Paper presented at the 22nd Asian Conference on Remote Sensing, 5 - 9 November 2001, Singapore.

VALIDATION OF THE WILDLIFE INHABITING SPACE USING GIS

Atsushi KIMURA, Susumu OGAWA

Faculty of Geo-Environmental Science,
University of Rissho 1700 Magechi, Kumagaya, Saitama, 360-0194 Japan
Tel : +81-485-39-1652 Fax : +81-485-39-1632
E-mail : 981w00079@ris.ac.jp

KEY WORDS: GIS, Validation of The Wildlife, Network

ABSTRACT: In late years, serious circumstances have led the decrease of wildlife inhabiting space with urbanization for both developed nations and developing countries. This study tried the estimation of wildlife inhabiting space using GIS in order to solve such a problem. The objectives of this study were to evaluate the inhabiting space by ranking biotopes and to estimate the ecological core-areas and corridors. Biotope-networks were evaluated with animal and vegetation maps made by the Environment Ministry and satellite remote sensing images. The application validation to inhabiting space observed by satellite images was carried out. In addition, buffer analysis from an urban district extraction area was done in order to consider influence of human activities.

As a result, index and inhabiting space estimation of creature class became in high precision by adding GIS after inhabiting space estimation by satellite image. When biotope network is devised by adding influence of urban district and roads, a good document will be presented.

The objective area was Hiki Hills country, Saitama, composed of forest and agricultural fields.

1. INTRODUCTION

With urbanization and development by human activities the prevention and control of wildlife are proposed powerfully. Prevention of biological diversity was positioned in an important problem in Rio de Janeiro International Conference in 1992, and prevention of biological diversity was regarded as important in many parts of the world (Morita *et al*., 1999). This study applied satellite image and GIS for information integration for enormous volume of wildlife ecosystem, connected with each element interval extend (Nagatani *et al*., 2000). Biotope is thought as unit of forest (broad-leaved tree forest, conifer forest), rice field and the water body for ecosystem prevention. Finally, biotope networks are constructed.

2. TARGET PLACE

The objective area, Hiki-gun, Saitama high plain hill zone, is located in the middle between east low land and the mountainous region of Chichibu, covering 19% of prefecture lands. There are high plains such as Musashino, Iruma, Higashimatsuyama, Konan, and north Musashi from south to north. There are also hills: Sayama, Kaji, Koma, rock, Hiki, and Kodama from western low mountains to east high plains.

3. MATERIALS AND METHOD

Multi-temporal images of Landsat-TM were used in this study, and unsupervised classification was done with five categories: forest area, water bodies, grassland, a farm and urban areas. In separation of fallen-broad-leaved tree forest, summer and winter images with different vegetations were used. Multi-temporal images were used for extraction of rice field area because it was misjudged as forest area in summer and as farmland and grassland in winter. The change of seasonal NDVI was available in separation of a rice field and broad-leaved tree forest. Moreover, GIS information such as a reservoir distribution map and golf courses, and laws and social environment information such as protection areas were added to this. It was classified into five ranks to evaluate wildlife inhabiting spaces from unsupervised classification and GIS information. A farm field and residential area at a corner of wide forest area may not affect wildlife inhabiting spaces in this study. However, forest areas in high level scattering in urban areas may not become an essential inhabiting space of wildlife in this case. Then, such space scattering in the major area was deleted as an intermediate area. Therefore, only wide stable important wildlife inhabiting space remained and the rest small areas were deleted.

4. RESULTS

From the result of unsupervised classification and GIS information, the next five ranks were evaluated.

Level 5: Most important creature inhabiting / growth space (Figure 1).
Broad-leaved tree forest + rice field area, or water bodies+ forest area,
where diversity of vegetation and naturalness are quite high, and biological diversity can be kept.

Level 4: Important creature inhabiting / growth space.
Broad-leaved tree forest + farm, or conifer forest,
where diversity of vegetation inferior to Level 5, but there is a relatively little influence of human activities, and therefore, such important space should be kept in good condition for wildlife.

Level 3: Universal creature inhabiting / growth space (Figure 2).
Rice field + farm, or rice field,
where there are always influence of human activities, and no hideout area such as forests.
There is poor space in biological diversity for vegetation and creatures.

Level 2: Creature inhabiting / growth space where human activities extended to (Figure 3).
Urban area + grassland, or barren land + urban area,
where forest area becomes isolated by urbanization, and degree of naturalness is extremely low.

Level 1: Creature inhabiting / growth space where human activities extended to most (Figure 4).
Urban area,
where only trees in residential areas exist as garden trees, and the environment was extremely limited as inhabiting space of creatures.

