

Evolution of mangrove area in a war and land use change affected region of Vietnam (Ca Mau) over a 60 year period

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Ca Mau Cape is located at the southernmost tip of Vietnam between 8°32' to 8°49'N and 104°40' to 104°55'E. It has the potential to support a substantial area of mangroves (Hong and San, 1993) and is considered as a natural mangrove ecosystem that has a high biodiversity conservation value and scenic beauty (Tri, 2009). In the US-Vietnam war strategy (1961-1971), large tracks of forest in the Southern provinces were defoliated, through herbicides (Agent Orange), in order to reveal military shelters and food supplies (Stellman *et al.*, 2003). Ca Mau was amongst the most affected areas. Heavy defoliation has not only exterminated the vegetation, but also destroyed the heterotrophic elements and changed the whole ecosystem (Hong and San, 1993).

Since 1978, the Vietnam government established management activities such as reforestation programmes and conservation actions (Binh *et al.*, 2005). Despite these efforts degradation still continues. The major causes are the intensive exploitation of firewood, the expansion of rice farming and the subsequent higher benefits of shrimp aquaculture driving land use change and forest management cycles (Binh *et al.*, 2005; Koedam *et al.*, 2006). In order to stop further deforestation of mangrove forests the Government reformed the national law in 1991 to assure a strict protection of forests (Hong, 2000). The result was not entirely satisfying: although the rate of destruction of mangroves decreased, it could not be halted or reversed. This is the reason for issuing two new laws in 1998, namely the reinforcement to protect and develop forest area as soon as possible and the objective to reforest an extra 5 million ha forests (more than mangrove) spread over the country (Binh *et al.*, 2005).

In this study, aerial photographs from 1953 and remotely sensed image data of Landsat (1975, 1979, 1988, and 2000) and SPOT (1995, 2004 and 2011) images were used to determine land use and land cover changes over 58 years, especially the change of mangrove area in relation with human impacts. The result is very useful for management of mangroves to improve their contribution towards natural resources, ecotourism and the local livelihood.

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