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# USING RADARSAT IMAGERY TO ASSESS RESIDUAL ENVIRONMENTAL EFFECTS OF THE VIET NAM WAR (1961 - 1975)

**PWGSC FILE NO. 9F005-5-0930/01-SW**

**PHASE IIb REPORT**

**Volume 2:**
**FOLIO OF IMAGERY**

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**FEBRUARY 1998**

## LIST OF PLATES

## Plate 1 Quang Tri Province and Former DMZ, Central Viet Nam

*Sensor / Mode:* *Radarsat-1 SAR, Standard Mode 7*
*Acquisition Date:* *13 January 1997*
*Scale:* *1:250,000 (area coverage: 60 km x 42 km)*
*Nominal resolution:* *28 m; original pixel spacing 12.5 m*

### Annotation and Feature Detection

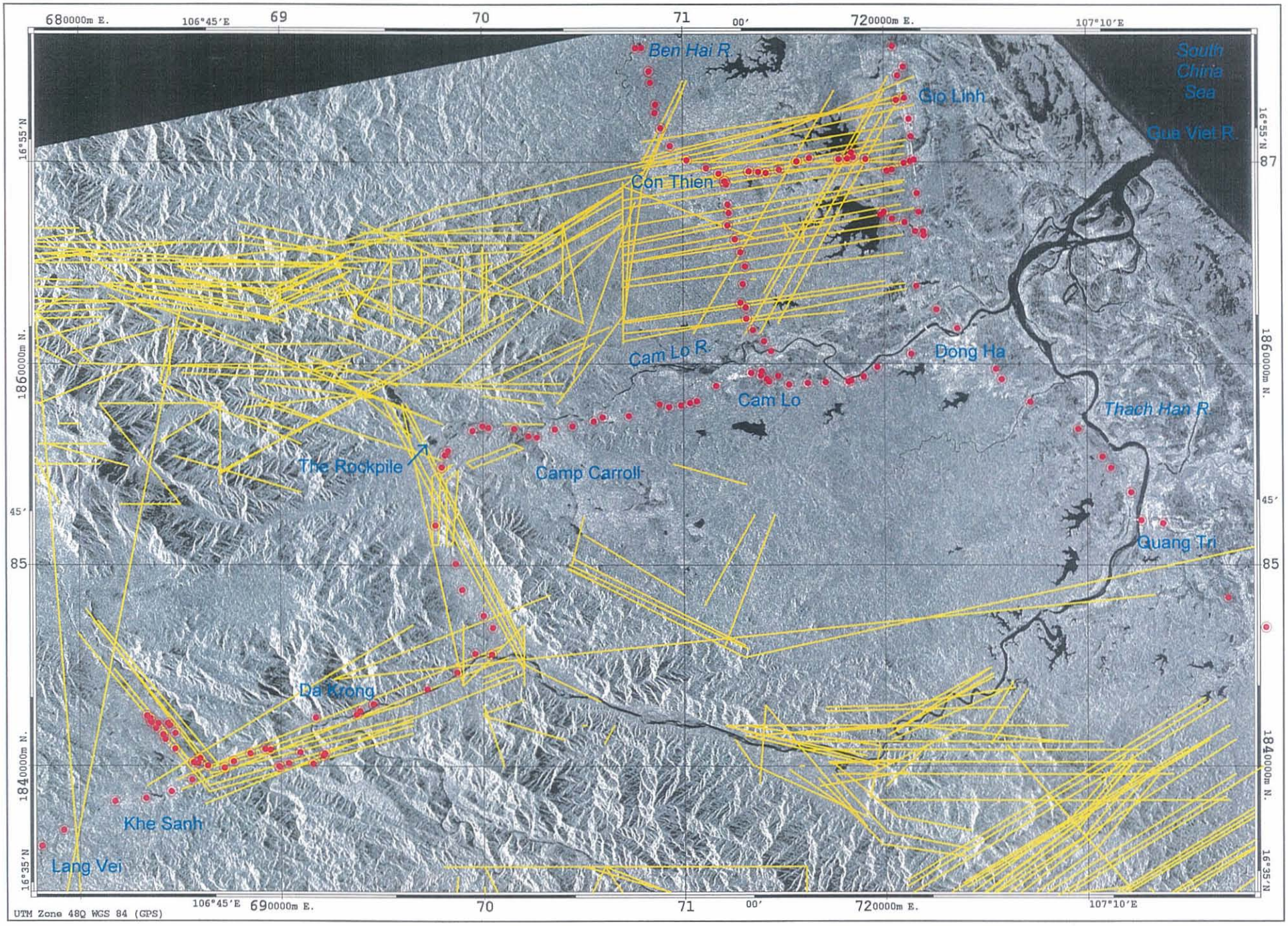
For a full description of image and annotation points, see Section 3.1.1 of the report.

**Map Legend**

- Aerial herbicide applications (1965 to 1971)
- GPS waypoints (November/December 1997)

Comparing RADARSAT data with land-use maps near Dong Ha.

Near the Rockpile, former US artillery position, Highway 9, between Dong Ha and Khe Sanh.




Overview, Quang Tri Province and former DMZ, Central Viet Nam

RADARSAT STANDARD MODE (S7), 13-January-1997

1:250 000 Scale

Kilometres 10 0 10

Miles 10 0 10

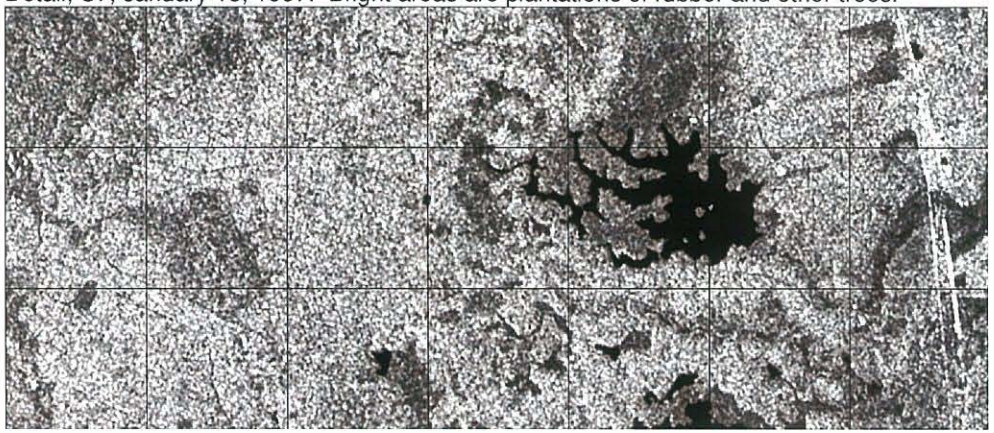
## Plate 2 Dong Ha/Con Thien, Central Viet Nam

*Sensor / Mode:* *Radarsat-1 SAR, Standard Mode 7 (both dates)*
*Dates:* *13 January 1997 / 21 November 1997*
*Scale:* *1:100,000 (area coverage: 24 km x 17 km)*
*Nominal resolution:* *28 m*

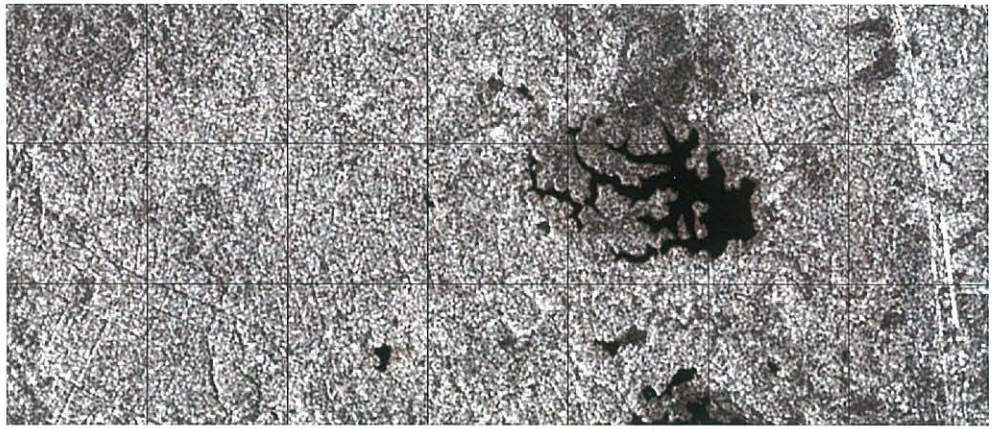
### Annotation and Feature Detection

For a full description of image and annotation points, see Section 3.1.1 of the report.

Detail, S7, January 13, 1997. Bright areas are plantations of rubber and other trees.

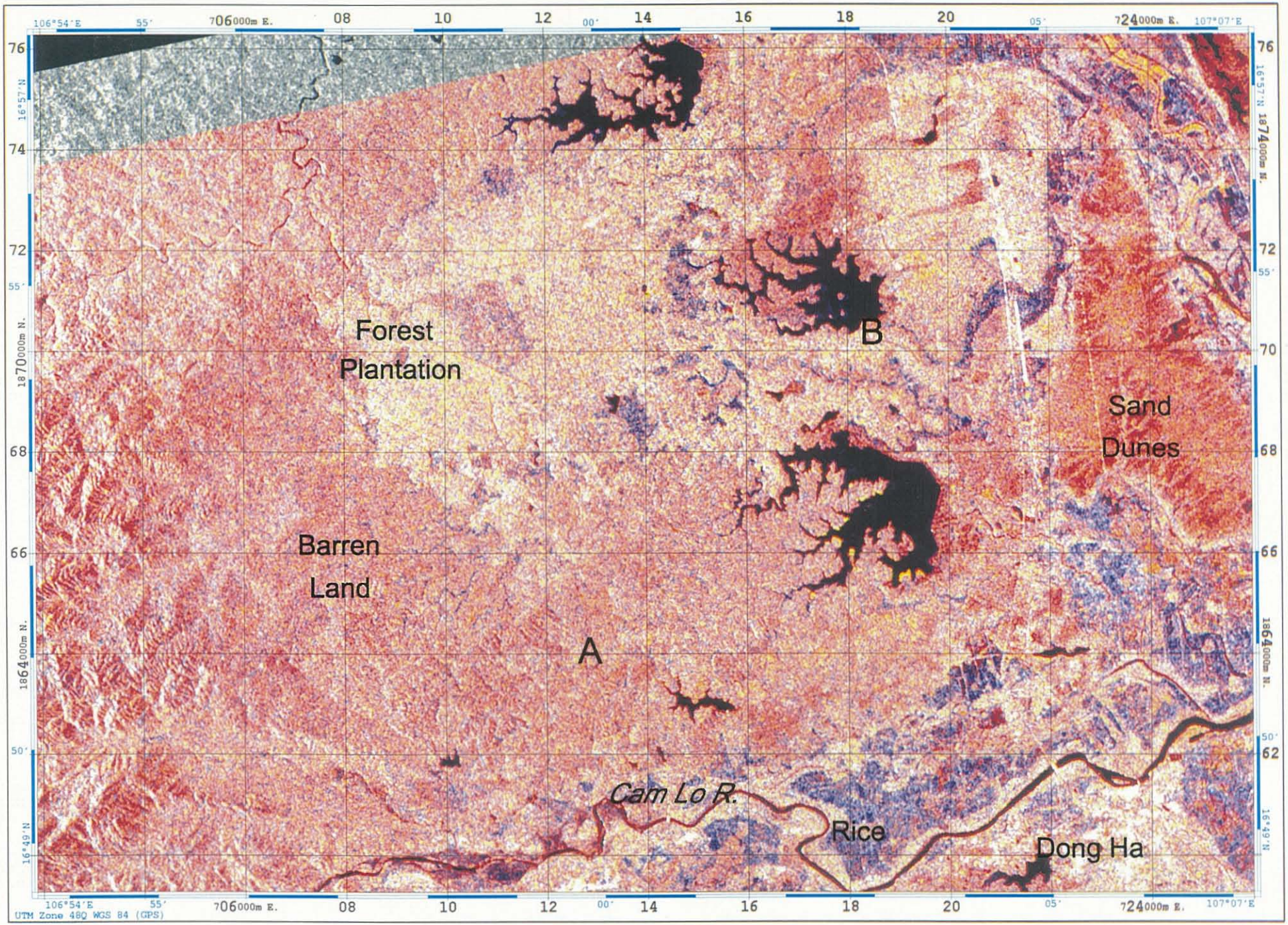


Detail, S7, November 21, 1997. Roads within and between rubber plantations visible (lower-left).



Barren land northeast of Dong Ha (centre-left in scene)

Low grasslands at edge or reservoir shown at left




Dong Ha, Central Viet Nam

RADARSAT STANDARD MODE S7a/S7b-S7a-S7b Composite, 13-1-97 (S7a) and 21-11-97 (S7b)

1:100 000 Scale

Kilometres 1 0 1 2 3 4 5 6 7

Miles 1 0 1 2 3 4 5

## Plate 3 Khe Sanh/Lang Vei, Central Viet Nam

*Sensor / Mode:* *Radarsat-1 SAR, Standard Mode 7 (both dates)*
*Dates:* *13 January 1997 / 21 November 1997*
*Scale:* *1:100,000 (area coverage: 24 km x 17 km)*
*Nominal resolution:* *28 m*

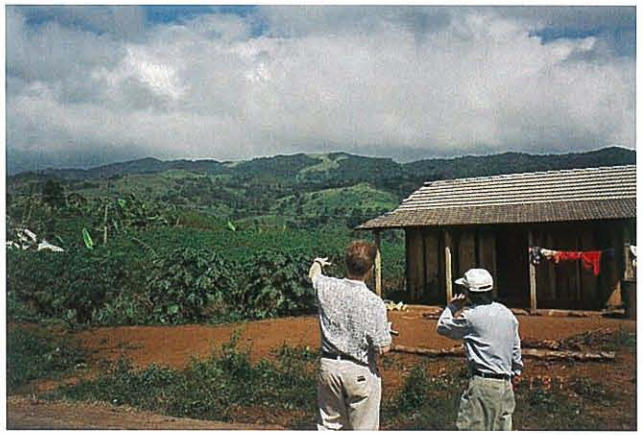
### Annotation and Feature Detection

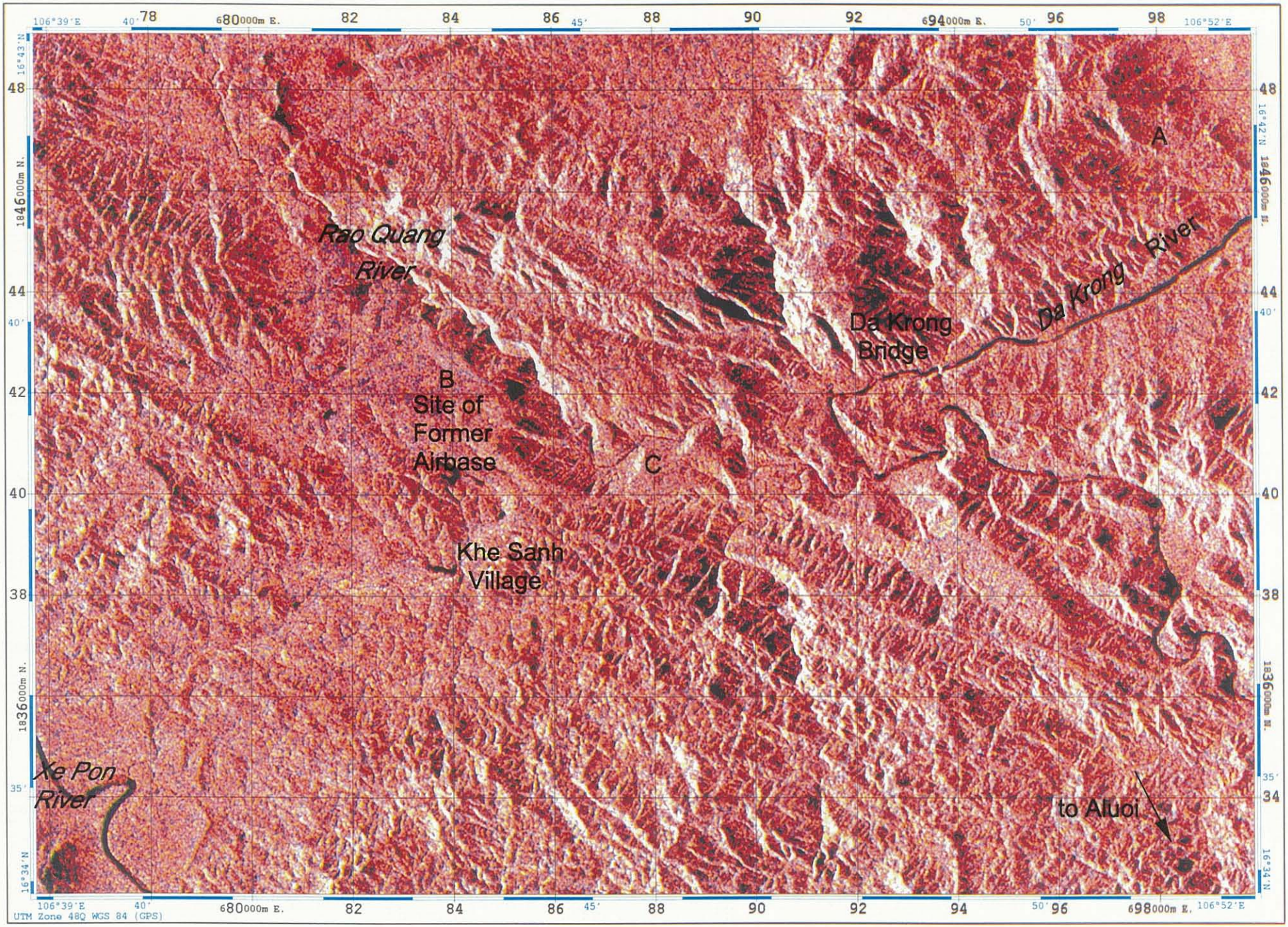
For a full description of image and annotation points, see Section 3.1.1 of the report.

