Contributed paper

Land Use Change and their Determinants in the Coastal Area of Guinea: 
A Study based on Spatial Analysis and Field Survey

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Summary

Lack of statistical data constitutes the main constraint to assess the effects of land use change in developing countries like Guinea. Here we examine the role of land use change in improving the livelihood of local mangrove rice farmers in the Guinean coastal zone based on both satellite and field survey data. We investigated land use change dynamics using spatial analysis and field survey data for the Dubreka prefecture, Guinea, from where statistics and maps are not sufficiently available. For this research, Landsat Thematic Mapper (TM) remote sensing data were used to perform the imagery analysis on land use change. In addition, a field survey was conducted to collect socioeconomic data on households and farm management. Our results showed a substantial recent land use change with 41.7% of the total area (5,099 ha) undergoing transition. The logistic regression analysis revealed that membership in the farmers’ organizations and crop yields are the two main factors determining land use transition from mangrove forest to paddy land. This study presents several guidelines or policy directions for improvement of farmer’s livelihood and mitigation of rapid land use change in the Guinean coastal belt. These include; improvement of mangrove rice productivity by incorporating modern farming technologies, strengthening and maintaining strong embankments to prevent sea water intrusion into the rice fields, and strengthening farmers’ organizations to enhance farmer participation.

Key Words: Field survey, Land use change, Livelihood improvement, Logistic regression, Mangrove rice farming, Spatial analysis.

1. Introduction

In Guinea, 85% of the 10 million inhabitants work in the agricultural sector, mainly dedicated to produce rice, the country’s staple food. Rice provides 35% of the population’s daily calorie intake; however, national consumption (800,000 t) exceeds rice production (650,000 t in 2001) (MAL 2009), leading to concerns about food security. Thus, recent governmental measures have been directed towards promoting rice production, particularly through the use of irrigation, to ensure higher productivity and stable production discouraging the current volatile and low productive rain-fed agriculture. In Guinea, rice cultivation is practiced under four majors cropping systems: (1) The traditional rain-fed rice farming, known as dry rice farming, is by far the most widespread system (65% of the cultivated area). It is mostly carried out on mountain hillsides, and forested areas after slash and burning. Cultivation is done manually and no fertilizer is used. Yields may vary from 500 to 900 kg/ha depending on natural soil fertility and rainfall. (2) The lowland rice system accounts for 10% of rice crop land. Yields
usually range between 1.5 and 2.5 t/ha. The Guinean forest accounts for the largest stretch of lowland compared to other natural regions in the country. (3) The “upland” rice system (the term “upland” is used to represent Upper Guinea region) is grown on river valleys and differs from dry rice farming. This system is the most dominant system in Upper Guinea and in the Gaoual/Koundara areas. It accounts for 9% of the total rice cultivated area and its yields vary between 500 kg/ha and 2 t/ha depending on the water levels of the Niger and its tributaries. It is highly sensitive to changes in climatic conditions and flood levels. (4) The mangrove rice farming makes use of cleared mangrove forest land. It includes plains spread into the mangrove forests where rice can be cultivated. Mangrove rice farming represents 16% of the total rice crop area in Guinea (MAL 2009) and 18% of the total rice production in the country. It is considered the most important rice crop system due to the wide variability in yield (1.5-3.5 t/ha). This system is limited to the coastal area of Guinea. Mangrove swamp rice production is found in flood plains inundated at high tide and drained at low tide. Most mangrove swamps experience a salt-free growing period during the rainy season when freshwater floods displace tidal flows. These soils are generally more fertile than those of other cropping systems, since they benefit from regular deposits of silt during annual flooding; however, they are also characterized by the presence of high salinity and sulfate acidity. Soil fertility in these soils could be maintained if sea water rich in sediments is allowed to flood the land also during the dry season.

