Executive Summary
Inventory of Wetlands Within Reserved Forest Area of Assam

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CONTENTS

EXECUTIVE SUMMARY

1.0 Introduction :

Wetlands and unique ecosystems which provide water and habitat for a diverse range of plants and animals. It is increasingly realised that earth is facing grave environmental problems with fast depleting natural resources and thereby threatening the very existence of most of the ecosystems. Looking at the consequences serious concerns are voiced among societies at large to conserve and preserve the natural resources. To explore and asses authentic data is need of the hour. Often the data are sparse and rarely inform of geospatial database (maps). Hence emphasis is given to have an appropriate geospatial database using modern scientific methods.

Present day directions of Remote Sensing (RS) Application along with Geographical Information System (GIS) is found to be an effective tools for identification of objects or phenomenon for mapping, inventory, surveillance and monitoring. Hence can very will be utilitised for effective planning of natural resources. Remote sensing is defined as the science of acquiring and analysing information about objects or phenomena from a distance without any physical contact with the object or phenomena (Jensen 1986, Lillesand and Keifer 1987). When we say Remote sensing, basically we confined to satellites sensors. Satellite remote sensing can be defined as the use of satellite borne sensors to observe, measure and record the electromagnetic radiations (EMR) reflected or emitted by the earth and its environment for subsequent analysis and extraction of information. Currently more than a dozen orbiting satellites of various types provide data crucial to improving to knowledge of the earth's atmosphere, ocean, ice, snow and land. Over past few decades, Indian Remote Sensing data has been successfully used in various fields of natural resources (Navalgund et.al,2002)

Development of technologies like Geographic Information System (GIS) has enhances the use of RS data to obtain accurate geospatial database. GIS specialises in handling related, spatially referenced data, combining mapped information with other data and acts as analytical tools for research and decision making. During the past few decades, technological advances in the field of satellite remote sensing (RS) sensors, computerized mapping techniques, global positioning system (GPS) and GIS has enhanced the ability to capture more detailed and timely information about the natural resources at various scales catering to local, regional and global level study.

1.1 Wetlands (Definition)

Wetlands are areas of land that are either temporarily or permanently covered by water and its is one of the crucial component of the natural resources and our ecosystems. Cowardin et.al (1979) provides the official federal definition wetlands as "Wetlands an lands transitional between

terrestrial and aquatic system where the water table is usually at or near the surface or the land covered by Shallow Water". Cowardin also devised the widely used classification systems associating wetlands to its hydrological, ecological and geological aspects such as : marine (coastal wetlands including rock shores & coral reefs), estuarine (including deltas, tidal, marshes and mangrove swamps), lacustarine (lakes), riverine (along rivers and streams), palustrine ('marshy'-marshes, swamps and bogs). Given these characteristics, wetland support a large variety of plant and animal species adapted to fluctuating water levels, making the wetlands of critical ecological significance.

1.2 Objectives :

> To detect wetlands wing satellite data.

> Mapping wetlands inside reserved forest.

> Inventory of number of wetlands in each reserved forest and districts.

> Assessment of area of each wetland in GIS.

2.0. Study Area

Present study is confined to reserved from area of Assam as per request of Project Management unit of Assam Project on

Forest and Biodiversity Conservation Society (APFBC Society) The state of Assam has an area of 78,438 sq.km situated in the North Eastern part of India between 24°3' N and 28° N latitude and 89°51' E to 96°1' E longitudes. The reported reserved forest area of Assam in 14194.82 Sq.km (Statistical handbook of Assam) ie. around 18.09 percent of state total area. It has the mighty river Brahmaputra flowing from Northeast to Southwest direction (Sadiya to Dhubri) and Barak river which in flowing through Southern part of Assam. The region receives high rainfall during Southwest monsoon (April to September). The average annual rainfall in the region is around 2200 mm. Following **Map (No. 1)** shows the whole study area.

