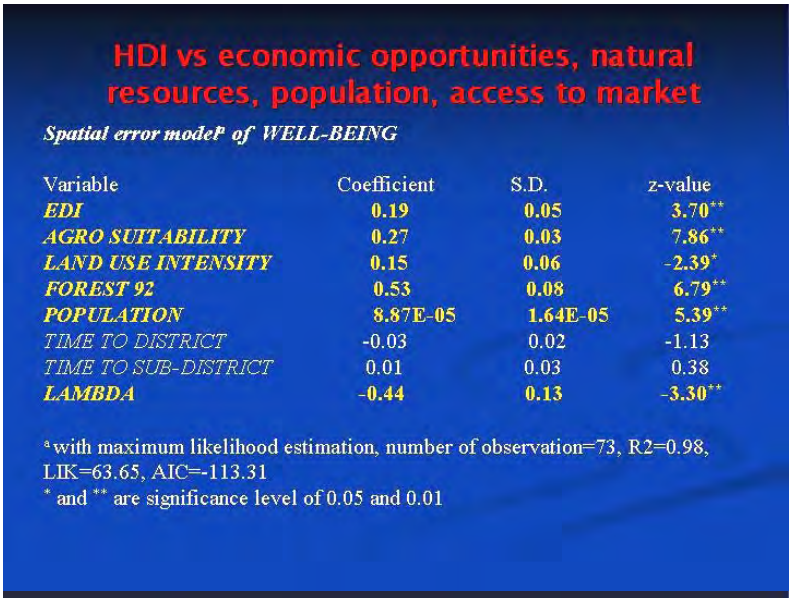
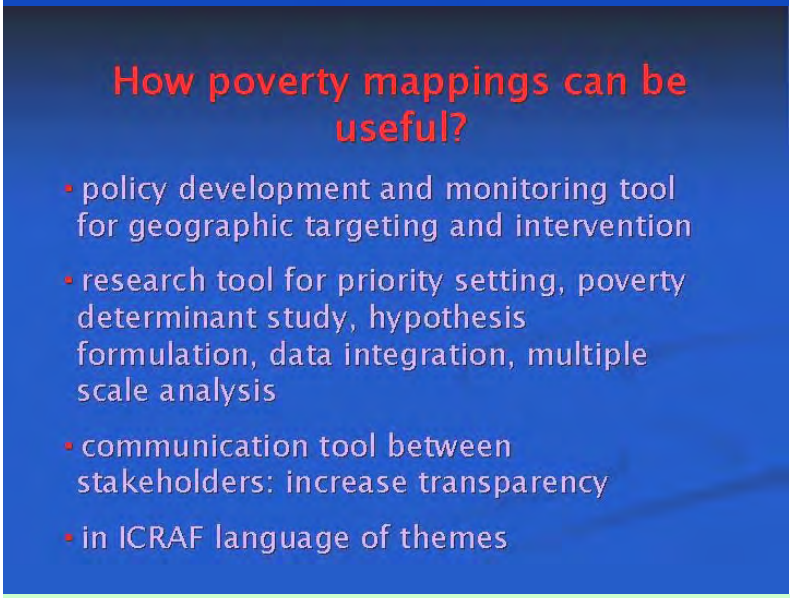


"The human development index (HDI) was positively linked to 1992 forest cover, agro-suitability and population density, and negatively associated with current land use intensity."



"Analyses such as the above can help in developing policies that target the poor and help to maintain forest cover. The relationships prove to be richer and more complex than the 'poverty-driven deforestation' hypothesis suggest. In applying the approach to agroforestry the problem: is a lack of 'agroforestry' maps."

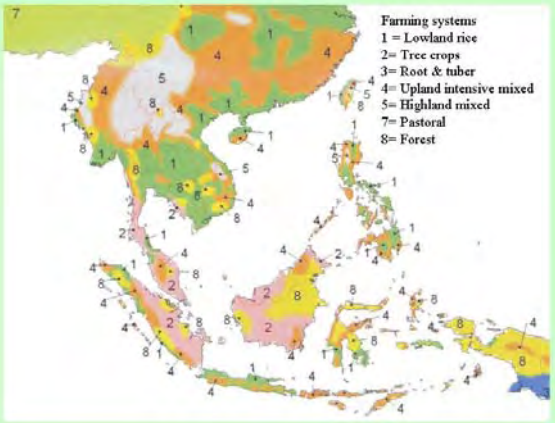
"Rewarding the Upland Poor for the Environmental Services they provide ('RUPES') assumes that poverty and 'upland' conditions are linked. The analysis presented here of agro-ecosystems, population densities and land cover is targeting upland-lowland relationships in Indonesia."

