Govt. of Assam

WATER RESOURCES DEPTARTMENT

Good Practices in Dealing with River Bank Erosion Problems in Assam

Presented by :-

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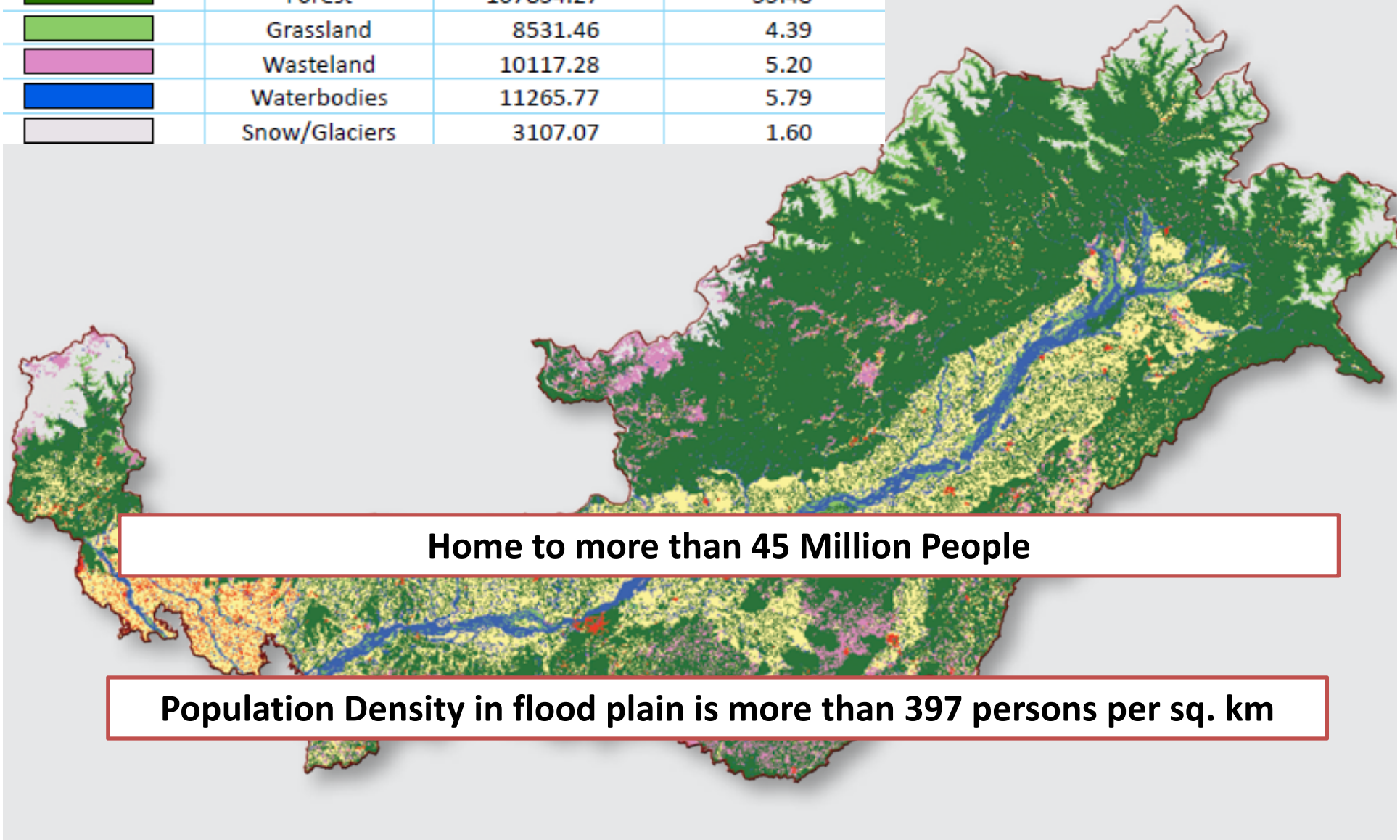
BRAHMAPUTRA BASIN

- **The total catchment area = 5,80,000 sq km.**
  (China = 293,000 sq km, India = 195,000 sq km, Bhutan=45000 sq km and Bangladesh=47000 sq km)

- **The Brahmaputra river is joined by 52 numbers of Major tributaries from both north and south bank.**
  (Total no of major and minor tributaries in Brahmaputra and Barak Basin = 121)

- **Flood discharge of Brahmaputra basin is fourth highest in the World. Its annual sediment transport is about 700 million metric tons.**

Symbol	Category	Area (Sq. km)	% of Total Area
	Built Up Land	3162.58	1.63
	Agricultural	50374.57	25.91
	Forest	107854.27	55.48
	Grassland	8531.46	4.39
	Wasteland	10117.28	5.20
	Waterbodies	11265.77	5.79
	Snow/Glaciers	3107.07	1.60



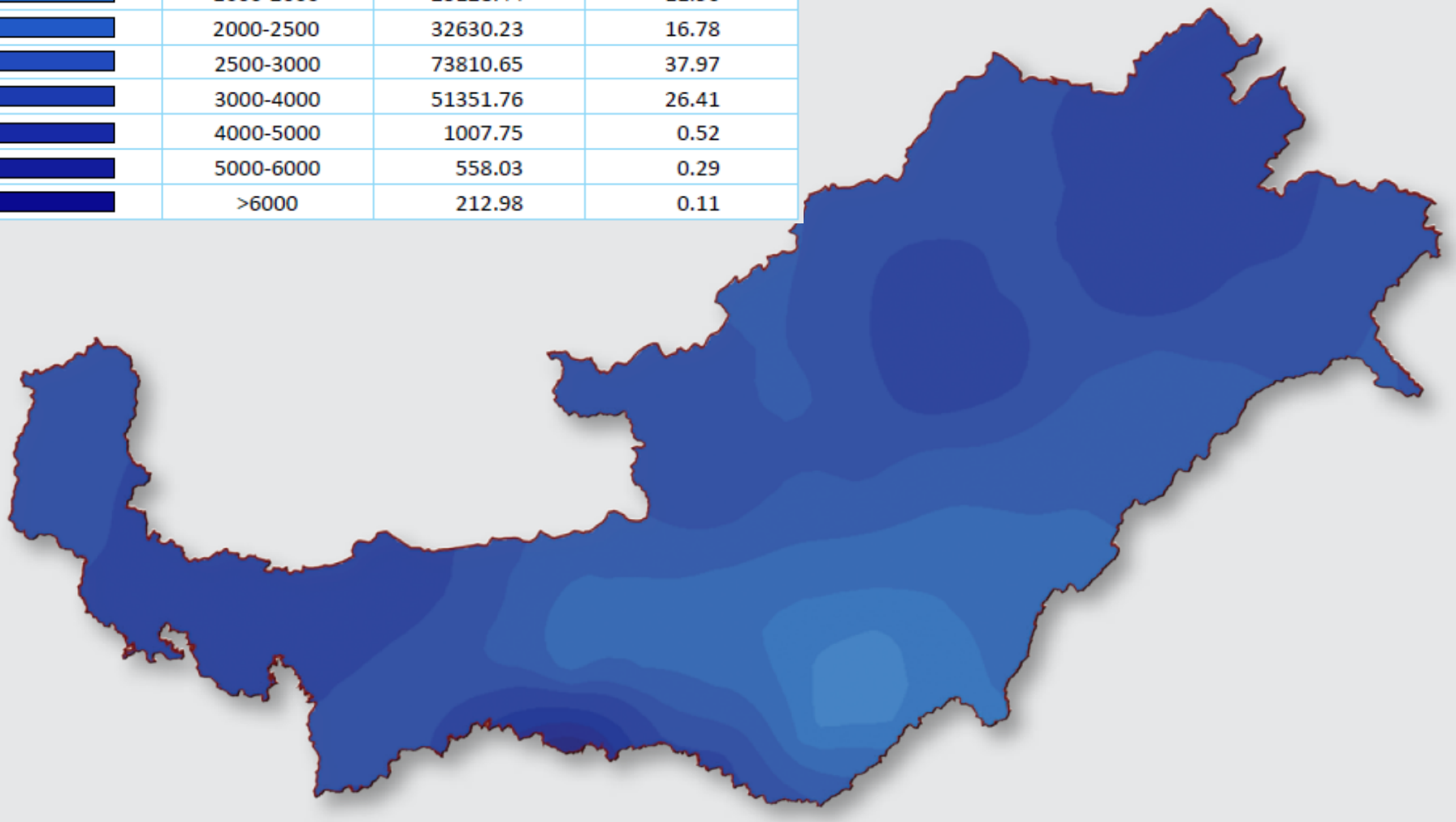
Home to more than 45 Million People

Population Density in flood plain is more than 397 persons per sq. km

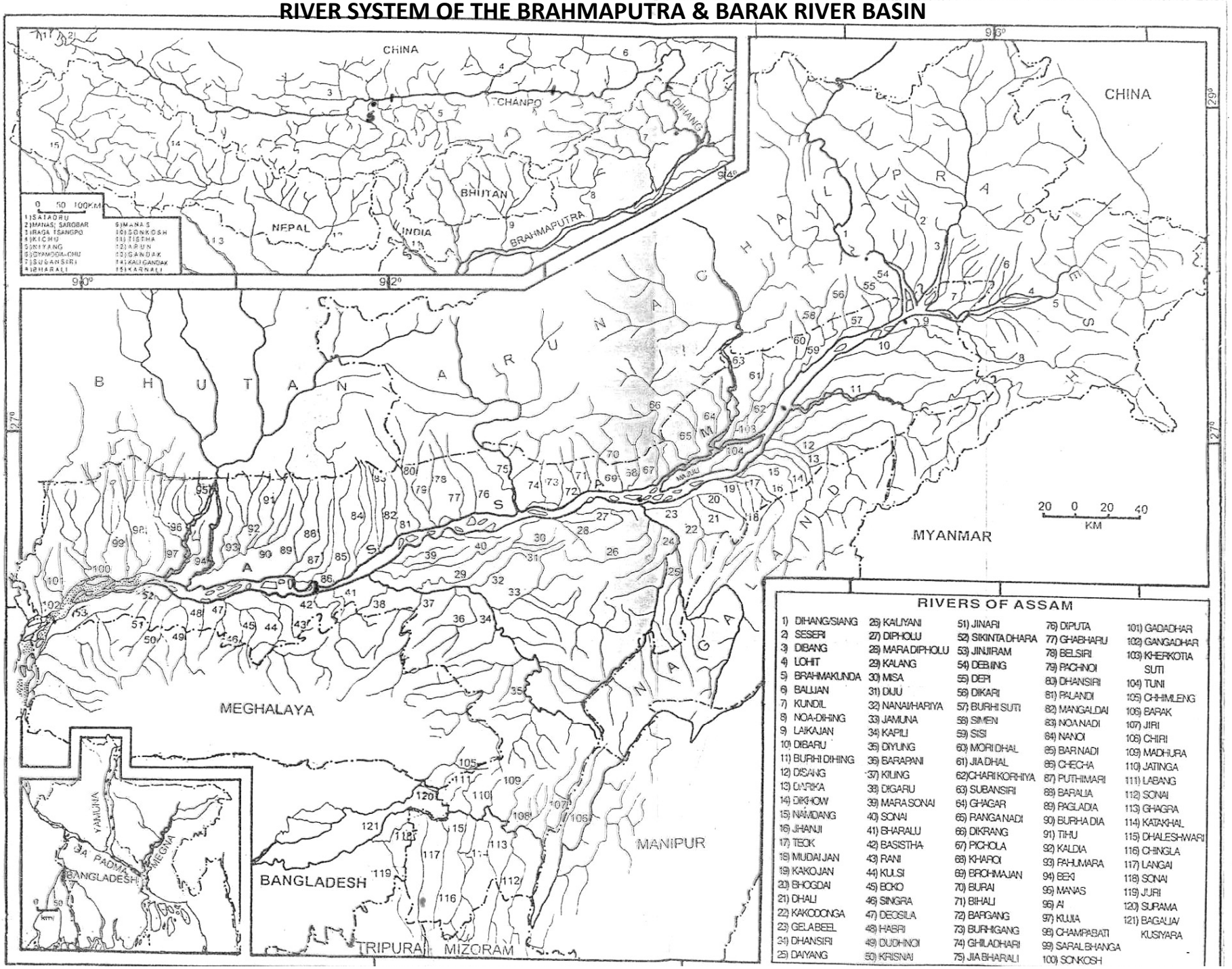
Rainfall distribution in the Brahmaputra basin

