Tsukuba Geoenvironmental Sciences, Vol. 9, pp. 37-42, Dec. 26, 2013

A cultural ecological study on traditional farm management in Maués, Brazilian Amazon

Akio YAMASHITA* and Hiroaki MARUYAMA**

Abstract

The purpose of this study is to find out how the residents in Brazilian Amazon effectively use spatial differences in natural environment such as the landform and flora and fauna in terms of cultural ecology through the fabrication of some maps by field survey combined with spatial information technologies. In this study, the first thing we conducted is to develop a map for grasping large-scale natural conditions in the study area and a base map for detailed fieldwork using existing digital data, satellite images and GIS in the Brazilian Amazon. Second, using those maps, detailed vocations and lifestyles of the residents were qualitatively interviewed and the results were recorded to make detailed land-use and facility placement maps. In this study, we found the following characteristics in terms of cultural ecology of the local residents regarding land properties and works in an example farm family in Amazon. The example farm family owns lands in both "terra firme" and "várzea" and conduct "transhumance" between them, releasing cattle in pasture in fertile "várzea" during dry season, and in pasture in "terra firme" during rainy season. The timings of intentional burn to develop pasture are different depending upon the grazing areas. At the intentional burn, many types of trees for foods or medications were saved and left intentionally for family usage. In the fields in "terra firme" without having flooding throughout a year, swidden farming producing such crops as banana, cassava, cará (yam) and so on for mainly self-sufficiency and guaraná cultivation for market oriented are conducted.

Key words: field work, cultural ecology, Brazilian Amazon, Maués

1. Introduction

Maps are indispensable for a geographical fieldwork. In some regions in developing countries including Brazilian Amazon, however, large-scale official maps aren't published. To do geographical field survey in such regions, we must firstly make a large-scale base map ourselves (e. g. Yokoyama, 2001; Maruyama and Nihei, 2005; Maruyama ed., 2011). Recently, spatial information technologies such as GIS, GPS and RS (remote sensing) become increasingly popular, and many software and tools to process digital spatial data are provided free over the internet (Hashimoto ed., 2011; Furusawa et al. eds., 2011). Those computer equipments help us make the base map for fieldworks.

The purpose of this study is to find out how the residents in Brazilian Amazon effectively use spatial differences in natural environment such as the landform and flora and fauna in terms of cultural ecology through the fabrication of some maps by field survey combined with spatial information technologies.

In this study, the first thing we conducted is to develop a map for grasping large-scale natural conditions in the study area and a base map for detailed fieldwork using existing digital data, satellite images and GIS in the Brazilian Amazon. Second, using those maps, detailed vocations and lifestyles of the residents were qualitatively interviewed and the results were recorded to make detailed land-use and facility placement maps.

2. Location and natural condition of the study area

The legal Amazon in Brazil consists of the seven states in the north region including Amazonas (AM), Pará (PA), Roraima (RR), Amapá (AP), Acre (AC), Rondônia (RO) and Tocantins (TO) States as well as Mato Grosso (MT) State in the center-west region and a part of Maranhão (MA) State in the northeast region (Fig. 1). The capital of Amazonas State is Manaus, and other major cities in Amazonas State are Itacoatiara and Parintins locating along the Amazon River. Maués, which is the city we investigated, is located on the right bank of the Maués-Açu River. We can take a commercial international or domestic flight to Manaus. Main transportation to reach Maués from Manaus is a regional boat with accommodation in hammocks and it takes about 18 hours, but when we come back, it takes about 24 hours to go up stream on the Amazon River.

The population of the capital city, Manaus, is about 1.8 million in 2010. Its population growth is rapid and the population had risen threefold in thirty years between 1980 - 2010. However, the population density is not very high since broad rural areas are included around the urban area. The population of Maués is about 50,000 and its population density is only 1.31 per square kilometers (Table 1).