Bare, uncultivated land on the road to Khe Sanh.

Site of former U.S. runway and airbase, Khe Sanh.

Mixed crop cultivation and bare hills, betweeen Da Krong and Khe Sanh






Khe Sanh, Central Viet Nam

RADARSAT S7a/S7b-S7a-S7b Composite, 13-1-97 (S7a) and 21-11-97 (S7b)

1:100 000 Scale

Kilometres 1 0 1 2 3 4 5 6 7

Miles 1 0 1 2 3 4 5

## Plate 4 Overview, A Luoi Valley, Central Viet Nam

*Sensor / Mode:* *Radarsat-1 SAR, Standard Mode 7*
*Date:* *13 January 1997*
*Scale:* *1:250,000 (area coverage: 46 km x 60 km)*
*Nominal resolution:* *28 m*

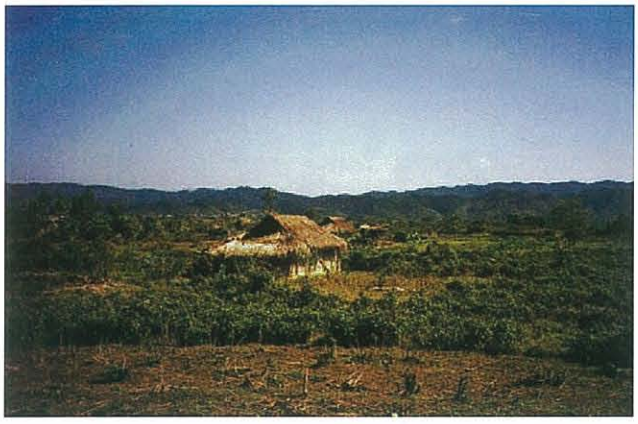
### Annotation and Feature Detection

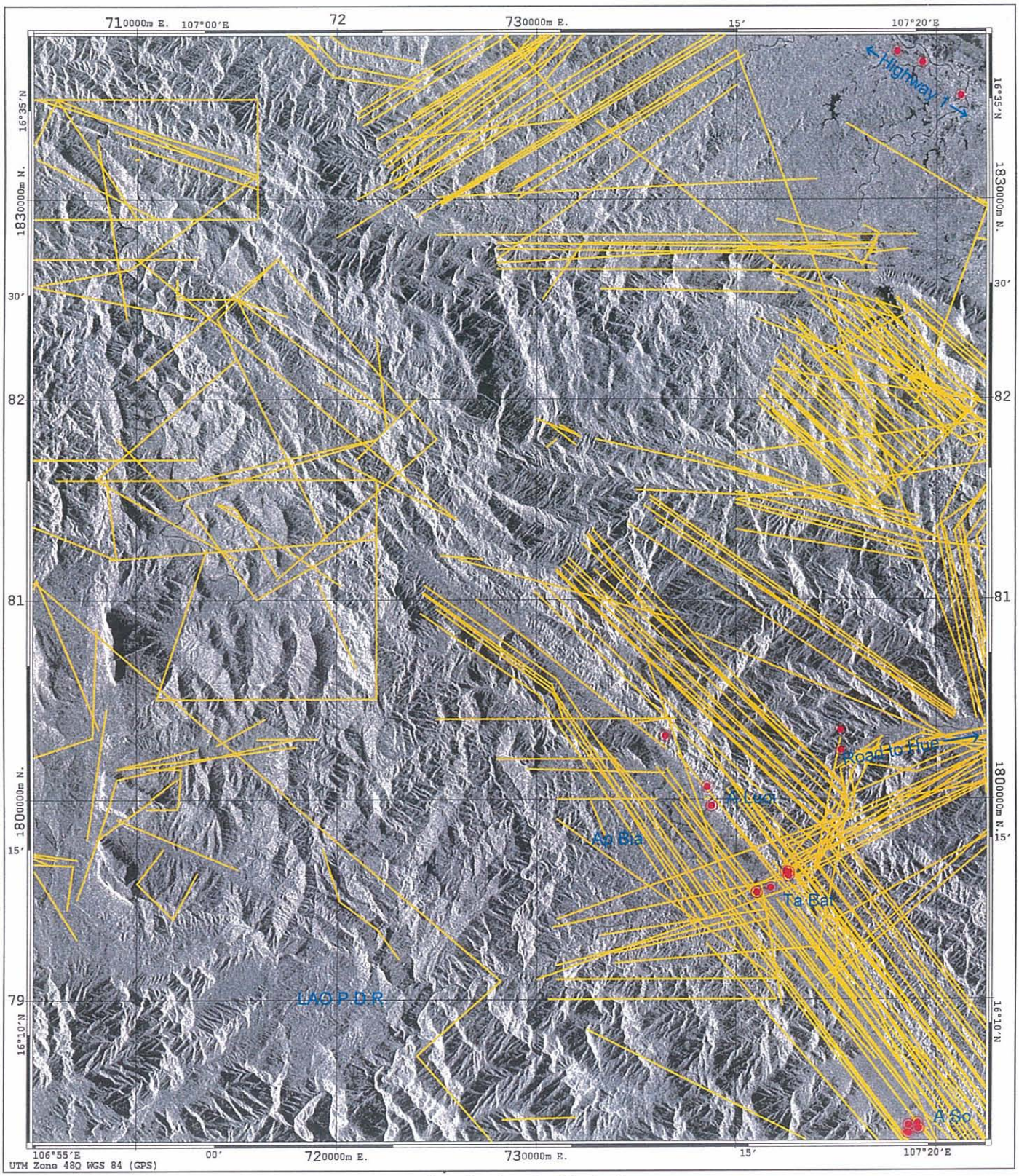
For a full description of image and annotation points, see Section 3.1.2 of the report.

**Map Legend**

- Aerial herbicide applications (1965 to 1971)
- GPS waypoints (November/December 1997)

The A Luoi valley was heavily sprayed with herbicides during the war, due to its strategic position on the Ho Chi Minh Trail. This area is very remote from the rest of Viet Nam, and people live in extreme poverty.






A Luoi, Central Viet Nam

RADARSAT STANDARD MODE (S7), 13-January-1997

1:250 000 Scale

Kilometres 10 0 10

Miles 10 0 10

## Plate 5 A Luoi Valley, Central Viet Nam

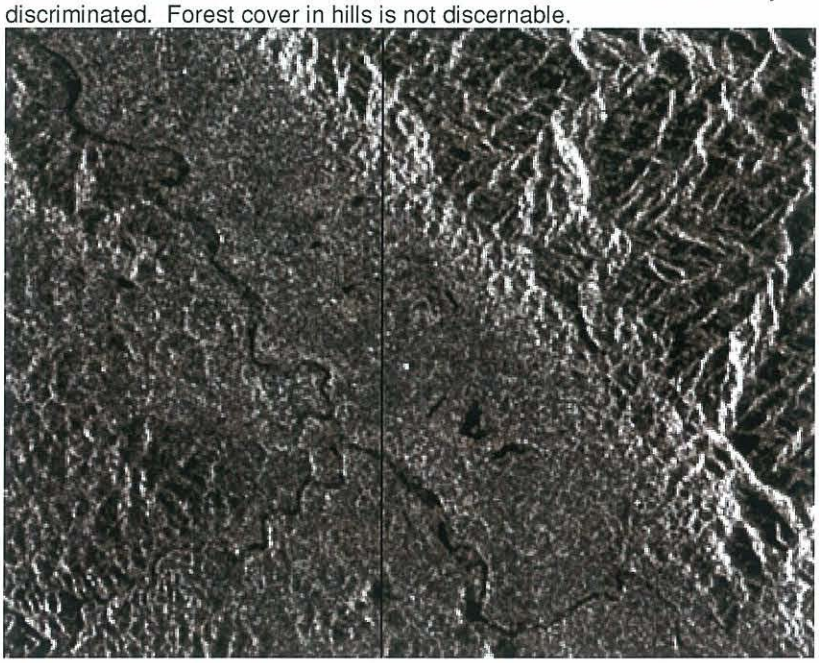
*Sensor / Mode:* *Radarsat-1 SAR, Standard Mode 7 (both dates)*
*Dates:* *13 January 1997 / 21 November 1997*
*Scale:* *1:250,000 (area coverage: 60 km x 46 km)*
*Nominal resolution:* *28 m*

### Annotation and Feature Detection

For a full description of image and annotation points, see Section 3.1.2 of the report.

Detail, S7, January 13, 1997. Areas of rice cultivation appear dark. Forest cover in hills is not discernable.

Detail, S7, November 21, 1997. Areas of rice cultivation cannot be easily discriminated. Forest cover in hills is not discernable.




# A Luoi, Central Viet Nam

**RADARSAT S7b/S7a-S7b-S7a Composite, 13-1-97 (S7a) and 21-11-97 (S7b)**

1:250 000 Scale

Kilometres 10 0 10

Miles 10 0 10

## Plate 6 Detail, Northern A Luoi Valley, Central Viet Nam

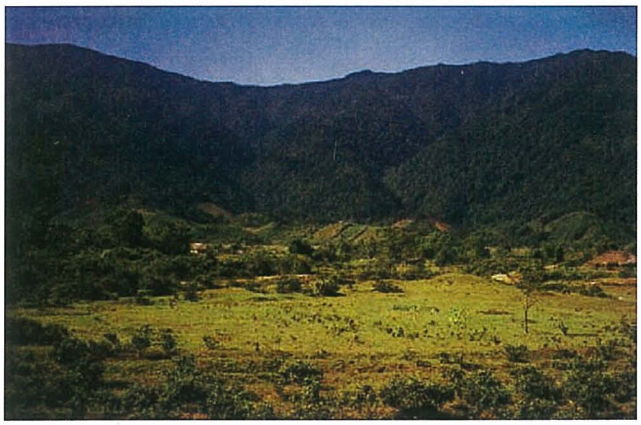
*Sensor / Mode:* *Radarsat-1, Fine Mode (F3)*
*Date:* *5 August 1996*
*Scale:* *1:50,000 (area coverage: 9 km x 9 km)*
*Nominal resolution:* *8 m*

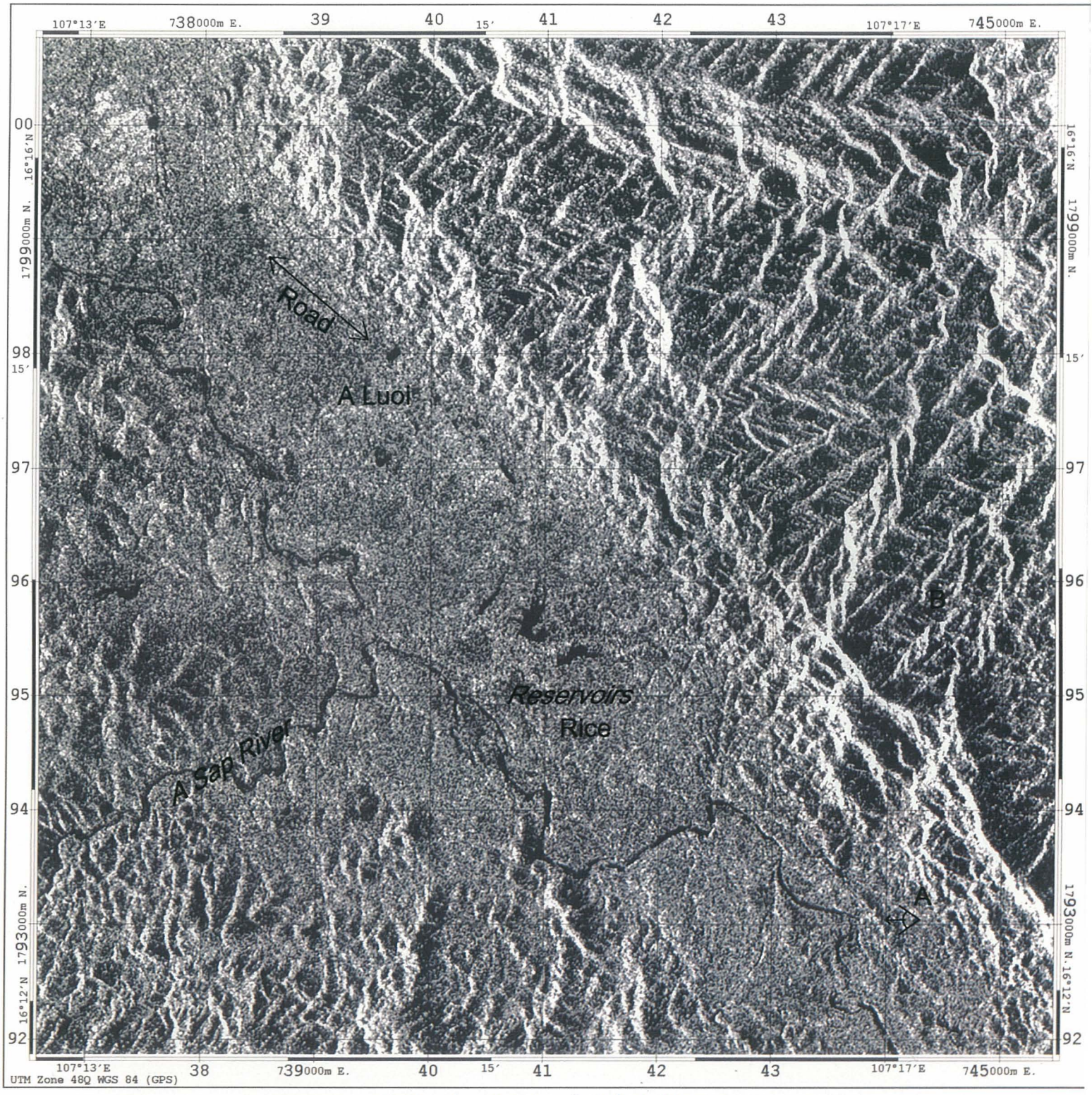
### Annotation and Feature Detection

For a full description of image and annotation points, see Section 3.1.2 of the report.

Detail, Standard mode (S7), January 13, 1997. The Fine mode F3 scene, right, shows drainage patterns and linear features (e.g., roads) more effectively than the standard mode scene below.

Mountains demarcating the western edge of the A Luoi valley and the border with the Lao PDR (below left), and a barren hillside in a herbicide-sprayed area east of A Luoi (below right). Neither RADARSAT standard mode nor fine mode was effective at showing differences in land cover in steep terrain.






# A Luoi, Central Viet Nam

RADARSAT FINE MODE (F3), 5-August-1996

1:50 000 Scale

Kilometres 1 0 1 2 3 4

Miles 1 0 1 2

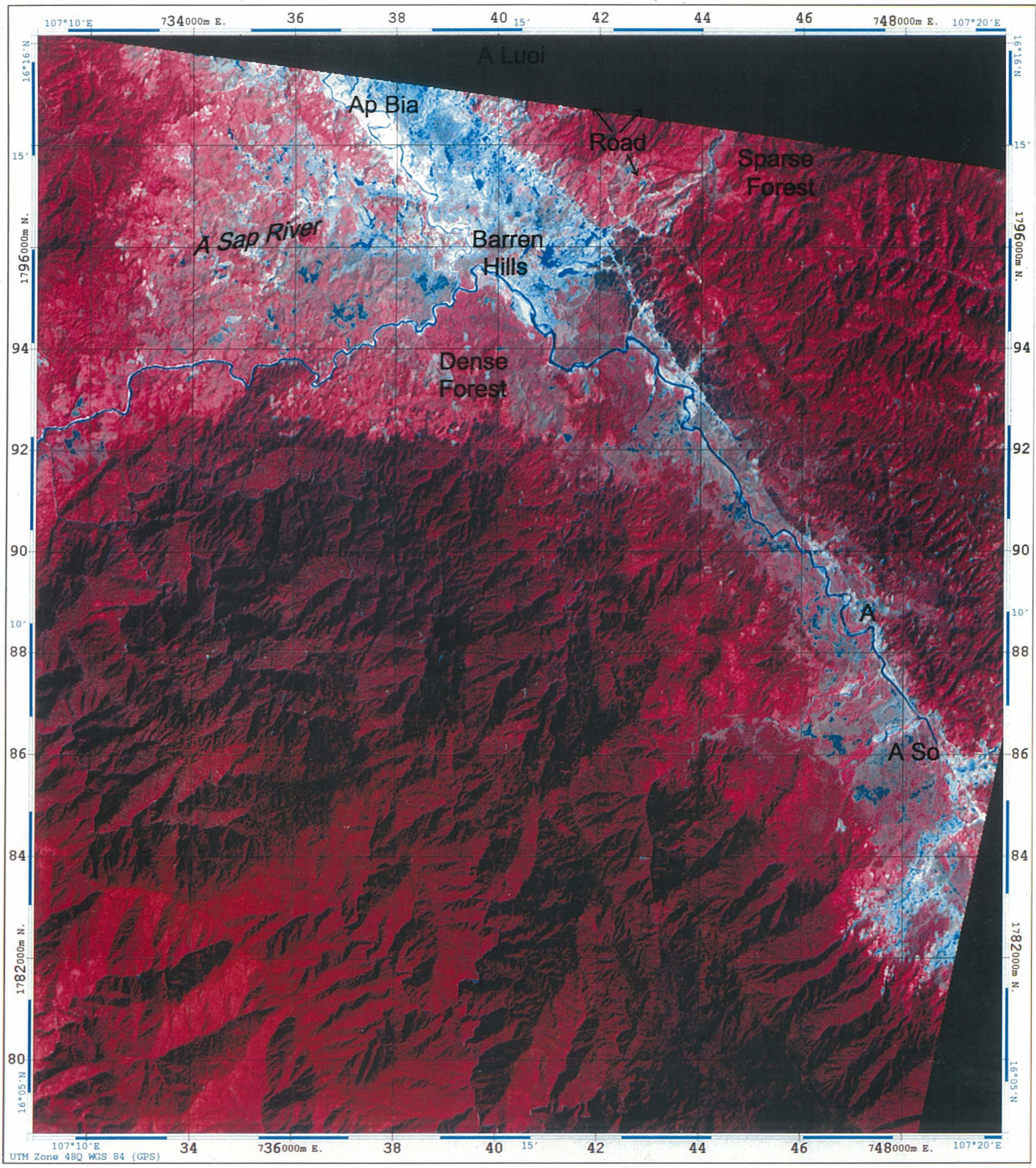
## Plate 7 A Luoi Valley, Central Viet Nam

*Sensor / Mode:* *SPOT - XS*
*Date:* *3 May 1996*
*Scale:* *1:100,000 (area coverage: 19 km x 21 km)*
*Nominal resolution:* *20 m (SPOT)*

### Annotation and Feature Detection

For a full description of image and annotation points, see Section 3.1.2 of the report.

