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Environmental impact study in application of a lake-shore holiday village planning

Zhuhui Bai

Architecture College of Inner Mongolia University of Technology, Hohhot, China, 010051

Abstract: *A new holiday village will be located by the Fleesensee lake of Silz district in Germany. It is proposed to serve travelers and citizens for boating and water sports. The existing planning plan will interrupt local environment due to an indiscriminately transformation of the landscape. Though Environment Landscape Convention (ELC) provides designers a reference for planning policies and tools, there is still a gap between researches and planning practices. Planning plans are always carried out based on designer's personal inclination into the landscape and results in an impossible prediction of change for the landscape and locals. This paper presents a process of using the Environmental impact study (EIS) as a tool to set up a temperate planning plan for the holiday village. Two steps were evolved: landscape interpretation and landscape evaluation. In the first step, multidisciplinary data of the site was collected. Parameters consist of nature and cultural elements were mapped out. Based on the characteristics and identities of the landscape, the second step was rating, overlaying and analyzing parameters according to their protective function. By calculating the environmental net loss and gain, the validity and reliability of the study could be verified. The compliment of EIS can explicitly demonstrate a reasonable decision making process based on respecting existing site condition. The result will indicate the protective area and the new potential design boundary of the site. From the results of the study, a new planning boundary has been put froward to compensating ecology loss by creating new habitats and corridors. Two goals have been attained by the new planning plan: (1) minimal deconstruction of the site; (2) 13.3 ha of additional biotopes was created.*

Keywords: *Landscape planning, Environmental Impact Study, Lake-shore Holiday Village*

1. Introduction

Holiday villages are designed to accommodate people since 1950s. The holiday village design aims at having people get away from daily lives. Most holiday villages are usually located on the shore of water-body and take advantage of water to create opportunities for visual and recreational landscapes (Lawson, 1995). Two standards include cultural identity and environmental adaptation are used to evaluate the success of holiday villages landscape design(Donmez & Aciksoz, 2010). "Landscape" is regarded a zone or area. It is created by the action of natural or cultural factors. A landscape is an ongoing process involved with natural forces and human beings. Its visual features and character are highlighted. It also underlines that landscape forms an entirety, whose natural and cultural components are taken together, not separately (Explanatory Report to the European Landscape Convention, 2017). Aesthetic experiences created by the landscape design for holiday villages is essential but not as important as ecological function and structure. Promoting ecological integrity should be a critical task of developing designs of holiday villages.

Holiday villages have been scattered on the landscapes which are outside of the urban perimeter, and that is why they are so called as "island settlements" which are environmentally detrimental and possibly unsustainable (Cavaco, 2018). The construction of holiday villages have a variety of social-cultural, ecological and environmental impacts(Cavaco, 2018). Especially, fast developments by the water-body have brought ecological degradation, for example, valued forest patches are vanishing (Sirens, 2010). Researchers, therefore, claim that though as a part of nature, human's movement still needs to be outlined in the landscape. As a result, the nature gets an opportunity to regenerate itself. Landscape planning is the process which is widely used to ensure the balance for both human society and nature. Environmental quality objectives are also taken into account for a landscape planning task (Explanatory Report to the European Landscape Convention, 2017).

Many of the aspects should be evaluated by Environmental Impact Study (EIS) to consolidate the reliability of landscape planning. This includes land use and visual quality, geology and soil, hydrology

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and water quality, social-economic impact, etc. As UNECE (1991) said: "EIS is an assessment of the impact of a planned activity on the environment". Designers should use EIS as a framework to solve design issues. EIS plays an important role in achieving sustainable development (introduction to environmental impact assessment, 2017).

Several landscape design rules of holiday villages have been carried out, for example: "design should be suitable with topography" (Ayala, 1991). Yet more designers begin to understand that all design rules should be set up on the interpretation of the condition of the site, and EIS is the key to start. Besides, EIS leads to an effective environmental offset so that the final design could compensate for the residual adverse impacts of an action on the environment, such as enhancing or protecting similar environmental values elsewhere (The development of the Australian environmental offsets policy: from theory to practice.2017). 'No net loss' of the environment is the ultimate goal to achieve by EIS.