If you look at the climate in Amazon, the annual range of the temperature is small and the average monthly temperature is between 25 and 28 (Nishizawa et al., 2005).

* Faculty of Life and Environmental Sciences, University of Tsukuba
** Faculty of Letters, Rikkyo University

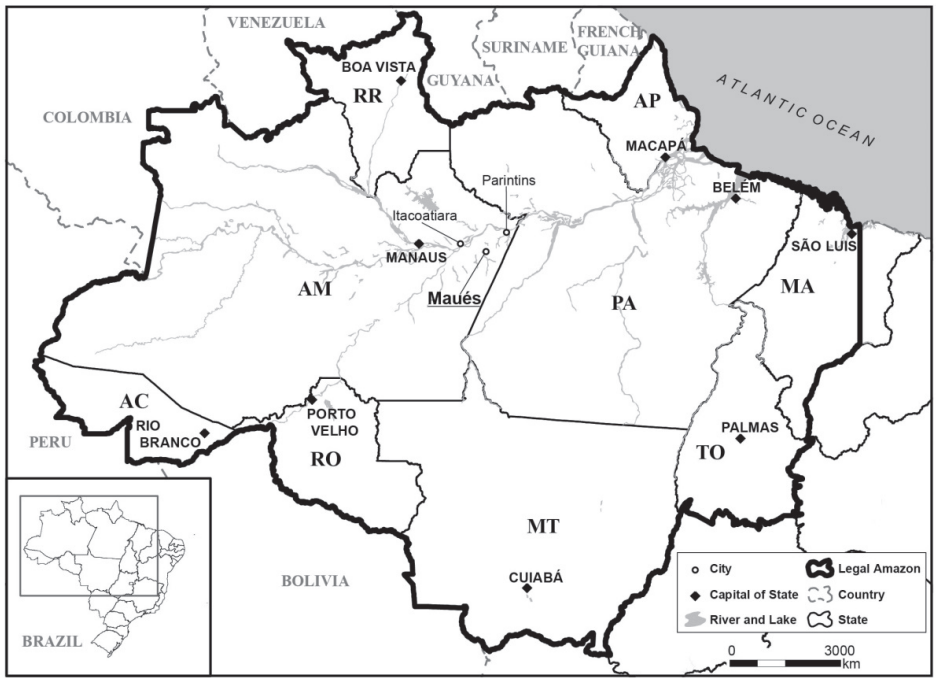

Fig. 1 Area of Legal Amazon and location of Maués
source:material from IBGE

Table. 1 Population characteristics in the major cities in Amazonas State

	Manaus	Itacoatiara	Parintins	Maués
Population(2010)	1,802,014	86,839	102,033	52,236
Population density (persons/km^2) (2010)	158.06	9.77	17.14	1.31
Increase rate of population (%)(1980-2010)	184.5	64.2	98.6	74.0

source: data from IBGE

On the other hand, annual variability of precipitation is large and we can roughly divide the whole year with rainy season and dry season. Rainy season has 200mm or more of precipitation between December and May, but dry season has 100mm or less precipitation between June and November (Nishizawa et al., 2005). Because of that, the annual water level fluctuation of the Amazon River is high (Matsumoto, 2012), showing about 10m, although it varies depending on the year.

Fig. 2 is a color shaded relief map using SRTM data that is the elevation data collected by a space shuttle. We can obtain the data from the USGS web site for free. In this figure, the range from 0 to 10m represents regular water areas and the legend between 10 and 20m shows the areas of dry land in dry season but submerged during rainy season. The areas with altitude of 20m or over are the lands without submersion, but the level of submersion varies every year, so these classifications only indicate average situation.

