



Restoration and management of Kuandu wetland of Taipei City, Taiwan

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Abstract

Kuandu, located in Taipei City, is a part of flood plain of Tamsui River as well as one of the major wetlands in Taiwan. Due to its unique location and special environmental characteristics, Kuandu has been and continues to be an important habitat of migratory birds in winter. However, concerns about the degradation of its environmental quality have been increasing during the past several years. In response these concerns, the government of Taipei City recently authorized NT \$15 billion (US \$535 million) to purchase this 55-hectare wetland for its better preservation and management. This action was deemed as the most important victory for the local green groups (e.g., Wild Bird Society of Taipei City), because they have fought for the preservation of Kuandu for more than ten years. Although the city government adopted this praiseworthy action to save Kuandu wetland, coordination among its related agencies has been a critical issue that needs to be solved. In addition, several development projects (e.g., highway, drainage, breakwater, new town) initiated by different agencies of Taipei City are particularly threatening the conservation of Kuandu. This paper will describe the natural environment of Kuandu, analyze its current problems of conservation, and discuss the major issues in drawing up its restoration and management plan. The lessons learned from Kuandu will be summarized in this paper which will be valuable to the conservation and management of other wetlands in Taiwan or elsewhere.



1 Introduction

Wetlands are extremely diverse and highly productive ecosystems. In the last two decades, benefits of wetlands and the hazards that accompany their destruction have been well documented. Important wetland benefits include: water supply, flow regulation, prevention of saline water intrusion, shoreline protection and erosion control, toxicant removal, source of natural products, water transport, recreation and tourism, maintenance of biodiversity, religious and spiritual value, significance of education and research, and contribution to maintenance of natural processes (Chiau, 1996; Davies and Claridge, 1993).

However, wetlands have been viewed as wastelands, sources of mosquitoes and impediments to development and travel. Most people still have kept the perception that wastelands have little value and they have been converted for more "productive" uses. Thus, this common misperception has led to destruction of some of these unique habitats.

The fate of wetlands in Taiwan is similar to that in other countries. Most of the wetlands in Taiwan are threatened by human activities such as drainage for agricultural production, filling for industrial development, discharge of wastewater, and disposal of wastes. Today, the major issues to protect wetlands in Taiwan include the promotion of public awareness of wetland values, improvement of the efficiency of existing laws and regulations, integration of the divergent administrative systems, and prompt establishment of wetland protected areas. The protection of wetlands, therefore, should not be limited to scientific surveys because of the involvement of a variety of stakeholders. Its institutions, planning and the public-private partnership, in particular, deserve the same priority on the agenda of wetland protection. Among the various types of wetlands in Taiwan, the protection of Kuandu Wetland of Taipei City represents a typical and lengthy struggle between development and conservation. This conservation movement also reveals the difficulties of saving a wetland in a complicated political environment.

2 Actions for Saving Kuandu Wetlands

Kuandu, located in Taipei City, is a part of flood plain of Tamsui River as well as one of the major wetlands in Taiwan (Figure 1). Due to its unique location and special environmental characteristics, Kuandu area has been an important habitat of migratory birds in winter. Due to its abundance of natural resources, to be discussed later, Kuandu has been and continues to be a well-known nature center in the metropolitan Taipei.

The history of preserving Kuandu is closely associated with conservationists, particularly the members of Taipei Wild Bird Society. With the assistance and encouragement of several foreign experts, the first bird-watching organization of Taiwan was established in 1973. Since then, bird-