The multiple natural resources (firewood, rice, salt, fish, etc.) of Guinean coastal area are under pressure due to rapid demography transition and urbanization. The capital city, Conakry urban expansion is taking over nearby Dubreka (our study site) and Coyah prefectures, highlighting the pressing need for studying the causes and consequences of land use change in Dubreka. This paper focused particularly on land use change related to mangrove rice cultivation, as it constitutes the main livelihood of these coastal communities. The growth of mangrove rice farming coupled with urban migration has already transformed the entire upland area. Hence, investigating the spatial dynamics associated with the provision of natural resources such as arable land, mangrove forest etc. will contribute to improve these populations’ livelihood in a sustainable manner.

The advances in remote sensing and global positioning systems (GPS) have given rise to the advent of more precise and geographically referenced data on land cover and use, which in turn have created many opportunities for improved assessments and analysis. With the aid of these new tools, researchers have now started to unravel the processes that drive the cycle of land use change and resource degradation. Airborne and satellite remote sensing data have been proven to be a valuable technique for monitoring forest clearing, shifts in cultivation, and land use conversion patterns; therefore, it has been gradually integrated with socio-economic surveys, census data and other biophysical information, to bring about a better understanding of land use/cover dynamics and the factors that drive them (Samuel 2007).

Studies detecting land changes based on remote sensing and GIS have predominantly focused on examining how much, where, what type of land use and land cover change has occurred. However, only a few models have been developed to examine how and why the changes have occurred. The models dealing with land use and land cover change fall mainly into two groups: regression-based and spatial transition-based models (Baker 1989, Lambin 1997, Theobald and Hobbs 1998). Most land use models, which relates the geographical locations of land use and land cover change detected to a set of spatially explicit variables (Landis 1994). Therefore, due to the lack of available land use change monitoring data from the study area integrated both spatial transition and regression-based models.

This paper aims to analyze the contribution of land use change to livelihood improvements in the Guinean coastal area in Dubreka prefecture. It has the following specific objectives: (1) to determine land use change using satellite data and (2) identify which factors influence land use change using field survey. Ultimately, this study aims to provide a set of guidelines for policy-makers to take a balance development approach in view of the policy thrust, and to improve rice production in the rural area of Guinea.
2. Methodology

2.1 Study site:

The Dubreka prefecture (Fig. 1) is located in the North-East of Guinea, 50 km from the capital city of Conakry but under the influence of its suburban fringe. It is a coastal area and covers a total area of 3,973 km². Dubreka is limited to the West by the Atlantic Ocean; to the East by the prefectures of Coyah, Kindia, and Telimele; to the North by the prefectures of Fria and Bofia and to the South by the town of Conakry. According to the 1996 general census, the population of this prefecture is 131,750 comprising 16,564 households. 70% of its population lives in rural areas. The study site is located in the urban commune of Dubreka, with a population of 23,072 inhabitants in 1996 [Note 1] and was estimated to be 172,593 by 2008 [Note 2].

This area presents a wet subtropical climate with abundant seasonal rainfall. Its soils are suitable for cereal cultivation. The area is exposed to the sea through a 50 km stretch of land containing a hydrographic network that favors the practice of maritime fishing. The land serves multiple purposes, but the main agricultural activity in the area is the cultivation of mangrove rice.

Both traditional and improved mangrove rice farming require a complex management to utilize both sea and fresh waters. The traditional mangrove rice farms (TMRF) are enclosed by small embankments constructed by the farmers. They make ridges in the plots where rice is planted, to control the inflow of sea water and protect the rice field from crabs. Often palm tree trunks, and occasionally pipes, are used for the drainage systems. In contrast, the irrigated perimeter developed by the government for the improved mangrove rice farming (IMRF), is surrounded by a large embankment preventing the intrusion of sea water into the rice fields. These fields are separated by dikes and flood gates. Thus, during the dry season, the sea water intrusion is allowed for weed control and to prevent soil acidification, and during the cropping season, the gates remain closed to prevent sea water intrusion. However, farmers from the IMRF have reported that high tides during July and August lead to the intrusion of sea water, inflicting damage to the embankment, the dikes and to the rice production. Fig. 1 shows the location of each recorded IMRF (Doboro and Dofily) and TMRF rice field (Dofily village).