Anyway, Amazon is geographically divided by “várzea”

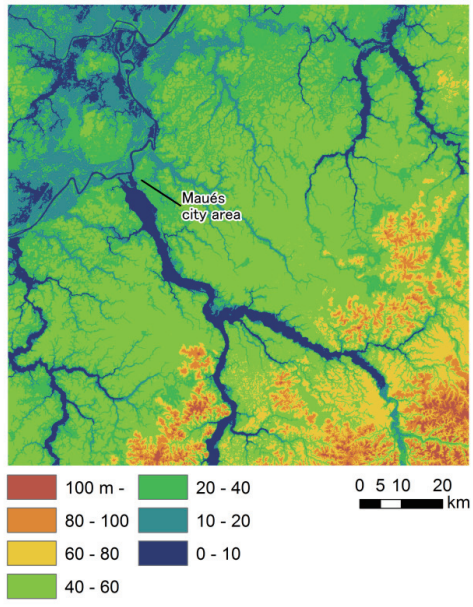

Fig.2 Elevation relief map around Maués
source: SRTM3 data

and "terra firme". The former is seasonally submerged and swamps. The latter is highlands without submersion throughout a year. They have different types of flora and fauna, and different hydrogeological environment. People in Amazon utilize the different types of biotopes seasonally for their daily living.

Photo 1 Forest in "várzea"
taken by Yamashita in Aug. 2011.

Photo 2 Forest in "terra firme"
taken by Yamashita in Aug. 2011.

Photo 3 A house along the Amazon River
taken by Yamashita in Aug. 2011.

As can be seen in Photo 1, there is no difference in height between the ground and water surface in "várzea" and some trees are immersed in water. The berries from these trees can be food for water creatures such as fish, forming a unique ecosystem integrating the forest and river in Amazon. We can see "várzea" in very small areas around the river and the most of the land parts in Amazon is "terra firme" (Photo 2). To manage flooding during rainy season, houses in "várzea" along the Amazon River are high-floored (Photo 3). Main transportation for the people there is canoes and boats and almost all families own their boats, but development of land transportation is poor.

3. Making base maps using satellite images

Satellite images are useful as it is very difficult to obtain the latest large-scale official maps of Amazon. In this study, we used AVNIR-2 data as a data source that was captured using an optical sensor of the land observing satellite "DAICHI" of Japan. AVNIR-2 data consist of data images observed by four wavelength bands (blue, green, red and near-infrared). With synthesizing the bands, true color images such as normal optical photos or false color images emphasizing the near-infrared band that is in the invisible range can be fabricated. Our study mainly used false color images for mapping. The reason for that is when identifying forests, water areas, urban areas and farms, in the areas like Amazon, where tropical rainforest is overwhelming, false color images can show the differences of land surface more clearly than the other.

Using false color images of the study area, we asked residents the names of the main places and rivers and recognized the overview of the study areas and relative locations of the example farms. Fig. 3 shows the locations and names of major rivers around Maués based on the interview. The major transportation in Maués is ships. Therefore, the stream network equals to the transportation network. To investigate the details of utilization of the environmental resources in activities such as works and daily life of the residents, knowing the locations and names of the rivers beforehand is very important.

The example farm family owns lands in both "várzea" and "terra firme" respectively and mainly manages cattle ranches. During the dry season, cattle are released in the fertile pasture in "várzea", and in the rainy season, shipped to the ranch in "terra firme". The farmland in "várzea" (Photo 4) is named "Fazenda Piranha" and one in "terra firme" (Photo 5) is called "Fazenda Santa Cecilia" (Fig. 3).

4. Land use and facility placement of Fazenda Santa Cecilia in "terra firme"

Since there is no detailed map for the property of the example farm family, to conduct investigation of land use,