Average Annual Rainfall (1971-2005)

Symbol	Rainfall (mm)	Area (Sq. km)	% of Total Area
	1200-1400	3124.43	1.61
	1400-1600	8588.73	4.42
	1600-2000	23128.44	11.90
	2000-2500	32630.23	16.78
	2500-3000	73810.65	37.97
	3000-4000	51351.76	26.41
	4000-5000	1007.75	0.52
	5000-6000	558.03	0.29
	>6000	212.98	0.11

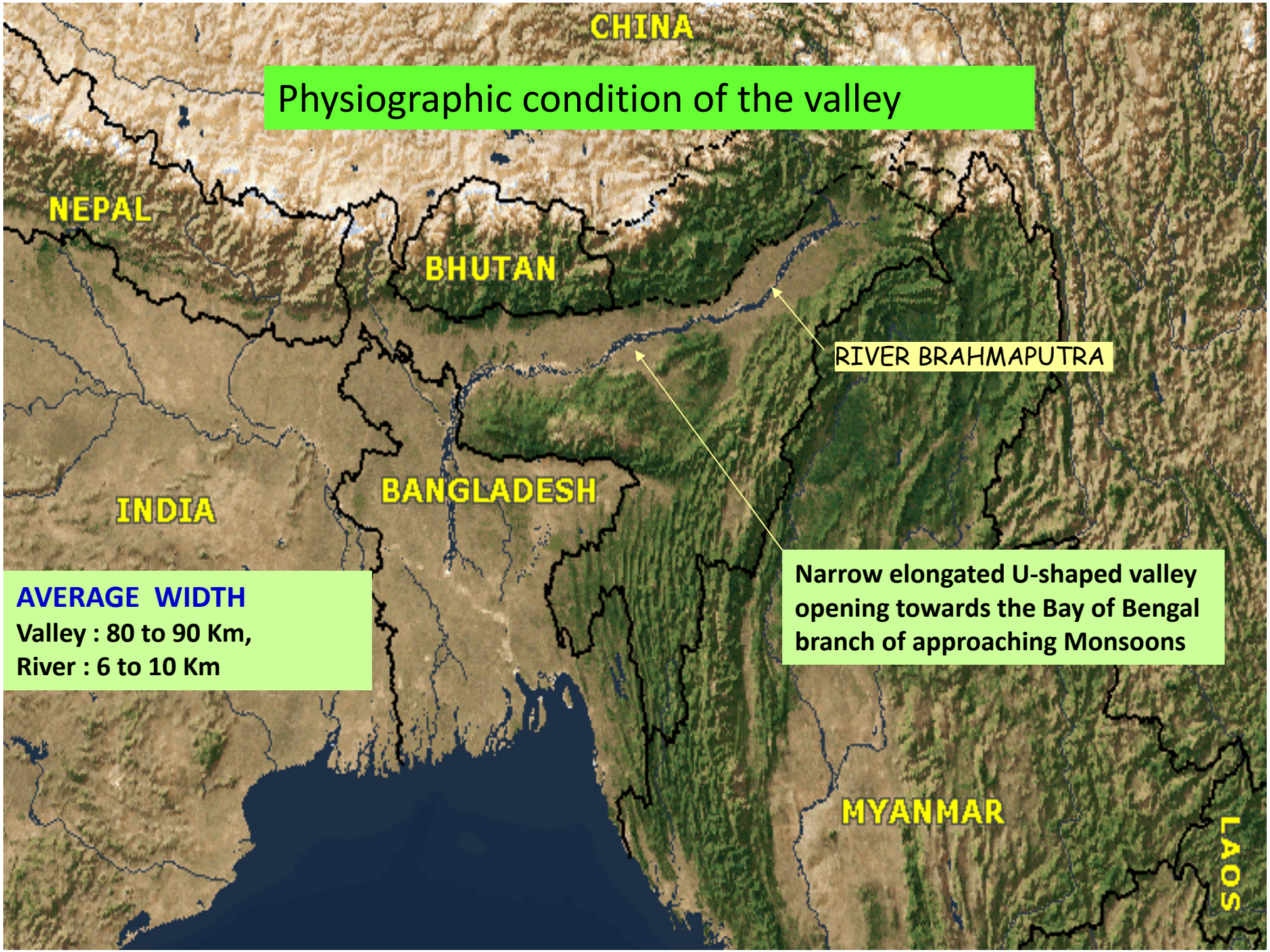


RIVER SYSTEM OF THE BRAHMAPUTRA & BARAK RIVER BASIN

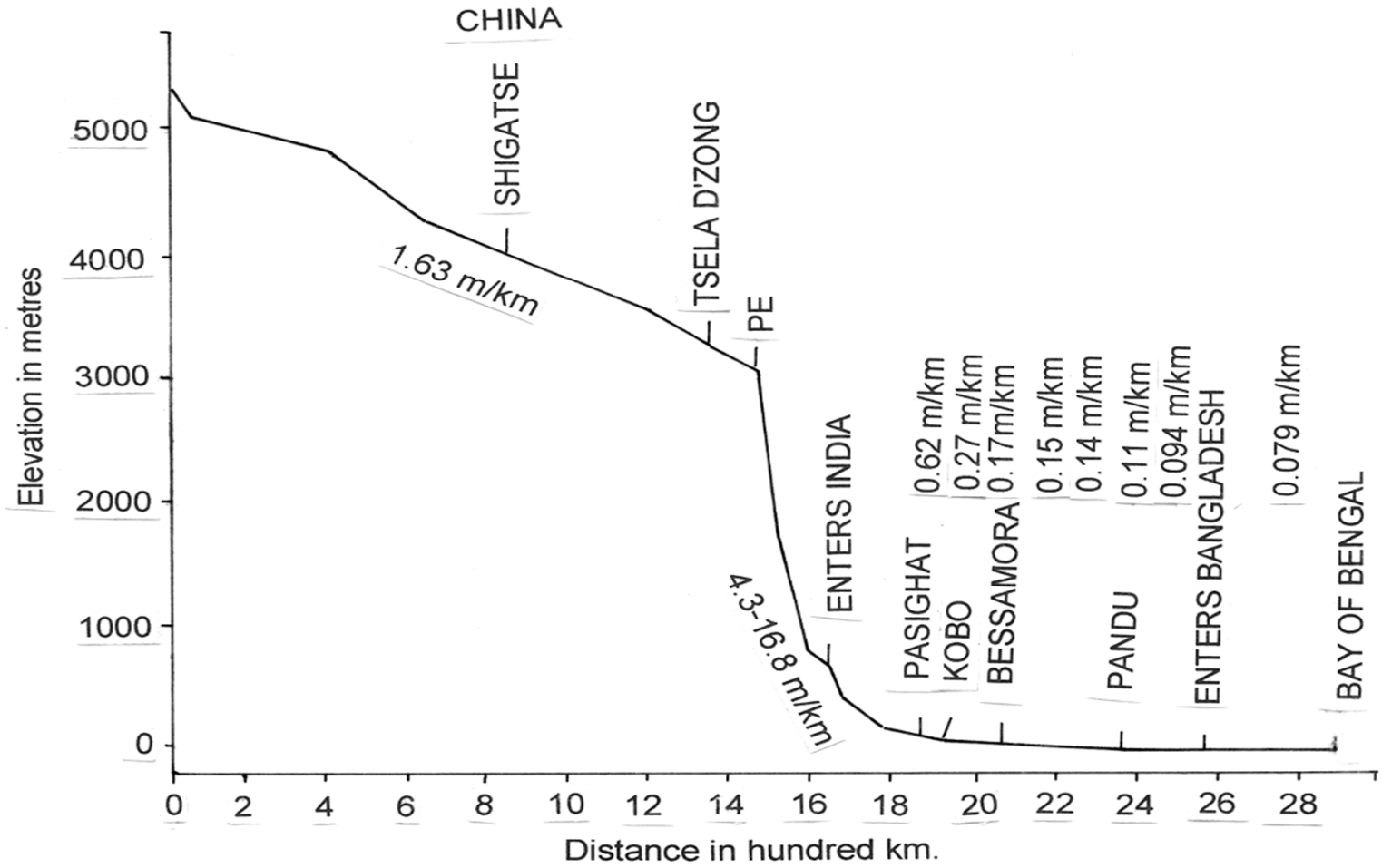


RIVERS OF ASSAM

1) DIHANG/SIANG	26) KALIYANI	51) JINARI	76) DIPUTA	101) GADADHAR
2) SESERI	27) DIPHOLU	52) SIKINTA DHARA	77) GHABHARU	102) GANGADHAR
3) DIBANG	28) MARA DIPHOLU	53) JINJIRAM	78) BELSIRI	103) KHERKOTIA SUTI
4) LOHIT	29) KALANG	54) DEBJING	79) PACHNOI	104) TUNI
5) BRAHMAKUNDA	30) MISA	55) DEPI	80) DHANSIRI	105) CHHIMLENG
6) BALUJAN	31) DIJU	56) DIKARI	81) PALANDI	106) BARAK
7) KUNDIL	32) NANAIHARIYA	57) BURHI SUTI	82) MANGALDAI	107) JIRI
8) NOA-DIHING	33) JAMUNA	58) SIMEN	83) NOA NADI	108) CHIRI
9) LAIKAJAN	34) KAPILI	59) SISI	84) NANOI	109) MADHURA
10) DIBARU	35) DIYUNG	60) MORI DHAL	85) BAR NADI	110) JATINGA
11) BURHI DIHING	36) BARAPANI	61) JIA DHAL	86) CHECHA	111) LABANG
12) DISANG	37) KILING	62)CHARI KORHIYA	87) PUTHIMARI	112) SONAI
13) DARIKA	38) DIGARU	63) SUBANSIRI	88) BARALIA	113) GHAGRA
14) DIKHOW	39) MARA SONAI	64) GHAGAR	89) PAGLADIA	114) KATAKHAL
15) NAMDANG	40) SONAI	65) PANGA NADI	90) BURHA DIA	115) DHALESHWARI
16) JHANJI	41) BHARALU	66) DIKRANG	91) TIHU	116) CHINGLA
17) TEOK	42) BASISTHA	67) PICHOLA	92) KALDIA	117) LANGAI
18) MUDAI JAN	43) RANI	68) KHAROI	93) PAHUMARA	118) SONAI
19) KAKOJAN	44) KULSI	69) BROHMAJAN	94) BEKI	119) JURI
20) BHOGDAI	45) BOKO	70) BURAI	95) MANAS	120) SURAMA
21) DHALI	46) SINGRA	71) BIHALI	96) AI	121) BAGAJAV KUSIYARA
22) KAKODONGA	47) DEOSILA	72) BARGANG	97) KUJIA	
23) GELA BEEL	48) HABRI	73) BURHIGANG	98) CHAMPABATI	
24) DHANSIRI	49) DUDHNOI	74) GHILADHARI	99) SARALBHANGA	
25) DAIYANG	50) KRISNAI	75) JIA BHARALI	100) SONKOSH	

