GIS-BASED MANAGEMENT OF URBAN TREE AND GREEN SPACES IN VIETNAM CITIES

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ABTRACT

Vietnam's cities and towns are growing fast with urban population growth of 8.9% per year demanding tremendous efforts to improve living conditions of the urban population. While the government has numerous investment programs to improve urban infrastructures and environmental standards, the urban green spaces are yet to get sufficient consideration in city planning and management. Through two examples of GIS-based management of urban tree and green spaces in Ha Tinh and Tra Vinh cities, this paper discusses the potential and challenges in using GIS technology in urban infrastructure management in Vietnam.

INTRODUCTION

Vietnam's cities and towns are growing fast with urban population growth of 8.9% per year demanding tremendous efforts to improve living conditions of the urban population. These processes have modified the urban environment from its natural state in terms of: (i) conversion from land to urban uses; (ii) excessive extraction and depletion of natural resources; and (iii) disposal of wastes into urban and sub-urban areas. The cities are now characterized by excessive runoff, shortage of groundwater, urban heat islands, lack of natural areas, with a large gap between urban dwellers and nature. While the Vietnam's government has numerous investment programs to improve urban infrastructures and environmental standards, the green development are yet to get sufficient consideration in city planning and management. During the last 30-40 years, the vitality of urban trees has fallen drastically, while urban green parks and recreational ponds had been significantly encroached by sprawl of construction land. Heavier traffic patterns have increased demands for road construction and thereby have changed the growing conditions of many roadside trees. This also is partly due

to numerous gaps and overlaps in urban management regulatory frameworks and practices. According to Ministry of Construction (MOC) data, the green coverage in Vietnam's cities currently reaches just about 1/3 to 1/2 of the thresholds specified in the Vietnam's Building Code QCXD01:2008 [1] and cannot compare to the well developed international cities. This calls for better urban management tools with support from geospatial information technologies / GIS.

REGULATORY FRAMEWORK OF GREEN SPACES MANAGEMENT

In the context of contemporary city development the connotation of urban green space has extended to include the green space of the complex urban ecosystem consisting of various forms of non-constructional land including gardens, parks, vertical plants, forestry, farm lands, wetland and waterways. Conservation of the urban green spaces can build up a backbone of natural ecological network to support the sustainability of the cities. Recently, the government of Vietnam had strengthened its regulatory framework with the newest Decree No. 64/2010/ND-CP dated 11/6/2010 [2], which comprehensively regulates urban green spaces / urban tree management from: (i) urban green spaces / tree planning (as integral part of urban master plans), to (ii) procedures for urban green spaces / tree management; (iii) institutional responsibilities and arrangement of related organizations; and (iv) implementation framework. As specified, the MOC has the overall oversight responsibility in urban spaces / tree management nationwide, which has issued Circular No. 20/2005/TT-BXD (dated 20/12/2005) to provide more detailed guidance for urban tree management and developed a number of technical guidelines for urban green spaces / urban tree planning and management as required standards in Vietnam Building Codes [1, 4]. Institutionally, at the national level, the MOC agency-in-charge is Urban Infrastructure Management Agency (UIMA), considering green spaces / urban trees as part of urban infrastructures. At local level, these functions are delegated to shared responsibilities between provincial Departments of Construction (which have technical supervising and appraisal role) and people committees (PC) of provinces, cities and districts (which have full ownership and approval power). For actual operation, URENCOs operating under provincial or town PCs, has been assigned responsibility for management, operation and maintenance of urban infrastructures including urban green spaces and street trees. Only few cities (e.g., Hanoi and Ho Chi Minh City) have separate public companies in charge of urban parks and trees. URENCOs are normally entering into Operation and Management Contracts with the provincial or town PCs annually as required by the Decree 88/2007.

Although, the regulatory framework of urban green spaces / urban trees management is in place for Vietnam, the implementation practices are current under a lot of questions. The lack of coordination between urban agencies, budget constraints and weak law enforcement have resulted in decreasing areas of urban green parks, recreational ponds and losing roadside trees. Working under contracts, URENCOs are still very traditional in terms of non-systematic management of work orders and normally keep O&M records only for internal uses. This practice makes it difficult to coordinate with other government departments or utility management companies when working on same street pavements. Recognizing the importance of urban green spaces and trees and to implement the Decree No. 64/2010/ND-CP, a number of town PCs started to implement the inventory (including putting tree label numbers) and assessment of urban trees as the first step in systematic management of urban trees and urban green spaces.

