

Research Application Summary

Improvement of land use information flow for mangroves forest conservation and rural farming in Democratic Republic of Congo

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Abstract

Communities adjacent to the Democratic Republic of Congo's mangrove forest areas depend on subsistence farming systems. These farming systems are characterized by insufficient use of improved knowledge and technology, and low levels of productivity. In addition information necessary for planning land use and conservation of mangrove ecosystem forest is unavailable. Spatial analytical methods, social-economic data and land use information were integrated with the goal of improving land use decision making. The study aimed to establish reliable and upto date information regarding mangrove vegetation cover and distribution; the spatio-temporal changes and documenting local knowledge on use of mangroves. Through a survey conducted in Moanda territory, constraints, such as (content, frequency and impact of land used information) and gaps in land use information service delivery were established. The spatio-temporal analysis revealed no significant change in mangrove spatial extent. The study results will help in the long-term land use planning and the conservation of Democratic Republic of Congo's mangrove forests to benefit the local communities.

Key words: Democratic Republic of Congo, local knowledge, mangrove conservation, rural information flow, spatial analysis

Résumé

Les collectivités voisines des zones des forêts de mangroves de la République Démocratique du Congo dépendent des systèmes agricoles de subsistance. Ces systèmes d'exploitation sont caractérisés par l'utilisation insuffisante de l'amélioration des connaissances et de la technologie, et de faible niveau de productivité. En outre, les informations nécessaires à l'aménagement du territoire et la conservation des écosystèmes forestiers de mangrove ne sont pas disponibles. Les méthodes d'analyse spatiale, des données socio-économiques et des informations d'utilisation des terres ont été intégrées dans le

but d'améliorer la prise des décisions de l'utilisation des terres. L'étude visait à établir des informations fiables et jusqu'à ce jour concernant la couverture de végétation de mangrove et de la distribution, les changements spatio-temporelle et documenter les connaissances locales sur l'utilisation des mangroves. Grâce à une enquête menée sur le territoire de Moanda, des contraintes, telles que (le contenu, la fréquence et l'impact des informations sur l'utilisation des terres) et des lacunes dans le service d'information sur l'utilisation des terres ont été établis. L'analyse spatio-temporelle n'a révélé aucun changement significatif dans l'étendue spatiale de la mangrove. Les résultats de l'étude aideront à l'aménagement du territoire à long terme et à la conservation des forêts de mangroves au profit des communautés locales en République démocratique du Congo

Mots clés: République Démocratique du Congo, les connaissances locales, la conservation des mangroves, les flux d'information en milieu rural, l'analyse spatiale

Background

In the Democratic Republic of Congo, the mangroves are declining due to conversion to other land uses and forest degradation (MINAFENV, 2001). The presence of rural livelihood activities and non-rural land use in the Congo's mangroves forest can often generate conflict due to their potential incompatibility. According to FAO's mangrove assessment study, Africa has lost about 500 000 ha of mangroves over the last 25 years (or about 13.8 percent), with the major losses occurring in Gabon, Sierra Leone, Bissau-Guinea, Senegal and the Democratic Republic of the Congo where annual deforestation is about -0.2%. (FAO,2007).

Literature Summary

Land use and land cover maps are fundamental for the purpose of coastal management planning (Cicin-Sain and Knecht, 1998; Mumby *et al.*, 1999; Stevens and Connolly, 2004). Mangrove management covers vast, mostly inaccessible areas, and where ground measurements become difficult and expensive (Held *et al.*, 2003). This statement is strongly supported by a large number of successful applications of remote sensing for mangrove studies, particularly in mangrove resource inventory and change detection (Green *et al.*, 2000). Organizations like the IUCN (IUCN, 1980) and the WCDE (WCDE, 1987) also stress that the sustainable management of natural resources can only be achieved by developing a science based on the priorities of local people, and creating a technical base that includes both traditional and modern approaches to problem-

solving. Incorporating indigenous and scientific knowledge means integrating information collected from farmers with scientific information and techniques. This means that there must be a way to process indigenous information the same way it is done for scientific information (Lawas and Luning, 1996).