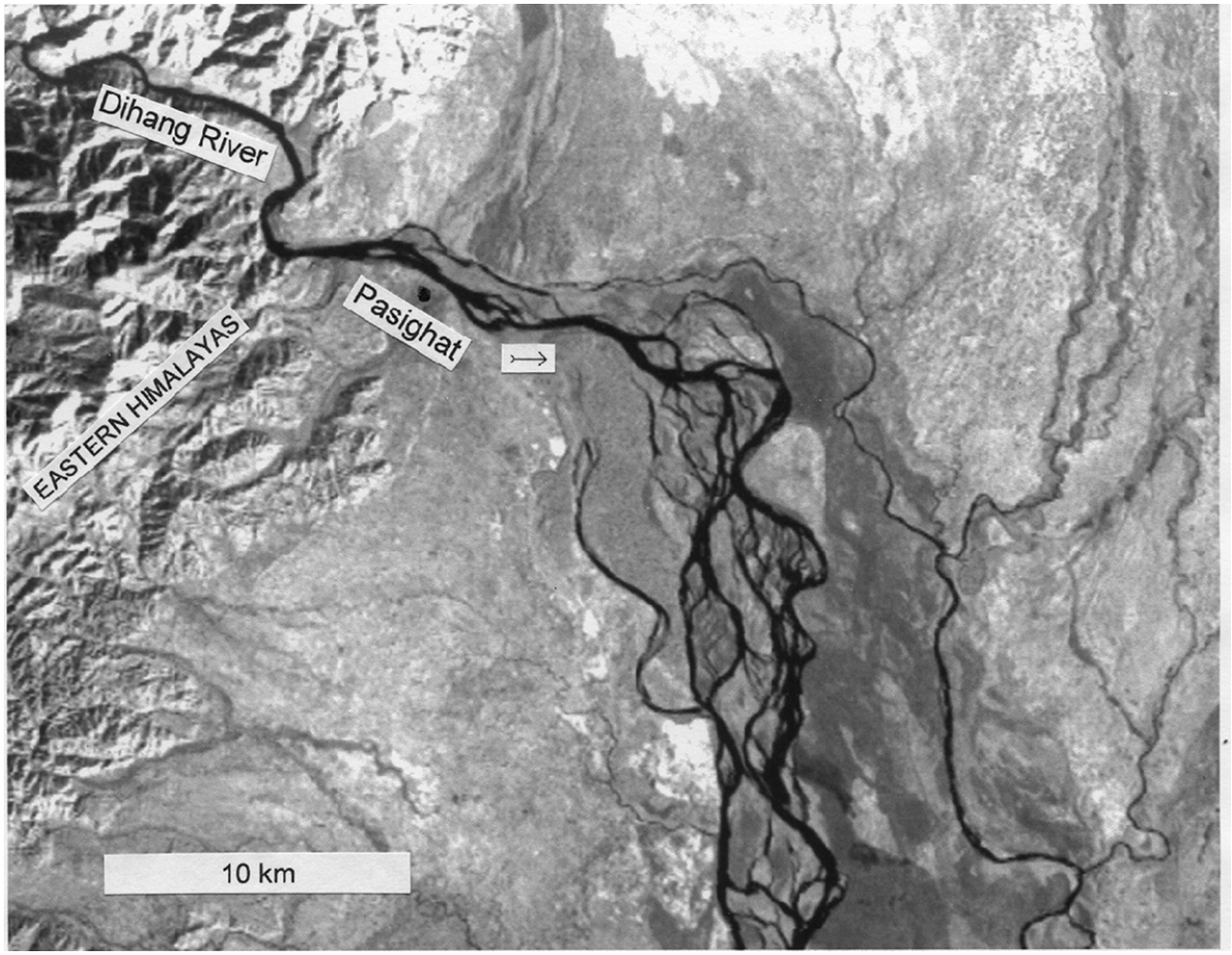

Physiographic condition of the valley
CHINA
NEPAL
BHUTAN
RIVER BRAHMAPUTRA
BANGLADESH
INDIA
MYANMAR
LAOS
AVERAGE WIDTH
Valley : 80 to 90 Km,
River : 6 to 10 Km
Narrow elongated U-shaped valley opening towards the Bay of Bengal branch of approaching Monsoons

LONGITUDINAL PROFILE OF THE BRAHMAPUTRA RIVER SHOWING ITS GRADIENT AT DIFFERENT PLACES



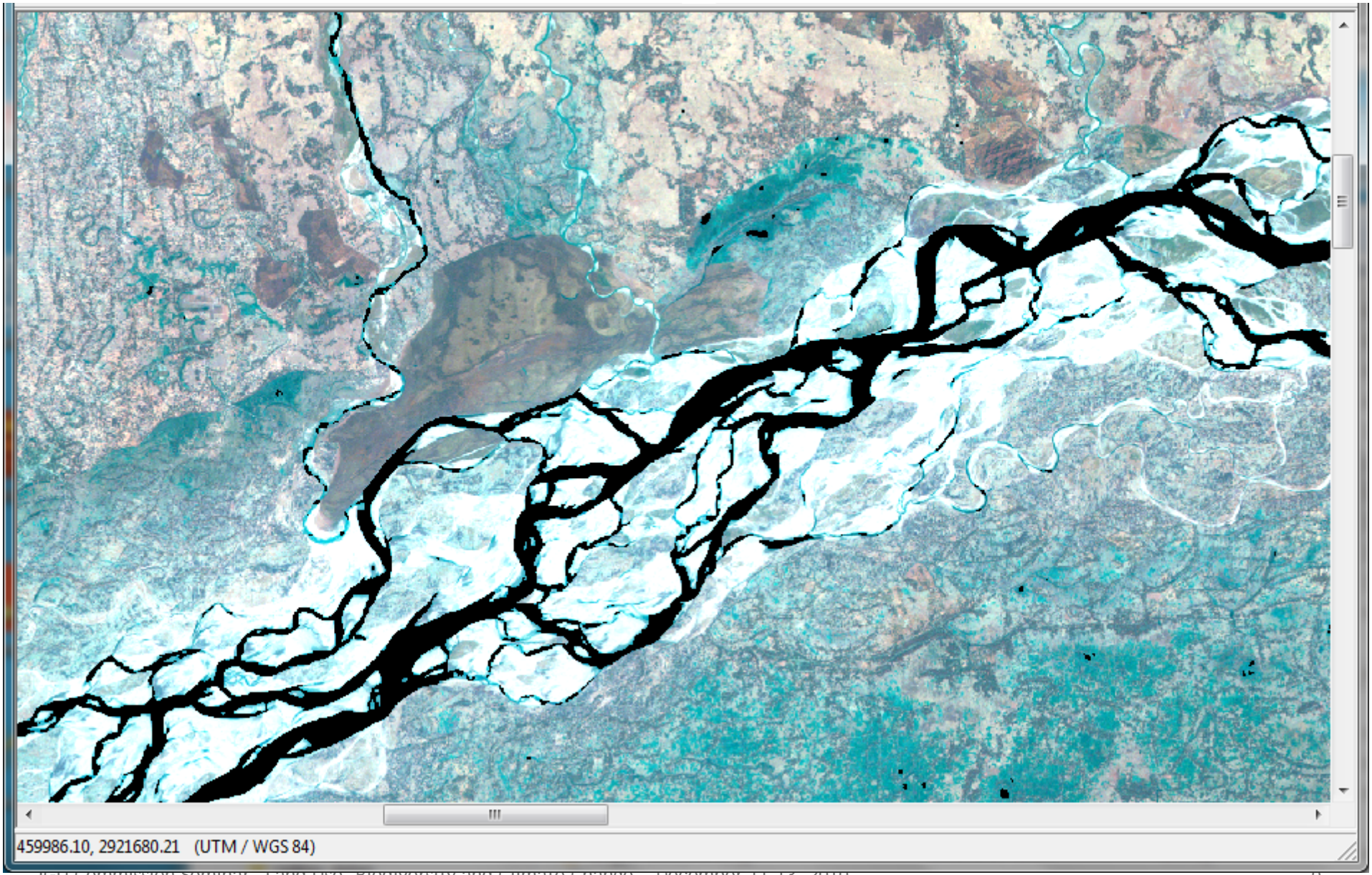
The sudden drop in elevation of the river (around 3 km in a distance of 300 km) indicates the energy gained before entering Assam.

Landsat image (April, 1988) around Passighat showing development of braiding where the Dihang river enters India



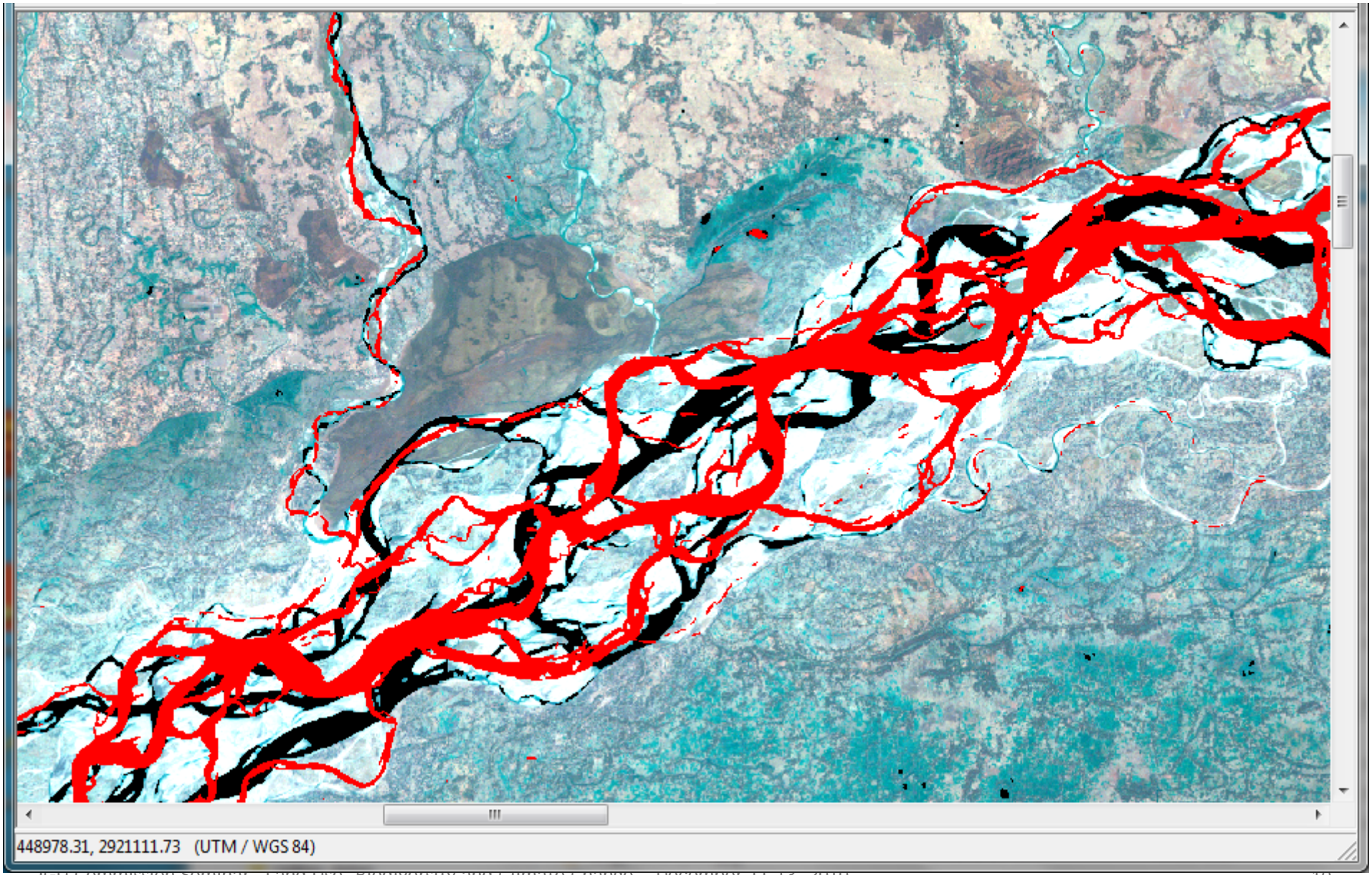
A sudden decrease in slope near Passighat results in a large amount of sediment deposition, giving rise to development of prominent braiding pattern of the river in its flood plain in Assam.

