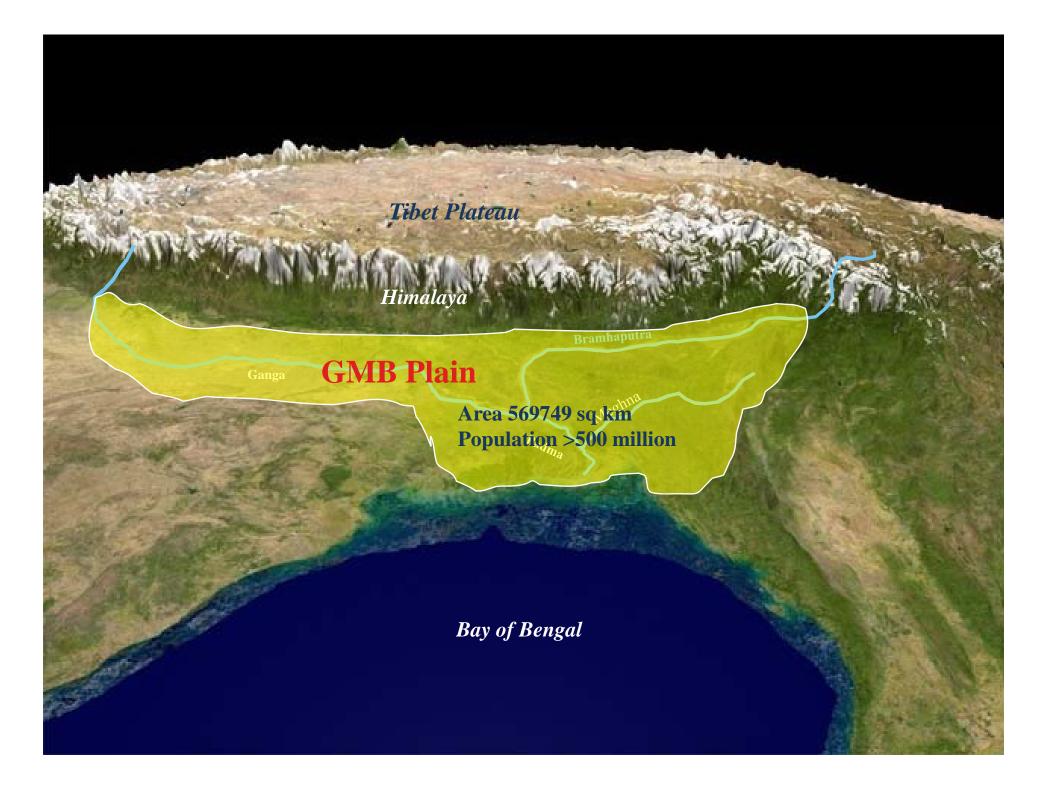


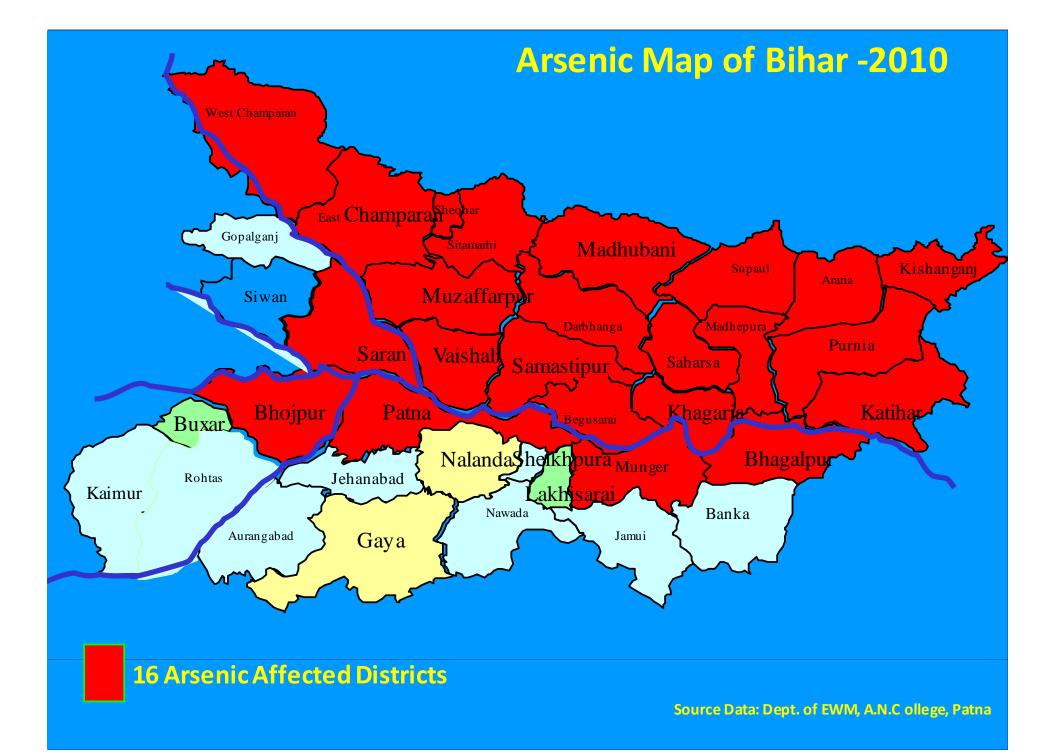
Herniation: Nauplius



GROUND WATER DETERIORATION

ARSENIC IN GROUND WATER OF BIHAR







BIHAR -Play Ground of Rivers Arsenic in Bihar -Highly Arsenic Infested



BIHAR FINDINGS (Ghosh et.al.-2008)