Study Description

The study was conducted in Moanda territory of the Democratic Republic of Congo, located between geo-coordinates 6° 25' – 5° 20' S and longitude 12° 05' – 12° 70' E on the Atlantic coast in Bas-Congo Province. The Democratic Republic of Congo's coastline enjoys a humid tropical climate of the AW4 type according to the Koppen classification. It is characterized by a strong contrast between two distinct seasons: the rainy season from October to May and the dry season from June to September. Humidity is high throughout the year, and varies between 77 and 81%. The average annual precipitation is between 1,750 and 2,100 mm. The area of study covered the Republic Democratic of Congo's mangrove marine national reserve. It is a multiple use reserve, class VI based on the IUCN classification.

Results

The temporal mangrove Land covers variability. Images were classified into 10 land use/cover Classes, with a global Overall accuracy of 78%: (1)Tropical forest, (2) mangroves, (3) Marshland, (4) Farming area, (5) open grassland, (6) settlement, (7) swamp, (8) Disturbed Forest, (9) Shrub land and (10) Water body. (Fig. 1)

Table 1 shows land cover types that have occurred from 1988, 2002 and 2010: mangrove forests covering approximately 23491.42; 23352.43; and 23351.40 ha in the 1988, 2002 and 2010 time periods, respectively. Comparison of the data between the three time periods shows that there has not been a dramatic change in mangrove cover over the last 22 years, although this does not necessarily mean that the mangrove ecosystem is in a good condition.

Forest cover declined by 113160 ha to 93690.22 ha in 2002, however from 2002 to 2010, the forest loss amounted to 94190222.5 and 93690.22 ha, respectively. The greatest threat to the largest forest stands was housing and industry expansion in the Moanda territory. It is hypothesize that the progress realized from 2002 was due to the result of the global policy reform undertaken by the COMIFAC for the Congo basin forest preservation over the last 10 years. On the other hand open

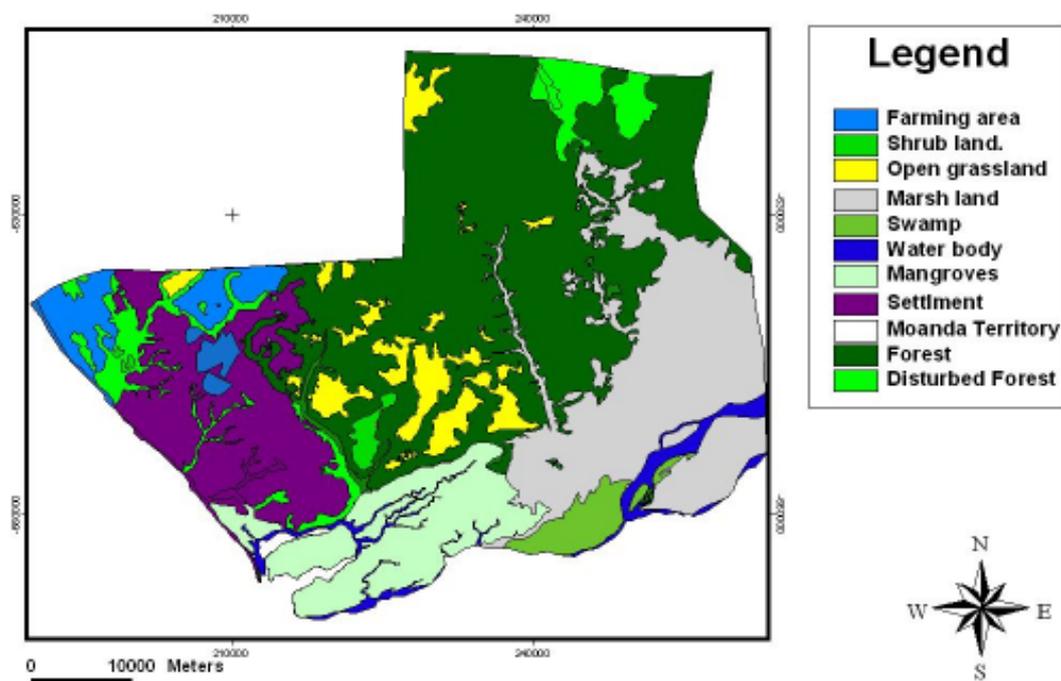


Figure 1. Moanda territory Land use/cover in 2010.