2.2 Data Collection and Analytical Methods

2.2.1 Remote sensing and interview data

Satellite image data from Landsat Thematic Mapper obtained between December 24, 1990, and December 22, 2010, and corresponding to path 202 and row 53 were used to detect land use change in the area. In addition, data was also collected from March to April 2011 using
a field survey questionnaire covering 40 farmers, 15 from the Doboro district and 25 from Dofily. The interview covered four main sections. The first section inquired about general household information. The second section covered information regarding land use and farm management. The third section covered information on economic aspects, and the final section inquired about social aspects and the farmers’ perception about government policies on land use. In addition to this field observation 348 data points were recorded through a GPS Garmin as ground truth control, to better understand the land cover of the area and to produce an accurate land use classification for the two selected years.

2.2.2 Analytical Framework

Fig. 2 describes the analytical framework adopted to integrate of the remote sensing and socio economic data to identify patterns of land use change. First, we obtained remote sensing data, based on satellites images of 1990 and 2010, obtained through Thematic Mapper™ sensors and defined by the orientation numbers of path and row as mentioned in section 2-2-1. These raw data were corrected for internal and external distortions. The geometric correction, or rectification, was performed by using Ground Control Points (GPCs) from the 1/50,000 topographical map (IGN France 1953). The rectified images were then projected on the plane coordinates using the common Universal Traverse Mercator (UTM) projection. These data were resampled using the nearest neighbor algorithm, maintaining the original brightness values of each pixel (Weng 2002). Keys to a successful supervised classification are how well training samples can be obtained on site. Training samples significantly affect the accuracy of the final output, namely, the land cover maps.

A supervised signature extraction using the maximum likelihood algorithm was employed to classify the Landsat images. Subsequently, eight classes of land use patterns were generated for comparison: (1) Build up area, (2) Mangrove forest, (3) Paddy fields, (4) Palm trees, (5) Savannah forest, (6) Slashed area (cleared mangrove forest for rice farming), (7) Upland area and (8) Water bodies. Land use maps were overlaid and compared using ERDAS IMAGINE 9.2. Some of the training data were collected by on-screen selection of polygonal training data (Weng 2002). A total of 100 training sites were chosen for each image, to ensure that all spectral classes constituting each land use and land cover category were adequately represented in the training statistics. The accuracy of the two classified maps was checked with a stratified random sampling method. Through this method, sample points were trained for each land use and land cover category. The reference data was collected from a field survey and from existing land use and cover maps and field-checked (IUCN 2010, Weng 2002). Large scale aerial photos (IGN France 1953, JICA 1982) were also used as reference data to assess the accuracy when necessary. A cross-tabulation detection method was used to detect land use and cover change (Juan et al. 2005), through which a land use change matrix was produced. The change matrix enables to understand the main types of changes (directions) in the study area. Quantitative areal data, of the overall land use and land cover changes, as well as gains and losses (Braimoh et al. 2004, Weng 2002) for each category between 1990 and 2010 was compiled. Finally, the accuracy of the land use change maps was validated using an error matrix and kappa coefficient. The Kappa coefficient is a discrete multivariate technique used in accuracy assessment. This coefficient typically ranges between 0 and 1, where the latter indicates a perfect match. It is often multiplied by 100 to give a percentage measure of the classification accuracy. Kappa values are also characterized into 3 groups: (1) a value greater than 0.80 (80.0%) represents a strong agreement, (2) a value between 0.40 and 0.80 (40.0 to 80.0%) represents moderate agreement, and (3) a value below 0.40 (40.0%) represents poor agreement (Congalton 1996). There are many techniques available to detect land use change, such as image differencing, post-classification comparison, etc.; however, post-classification comparison can provide a complete matrix of change directions. These change directions represent gains (increases) and losses (decreases) for each land use class. In addition, a logistic regression was used to examine determinants of land use change. For this purpose, socio economic variables were grouped into three levels (farm, household and community) and used in the following equation: \( \ln \left[ \frac{p}{1 - p} \right] = a + B_2X_2 + e. \)
Where, $X_n$ represents the independent variables (farm size, family size, education level, membership in farmers’ organization, migration, and yield) in the regression model and $B_n$ their coefficients showing the marginal effect. $Y_{i(1\text{ or }0)} = \ln[p/(1 - p)]$ refers to the dependent variable with a value of one indicating that the farmers contributed to the land use transition and a value of zero indicating otherwise.