2010, Feb.



2003, March

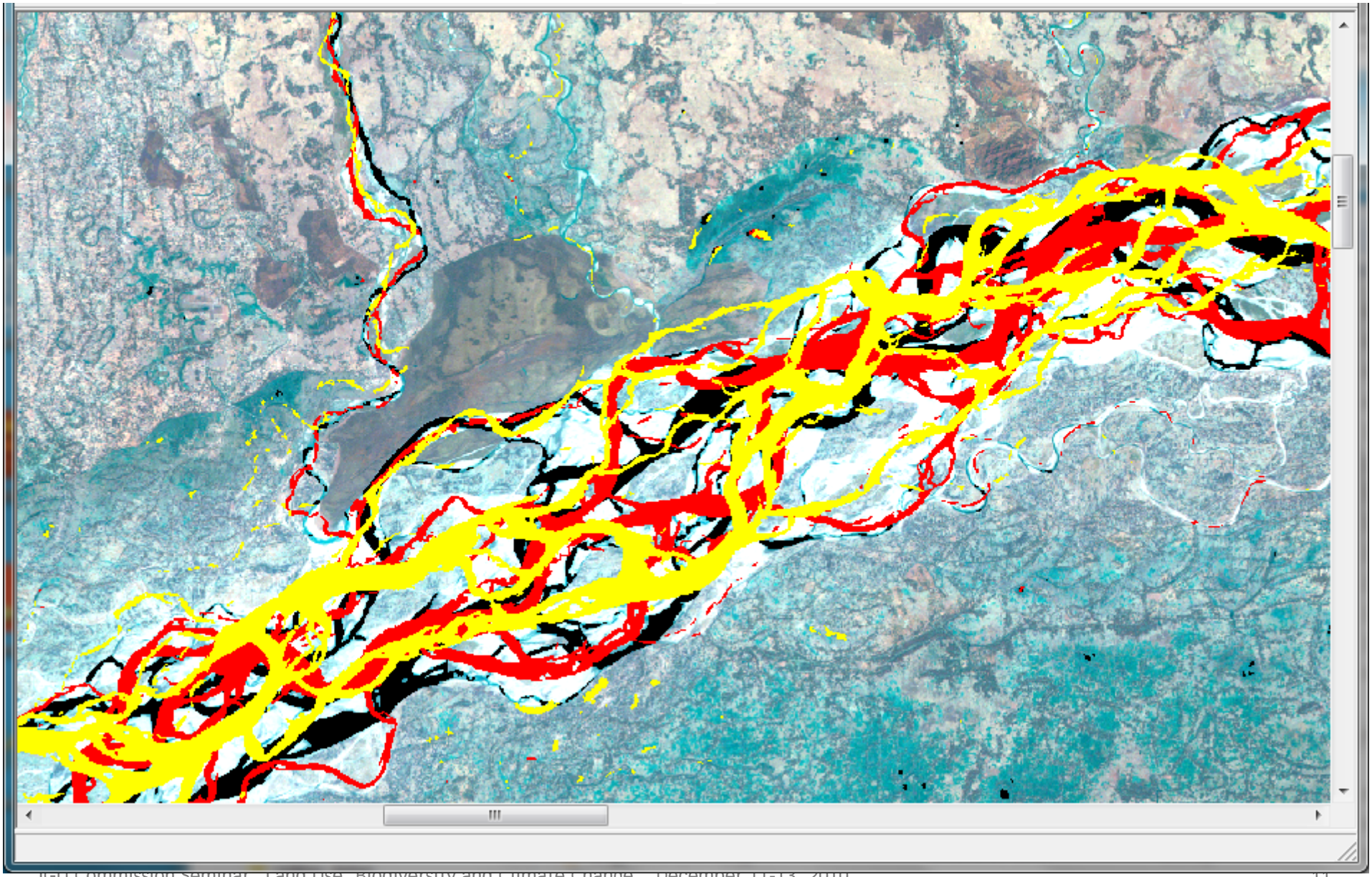
2010, Feb.



1987, Dec.

2003, March

2010, Feb.

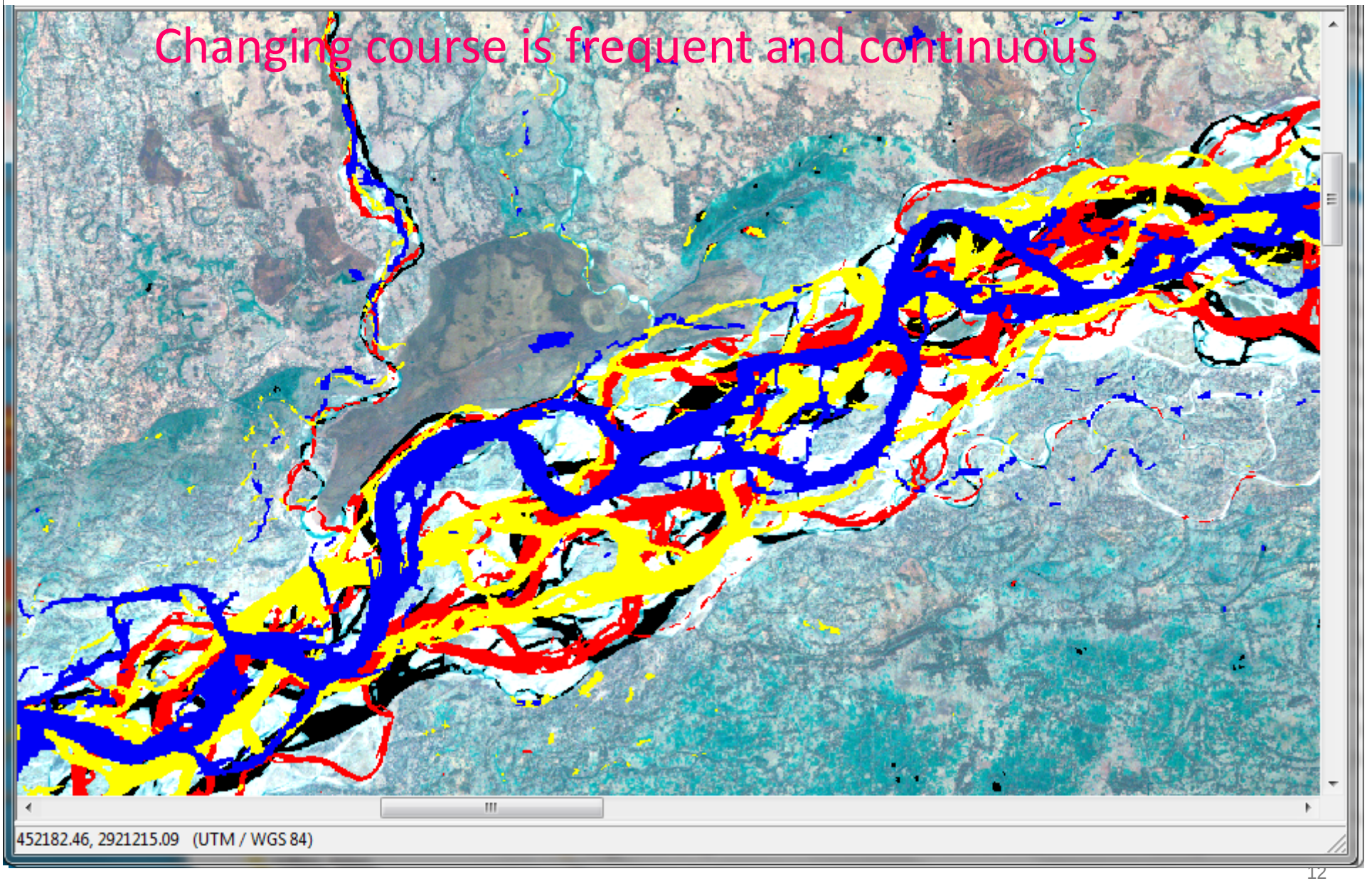


1979, March

1987, Dec.

2003, March

2010, Feb.



EROSION IN ASSAM

Since 1954

Total area eroded	**= 4,27,000 ha**
Rate of erosion	**= 8,000 ha/year**
No. of villages eroded	**= 2,534**
Families affected	**= 1,25,000**

Affected Reaches

Moderate to Severe	**= 130**
Most Severe	**= 15**

Oil Installations/Tea Gardens/ Important Towns and Cities/ Heritage Sites = 18

After the devastating floods of 2004 in Assam –Task Force constituted by Govt. Of India evaluated cumulative Loss due to flood damage & erosion (at 2004 price level) in the state. Loss due to Flood damage & Erosion worked out as Rs.36000 Crs. Updating to 2010 price level Rs.62000 Crs

Brahmaputra widening

1. First survey (1912-28): area: 3,870 km^2
2. Second survey (1963-75): area: 4,850 km^2
3. Third survey (2006 NESAC): area: 6,080 km^2