Level 5 to Level 4 was evaluated as a very high quality area of wildlife inhabiting / growth space, while Level 4 to Level 2 was evaluated as a high area of quality and Level 2 to Level 1 as a low area of quality.

It was paid attention to the point that the area where Level 2 overlapped with Level 4 was an area kept legally.

On the basis of result of the fourth basic investigation done by Biological Diversity Center in the Environment Ministry, validation of important inhabiting space was carried out. The wild animal which inhabited flatland and a plateau was considered to be an index mainly this time.

Table 2. Favorable biotope type

1. High inhabiting / growth area of quality is big.
2. The area of high naturalness is neighbored.
3. Traffic of conservation section is possible.
4. It is connected by a corridor.
5. The shape is circular.

Core areas and corridor areas are the center of inhabiting and growth for wildlife.

Therefore, a peripheral area of these areas is very important in order to let reduce influence of human activities, and it should be kept in good condition. For this reason, buffering analysis was done for core areas and corridor areas extracted in this study. In addition, buffering analysis for urban area was carried out with consideration for various influences of human activities in this study. Determination of biotope network becomes possible easily from buffering analysis (Figure 5).

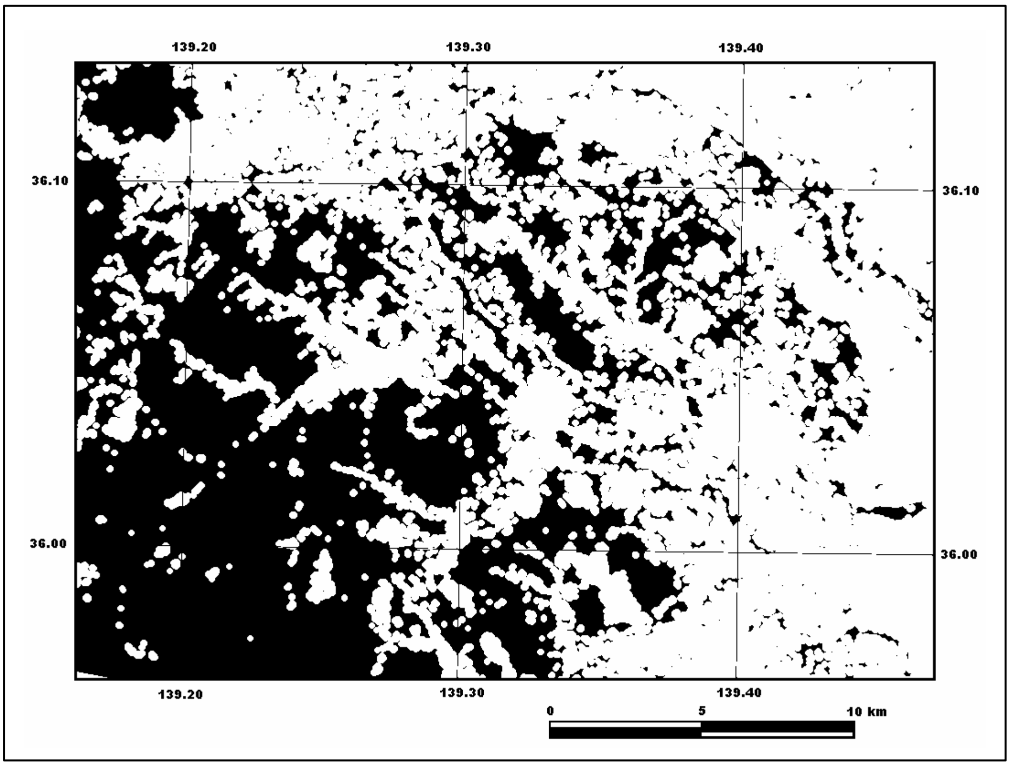

Figure 1. Level-5 image in the ecological core-area map

Level 5 areas Other areas

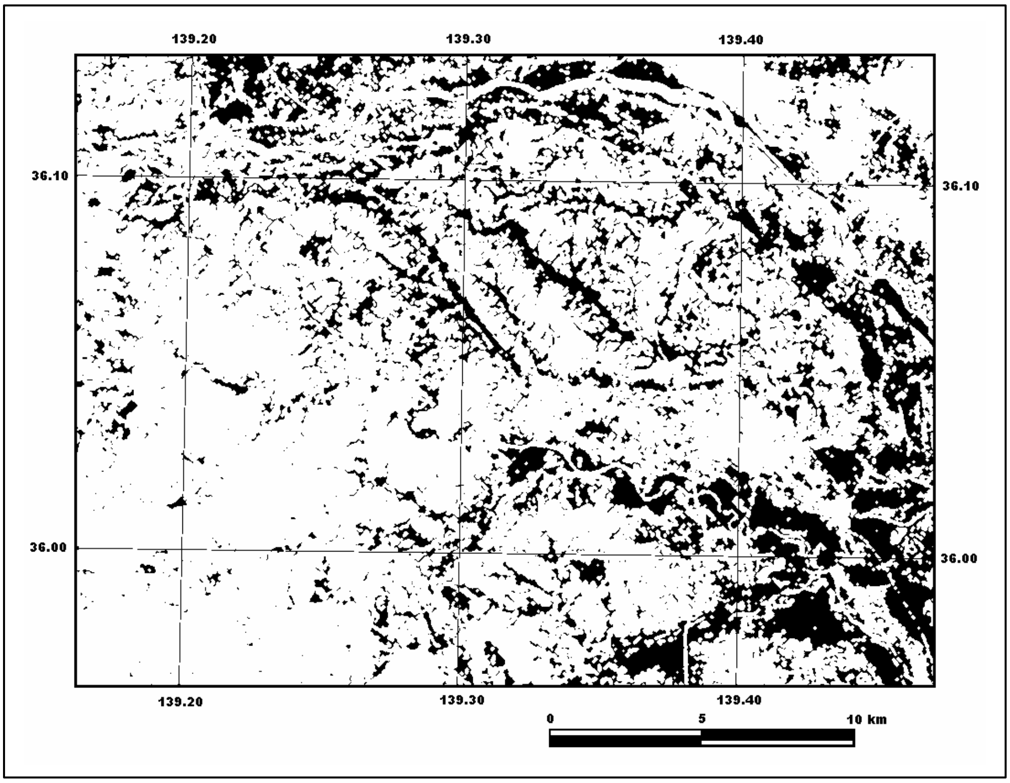

Figure 2. Level-3 image in the ecological core-area map

Level-3 areas Other areas

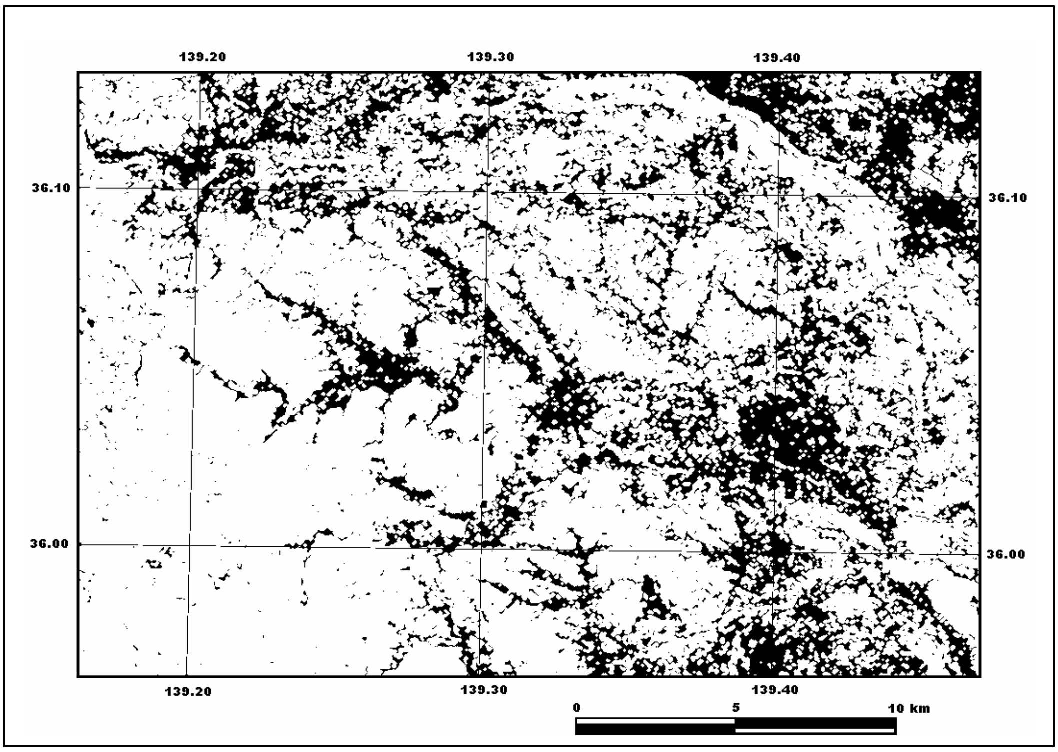

Figure 3. Level-2 image in the ecological core -area map

Level- reas Other are

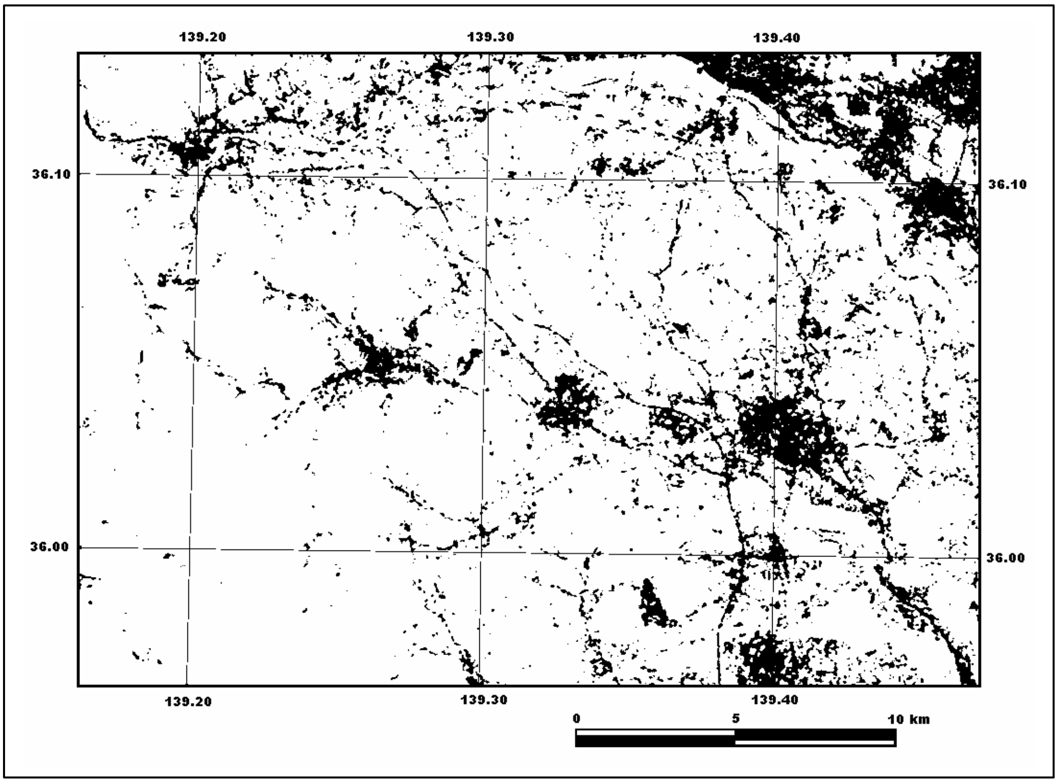

Figure 4. Level-1 image in the ecological core -area map

Level- reas Other are

5. DISCUSSION

The use of GIS has various advantages of connection with the other plan, and leads analysis between the elements included in landscapes. Integrating information can select corridor areas and connection to a kernel area at a glance. As a problem, since inhabiting environment is different for each wildlife species, the design result changes greatly depending on objective species in ecosystem. Because a raccoon dog, a fox, Japanese squirrel and the other animals which inhabited from low mountains to flatland mainly were an index in this study, the validation was not correct in a high-elevation area with high nature rather than a low mountain. The solution to treat high mountain forest area was considered that a good result was obtained when the wildlife that inhabited high mountain area such as Japanese deer was index. Analysis and validation of biotope networks with individual little range should be required for fixed creature class.

In addition, a shortage of construction of basic database such as distribution brief description of the wild animals and plants, and biological researches is pointed out.

6. SUMMARY

The influence of human activities, and the shape and area of inhabiting space are important for selecting wildlife inhabiting space and the network formation in this study. Data integration for a tall tree, a shrub, elevation, a slope, soil and weather condition was necessary to estimate wild inhabiting space more precisely. For a creature living mainly on a lower plant such as Japanese serow, sun azimuth becomes requirement. The systematic numerical model considering all conditions should be constructed.