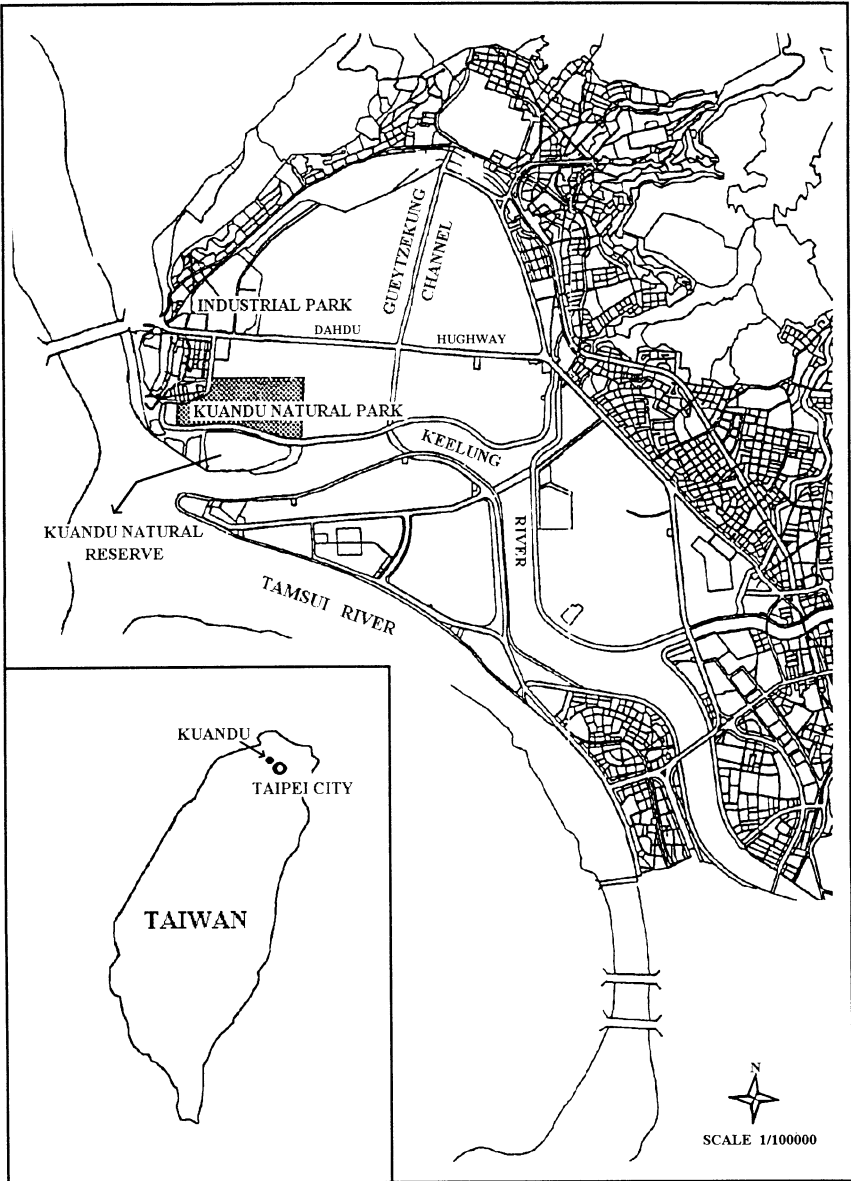


Figure 1: Location of Kuandu wetland.
(Adapted from Wild Bird Society of Taipei City, et al., 1996)



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watching has been a popular activity in this country (Lin, et al., 1988). Among a large number of sites available for bird-watching, Kuandu area is one of the most important wetlands because of its variety and quantity of waterfowls as well as its proximity to the capital city.

However, concerns about the degradation of Kuandu's environmental quality have been increasing during the past decade. In early 1980, an enthusiast wrote a letter to the city mayor of Taipei, Lee Teng-Hui, later elected to be the President of Taiwan, and received Mr. Lee's support. Since November 1981, the City Government had been drawing up a conservation program for Kuandu. This action also initiated a decade movement, which went through the administrative term of five mayors, for saving Kuandu area. On 17 September 1983, the City of Taipei delineated and announced the "Kuandu Waterfowls Conservation Area" on a 55-hectare mangrove island outside the breakwater (see Figure 1). In 1985, experts in the field of landscape and natural park further recommended that this area should be established as a protected area. With the endorsement of the Natural Heritage Protection Law, the island was established to be the "Kuandu Natural Reserve" on 27 June 1986 (Lin, et al., 1988).

Currently, the life area of waterfowls in Kuandu area had been expanded beyond the mangrove mudflat. Therefore, the City Government proposed a new plan for establishing a natural park within the breakwater inland. In addition to that, two theme parks (i.e., landscape park and sport park) were also proposed in the east of the new project site. As shown in Figure 1, nevertheless, the boundary of those three parks were delineated arbitrarily without careful considerations of the local biological and/or physical conditions.