The farmers’ contribution to the land use transitions (Table 1) is based on two premises: (1) Contribution to the land use change transition (LUCT), which was attributed a value of one as mentioned above, and was categorized into three land transition groups. The mangrove forest to paddy fields ($M\rightarrow P$) transition designates migrant or native farmers cultivating plots allocated by the management committee. The mangrove forest to slashed area ($M\rightarrow S$) transition considers members in farmers’ organization that has obtained permission [Note 3] to slash a very limited stand of mangrove forest for rice cultivation. The slashed area to paddy fields ($S\rightarrow P$) transition includes land owner farmers who practiced the traditional mangrove rice farming. (2) No contribution to land use change transitions implying no transition (Table 1) and is attributed the value zero. They included non-members in farmers’ organization and non-land owners, irrespective of whether they are native or migrant farmers.

<table>
<thead>
<tr>
<th>Table 1 Farmers’ contribution to LUCT</th>
<th>(M\rightarrow P)</th>
<th>(M\rightarrow S)</th>
<th>(S\rightarrow P)</th>
<th>No transition</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>Binary logistic regression (1; 0)</td>
<td>1= contribution to LUCT</td>
<td>0= otherwise</td>
<td></td>
</tr>
<tr>
<td>Plot number</td>
<td>8</td>
<td>5 (1)</td>
<td>22 (2)</td>
<td>3 (1)</td>
</tr>
<tr>
<td>(3)</td>
<td>(3)</td>
<td>(4)</td>
<td>(4)</td>
<td>(1)</td>
</tr>
<tr>
<td>number</td>
<td>6 (1)</td>
<td>3 (4)</td>
<td>6 (1)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>4 (1)</td>
<td>2 (6)</td>
<td>4 (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 (1)</td>
<td>1 (10)</td>
<td>1 (6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[a] Value in parenthesis indicates number of farmers
3. Results

3.1 Socioeconomic background

The average family size is 13.8 members and 55.0% of surveyed peasants were migrants (Table 2). These variables seem to affect the farm size in the mangrove rice farming, as 52.5% of farmers are cultivating less than 1 ha and 42.5% between 1 to 2 ha.

The only farmer recorded to own 6 ha of land previously owned 12 ha. He handed over half of his farm to the government in exchange for developing irrigation in its perimeter. The handed over plots were subsequently distributed to landless farmers. This is why 82.5% (Table 2) of the surveyed farmers received plots from the state endorsed by the management committee. Around the irrigated perimeters in the IMRF, peasants are not allowed to slash the mangrove forest without permission, limiting their access to the mangrove forest. However, the 8 ha under the TMRF were reported as the biggest farm size. Around this

![Fig.3 Land use maps](image)