MAP NO: 1
STUDY AREA: RESERVED FOREST OF ASSAM
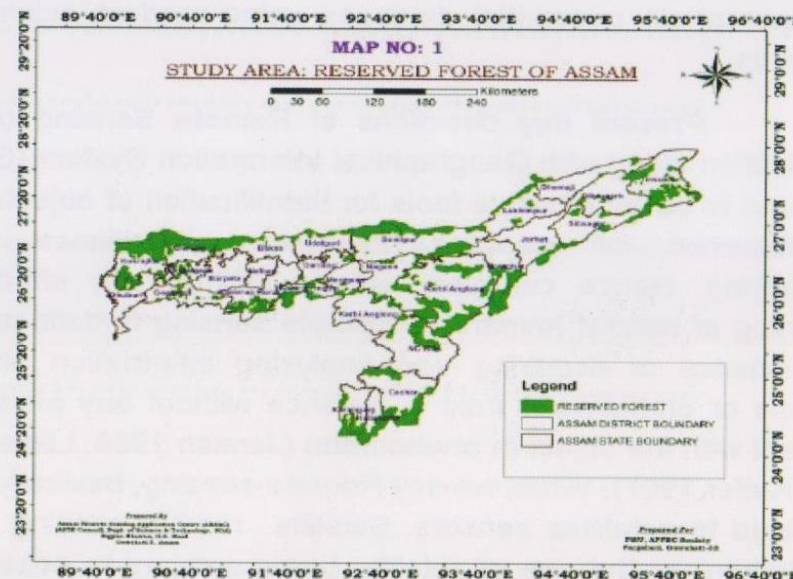
**3.0 Wetland inventory and Assessment** :As per assignment of the project Geospatial Database of wetlands within Reserved Forest of Assamare generated using satellite data. It is basically an inventory of wetlands within reserved forest area in Assam to identity its number and spatial extent in form of maps within limitation of resolution of satellite data used for the purpose. Natural Resources survey has already been well established by the initiative of ISRO under various national level mapping projects and same methodology and guideline has been adopted for inventory of the wetlands within Reserved Forest. As per classification of wetland is concerned it is categorised into two (2) classed river and other wetlands during this inventory. Assessment of areal extent of wetland are base on interpretation of single season satellite data.

4.0. Spatial Framework and GIS Database :

The National Spatial Framework (NSF) has been used as the spatial framework to create the database. The database design and creation standard formulated by National Natural Resources Management System (NNRMS) are followed. Feature codification scheme for every input element has been worked out keeping in view the administrative as well as natural hierarchy (State - district within feature class) 1:50,000 scale grid has been considered for mapping and
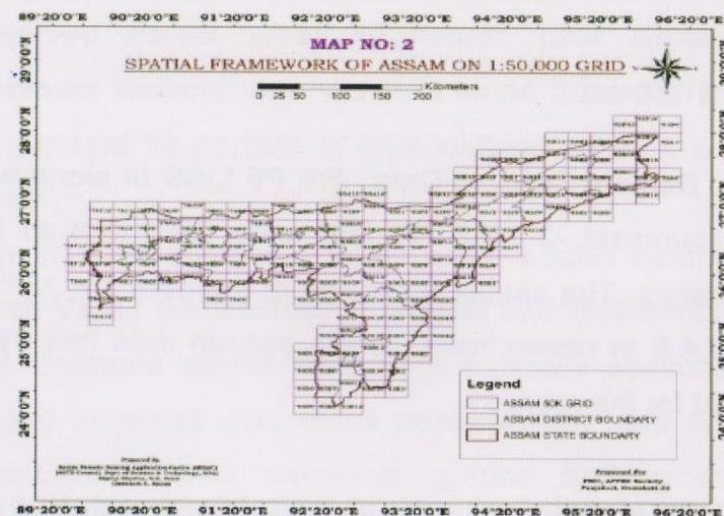
inventory of wetlands. **Map (No. 2)** indicates the spatial Framework of Assam on 1:50,000 grid. One season data has been used for mapping the water spread of wetlands and are being integrated with Reserved Forest Boundary and District Boundary (keeping total number of district as 27 Nos.) in GIS. Spread of Reserved Forest is found basically 25 district out of 27.

5.0 Data Used :

5.1. Remote Sensing Data: IRS P6 LISS III along with Resourcesat -2 LISS IV data were used to map the wetlands. The spatial resolution of the data are 23.5 m and 4.8 m respectively. Single season data has been used for the purpose.

5.2 Other Data : Survey of India topographical maps (SOI) were used for reference purpose. RF boundaries are extracted from SOI maps. District administrative boundaries are taken from SOI as well as Revenue maps. lineage data of National Wetland maps at 1:50,000 scale and SIS-DP data derived at 1:10,000 scale using LISS IV date were used.