The birth of Kuandu Natural Park has been experiencing great pains. Based on the idea of City Government of Taipei, Lin, et al (1988) finished a "Detail Plan for Kuandu Natural Park". In 1991, Lin also presented his report entitled the "Integrated Planning of Interpretation Facilities at Kuandu Natural Park". The Lin's original plan for Kuandu, however, was criticized as merely a descriptive literal presentation without detailed profile of the site. Moreover, the plan suggested to plant trees, even first on the low-lands, to surround the park. Recommendations as above might have contradicted in terms of the concept of natural parks (Taipei Wild Bird Society, et al., 1996). For restoring the damaged environment and providing more appropriate strategies for management of this natural park, the Government of Taipei contracted a project entitled "Revised Plan for Kuandu Natural Park" with the Wild Bird Society of Taipei City and two consulting firms in 1996.

In addition to a careful planning process for the new park, land acquisition was regarded as the first priority to firmly save Kuandu Wetland. Moreover, the environmental degradation is dramatically in the past several years. In particular, problems of illegal dumping of waste soil and reclamation at the designated areas have raised concerns about the management performance of Kuandu. In response to these concerns, the government of Taipei City recently authorized NT \$15 billion (US \$535 million) to purchase this 55-hectare wetland



for its better preservation and management. This action was deemed as the most important victory for the local green groups (e.g., Wild Bird Society of Taipei City), because they have fought for the preservation of Kuandu for more than ten years.

3 Constraints in Kuandu Wetland Protection

Although the City Government of Taipei adopted a unprecedented action to save Kuandu Wetland, the fate of this sensitive area is still uncertain. Institutional barriers and physical constraints which may hamper the protection of Kuandu are as follows.

3.1 Coordination between agencies of City Government

Coordination and integration of the related agencies have been the major issue in public administration of Taiwan as well as in many other countries. This is particularly true for a complicated affair, such as the coastal zone management and/or protection of sensitive areas, because of various considers and stakeholders. At Kuandu, there are at least four projects, which are sponsored by the subordinate agencies of city government, are undergoing and may have significant impacts on its preservation. In addition to the "Plan of Kuandu Natural Park", the Bureau of Maintenance Works is planning to re-construct a 9-meter new breakwater surrounding the wetland to prevent flooding. The Bureau of New Construction is going to building a highway passing through the east of the park, which may produce significant noise and attract intensive human activities. Consequently, the project will inevitably disturb the existing ecosystem, particularly the waterfowls. Moreover, the Bureau of Housing and Urban Development has proposed a low-density residential plan at Kuandu flood plain for more than ten years. Due to the possibility of residential development, landowners of Kuandu, therefore, have high expectations for higher land prices and therefore, have been strongly resisting against the land acquisition. Since these related projects may not be compatible to each other, it is likely that the environment at Kuandu will be further deteriorated if these projects are implemented.

3.2 Private ownership of the adjacent areas

Due to an administrative mistake made in land acquisition, a 50-meter belt zone which surrounding the south boundary of Kuandu Natural Park has been left to private owners. This belt space was originally kept for the construction of a 9-meter high breakwater. Based on a recent study, however, the Bureau of Maintenance Works may change the location of breakwater and has it moved to the very north of the wetland park. This strategy, recommended by the domestic experts, is designed to preserve the wetland as much as possible and to



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mitigate the human impacts on the wetland. Therefore, the “blank” zone, still owned by the private, becomes a barrier in the public access to the park.

3.3 Impacts resulted from the artificial structures

Hydrology is the most important element in wetland protection. The maintenance of water quality and quantity represents the major challenge to the wetland managers. Many artificial structures have posed significant threats to wetlands. At Kuandu flood plain, a constructed Gueytzekung water channel diverts the freshwater from the mountains directly into the Tamsui River and finally into the sea. Moreover, the Dahdu Highway forms a wall which blocks the discharge of freshwater into the park, because it is about 3 meters higher than the wetland. For the time being, Kuandu wetland will have difficulty to obtain enough freshwater and consequently, will become more salty than it is. If that happens, the ecosystem of Kuandu will be changed from freshwater to brackish, and eventually to salty one. Some plants (e.g., mangroves) will become dominant and the biodiversity of this wetland may be reduced.

