

The preliminary application of GIS-based spatial controls on planning environmental impact assessment

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Abstract: Spatial controls are import and requisite methods in Planning Environmental Impact Assessment to normalize the type, distribution and scale of industries. The traditional methods, such as matrix-based and Delphin-method assessment techniques, could easy identification of conflicts and trade-off between planning and environmental objectives, but ,they have a degree of subjectivity, and often fail to address the patio-temporal dimensions common to environmental and planning issues. In this essay ,we provide the GIS-based spatial controls to classified the planning area, so that to make more reasonable evaluation of the planning of land-use and the configuration of industry programs.

Introduction

Recent years, under the threatens of various pollutions of environment and destruction of ecological system, spatial control of land-use planning in Countries has been drew lot of attentions. A policy, announced by the Ministry of Environmental Protection of China in Feb. 2006, suggested that the assessments of spatial control, environmental content of pollution and environmental admittance should be strengthen of Environmental Impact Assessment of Planning (PEIA). Nowadays, the PEIA is becoming more and more important to take charge of the environmental impact of the industrial development in cities and areas. The implement of this policy will benefit the PEIA take part in the beginning of the planning-formulating, to identify and provide the inappropriate between development and environment. The spatial control will effectively optimize the land and space use pattern primarily and comprehensively.

Geographic Information Systems(GIS) are increasingly used to support decision-making in spatial planning[1]. Given that development plans commonly link land use to location, spatial evidence and approaches can significantly benefit plan-making. such a spatial framework could also effectively support the specific strategic environmental assessment (SEA) requirements of the plan-making process, and the requirements of Environmental impact assessment (EIA). Although the matrix-based assessment techniques have probably been most widely used in SEA and EIA, also easy identification of conflicts and trade-off between planning and environmental objectives, they have a degree of subjectivity, and often fail to address the patio-temporal dimensions common to environmental and planning issues [2], GIS can overcome some of these restrictions by identifying the spatial and/or temporal variability amongst impacts, and have the potential to augment conventional techniques by providing spatial evidence to both the assessment and the plan-making processes.

Furthermore, given the wide spatial and temporal scope needed for the PEIA, the capabilities of GIS can confer significant advantages in the prediction and evaluation of spatially distributed and/or cumulative impacts. GIS facilitate the preparation of maps and, thereby, present a PEIA support tool to illustrate and analyze data, particularly in land use planning[3]. Presenting baseline data in graphic form improves the delivery of information, enhancing the understanding of the distribution, patterns and linkages between relevant environmental factors.

The forbidding, limiting and evaluating rules of the land and space block are most important of the spatial controls in PEIA. These rules was formulated by different departments of Chinese government, so there requirement of environmental admittance was various. The Chinese government has been propelled the “one forbidding line” to control the different kinds of national space. But now, we still conclude the different rules and requirement of land-use with classification by using GIS to do the spatial controls on PEIA.

Case study

Here we take a case study of GIS-based spatial controls on PEIA. A planning formulated of an airport and several industries united in a city of south China. As described in the preliminary plan, there would be four industrial blocks: Logistics based on the airport, Aviation manufacturing and maintenance, High and new technology industries and Airport business industries.

Environmental background: The airport is on the south of the city and two villages around, as illuminated in Fig. 1. A main river and some branches flow through here, and hills on the north, west and east of the area. The area around the airport is easily erosion of water and soil with 21 °C and 1300 mm of annual average temperature and precipitation, especially around the rivers. A reservoir locates on the northeast of the airport. The south plain of the area between hills is the main agricultural products supply area.