INDICATIONS

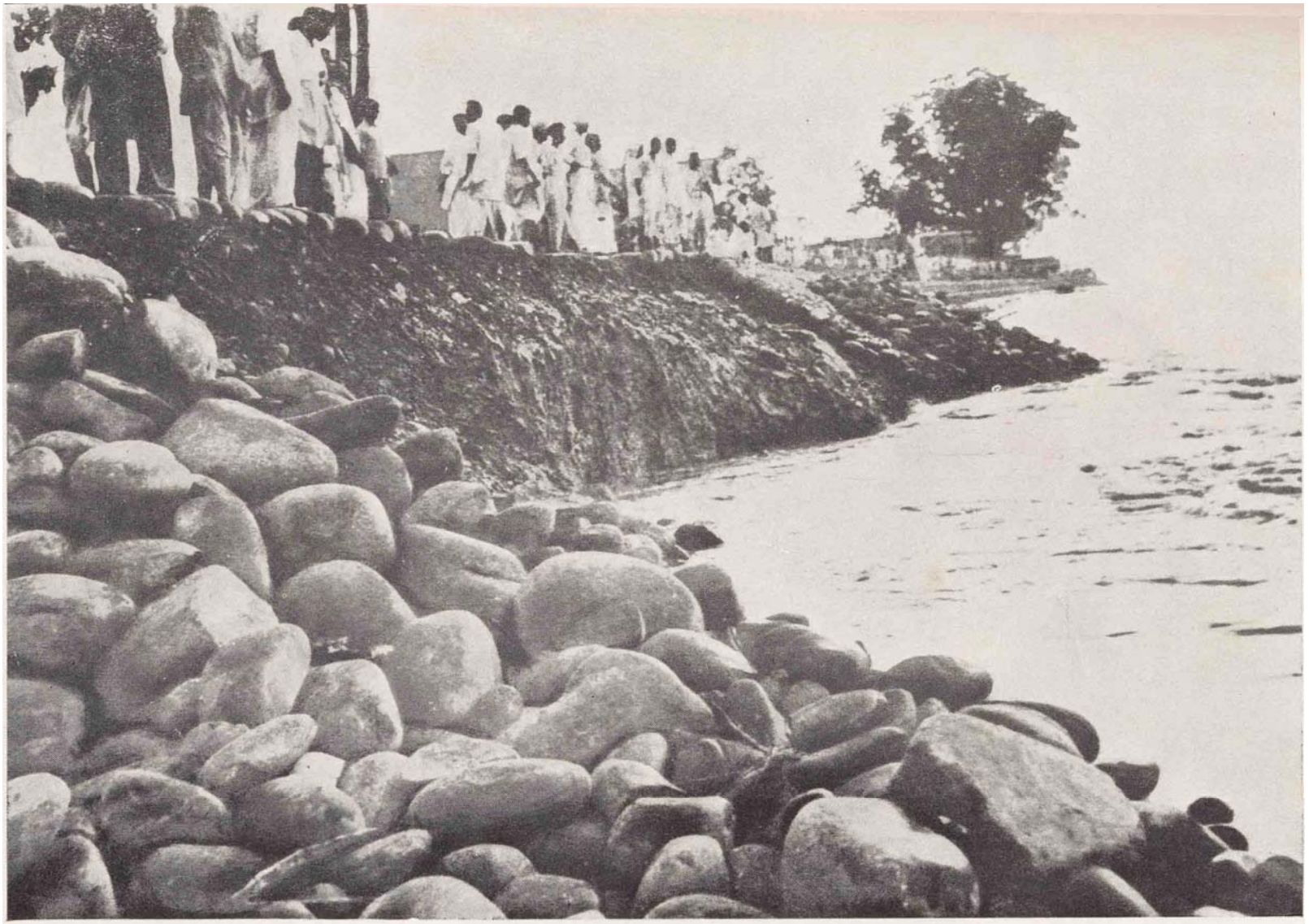
- **The river area has increased by about 50% due to erosion**

VISIT OF PANDIT JAWAHARLAL NEHRU, HON'BLE PRIME MINISTER AT DIBRUGARH ON 4th SEPT 1954

No. 6. The Prime Minister inspected Dibrugarh erosion on 4th September, 1954.

No. 4 Visit of Minister for Irrigation & Power to Dibrugarh on 22nd August, 1954.

ACUTE EROSION OF RIVER BRAHMAPUTRA AT DIBRUGARH TOWN OBSERVED IN 1954



No. 5. The failure of 1954 revetment.

NATIONAL FLOOD POLICY, 1954

After the unprecedented flood of 1954, the Government of India announced a National Flood Policy under which immediate, short-term and long-term flood protection measures were suggested.

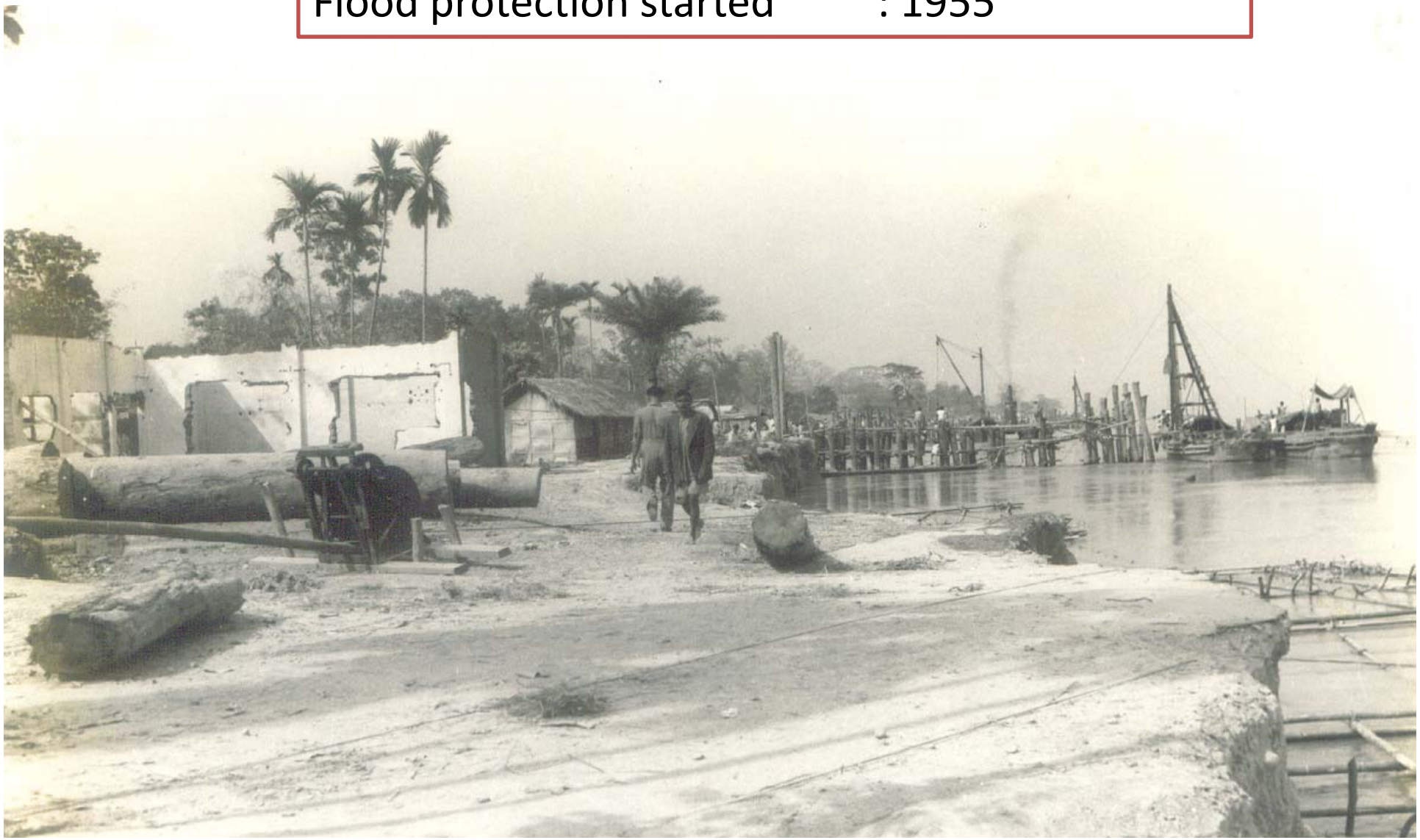
- **The Immediate Measures** (till the end of 2nd year)
  - Embankment
  - Drainage channel
  - Intensive collection of Data/investigation
- **The Short-term Measures** (from 3rd to 7th year)
  - Embankment
  - Channel improvement
- **The Long-term Measures** (from 8th to 12th year and Beyond)
  - Construction of storage reservoir
  - Additional embankments

The Story of Dibrugarh and Palashbari , 1954

Subsequently, “Outlined plan for flood control in Assam” along with various comprehensive plans were prepared and the priority areas, which need immediate and urgent attention were identified. Accordingly, the Water Resources Department has been implementing these flood management measures in reaches so necessary, as per recommendation of Rastriya Barh Ayog (R.B.A).

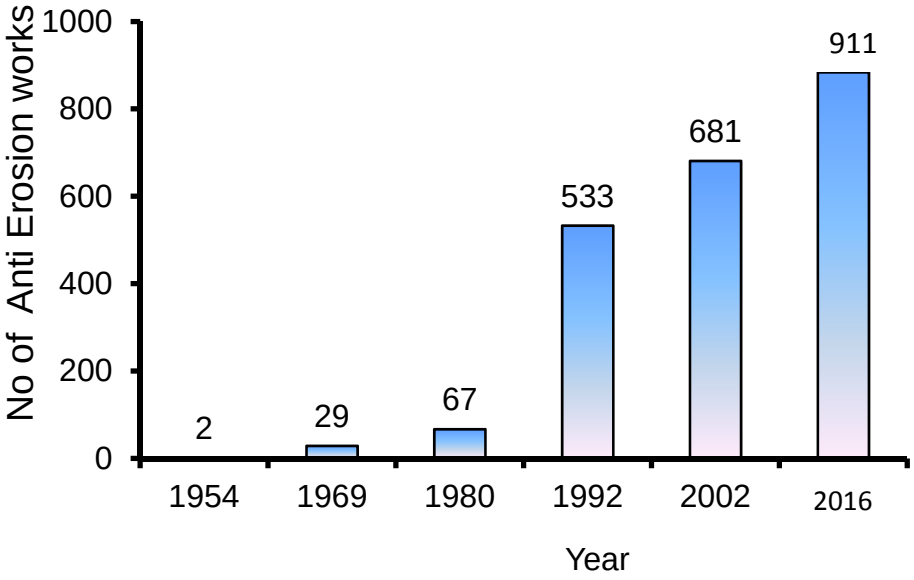
Dibrugarh

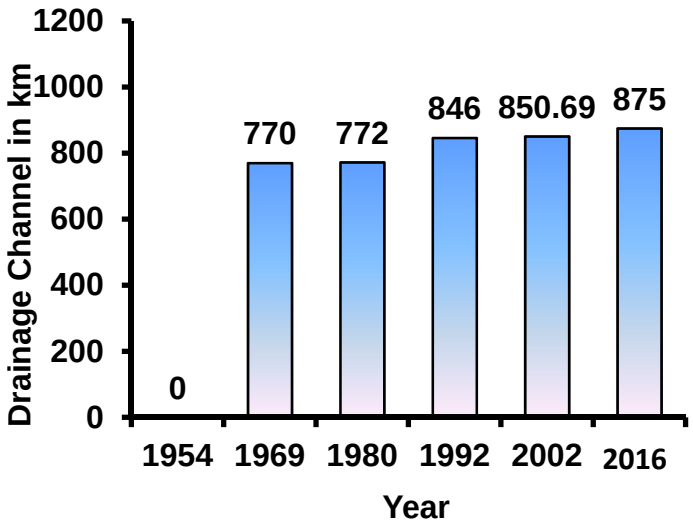
First Bank Protection work : 1954
Flood protection started : 1955