3.4 Degrading water quality

There are two streams, Gueytzekung and Shuimokung, originated from quarries in Yungming mountain. In addition to bad water quality in these two streams, the water quality at Kuandu Natural Park is also aggravated by a industrial area and the residential areas next to the wetland (Wild Bird Society of Taipei City, et al., 1996).

3.5 Land subsidence and salty water intrusion

Land subsidence is a common and serious problem, primarily due to overpumping of groundwater for either industrial or aquacultural uses (Chiau, 1997). According to a recent survey, land subsidence and salty water intrusion are found in Kuandu area. Land subsidence may induce more salty water intrusion from the Tamsui estuary into the wetland. On the other hand, it may increase the depth of waters and reduce the area of dry land. If the situation continues, wetland habitats for waterfowls will be damaged.

3.6 Increasing pressure of human activities

How to preserve the environmental quality at Kuandu from development and human activities represents a great challenge facing Taipei City and planners of the park. As mentioned above, illegal activities such as dumping of construction wastes and the reclamation close to the site are public concerns. Those filing activities, reaching some three to nine meters, may have serious impacts to maintain the ground level of wetland, hamper the flow pattern, reduce the area of waters, and damage the existing wildlife habitats. The wetland is



also being affected by the near-by commercial activities (e.g., horse riding, vendors) and the increase of strayed dogs and cats around the area. Illegal fishing and/or wildlife collection represent another problem (Wild Bird Society of Taipei City, et al., 1996).

Accompanying its name familiarity, the number of visitors in Kuandu will be continuously increasing. In other words, the planning and management of this wetland are definitely facing a strict challenge in the near future and need to develop adequate strategies as a response.

4 Opportunities of Kuandu Natural Park

In contrast to the numerous constraints at site, the Kuandu wetland provides a number of significant opportunities. They are the following: (Wild Bird Society of Taipei City, et al., 1996):

4.1 Abundance of wildlife resources

Vegetation in 46 families and 133 species have been documented within the boundary of Kuandu Natural Park. In this area, the dominant plants are *Phragmites communis*, *Cyperus malaccensis*, and *Kandelia candel*. In addition, a variety of wild birds in 14 families and 81 species were also observed in this wetland. For example, *Egretta alba*, *Egretta garzetta*, *Anas crecca*, *Gallinula chloropus*, *Calidris alpina*, *Tringa hypoleucos*, *Tringa stagnatilis*, and *Mptacilla cinerea* are commonly found in marsh and mudflat. Many insects, crabs, shell fishes, and reptiles discovered provided evidence indicating the abundance of ecological resources in the area.

4.2 Accessibility to metropolitan City

Accessibility and name familiarity are important factors for a wetland to be listed on the agenda of public affairs. Most wetlands in Taiwan are located in remote areas and few people can easily access the sites. Therefore, they have been neglected for a long time and are not advantageous for their protection. However, Kuandu is close to the central city of Taipei, e.g., some thirty minutes by public transportation, which can easily attract the people concerned.

4.3 Historical route for bird-watching

In addition to high accessibility, Kuandu is also well known for its good location for bird-watching. The breakwater around its south boundary has been a historical route for the above activity for more than twenty years. Any changes in the environmental and ecological resources of this wetland will certainly alert visitors and responses will come quickly.



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4.4 Water supply from Keelung River and other streams

Hydrology is one of the most representative elements of wetlands. The maintenance of sufficient, stable and good-quality water discharged into wetlands is essential to both the environment and ecology. Although there are existing obstacles of blocking freshwater supplies, as mentioned above, there are still several sources and ways to direct the freshwater into the park. Keelung River in the south and the small streams in the north can be used as freshwater sources to maintain the water level in the Kuandu wetland if necessary.

