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Policy brief

2011, No. 04

INVESTIGATING LAND COVER CHANGE IN CAMBODIA[1]

CHANN Sopheak[2], Nathan WALES[3], Kate GRIFFITHS[4]

KEY MESSAGES

Within Cambodia, land cover[5] change monitoring requires a combination of quantitative approaches using broad scale satellite remote sensing technology, and qualitative approaches using local knowledge. Some key messages from this research are outlined below:

- Effective methods to assess land use and land cover change in Cambodia are needed to ensure that suitable data is available for sustainable catchment management and monitoring.
- Land use and land cover change assessment and monitoring need to involve technically sophisticated quantitative methods such as remote sensing; however, these methods alone do not provide a comprehensive tool for measuring land cover change.
- A combination of quantitative methods such as remote sensing and qualitative methods such as interviews is essential to provide a complete picture of land use and land cover change in Cambodia.

THE PROBLEM

Across Southeast Asia, land cover change is increasing with population growth and the shift from subsistence-oriented to market-based agriculture. In Cambodia, land cover is changing rapidly, particularly as a result of commercial forestry, agricultural expansion and infrastructure development such as irrigation reservoirs and networks. Both the quality and quantity of water resources in Cambodia are linked to the characteristics of land cover and patterns of land use.

Changes in land cover are traditionally measured using technically sophisticated quantitative methods such as remote sensing techniques, Geographic Information Systems (GIS) and statistical analysis. Land use mapping involves classifying land use into generalised categories (typically arable and non-arable land, and primary forest). However, categories of land use such as these are broad and often fail to capture local nuances. Smaller scale studies which focus on the village or commune scale overcome this difficulty by using a combination of remotely sensed imagery, GIS and substantial "on the ground" verification (such as interviews and/or ethnographic studies). This mixed methods approach can show patterns of land use that overcome the oversimplification found in broader scale monitoring and mapping.

THE CASE STUDY

The case study conducted in the Stung Chrey Bak catchment in Kompong Chhnang province in 2008 showed that investment in both water resources and land over the last 20 years has been significant. Existing small-scale Khmer Rouge-era irrigation projects have been rehabilitated and expanded, thus extending the area for rice production and resulting in land use and land cover change.

Several methods were used to investigate land use and land cover change in Stung Chrey Bak catchment to understand both what the changes were and why they were occurring. These methods included GIS and remote sensing (including classifying land cover and calculating vegetation indices from ASTER and Landsat satellite imagery), semi-structured interviews, group discussions and participant observation. Change was measured across three distinct time periods: 1989, 2003 and 2008.

KEY FINDINGS

The case study found that land cover and land use within the catchment had changed significantly over the last two decades. However, the exact patterns of land cover and land use change and the reasons behind these patterns could only be determined by using a mixed methods approach.

1 This policy brief is based on the CDRI working paper by Chann S., N. Wales and T. Frewer (2011): *An Investigation of Land Cover Change in Stung Chrey Bak Catchment*. This working paper presents part of the results of the physical component research of the Water Resources Management Research Capacity Development Programme (WRMRCDP), a five-year project funded by AusAID aimed at improving the use and governance of water resources to increase agricultural production and the sustainable use of natural resources in Cambodia.

2 Environmental Science, Faculty of Science, Royal University of Phnom Penh

3 School of Geosciences, University of Sydney

4 Australian Mekong Resource Centre, School of Geosciences, University of Sydney

5 *Land cover* refers to features on the earth's surface whilst *land use* refers to human activity associated with a specific area of land.

CDRI – Cambodia's leading independent development policy research institute
56 Street 315, Tuol Kork, Phnom Penh, Cambodia
PO Box 622, Phnom Penh, Cambodia
(855-23) 881-384/881-701/881-916/883-603/012 867-278
(855-23) 880-734
E-mail: cdri@wicam.com.kh
Website: http://www.cdri.org.kh

The quantitative data (Figure 1) showed that:

- The area of rice fields and bare ground decreased between 1989 and 2003, and subsequently increased between 2003 and 2008;
- The area of secondary forest and shrub land remained similar between 1989 and 2003, but then decreased in 2008;
- The area of evergreen forest, by contrast, increased by 15 percent from 1989 to 2003 and then remained stable in 2008.