Strong political will, Funding and Cooperation

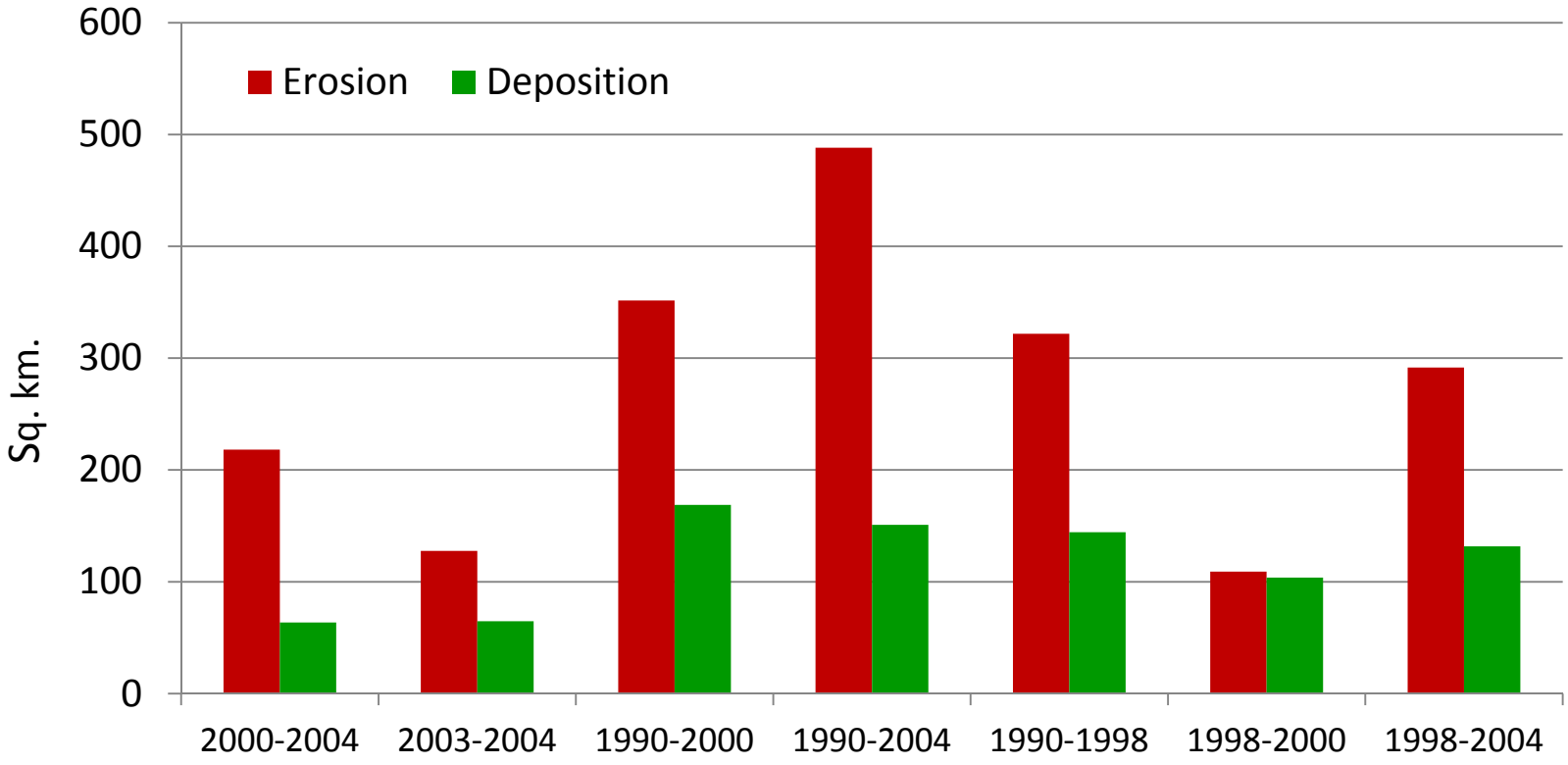
Extensive riverbank protection or anti-erosion work was started only after the flood protection embankments became more and more vulnerable to breaches from erosion.





Due to consequent widening of the river, the embankment system also becomes vulnerable at many reaches and as a result, adequate flood protection was lost. Since then, more emphasis was laid on building anti-erosion/bank protection works commencing about 20 years after embankment construction.

Erosion and Accretion in Brahmaputra river



Bank Protection works

A. Temporary
B. Permanent

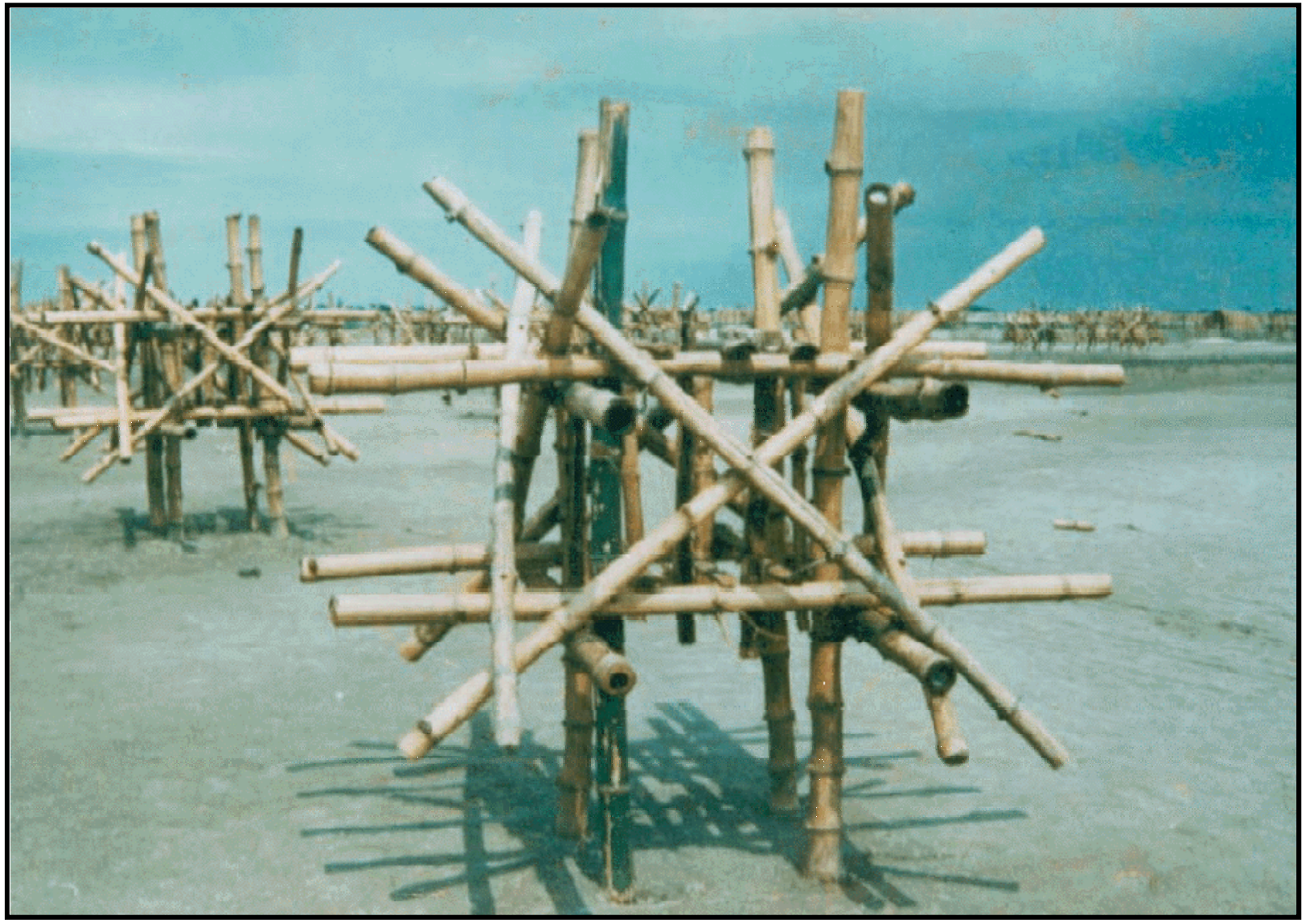
Permeable Structures

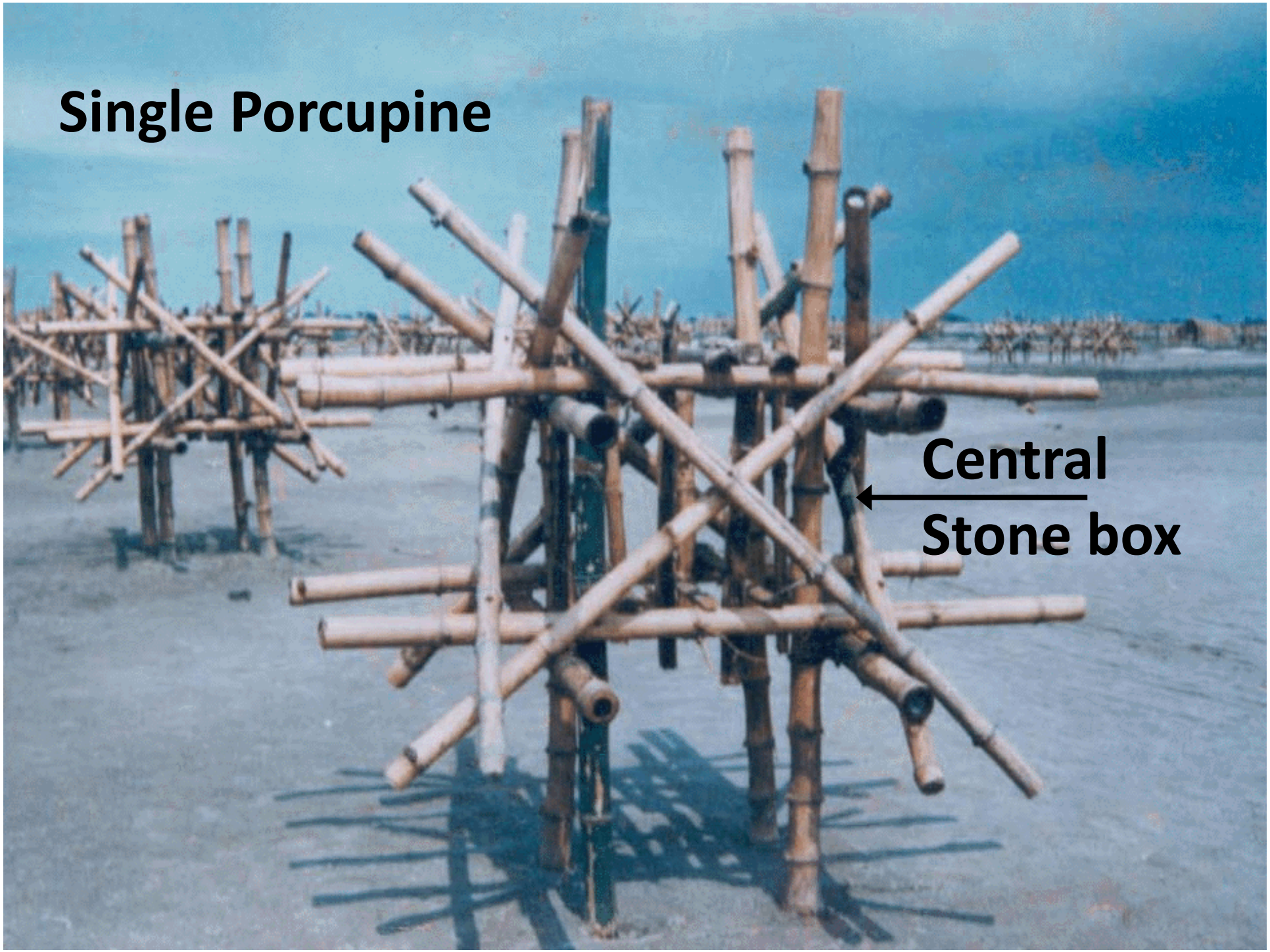
Elements :