6.0 Methodology :

The methodology to create the State level atlas of inventory of wetlands within Reserved Forest is adhered to National wetland inventory and Assessment (NWIA) technical guidelines and procedure manual developed by space Application Centre (SAC) Ahmedabad, ISRO, Govt. of India.

> Generation of spatial Framework (1:50,000 grid) in GIS environment for database creation and organisation.

> Geo referencing of satellite data.

> Generation of base layers (State-district boundary reserved forest boundary)

> Identification of Wetlands (two classes using one season satellite data) and mapping the same, base on onscreen interpretation.

> Mosaicing / edge matching to create district and state level database.

> Preparation of map composition and generation of statistics.

> Output on A$ and A) size prints.

Work was carried out using ERDAS Imagine image processing software and ARC/INFO, ARCASS software.

7.0 Results and Discussion

After mapping the wetlands of Assam within the reserved forest 7313 numbers of wetlands (excluding rivers and streams) are found within the reserved forest of Assam. The total wetlands area found 243791.29 Ha (i.e. 2439.91 Sq. km.). Wetlands during this inventory are categorised into two classes i.e. river and other water bodies. Out of 249 numbers of Reserved Forest wetlands (i.e. other wtaerbodies excluding rivers) could not be detected only in 45 numbers of Reserved Forest based on interpretation of satellite data used for inventory. It is also observed that out of 27 districts of Assam 2 districts viz. Barpeta and Nalbari have no Reserved Forest boundary. Moreover it is found that inside the Reserved Forest areas of Assam river stream occupy maximum wetland area which is found to be 234931.83 Ha. (i.e. around 96 percent of total wetland within the Reserved Forest).

Considerable number of other water bodies detected in the Barak Valley (ie. Cachar. Karimganj and Hailakandi Districts) and Golagaht district which are basically seasonally water logged in nature due to its physiographic and surrounding landscapes needs extensive ground truthing for proper inventory. Use of multi temporal satellite data also will help to enhance the spatial extent of the wetlands database.

Districtwise No. of Wetlands within Reserved forest of Assam

District	Name of Reserved Forest	No of Wetlands
Baksa	BATABARI R.F	NIL
	DARRANGA R.F	3
	KAHITAMA R.F	NIL
	MANAS R.F	NIL
	MORA PAGLADIYA R.F	1
	NORTH KAMRUP RESRVED FOREST	50
	R.F.4	NIL
Bongaigaon	BAMUNGAON R.F	59
	BHAIRAB R.F	6
	BHUMESWAR HILL R.F	1
	BONGAIGAON FROEST RANGE	37
	KAKAIJAN R.F	39
	MAHADEB PAHAR	34
	MILEGAL HILL	5
	NAKATI R.F	19
Cachar	BARAIL R.F	NIL
	BARAK R.F	9
	INNER LINE R.F	132
	KATAKHAL R.F	5
	LOWER JIRI R.F	NIL
	NORTH CACHAR R.F	NIL
	SONAI R.F	173
	UPPER JIRI R.F	13
	BENGTOL R.F	44
	BHUMESWAR HILL R.F	NIL
	BIRINCHI R.F	4
	CHIRANG R.F	NIL

Chirang	KAKULONG R.F	NIL	
	KATRIBARI R.F		1
	MANAS R.F		36
	PANBARI R.F		4
	SHISHUBARI R.F		1
Darrang	BAMON PARBAT		2
	BARKHOLA PARBAT		6
	BURA MAYANG R.F	Nil	
	GANDHIA PARBAT		3
	JAUHARI PARBAT		3
	KUMA PARBAR		1
	ORANG R.F		28
Dhemaji	DIBRU R.F.	NIL	
	POBHA R.F.		9
	SENGAJAN R.F.		24
	SUBANSIRI R.F.		9
Dhubri	BHELAKUPA R.F		1
	CHAKRASILA R.F		1
	DUDHNATH HILL R.F		6
	MANGALAJHORA R.F		2
	SARPAMARI R.F		15
	SHRIGRAM R.F		10
	TILAPARA R.F.		3
	TOKRABANDHA HILL		2
Dibrugar	DIBRU R.F.		66
	DIHING MUKH R.F.		80
	DILLI R.F.	NIL	
	JAIPUR R.F.		1
	JOKAI R.F.		10
	NAMDANG R.F.		18
	SAPETHATI R. F.		1
	SENGAJAN R.F.	NIL	

