internal report **371**

eriss presentations - NARGIS 2001

Lowry J, Begg G, Boggs G &
Pfitzner K

August 2001

supervising scientist

eriss presentations - NARGIS 2001

The following notes represent the materials presented by *eriss* staff and students at the NARGIS (North Australian Remote Sensing and Geographical Information Systems) conference, held in Darwin from the 3rd – 5th of July, 2001.

The presentations, listed in the order in which they were made to the conference, and the presenting author (and the registry file numbers of projects / documentation relating to the presentations) is as follows :

"A review of spatial datasets for wetland inventory in northern Australia" – John Lowry (SG2001/0155)

"A GIS-based approach for mapping wetlands in the Daly Basin" – George Begg (SG2001/0156)

" Progress in the development of a GIS-based method for the assessment and management of mining impact on landform evolution" – Guy Boggs (SG2001/0110)

"Remote sensing projects at eriss for the assessment of abandoned uranium mine sites" – Kirrilly Pfitzner (SG2000/0144)

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Supervising Scientist

NARGIS 01 paper

5th North Australian Remote Sensing and GIS conference.

03 – 05 July 2001

A review of spatial datasets for wetland inventory in northern Australia.

John Lowry & C Max Finlayson

National Centre for Tropical Wetland Research, C/- Environmental Research Institute of the Supervising Scientist, Locked Bag 2, Jabiru, NT 0886, Australia.

Abstract:

The increasing recognition of the importance of wetland ecosystems to both the economic and environmental health of regions has stimulated renewed interest in mapping and identifying the distribution of wetlands around the world. In recent years, a variety of techniques have been developed to map the distribution of wetland ecosystems, at a variety of scales. Using nine different datasets collated at global and regional scales, this paper compares estimates of wetland areas at a sub-continental scale, comprising, the bio-geographical region of northern Australia that encompasses the 'Wet-Dry Tropics', and at a regional scale, Kakadu National Park in the Northern Territory. The datasets used in this study included both vector-based coverages and raster-based images and grids. Large variations were found in the estimates of wetland areas between the different datasets for both study areas, with estimated spatial extent of wetlands in northern Australia ranging from 30849 km^2 to 98703km^2. The paper discusses the variations in the data extracted, and explores potential applications and the utility of the different datasets from a wetland management perspective.

A review of spatial datasets for wetland inventory in northern Australia

John Lowry / Max Finlayson
National Centre for Tropical Wetland Research

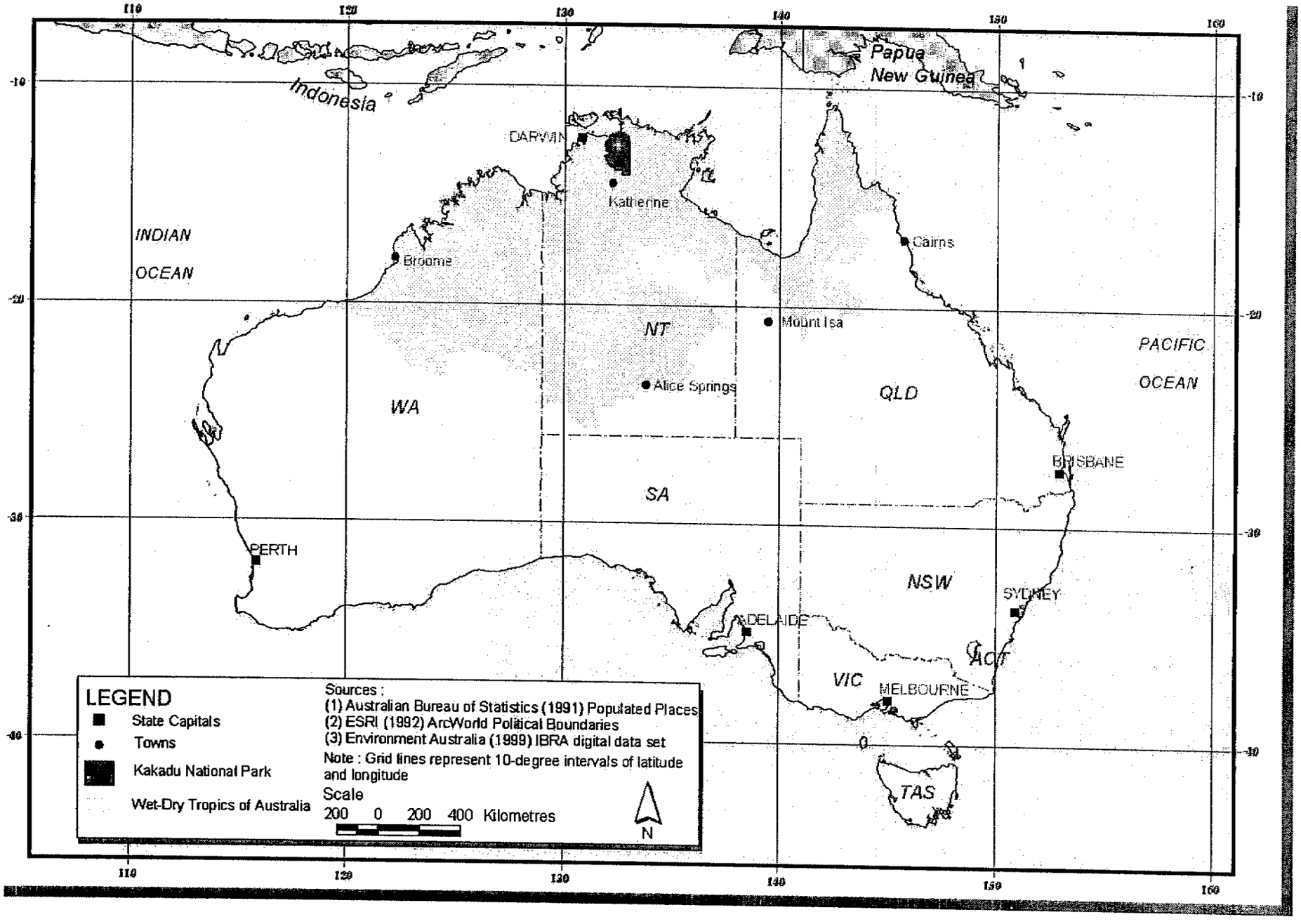
NARGIS 2001
Northern Territory University 3 - 5 July 2001

... A bit of background

- Importance of wetland ecosystems increasingly recognised,
- Need to be able to identify wetlands, and the potential risks / threats
- Associate them in a common spatial context
- Gaps in data exist -
  - northern Australia in general
  - NT in particular

More background ...

- Continental-scale data
  - northern Australia "Wet-Dry Tropics"
- Regional-scale
  - Kakadu National Park
- Focus on users perspective
  - already exist
  - easy to use
  - cost / cheap to acquire


110
120
130
140
150
160
-10
-20
-30
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Indonesia
Papua New Guinea
DARWIN
Katherine
INDIAN OCEAN
Broome
Cairns
NT
Mount Isa
PACIFIC OCEAN
Alice Springs
WA
QLD
SA
BRISBANE
PERTH
NSW
SYDNEY
ADELAIDE
ACT
VIC
MELBOURNE
TAS
LEGEND
State Capitals
Towns
Kakadu National Park
Wet-Dry Tropics of Australia
Sources :
(1) Australian Bureau of Statistics (1991) Populated Places
(2) ESRI (1992) ArcWorld Political Boundaries
(3) Environment Australia (1999) IBRA digital data set
Note : Grid lines represent 10-degree intervals of latitude and longitude
Scale
200 0 200 400 Kilometres
N

Whats out there ...

- Directory of Important Wetlands
  - Produced by Environment Australia - updated 2001
  - variety of data sources
  - vector-based
- CSIRO Wetland Database
  - grid/cell based
- AUSLIG 1:250 000 Topo data
  - vector based

- Matthews Natural Wetlands
  - 1-degree resolution, cell-based data set
  - compiled from multiple sources
- Digital Chart of the World
  - nominal 1:1 million scale vector data set
  - compiled from multiple sources
- DIScover Landcover
  - 1 km- resolution
  - utilised AVHRR

- 4-minute landcover
  - collaborative product between multiple parties
  - used AVHRR data
- Olsens Vegetation
  - compiled from multiple sources
  - resolution of 0.5 degrees
- Land systems
  - Mapping done by range of organisations
  - reflect combination of landform/vegetation/ geology

What are wetlands ?

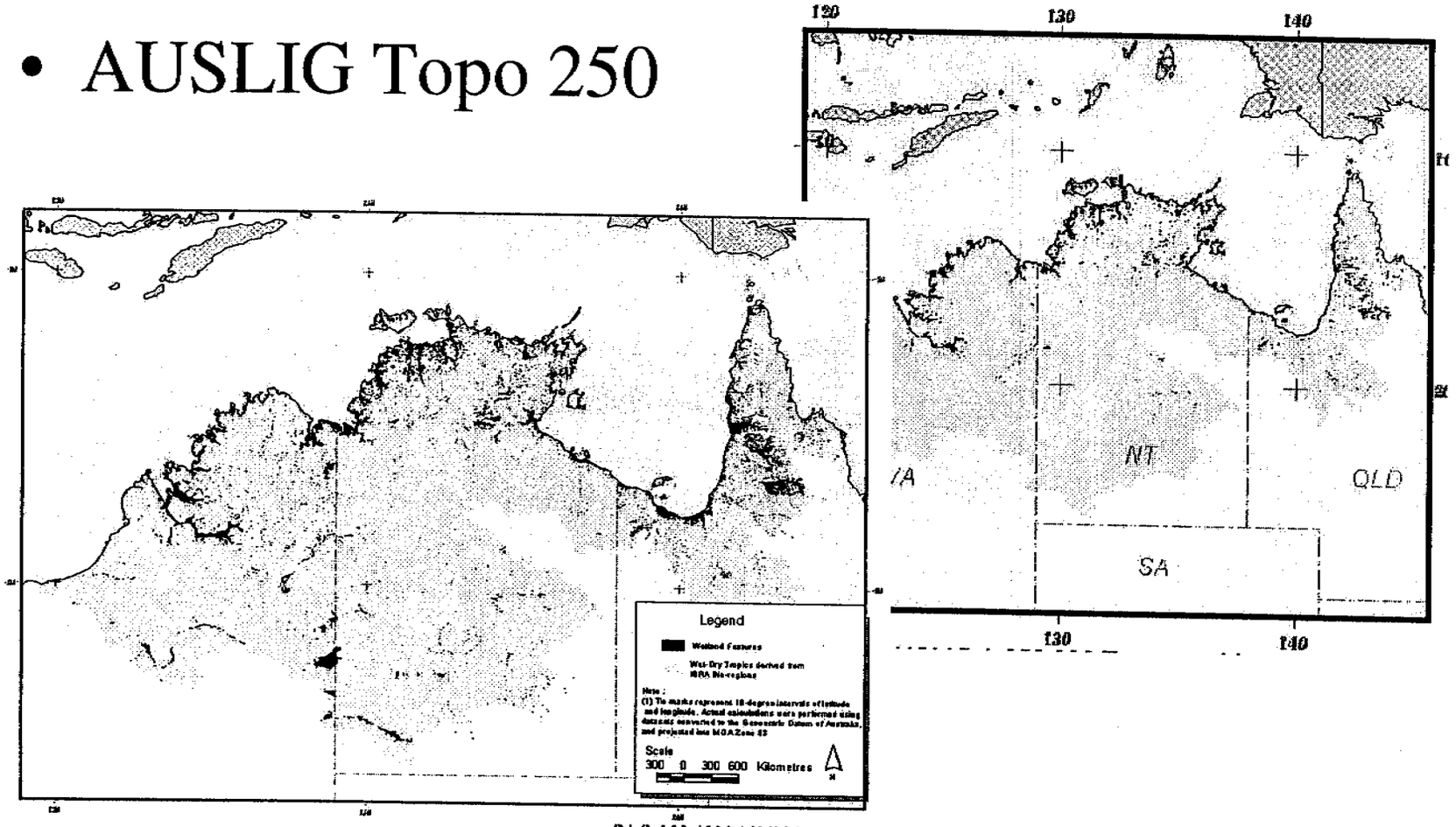
- Marsh
- Lake
- PerennialSwamp
- Perennial Mire
- Bog
- Mangroves
- Fen
- Peatland
- Paddy field
- Dam
- Sumplands
- Ephemeral swamp
- Springs
- Perennial watercourses

Sum areas of wetlands

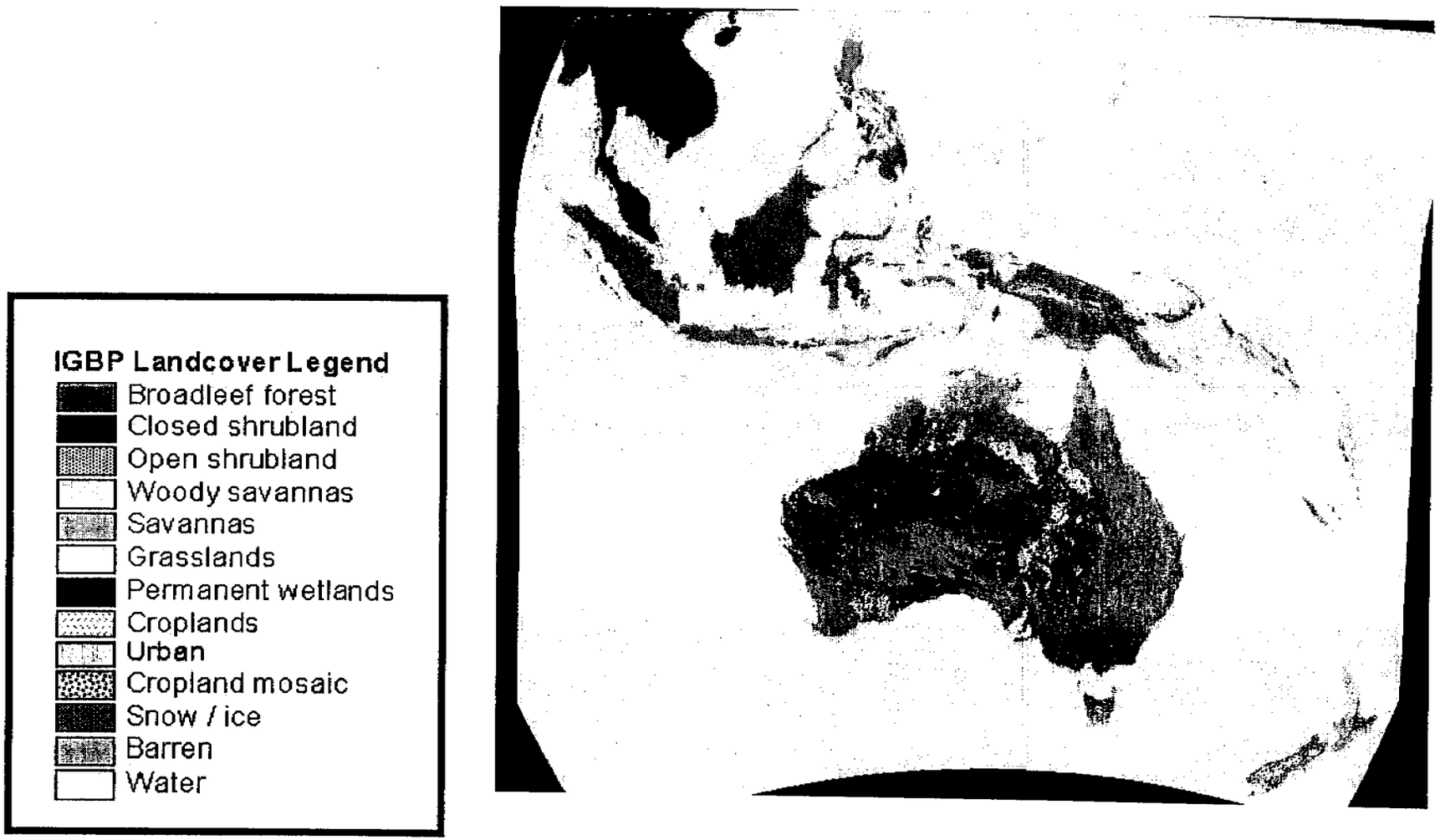
Data source	Northern Australia		Kakadu National Park	
	Area of *swamp & land subject to inundation* (km^2)	Total Wetland Area (all classes - km^2)	Area of *swamp & land subject to inundation* (km^2)	Total Wetland Area (all classes - km^2)
AUSLIG 250k Topographic Data	51 495	98 704	2 429	2 886
Digital Chart of the World	54 912	70 078	2 840	2 906
Mathews Natural Wetlands	35 649	35 649	3 799	3 799
DISCover Land cover - using IGBP Legend	-	4 727	-	42
Global 4-Minute Landcover *	0	0	0	0
Olsons Vegetation*	0	0	0	0
Directory of Important Wetlands	16 472	30 849	2 248	2 595
CSIRO Wetland Database	5 796	18 539	0	502
Land Systems	-	-	3 426	3 426
Range	**5 796 - 54 912**	**18 539 – 98 704**	**0 – 3 799**	**0 – 3 799**

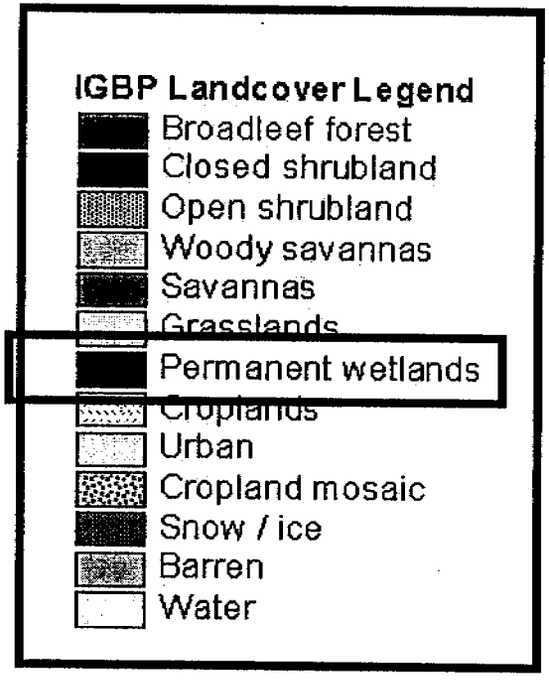
A few results - continental scale

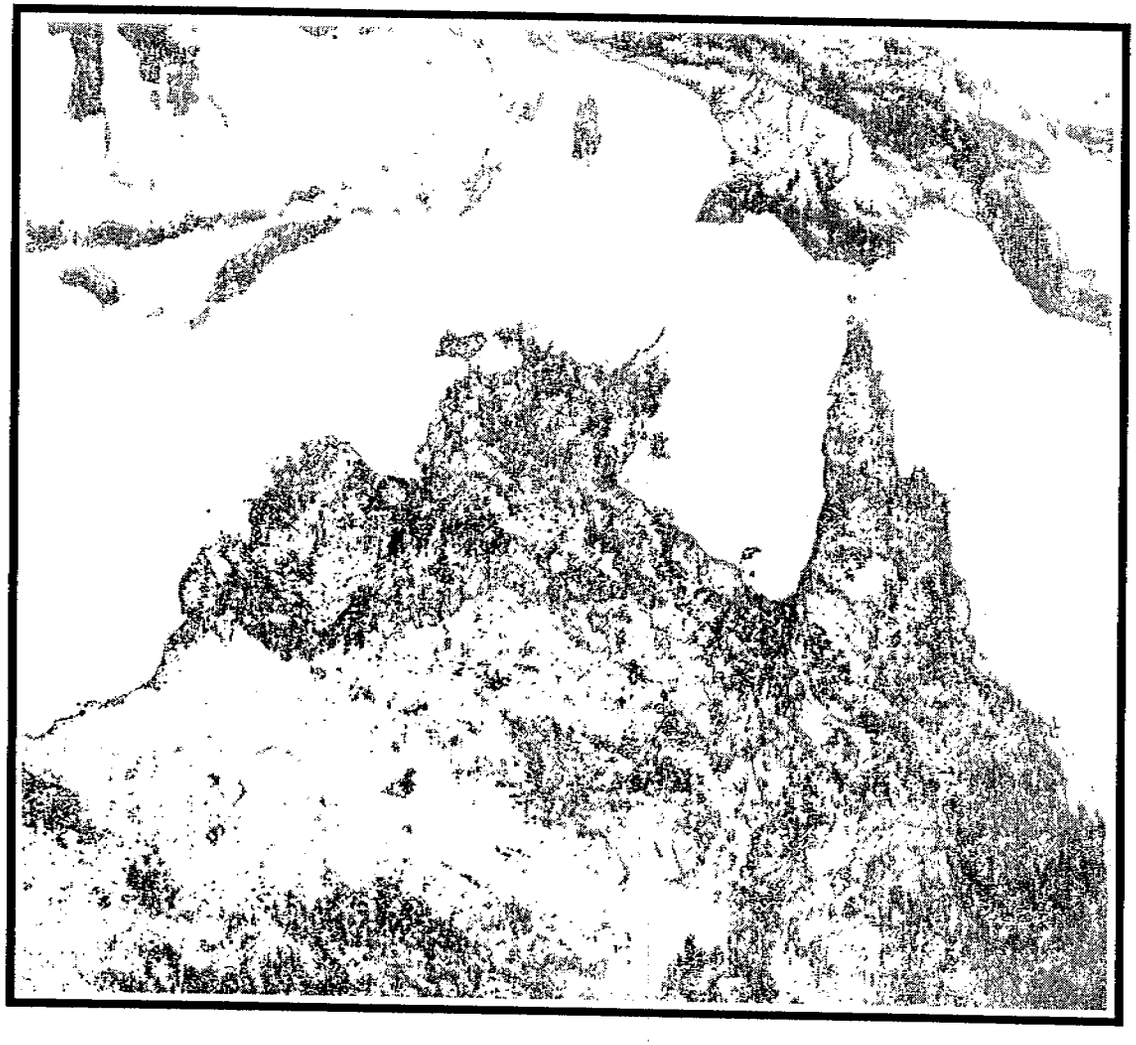
- AUSLIG Topo 250



DISCover 1-km Landcover

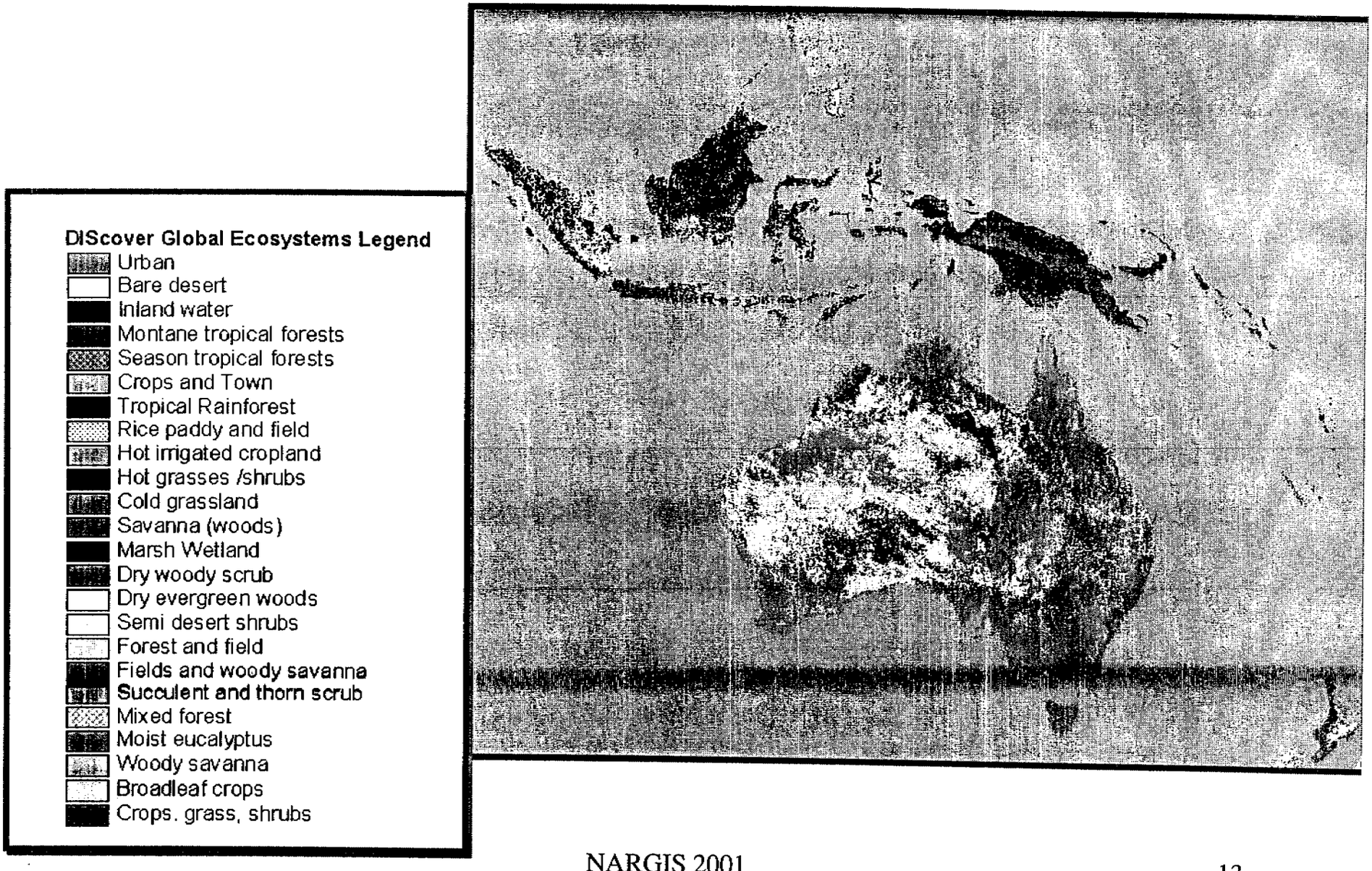



IGBP Landcover Legend
Broadleef forest
Closed shrubland
Open shrubland
Woody savannas
Savannas
Grasslands
Permanent wetlands
Croplands
Urban
Cropland mosaic
Snow / ice
Barren
Water