GIS FOR URBAN TREES AND GREEN SPACES MANAGEMENT

As a platform for data capture, managing, analyzing and disseminating all forms of geographically referenced data, GIS provides effective tools for urban trees and green spaces planning and management. GIS in fact has been successfully applied for urban tree management in many international and Vietnam's cities [6, 7, 8]. Within the DANIDA-funded "Sustainable Development in Urban Poor Areas (SDU)" Component, GeoViet Consulting has piloted GIS applications for urban tree and urban green spaces management in two selected medium-size cities:

(1) Ha Tinh – a 3rd class city in the North Central Coast Region, approximately 340 km south of Hanoi, with a population of about 117,546 in 16 wards/communes in 2009 (Figure 1). The town functions as the economic and administrative center for its surrounding rural area and experiences rapid urban expansion in the last decade. It is reported that the urban infrastructure system in Ha Tinh is unable to meet the growing demand for urban services because of a lack of investment, inadequate maintenance, and weak institutional arrangements. In the urban parts of Ha Tinh 97% of the population had access to piped water, about 57% of roads had drainage systems, septic tank coverage was around 66%, and solid waste was collected from about 78% of households. The green coverage of Ha Tinh is rather limited making the city more scorching in the hot climate of central region and only recently the city government has started a city greening programme (Figure 2).

(2) Tra Vinh - a 3rd class city in the Mekong River Delta, approximately 180 km south of Ho Chi Minh City, with a

population of about 131,360 in 10 wards/commune in 2009 (Figure 1). This is very unique green town with well layout in inner city part (Figure 3). Fast urban expansion and rapid population growth during the last decade put strong pressure on urban infrastructure system. It is important for Tra Vinh city to maintain the green coverage in inner part while plant new in the newly expended suburb areas.

The integrated GIS databases, originally developed for multi-purpose urban infrastructure management, include following information groups:

- City base maps (administrative boundaries, topography, street network, hydrology, landmarks and buildings…)
- Urban land use and land use planning
- Urban infrastructures of transportation, water supply, waste water drainage, solid wastes collection and dumping, cemetery and lighting
- Urban green spaces and urban trees (Figure 2).

