"Biodiversity-Facility Level" Analysis in Yushan National Park of Taiwan

Ching Lin¹ Lan-sheng Kuo² Ji-pon Fang³ Pei-shuan Lee⁴

Abstract

The purpose of this study was to evaluate the sufficiency of current and proposed facility levels in National Yushan Park (NYP), while also keeping preservation of biodiversity in mind. This work was done over the past few years through the on-site investigation, visiting people relevant to the research matter, data collection and inviting specialists to consult us in forums. As the research results showed, some set-up facilities such as: forest trails, roads, waste water and litter treatments, interpretation signs, and conservation workshops in the Yushan National Park caused damage to the environment to a certain extent. In terms of ecological conservation, after investigating on-site facilities related to biodiversity of YNP from September 2003 to March 2004, we suggest that our commitment to biodiversity relies on the establishment of a mountain climbing museum, a wild animal monitoring station in Walame of Hualien county, educational biodiversity models, a camping ground near Tataja tourist center, new and renovated view points, lodges in high mountains, forest trails built-in without environmental deterioration, suspension bridges, and facilities for treating waste and spent liquor in the recreation resort between 2004-2005. Another goal of YNP - biodiversity facilities set-up plan between 2005-2007 which we suggested includes: i)The establishment of an overall ecological surrounding monitoring system, forest trail from Meishan to Wufdontshan and the ecological conservation stations at Kuankao and Patonkuan. ii) The integration of ecological data to be used as the source and facility's activities. iii)Making plans relating to the conservation and reutilization of historical remains. iv)Using optimum ecological engineering methods in construction. In general, for the development of a good profile in the biodiversity of mountainous YNP, we are concerned that the optimum facilities be established with an admirable ecological conservation system.

Key words: biodiversity, facility, ecological conservation, mountain climbing museum, forest trail, ecological engineering method.
論述

玉山國家公園生物多樣性之分析

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【摘要】
本研究目的為在保持生物多樣性之大前提下，評估玉山國家公園之現有與生物多樣性有關之設施之合理性以為未來添加設施之參考。經由現場查勘、訪問有關試驗人員，搜集資料及邀請專家座談等方式進行本研究。研究結果顯示，已有之森林步道、道路、廢水、遊客中心、垃圾處理設備及保育站等設施對玉山國家公園之環境有一定之衝擊。就生態保育觀點而言，2004 至 2005 年間之可考慮：登山博物館、近花蓮瓦拉米之動物監測站、教育生物多樣性之設施、近塔塔加遊客中心設立露營區、新景點之設立與維護、高峯地區遊客住宿設備，不損及生物多樣性之森林步道、吊橋及廢水及廢棄物處理設備之興建。2005～2007 年間可考慮之生物多樣性設施計有：i) 生態環境監測站之建立，包含由梅山至烏夫冬山間及在八通關及觀高地點應設立生態環境監測站，以維生物多樣性之永續經營。ii) 建立完整之環境資料庫以維護玉山國家公園之生物多樣性。iii) 維護歷史文物及保育環境。iv) 利用適當之生態工法進行各種生物多樣性之建設。綜言之，為期在崇山峻嶺之玉山國家公園內建立良好之生物多樣性，吾人建議應在維持完整之生態保育大前提下，進行適當之建設。
【關鍵字】生物多樣性、設施、生態保育、登山博物館、森林步道、生態工法

I、Introduction

Biodiversity (a contraction of biological diversity) is one Taiwanese attempt to capture the complexity of life, to enhance human understanding of it and seek sustainability. About 2/3 of the land in Taiwan is mountainous and mostly forested. In order to protect the essential biodiversity heritage, there are 6 national parks i.e., Yanminshan National Park, Shueba National Park, Yushan National Park (YNP), Taroko National Park, Kingmen National Park and Kenting National Park, which were successively set up since 1982. Yushan National Park—a mountainous and watershed park—has 105,000 ha, making it the largest national park.

Located in the center of Taiwan, YNP stretches over Hualien, Kaohsiung, Nantou and Chiyi counties. YNP is subtropical in climate and is 39 km in length and 43 km in width.

Mt. Yushan (Jade mountain) is 3952 high in YNP, making it the highest mountain in Northeastern Asia. Because plenty of ecological and genetic diversity, which are the basic building blocks of biodiversity in YNP. In order to understand the effect of facilities be built over the past years, we intend to investigate the adaption of current facilities as references for the new construction proposal.

Currently there are concerns about facilities in YNP having some impact on the park’s ecological and genetic diversity, we plan to
carefully monitor the effect of existing and future facilities on the maintenance of biodiversity. These recommendations will be used as references for the new construction proposal.

Due to some limitations in transportation, the preliminary biodiversity species investigated by researchers are as follows:

**A. Animals:**
- i) 151 bird species.
- ii) 34 mammals.
- iii) 17 reptiles.
- iv) 13 amphibians.
- v) 228 butterflies.
- vi) 9 rare or extinct animals.