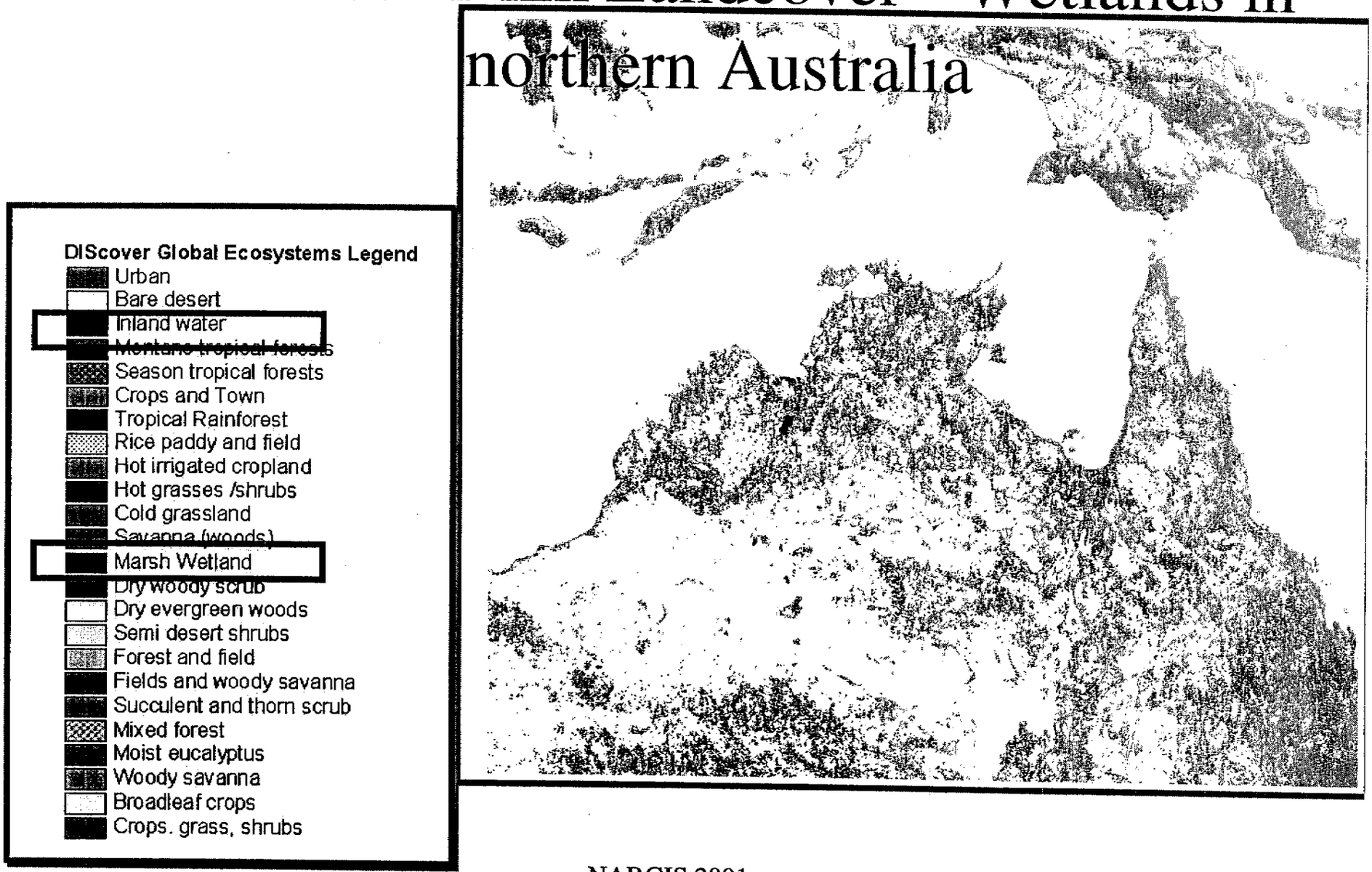


NARGIS 2001

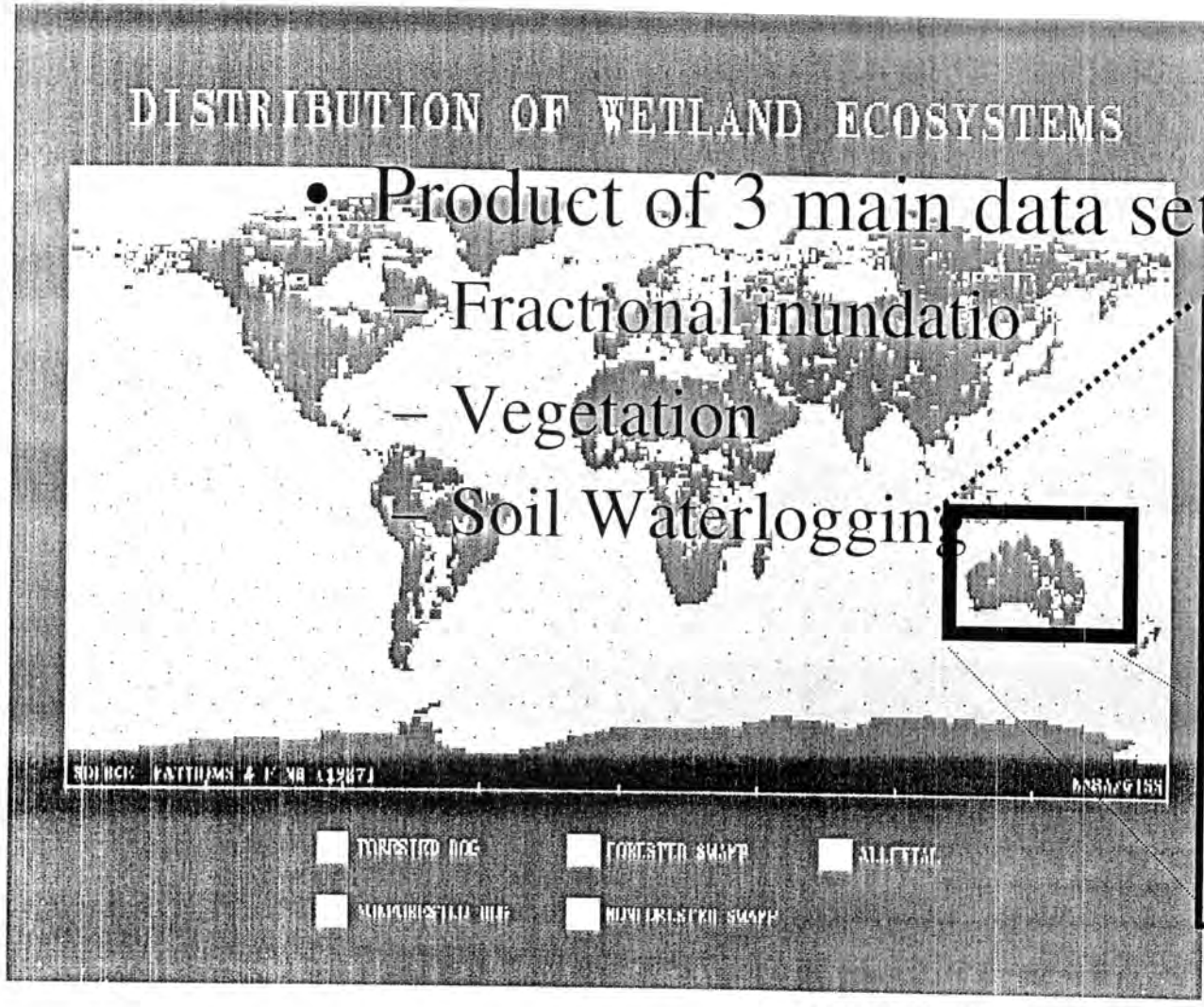
DISCover 1-km Landcover



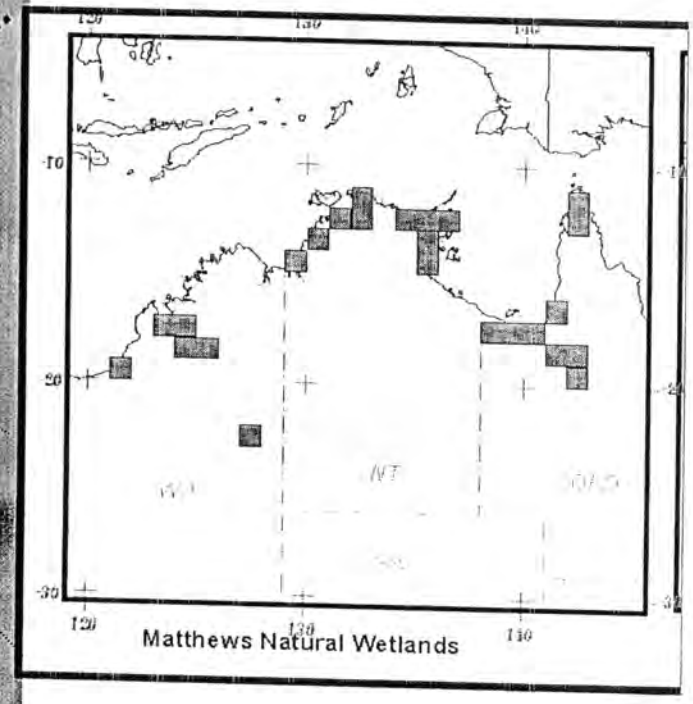
DISCover 1-km Landcover - Wetlands in northern Australia



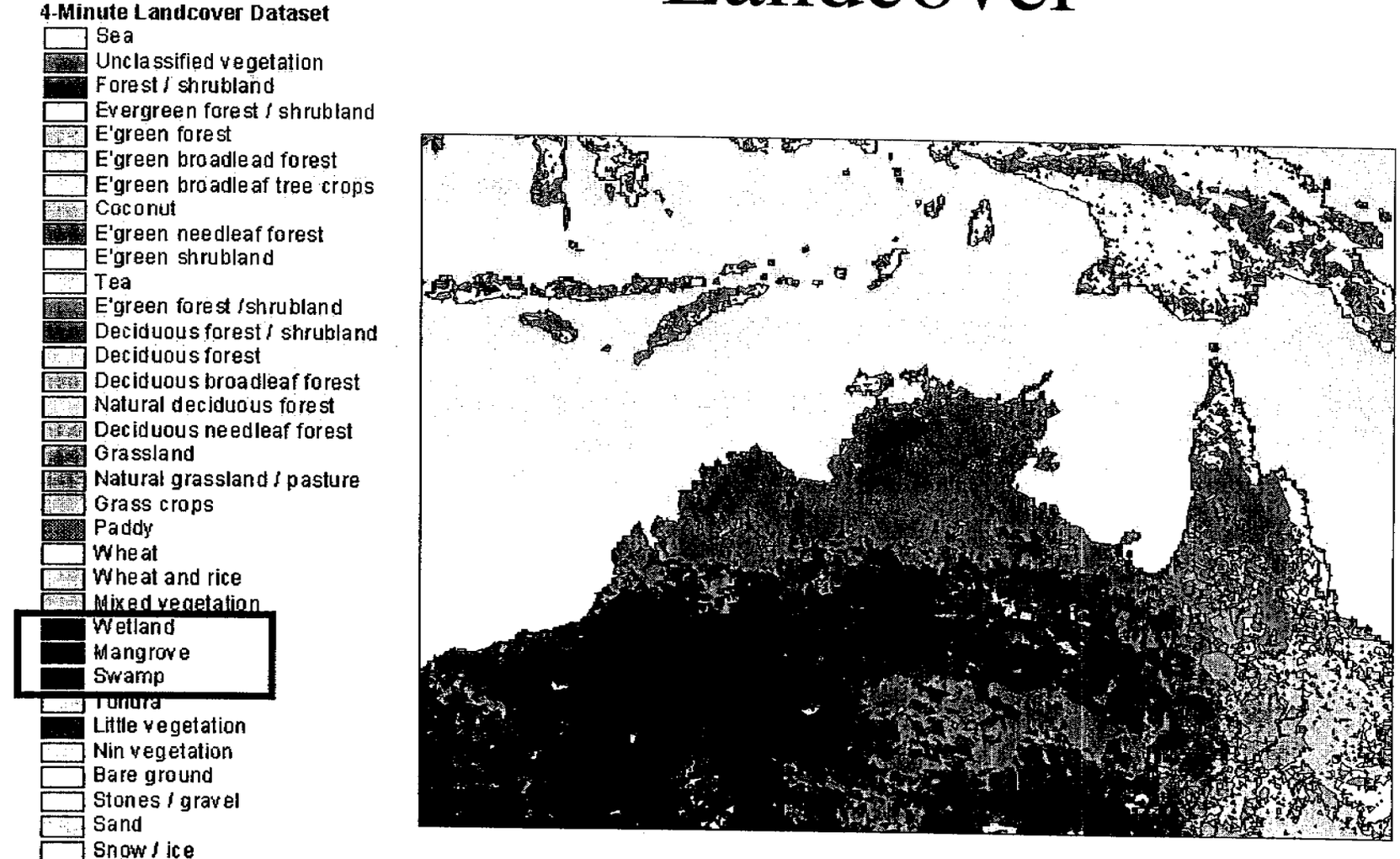
Matthews Natural Wetlands



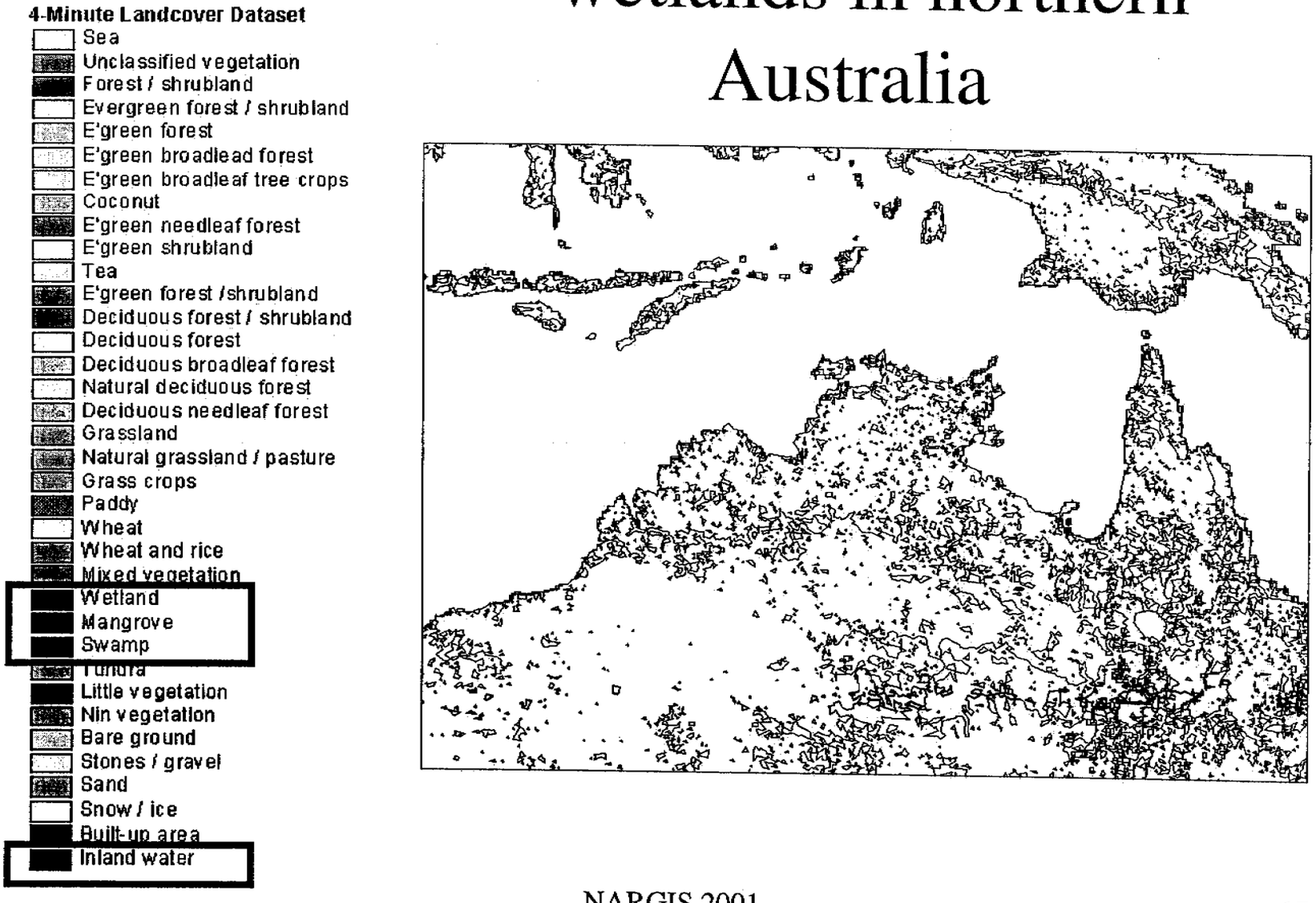
- Product of 3 main data sets
  - Fractional inundatio
  - Vegetation
  - Soil Waterlogging