This research is carried out in the holiday village founded in Silz. Silz is a municipality in the Mecklenburgische Seenplatte district, Germany. The famous Fleesensee lake is a noteworthy tourism resource attracted people by its shore beauties and associated water sports. A holiday village is demanded by local economic developing needs. In terms of the sensitive environment condition, refined designs should be proposed with a goal of mitigating ecological impact.

The main aim of this study is to provide a measure to fill the gap between research and design practice by exploiting EIS. Additionally, the aim of this study is to reveal the rationality of the EIS by presenting the study process. The ultimate objective is to analyze critical characteristics of design site behalf of EIS and map out the possible design boundary.

2. Study area

A holiday village with a marina for sport and leisure is proposed for construction. The facilities required are a hotel complex, holiday homes, a multifunctional sports complex and a marina for small boats and pleasure craft. Additionally, corresponding technical infrastructure, including access roads, power lines, and water and sewer mains must be planned and implemented. The project contains the following key benchmark figures: the marina for pleasure craft is to include moorings for 150 boats, a hotel complex and holiday homes with accommodation for 1200 guests.

Figure 1. Geographical location of the study area.

The design site (Figure 1) located in the middle of two patches of commercial forests whose human track can be followed. The forests showed a slight sign of recession of vegetation degradation. The design site was covered by herbaceous plant species. Two small bushes scattered on the open ground. They were regarded as stepping stones of animal migration and small habitats for animals like frog. One kettle hole was located in the middle. The old jetties were right in front of the small town.

The main environmental conflicts in the planning process could be summarized as below:

(1)The lake-shore area vegetation was ecologically sensitive. Bathing, motorboats, and the resulting waves would lead to a degradation of water quality and thus affected underwater flora, especially the reed bed.

(2) Animals including crustaceans and several rare aquatic birds would lose their habitat consequently. The activity of human would drive animal away further more. Adversely, anthropophilic animal species could adapt to the rapidly changing environment and thus suppress sensitive, specialized, and rare or endangered species.

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(3) The construction consists of roads, buildings, sports facilities and parking area will alter natural land into impervious surface which allows no surface water trickling into the soil. With the increase of impermeable pavement, the net recharged would be decreased largely.

3. Methods

The study consists of two stages including landscape interpretation and landscape evaluation as shown in figure 2. At the landscape interpretation stage, data was obtained from the relevant institution and government websites. Map used in this study is 1/100 scale digital basic map. Six critical parameters were selected including habitat types, local biodiversity, groundwater recharge ability, runoff regulative function, soil biotic fertility function and soil physicochem buffer ability. The data shared one base map in order to unify the scope of the analysis. Software including Auto CAD and Photoshop were involved. A rating was given to each parameter according to its protective characteristics and showed by a color gradient. The landscape evaluation stage conducted a union analysis result performed to ensure a holistic assessment of all data. After the creation of the six gradient maps which are evaluated, maps were overlaying and analyzed in order to describe the environmental impact of the site, and which are further helping with the design decision making.

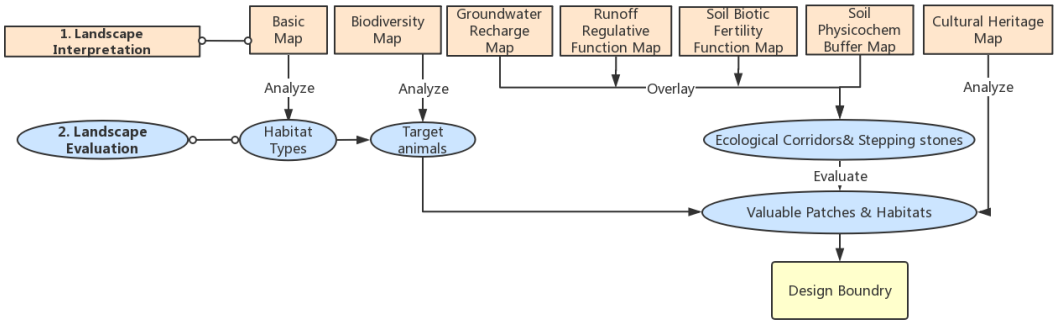

Figure 2. Environmental Impact Study Process (maps, parameters, and analysis process)