Background

- The world's highest population densities region
- Contains closed forest area and many land cover types intermediate between closed forest and open-field agriculture or urban domains
- The world's highest rate of land-ocean transfer sediment (*Milliman et al. 1999*)
- Increasing interest in landscape level interactions between land users in uplands and lowlands
- Basic data on the total area and the number of people involved in the various combinations of land use types is needed

"South + East +Southeast Asia has the world's highest population densities. Nevertheless, it still contains closed forest areas of various types and high biodiversity value. It has the highest transfer of sediment to the oceans and thus major challenges to 'environmental services'."

Major farming systems in East Asia and Pacific
(source: Dixon et al., 2001)



"In a global comparison of farming systems, southeast Asia is dominated by types 1, 2, 4 and 8, with a noticeable area of 5 in the montane mainland part. We focus here on forest (8), upland mixed systems (4), tree crops (2) and lowland rice (+ urban) (1)."

Objectives

- Distinguish upland-lowland linkages among agro-ecosystems

  Key combinations related to watershed functions
  -- lowland rice (1) downstream of upland mosaics (4)
  -- lowland rice (1) downstream of forest (8)

  Key combinations related to biodiversity functions
  -- tree crops (2) next to forest (8)
  -- tree crops (2) next to upland mosaics (4)
  -- upland mosaics (4) next to forest (8)

- Estimate the area, population density and total number of people involved in the various landscape combinations of agro-ecosystems at district and island level
- Estimate the fraction of actual forest cover in the various agro-ecosystems

"By superimposing an upland-lowland distinction onto this map of agroecosystems we can get a sense of how much of the lowland rice system is downstream of 'forest' rather than 'upland mixed', and how much of the 'tree crops' is in close association with 'forest' (relevant for biodiversity values)."

Datasets and Methods

Datasets:

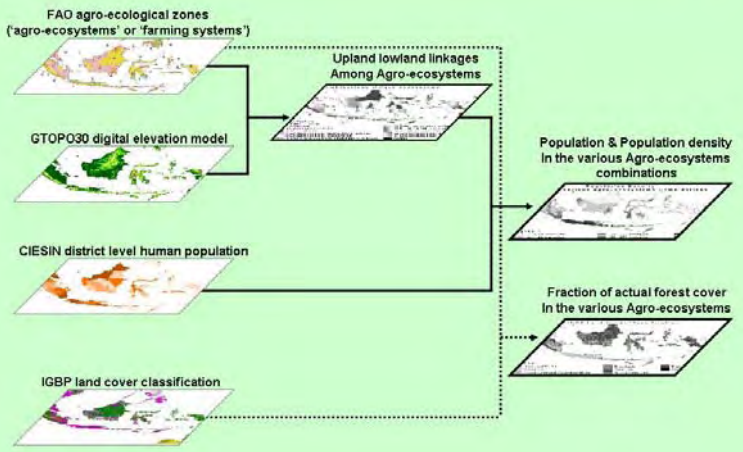
- **FAO classification of agro-ecological zones ('agro-ecosystems' or 'farming systems'), 2001**
- **CIESIN district level human population data, 1995**
- **IGBP land cover classification, 1996**
- **GTOPO30 digital elevation model**

Methods:

- **Spatial analysis using overlay technique**

"Technically, the analysis was basedon the combination and overlays of a number of spatial datasets, all rectified to the same coordinate system"

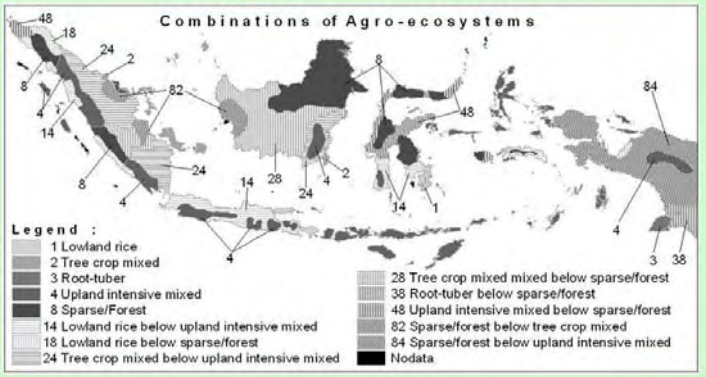
Flowchart



"Combination of the farming system map and a digital elevation model led to the distinction of upland-lowland relations, which were then combined with population data and compared to existing 'standard' land cover maps."