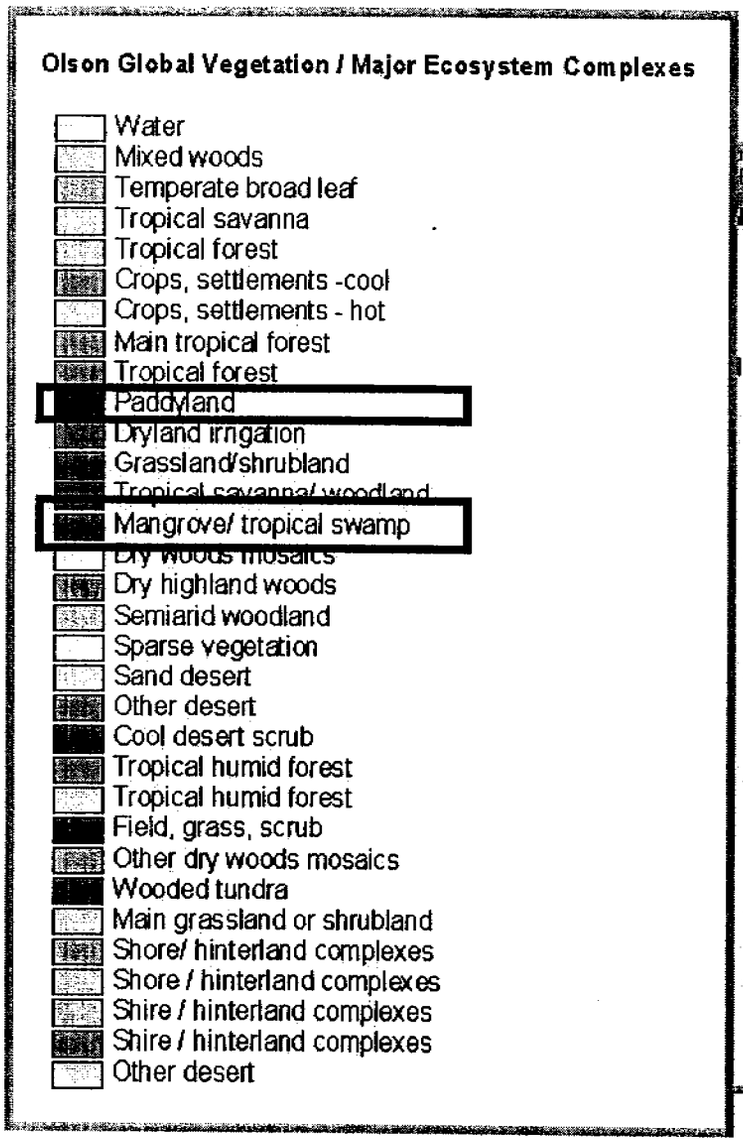
Global 4-Minute Landcover

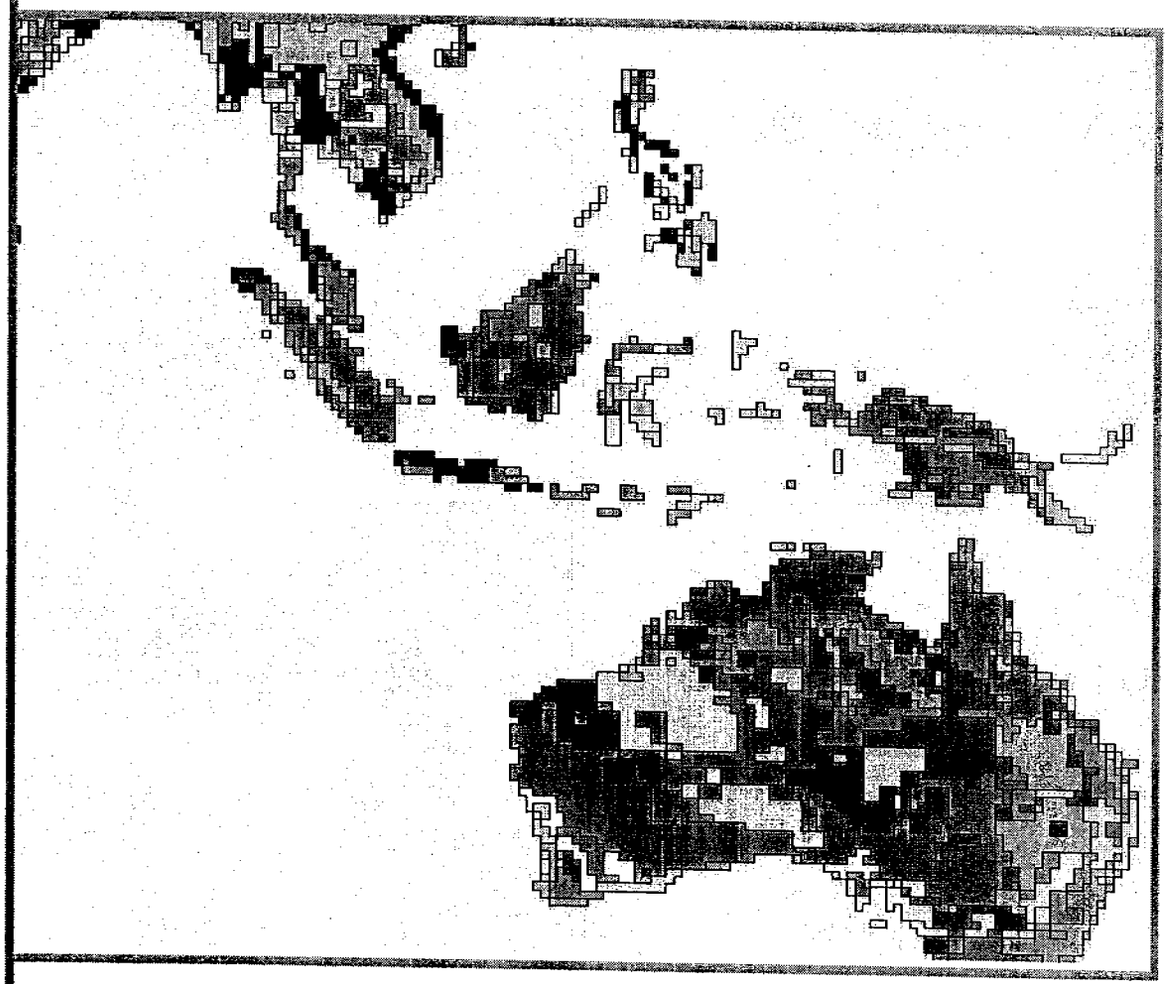


Global 4-Minute Landcover - wetlands in northern Australia

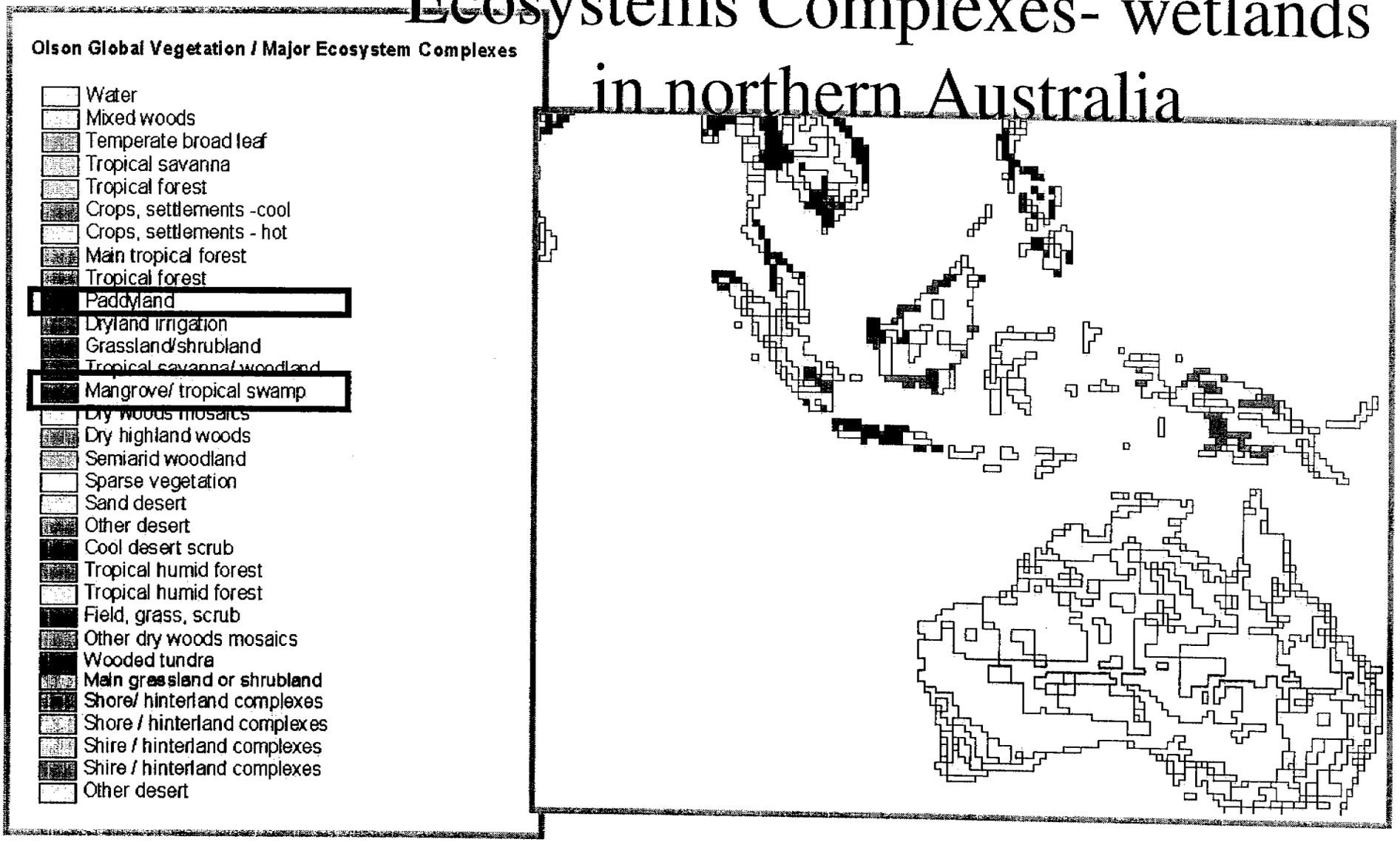


Olsons Vegetation / Major Ecosystems Complexes

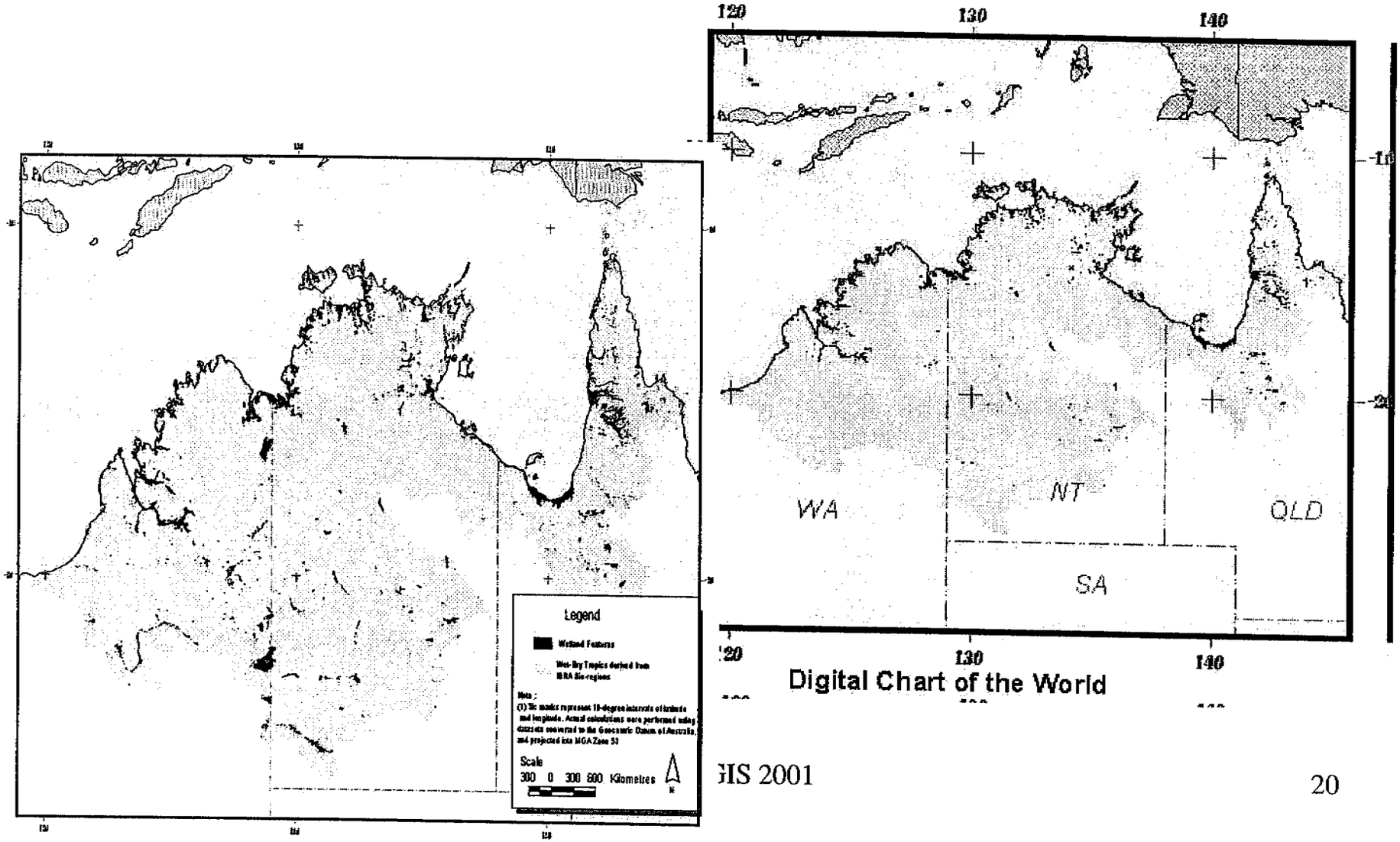




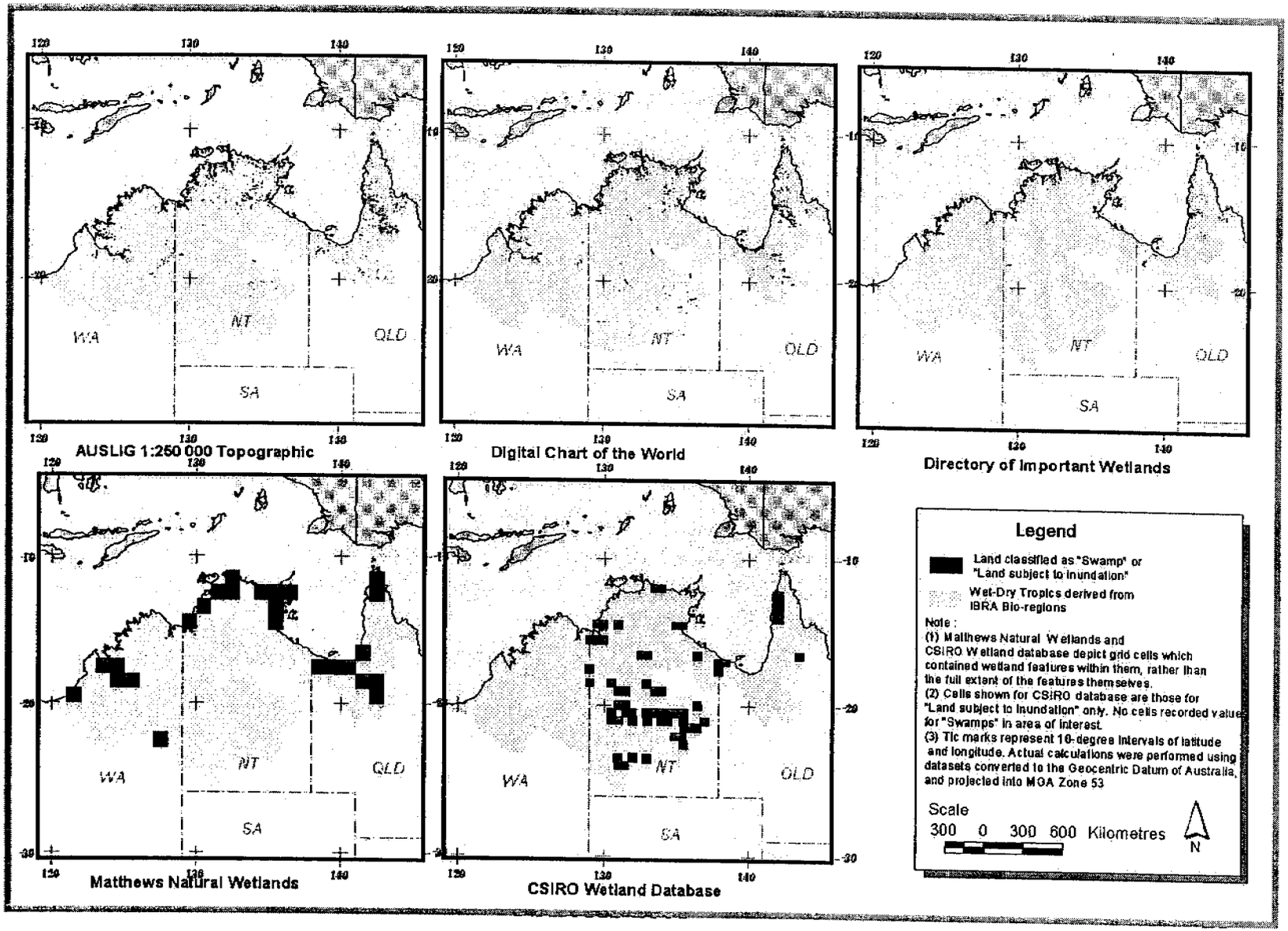
Olsons Vegetation / Major Ecosystems Complexes- wetlands in northern Australia



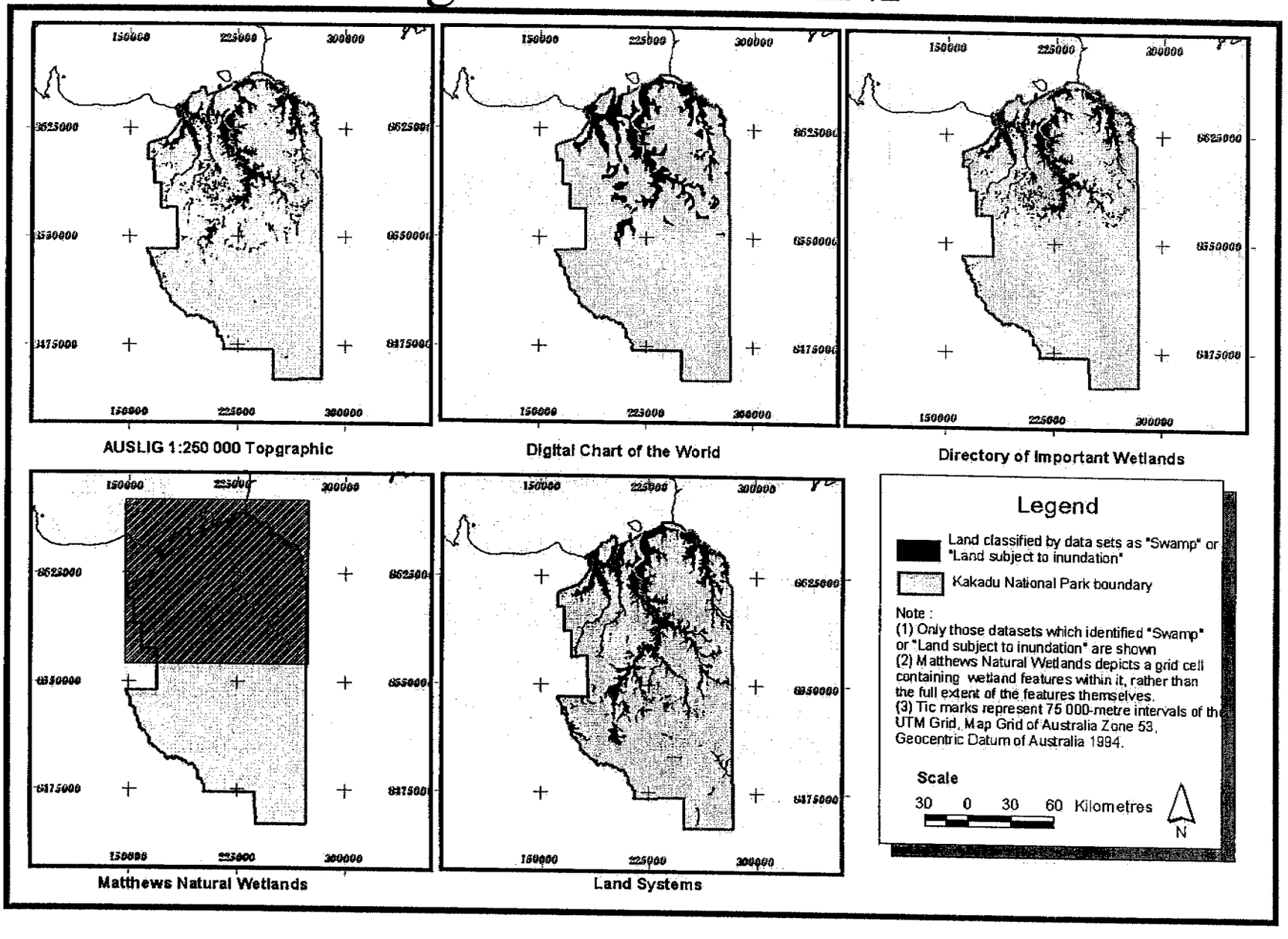
Digital Chart of the World - wetlands features



Sum - selected classes



Regional Scale : KNP

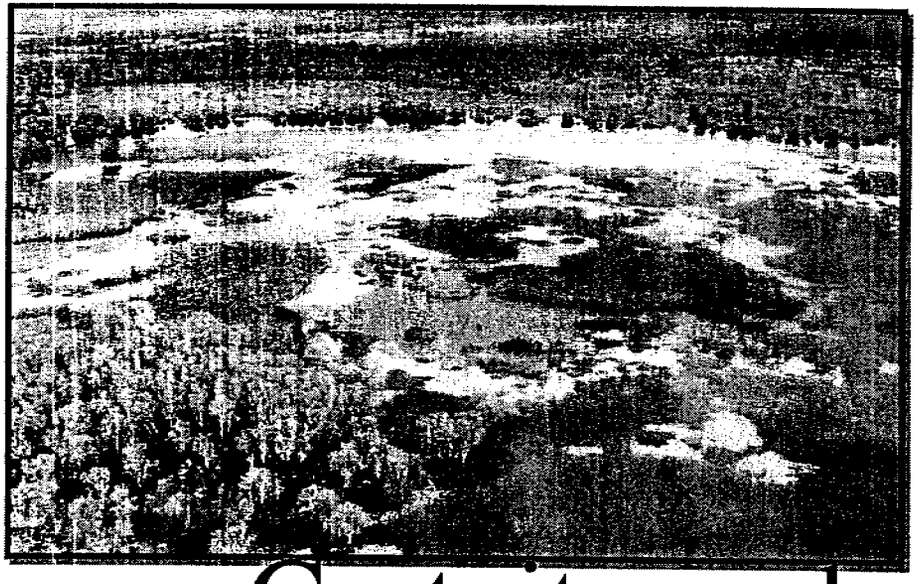


Potential causes of variations

- Spatial resolution of data
- Identification / classification of wetlands and land cover types
  - attribute accuracy / ground truthing
  - rationale for data set creation

Conclusions

- Major differences in estimates of extent of wetlands
- Need to use explicit, common wetland classes - and common understanding as to what they represent
- Need for ground surveys in conjunction with remotely-sensed surveys



Gratuitous shots of wetland ...

NARGIS 01 paper

5th North Australian Remote Sensing and GIS conference.

03 – 05 July 2001

A GIS-based approach for mapping wetlands in the Daly basin

G. Begg, R. van Dam, J. Lowry & M. Finlayson

Environmental Research Institute of the Supervising Scientist, PO Box 461 Darwin NT 0801

Abstract:

The Daly Basin (area 19 382 km^2) lies within the largest river catchment in the Northern Territory. The presence of reliable flows of good quality water and areas of high agricultural potential soils has resulted in serious consideration being given to water resource and agricultural development in the region.

Over the period March 2000 – March 2001 an inventory of water dependent ecosystems (wetlands) in the Daly Basin was undertaken as part of a larger assessment of environmental flow requirements coordinated by the Department of Lands, Planning and Environment. The study focused on the use of a Geographical Information System (GIS) to identify the extent, distribution and location of wetlands in the Daly basin.

To identify which wetlands are most at risk and provide an assessment of the extent of this risk the paper also highlights how a GIS-based wetland risk assessment procedure could be used in the future when an official land use plan for the Daly basin is finally developed by the NT Government.