Table 2 Socioeconomic background of surveyed mangrove rice farmers

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Attributes</th>
<th>Farmers[a] (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Head of household age</td>
<td>35</td>
<td>82</td>
<td>58.45</td>
<td>7- Farmer organization: Member</td>
<td>23 (57.5)</td>
</tr>
<tr>
<td>2- Family size</td>
<td>5</td>
<td>27</td>
<td>13.75</td>
<td>Non-member</td>
<td>17 (42.5)</td>
</tr>
<tr>
<td>3- Farm size : &lt; 1 ha</td>
<td>21</td>
<td>52</td>
<td>25.5</td>
<td>8- Access to credit: No</td>
<td>32 (80)</td>
</tr>
<tr>
<td>1 - 2 ha</td>
<td>17</td>
<td>42.5</td>
<td></td>
<td>Yes</td>
<td>8 (20)</td>
</tr>
<tr>
<td>6 ha</td>
<td>1</td>
<td>2.5</td>
<td></td>
<td>9- Access to extension service: No</td>
<td>16 (40)</td>
</tr>
<tr>
<td>8 ha</td>
<td>1</td>
<td>2.5</td>
<td></td>
<td>Yes</td>
<td>24 (60)</td>
</tr>
<tr>
<td>4- Land tenure system: State</td>
<td>33</td>
<td>82.5</td>
<td></td>
<td>10- Use of improved seed varieties: No</td>
<td>34 (85)</td>
</tr>
<tr>
<td>Rental</td>
<td>4</td>
<td>10</td>
<td></td>
<td>Yes</td>
<td>6 (15)</td>
</tr>
<tr>
<td>Owner</td>
<td>3</td>
<td>7.5</td>
<td></td>
<td>11- Fertilizer usage: No</td>
<td>36 (90)</td>
</tr>
<tr>
<td>Native farmers</td>
<td>18</td>
<td>45</td>
<td></td>
<td>Yes</td>
<td>4 (10)</td>
</tr>
<tr>
<td>Migrated farmers</td>
<td>22</td>
<td>55</td>
<td></td>
<td>12- Agrochemical usage: No</td>
<td>34 (85)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>6 (15)</td>
</tr>
</tbody>
</table>

[a] Farm households = 40. Source: Author’s survey (2011)
TMRF, farmers slashed over larger extents because the mangrove forests are controlled by the farmers themselves.

The application of improved seeds, fertilizer and agrochemicals by farmers represents only 15.0%, 10.0% and 15.0% respectively, indicating that the usage of modern farming technologies remains low in the study area (Table 2). Due to the reduced use of modern farming technologies (Table 2), their contributions to crop yield were not examined.

3.2 Determination of land use change based on satellite data

The land use maps obtained through the supervised classification displaying the different classes found in the study area are shown in Fig. 3. The recorded data of the rice fields shown in Fig. 1 are also displayed in these land use maps (Fig. 3). The total area display in the each figure is 5,099 ha. This paper mainly investigated the mangrove rice farming indicated in yellow (Fig. 3). The slashed area also constitutes an extension of the mangrove rice farming areas. This slashed area was the result of the actions by both TMRF farmers and peasants belonging to farmer’s organizations under the IMRF, who obtained permission to slash a new area by adhering to the conditions described in section 2.2.2. During our field visit, we observed that the TMRF farmers have access to larger farms (e.g., 8 ha, Table 2); however, they still slashed new stand of mangrove forest to extend their farm size.

Table 3 shows the land use change matrix of 1990 and 2010, indicating a considerable change (42% of the total area) during the 20-year period. Mangrove forest, savannah forest and palm trees have decreased in the area by 19.8%, 41.1% and 63.9%, respectively. In contrast, other land uses such as paddy fields, build up area, slashed area targeted for rice farming, upland area and water bodies have increased by 77.1%, 87.7%, 99.8%, 448.2% and 11.5%, respectively. The significant increase of upland area (448.2%), build up area (87.7%) and slashed area (99.8%) can be attributed to factors such as local population growth, whose annual growth rate is estimated to be 54% [Note 4], and immigration of farmers’ (55.0% in Table 2). The increase in paddy fields (77.1%), along with slashed area targeted for mangrove rice cultivation, could also be attributed to these factors. The main land use types that have been transformed into paddy fields include mangrove forest (37.0% of paddy field) and slashed area (26.0% of paddy field). Accuracy assessment is a very important tool to understand these results and use them for decision-making. The validation of the land use/land cover maps for 1990 and 2010 was carried out using our reconnaissance survey data as reference for the image interpretation, by observing the actual land classes of the study site and comparing them with the land classification, as assigned in the thematic map.