District	Forest	Count
Dibrugarh	TEA GARDEN	NIL
	TENPANI R.F.	13
	UPPER DIHING R.F. (WEST BLOCK)	NIL
Goalpara	AJAGHAR HILL	NIL
	BORJHAR	12
	CHATABARI R.F	2
	DARKA R.F	21
	DHAMAR R.F	3
	DHERALCHANG R.F	3
	GHAGRA HILL R.F	27
	KAHIBARI R.F	2
	KANYAKUCHI R.F	NIL
	KHEROPARA R.F	5
	MATIA R.F	13
	MOGO R.F	3
	NALANGA HILL	5
	PAGLAJEK KHUTAMARI	2
	PHOPONGA	5
	RAKSHASINI	1
	RAMANDANGA R.F	8
	ROKHAPARA R.F	20
	SAGUNBASI R.F	19
	UPARTALA R.F	1
Golaghat	DAYANG R.F.	270
	DIPHU R.F.	300
	KAZIRANGA R.F.	183
	LOWER DOIGURUNG R.F.	12
	NAMBAR R.F.	214
	NON-FOREST	1
	PANBARI R.F	3
	RENGMA R.F.	81
	UPPER DAIGURUNG R.F.	NIL

District	Reserve Forest	Count
Hailakandi	INNER LINE R.F	358
	KATAKHAL R.F	638
Jorhat	DAYANG R.F.	NIL
	DISAI R.F.	2
	DISAI VALLEY R.F.	NIL
	HOLONGAPAR R.F.	7
	TIRUHILL R.F.	4
Kamrup_Metro	AGYATHURI R.F	2
	AMSING R.F	2
	BURA MAYANG R.F	4
	DIMORIA R.F	NIL
	GARBHANGA R.F	7
	KALA PAHAR	1
	MARAKDOLA R.F	3
	PABITARA R.F	NIL
	PHATASIL R.F	7
	RANI R.F	15
Kamrup_Rural	BARADOBHA R.F	NIL
	BARDUAR R.F	43
	BARJULI R.F	12
	GIZANG R.F	2
	JAIPUR R.F	3
	JARASAL R.F	4
	JHARIKHURI R.F	2
	KAWASING R.F	3
	KHAKSI SIKRABURA HILL R.F	3
	KHATAJULI R.F	1
	KHURKHURI R.F	1
	KULSI R.F	16
	MALIYATA R.F	5
	MAYANG HILL R.F	10
	MELAGHATI R.F	2

District	Forest	Count
Kamrup Rural	MILMILIA R.F	41
	MOGAKHAL R.F	1
	MOMAN R.F	11
	NAMPATHAR R.F	1
	NON-FOREST	9
	PANTAN R.F	43
	SINGRA R.F	6
	TARAIBARI R.F	3
Karbi Ang long	AMRING R.F	1
	CHELABOR R.F.	13
	DAIDALI R.F.	26
	DHANSIRI R.F	48
	DISAMA R.F.	1
	JOKATA R.F.	12
	JUNGTHUNG R.F.	16
	KHOLAHAT R.F.	15
	KOMRAKATA R.F.	1
	MIKIR HIILS R.F.	3
	NAMBAR R.F.	93
	NON-FOREST	2
	RONGKHONG R.F.	40
	RONGKHONG R.F.	49
	SILDHARAMPUR R.F.	25
Karimganj	BADSHAHITILLA R.F	691
	DOHALIA R.F	152
	LANGA R.F	665
	PATHARIA HILL R.F	132
	SINGLA R.F	150
Kokrajhar	BENGTOL R.F	NIL
	BHELAKUPA R.F	4
	CHAKRASILA R.F	3
	CHIRANG R.F	156

Kokrajhar	GUMA R.F	9
	KATRIGACHA R.F.	1
	MAGURMARA R.F.	Nil
	MAHAMAYA R.F	17
	MANAS R.F	Nil
	MANGALAJHORA R.F	26
	RIPU R.F	33
	SATBHENDI R.F	29
	SILKIKHATA R.F	2
Lakhimpur	DULANG R.F.	2
	GOHPUR R.F.	NIL
	KADAM R.F.	15
	KAKOI R.F.	NIL
	PABHA R.F.	41
	RANGA R.F.	2
Morigaon	BABA PARBAT R.F	9
	BURA MAYANG R.F	10
	KHOLAHAT R.F.	10
	KILING R.F	6
	PABITARA R.F	21
	SONAI KUCHI R.F	27
	TETELIA BAGHARA R.F	11
Nagaon	BAGSER R.F.	4
	BAMUNI R.F.	2
	BORPANI R.F.	35
	DABAKA R.F	2
	HAWAIPUR R.F.	19
	JAMUNA MAUDANGA R.F.	29
	JOKATA R.F.	6
	KAKI R.F	100
	KAMAKHYA HILL R.F.	1
	KAZIRANGA R.F.	122