A GIS-BASED APPROACH FOR MAPPING WETLANDS IN THE DALY BASIN

Environmental Research Institute of the Supervising Scientist

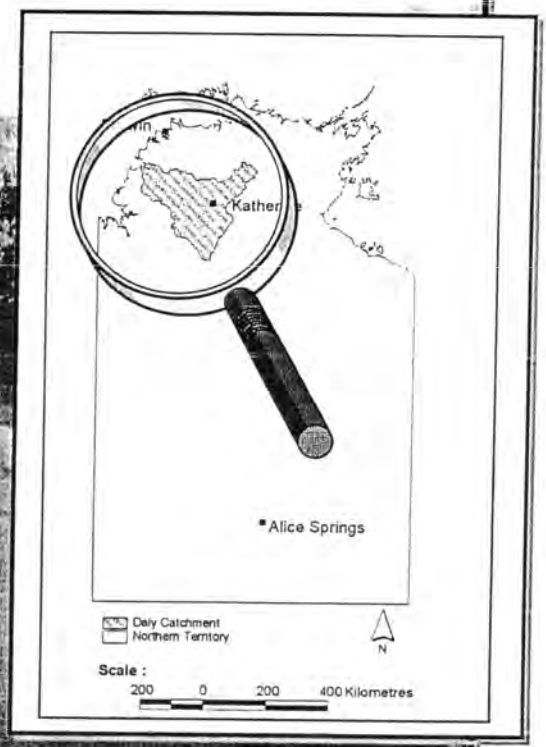
Acknowledgments

- Environment Australia
- Staff of Natural Resources Division, DLPE
- Staff of Land Information Services, DLPE
- AUSLIG
- ADF
- *eriss* staff - Ben Bayliss, Dave Walden

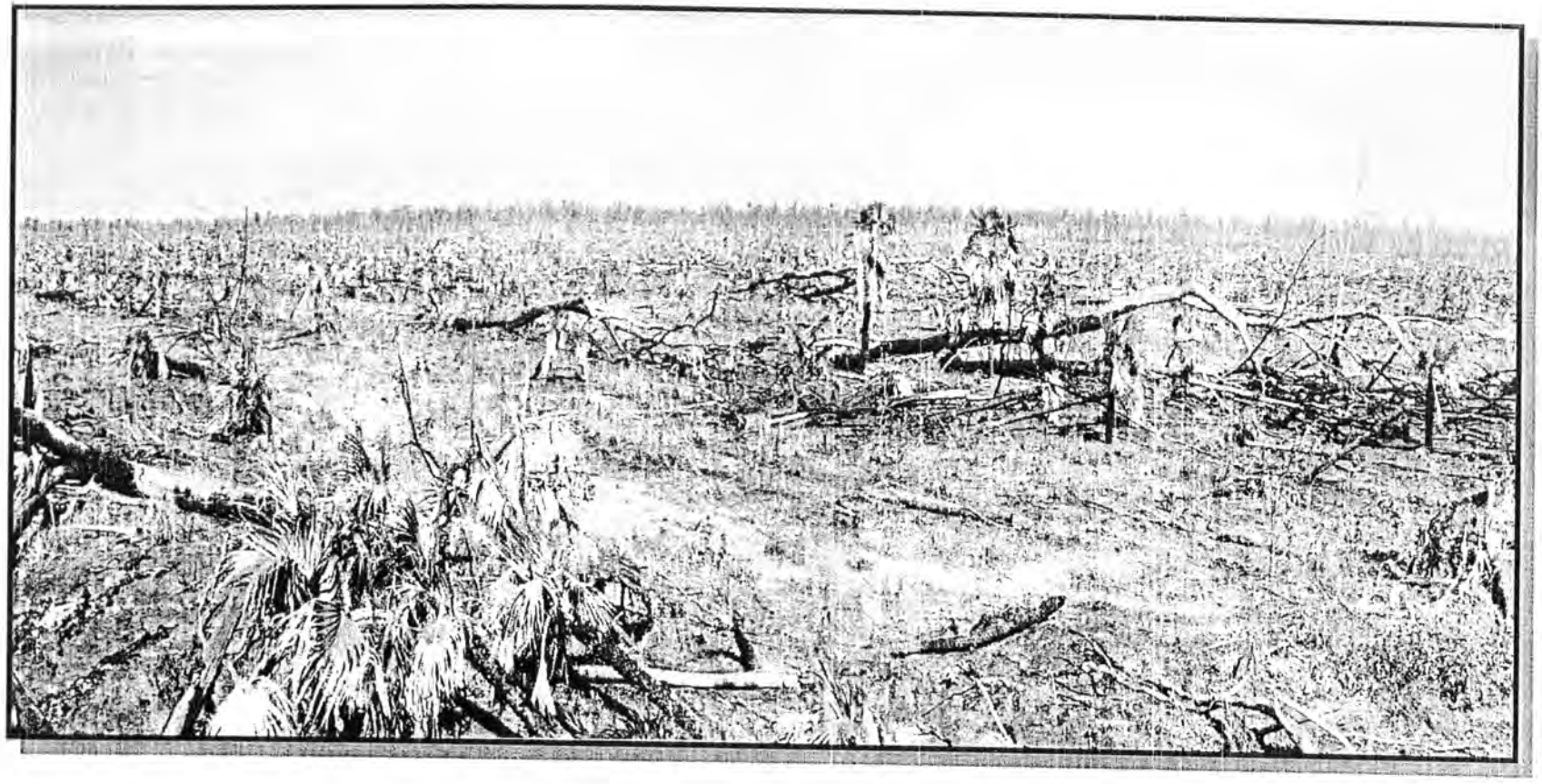
Project Objectives

Use a GIS to :

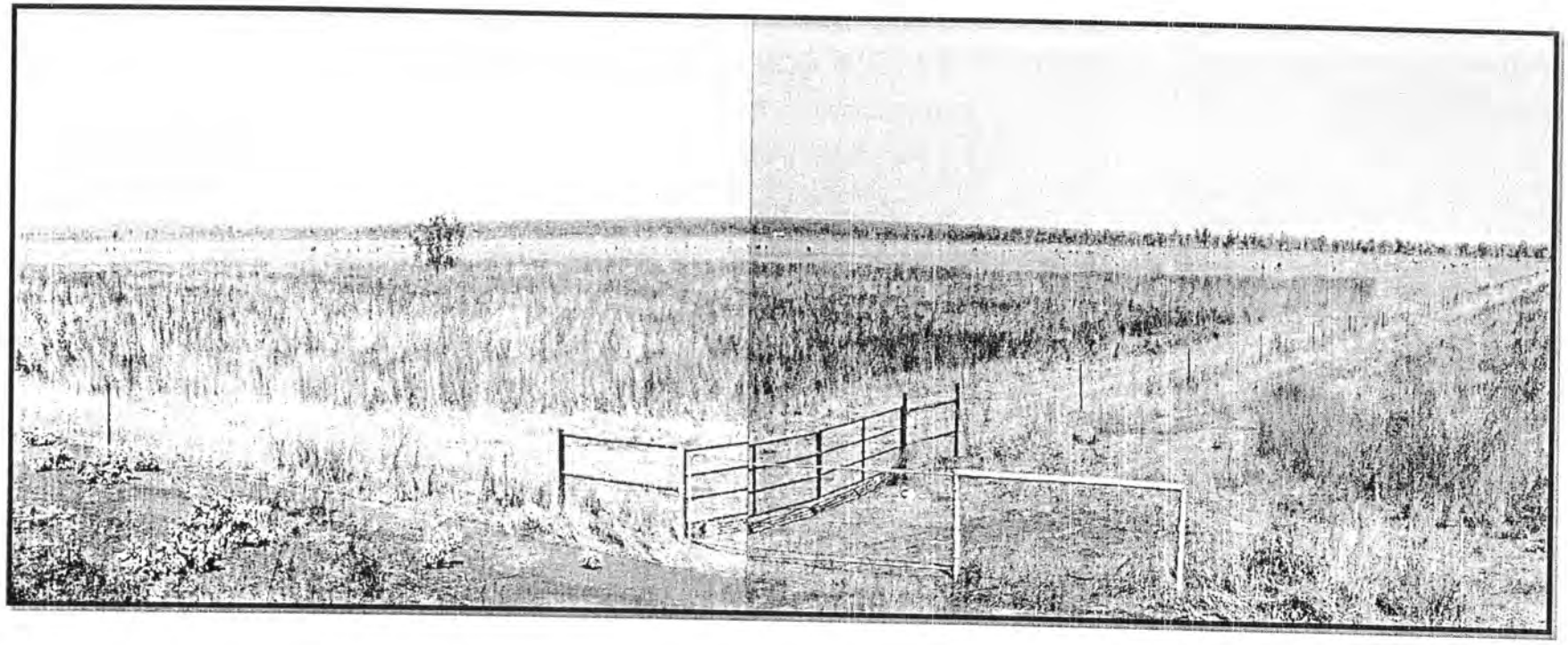
- identify distribution and location of wetlands
- demonstrate how a GIS could be use in wetland risk assessment



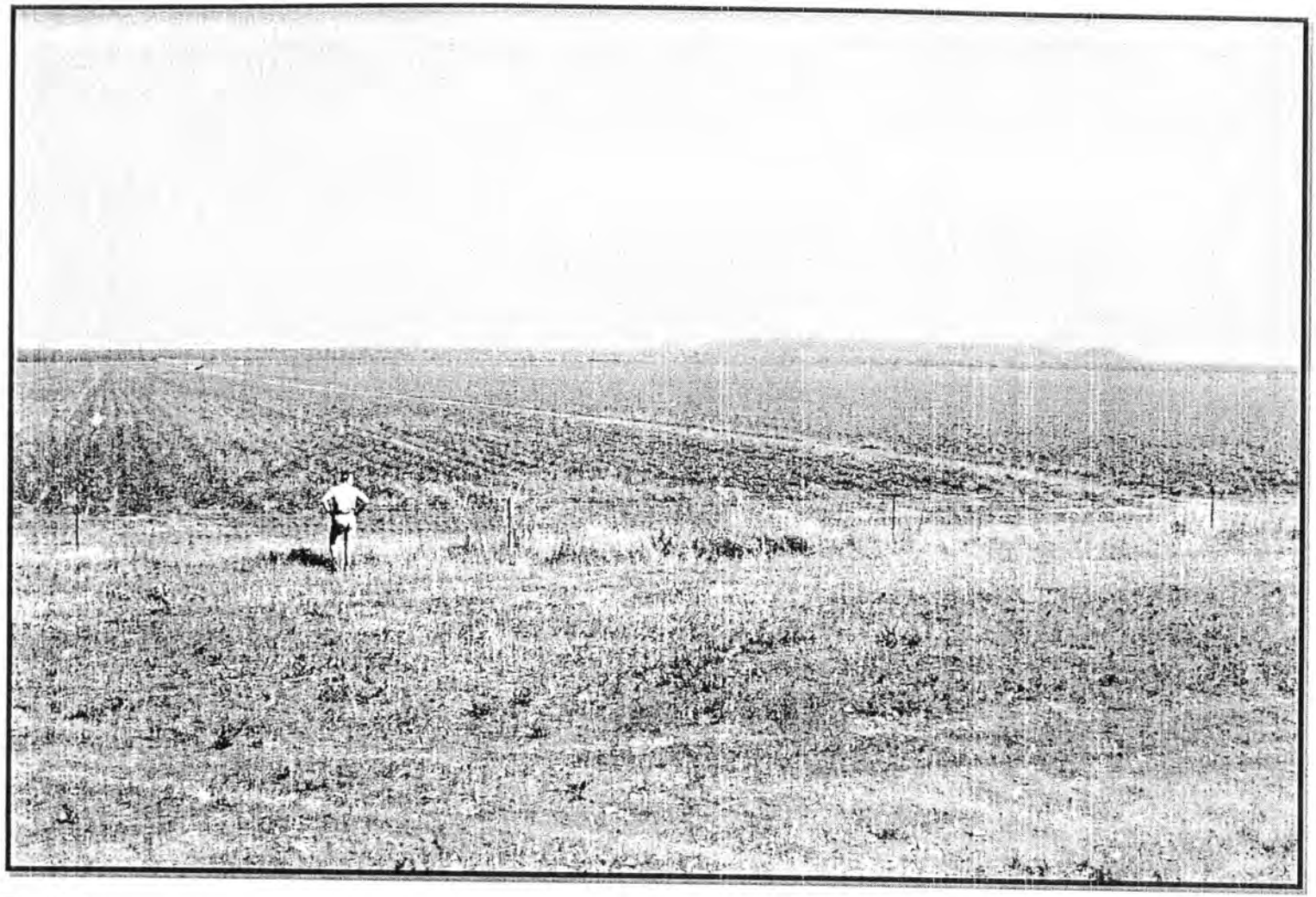
THREATS : Clearing



Improved Pasture

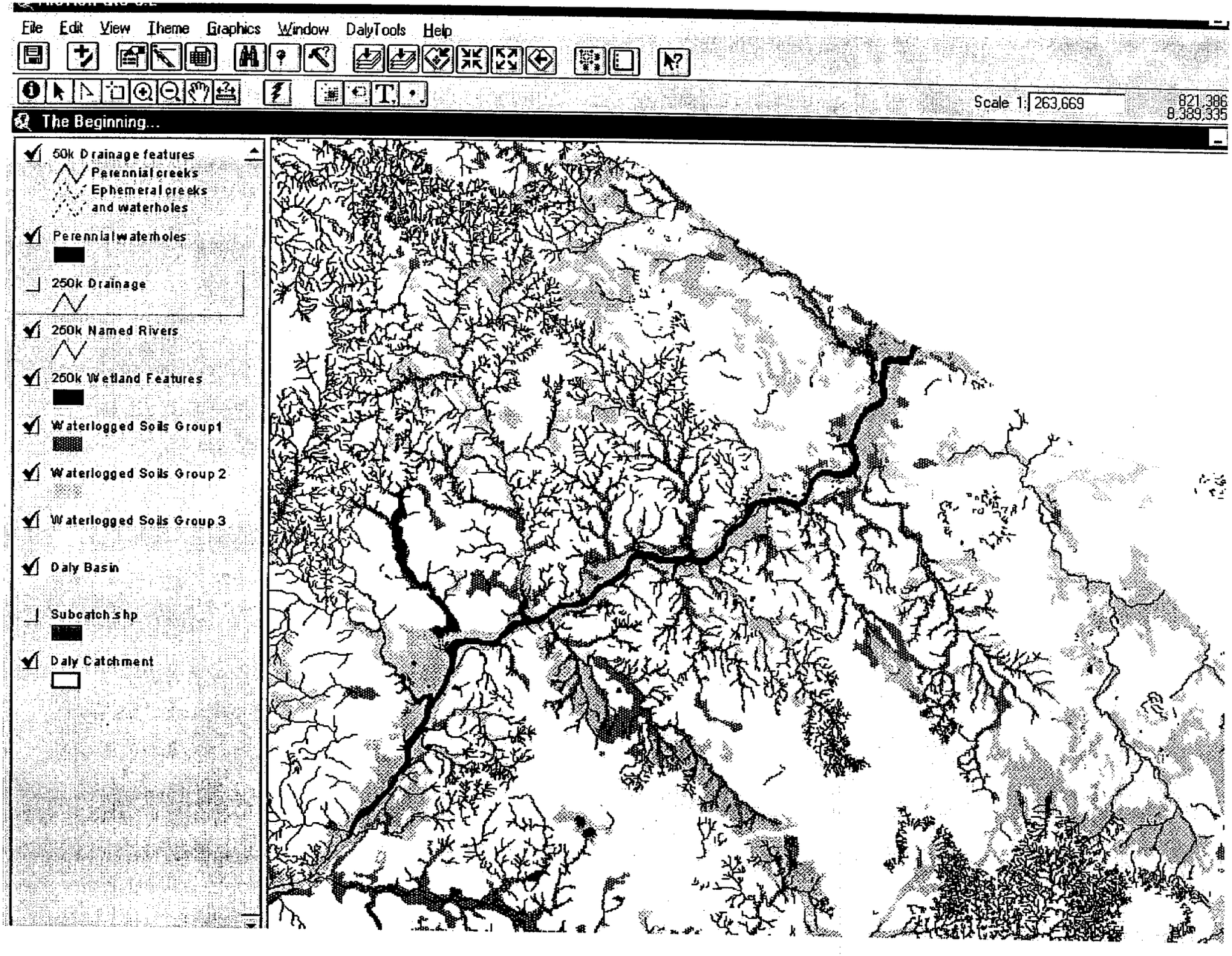


Irrigation

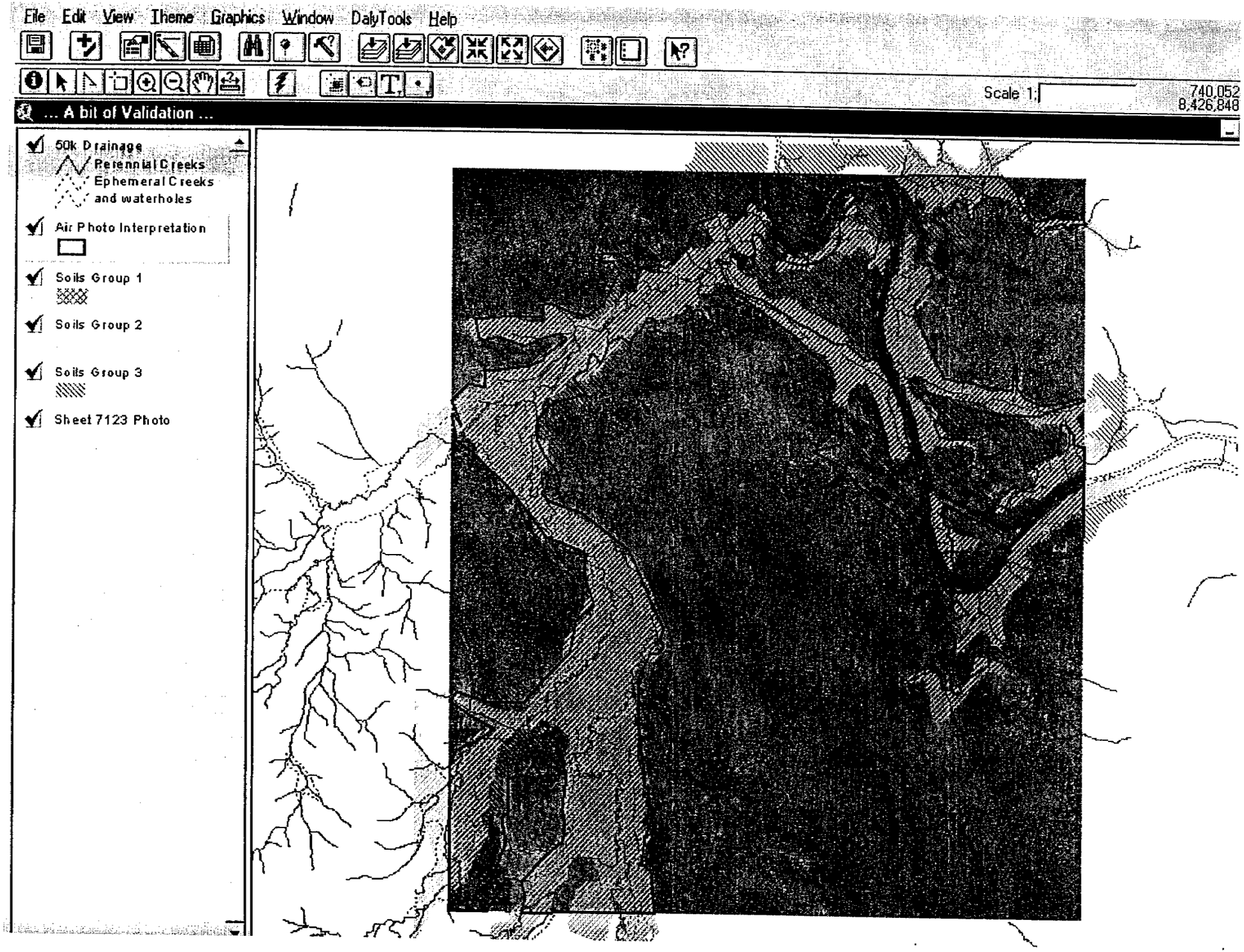


GIS Framework

- 2 main data types :
  - Land units (1 scale)
  - Water body features (various scales)
- Study area has the UTM zone boundary running down centre
- Quality of data varied within datasets
  - attributes incomplete;
  - features not 'built'


File Edit View Theme Graphics Window DalyTools Help
Scale 1: 263,669
821,386
8,389,335
The Beginning...
50k Drainage features
Perennial creeks
Ephemeral creeks
and waterholes
Perennial waterholes
250k Drainage
250k Named Rivers
250k Wetland Features
Waterlogged Soils Group1
Waterlogged Soils Group 2
Waterlogged Soils Group 3
Daly Basin
Subcatchship
Daly Catchment

… A spot of validation ...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Scale 1:
740,052
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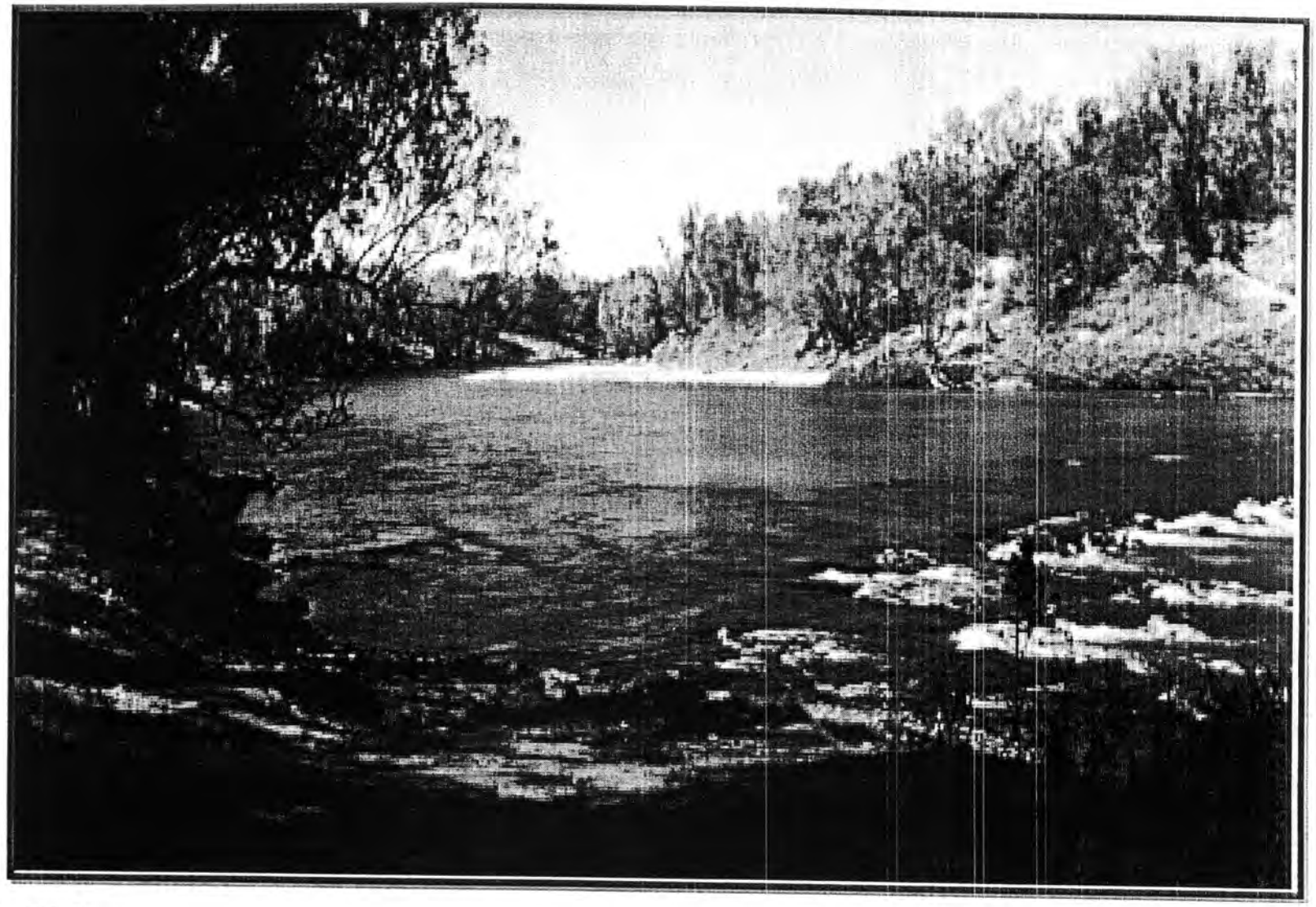
... A bit of Validation ...
50k Drainage
Perennial Creeks
Ephemeral Creeks
and waterholes
Air Photo Interpretation
Soils Group 1
Soils Group 2
Soils Group 3
Sheet 7123 Photo

