
PNC/ECAI Joint Annual Meeting, Bangkok
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Overview: Southeast Asia
Overview: Cambodia’s Great Lake
Greater Angkor Project (GAP)

A collaborative project between:
- The University of Sydney
- The French Institute of the Far East (EFEO)
- APSARA

Theoretical objectives:
- To gain an understanding of Angkor as an inhabited space
- Analyse the material and ecological circumstances of Angkor’s decline
- To develop an understanding of the growth constraints on low-density settlements
Greater Angkor Project

Fieldwork objectives:
- Understanding of environmental changes
- Small-scale residential patterning
- Spatial extent of the settlement
- Population and density
- Patterns and intensity of land-use
- Understanding subsistence: rice and irrigation
- Evidence of stress or decline
Greater Angkor Project

- **Horizontal methods**
  - Low-level aerial survey
  - Surface survey and GPS mapping
  - Hydrological modelling
  - GIS spatial analysis
  - Mapping: Remote sensing
    - Aerial photography
    - Synthetic aperture radar (SAR)
Previous Research

In 1979, the EFEO’s Bernard-Philippe Groslier published a seminal article in which he argued that Angkor’s growth had precipitated an environmental disaster. Groslier believed that the hydraulic network failed and caused the settlement’s demise. His 1979 map was the first to explore the relationship between the large-scale hydraulic network and the small-scale pattern of residence in the north and the south.
Previous Approaches

- Angkor Thom as ‘city’
- B.-P. Groslier
  - Environmental collapse
- Acker, van Liere
  - Non-irrigationists
- Elizabeth Moore
  - Power, symbolic dimensions
Recent Research

The black-and-white map on the left shows the archaeological site from 1971, highlighting the layout and structures of the area. On the right, the 1995 and 1999 maps illustrate changes over time, with the 1999 map showing additional details and a more intricate representation of the site. The maps were prepared by Christophe Potter and his team as part of the EFFO's project to map the site and understand its history and development. The maps were digitalized and made available through The University of Sydney's Archaeological Computing Laboratory (ACL) in 2009.
Archaeological Assemblage
Residential Patterning
Implications

- Angkor Thom not just the ‘city’
- B.-P. Groslier, Michael Coe
  - Environmental collapse feasible
- Acker, van Liere
  - Non-irrigationists – difficult to sustain
Further Questions:

- Spatial & functional interrelationship of components
- Extent -- where does it all end?
  - Occupation
  - Water management system
- Population density and intensity of land use
- Where is the evidence for collapse?
- What’s happening up North?
PACRIM 2 AIRSAR Coverage
Central Strips
Multi-band & polarimetric
Current Map of Angkor

The black-and-white map of 1995, Map in the 1994 Shuttle the first time. Although the map is not complete, it provides an overview of the Angkor region. The map from 1999 shows the expansion of the city and the inclusion of more structures. The map from 2002 illustrates the continued growth and development, with additional elements added to the map. The University of Sydney’s Greater Angkor Project, directed by Roland Fletcher, has provided maps of the north of Angkor that complement Potter’s maps of the south. They are based on interpretation of radar data acquired by NASA in September 2000. Angkor is revealed as a vast low-density settlement stretching across more than 1000 square kilometres — perhaps the most extensive urban complex in the pre-industrial world.
Results

- Several hundred features mapped in the north
- Similar small-scale structure to the south
- A more extensive and quite different water management system
- Extent of occupation > 1000 km²
Evidence for Decline

- Preconditions there; Otherwise, difficult to say
Density of Features

![Density of Features Map]

- Study Area
- 10m Contours
- Water
- Reservoirs
- Water

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Spatial Non-correspondence

Area (sq m)

0 - 4395
4396 - 12701
12702 - 20771
20772 - 29233
29234 - 38285
38286 - 50952
50953 - 66654
66655 - 86783
86784 - 113147
113148 - 140091
140092 - 185440
185441 - 272964
272965 - 385498
385499 - 549107
549108 - 818218
818219 - 1000000

± 05 102.5 Kilometers
Study Area
10m Contours
Water

The University of Sydney
Slope & Occupation

- **Statistics (Slope %):**
  - Minimum: 0
  - Maximum: 8.9
  - Mean: 0.113798
  - St dev: 0.287462
Implications for Theory

- Groslier was right: Angkor is undeniably a ‘hydraulic city’
- Irrigation not highly productive
  - Flooding and reduction in available land
  - May not have been used effectively
- Was it all the ‘one’ settlement, tied together functionally and operationally? Why would failure of the water management system necessarily take down the entire occupation zone?
Further Information

- Greater Angkor Project
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- Damian Evans (GIS & Remote Sensing)
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