- More than 30 thousand hand pumps tested – 32 % of tested sources had arsenic contaminated water of>10 ppb.
- Highest As. Value Recorded **1861 ppb**
- A total of 16 Bihar districts (57 blocks) are affected by high level of arsenic in the groundwater
- **Trivalent arsenic 87 %** in ground water of Bihar
- Worst-affected districts are **Bhojpur**, **Bhagalpur**, **Samastipur**, **and Khagaria**,



The Hottest Arsenic Hand Pump of Bihar



Krishna Kumar Panday,Pandaytola,Bhojpur – Owner of hand pump with highest recorded Arsenic Concentration of 1861 ppb in Bihar



Arsenic in food chain of Bihar Food Chain



Irrigation Tube well =As 980 ppb

Gift of home coming.....



Gift of home coming.....



Kisan Panday – Ex Army Man – Developed Symptoms after his Return to native village – Panday Tola,Bhojpur

Arsenic Patients – Bhaglpur- Pirpainti





Arsenic Patients – Bhaglpur- Kahalgaon



Arsenic Patients – Khagaria



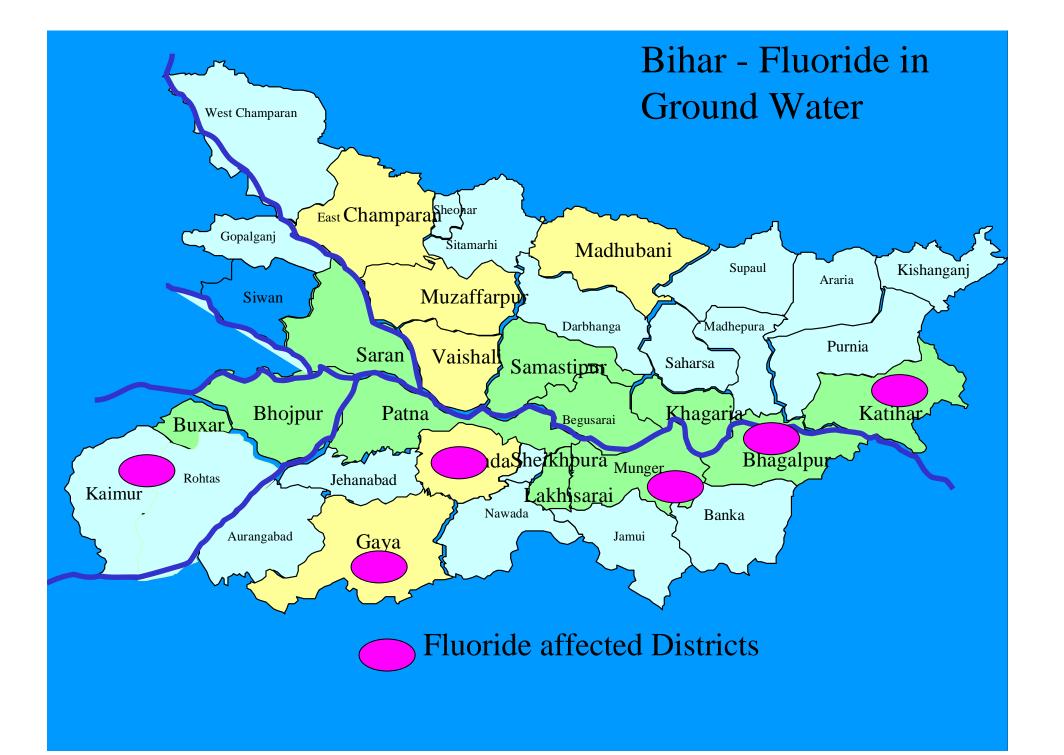


FLUORIDE IN GROUND WATER OF BIHAR

FLUORIDE CONTAMINATED WATER SOURCES

Fluoride contaminated aquifers in dry areas of following southern districts of Bihar is confirmed:-

- Gaya
- Nawada
- Rohtas
- Katihar
- Munger
- Bhagalpur



Our Fluuride Reserch ...

- We have initiated study on Fluoride contamination in Nawada District
- Fluoride level up to 6.8 ppm has been detected against the permissible limit of 1.5 ppm
- Majority of water sources of many villages have very high concentration of Fluoride
- Hundreds of persons with symptoms of Fluorosis have been identified

Clinical Outcomes of Endemic Fluorosis

- Dental Fluorosis in Children
- Skeletal Fluorosis in Adults
- Non Skeletal Fluorosis

Children of Kachariya Dih, Nawada



Trauma of Kachariya Dih, Nawada





Kachariya Dih, Nawada: Deteriorating water quality striking humanity



Dental Fluorosis







Kachariya Dih, Nawada: WE are allowing this happen to our children



Nature vs. Man

Will water crisis become endemic in this "WATER SURPLUS STATE"?

Faced with Such a Complex and Expansive Challenge, Where Do We Begin?

Priorities

- 1. Control of indiscriminate ground water usage.
- 2. Match specific water demand to quality needed
- 3. Maximize use of reclaimed water at site
- 4. Sustained resources for technology, training, infrastructure
- 5. Enforce healthy land use policy
- 6. Attention on agriculture and industry
- 7. Emphasis on water education, water as ultimate human resource



Path Forward