Barren hillsides near A So village, southern A Luoi valley. This photograph was taken in January 1996; in November 1997, the sparse banana plantation in the foreground had become much more dense.




# A Luoi, Central Viet Nam

SPOT XS 3-2-1 False Colour Composite, 5-March-1996

1:100 000 Scale

Kilometres 1 0 1 2 3 4 5 6 7

Miles 1 0 1 2 3 4 5

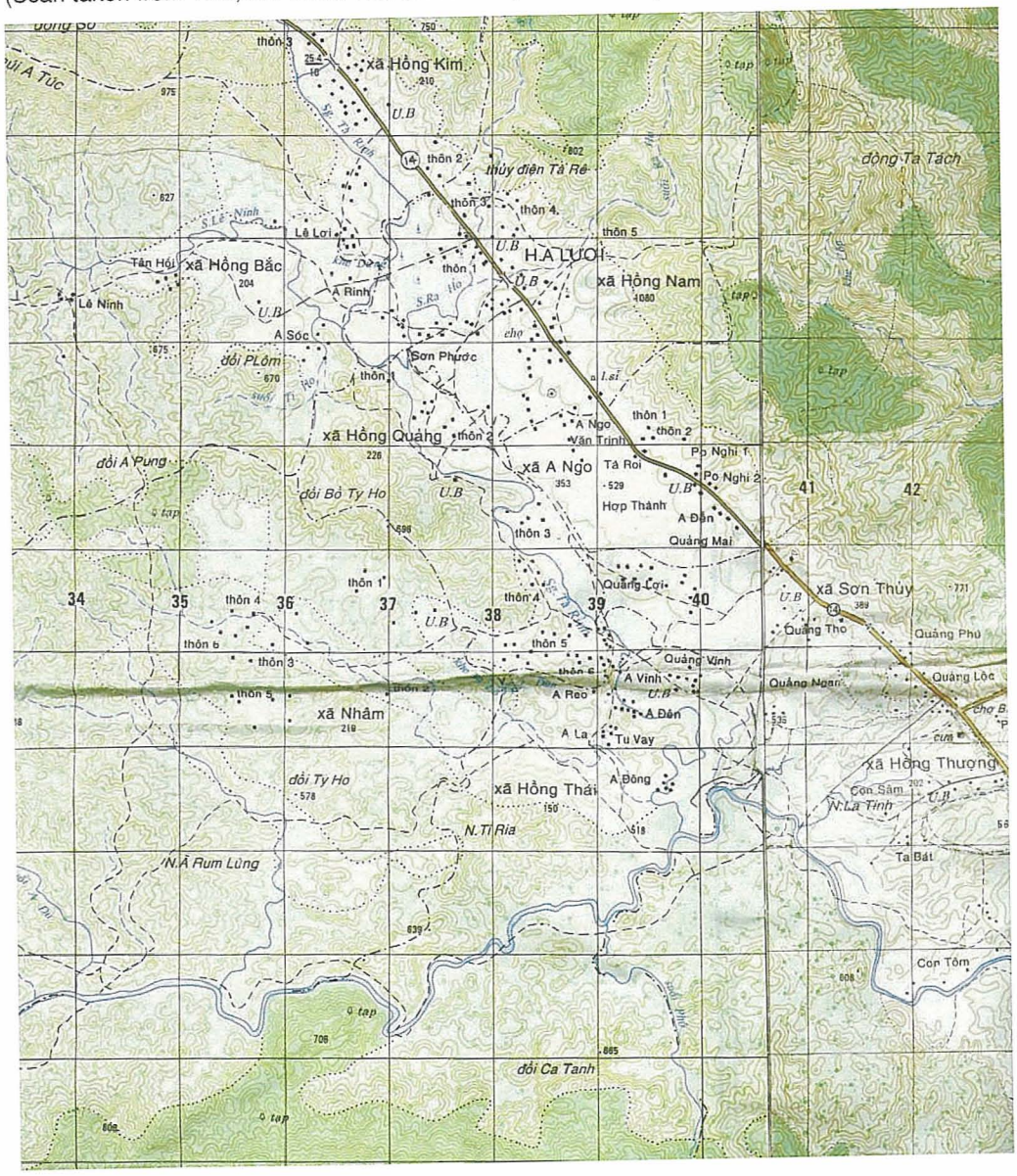
## Plate 8 Detail, Northern A Luoi Valley

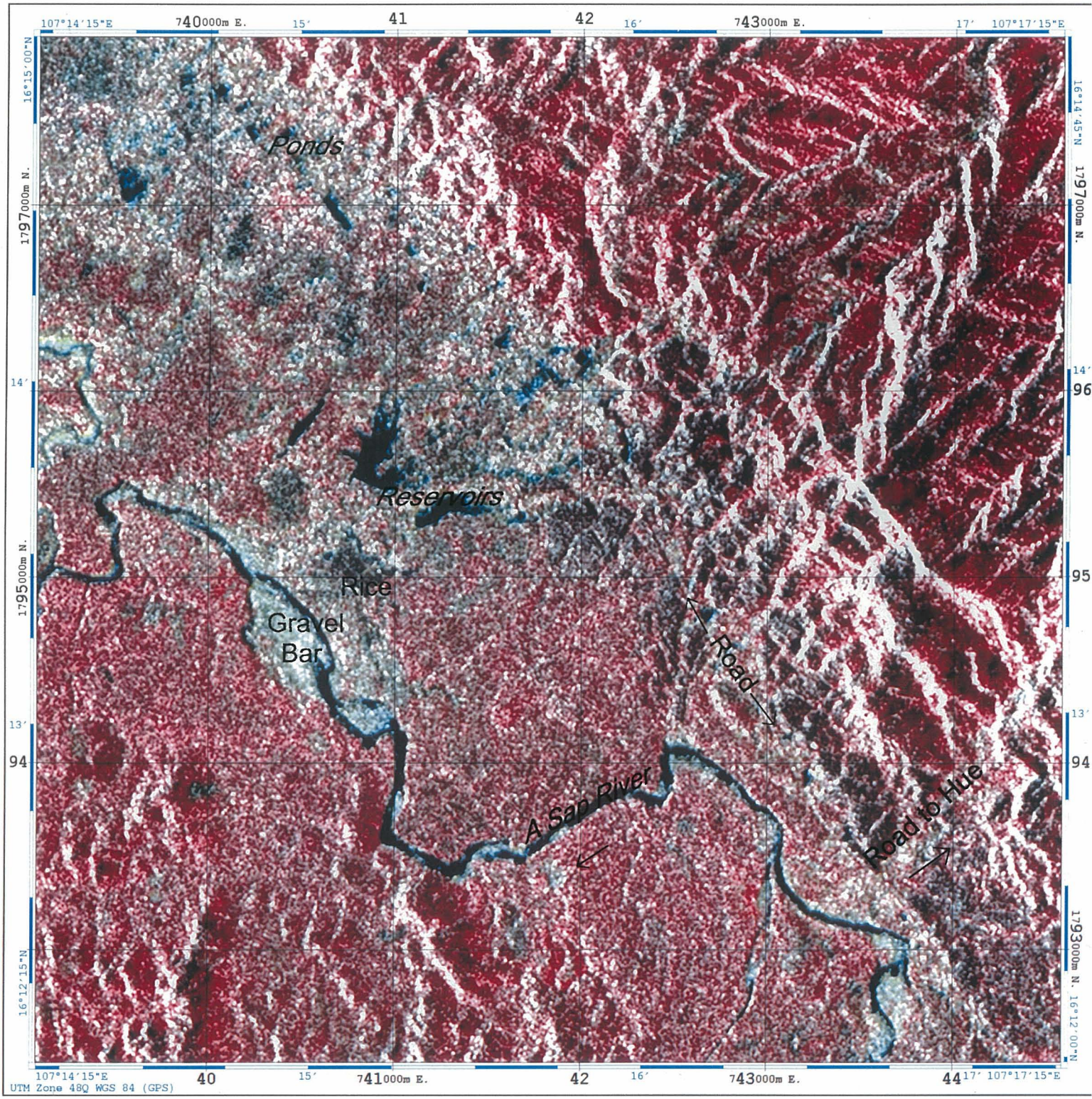
*Sensor / Mode:* *SPOT / XS and Radarsat-1 SAR, Fine Mode (F3)*
*Dates:* *3 May 1996 / 5 August 1996*
*Scale:* *1:30,000 (area coverage: 5 km x 5 km)*
*Nominal resolution:* *20 m (SPOT) and 8 m (Radarsat)*

### Annotation and Feature Detection

For a full description of image and annotation points, see Section 3.1.2 of the report.

Topography, amount of forest cover (green tones), and land use, northern A Luoi valley.
(Scan taken from 1:50,000-scale Vietnamese map E-48-131-C)






A Luoi, Central Viet Nam

RADARSAT F3 (5-8-96) integrated with SPOT XS 3-2-1 FCC (3-5-96)

1:30 000 Scale

Kilometres 1 0 1 2

Miles 1 0 1

## Plate 9 Hue City and Surroundings, Central Viet Nam

*Sensor / Mode:* *Radarsat-1 SAR, Standard Mode (S-4)*
*Date:* *12 August 1996*
*Scale:* *1:100,000 (area coverage: 19 km x 19 km)*
*Nominal resolution:* *28 m*

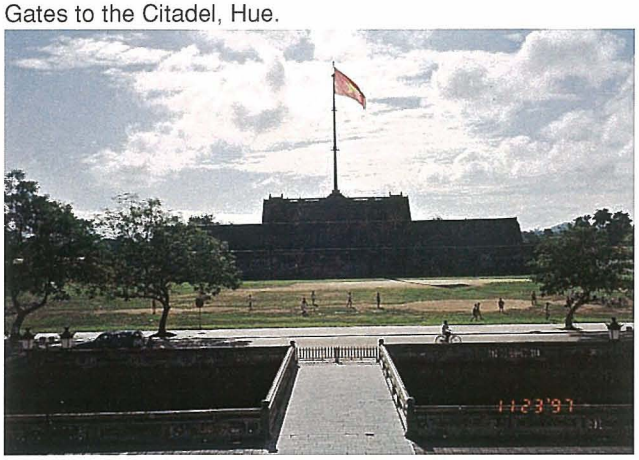
### Annotation and Feature Detection

For a full description of image and annotation points, see Section 3.1.3 of the report.

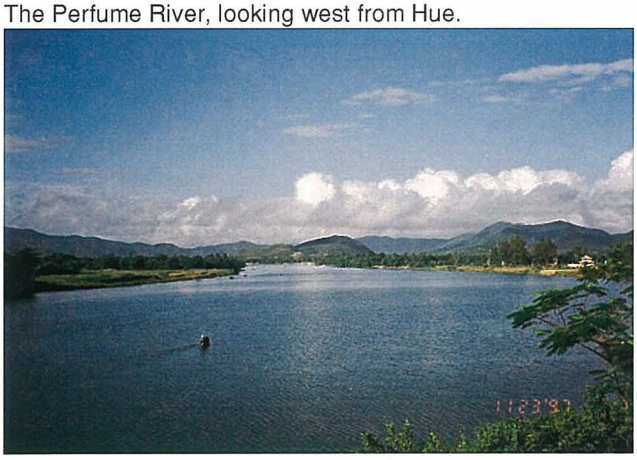
**Map Legend**

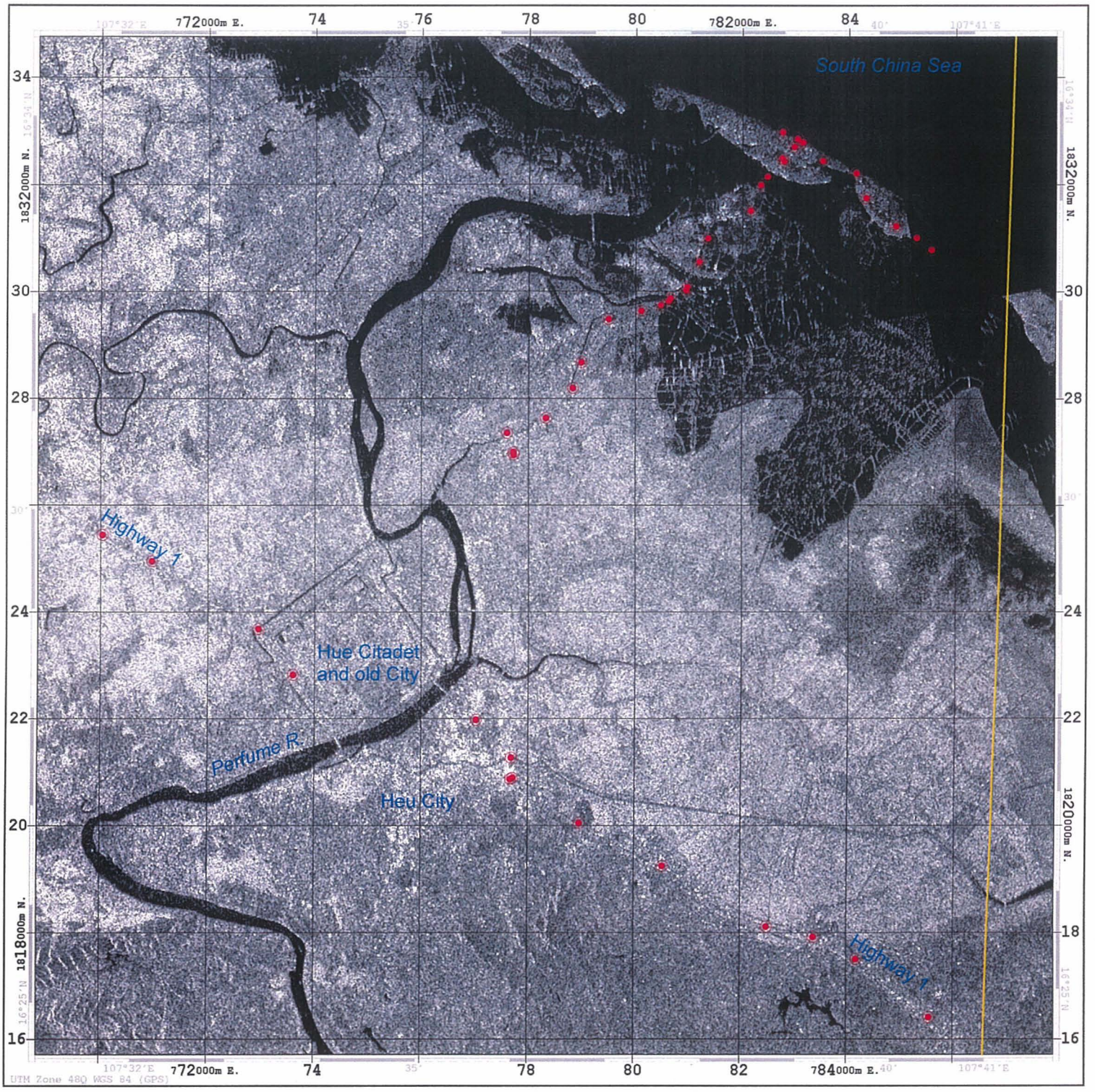
- Aerial herbicide applications (1965 to 1971)
- GPS waypoints (November/December 1997)

Gates to the Citadel, Hue.



The Perfume River, looking west from Hue.