Classification

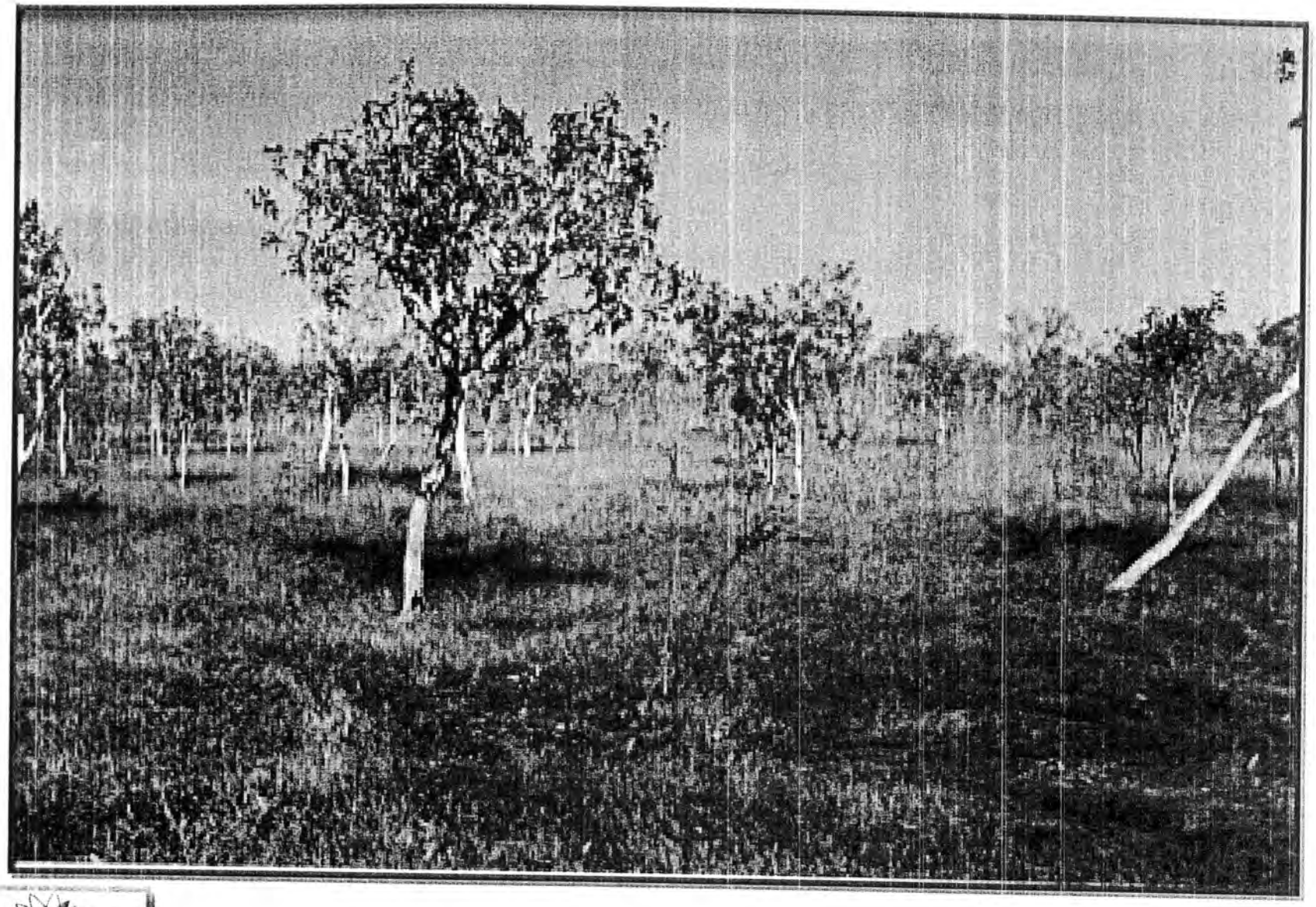
Landform		Water regime	Wetland class
Basic shape	**Distinguishing features**		
CHANNEL	Active drainage line	Permanently inundated	River
	Active drainage line	Seasonally inundated	Creek
	Pool in flow channel	Permanently inundated	Channel billabong
	Off-channel pool with connection to flow channel	Permanently inundated	Backflow billabong
	Off-channel pool with no connection to flow channel	Permanently inundated	Floodplain billabong
FLAT	Well defined margins	Seasonally inundated	Floodplain
	Ill-defined margins	Seasonally waterlogged	Dampland
BASIN	Depression on floodplain	Seasonally inundated	Sumpland
	Depression in non-floodplain setting	Permanently inundated	Waterhole
	Depression in non-floodplain setting	Seasonally inundated	Sinkhole or doline

River

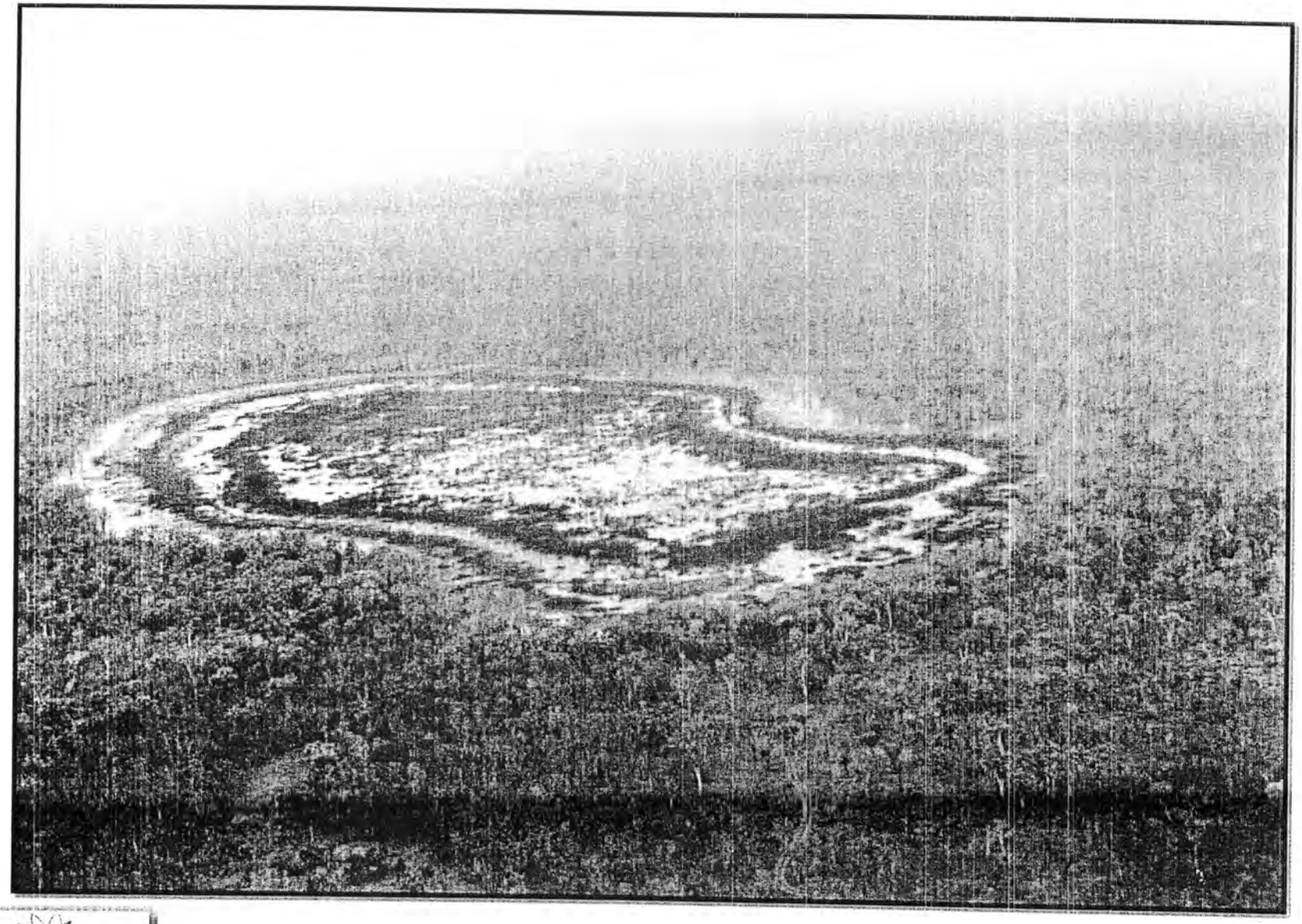


Floodplain

Dampland



Waterhole



Sumpland

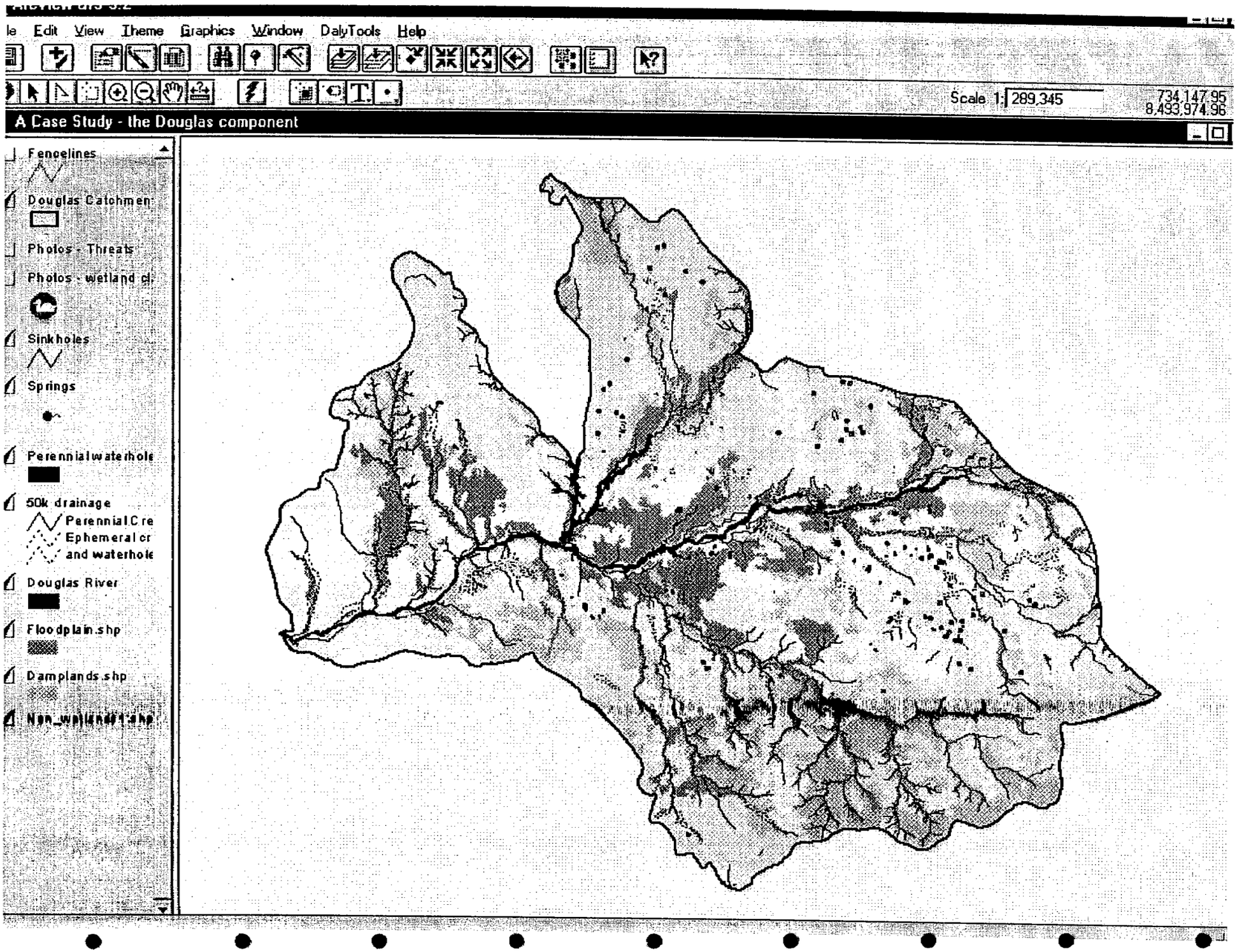
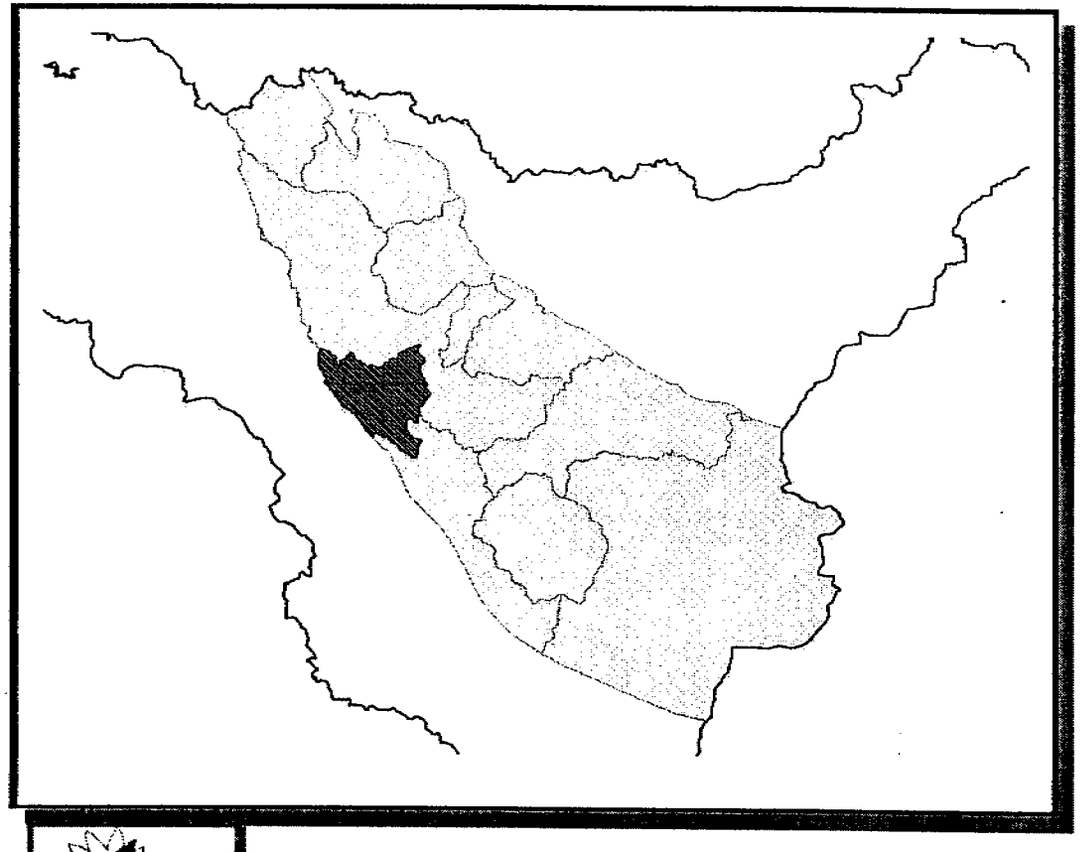

le Edit View Theme Graphics Window DalyTools Help
Scale 1: 289,345
734,147.95
8,493,974.96
A Case Study - the Douglas component
Fencelines
Douglas Catchmen
Photos - Threats
Photos - wetland cl
Sinkholes
Springs
Perennialwaterhole
50k drainage
Perennial Cre
Ephemeral cr
and waterhole
Douglas River
Floodplain.shp
Damplands.shp

Table 4: Overview of the extent of the major wetland types in the Daly Basin

Basin Component	Floodplain (km^2)	Dampland (km^2)	River/Creek channels (km)
Daly	605	416	5 023
Green Ant	153	166	1 425
Douglas	183	210	905
Stray	75	77	839
Dead Horse	11	48	398
Fergusson	95	89	1 620
Katherine	370	118	3 758
King and Dry	304	171	5 157
Limestone	86	84	2 431
Flora	63	102	2 484
Bradshaw	65	43	1 520
TOTAL	2 010	1 524	25 560



eriss

Information gaps

- Temporal information
- Soils coverage
- Specific land and water use data
- Topographic information
- Ecological characteristics
- Water regime requirements of wetland fauna and flora

Conclusions

- The combination of 1:50 000 topographic waterbody data + water logging attributes of land unit data provides a reasonably accurate and rapid means of identifying wetlands
- The combination of wetland features with land / water use provides a potential means for undertaking wetland risk assessment

Progress in the Development of a GIS-Based Method for the Assessment and Management of Mining Impact on Landform Evolution.

G.S. Boggs[1], C.C. Devonport[1] and K.G. Evans[2]

[1] Northern Territory University
Darwin NT 0909
[2] Environmental Research Institute of the Supervising Scientist
Locked Bag 2, Jabiru NT 0886

ABSTRACT

A collaborative project between the Environmental Research Institute of the Supervising Scientist (***eriss***) and the Northern Territory University (NTU) was established in 1999 to develop a Geographic Information System (GIS) that interacts with sediment transport, hydrology and landform evolution modelling techniques for use in the assessment and management of mining impact at the ERA Jabiluka Mine, Northern Territory, Australia. This paper will provide an overview of the progress of this project and describe future directions required to provide a valuable tool for the assessment and management of mining impact.

Progress in this project has seen; i) the development of a GIS that provides a central focus point for the storage, manipulation and retrieval of information generated by the investigation into the geomorphological impact of the ERA Jabiluka Mine; ii) the linkage of the DISTFW hydrology model and SIBERIA landform evolution model to the ArcView GIS package; iii) a preliminary assessment of landform evolution in the catchment containing Jabiluka iv) the development and application of GIS-based geomorphic statistics to analysing landform evolution. Three areas have been identified as requiring further study in this project including; i) the incorporation of spatial variation in SIBERIA input parameters in the modelling process; ii) an analysis of the sensitivity of the SIBERIA model to input parameter variations or error and; iii) the practical application of the GIS/modelling approach to assessing the impact of the ERA Jabiluka Mine on landform evolution.