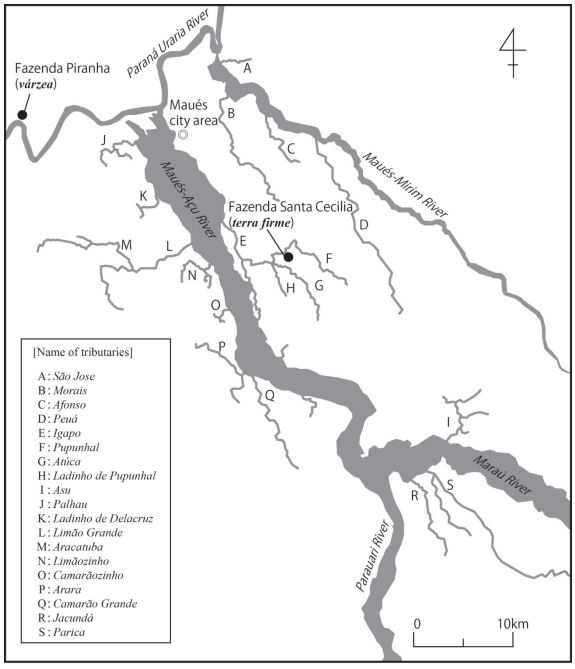

Fig.3 Location of major rivers and example farms
source: authors' field survey based on ALOS image of 2009

we first confirmed the border of their property by actually going there with the owner. Recording the course with GPS, we cruised along with the border of the property and obtained the location information on the border between adjacent neighbor's properties. By this survey, the area of their property in "terra firme" (Fazenda Santa Cecilia) confirmed. The river is the borderline in the most of areas, but the south east part has a border on the land. Originally all of area were forests, but they burned a part of them and utilize the lands for farms.

To know the detailed land use in the farm, we walked around in the farm with the owner, recording the route using GPS. Obtaining waypoints at the boundary of land use and point-like objects such as the edges and corners of fences and isolated trees, we noted the location and directions of objects around there. Fig. 4 shows the land use and distribution of major trees and fences in Fazenda Santa Cecilia based on the results of the investigation. A majority of the parts except for forests are pasture in addition to some swiddens. The pasture consists of three parts: A, B and C plus D and they keep about 120 cattle for meat. The total area of the pasture in Fazenda Santa Cecilia is about 60ha (the pasture in Fazenda Piranha is also 60ha) and the times the forests are burned and turned them into the pasture are different depending on the grazing area. The main house for the owner and his wife is located along the river in the pasture A. In the pasture, isolated trees such as brazilian nut and palm are distributed. These trees were saved at the intentional burn just because they produce edible fruits. Besides the pasture, there are three swiddens (about 6ha) for subsistence crops and one guaraná field (about 1ha) for cash crops. Two of three swiddens are noncultivated as one had abandoned already and the rest one was opened recently. The area of swidden under cultivation is about 3ha. Such subsistence crops as banana, cassava, cará (yam) and so on are extensively cultivated there.

Since various facilities for the management of cattle and the daily life of the owner family are located around the main house, our next step of the study was mapping the facilities around the main house in large-scale. Recording the track using GPS, we walked along with the land use boundaries and fences and obtained waypoints at point-like objects such as the edges of buildings and fences, gates of fences and utility poles. Then, rough sketches of a map for the facility placement were made. After that, GPS data were integrated into GIS and developed a precise facility location map, comparing the record on our field note. According to Fig. 5, there are a barn, a hen house, and

Photo 4 Fazenda Piranha in "várzea"
taken by Yamashita in Sep. 2012.

Photo 5 Fazenda Santa Cecilia in "terra firme"
taken by Yamashita in Aug. 2012.