# Hue City and Surroundings, Central Viet Nam

RADARSAT S4/F4-S4-F4 Composite, 12-08-96 (S4) and 29-08-96 (F4)

1:100 000 Scale

Kilometres 1 0 1 2 3 4 5 6 7

Miles 1 0 1 2 3 4 5

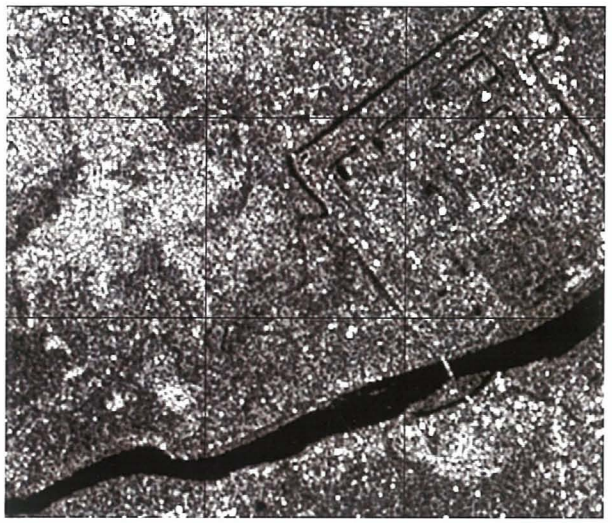
## Plate 10 Hue City and Surroundings, Central Viet Nam

*Sensor / Mode:* *Radarsat-1 SAR / Standard Mode (S4) and Fine Mode (F4)*
*Dates:* *12 August 1996 / 29 August 1996*
*Scale:* *1:100,000 (area coverage: 19 km x 19 km)*
*Nominal resolution:* *28 m (S4) and 8 m (F4)*

### Annotation and Feature Detection

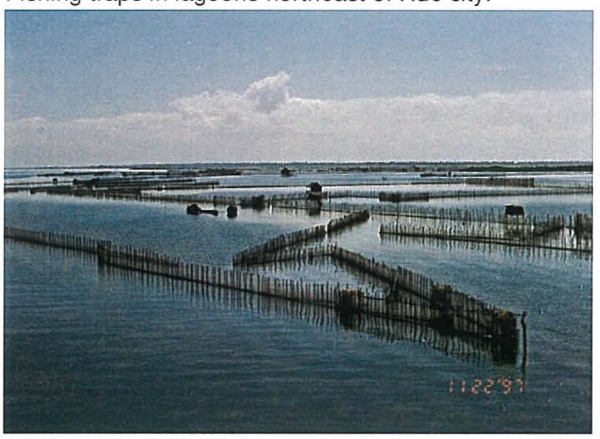
For a full description of image and annotation points, see Section 3.1.3 of the report.

Detail, S4, August 12, 1996. Old city of Hue appears at right, north of Perfume River. Rice cultivation at left.

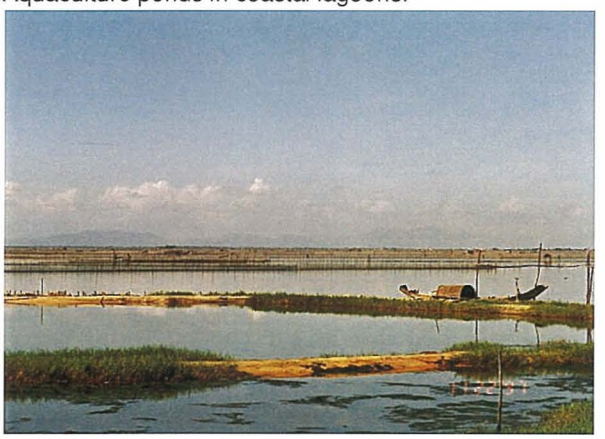


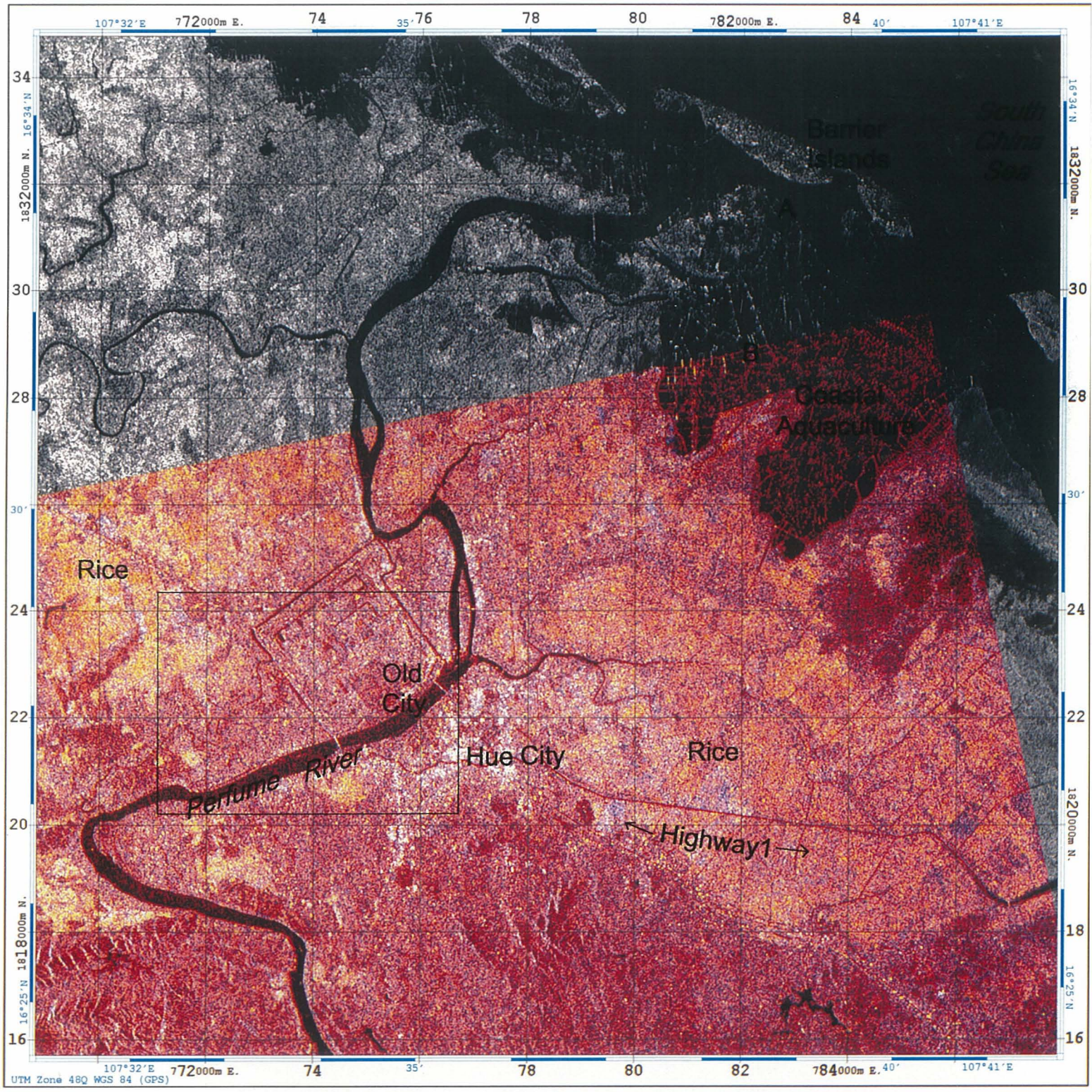
Detail, F4, August 29, 1996. Old city to right, rice cultivation left. Small streams and canals visible.

Fishing traps in lagoons northeast of Hue city.



Aquaculture ponds in coastal lagoons.






Hue City and Surroundings, Central Viet Nam

RADARSAT S4/F4-S4-F4 Composite, 12-08-96 (S4) and 29-08-96 (F4)

1:100 000 Scale

Kilometres 1 0 1 2 3 4 5 6 7

Miles 1 0 1 2 3 4 5

## Plate 11 Da Nang City and Surroundings, Central Viet Nam

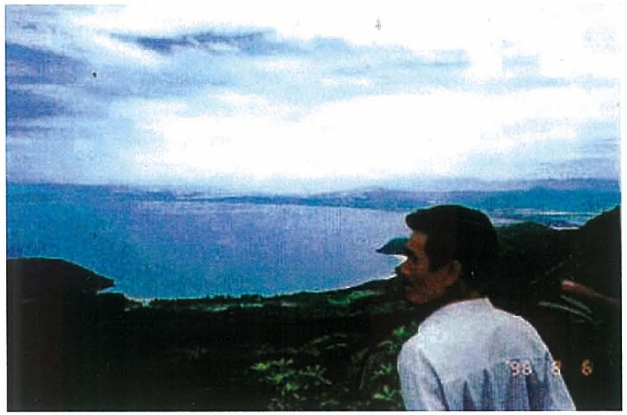
*Sensor / Mode:* *Radarsat-1 SAR, Standard Mode (S7)*
*Date:* *31 July 1997*
*Scale:* *1:250,000 (area coverage: 60 km x 42 km)*
*Nominal resolution:* *28 m*

For description of image and annotation points, see Section 3.1.3 of the report.

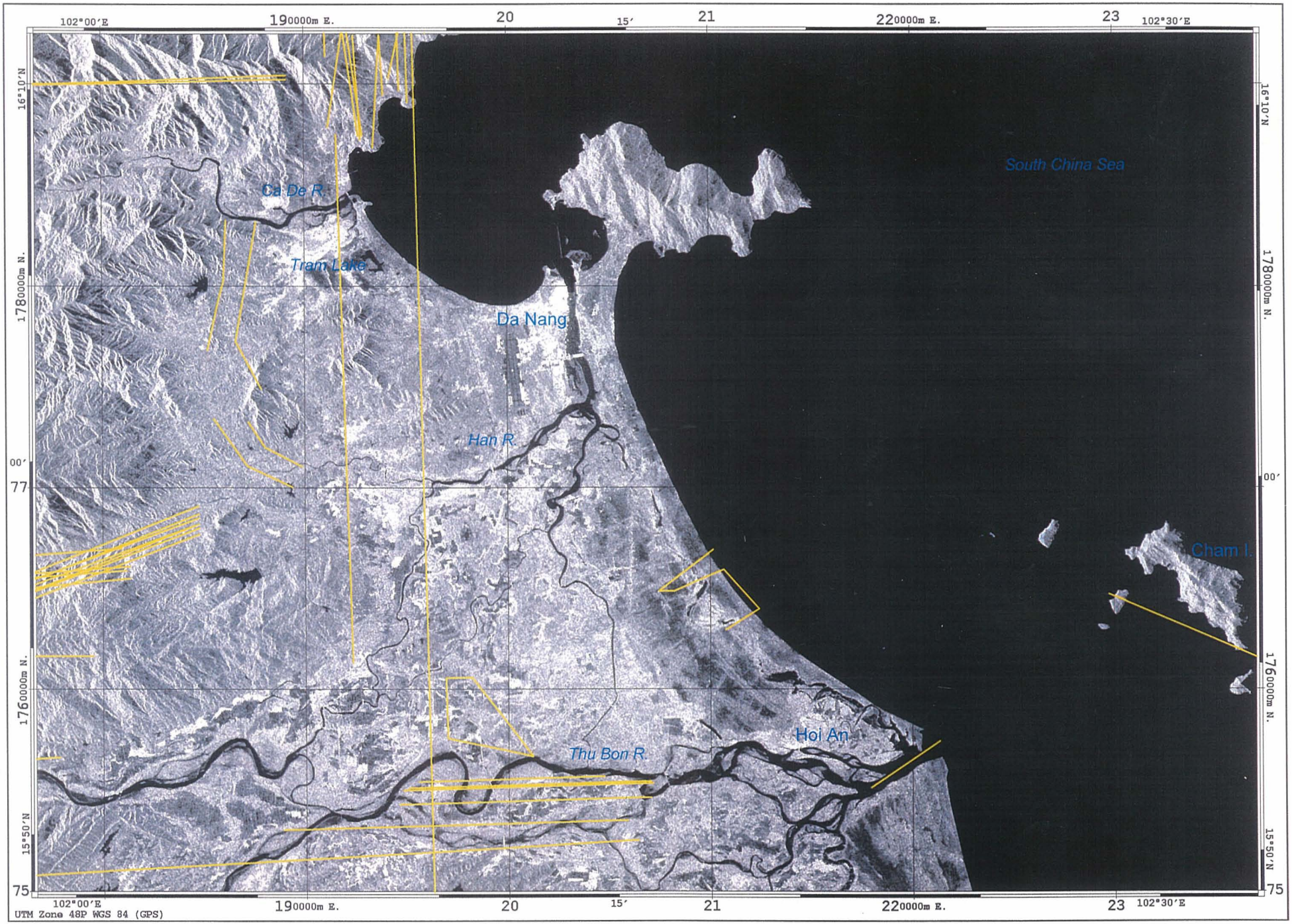
**Map Legend**

— Aerial herbicide applications (1965 to 1971)

Looking southeast over Da Nang Bay.



Grassy areas around Tram Lake, north of Da Nang. White sand dunes are visible in the upper left portion of the photograph.




# Da Nang, Southern Viet Nam

RADARSAT STANDARD MODE (S7), 4-November-1997

1:250 000 Scale

Kilometres 10 0 10

Miles 10 0 10

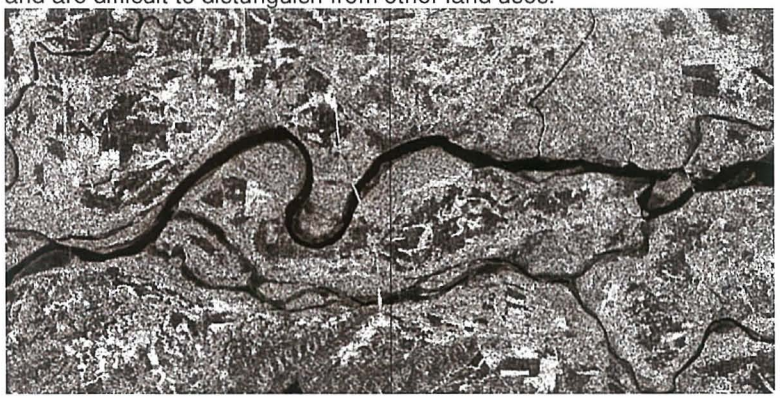
## Plate 12 Da Nang City and Surroundings, Central Viet Nam

*Sensor / Mode:* *Radarsat-1 SAR, Standard Mode (S7) (both dates)*
*Date:* *31 July 1997 / 4 November 1997*
*Scale:* *1:250,000 (area coverage: 60 km x 42 km)*
*Nominal resolution:* *28 m*

### Annotation and Feature Detection

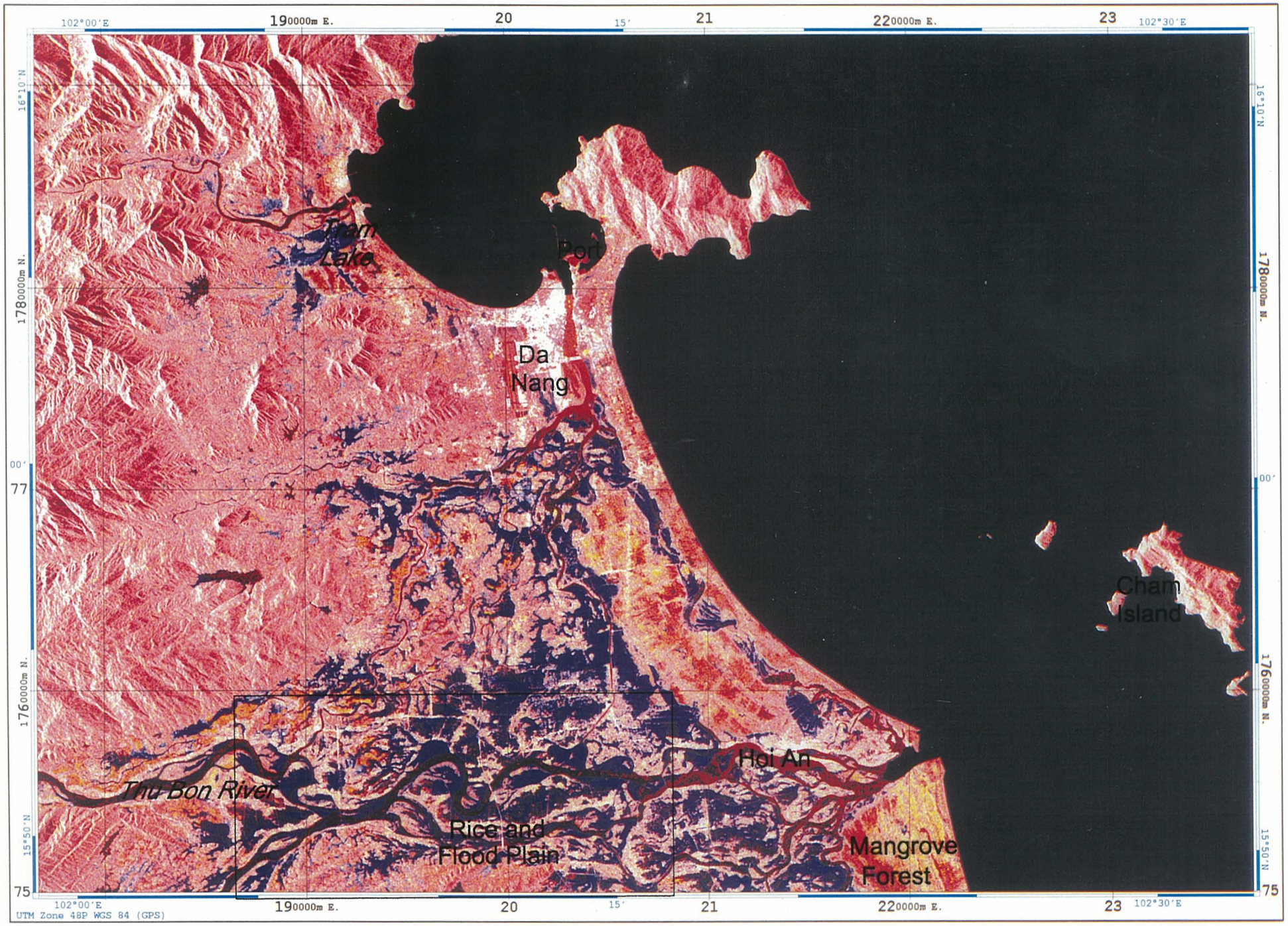
For description of image and annotation points, see Section 3.1.3 of the report.