Nagaon	KHOLAHAT R.F.	2
	KOMRAKATA R.F.	9
	KUKURAKATA HILLS R.F.	19
	LANGTING MUPA R.F	NIL
	LAOKHOA R.F.	93
	LUMDIMG R.F	10
	LUTUMAI R.F.	16
	MADHOPARA R.F.	6
	NON-FOREST	3
	NORTH DIJU VALLEY R.F.	1
	SOUTH DIJU VALLEY R.F	1
NC Hills	KRUNGMING R.F	8
	LANGTING MUPA R.F	11
	LUMDIMG R.F	NIL
	NON-FOREST	6
Sibsagar	DIHING MUKH R.F.	NIL
	DILLI R.F.	30
	DIROI R.F.	4
	GELEKI R.F.	10
	JAIPUR R.F.	NIL
	PANIDIHINGIA R.F.	97
	R.F.1	3
	SAPETHATI R. F.	7
	SOLA R.F.	8
	TIRUHILL R.F.	NIL
Sunitpur	BALIPARA R.F.	29
	BEHALI R.F.	14
	BHOMORAGURI HILL R.F.	10
	BISHWANATH R.F.	76
	CHARDUAR R.F.	118
	GOHPUR R.F.	21
	KAZIRANGA R.F.	NIL

District	Reserve Forest	Count
Sunitpur	KUKURAKATA HILLS R.F.	NIL
	LAOKHOWA R.F.	NIL
	NAUDUAR R.F.	24
	ORANG R.F	NIL
	ROWTA R.F	NIL
	SENGELIMARI R.F.	3
	SINGRI HILL R.F.	3
Tinsukia	BHANJAN R.F.	NIL
	BOGAPANI R.F.	5
	BURHI DIHING R.F.	NIL
	DANGORI R.F.	1
	DIBRU R.F.	54
	DIGBOI R.F. (WEST BLOCK) R.F.	6
	DIRAK R.F.	1
	DUARMARA R.F.	NIL
	DUMDUMA R.F.	14
	GELAPUKHURI R.F.	4
	HAHKHATI R.F.	3
	HOLOGAON R.F.	51
	JAIPUR R.F.	NIL
	KAKAOJAN R.F.	3
	KOTHA R.F.	1
	KUKURAMORA R.F.	21
	KUMSONG R.F.	14
	MECHAKI R.F.	6
	NALNI R.F.	5
	NAMPHAI R.F.	12
	NAMPHUK R.F.	NIL
	TAKAUANI R.F.	1
	TARANI R.F.	NIL
	TEA GARDEN	NIL
	TINKOPANI R.F.	NIL
	TIPANG R.F.	5
	TIRAP R.F.	3
	UPPER DIHING R.F. (WEST BLOCK)	64
	UPPER DIHING R.F.(EAST BLOCK)	7
Udalguri	DARRANGA R.F	3
	KHALINGDUAR R.F	1
	ORANG R.F	1
	R.F.2	8
	ROWTA R.F	10
Grand Total		**7313**