**B. Vegetations (low altitude to high latitude (3900 m)):**
- i) 257 ferns.
- ii) 22 gymnosperms.
- iii) 707 dicotyledons.
- iv) 259 monocotyledons.
- v) 100 rare species.

Based on the above information, we concluded the richness of biodiversity in YNP is very high. The notion of ecological conservation is key role for environmental conservation groups, political decision-makers, economists and ordinary citizens alike. But what does "biodiversity conservation" mean, and what does it mean when we talk about maintaining biodiversity?

It is very unfortunate that the increased number of tourists visiting YNP has done damage to ecological conservation efforts. The gradual extinctions of Taiwan's black bear and pheasant are only a few examples. The current and projected losses of biodiversity have been called a "crisis". Many crises of biodiversity can be traced back to the facilities established in a national park. This is true of areas with long history of facilities set up in YNP. The crisis of biodiversity is "a state of affairs in which a decisive change for better or worse is imminent". It seems that a loss of biodiversity is presently already taking place.

In this study we argue for "evaluation of the effect of varying biodiversity facilities i.e., forest trails, accommodations, pavilions, facilities in rest area, and view points which had built in YNP for the past years on maintaining the biodiversity ". We look forward to having constructive advice for the officers of YNP to prepare a sensible budget, which can best meet the requirements of ecological conservation and serve as reference for the future establishment of biodiversity facilities from 2004 to 2007.
Experiments

Experimental process

First of all, we got more useful information (66 publications from YNP) about "what the YNP has done about the biodiversity maintaining", which helped us to carry out this study. We have investigated various recreation centers in YNP, i.e., Nan-An Center (east), Meishan Center (south), Tataja Center (middle), Mt. Yushan and Paiyunshan Lodge (near Mt. Yushan) and Kuankao station in order to collect information on ecological resources and facilities (forest trails, mountain lodge, restrooms, viewing points, pavilions) as the reference for our proposal. We also asked several specialists/professors to advise us on the "effect of current facilities on the biodiversity in YNP" in three seminars.

II. Results and discussion

1. Planned facilities can avoid damaging the biodiversity resources in Yushan National Park

Although YNP is striving to set up some facilities such as forest trail, accommodations, viewing views, restroom and rest areas previously opened to visitors, YNP has spared no effort on ecological conservation affairs. Table 1 shows that the YNP has carried out several ecological conservation research plans for the past years. The YNP paid much attention to the animals, management practices and vegetation that are related to the ecology conservation shown in Table 1.

People are very fond of seeing the beautiful views in Yushan National Park during their leisure time. In order to protect the biodiversity resources, the staffs of YNP must plan some facilities to avoid the damage of biodiversity from the tourists. The planned facilities often that can be seen in YNP are as follows:

1) Roads & Forest trails

The total area of roads and forest trails
Table 1. Types and quantities of ecological conservation research plans in YNP from 1982 to 2003.

<table>
<thead>
<tr>
<th>Year</th>
<th>Humanities &amp; relics</th>
<th>Ecology</th>
<th>Geoscience</th>
<th>Environmental monitoring</th>
<th>Animals</th>
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constitutes the largest percentage of facilities area in YNP. Due to the high temperature and humidity, frequently leading to serious water and soil erosion frequently, good maintenance of roads and forest trails is constantly required. The collapsed Juangau and Walame forest trails and roads attest to this need. A good divided pedestrian-road trail has been established that allows visitors to walk on the divided trail, thus protecting the road from wear and preserving vegetation growth. Because there is no pavilion on 17 kilometers long forest trail to Kuankau, we suggest that the YNP should build some pavilions for the convenience of visitors by the forest trails.
In general, a planned trail or road can confine tourists' activity to certain areas in order to protect the biodiversity resources.

2) Spent water and wastes treatment facility

The existing water supply seems sufficient for the needs of visitors at Tataja visitor center, Kuankau, Jiasing and Walame, but there is a shortage of water for Paiyunshan lodge's visitors. For fulfillment of the commitment to environmental protection, some suitable facilities for the treatment of spent water, wastes and recycled water are very important.

3) Interpretation facility to be established

We have seen many interpretation facilities for illustrating the local vegetations, warnings and landmarks along forest trails, which serves as a good forest classroom for the visitors. However, it is better to hang the vegetation interpretation labels on tree trunk for an immediate recognition, instead of inserting the interpretation labels into the earth.

4) Set up conservation center and its subsidiary facilities

Set up new conservation center and subsidiary facilities to monitor the effects of biodiversity protection and long-term ecological research. For instance, we may set up a conservation center at Tataja biodiversity area, Kuangau, Dafen, Batonguan and small stream Bashen. Using helicopter transportation in this area may reduce the environmental impact.