Detail, S7, July 31, 1997. Thu Bon River is low; rice fields are not flooded and are difficult to distunguish from other land uses.



Detail, S7, November 4, 1997. Thu Ban River is high; rice fields are flooded.

Detail, multi-temporal merge of the two above images. Rice crops are clearly distinguishable as blue fields; river floodplain also appears blue. Mountainous, forested areas appear red (lower middle).




Da Nang, Southern Viet Nam

RADARSAT STANDARD MODE S7b/S7a-S7b-S7a, 4-11-97 (S7a) and 31-7-97 (S7b)

1:250 000 Scale

Kilometres 10 0 10

Miles 10 0 10

## Plate 13 Overview, Ma Da Upland Forest, Southern Viet Nam

*Sensor / Mode:* *Radarsat-1 SAR, Standard Mode (S7)*
*Date:* *15 August 1996*
*Scale:* *1:250,000 (area coverage: 48 km x 48 km)*
*Nominal resolution:* *28 m*

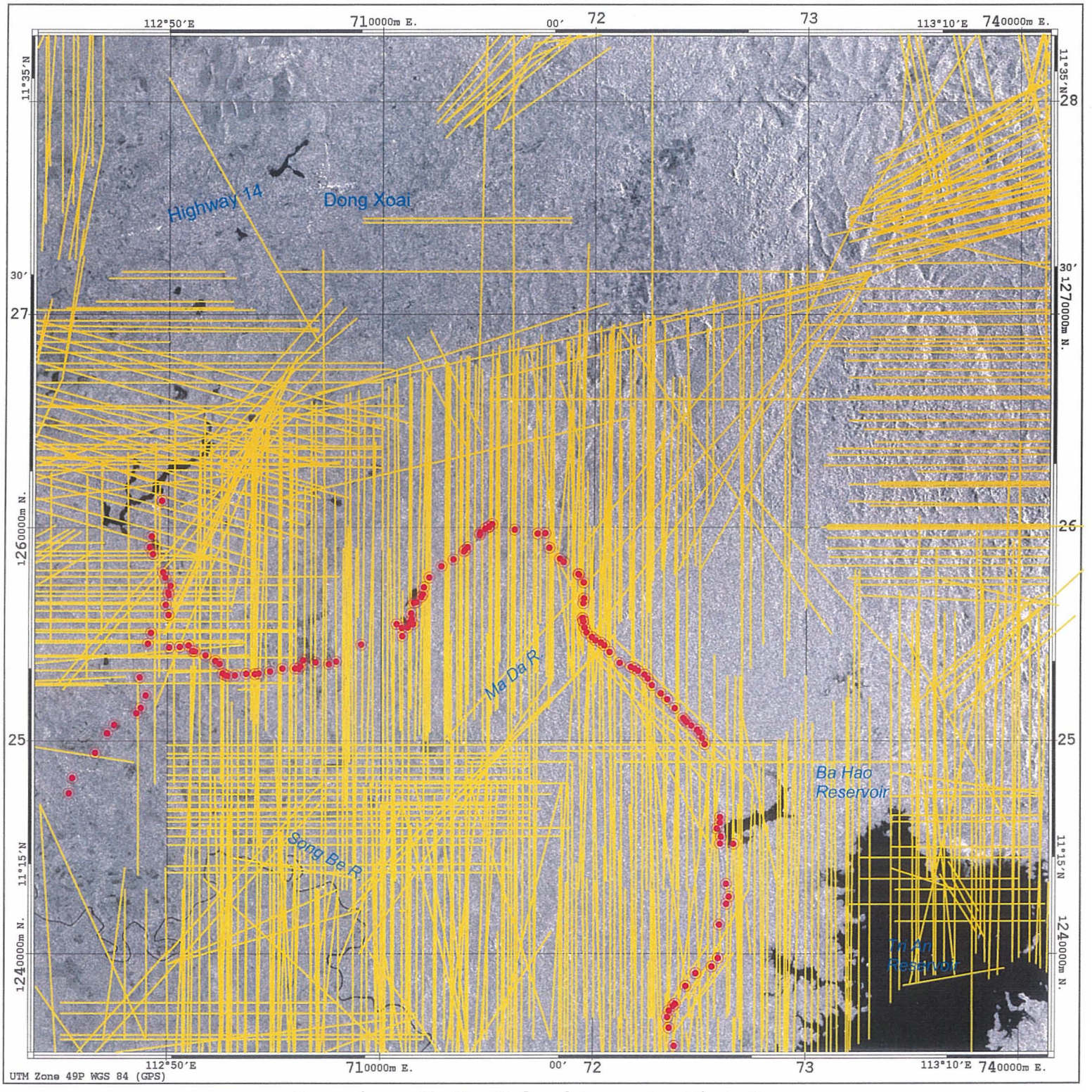
For description of image and annotation points, see Section 3.1.4 of the report.

**Map Legend**

- Aerial herbicide applications (1965 to 1971)
- GPS waypoints (November/December 1997)

Many areas in the Ma Da region have not been rehabilitated since the war. This area, which was heavily sprayed by herbicides, remains barren and uncultivated.

While much of the region has not been rehabilitated, many areas have been replanted with various economic tree species, including rubber (below).




# Overview, Ma Da Upland Forest, Viet Nam

RADARSAT STANDARD MODE (S7), 15-August-1996

1:250 000 Scale

Kilometres 10 0 10

Miles 10 0 10

## Plate 14 Ma Da Upland Forest, Southern Viet Nam

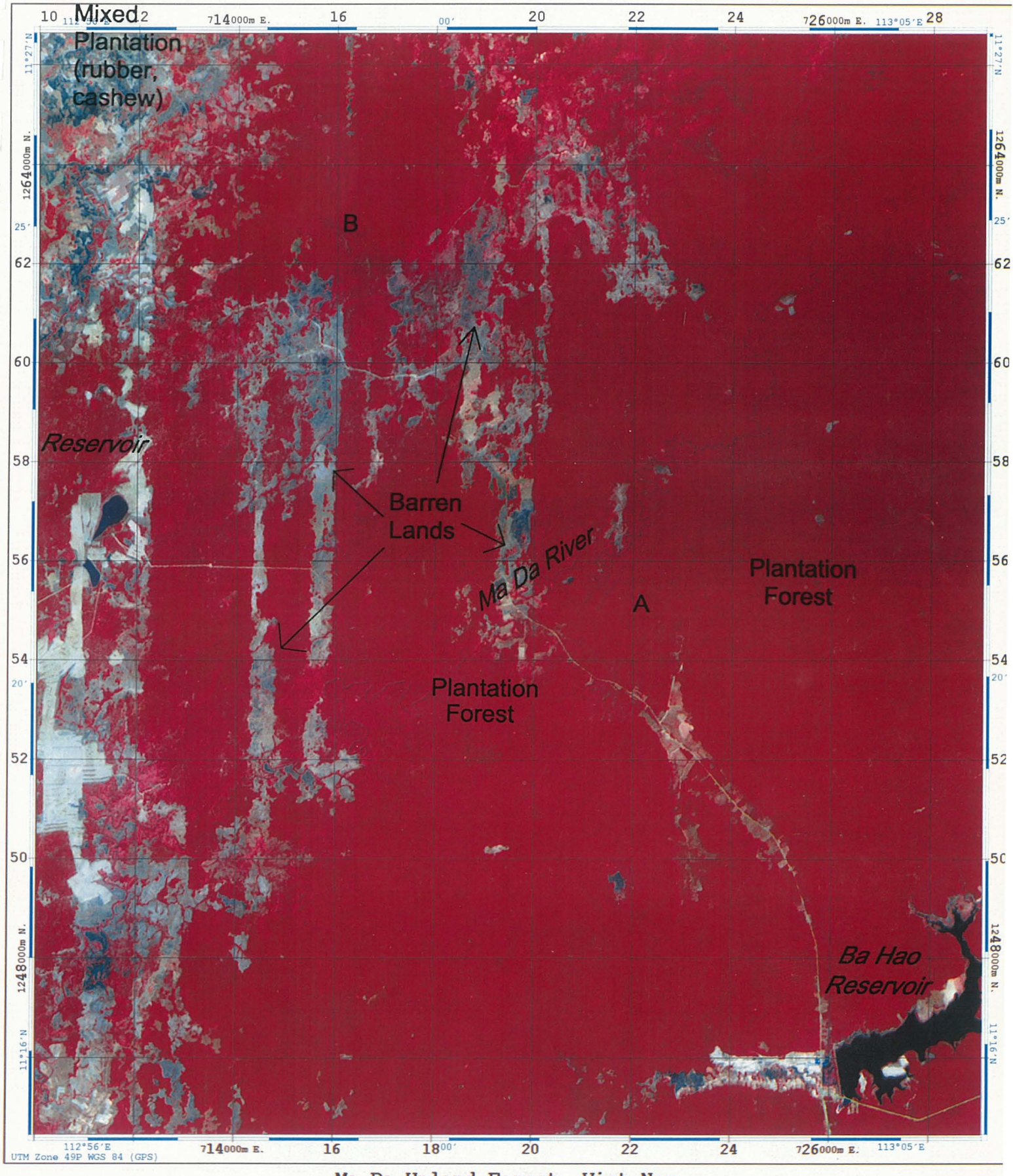
*Sensor / Mode:* *SPOT – XS (Bands 3-2-1)*
*Date:* *5 March 1996*
*Scale:* *1:100,000 (area coverage: 19 km x 22 km)*
*Nominal resolution:* *20 m*

### Annotation and Feature Detection

For a full description of image and annotation points, see Section 3.1.4 of the report.

Regenerated forest, south of former Rang Rang airbase. Large standing trees are *Invingia* sp., which were resistant to herbicide application.

Barren herbicide-sprayed area north east of Rang Rang. Edge of uncultivated grasslands and regenerated forest is visible in the distance.




**Ma Da Upland Forest, Viet Nam**

SPOT XS 3-2-1 False Colour Composite, 5-March-1996

1:100 000 Scale

Kilometres 1 0 1 2 3 4 5 6 7

Miles 1 0 1 2 3 4 5

## Plate 15 Ma Da Upland Forest, Southern Viet Nam

*Sensor / Mode:* *Radarsat-1 SAR, Fine Mode (F5)*
*Date:* *10 August 1997*
*Scale:* *1:100,000 (area coverage: 19 km x 22 km)*
*Nominal resolution:* *8 m*

### Annotation and Feature Detection

For a full description of image and annotation points, see Section 3.1.4 of the report.

Edge of herbicide-sprayed area, immediately north of Rang Rang.

Area prepared for planting of rubber trees. Mature rubber plantation to left.

Ba Hao reservoir, south of Rang Rang. HCL biologists taking sediment samples for analysis of dioxin contamination.


Ma Da Upland Forest, Viet Nam

RADARSAT FINE MODE (F5), 10-August-1997

1:100 000 Scale

Kilometres 1 0 1 2 3 4 5 6 7

Miles 1 0 1 2 3 4 5

## Plate 16 Ma Da Upland Forest, Southern Viet Nam

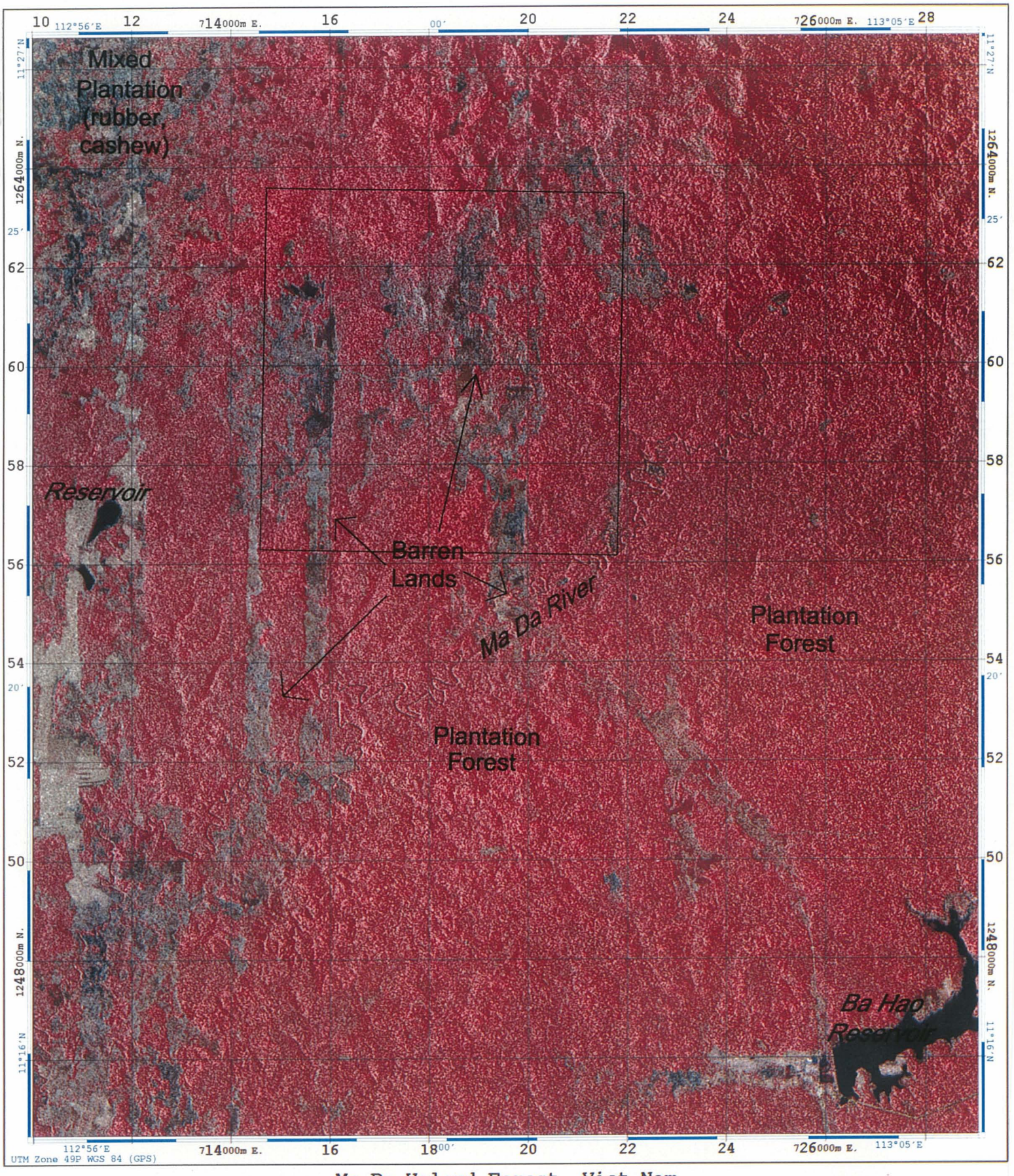
*Sensor / Mode:* *SPOT – XS (Bands 3-2-1) and Radarsat-1 SAR, Fine Mode (F5)*
*Date:* *13 August 1996 / 5 March 1997*
*Scale:* *1:100,000 (area coverage: 19 km x 22 km)*
*Nominal resolution:* *20 m (SPOT) and 8 m (F5)*

### Annotation and Feature Detection

For a full description of image and annotation points, see Section 3.1.4 of the report.

Detail, RADARSAT Fine-5F, August 10, 1997.

Detail, SPOT-XS (3-2-1), March 5, 1996.