4. Results

4.1 Landscape interpretation stage

One 1/100 scale digital map about subject of protection of plants included types and biotope protective function was mapped out as shown in figure 3. Forest has a area of 1.36ha. The main tree species could be found in the forest are pine stock, spruce stock, hybrid poplar stock, and common oak stock. Forest free bitopes of the shores include reeds and cattail reeds which locates along the shoreline measured 385.2m.Fields with sandy soil has a area of 10.34ha. Wet meadow of eutrophic moor sites and swamp site has a area of 3.97ha which locates besides reedbeds.

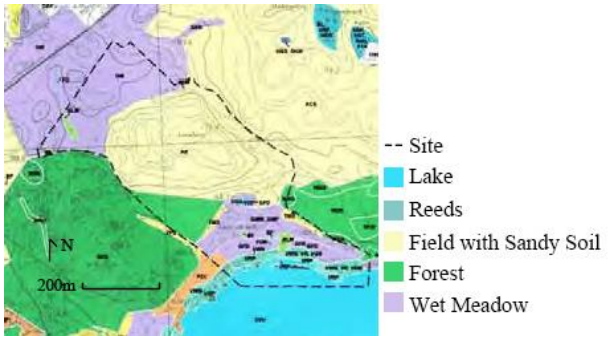

Figure 3. Vegetation types map

Biodiversity map revealed the vulnerable animal species of the site. The analysis further helped to screen target species to bittern and otter. The population of bittern and otter in Germany is declining over the years. These two species prefer to breed and nest in areas with a stable hydrological condition. Dense reeds and cattails near lake edges were optimal nesting spots for them. Bittern is a shy and secretive bird.

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They like wet, tall marshy habitats, mostly related with reedbeds. Its camouflage is perfect for its reedy home. Bittern takes a diverse prey including fish, amphibians, mammals, crayfish or aquatic invertebrates. Otter mainly live in fresh water pond. In order to preserve the two species, the food web was analysis as shown in figure 4.

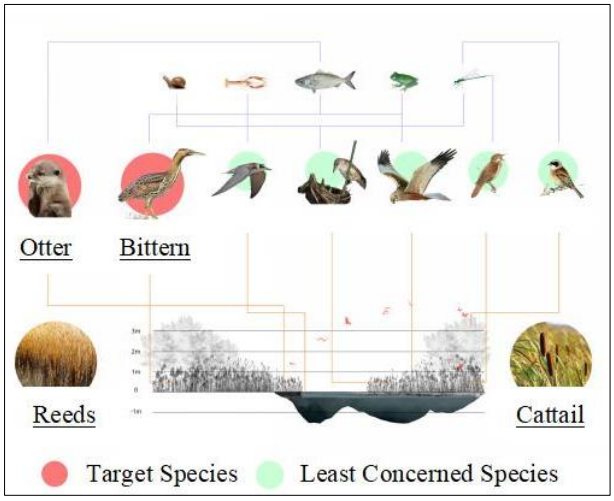

Figure 4. Target Species and food web

Groundwater recharge function is valued high due to water deficit around Germany. One 1/100 scale digital map about subject of the stability of groundwater recharge was mapped out as shown figure 5. 1.90ha of the forest has the most stable groundwater recharge function with an average of 128mm/a. However, 1.12ha of the forest exposed a weakness of groundwater recharge function ranging from 30 to 90mm/a. One of the reasons of this phenomenon was the degradation of vegetation. The area of 4.97 ha showed no groundwater recharge function while 13.81ha showed a sensitive ability range from 45 to 135mm/a. One 1/100 scale digital map about subject of the runoff regulative function was mapped out as shown in figure 6. Runoff regulative function over the site was given scores according to three experts. Overall, the situation was optimistic that 1.90ha of area showed a very high level of regulation, 12.55ha of area was at high level of regulation and 7.34ha of area was at average to high level.