Progress in the Development of a GIS-Based Method for the Assessment and Management of Mining Impact on Landform Evolution

Presented by Guy Boggs

Co-authors: C. Devonport and K. Evans

Environment Australia
Department of the Environment and Heritage

Northern Territory University

Supervising Scientist

Presentation Structure

- Project Background
- GIS-Based Approach
- Rapid Erosion Assessment
- Landform Evolution Modelling
- Geomorphic Statistics for Assessing Change

Environment Australia
Department of the Environment and Heritage

Northern Territory University

NTU Northern Territory University

Supervising Scientist

Project Background

Project Background

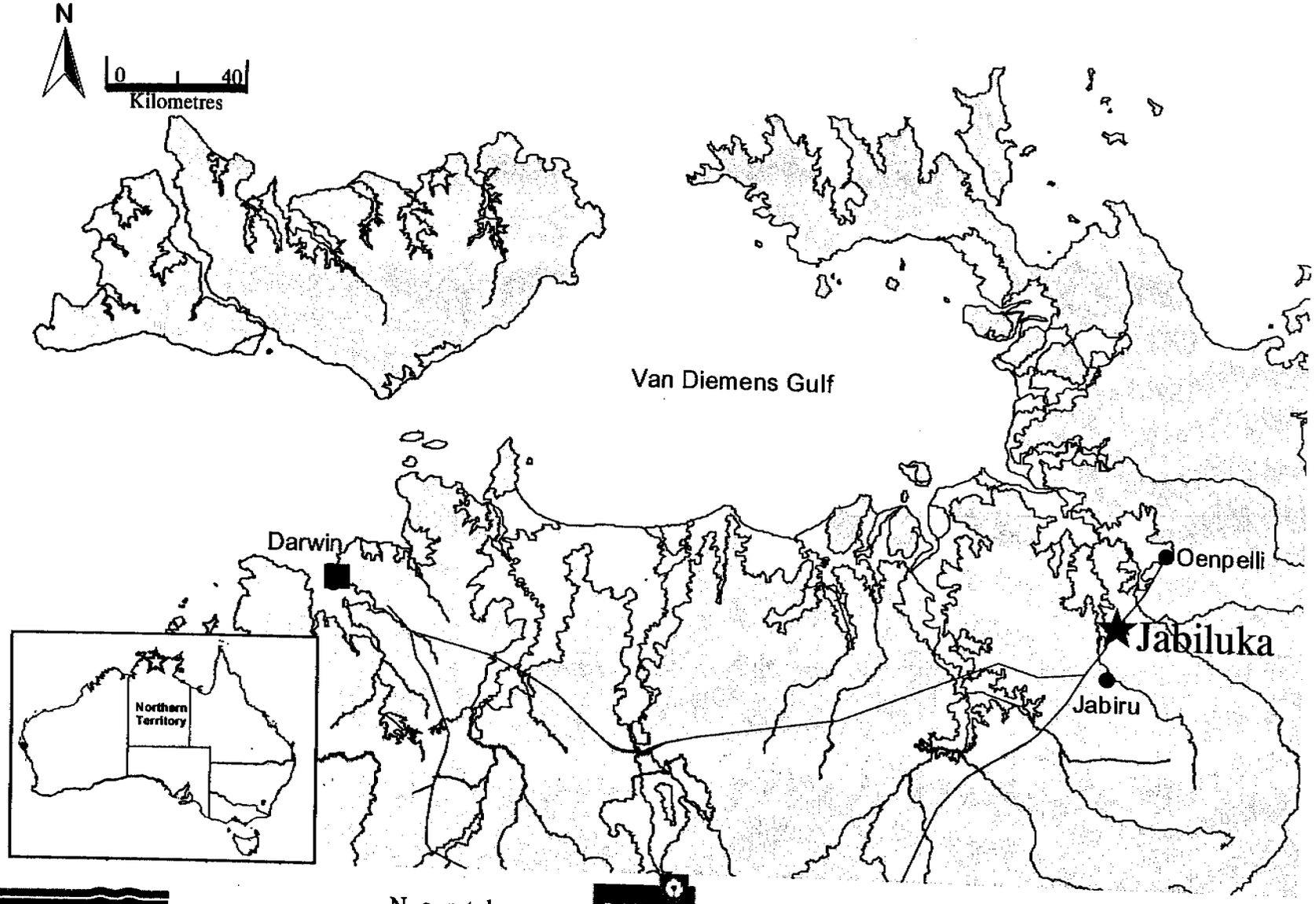
- Construction of Jabiluka began in June 1998
- ***eriss*** established two PhD projects for assessing geomorphic impact;
  - Field-based characterisation of channel stability and baseline hydrology and sediment transport processes
  - Integrated GIS and modelling based assessment of long-term mining impact on landform evolution

Environment Australia
Department of the Environment and Heritage

Northern Territory University

Supervising Scientist

2.0 Study Area



Environment Australia
Department of the Environment and Heritage

Northern Territory University

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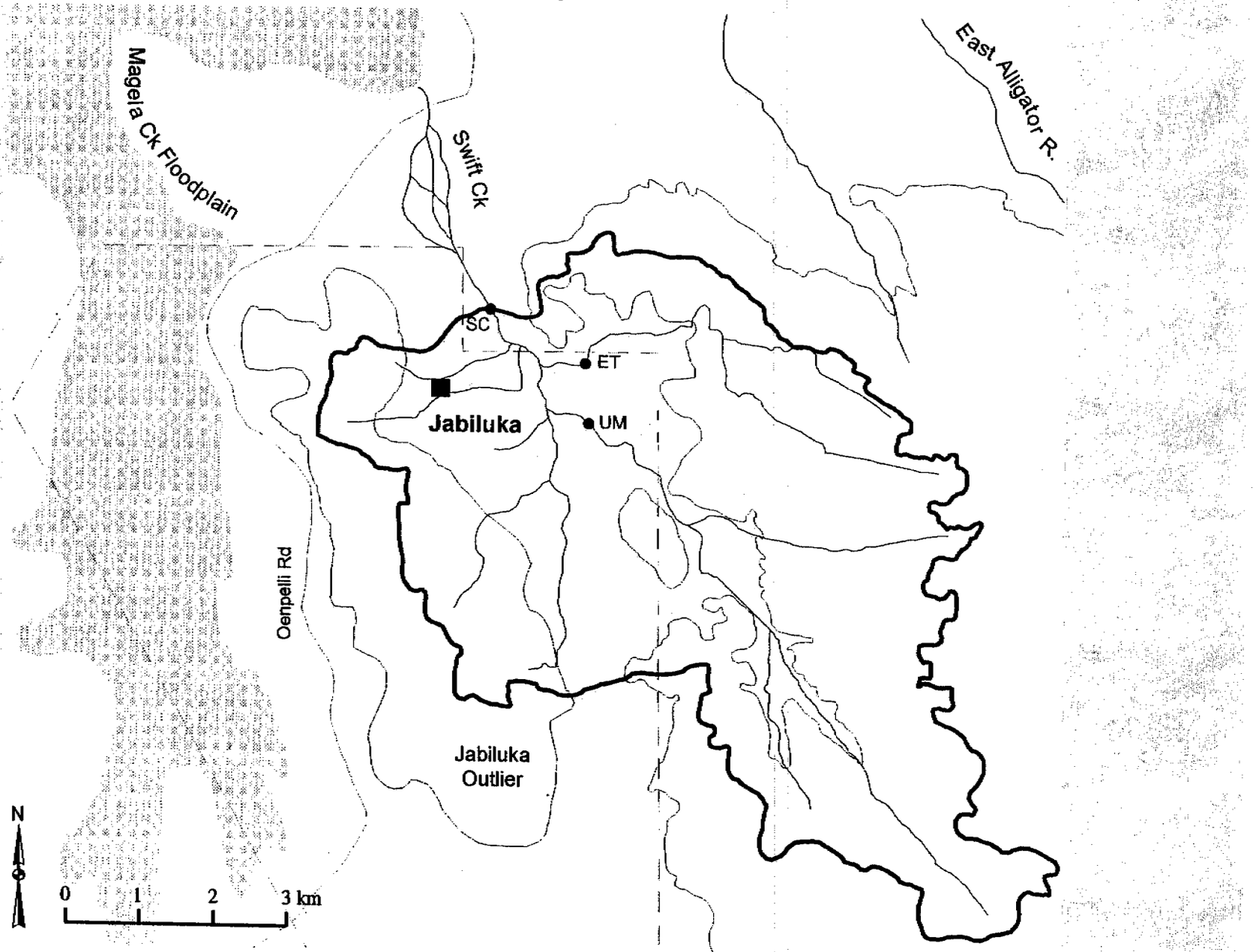
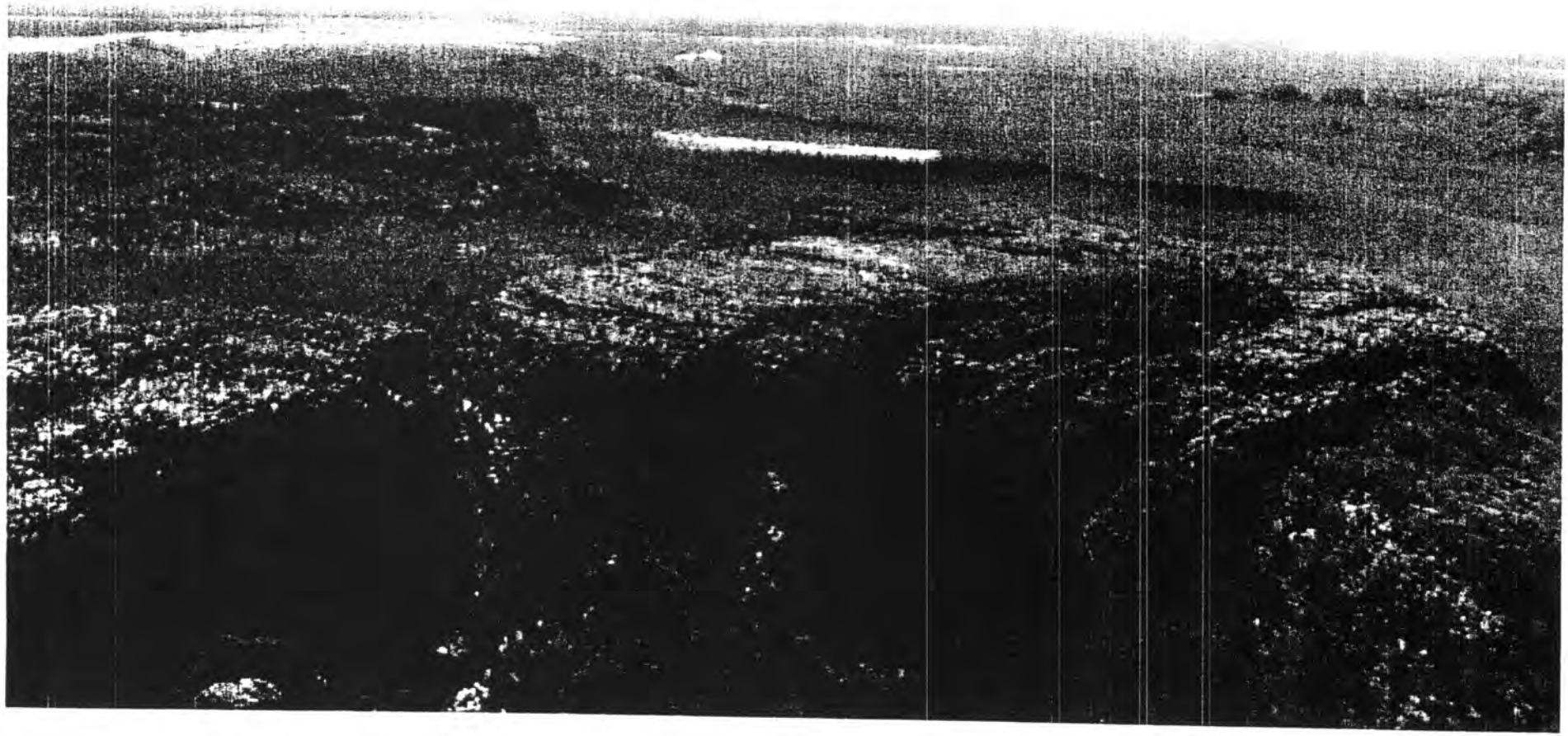
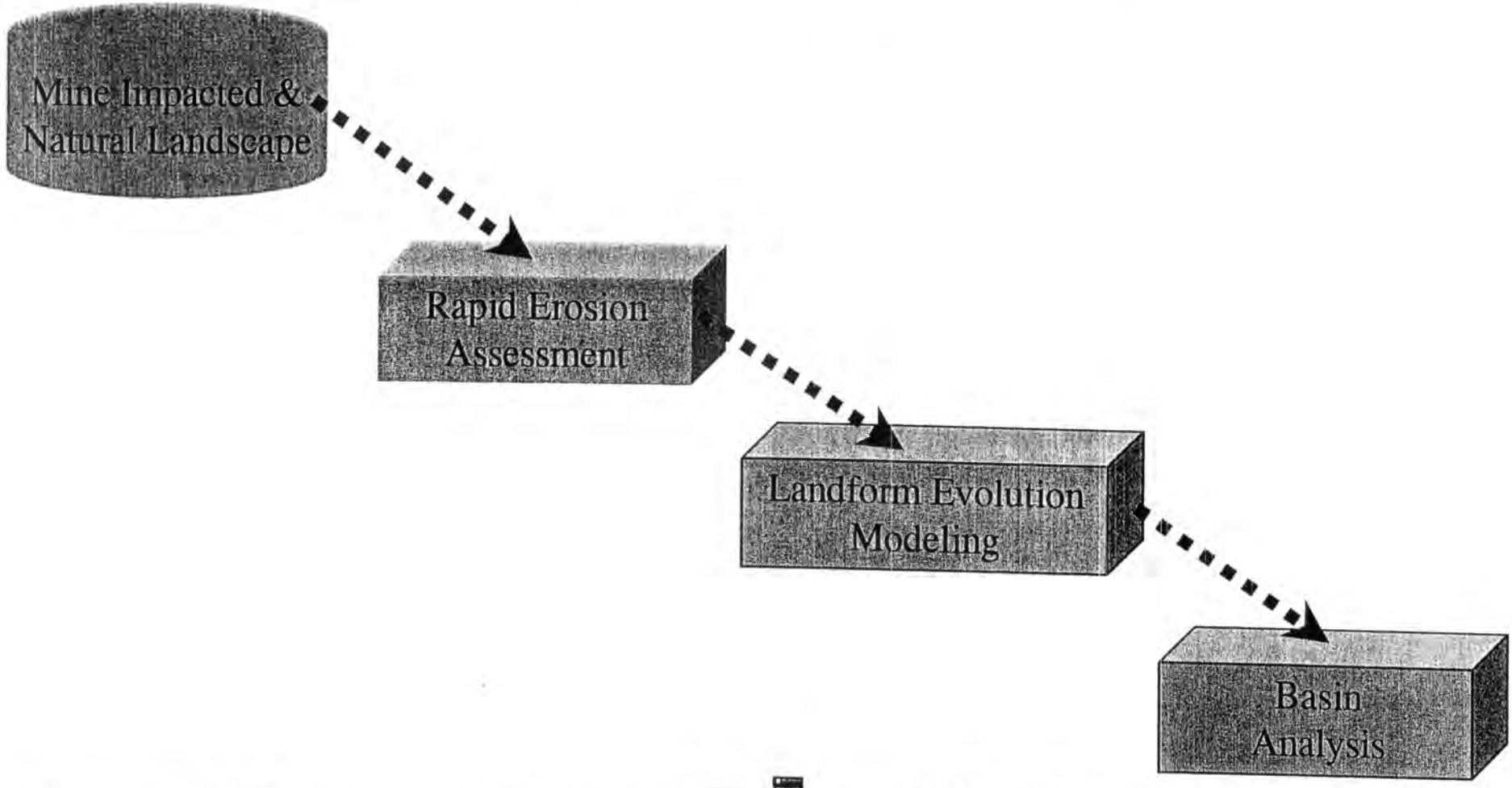
2.0 Study Area



2.0 Study Area



GIS-Based Approach



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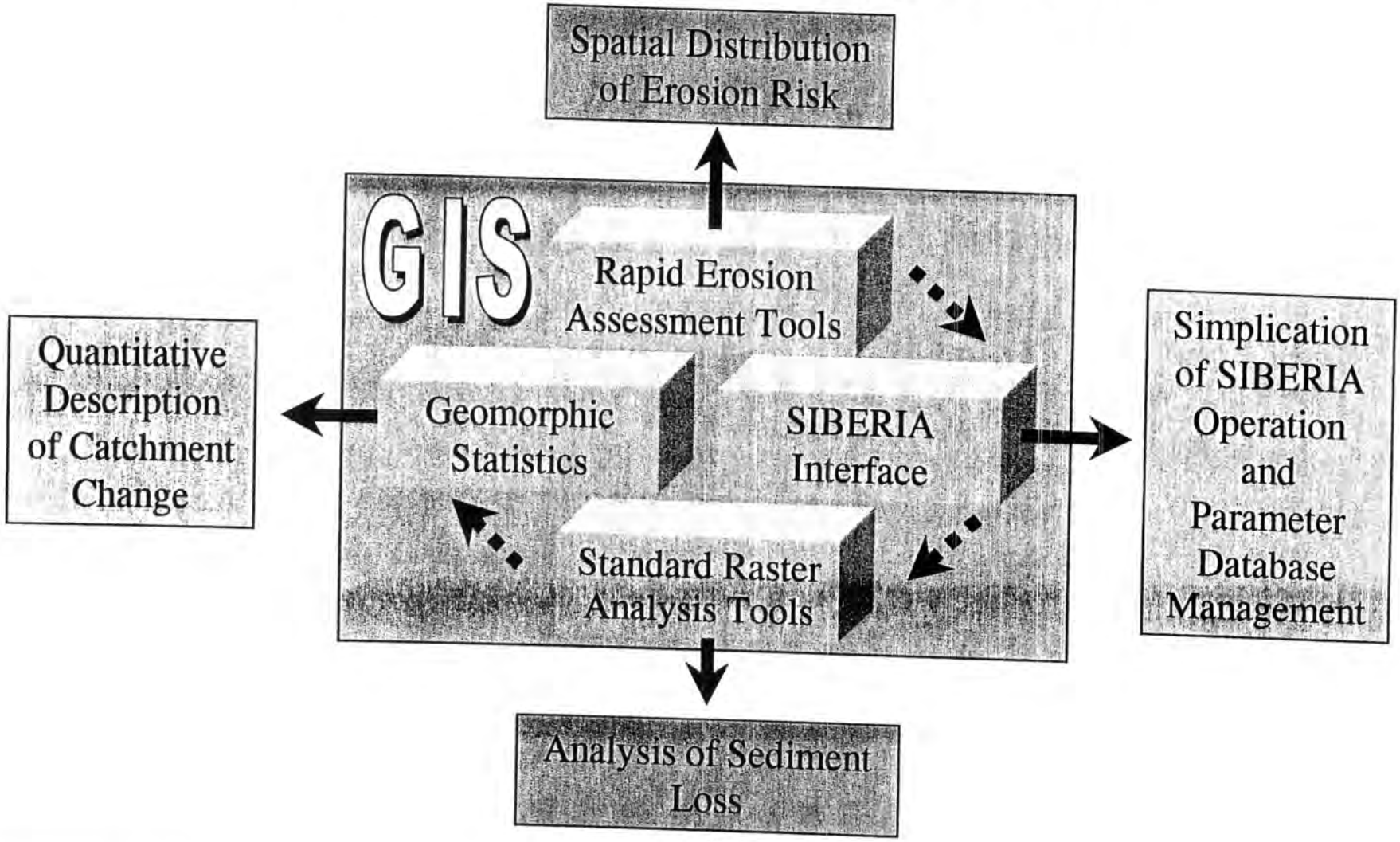
GIS-Based Approach



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Rapid Erosion Assessment; *Erosion Hazard Model*

- Initial step in modeling based geomorphological impact assessment
- Simplification of RUSLE where rainfall erosivity and support practice factors have been removed
- Considers soil erodibility, land cover, slope steepness and slope length

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Rapid Erosion Assessment; *Parameter Derivation*

- Uses widely available data to derive dimensionless values
- Land unit data provides soil erodibility and land cover information
- Slope angle and length derived from a DEM generated from AUSLIG's elevation and hydrography datasets

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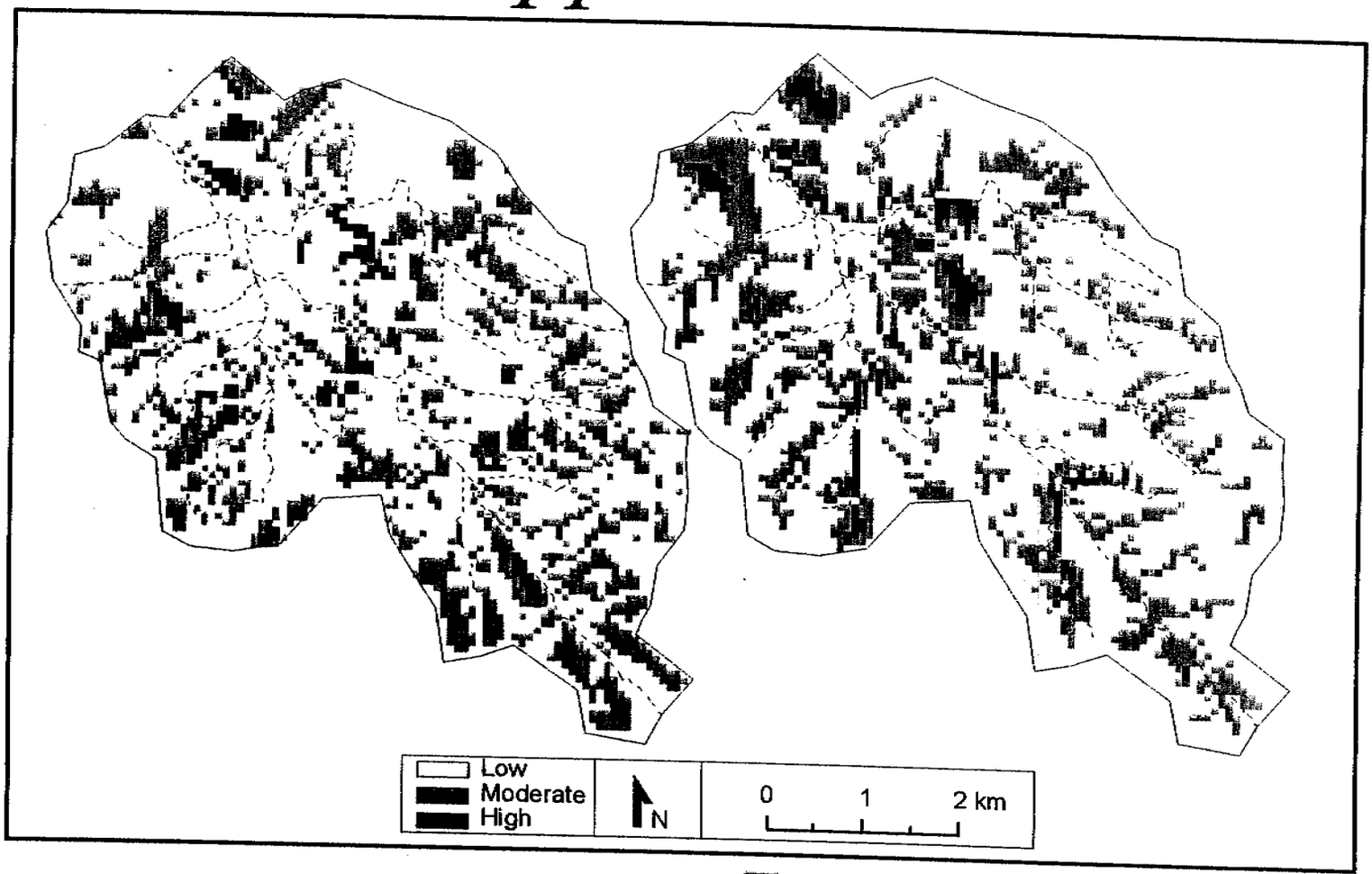
Rapid Erosion Assessment;

Application



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Rapid Erosion Assessment; *Application*

- Applied by multiplying input factor grids
- Erosion risk *'values'* classified based on distribution of output dataset into high/medium/low risk
- Both slope length methods correspond well with land unit data
- Accumulated flow slope length appears to provide more realistic distribution compared with field observations

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Modelling; *SIBERIA Landform Evolution Model*

- L.E.M takes a holistic, catchment based view and considers both hydrologic and geomorphic change
- SIBERIA is a complex model that operates on a DEM
- SIBERIA has been extensively validated and successfully applied to mine sites in the ARR