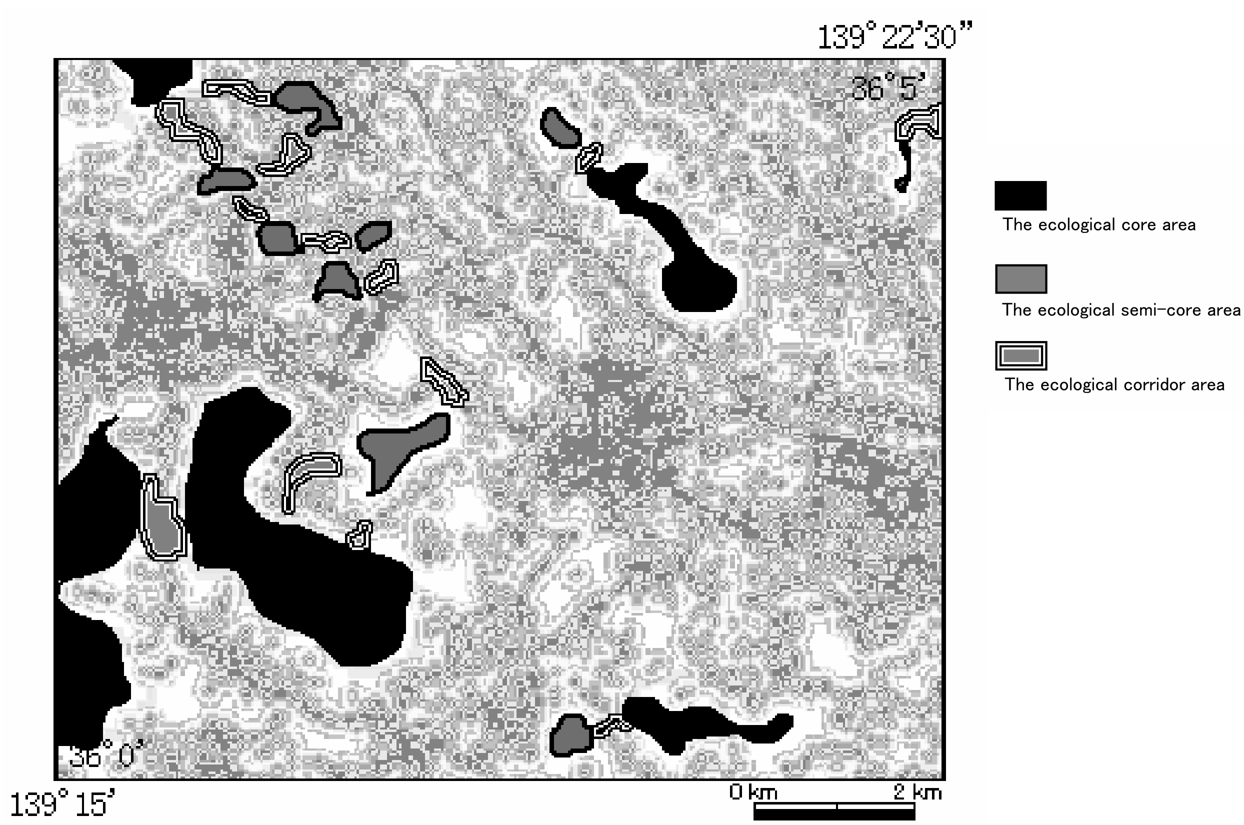

Figure. 5 Image Map of estimation of biotope network

REFFERENCES

Environment ministry, Aiming at the symbiosis with various creatures, 1997.

Environment ministry, Natural environment GIS, Saitama version, 1999.

Environment ministry, Biological diversity center, No. 4 building block investigation, 1988-1992.

Atsushi Kimura and Susumu Ogawa, Ecological core-area estimate by Landsat-TM, Journal of Remote Sensing Society of Japan, No.30, 2001.

Atsushi Kimura and Susumu Ogawa, Estimation of wide biotope network using GIS, Proceedings of the Japan Society of Photogrammetry and Remote Sensing, 21-22, June, pp.5-8, 2001.

Kanichiro Mochizuki, Keitaro Hara and Shinichi Okamoto, Fixed-quantity validation of vegetation patch connectivity that considered shape / a course, Proceedings of the Japan Society of Photogrammetry and Remote Sensing, Autumn, Tottori, pp.193-198, 2000.

Gyosei, natural history of Ogawamachi (animal), 2000.

Saitama, Making of natural environment plan that a country of Sai is rich in, 1999.

Izumi Nagatani, Haruo Swada, Kouzou Kawabata, Michio Anazawa, Naoki Mituzuka and Etsuko Nakazono, Evalution of Forest Diversity using Remote Sensing and GIS, Theory and Applications of GIS, Vol.8, No.1, pp.107-113, 2000.

Tetsurou Morita, Tsuyoshi Yoshida, Ko Nagase and Kazuhiro Tanaka, Estimating Understory Vegetation by the GIS A study for Habitat Modeling of Japanese Serow in the Kii Peninsula, Geographic Information Systems Association, Vol.8, pp.371-374, 1999.