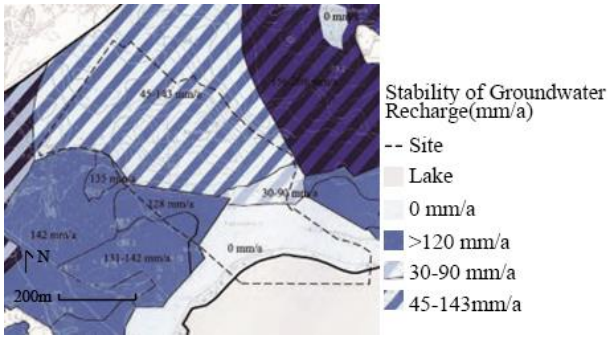

Figure 5. Stability of groundwater recharge map.

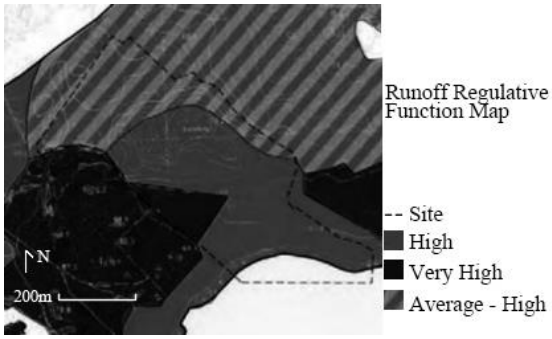

Figure 6. Runoff regulative function map.

One 1/100 scale digital map about subject of the soil biotic fertility function was mapped out. It is

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commonly acknowledged that soil supplies nutrition for plant and animal life. Four categories were given by three experts. It was measured that 10.40ha of the site was very low, 0.80ha was low, 0.52ha was average, 2.38ha was high and 7.70ha very high in soil nutrition. The specific location of the patches could be seen in figure 7. One 1/100 scale digital map about subject of the soil physician function was mapped out as shown in figure 8. Soil physicochemical buffer function property forms a base for biological activity and can be exploited to evaluate soil health. Seven categories were adopted. Within the site, it was seen that 7.63ha of site was very high, 6.32ha was high, 2.33ha was medium, 0.75ha was low and 4.76ha was very low. It was notable that the soil along the shoreline was very low in nutrition as well as physicochemical buffer function.