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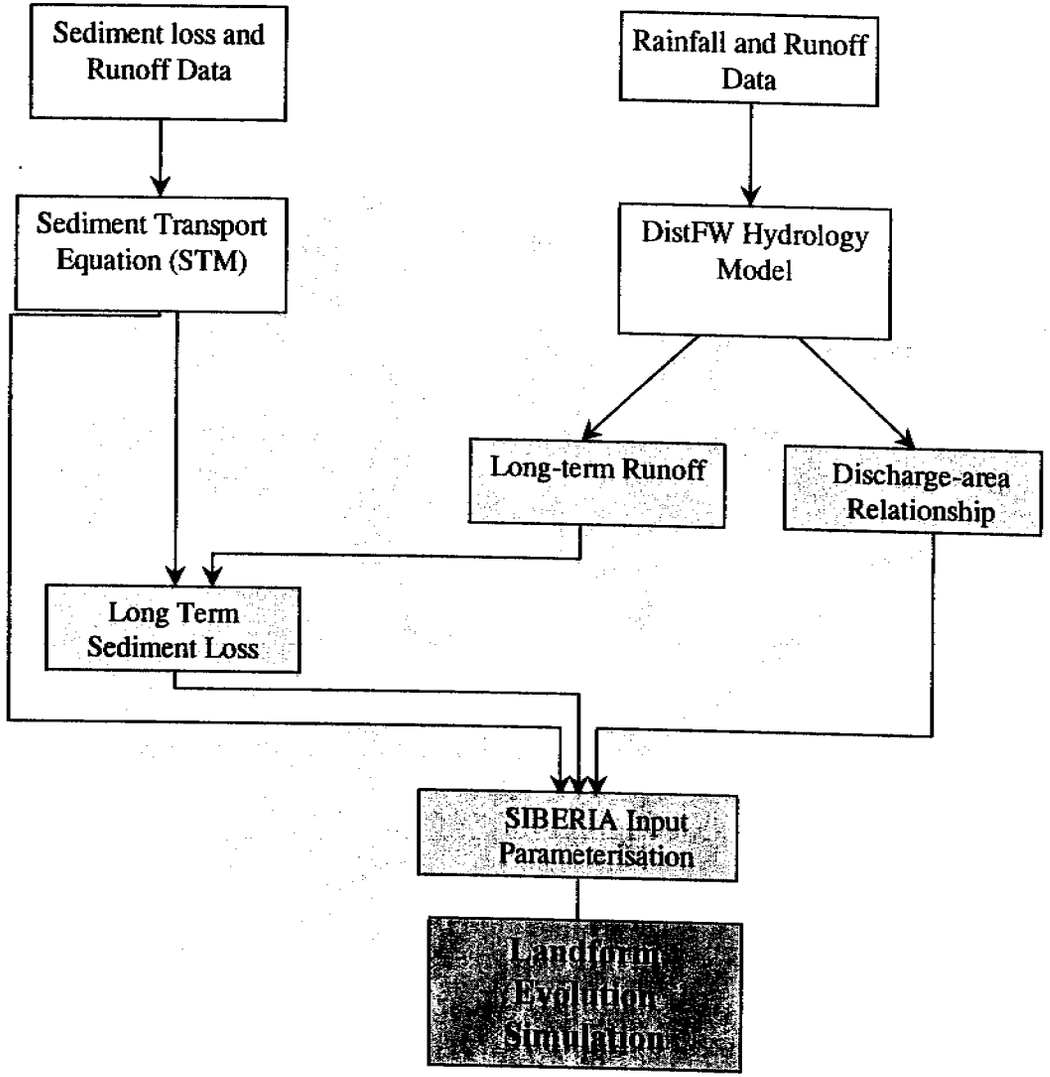
Parameter Derivation



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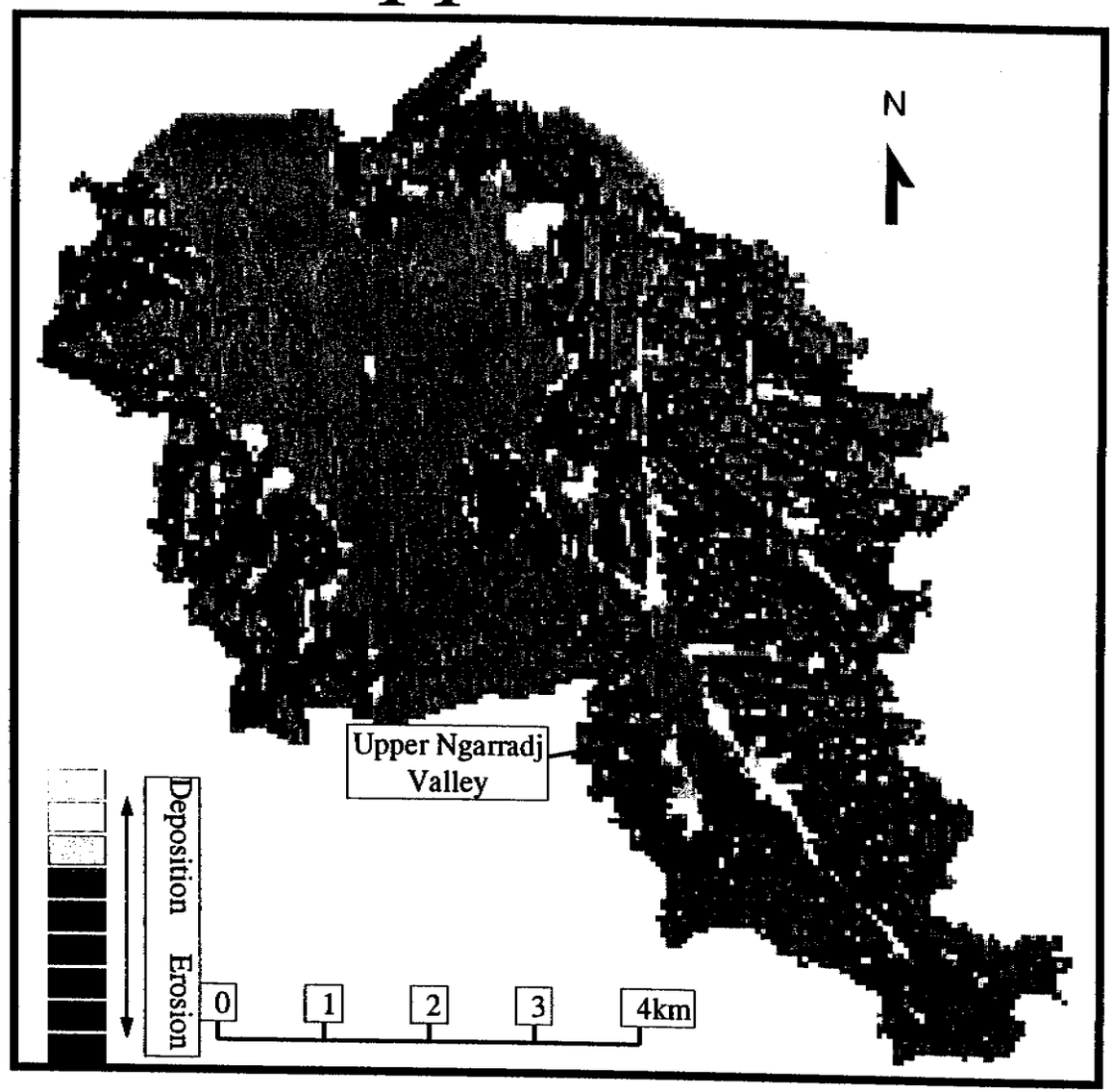
Landform Evolution Modelling

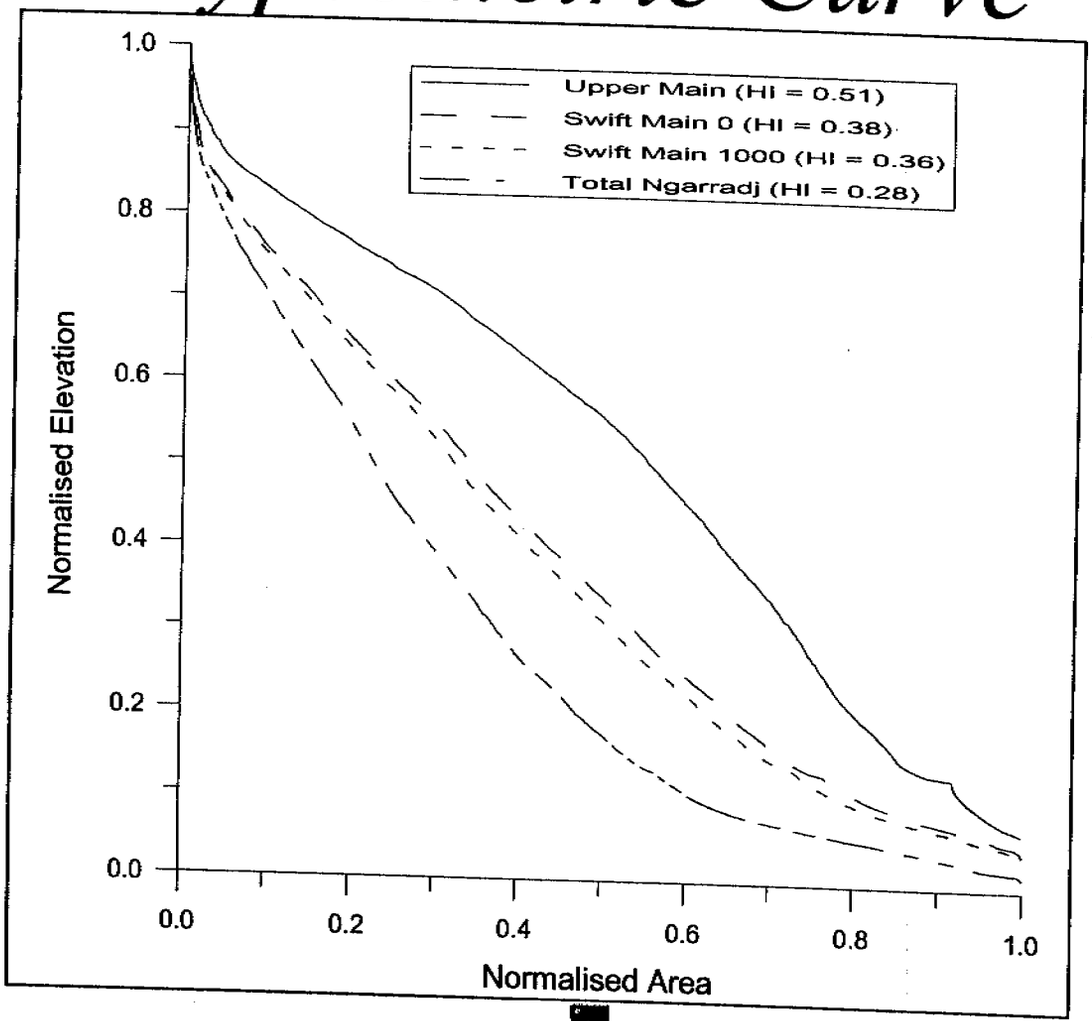
Application



Basin Analysis

- Geomorphic statistics provide a more quantitative means of assessing basin form
- Catchment change can be assessed by comparing the geomorphic statistics of modeled output
- Application of the statistics can occur at a variety of scales to assess small and large-scale impacts

Basin Analysis;
Hypsometric Curve



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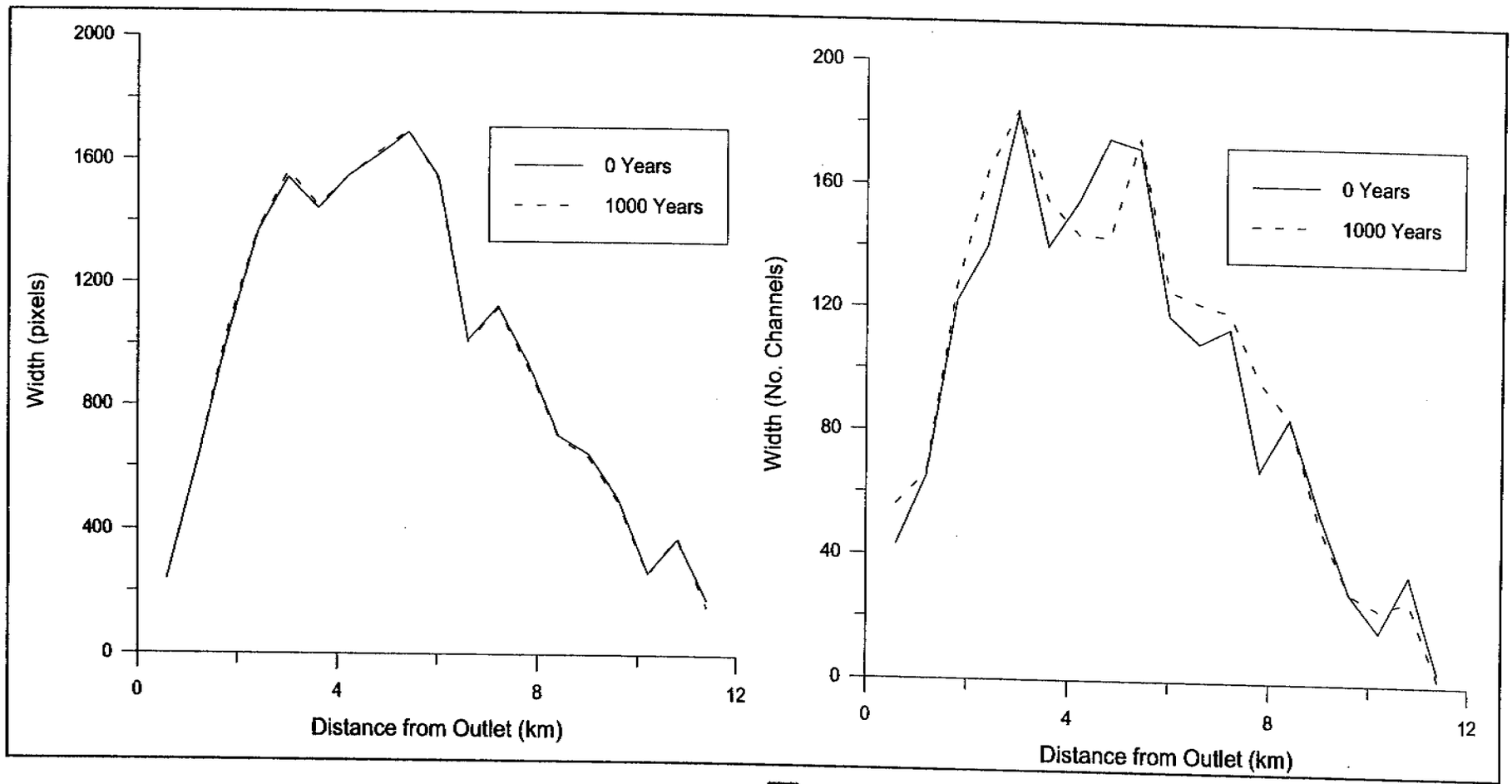
Basin Analysis;
Width Function



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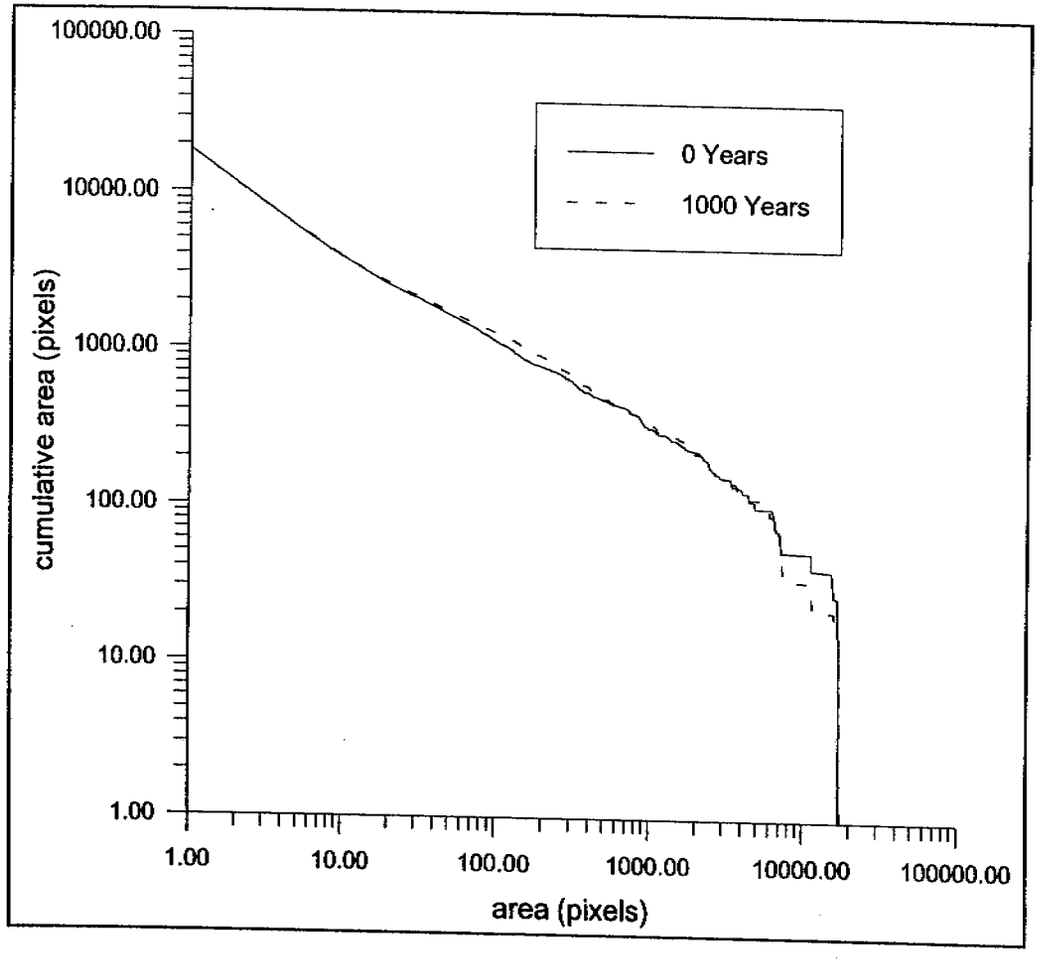
Basin Analysis;
Cumulative Area Diagram



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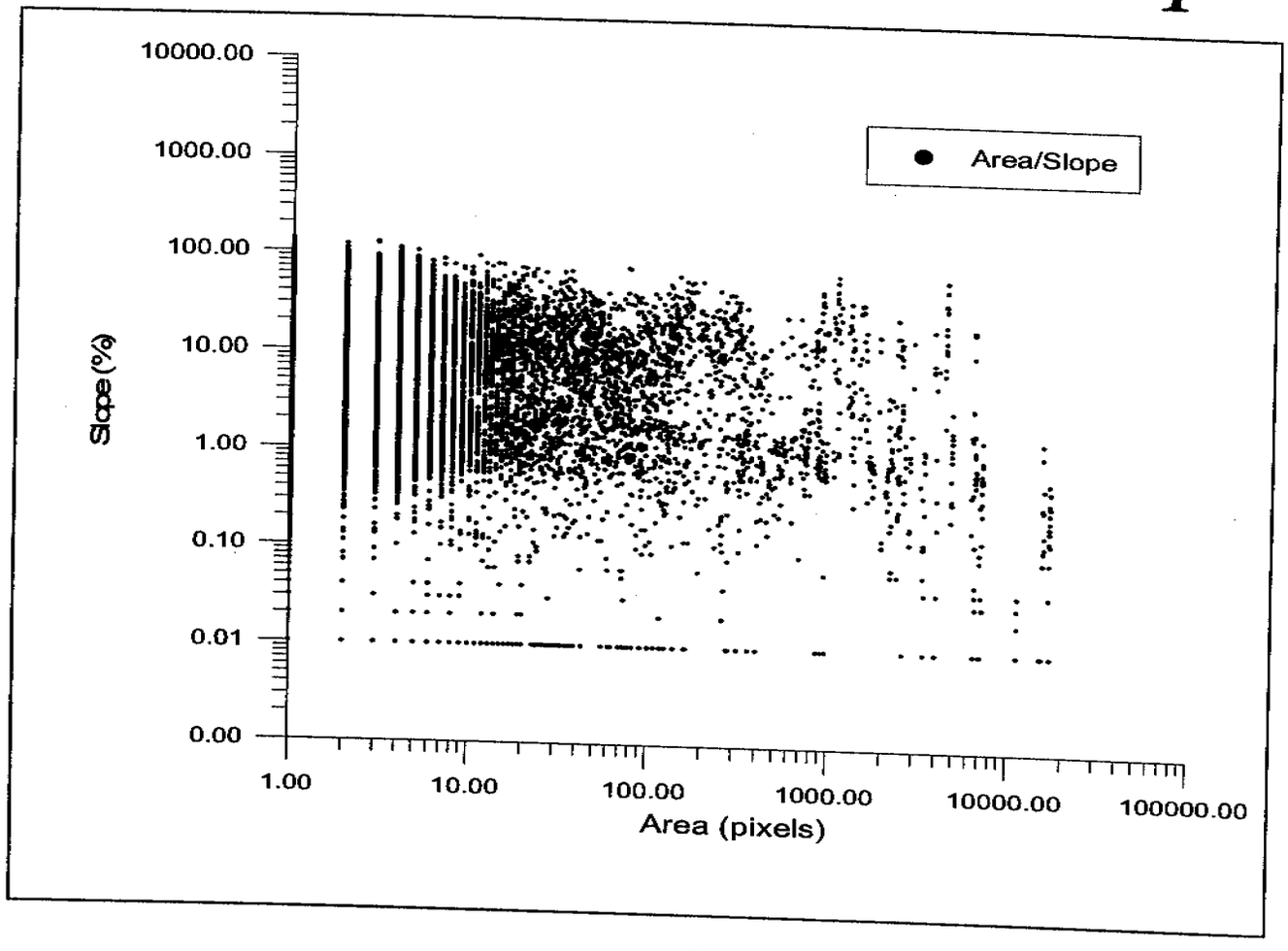
Basin Analysis;
Slope Area Relationship



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Conclusions

- A GIS-based approach to the assessment and management of mining impact on landform evolution has been developed
- The modelling techniques and analysis tools have been applied to an undisturbed version of the Ngarradj catchment
- Modelling the impact of Jabiluka will include spatially variable parameters and a modified DEM

5.0 Acknowledgements

- Thankyou to Dr Greg Hancock (University of Newcastle) for his advice on geomorphic statistics and landform evolution modelling. The assistance of Mr Dene Moliere, Mr Mike Saynor, Mr Bryan Smith and Mr Gary Fox (***eriss***) in the field and office is greatly appreciated. We are grateful to Dr Ann Bull for her advice on the ***eriss*** GIS.

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Question Time!

Remote Sensing Projects at *eriss* for the Assessment of Abandoned Uranium Mine sites.

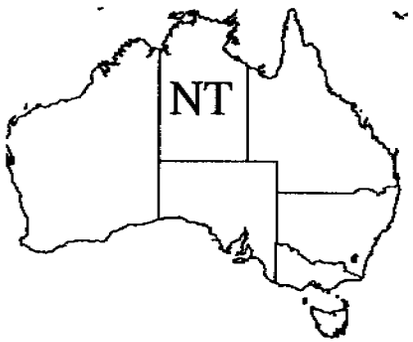
The aim of this research is to collect remotely sensed data to provide information on the state of abandoned uranium mine sites in the upper South Alligator River Valley, Kakadu National Park. Several small abandoned uranium mines exist in the upper South Alligator River valley as a result of mining and milling which occurred in the 1950s and 1960s, at a time when contemporary environmental legislation did not exist. When mining ceased in 1962, the sites were abandoned, with no attempt for environmental rehabilitation. These mines were subject to a hazard reduction program in the early 1990s and the need for further rehabilitation is the subject of negotiations between Parks Australia North and the Jawoyn traditional owners. In order to gain a synoptic view of the state of abandoned mine sites, remotely sensed data sets were captured over the valley. This paper provides an overview of the use of airborne gamma spectrometry and other remotely sensed data for the environmental radiological assessment of uranium mine sites.