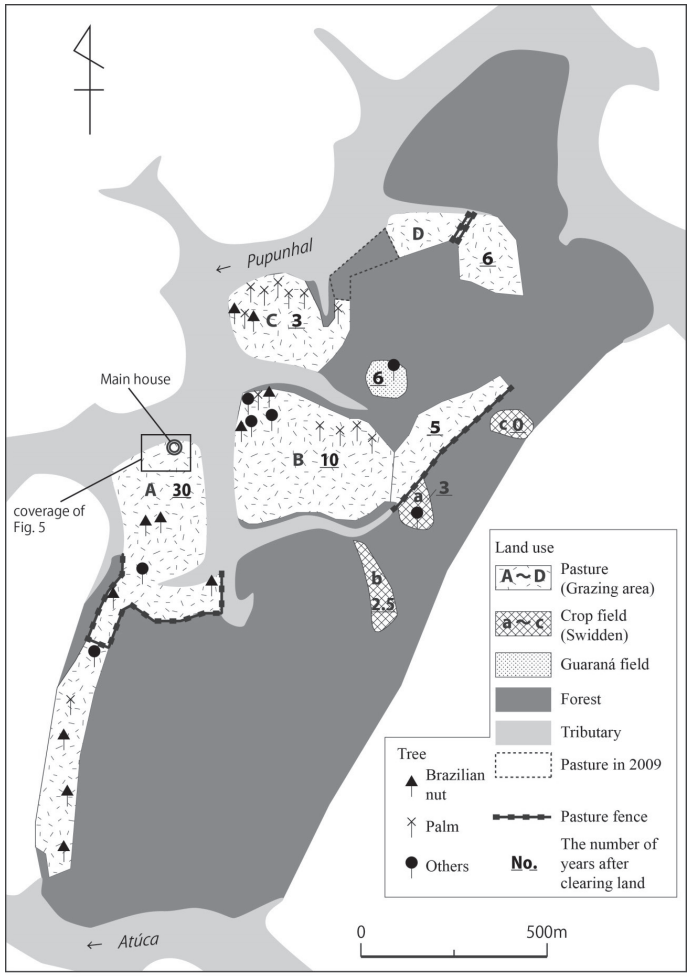

Fig.4 Land use in Fazenda Santa Cecilia (Aug. 2012)
source: authors' field survey based on ALOS image in Oct. 2009

a pigsty around the main house. Electricity is distributed, but no running public water, so they use water in a well. To efficiently manage cattle, the corral was divided by fences and the aisle for steering cattle to a boat one by one was made on the riverside slope. In their backyard (kitchen garden), many kinds of palm trees, fruits, vegetables and nuts for food and other herbal plants are planted.

5. Conclusion

In this study, we found the following characteristics in terms of cultural ecology of the local residents regarding land properties and works in an example farm family in Amazon.

- The example farm family owns lands in both "terra firme" and "várzea" and conduct "transhumance" between them, releasing cattle in pasture in fertile "várzea" during dry season, and in pasture in "terra firme" during rainy season.
- The timings of intentional burn to develop pasture are different depending upon the grazing areas. At the intentional burn, many types of trees for foods or medications were saved and left intentionally for family usage.
- In the fields in "terra firme" without having flooding throughout a year, swidden farming producing such crops as banana, cassava, cará (yam) and so on for mainly self-sufficiency and guaraná cultivation for market oriented are conducted.

Geography is the science that analyzes and examines regions using both spatial and ecological approaches. The methodology tried and presented in this study embodies the approach that comprehends lifestyles of local residents in a certain areas from a standpoint of cultural ecology. This is a fundamental approach in geographical studies.

Acknowledgement

This study is financially supported by Grant-in-Aid for Scientific Research B (No.23401039, representative is