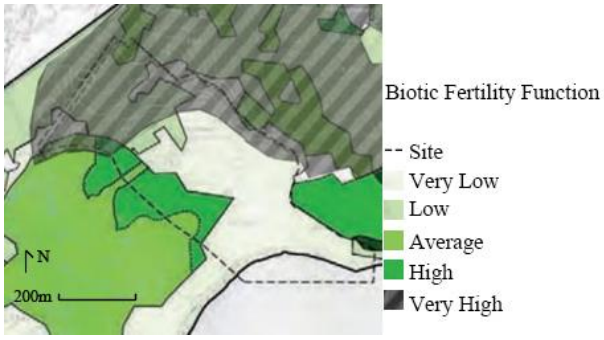

Figure 7. Soil biotic fertility function map

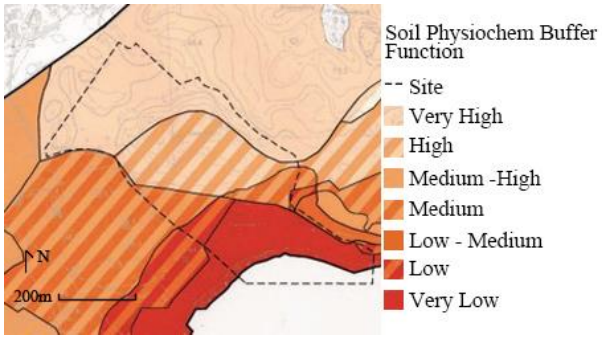

Figure 8. Soil Physiochem buffer function map

One 1/100 scale digital map about subject of protection of cultural and other materialistic goods including the function of the geography, history and civilization of the county was mapped out as shown in figure 9. Visual quality of the site was checked by overlaying the topographic map and cultural assets map. Existing hill provided a stunning view of the lake and the surrounding greeneries. The lowest point of the site was marked by the two drainage ditches.

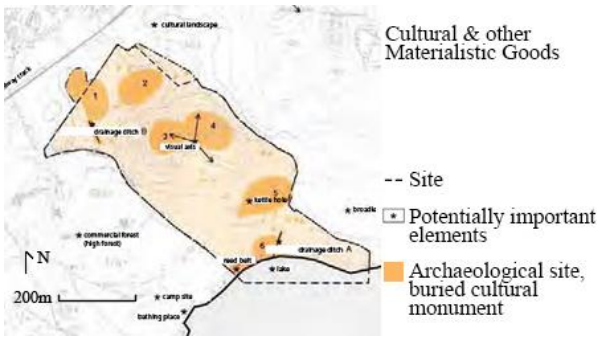

Figure 9. Cultural and other materialistic goods map.

4.2 Landscape evaluation stage

As a result of overlaying and analyzing maps mentioned above, the design boundary which marked three valuable patches and one arguable patch were obtained as shown in figure 10. The patch one was not only acknowledged as an important corridor for animal movements, but also a critical joint to abridge forest fragmentation. However, patch one was seen as less stable for groundwater recharge. The patch

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two had high quality of soil fertility and was highlighted by its runoff regulative function. More than that, the vegetation cover was mainly fresh pastures which create pleasant views for both tourists and citizens. The patch three was maintained to create the future view from the hill. It was seen that 0.17ha of site area worth of conserving. The patch four along the shore was the least valuable in terms of soil biotic fertility function with soil physiochem buffer function, yet it conflicted with the most valuable biodiversity habitat.

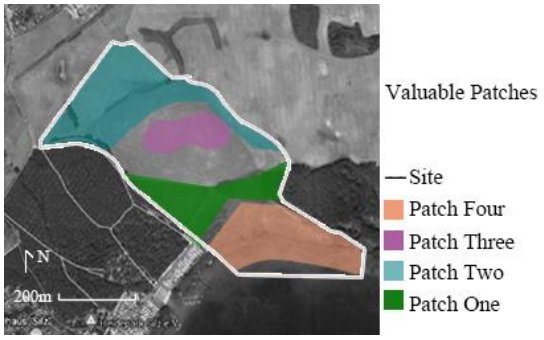

Figure 10. Design boundary

5. Discussion

By comparing the new design and old design, the net loss and net gain was calculated to prove that the rationality of this study process and results. The environmental loss of the existing planning plan of the holiday village as shown in figure11 was calculated. In spite of the fact that the shoreline biodiversity was rich and valuable, total 4.97 ha of shoreline biotope would be sacrificed to marine development. This lost biotope was covered by reeds included a 185m long and 25m wide water lane. In all, 36.55ha of habitat would be interrupted severely. It was also calculated that 16ha of land would turn into impervious pavement for facilities. Through the construction of the access road into the holiday village, 8.8% of the area with a very high noise protection function were to be destroyed. Meanwhile, the filtering layer of air pollution would have been weakening. It was seen that the majority of areas which were essential to protect cultural and other material goods would be devastated supposedly as well.