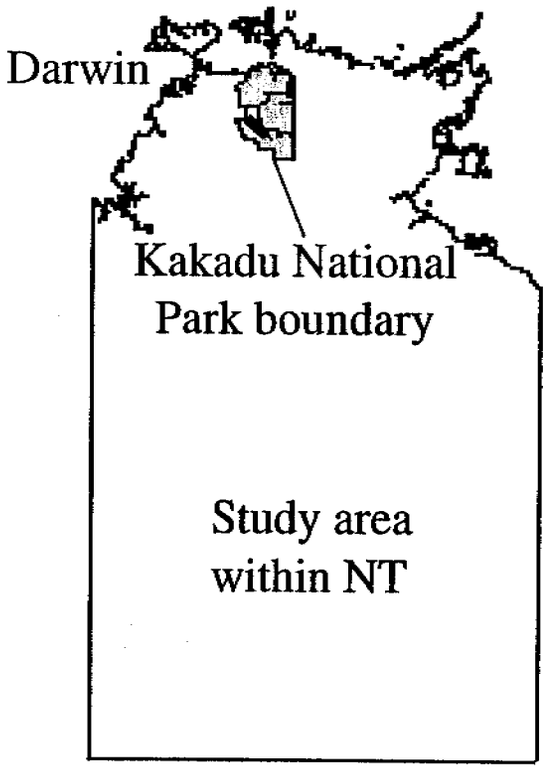
Remote Sensing Projects at *eriss* for the Assessment of Abandoned Uranium Mine sites.

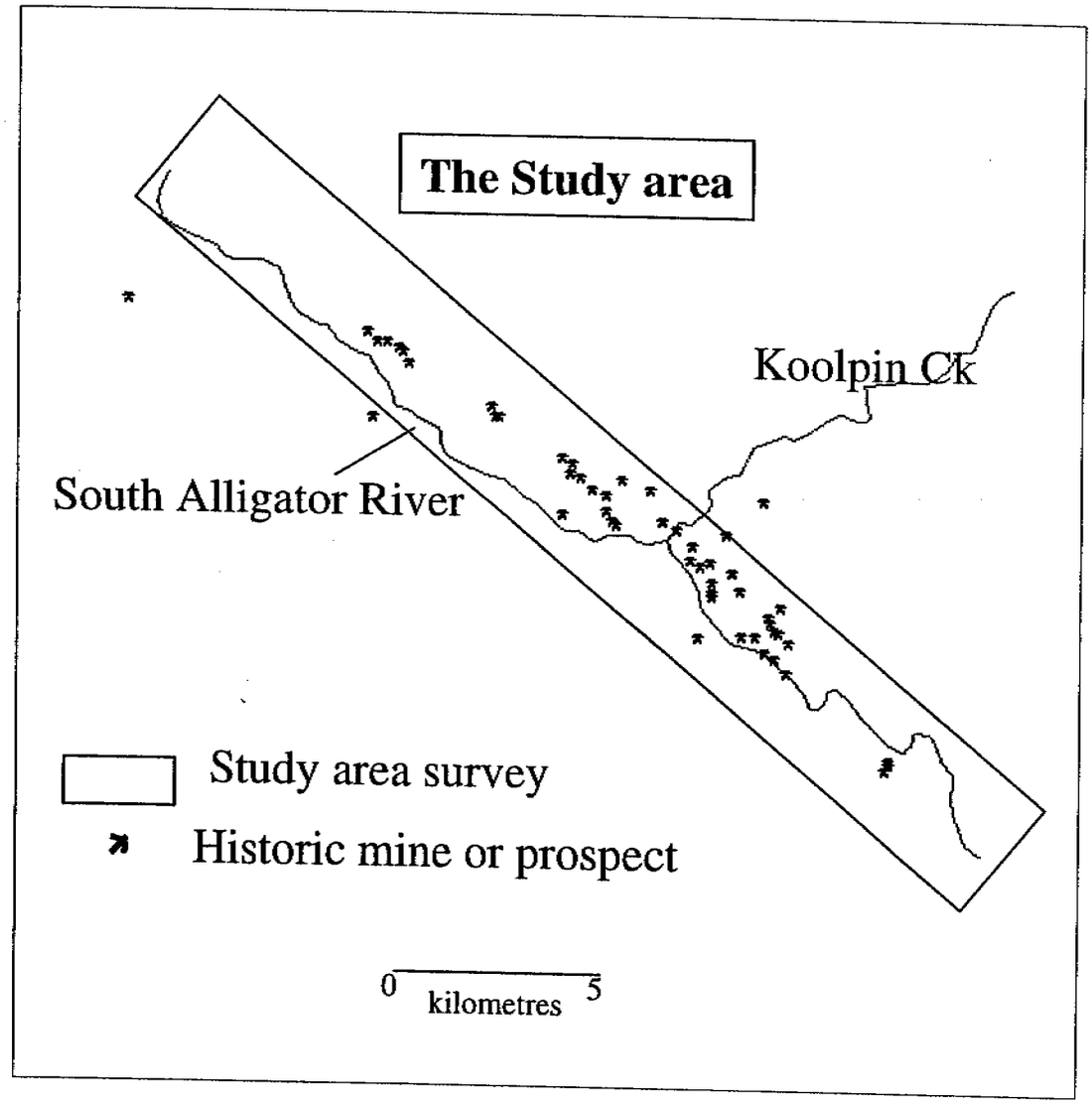
Kirrilly Pfitzner and Paul Martin

eriss = Environmental Research Institute of the Supervising Scientist

The South Alligator River Project - the location







The South Alligator River Project - the objectives

To provide remotely sensed data giving information on the state of abandoned mines in the upper South Alligator River valley

- To determine whether remotely sensed data can provide useful information to assess the state of abandoned uranium mines;

- To determine the suitability of an airborne gamma survey to assess any radiological impact in the valley;

- To provide a detailed radiological description of the sites in order to judge radiological risk; and,
- Provide spatially accurate and detailed locations of mine sites.

Remotely sensed data

- Airborne gamma Survey
- MASTER airborne multispectral data
- High spatial resolution CIR airborne digital photography (ADAR)

Airborne Gamma Survey (AGS)

AGS for uranium mine site rehabilitation assessment?

High resolution AGS flown

- 50-m line spacing
- 50 m s^{-1} nominal ground speed, count period of 1 s
- 50 l Exploranium Spectrometer

eU, eTh, K and Total Count Rates,
Elevation data and Magnetic Intensity

MASTER data

IR, R, G (RGB)

MNF bands 1, 5 and 6 (RGB)

ADAR Colour Infrared Imagery

summary

Processing and griding performed by UTS Geophysics

↓

Interpolation resulted in
12m pixels

↓

Basic statistics generated from the eU channel

↓

Contrast stretch of Rainbow Colour Table emphasised
higher counts

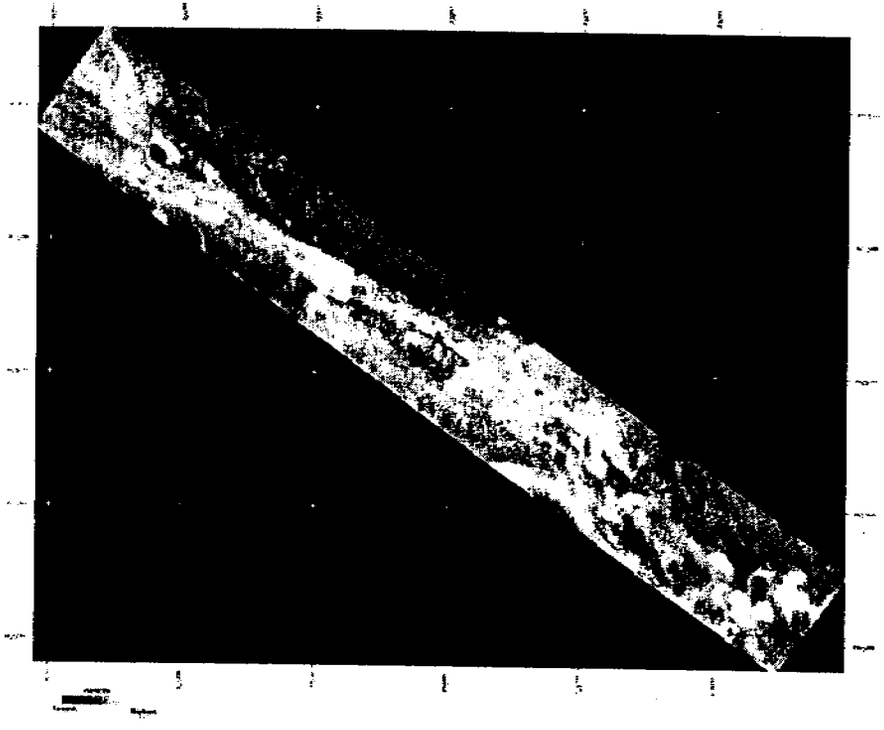
↓

GPS coordinates of known mine site locations used for correlation
with the eU channel

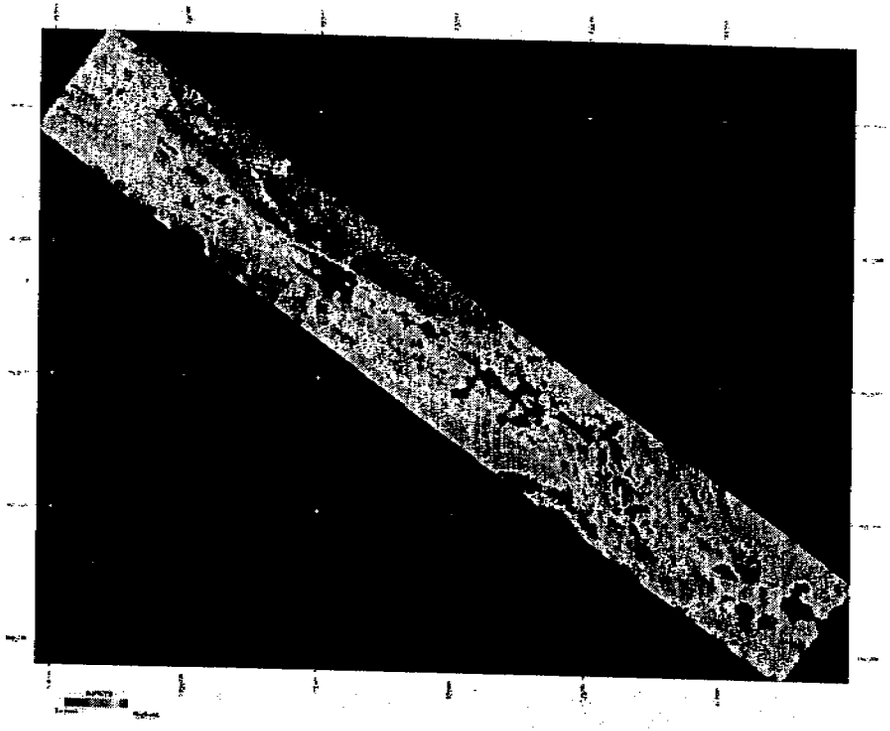
↓

Counts > 200 threshold into ranges of 150 s^{-1}

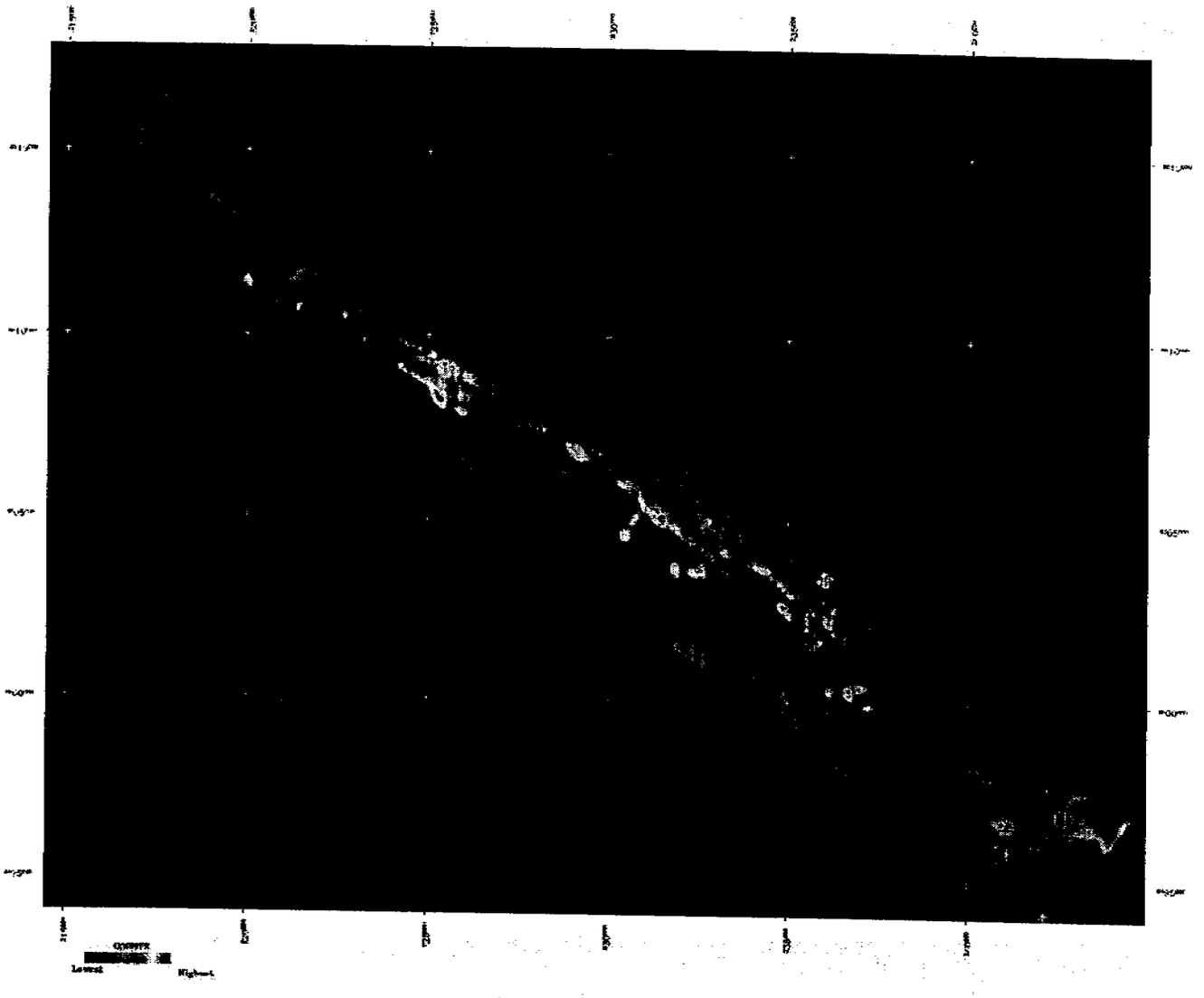
Preliminary Results

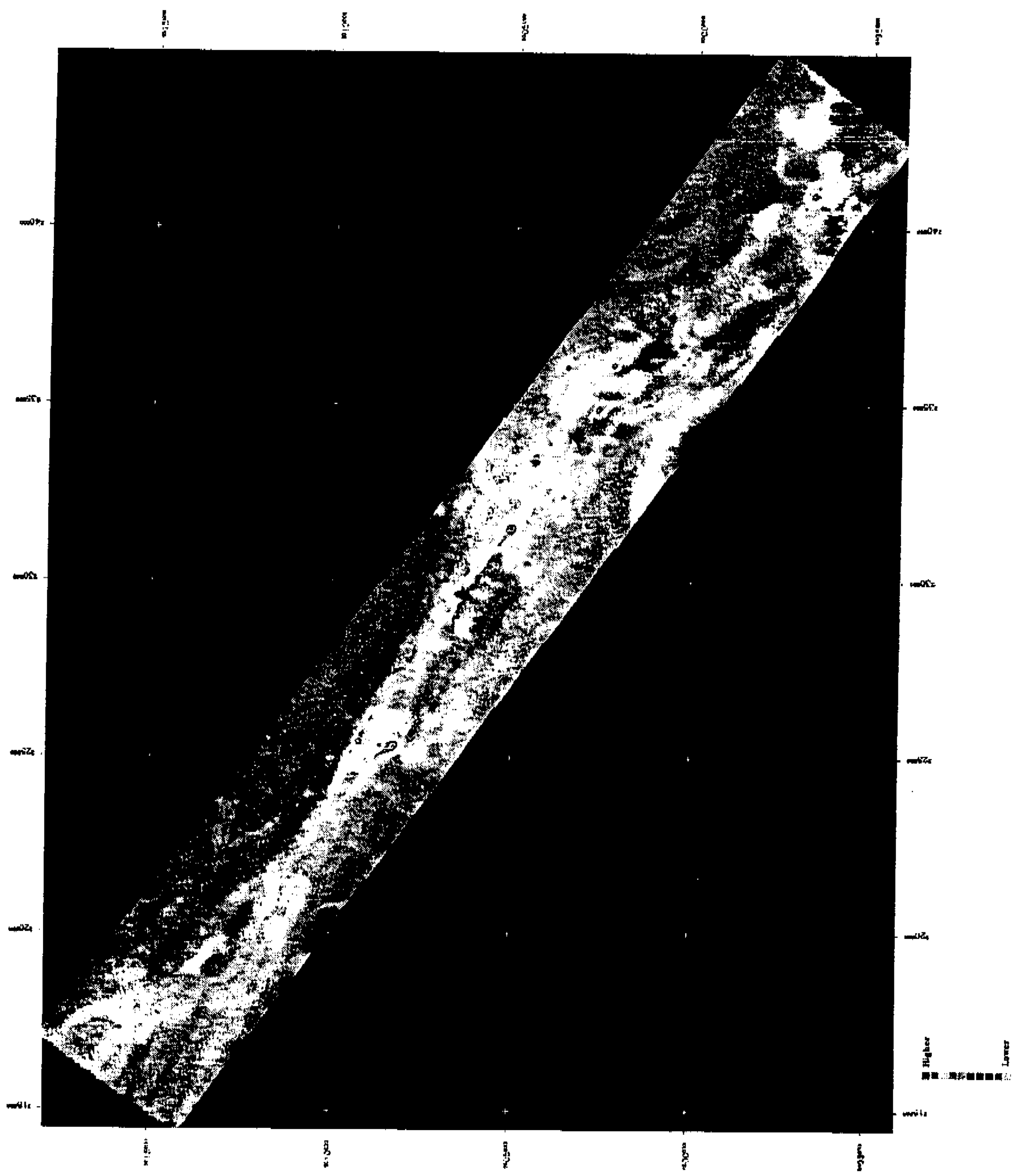


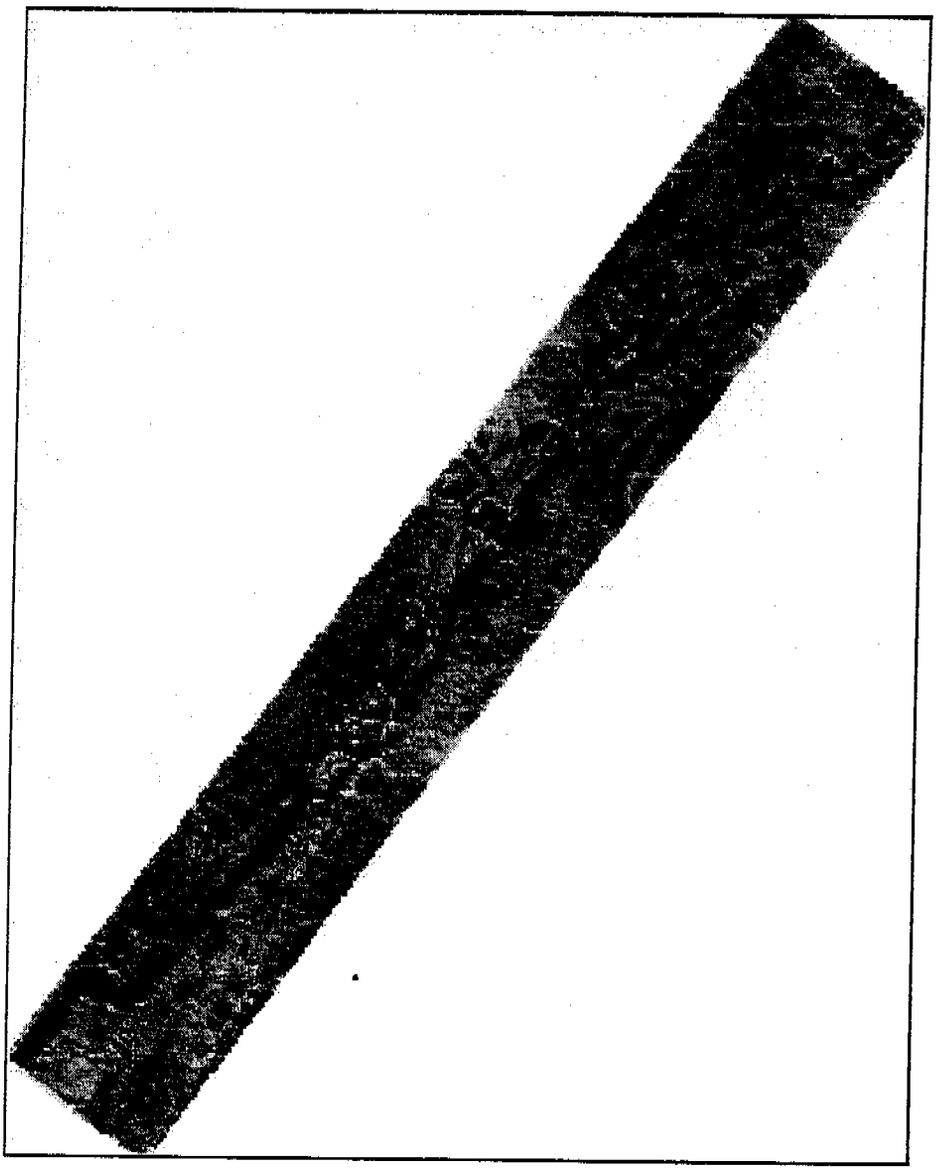
eU channel greyscale
white>grey>black



eU channel Rainbow Colour Table
red>green>blue




Higher
Lower



Conclusion

The AGS results will need to be field verified and until such field work is performed, limitations of the AGS should be noted. Ground-based investigations will continue in July 2001.

Future Work:
Processing and analysis of multispectral MASTER data
Analysis of eU, eTh, K and Total Count rates to provid information for geomorphological studies

Based on the findings of the remotely sensed AGS and field investigations so far, the use of high resolution airborne gamma data, particularly the eU channel, has proven useful in highlighting the nature of historic mine areas within the valley and directing field analysis.

Acknowledgment:
Parks Australia North (PAN) and eriss jointly funded the airborne gamma survey