The qualitative results helped identify the nuances and reasons for the changes highlighted by the quantitative data. The main qualitative findings revealed that:

- The pattern of land use and land cover varied considerably from commune to commune and on-the-ground verification was needed to gain a detailed understanding of land cover and land use change.
- The reasons for land use and land cover change, according to informants, were:
  - Illegal logging for valuable timber. Following the departure of the Khmer Rouge from Stung Chrey Bak, illegal logging declined which resulted in an increase in evergreen forest between 1989 and 2003;
  - Forest encroachment, specifically within the secondary forests as a means to "claim" land ownership, between the mid-1990s to early 2000s due to population increase across the study area;
  - Decline in the quality and area of secondary forests because of their value as a source of fuel wood and charcoal for local people;
  - Decline in the quality of evergreen forests even though the area of evergreen forest cover has increased over time in some locations.

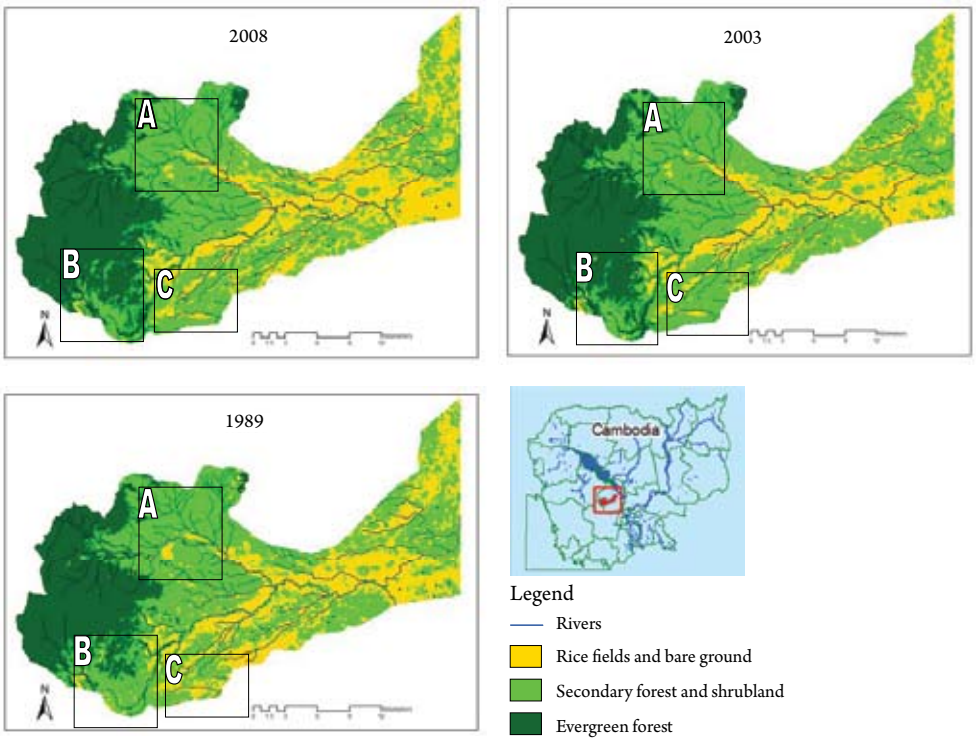
POLICY IMPLICATIONS

- Researchers and policy makers in Cambodia should use satellite remote sensing data and ground truthing techniques, as well as local knowledge, to examine and understand the complexities of land cover and land use change;
- Relying solely on remotely sensed imagery to determine these changes can lead to an oversimplification of observed patterns;
- Remote sensing methods can be expensive and constrained by image availability and lack of technical skills required for data processing and interpretation.

Key actions that the Cambodian government can take to improve land use and land cover data are:

- Encourage and invest in the integration of high quality technical quantitative approaches and qualitative approaches using local knowledge and ground truthing to avoid over simplification and to understand local nuances and specificity. Attention should be paid to strengthening local expertise in land cover and land use change analysis and ensuring quality data.
- Draw upon the Royal University of Phnom Penh (RUPP) and CDRI for the capacities that these institutions have built through this project by using the mixed methods approach to advance knowledge and understanding of land use and land cover change in Cambodia.

Figure 1: Land cover derived from ASTER and Landsat imagery for 2008, 2003 and 1989[6]



6 Boxes A, B and C refer to areas of interest that were identified and examined during fieldwork