Figure 11. Existing design boundary

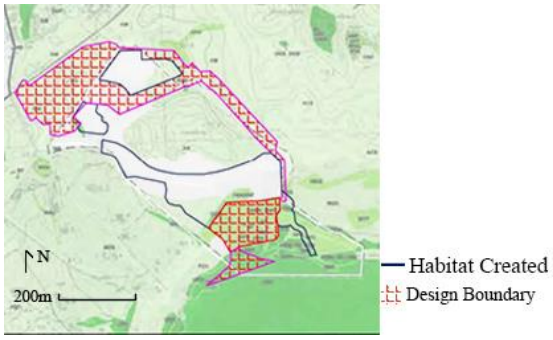

Figure 12. New design boundary.

However, the new planning plan based on EIS fitted in its environment. It was concluded that for

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plant biotope, only 1.1 ha of high valuable biotope area in new planning plan was involved, compared with 3.8ha of the old planning plan without EIS design. Average Value Biotope area which under construction was reduced from 5.6ha to 3.7ha while low value biotope was reduced from 22.3ha to 15.45ha. Additionally, total 13.3ha of habitat was created. The valuable patches were protected as much as possible according to the results from EIS.

The two steps of environmental impact study provided an intelligible design to the site as shown in figure 13. Four zones were planned to meet the needs of tourism and to unify its environment. The living zone was designed to accommodate tourists.Villa were arranged closed to the existing highway and the town on the north-western part of the site. The valuable patches within this zone were carefully protected but still allow people to have close access to the them. The cultural heritage zone consisted of tails along the contour-line and conserved sightseeing spots. Activities such as hiking, bird watching and camping were recommended. The forest corridor zone was set up to have reforestation and to performed as a link for the two separated forest patches. Besides that, the existing drainage ditch would be transferred to a natural style stream, and which will work as stepping stones for animal movements, together with the existing pasture patches. In order to compensate habitat loss due to the development along the shoreline, new habitats for bittern and otter was created as shown in figure 14. These habitats would provide proper living condition for them such as shallow water close to woods and scrub. The bay zone was designed to mitigate the interruption of shoreline as least as possible. Instead of a “stretched out” jetty, a pier hidden back of the existing reed belt were selected. The jetty would be made up by three parts. They were open water which allow boat traffic, a transaction area with few vegetation and a wetland acted as a animal corridor with dense wetland species to filter the pollution. These four zones were connected by a smooth transportation system.

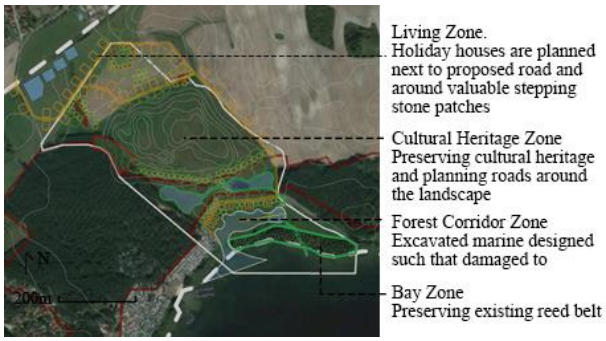

Figure 13. New planning plan.

Figure 14. Conception drawing of stream habitat.

6. Conclusion

This study presented the specific process of exploiting Environmental Impact Study as a design guide. It is essential for such a lake-shore holiday village to be sensitive towards nature, considering its immersion in nature areas. This study may contribute to the decision making process. The most important result of the study is the potential design boundary. It is showed as a map that is compatible with critical ecological resources produced by EIS and can be completed by similar analysis.

In this study, accessible information was collected and analyzed. However, the priority of different parameters could be further investigated. Take the shoreline area as an example, though it supports habitats for animals, its other natural functions were in low protective function. It should be pointed out

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that each parameter map should be incorporated during decision-making process and reviewed. Moreover, lacking of information about the condition of forest habitats left a chance to further discuss the design boundary in a preciser scale.

As a result, the EIS is one of the important instruments to tide over practice and researches. Consequently, its utilization as a foundation for landscape planning is a need beyond desire. Moreover, public participation should be valued in both EIS and the future use of natural space. Only when people get to know surroundings, people start to care about them.

Acknowledgement

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