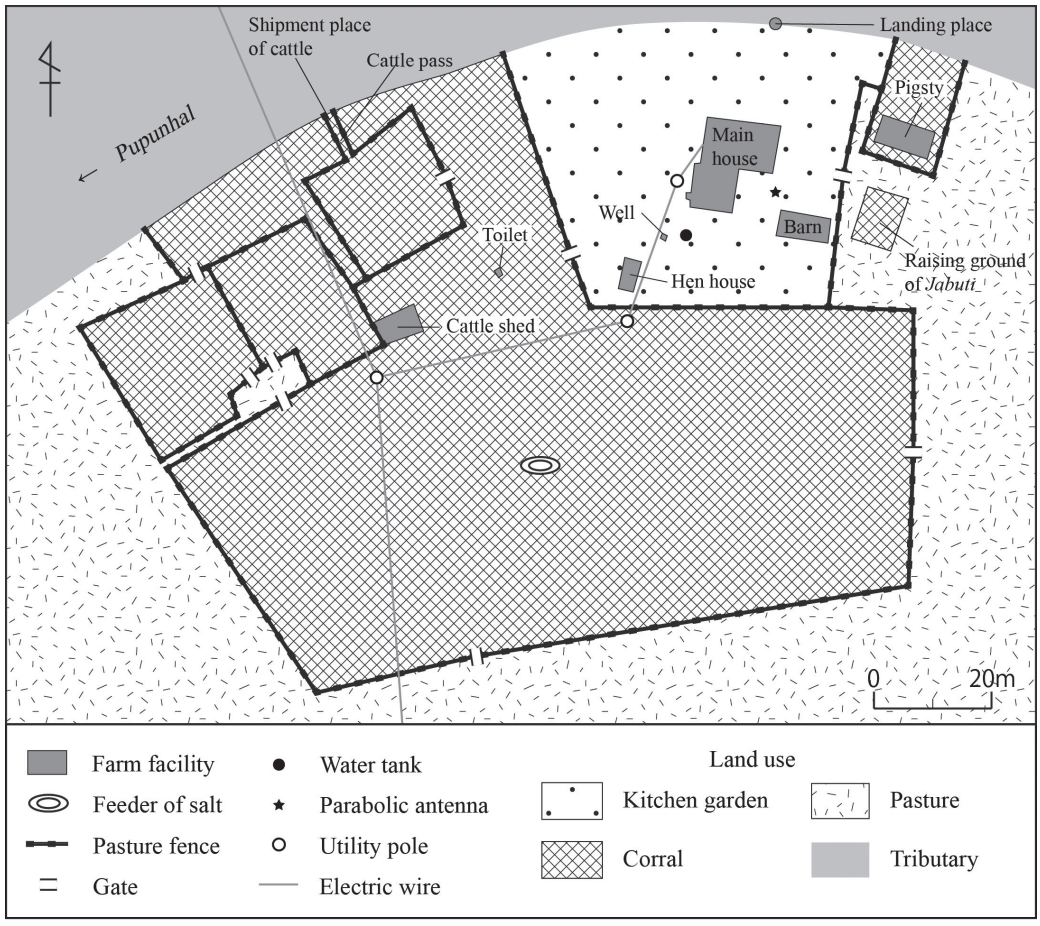

Fig.5 Facility placement around the main house in Fazenda Santa Cecilia(2012)
source: authors' field survey

Hiroaki Maruyama, Rikkyo Univ.) and Grant-in-Aid for Scientific Research A (No.22242027, representative is Yuji Murayama, Univ. of Tsukuba).

References

Furusawa, T., Onishi, T. and Kondo, Y. eds. 2011. "How to use GPS/GIS in your fieldwork." Kokon-shoin.

Hashimoto, Y. ed. 2011. "GIS and geo-spatial information: applications of ArcGIS 10 and download data." Kokon-shoin.

Maruyama, H. ed. 2011. "Pantanal: richness and vulnerability of the world's largest wetland in South America." Kaiseisha.

Maruyama, H. and Nihei, T. 2005. Biotope map of the southern Pantanal in Brazil: the case of Fazenda Baía Bonita. *Journal of Geography*, **114**, 68-77.

Matsumoto, E. 2012. "Attractiveness of South America, Brazil and Amazon told by photographs." Ninomiya-shoten.

Nishizawa, T., Koike, Y., Hongo, Y. and Yamada, M. 2005. "Amazon: conservation and development." Asakura-shoten.

Yokoyama, S. 2001. Mapping by GPS and GIS in rural villages of Laos. *Theory and Applications of GIS*, **9**(2), 1-8.

Received 14 September 2013
Accepted 29 October 2013