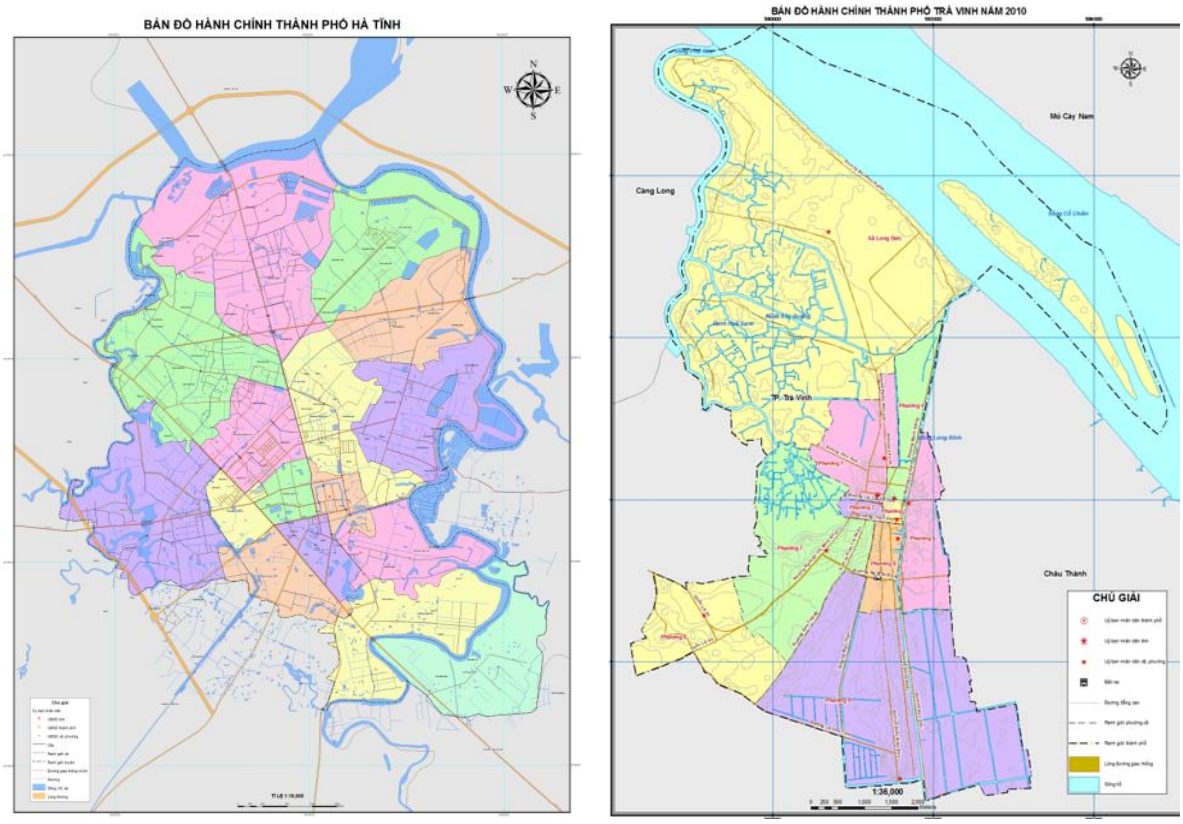

Figure 1. Administrative maps of Ha Tinh and Tra Vinh cities

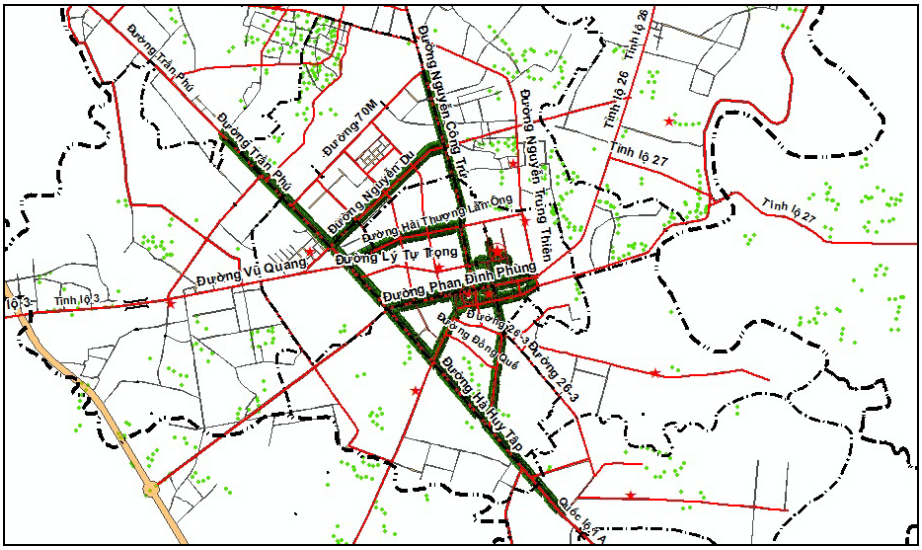

Figure 2. The distribution of streets tree and green strips in Ha Tinh city

Figure 3. The urban tree distribution in Tra Vinh inner city

In order to develop detailed database of urban green spaces and urban trees, Ha Tinh and Tra Vinh URENCOs had been consulted on existing practices and desired standard operation procedures. The structure of street trees data layers is designed to include basic tree information such as position (or street names), species, name, tree label number, age, height, diameter, owner, photos, related documents, condition as well as caring history (pruning, pest control and fertilization), while the urban green spaces to include gardens, parks, temples and recreational ponds. Based on detailed land use maps, urban green spaces are mapped and organized into the GIS database. The surveyed data of individual urban trees

provided by URENCOs are organized into GIS tree inventory layer. This is really a daunting and time consuming task. In total, Tra Vinh URENCO can locate 11263 trees, of which 5319 trees are collected with detailed information and given numbered labeled plates. With completed tree inventory data, URENCOs can use basic GIS functions to query for and visualize detailed tree information (Figure 4), which can support effectively monitoring of trees' health and making plan to protect valuable trees, maintain (pruning/ thinning) or move existing trees and to plant new trees (Figure 5). As for Ha Tinh city, the URENCO's survey of roadside trees are on-going with 3161 trees had been located and inventoried.

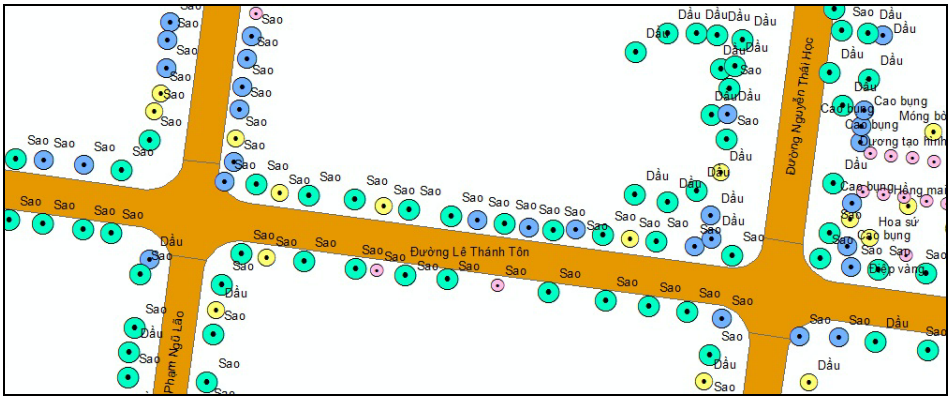

Figure 4. Map with detailed information of street trees
(e.g., species, height, diameter, condition, etc.) in Tra Vinh city