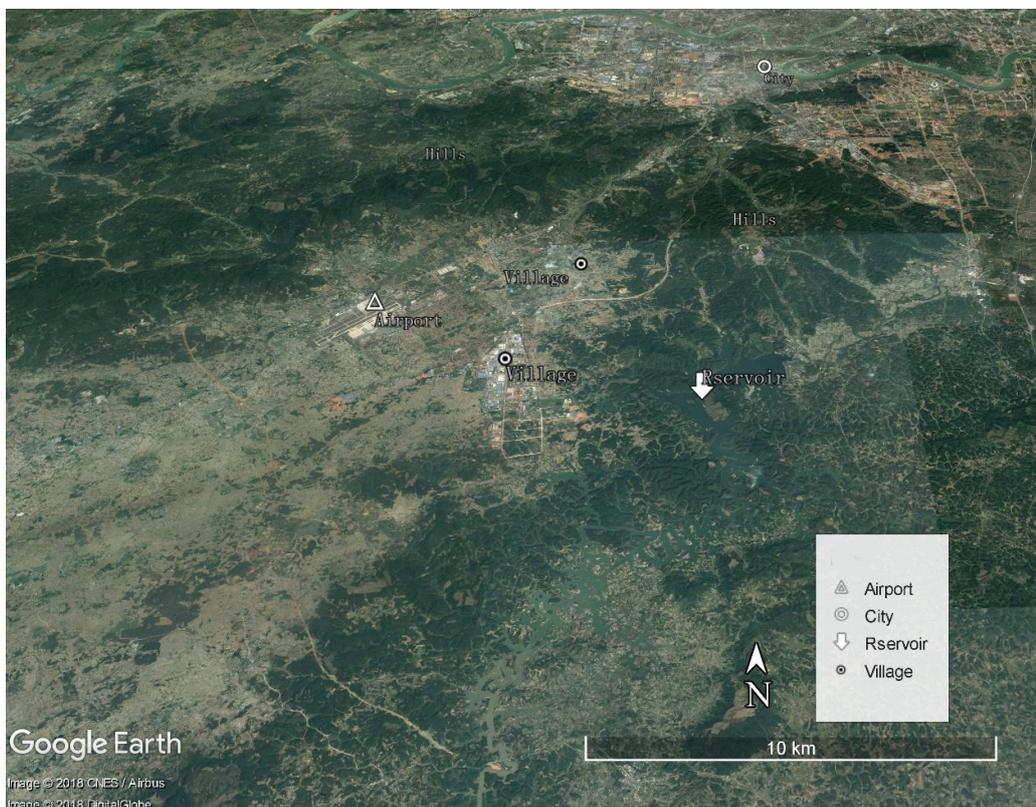


Fig. 1: the geomorphic and environmental background of the evaluating area

Spatial control system building: the land and space around the airport are classified as three levels controlled by land-use lines under GIS program: the forbidding area, the limiting area and the evaluating area. The levels and requirements of the three areas illuminated as the Tab. 1 and Fig. 2

1. the forbidding areas: the areas which besides the red dotted lines in Fig. 2 was the forbidding areas. the area which 200 m-around the reservoir, which also the water conservation area was forbidden to construction, it is also stipulated by the law of water conservation. But, the hills area, which height above 300m above sea level (asl), was also suggested define as forbidden area in the PEIA. Because, the forests and hills in this area was the main area of the conservation space of water and soil, which between the city and villages. These areas are important ecological protection belt around the city.
2. The limiting areas: the areas which besides the blue dotted lines, between the red dotted lines and blue dotted lines and around the rivers in Fig.2 was the limiting areas. The area was mainly the buffer zone between the airport area and the forbidding areas. Also, the river buffer areas, which in this easily erosion of water and soil, are suggested not to changes their land-use type and make protecting projects to promote its ecological functions.
3. The evaluating area: the other areas besides the two areas above-mentioned around the airport, mainly the plain below 100 m asl between the hills. In this area, the The industrial programs should be located after the evaluated of their distributing, scale and pollution discharge, consider the interaction of village, airport, the current situation of land-use and so on.

Control levels	Requirements
Level 1: forbidding area	All the industries was forbidden excepted environmental protecting infrastructures.
Level 2: limiting area	The industrial programs with low pollution discharge and low degree impact on ecology system.
Level 3: evaluating area	The industrial programs should be located after the evaluated of their distributing, scale and pollution discharge.