1. Porcupines
2. Cribs
3. Tree Branches
4. Screens

Permeable Structures

Elements : Porcupines

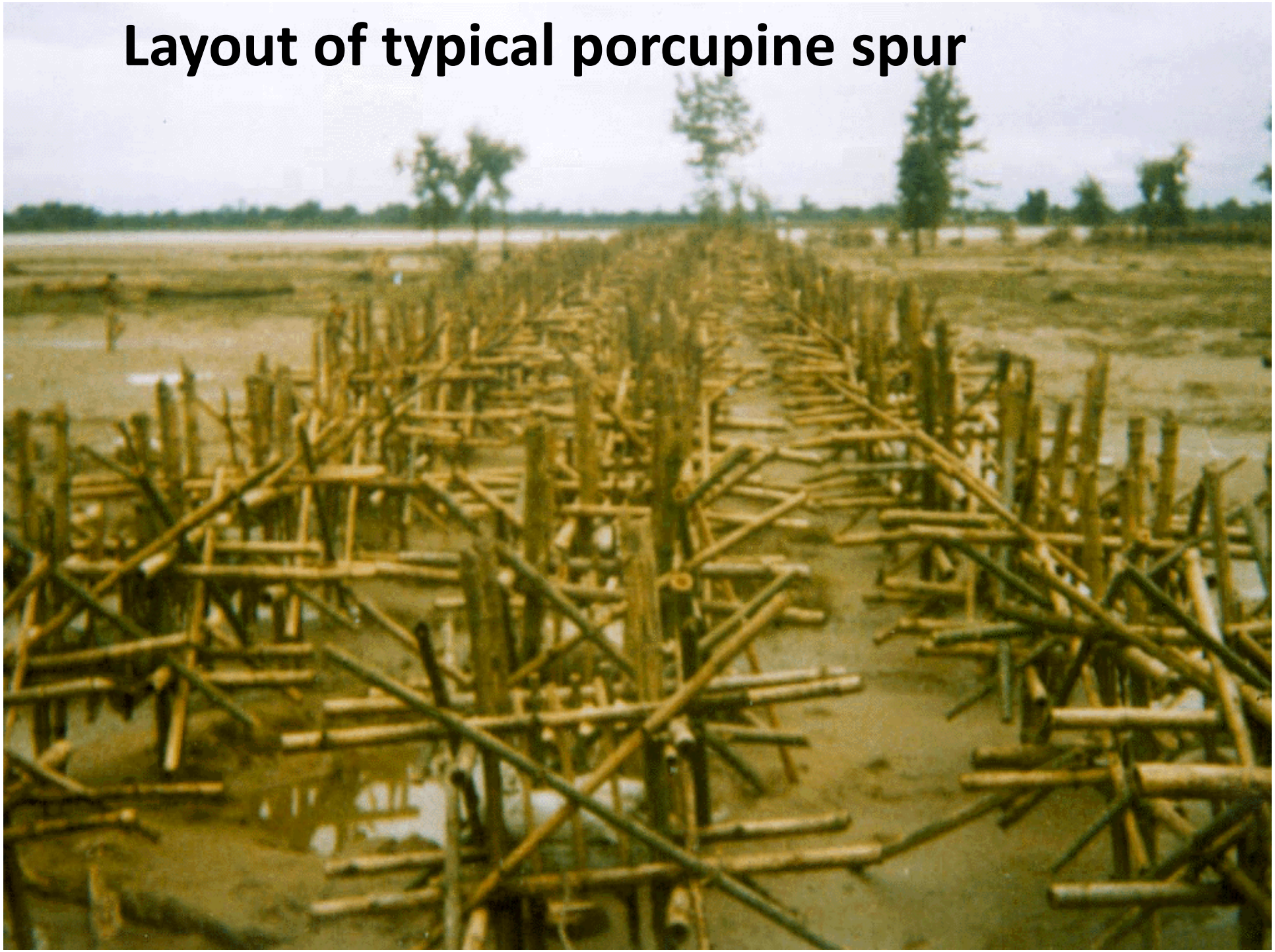



Single Porcupine
Central
Stone box

Storage Yard for Porcupines

Carrying porcupines to site

Layout of typical porcupine spur




Laying during floods

Porcupines in Action (during floods)

Permeable Structures

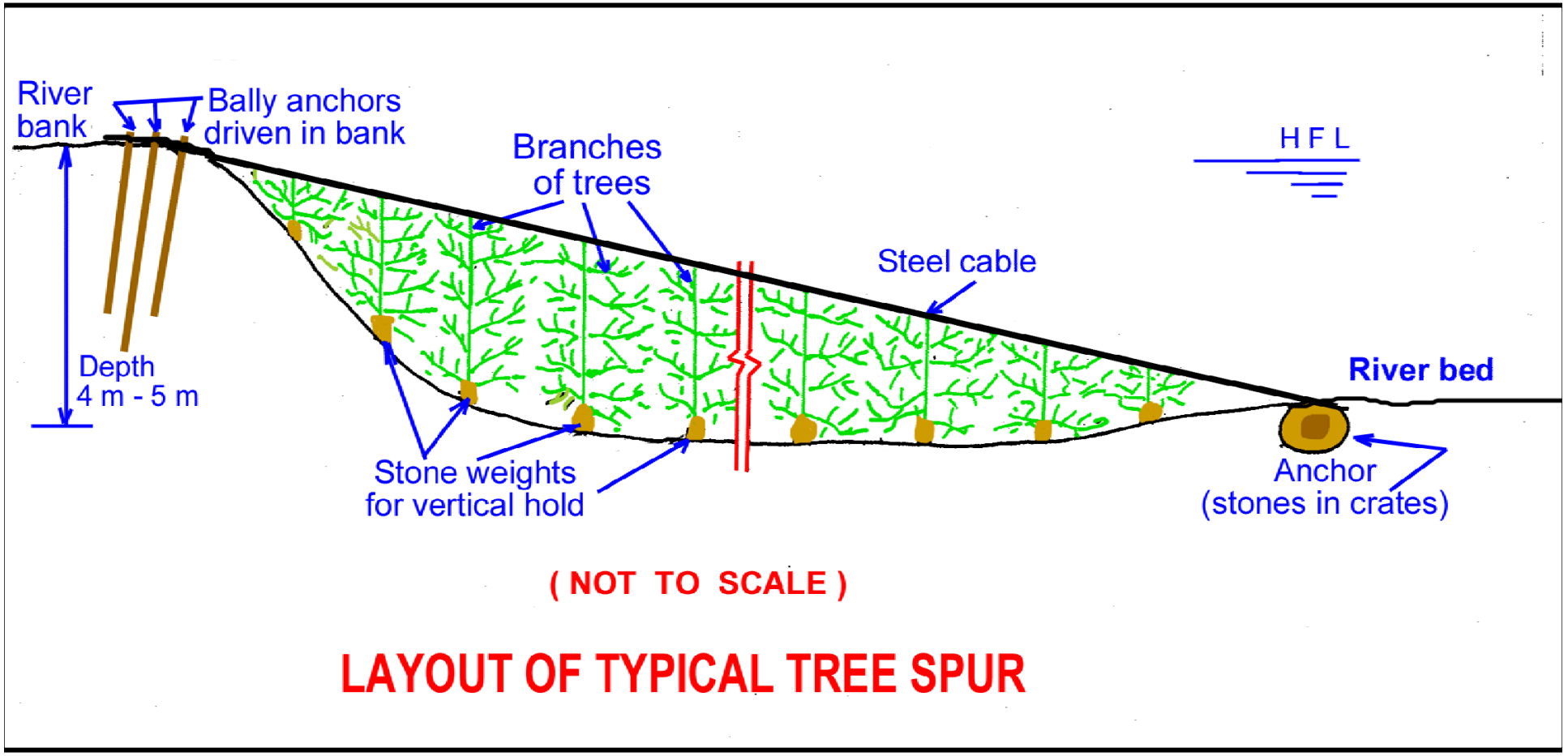
Elements : Cribs (Normal)

Permeable Structures

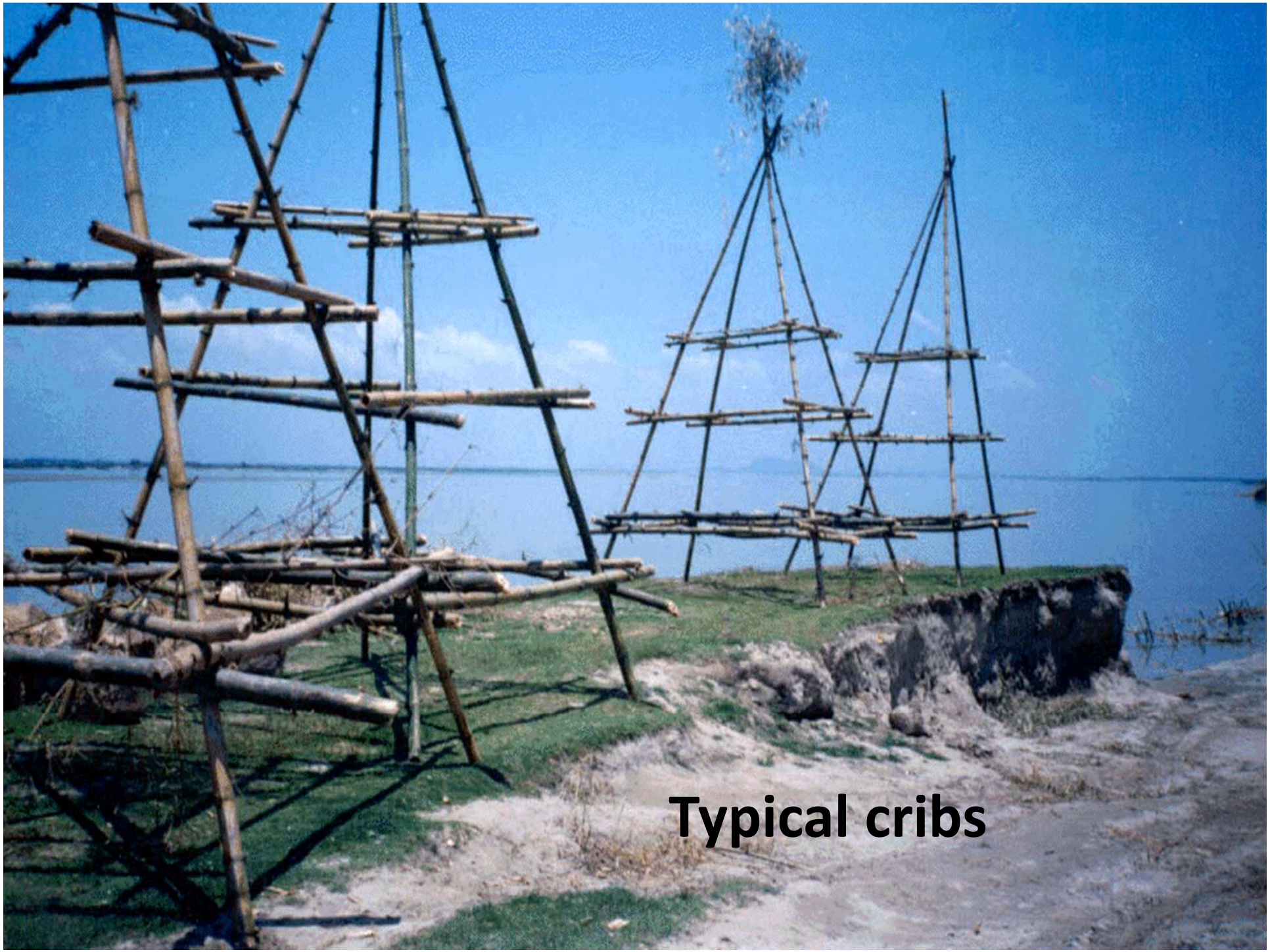
Elements : Cribs (strong)

Permeable Structures

Elements : Tree Branches



LAYOUT OF TYPICAL TREE SPUR


Typical cribs

Cribs with double members and cross bracings for strength.