Results (cont.)

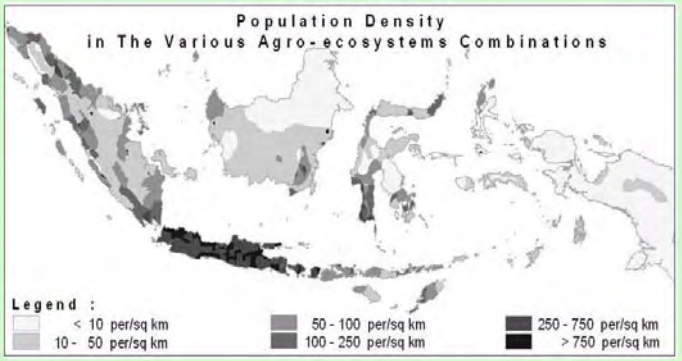
Agro-ecosystems of Indonesia split by subcategory according to upland-lowland links



"Although the FAO farming systems classification is rather coarse, its combination with elevation data resulted in clear patterns of upland-lowland relations, with clear differences between the major islands."

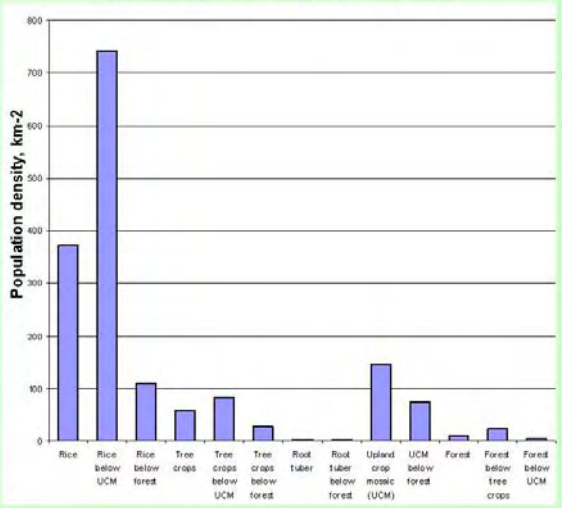
Results (cont.)

Human population density in Indonesia in 1995, ranging from < 10 persons km-2 in parts of Kalimantan, Sulawesi and Papua, to more than 750 persons km-2 in Java/Bali/Lombok.



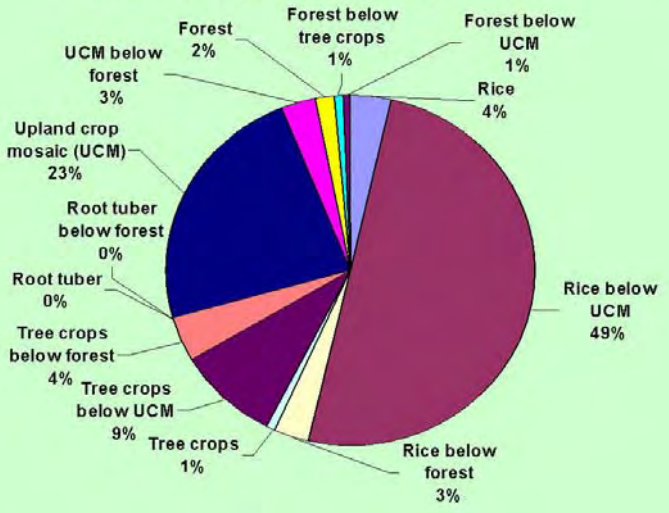
"Human population density is high on Java + Bali (+ Lombok), intermediate in Sumatra and S Sulawesi and generally low in most other parts."