Tab. 1 the requirements of the classified areas under the spatial controls

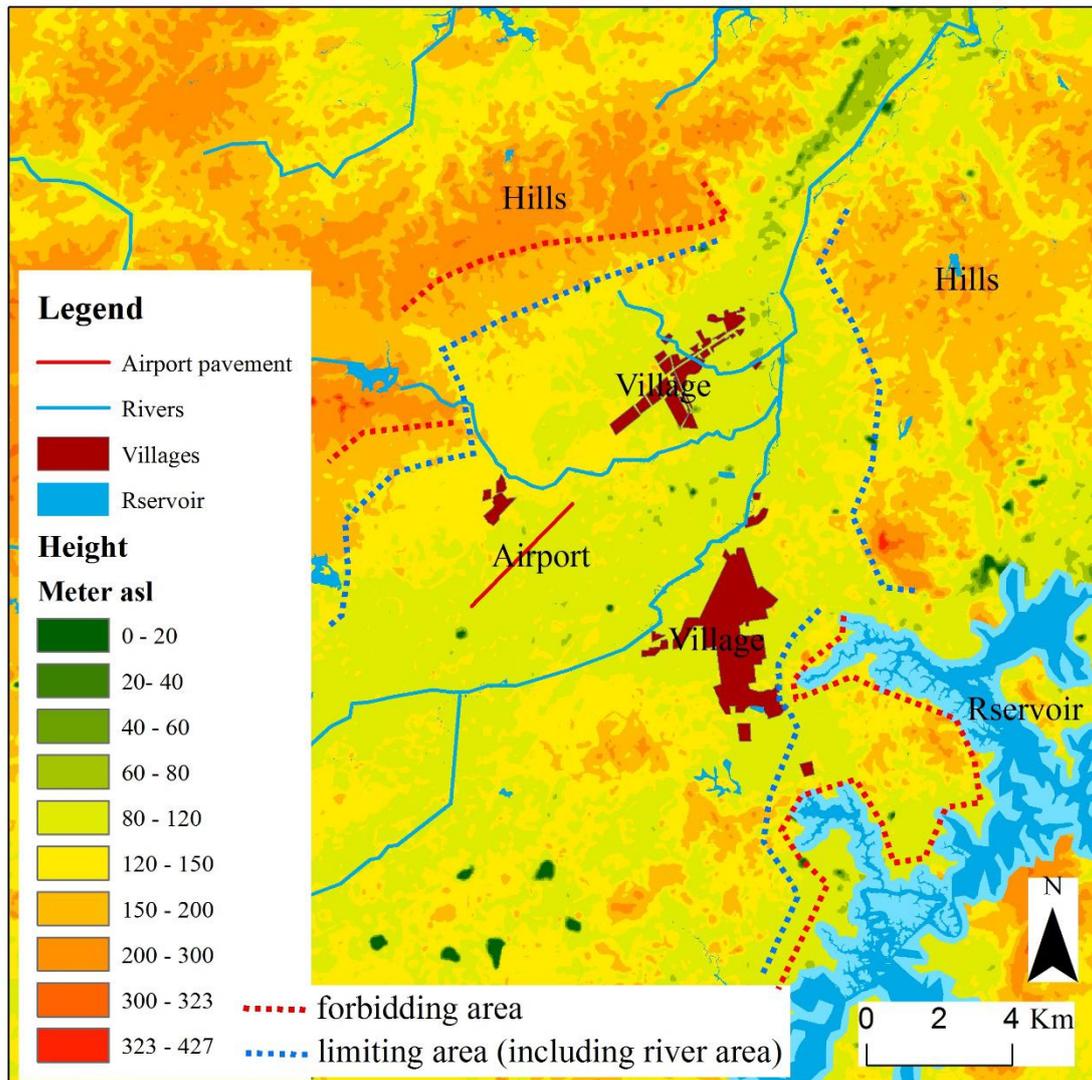


Fig. 2 the areas classed by the spatial control system of the evaluating area

As controlled by this system, our PEIA program suggest the industries of logistics based on the airport, Aviation manufacturing and maintenance should be focus on the area around airport of the evaluating area, the industries of high and new technologies and airport business could be a little away from the airport, near the limiting areas, or in the limiting area with environmental protecting measures.

Conclusion

We applied The GIS method to build spatial controls system of a PEIA project. The planning area was classified into three kinds of spaces with different admittance principles, the forbidding area, the limiting area and the evaluating area. With the different demands of the area, the kind, distribution and scale of the industry construction could be well-planned. The GIS gives the wide spatial and temporal scope needed for the PEIA, the capabilities of GIS can also confer significant advantages in the prediction and evaluation of spatially distributed and/or cumulative impacts, the analyses of big data of society, economic, people and environment to make more reasonable evaluation of the future.

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