Sl. no.	District	No of Wetlands Excluding River	Wetland		Total Area in (HA)
			River	Other	
1	Baksa	54	3267.500711	24.50503831	3292.005749
2	Barpeta	Nil	Nil	Nil	Nil
3	Bongaigaon	200	18.74162534	194.5269082	213.2685335
4	Cachar	332	2791.487404	180.9211919	2972.408596
5	Chirang	90	7205.756345	48.13724126	7253.893586
6	Darrang	43	3245.345078	33.09013408	3278.435212
7	Dhemaji	42	1491.079589	26.42913288	1517.508722
8	Dhubri	40	9.355577076	49.46373208	58.81930916
9	Dibrugar	189	26867.56255	228.9380589	27096.50061
10	Goalpara	152	18.14358502	202.2768914	220.4204764
11	Golaghat	1064	9063.91412	2779.534322	11843.44844
12	Hailakandi	996	4511.508598	391.5177064	4903.026304
13	Jorhat	13	137.1892083	14.22746309	151.4166714
14	Kamrup_Metro	41	20.91942663	20.99068624	41.91011287
15	Kamrup_Rural	222	8013.805462	291.5375238	8305.342986
16	Karbi Ang Long	345	3.914526272	173.7599771	177.6745034
17	Karimganj	1790	91.0350176	921.3965934	1012.431611
18	Kokrajhar	280	6571.112703	562.7289935	7133.841697
19	Lakhimpur	60	24462.9192	74.28083503	24537.20004
20	Morigaon	94	99.5884328	38.37231402	137.9607468
21	Nagaon	480	2905.288621	1854.983603	4760.272224
22	Nalbari	Nil	Nil	Nil	Nil
23	NC Hills	25	488.4953836	147.5059091	636.0012927
24	Sibsagar	159	9097.188232	198.6308113	9295.819043
25	Sonitpur	298	92684.80309	222.5545436	92907.35763
26	Tinsukia	281	29160.49699	170.3086285	29330.80562
27	Udalguri	23	2704.492434	9.031069843	2713.523504
Grand Total		7313	234931.6439	8859.649309	243791.2932

Wetland within Reserve forest of Assam Area in (HA)
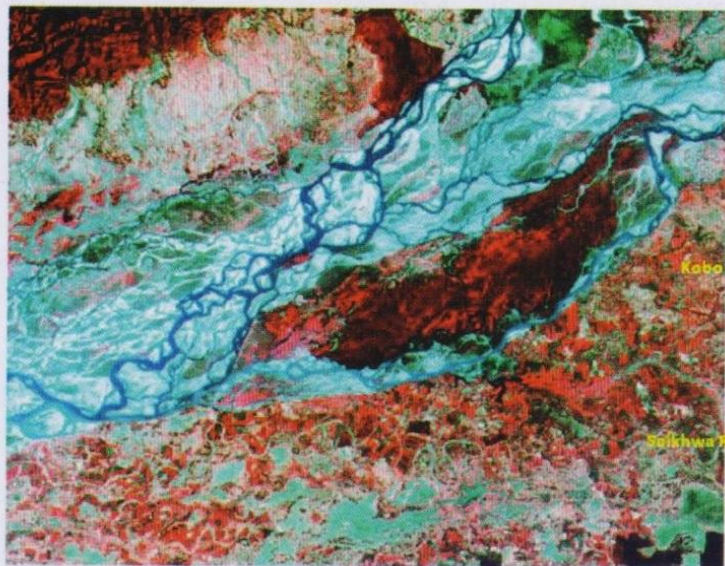
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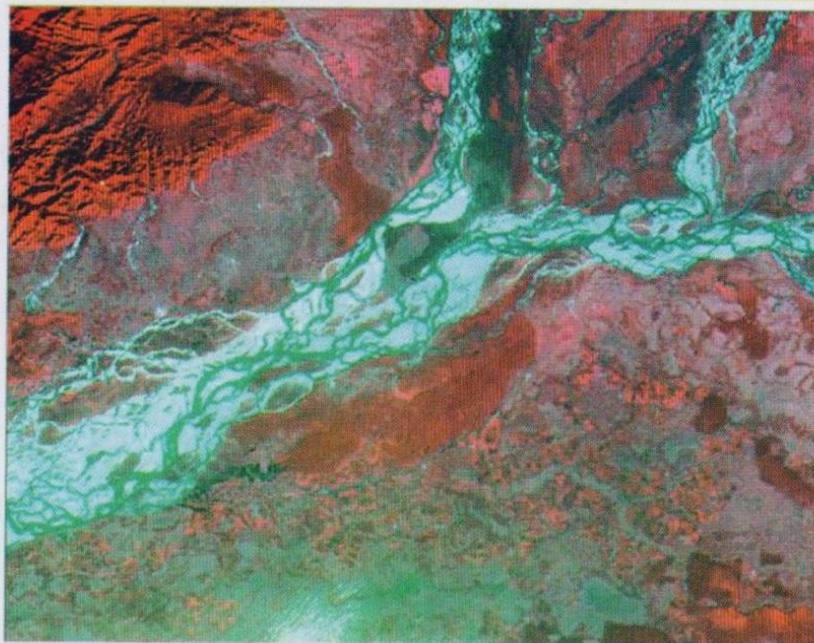
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