5) Communication and medical treatment in high mountain areas

For the safety of visitors and maintenance of facilities, we suggest that mobile phone, wireless telephone and medical treatment facilities should be gradually set up in high mountain area between 2004-2007.

6) Control center and subsidiary facilities

We suggest that a control center be established in front of Paternity Broken Ridge to oversee reservation land affairs for the aboriginal people. The old mountain house at Loloshan should be repaired immediately.

7) Ecological monitoring system

In order to keep integrated biodiversity in YNP, an ecological monitoring system must be set up. The biology and its surroundings should be considered as integrated parts of the same system. Environment creates biology and biology changes the environment successively; these two entities coevolving . The aforementioned illustrations are the basic concepts for biological evolution and ecological monitoring. We strongly suggest the establishment of an ecological monitoring system i.e., indicating biological method, stratification of community and ecological system in YNP.

8) Management model of leisure impact

To attain win and win result, it seems necessary to establish a management model for reducing the leisure impact in YNP.

9) Set up a mountain climbing museum

Two third of the total area are mountainous land in Taiwan, so lots of tourists are very fond of climbing. Forest trails are provided for satisfying the climbers in national parks of Taiwan. The tools for the mountain climber are: traditional tents, ropes, nails, charcoal, light-weight tents, foldable sleeping bag, head light, light gas burner, dried preserved food, communication equipments and light-weight climbing materials, etc. An innovative mountain climbing museum can archive the above valuable materials, forest trails, mountain views, climbing methods to reach the top of Mt. Yushan, mountain disasters and important mountain climbing events for the purpose of preserving our mountain climbing heritage. Additionally, we also can display the
knowledge of natural resources, geology, the
history of forest trails build-up in the to-be-build-
up mountain climbing museum.

We may also use dead coniferous wood
(Hemlock (Tsuga chinensis)) to decorate the
indoor wall of the mountain climbing museum,
which simultaneously serves as forest educational
materials for the visitors. Because many tourists
favor sightseeing and hiking in YNP, they could
benefit greatly from a mountain-climbing
museum.

10) Set up camping ground

There are more than 6 months of high
temperature (>26°C) in Taiwan, so people like
living in high mountain lodges for summer
resorts. Mt. Yushan is located mostly above the
altitude of 2000 m., which satisfies the tourists
seeking to enjoy the cool environment. So we
suggest the establishment of a big camping
ground near Tataja recreation center for a summer
resort. Of course, the location chosen should meet
the following environmental protection criteria: i)
Barren forest site. ii) Hardwood- not easy to catch
fire. iii) Ground area should not be greater than 2
hectares. iv) Enough water supply and good
transportation.

2. Facilities suggested to preserve biodiversity in
Yushan National Park between 2004-2007

1) Survey and monitor the biodiversity resources
successively.
2) Set up permanent vegetation sample area at
Tataja and Walame to survey the ecological
resources variations.
3) Improve Taiwan black bear research facilities,
i.e. protect the habitat of black bear and
prohibit human interference during bear
breeding.
4) Monitor pheasant population variations,
survey its reproduction rate, and set up a
permanent observation center.
5) Set the priority of spruce preservation area at
Mts. southern Yushan and Mojewan.
6) Study the relation between biological
migration and vegetation characteristics.
7) Improve transportation and communication to
access various research centers of
biodiversity.
8) Set up more warning and interpretation signs
at Tataja, Walame, Donpu and Patonguan
ecological preservation areas.
9) Set up Tafen and Walame ecological
preservation centers at eastern Yushan
National Park.
10) Establish ecological monitoring, information
management system and large-scale
biodiversity information computer center.
11) Set up facility to ban unlawful hunting.
12) Interpretation education plan.
13) Repair forest trail between Tafen and
Patonguan and build helicopter stop near
Patonguan for researcher's easy access and
land protection.
14) Besides the above recommendations, no
additional facilities are needed in order to
maintain the healthy biodiversity in YNP.

III、Concluding remarks

Suggestions for the miscellaneous
biodiversity facilities levels in between 2004
-2007:

1. Set up permanent vegetation ecological
sample plot and carry out resources
investigation and long term ecological
monitoring.
2. Investigate the vegetation growth beside the
forest trail to understand the environmental
shift.
3. Increase the apparatus of the current
ecological station.
4. Long-term ecological research.
5. Widening Tonpu forest trail to Kuankao and also building more lodges for the visitors.
6. Set up new lodge to accommodate more visitors at Tataja visitor center.
7. Set up a mountain climbing museum.
8. Set up camping ground near Tataja center.

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Fig. 1. Map of National Parks in Taiwan and YuShan National Park
(Source: http://np.cpami.gov.tw)

Fig. 2. Visitor centers, cottage, village and campground in YNP
"Biodiversity-Facility Level" Analysis in Yushan National Park of Taiwan

Fig. 3. Animals in YNP

Fig. 4. Vegetations in YNP

Fig. 5. Biodiversity conservation facilities in YNP