Ma Da Upland Forest, Viet Nam

RADARSAT F5 (10-8-97) integrated with SPOT XS 3-2-1 FCC (5-3-96)

1:100 000 Scale

Kilometres 1 0 1 2 3 4 5 6 7

Miles 1 0 1 2 3 4 5

## Plate 17 Overview, Rung Sat Mangrove Forest, Southern Viet Nam

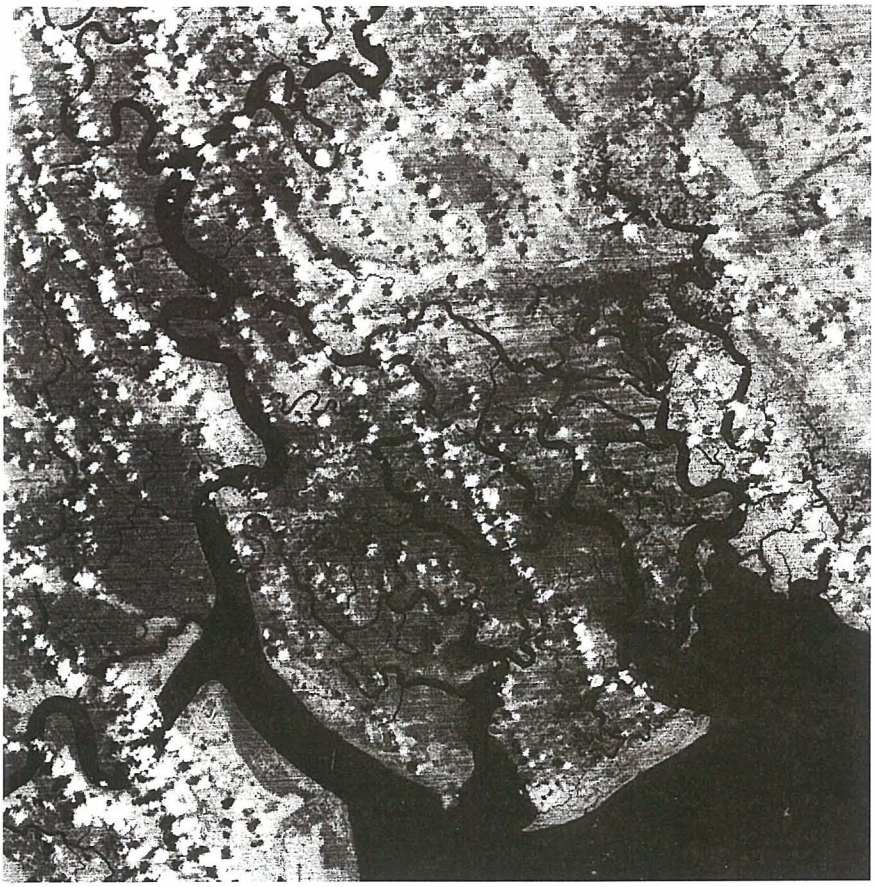
*Sensor / Mode:* *Radarsat-1 SAR, Fine Mode (F4)*
*Date:* *7 August 1996*
*Scale:* *1:250,000 (area coverage: 47 km x 55 km)*
*Nominal resolution:* *8 m*

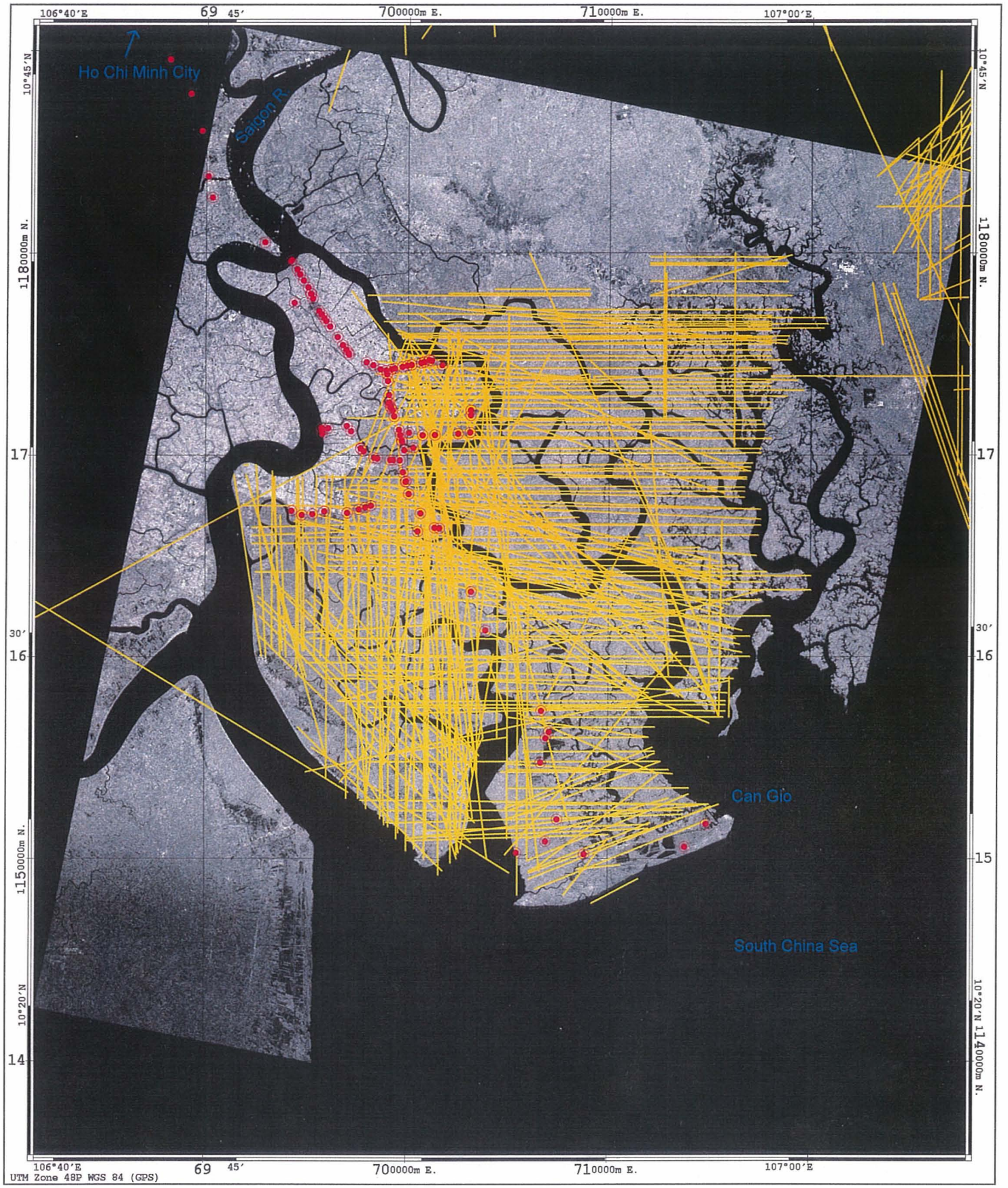
For description of image and annotation points, see Section 3.1.5 of the report.

**Map Legend**

- Aerial herbicide applications (1965 to 1971)
- GPS waypoints (November/December 1997)

Landsat-1 MSS image of Rung Sat mangrove forest, February 24, 1973. Herbicide-sprayed areas are visible as dark east-west lines across the lower three-quarters of Rung Sat. Light cloud cover reduces the visibility of the peninsula.






Overview, Rung Sat Mangrove Forest, Southern Viet Nam

RADARSAT FINE MODE (F4), 7-August-1996

1:250 000 Scale

Kilometres 10 0 10

Miles 10 0 10

## Plate 18 Rung Sat Mangrove Forest, Southern Viet Nam

*Sensor / Mode:* *Radarsat-1 SAR, Fine Mode (F5 and F4)*
*Dates:* *3 September 1997 and 7 August 1996*
*Scale:* *1:250,000 (area coverage: 47 km x 48 km)*
*Nominal resolution:* *8 m*

### Annotation and Feature Detection

For a full description of image and annotation points, see Section 3.1.5 of the report.

Mature rice in northern Rung Sat (early December, 1997), with *Nipa* palm front right and in the distance.

Empty rice fields in northern Rung Sat (mid-April, 1997), with *Nipa* palm front in the distance.

Newly-planted mangroves in an area sprayed with herbicides, with more mature mangrove plantation in the background.


Rung Sat Mangrove Forest, Southern Viet Nam

RADARSAT F5/F4-F5-F4 Composite, 03-09-97 (F5) and 07-08-96 (F4)

1:250 000 Scale

Kilometres 10 0 10

Miles 10 0 10

## Plate 19 Detail, Rung Sat Mangrove Forest, Southern Viet Nam

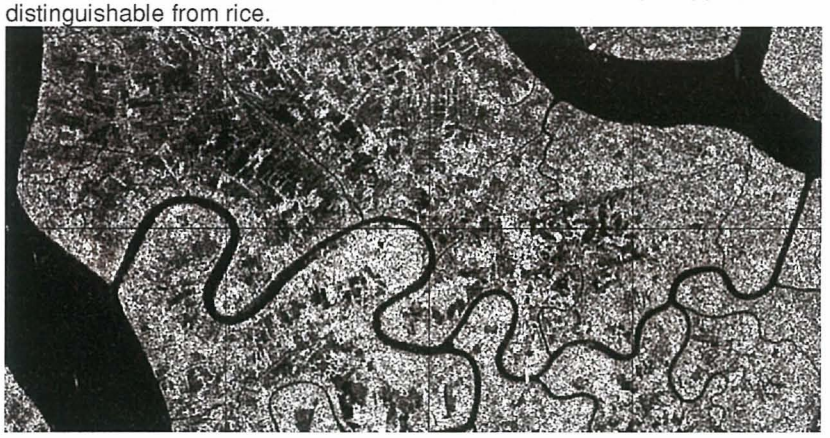
*Sensor / Mode:* *Radarsat-1 SAR, Fine Mode (F5 and F4)*
*Dates:* *3 September 1997 and 7 August 1996*
*Scale:* *1:70,000 (area coverage: 13 km x 13 km)*
*Nominal resolution:* *8 m*

### Annotation and Feature Detection

For a full description of image and annotation points, see Section 3.1.5 of the report.

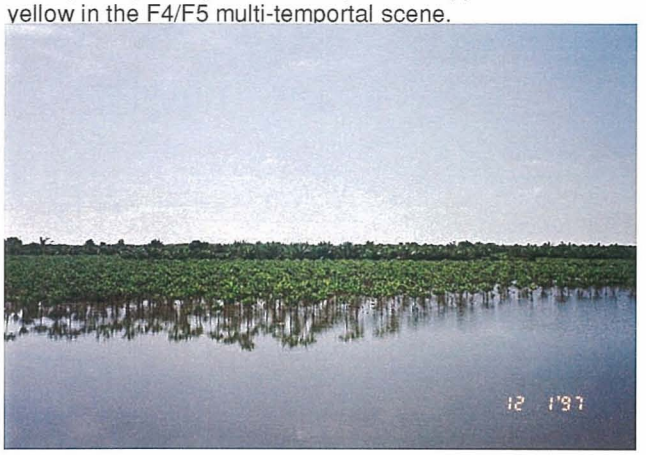
Detail, F4, August 7, 1996. Rice fields are not flooded and are difficult to distinguish from other land uses. Mangrove channels are clearly visible, as are small aquaculture ponds.

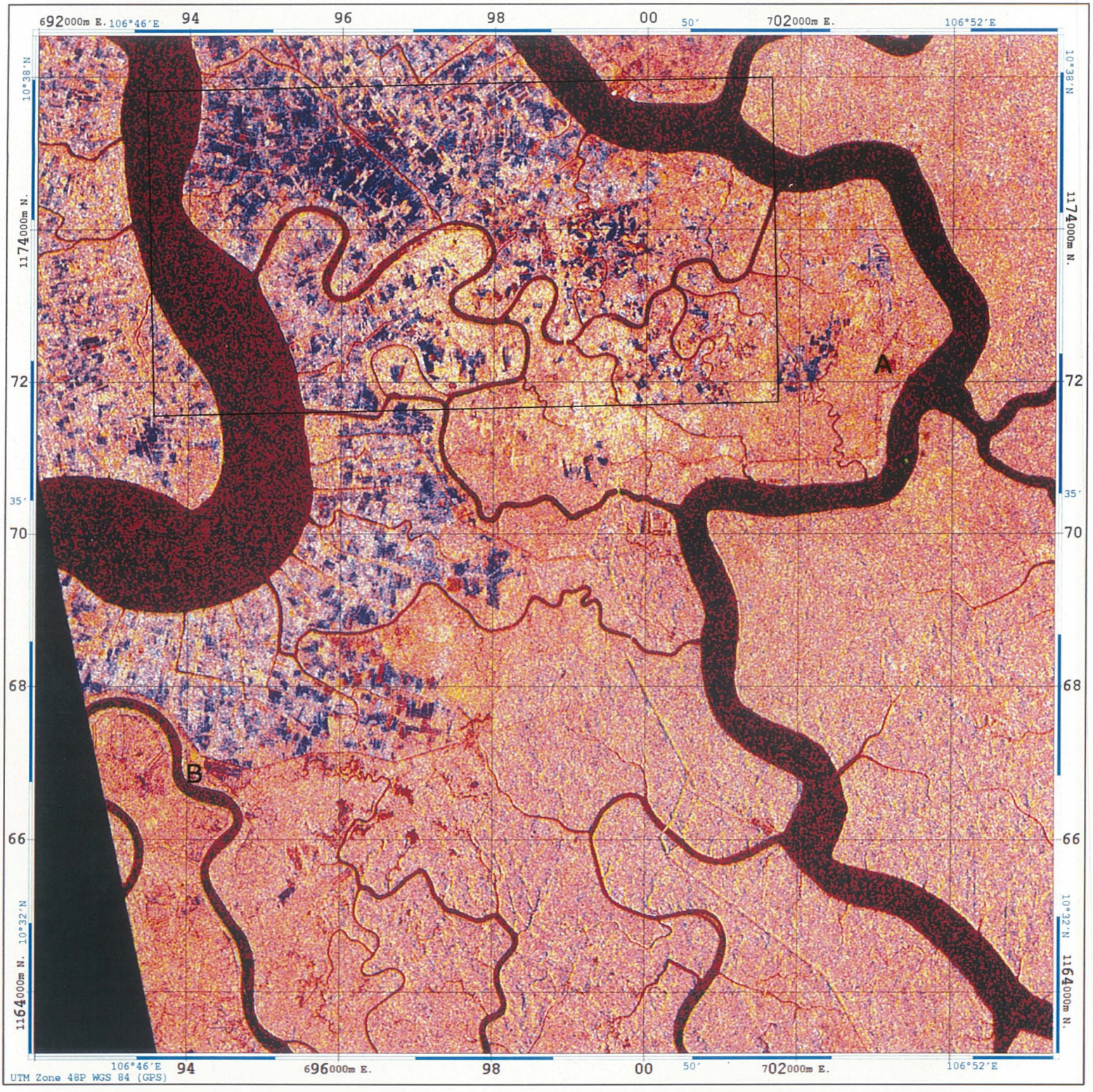
Detail, F5, September 3, 1997. Rice fields are flooded and visible; aquaculture ponds cannot be distinguished from rice paddy. Areas of dry cropping are distinguishable from rice.



Small shrimp ponds, which appear dark red in the F4/F5 scene.

Young mangrove (planted 1996), which appears yellow in the F4/F5 multi-temportal scene.






# Rung Sat Mangrove Forest, Southern Viet Nam

RADARSAT F5/F4-F5-F4 Composite, 03-09-97 (F5) and 07-08-96 (F4)

1:70 000 Scale

Kilometres 1 0 1 2 3 4 5 6

Miles 1 0 1 2 3

## Plate 20 Detail, Rung Sat Mangrove Forest, Southern Viet Nam

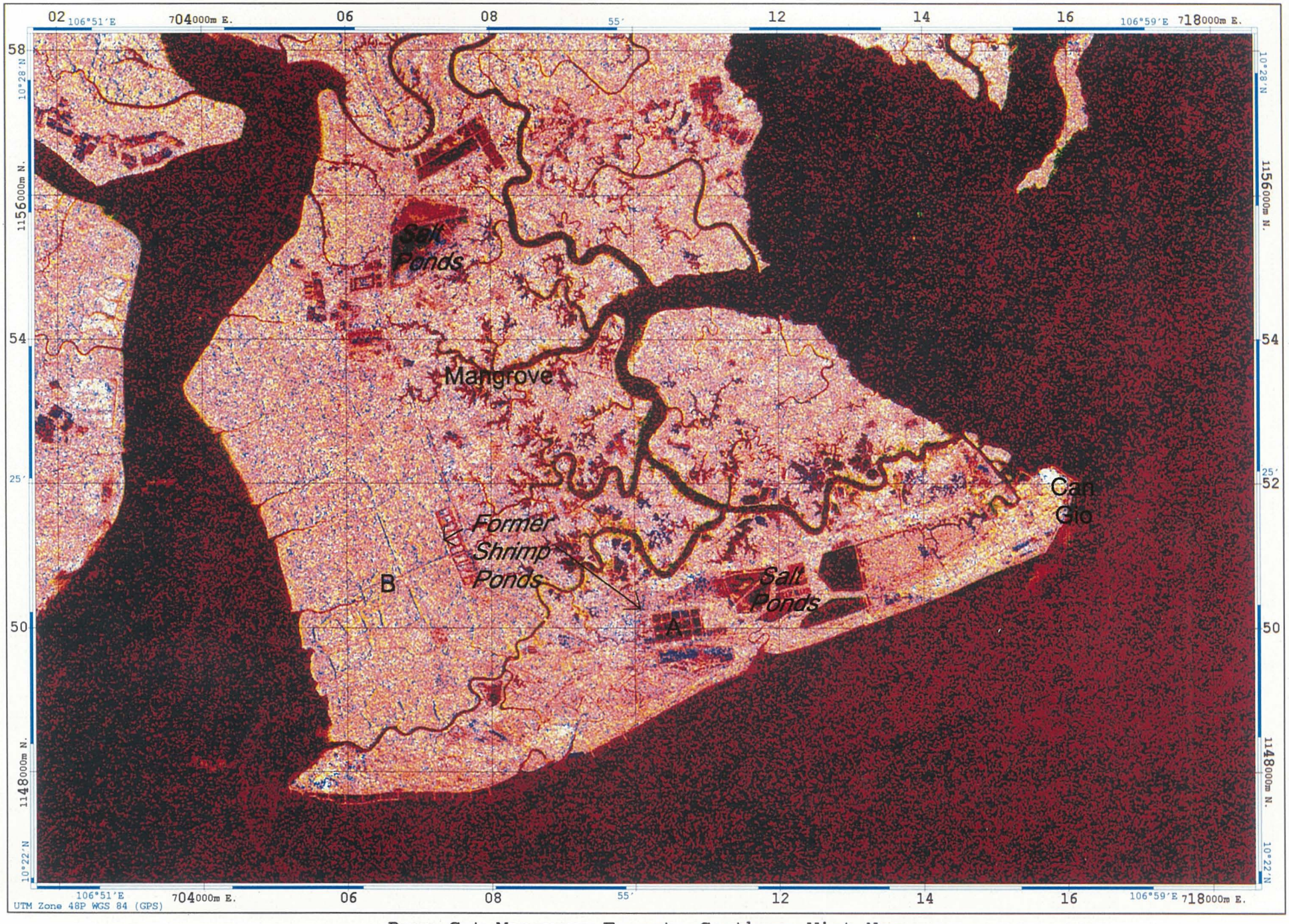
*Sensor / Mode:* *Radarsat-1 SAR, Fine Mode (F5 and F4)*
*Dates:* *3 September 1997 and 7 August 1996*
*Scale:* *1:70,000 (area coverage: 17 km x 12 km)*
*Nominal resolution:* *8 m*

### Annotation and Feature Detection

For a full description of image and annotation points, see Section 3.1.5 of the report.