There are a number of ways to quantitatively express the level of agreement between the ground truth classes and the remote sensing classes. The most common accuracy assessment elements include overall accuracy and Kappa coefficient. The overall accuracies of the analysis in this paper are 72.0% and 87.0% (see Table 3) for the land use maps of 1990 and 2010, respectively. The high accuracy for the 2010 land use can be attributed to the availability of field data. Based on Congalton (1996) and in terms of kappa coefficient, we can conclude that the accuracy assessment of land use map 2010 shows a strong level of agreement (83.0%). In the case of the 1990 map, its accuracy shows a moderate agreement (62.0%).

3.3 Factors influencing land use change based on the field survey

Table 4 shows a positive regression coefficient between farm size and land use transition (although not significant), meaning that an increase in farm size will increase the likelihood of land use transition from mangrove forest to paddy fields. Membership in farmer’s organization shows a significant negative regression coefficient implying that being a member of a farmers’ organization could significantly contribute to a decrease in land use transition. However, farmers under the TMRF system manage more plots than those under IMRF. These farmers were slashing more area, as they inherited the land, while they are not members of a farmers’ organization. In addition, the traditional irrigation system was more prone to damage during high tide, leading to an extremely low production. In some instances, they could not get any harvest during particular seasons due to strong high tides (in 2009 and 2010, tides had a negative impact on the production).
The peasants involved in the traditional irrigation system are illiterate farmers and are not members of any farmers’ organization. Therefore, assistance and supervision by farmers’ organizations could limit the extent of the land use change.

Yield showed a significant negative regression coefficient with land use change, implying that the increase in crop yield decreases the probability of land use transition and therefore, a decrease in the crop yield leads to land use transition. When yield decreases, farmers need more land to meet to their food needs. The yield is mainly affected by sea water intrusion into the rice plots during the cultivation season, mainly due to the destruction of the dike constructed to prevent sea water intrusion into the rice plots.

### 4. Conclusion

This paper examined the role of land use change in improving the livelihood of local farmers in the Guinean coastal zone. This objective was achieved by determining the land use change that occurred in this area from 1990 until 2010, using satellite data, and identifying the factors influencing land use change via field survey. This study revealed that family size and migrant farmers are significant determinants of land use change. The majority of farmers in the study area own less than one hectare. Despite a significant number of farmers being members of the farmers’ organization, access to credit and use of modern farm technologies (improved seed varieties, fertilizer and agrochemical usage) remained negligible.

The study based on the spatial analysis revealed that
about 41.7% of the 5,099 ha studied has undergone changes during this period. Paddy fields, build up, slashed and upland areas have notably increased in extent, while mangrove forest, savannah forest and palm trees have decreased. These changes indicate an increasing human pressure on natural resources in the Guinean coastal belt, mainly exerted by the migrant farmers and the growing local population. The mobility of farmers into the mangrove forest could result in embankment subsidence, to factors related to the management at the plot level, to the reduce use of modern farm technologies. Therefore, an increase in the use of modern farm technologies will have a positive effect on food supply through increasing agricultural production.

The binary logistic regression results indicated that yield and membership in farmers’ organizations are two important factors determining land use change. The three most important policy implications of this study for mitigating rapid land use change in the Guinean coastal belt are: (1) the pressing need to improve mangrove rice productivity, (2) the need to strengthen and maintain strong dikes to prevent sea water intrusion into the rice fields, and (3) the need to strengthen the farmers’ organizations to enhance farmer participation.