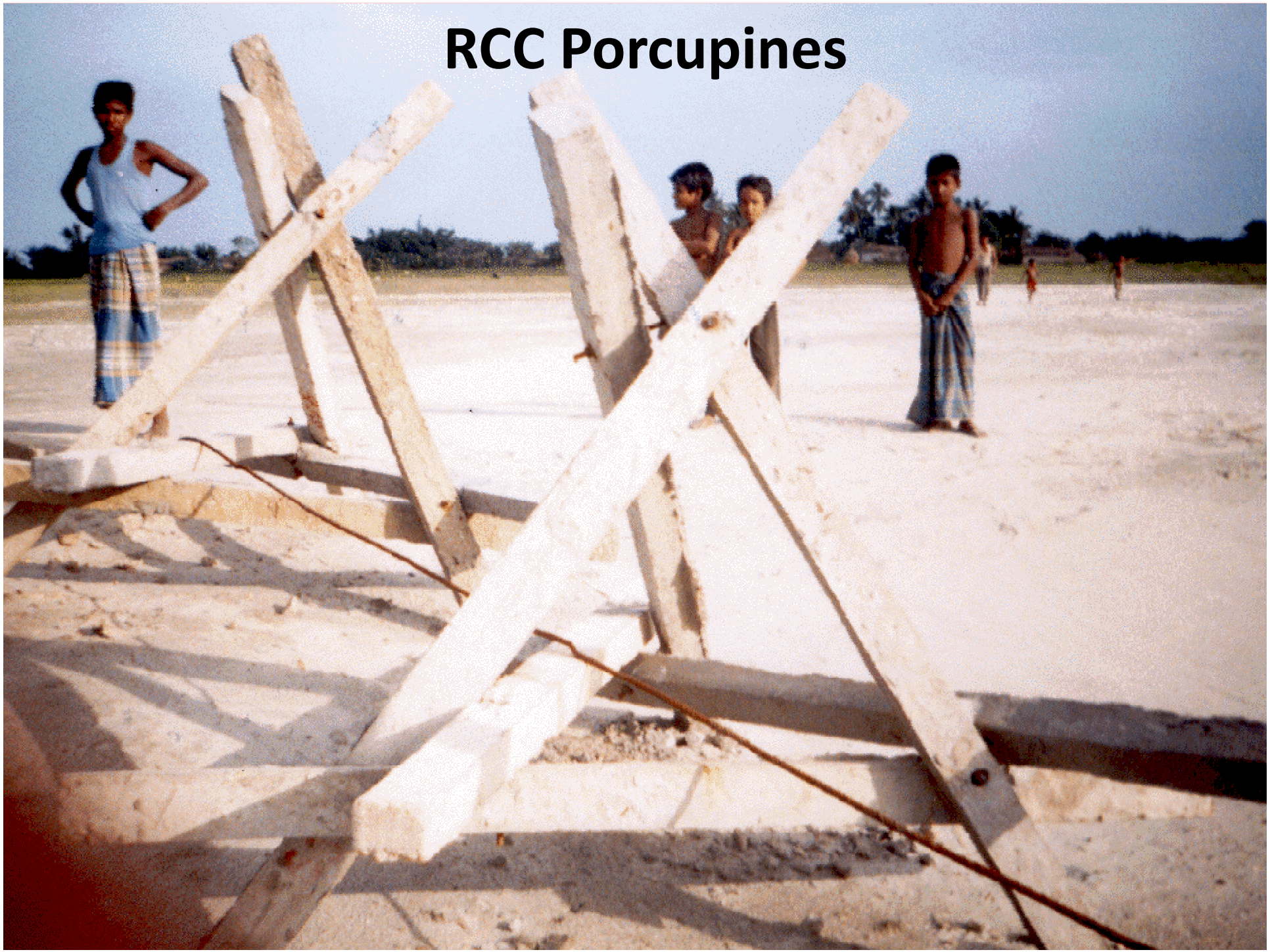
Cribs aligned in single row

May not be very effective

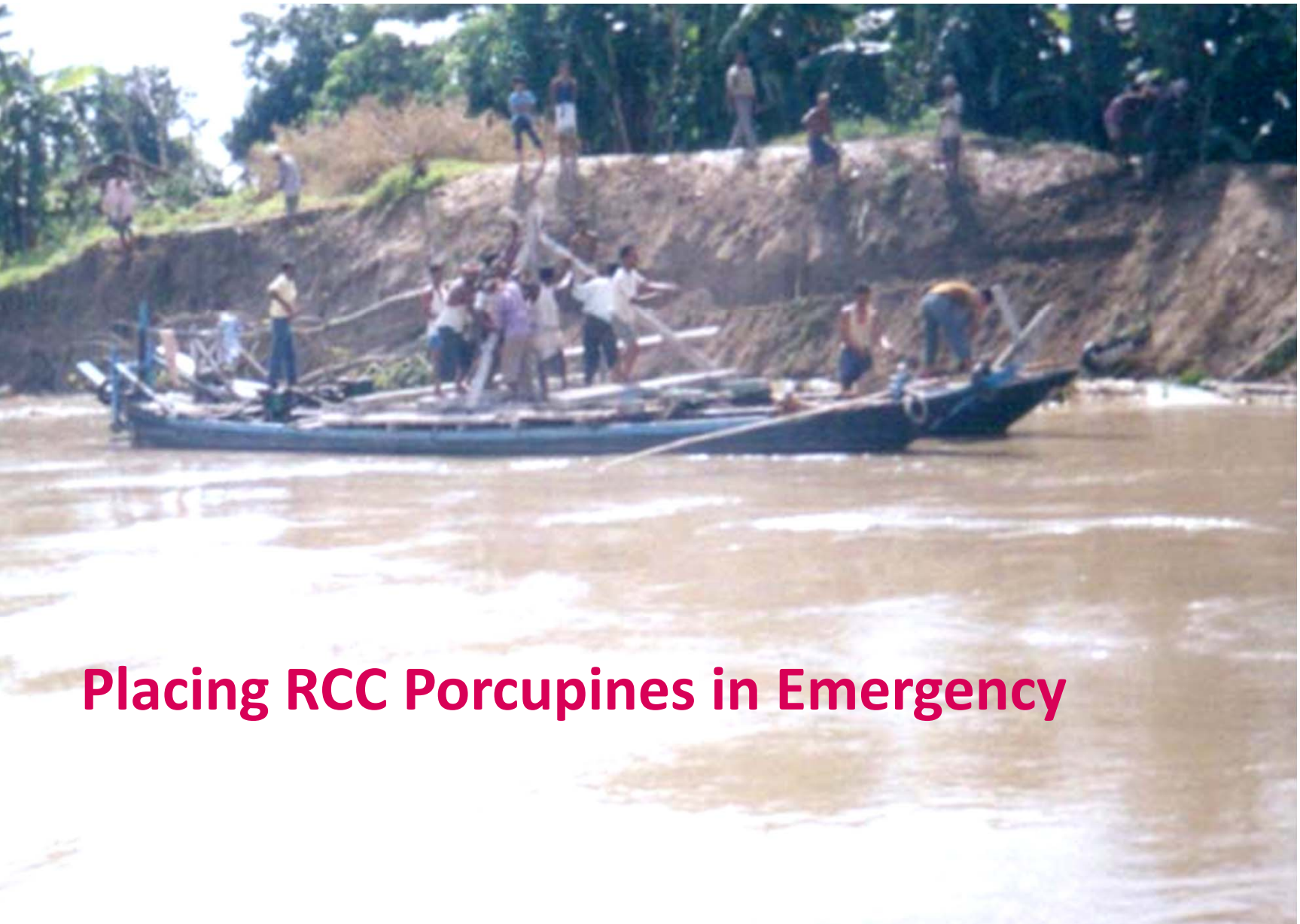
Working after damage - cribs

Work even after failure - Cribs

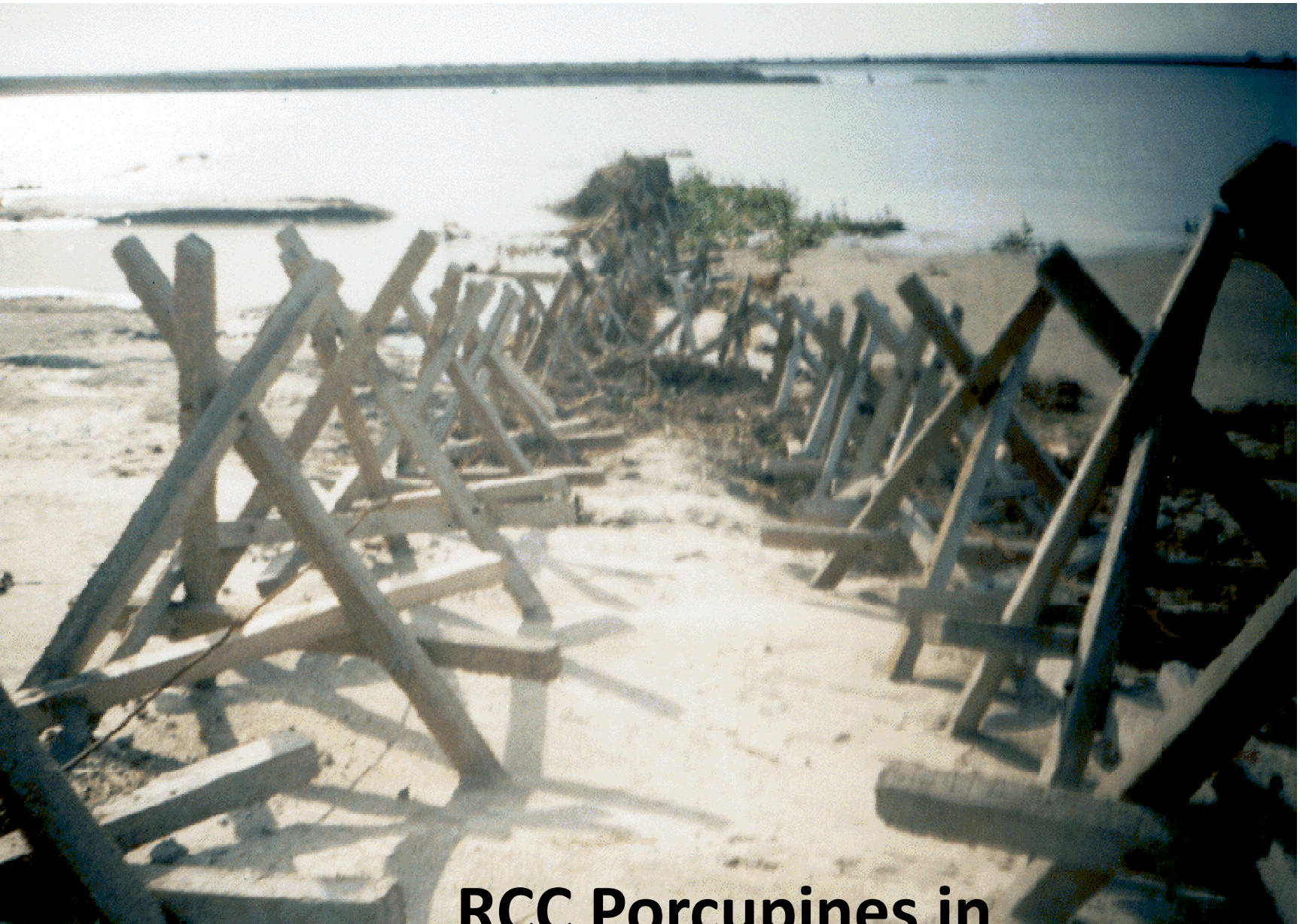
RCC Porcupines



Transport of porcupine members by boat



Placing RCC Porcupines in Emergency


RCC Porcupines in


noring by
rope

Pile spurs of wooden ballies

Ballies for onstructing bally spur

Erecting gantry for bally pile driving at desired location

Erecting bally pile at desired location


PILE SCREEN NO.3

Permeable Structures

Function served : Dampening

Permeable Structures

Function served : Sedimenting

Permeable Structures

Function served : Diverting

Permeable Structures

Function served : Diverting

Permeable Structures

nstruct. material : Bamboo, Ballies

Permeable Structures

nstruct. Material : Tree Branches