Replanted mangroves in abandoned shrimp ponds near Can Gio, southern Rung Sat.

Replanted mangroves (*Rhizonphora* and *Avicennia* sp. ) of various ages, southern Rung Sat.




Rung Sat Mangrove Forest, Southern Viet Nam

RADARSAT F5/F4-F5-F4 Composite, 03-09-97 (F5) and 07-08-96 (F4)

1:70 000 Scale

Kilometres 1 0 1 2 3 4 5 6

Miles 1 0 1 2 3

## Plate 21 Overview, Ca Mau Peninsula, Southern Viet Nam

*Sensor / Mode:* *Radarsat-1 SAR, Standard Mode (S7)*
*Date:* *23 November 1997*
*Scale:* *1:250,000 (area coverage: 60 x 42 km)*
*Nominal resolution:* *28 m*

For description of image and annotation points, see Section 3.1.6 of the report.

**Map Legend**

- Aerial herbicide applications (1965 to 1971)
- GPS waypoints (November/December 1997)

Tan An village, southern Ca Mau peninsula.


Shrimp farm, with mangroves newly planted between canals.


Overview, Ca Mau Peninsula, Southern Viet Nam

RADARSAT STANDARD MODE (S7), 19-August-1997

1:250 000 Scale

Kilometres 10 0 10

Miles 10 0 10

## Plate 22 Ca Mau Peninsula, Southern Viet Nam (1973)

*Sensor / Mode* *Landsat-1 MSS (Bands 6-5-4):*
*Dates:* *3 January 1973*
*Scale:* *1:250,000 (area coverage: 60 km x 42 km)*
*Nominal resolution:* *80 m*

For description of image and annotation points, see Section 3.1.6 of the report.

Photograph of mangrove forest after herbicide application, Ca Mau peninsula.

(Photo from Fischer 1986)


# Overview, Ca Mau Peninsula, Southern Viet Nam

LANDSAT-1 6-5-4 False Colour Composite, 3-January-1973

1:250 000 Scale

Kilometres 10 0 10

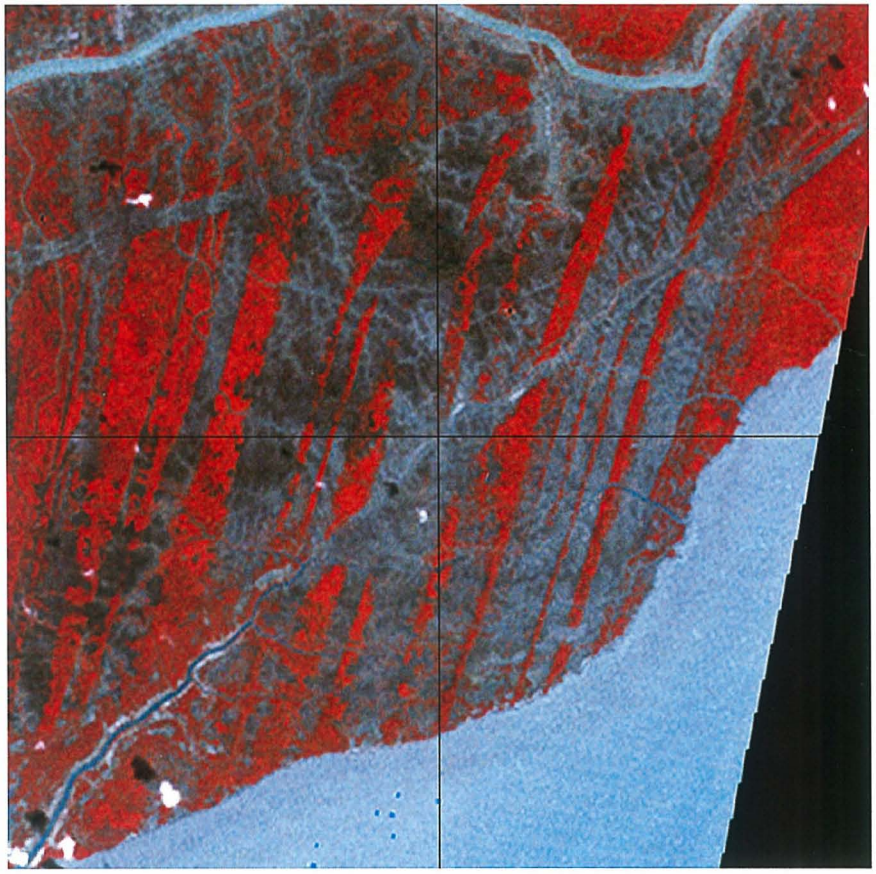
Miles 10 0 10

## Plate 23 Change Detection, Ca Mau Peninsula, Southern Viet Nam

*Sensor / Mode:* *Landsat MSS (6,5,4) and Radarsat-1 SAR Standard Mode (S7)*
*Dates:* *3 January 1973 / 23 November 1997*
*Scale:* *1:250,000 (area coverage: 60 km x 42 km)*
*Nominal resolution:* *80 m (MSS) and 28 m (S7)*

For description of image and annotation points, see Section 3.1.6 of the report.

Detail, eastern Ca Mau peninsula, Landsat-1 MSS, January 3, 1973



Detail, eastern Ca Mau, RADARSAT S7, November 23, 1997


Overview, Ca Mau Peninsula, Southern Viet Nam

RADARSAT S7 (23-11-97) integrated with LANDSAT-1 6-5-4 FCC (3-1-73)

1:250 000 Scale

Kilometres 10 0 10

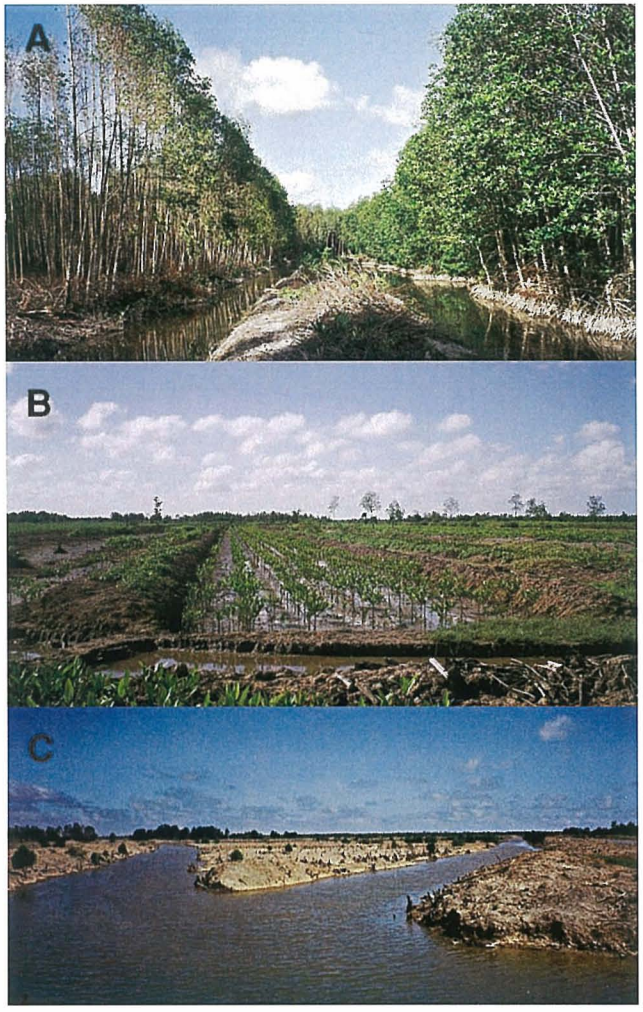
Miles 10 0 10

## Plate 24 Detail, Ca Mau Peninsula, Southern Viet Nam

*Sensor / Mode:* *Radarsat-1 SAR Fine Mode (F5)*
*Dates:* *17 December 1997*
*Scale:* *1:50,000 (area coverage: 12 km x 8 km)*
*Nominal resolution:* *8 m*

### Annotation and Feature Detection

For a full description of image and annotation points, see Section 3.1.6 of the report.




*Left:* Clearing of mangroves for small-scale shrimp aquaculture has been undertaken throughout the Ca Mau peninsula. Efforts are underway to replant mangroves within shrimp farms, to help bring back mangrove-dependent wildlife, but also to make shrimp farming more sustainable and productive, and to provide wood as an additional source of income to local farmers. Fine mode RADARSAT imagery (right) of areas of intensive shrimp aquaculture differentiated areas of greater mangrove cover,(e.g., A) which give a stronger radar backscatter than areas without any mangrove cover (e.g., C). The farm shown left-top is a demonstration farm for a mangrove rehabilitation project; this farm and its boundaries are clearly visible in the RADARSAT scene as a triangle-shaped bright return in the upper right of the scene.

Below: Fishing nets extending from shore into the Cua Lon River, which crosses the adjacent RADARSAT scene from west to east, are also visible in this fine mode scene.


Detail, Ca Mau Peninsula, Southern Viet Nam

RADARSAT FINE MODE (F5), 17-December-1997

1:50 000 Scale

Kilometres 1 0 1 2 3 4

Miles 1 0 1 2

## Plate 25 Detail, Ca Mau Peninsula, Southern Viet Nam

*Sensor / Mode:* *Radarsat-1 SAR Standard Mode (S7) (both dates)*
*Dates:* *19 August 1997 / 23 November 1997*
*Scale:* *1:100,000 (area coverage: 24 km x 17 km)*
*Nominal resolution:* *28 m*

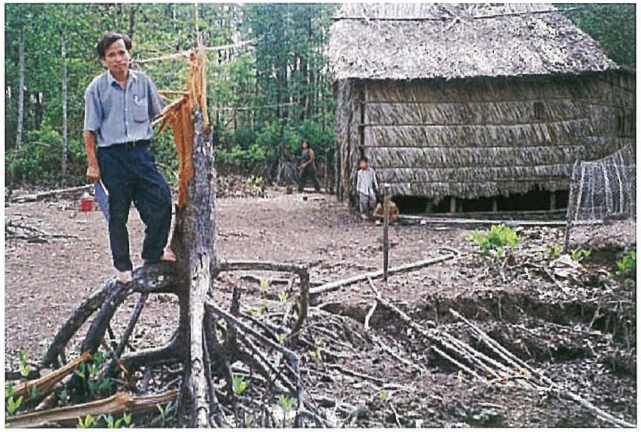
### Annotation and Feature Detection

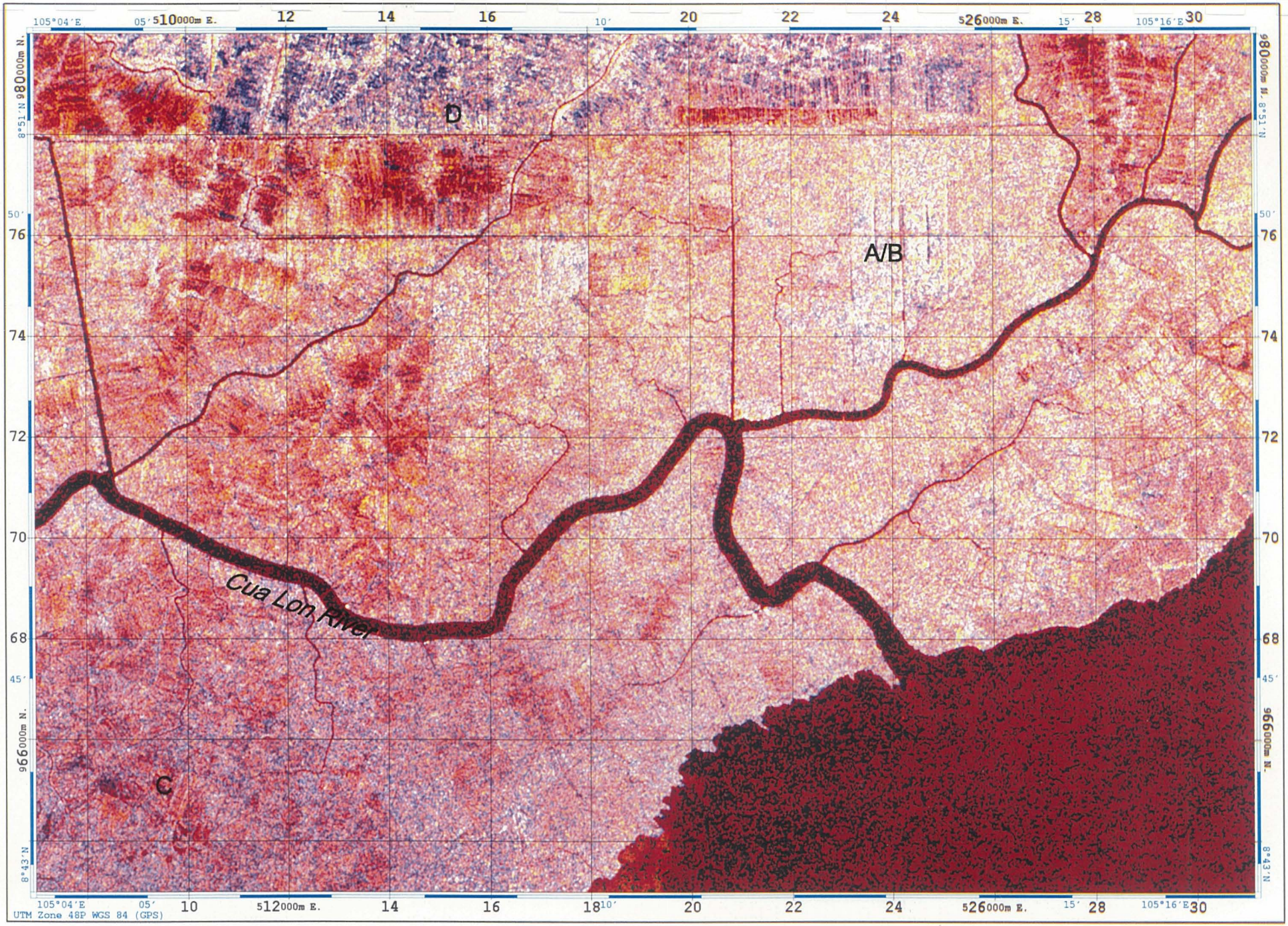
For a full description of image and annotation points, see Section 3.1.6 of the report.

In early November 1997, the ca Mau peninsula was stuck by a major typhoon, which killed dozens and left thousands homeless. In addition, the few remaining stands of mangrove forest were heavily damaged. The photo upper-left shows a mangrove forest in Tam Giang III forest enterprise a few months previous to the typhoon (photo courtesy of Ca Mau news agency); the photo upper-right shows the same forest in late November 1997, after the typhoon.

A mature mangrove tree blown down by the typhoon. The home in the background was rebuilt in the weeks following the storm.


The adjacent multi-temporal RADARSAT scene also discriminates rice cultivation (below) from shrimp farming.