4.5 Political and public support from Taipei City

After more than ten-year endeavors of the conservationists, the establishment of Kuandu Park has clearly obtained the support from both the City Government and the general public. Through a successful strategy of media propaganda, the Wild Bird Society of Taipei City initiates a bird-water festival each year and invites the city major for the opening ceremony. In addition to giving the politicians a chance for public appearance, the festival also reminds them of their promises and poses a direct pressure on them for providing more efforts to protect the natural environment in the park.

5 Planning Strategies for Kuandu Natural Park

There are several issues facing planners for the project of Kuandu Natural Park. Firstly, the environmental changes are more significant than before. Particularly, the salinity of the water at the site is changing. In the past, *Cyperus malaccensis* Lam. and *Phragmites communis* (Linn.) Trin dominated the wetland. However, they were replaced by *Kandelia candel* (L.) Druce. Secondly, the water quality at the site is deteriorating due to the decreasing supply of freshwaters and the increasing discharges of wastewaters from the industrial and residential areas. Thirdly, the illegal filing in the park and the reduction of wetland area. Fourthly, the increasing pressure of human activities, such as visitors, commercial activities, and related construction projects, which threaten the preservation of Kuandu Wetland.

In response to the challenges, the planning team for Kuandu natural Park proposed the following strategies (Wild Bird Society of Taipei City, et al., 1996):

1. To maintain the environmental quality and ecological diversity as possible as the management plan can. Through a thoughtful discussion on selecting management targets (i.e., which waterfowls and/or plants deserve the priority), this strategy was regarded as appropriate for the limited knowledge on environmental succession and few experience of wetland management. Thus, the team adopted a comprehensive and multi-species approaches to maintain the biodiversity at Kuandu.



2. To build retention ponds to facilitate sediments of wastewaters discharged into the wetland. In addition, some old agricultural channels and the rivers around were considered as the new freshwater sources. They will be connected with several ponds to keep the quantity and quality of water at an acceptable levels for better wetland protection.
3. To delineate core area and buffer zone for better management of the natural park. Zoning has been a common method to properly locate different land uses. In order to avoid and/or mitigate conflicts among different uses, a patten with buffer zone surrounding the core area had been proposed as the framework for developing a detailed plan for the natural park.
4. To restore the damaged wetland. The water area at Kuandu is decreasing because of illegal dumping of construction wastes. Grading down the high lands and restoring them as wetlands again are necessary. Moreover, man-made habitats in deep waters of Kuandu are also deemed as a proper measures for most of waterfowls.
5. To establish a management unit for the Kuandu Natural Park. For a long-term prospect, the natural park needs a management mechanism. A responsible organization, proper ordinances, and the monitoring system will be essential. Therefore, the City Government of Taipei should be actively involved in establishing a new administrative unit and facilitating coordination and integration of related agencies through this new unit. Budgets and qualified professionals should be included for further consideration.

Based on the above strategies, the revised plan for the Kuandu Natural Park was presented to the City Government of Taipei recently.

6 Concluding Remarks

The lessons learned from Kuandu are valuable to the conservation and management of other wetlands in Taiwan or elsewhere. Clearly, the winning of political and public support has serves as the most important catalyst for a successful action to save this wetland. This experience implies that a grass-root conservation movement accompanying with appropriate media propaganda and the continuous efforts to increase the public awareness are essential, which can also be exert a direct pressure to the politicians. Better recognition of constraints and opportunities on the site, which based on the concept of environmental planning, is the fundamental task to planning and management of a protected area. Moreover, the case at Kuandu highlights that a comprehensive and multi-species approaches adopted in planning strategies for preserving biodiversity at site has its merits while confronting the uncertainty of environmental factors and the limited knowledge for making conservation decisions. Finally, the maintenance of water quality and quantity in the region will always be the key issue in wetland protection.



7 Acknowledgments

Served as one of the consultants to the research project entitled “*Revised Plan of Kuandu Natural Park*”, the author is grateful to the Wild Bird Society of Taipei City, the Dillingham Associates of Taipei City, and Han-Bin Liang & Associates of Dublin, California for providing invaluable information on the Kuandu wetland. Appreciation is also expressed to my colleagues Dr. Wen K. Shieh for his invaluable comments and Ms. Annie Jan for her help in word-processing while preparing the manuscript.

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