Table 1. Land use/cover change trend 1988-2010.

Land use	1988		2002		2010		% change		
	(ha)	(%)	(ha)	(%)	(ha)	(%)	1988-2002	2002-2010	1988-2010
Disturbed Forest	14824.2	6.1	14219.4	5.9	14026.11	5.8	0.20	0.10	0.3
Farming area	3986.74	1.6	7998.68	3.3	8452.91	3.5	-1.7	-0.2	-1.9
Forest	113160	46.6	93690.22	38.6	93580.82	38.5	8	0.1	8.1
Mangrove	23491.42	9.7	23352.43	9.6	23351.40	9.6	0.1	0.0	0.1
Marshland	27943.92	11.5	46344.85	19.1	46298.37	19.1	-7.6	0.0	-7.6
Open grassland	33405.42	13.8	14268.55	5.9	14179.78	5.8	7.9	0.1	8.0
Settlement	11716.16	4.9	30669.6	12.6	30679.7	12.6	-7.7	0.0	-7.7
Shrub land	3049.8	1.2	1304.91	0.5	1279.5	0.6	0.7	-0.1	0.6
Swamp	4968.4	2	4697.42	1.9	4697.42	1.9	0.1	0.0	0.1
Water body	6343.74	2.6	6343.74	2.6	6343.74	2.6	0.0	0.0	0.0
Total	242889.8	100	242889.8	100	242889.8	100	0.0	0.0	0.0

grassland declined from 33405.42 in 1988 to 14179.78 ha in 2010. It is the result of the conversion of large areas of open grassland to residential and agricultural use.

Socioeconomic. About 77% of the respondents interviewed had low educational level; a meager 2% had postsecondary education. It is argued that educated farmers can understand

agricultural and conservation instructions better than the uneducated ones. In all study sites mangrove provide sources of food and/or medicine (54%), charcoal and firewood (28%), timber for building (11%) and fodder for domestic animal (5%).

Approximately 86% of the farmers interviewed were not satisfied with the content and the impact of information delivered by locals NGOs and the mass media. However, a few farmers (<20%) interviewed were satisfied with the frequency of delivery. It is also important to note that the majority of respondents were dissatisfied with government institutions in terms of content of information, frequency of delivery and impact of information (Table 2).

Table 2. Level of satisfaction with land use information services delivery in (%).

	Mass media	Local NGOs	Government Institutions
Content of information			
Very satisfied	33.15	48.50	2.00
Satisfied	51.83	36.07	11.65
Not satisfied	15.02	15.43	86.35
Frequency of delivery			
Very satisfied	7.14	16.79	4.16
Satisfied	12.11	35.09	9.97
Not satisfied	80.75	48.12	85.87
Impact of information			
Very satisfied	5.98	42.35	9.69
Satisfied	36.48	40.13	23.4
Not satisfied	57.54	17.52	66.91

Research Application

These results can be used to exploit spatial relationships between mangroves and its environmental gradient in order to yield information that will ensure the long-term quality of the land for human use, the prevention or resolution of social conflicts related to land use, and the conservation of ecosystems.

With the baseline information, regular monitoring and proper management decisions should be pursued for the sustainability of the mangrove resources and rural livelihood in Democratic Republic of Congo. Sustained enforcement of regulations, frequent monitoring, clear demarcation of forest boundary and discontinuation of the non-resident cultivation are recommended as the necessary steps to check deterioration in the forest reserve. Information exchange through exchange tour within the study sites and with other districts, and introducing simple participatory planning tools are some of the activities that should

be initiated in order to ensure sustainable natural resources management. Further studies about mangrove ecosystem functions and density of the mangrove trees need to be conducted to answer biological questions on sustainable development.

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