Detail, Ca Mau Peninsula, Southern Viet Nam

RADARSAT S7b/S7a-S7b-S7a, 23-11-97 (S7a) and 19-8-97 (S7b)

1:100 000 Scale

Kilometres 1 0 1 2 3 4 5 6 7

Miles 1 0 1 2 3 4 5

## Plate 26 Overview, Pakse/Bolavens Plateau, Southern Lao PDR

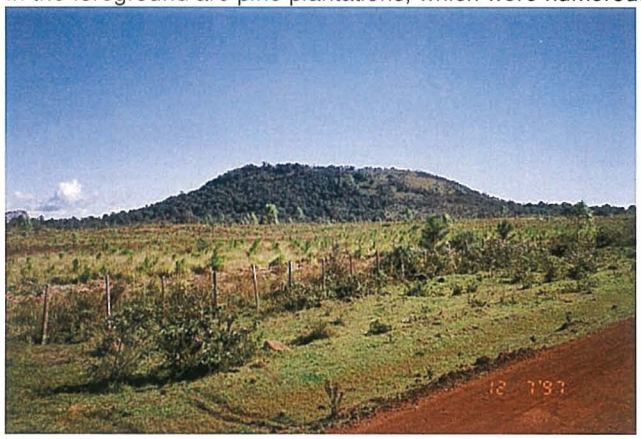
*Sensor / Mode:* *Radarsat-1 SAR, Standard Mode (S7) (both dates)*
*Dates:* *22 December 1996 / 26 July 1997*
*Scale:* *1:250,000 (area coverage: 60 km x 42 km)*
*Nominal resolution:* *28 m*

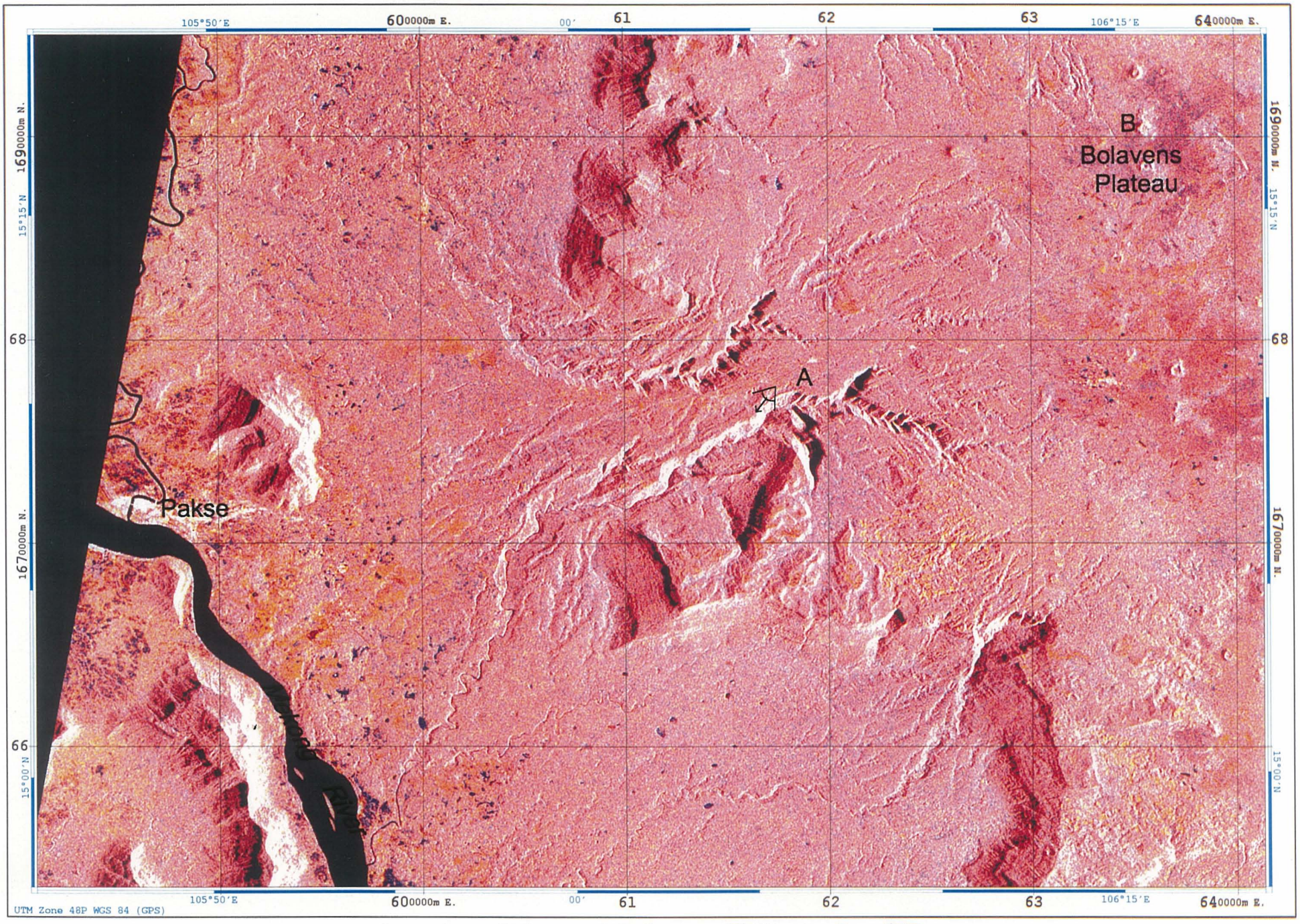
### Annotation and Feature Detection

For a full description of image and annotation points, see Section 3.2.1 of the report.

Looking east from the western edge of the Bolavens Plateau toward the Mekong River valley.
Beyond the visible mountains is the Thai border.

One of several small, conical, possibly volcanic hills near Paksong in the Bolavens Plateau.
In the foreground are pine plantations, which were numerous throughout the central plateau.






Overview, Pakse and Bolavens Plateau, Lao PDR

RADARSAT 96/97-96-97 Composite, 22-12-96 (S7) and 26-07-97 (S7)

1:250 000 Scale

Kilometres 10 0 10

Miles 10 0 10

## Plate 27 Pakse and the Mekong River, Southern Lao PDR

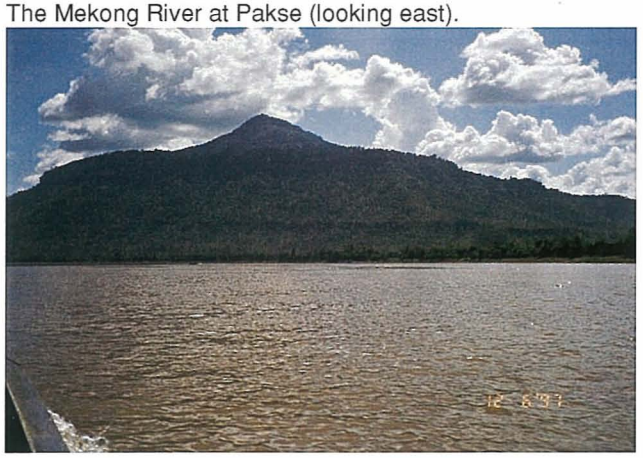
*Sensor / Mode:* *Radarsat-1 SAR, Standard Mode (S7) (both dates)*
*Dates:* *22 December 1996 / 26 July 1997*
*Scale:* *1:100,000 (area coverage: 17 km x 17 km)*
*Nominal resolution:* *28 m*

### Annotation and Feature Detection

For a full description of image and annotation points, see Section 3.2.1 of the report.

Landscape north of Pakse (Xe Don River is visible to left), showing rice cultivation and fish ponds.

The Mekong River at Pakse (looking east).




Pakse and Mekong River, Lao PDR

RADARSAT 96/97-96-97 Composite, 22-12-96 (S7) and 26-07-97 (S7)

1:100 000 Scale

Kilometres 1 0 1 2 3 4 5 6 7

Miles 1 0 1 2 3 4 5

## Plate 28 Overview, Plain of Jars, Northern Lao PDR

*Sensor / Mode:* *Radarsat-1 SAR Standard Mode (S7)*
*Dates:* *23 December 1996*
*Scale:* *1:250,000 (area coverage: 48 km x 48 km)*
*Nominal resolution:* *28 m*

### Annotation and Feature Detection

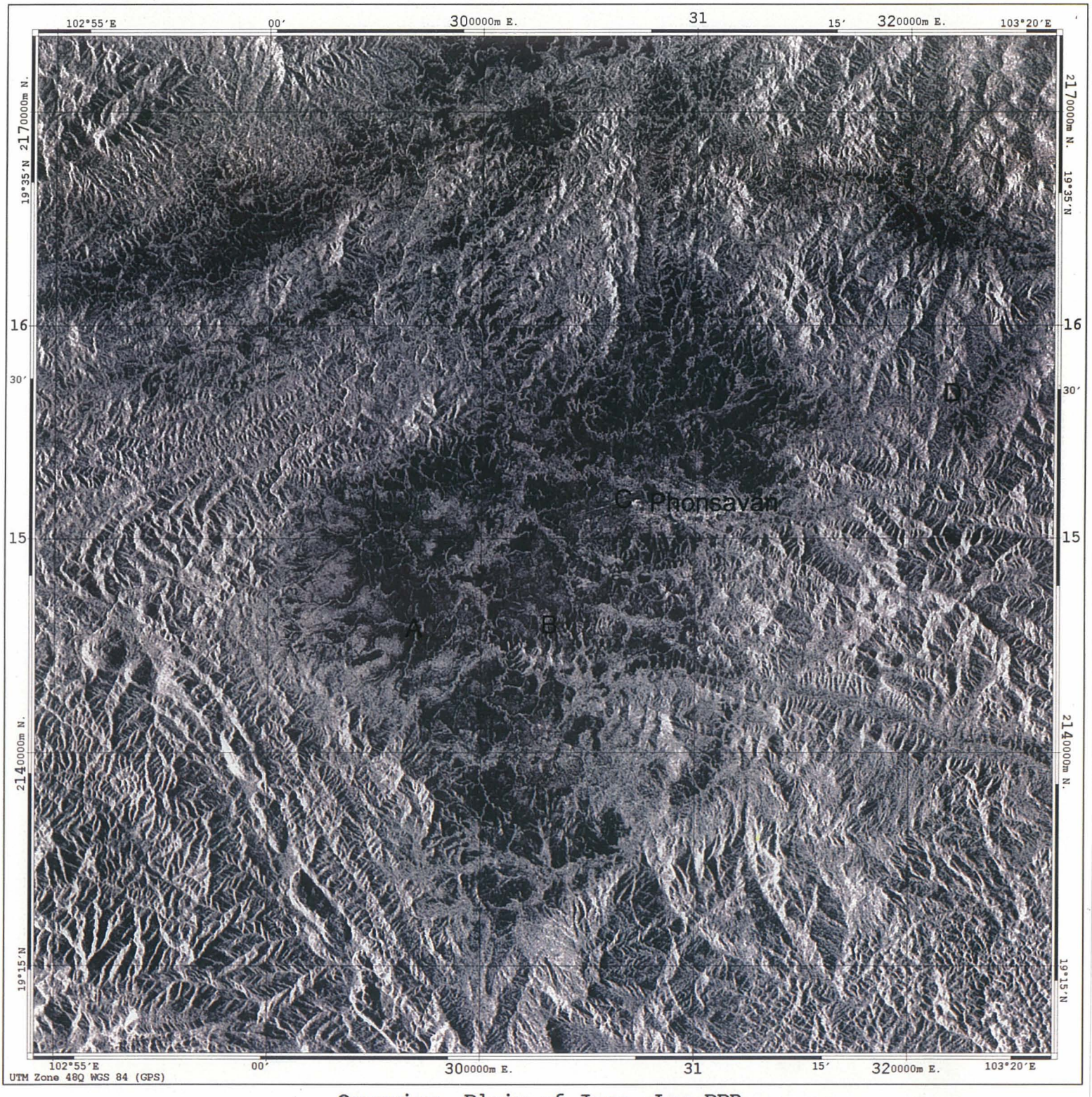
For a full description of image and annotation points, see Section 3.2.2 of the report.

Looking down onto the Plain of Jars. Shifting agriculture, with burning of fields, is evident, as are numerous bomb craters (particularly below-left) , which have yet to be filled in.



Drainage areas of the Plain of Jars typically support paddy cultivation of rice.


The Plain of Jars area was so heavily bombed during the 1960s and 70s that bomb casings are regularly used as building materials, feeding troughs, planters, etc.; the home below stands on stilts constructed from bomb casings.




# Overview, Plain of Jars, Lao PDR

RADARSAT STANDARD MODE (S7), 23-December-1996

1:250 000 Scale

Kilometres 10 0 10

Miles 10 0 10

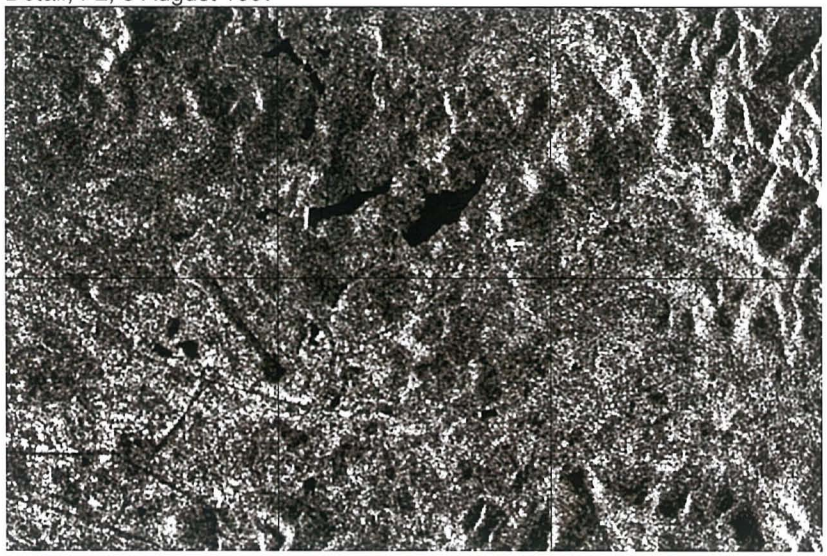
## Plate 29 Phonsavan, Plain of Jars, Northern Lao PDR

*Sensor / Mode:* *Radarsat-1 SAR Standard Mode (S7) and Fine Mode (F2)*
*Dates:* *23 December 1996 / 3 August 1997*
*Scale:* *1:70,000 (area coverage: 17 km x 12 km)*
*Nominal resolution:* *28 m (S7) and 8 m (F2)*

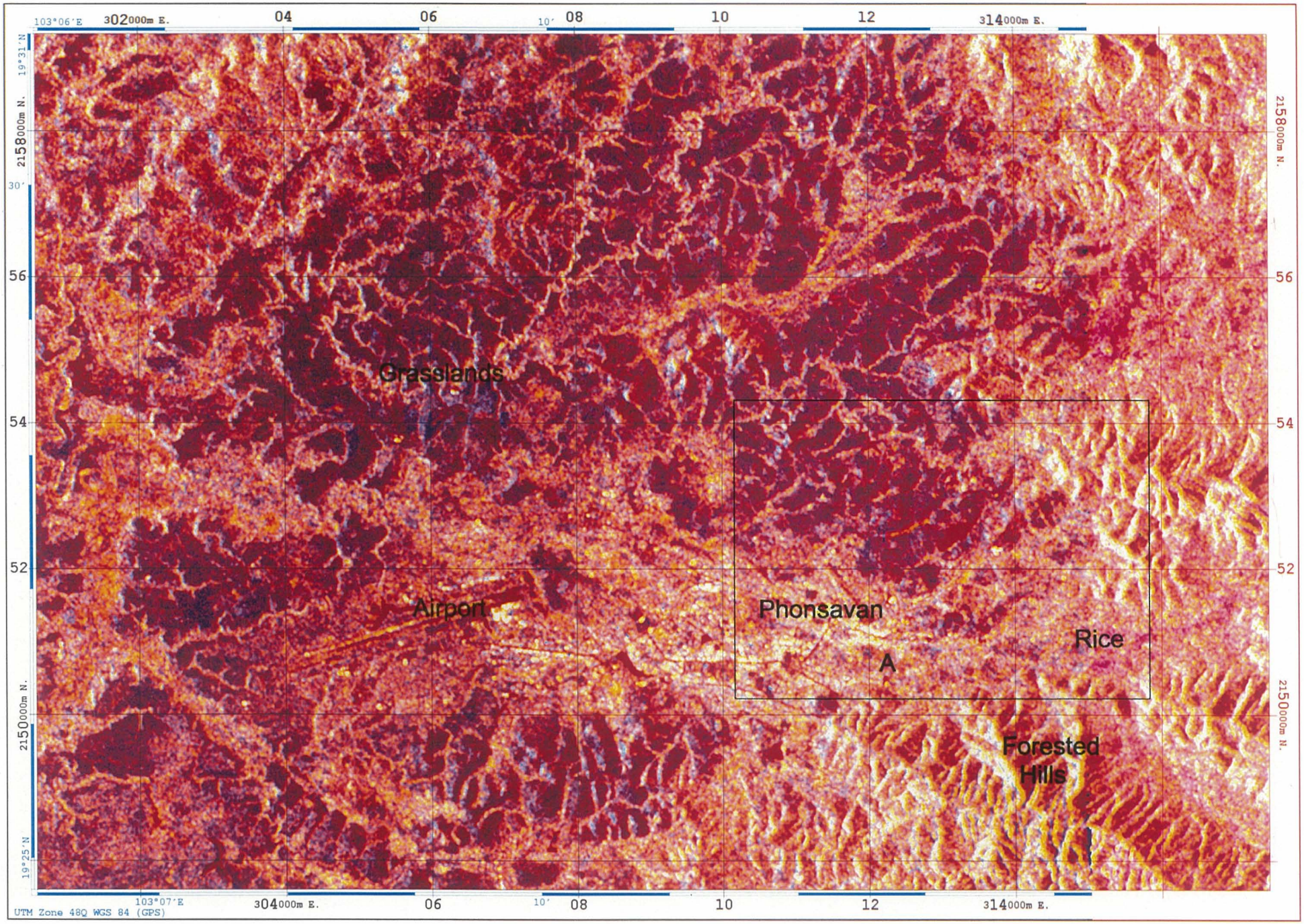
### Annotation and Feature Detection

For a full description of image and annotation points, see Section 3.2.2 of the report.

Detail, F2, 3 August 1997



Looking northwest at Phonsavan town; rice paddy in foreground.




Plain of Jars, Lao PDR

RADARSAT S7/F2-S7-F2 Composite, 23-12-96 (S7) and 03-08-97 (F2)

1:70 000 Scale

Kilometres 1 0 1 2 3 4 5 6

Miles 1 0 1 2 3