Average population densities in the various landscape-level combinations of agro-ecosystems

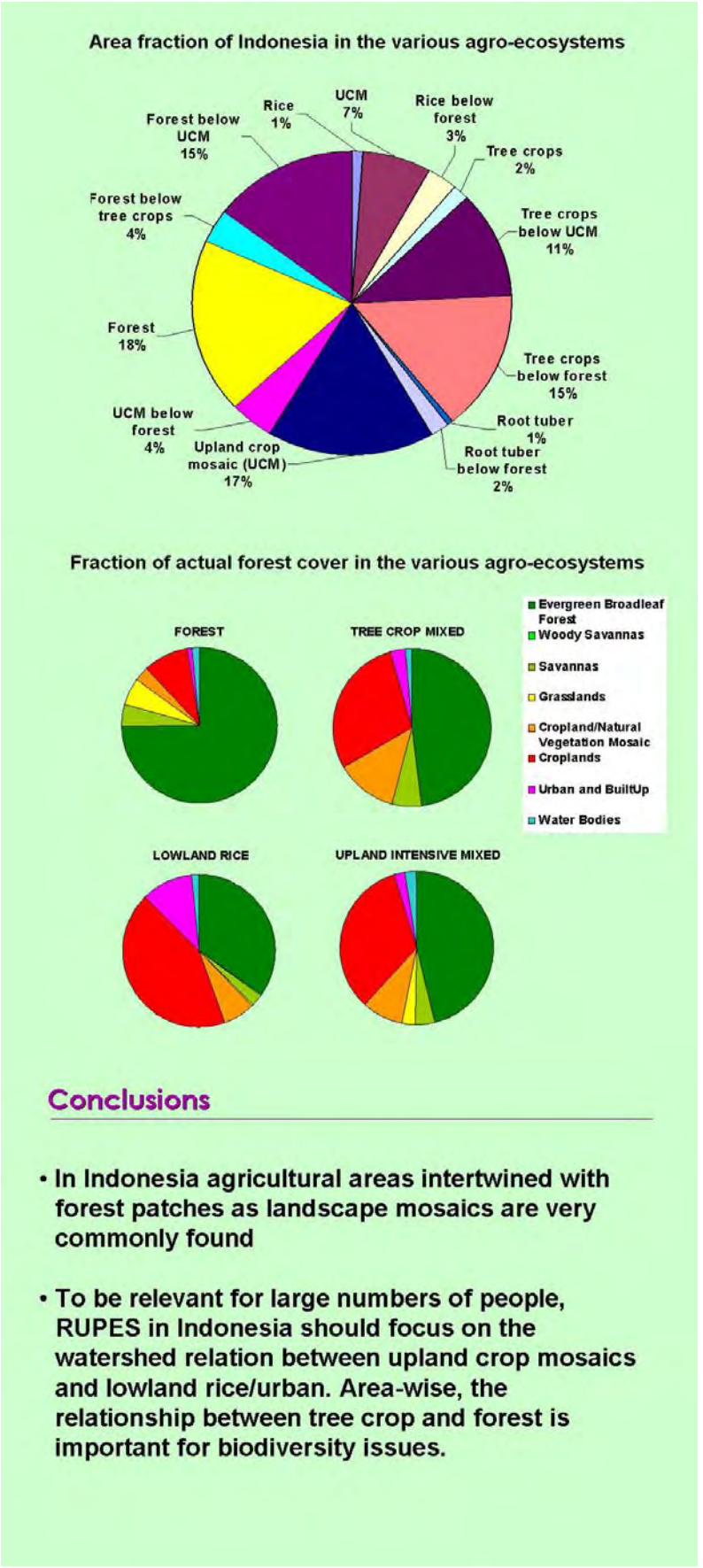


"Combining the population density data with the upland-lowland agroecosystem maps, we see that the highest densities occur in 'rice below upland crop mosaic', while the density in 'rice below forest' is less than that in the 'upland crop mosaic' per se."

Fractions of Indonesia's 195 M people (in 1995 – 2005 estimates are 230M) living in the various agro-ecosystems



"Overall ¾ of the Indonesian population is related to the 'upland crop mosaics', either because they live in a rice (urban) system downstream of upland crop mosaic upland areas, or because they live in such a mosaic themselves. 'Rice below forest' harbours only 3% of the Indonesian people."



"Area-wise the 'tree crops' in association with upland crop mosaics or forest account for a quarter of the land, as does the upland crop mosaics; the 'forest agroecosystem' covers 37% of the land."

"In combination with the IGBP land cover classification, we see that all the 4 major 'farming systems' still contain at least 1/3 of 'evergreen broadleaf forest' – which at 'pixel' level may in fact be a dense homegarden/ village under coconut cover… The forest agroecosystem is ¾ forest."

"The simple conclusion is that nearly all of Indonesia is thus part of an agroforestry landscape mosaic, with variable intensity of land use. In terms of number of people affected, the dynamics of the 'upland crop mosaics' above 'lowland rice + urban' systems' should be our main focus."