The mechanisms for strengthening the participation in farmers’ organizations include the diffusion of modern farm technologies, the reconstruction of the embankment, training related to natural resources management, etc. The maintenance of the embankment could limit the intrusion of sea water in the rice plots leading to higher yield. It could also mitigate plot abandonment and farmers’ encroachment on the mangrove forest. This strategy will contribute to the increase in land productivity and the improvement in farmer’s livelihood. Moreover, it will reduce human pressure on the mangrove forest, thereby enabling a balance between livelihoods and the exploitation of natural resources.

As with any research, this study too had certain limitations. Overall accuracy and kappa coefficient were not relatively high (e.g., for 1990). Since the empirical results are based on relatively limited sample size, the findings should not be generalized. To generalize the findings further scrutiny through spatial and empirical studies would be required. A cross-county comparison of the entire Guinean coastal zone can be useful to improve the relevance of the findings of this study.

Notes
[Note 1] Data from the General Census of Population and Habitat of the urban commune of the Dubreka prefecture in 1996 collected as secondary data.
[Note 2] Census of Population of the urban commune of the Dubreka prefecture in 2008, this census was carried out on the occasion of the Guinean presidential election in 2010. It was used as secondary data.
[Note 3] This permission requires some prerequisites which include: being a member of the farmers’ group, to contact subsequently the prefectural authorities and also the Water and Forest Service for instructions on delimitation and finally the prefectural service of agriculture for development of the given area. This delimitation requires keeping a distance of over 100 meters between plots and the rivers in the middle estuaries, and just 100 meters in the case of upper estuaries according to the information provided by the surveyed farmers.
[Note 4] The population growth rate (PR) was computed based on the following formula:
PR = [((V_{2008} - V_{1996})/ V_{1996})*100]/N.
Thus, PR becomes
PR = [((172,593 - 23,072)/ 23,072)*100]/12
= 54.0%.

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IGN France, 1953, Photo aérienne Noir et Blanc,
Panchromatique AOF, Toute la Guinée (1/50,000).
IGN France, 1956, Carte topographique de la Guinée en 378 coupures (1/50,000).
JICA, 1982, Photo aérienne infrarouge, Guinée (1/30,000).
研究論文

ギニア沿海地域における土地利用の変化とその要因
—空間分析と現地調査に基づく研究—

Land Use Change and their Determinants in the Coastal Area of Guinea:
- A Study based on Spatial Analysis and Field Survey -

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要旨

本研究では、ギニア共和国沿海地域におけるマングロープ稲作農民の生計向上に対して、土地利用の変化が及ぼす役割を検討することを目的とした。分析の対象としたドゥプレラ県は、統計や地図を十分に利用できないため、衛星データと現地実態調査のデータを用いて、土地利用の変化を検討した。統計データの欠如は、ギニアのような発展途上国の評価を行う際の主要な制約要因となる。本研究では、画像解析により土地利用の変化を検討するために、ランドサット TM のリモートセンシングデータを用いた。加えて、社会経済的側面から土地利用の変化要因を特定するために、農家を対象とした現地実態調査を実施した。

分析の結果、1990 年との比較で 2010 年には総面積の 41.7％の土地利用が変化し、マングロープ林の 19.8％が失われているという大きな変化が確認された。ロジスティック回帰分析の結果、農民組織への参加状況、及び水稲の単収水準が、マングロープ林から水田への土地利用変化の主要な決定要因であることが示された。

ギニア沿海地域におけるマングロープ稲作農民の生計向上、急速な土地利用変化を軽減するため必要となる政策提言は以下の通りである。第1に、近代的な生産資材の利用によるマングロープ稲作の生産性向上、第2に水田への海水侵入を防ぐ堤防の強化と維持、第3に広範な農民の参加を可能とする農民組織の強化である。

キーワード：現地実態調査、土地利用変化、ギニア沿海地域における生計向上、ロジスティック回帰分析、マングロープ稲作、空間解析

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