Figure 5. Protecting of mature/valuable and planting new trees in Tra Vinh city

Further, this also helps URENCOs to share tree GIS data with other city government departments or utility management companies (water pipes, drains, communication lines, etc.) in order to make tree protection plan early in the planning stage of nearby construction or maintenance works. As different departments of a city government are in charge of the construction, maintenance and management of these elements, such coordination will decide the result of efficient urban green space management.

Table 1. GIS estimates of green coverage in Ha Tinh and Tra Vinh cities

No.	City	Green coverage as compared to constructed area (%)	Per capita green coverage (m^2/persons)	QCXD 01:2008
1	Tra Vinh	18.16	16	≥ 5
2	Ha Tinh	1.4	0,8	≥ 5

Beside for operational urban tree management, the GIS system is designed to support the city government to comprehensively plan and manage the urban green spaces in integration with other land uses. It is suggested that the GIS databases be installed in the Division for Urban Management (DUM) under the City PCs, whose function is to oversee overall urban development and supervise the URENCOs' operation. A set of GIS tools are being developed based on GIS analytical capability to enable city government to generate regular statistical reports on per capita urban green coverage for whole city or for a particular ward / commune (Table 1). This can help city planners and decision makers to assess the current green states of the city as compared to the required building code (QCXD01:2008) and to prepare for or adjust city greening programs. This is to support a broader concept of urban green development, including:

- Planning the overall spatial structure of urban green spaces planning, identifying environmental sensitive areas and green site selection in close integration with city comprehensive master planning – using GIS spatial and multi-criteria analysis
- Detailed planning for construction and conservation of urban green spaces – using 3D design tools of GIS (Figure 6)
- Monitor the integrated implementation of urban greening programs in close relation with other urban utilities works – using interactive querying and visualization tools of GIS.

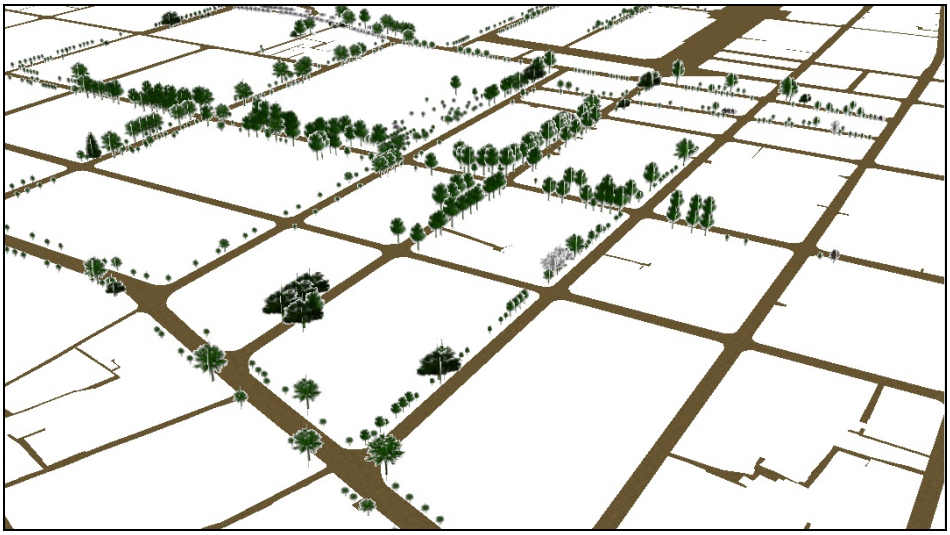

Figure 6. 3D View of Street trees in Tra Vinh city

DISCUSSION AND RECOMMENDATIONS

The applications of GIS for planning and management of urban green areas and urban trees in Ha Tinh and Tra Vinh cities are still in its early stage and are being implemented. Although, Vietnam's cities are increasingly recognizing the needs for better urban tree management, the use of GIS and mapping is still rather rare. With preliminary results presented in this paper, it shows practical potential of the GIS technology in supporting urban green development. In particular, the well designed and developed GIS tree databases can help urban authorities to systematically and effectively monitoring of trees' health, maintaining (pruning/ thinning/ transplanting/ protecting) mature trees and planting new trees… Further works are being continued aiming at completing and operationalizing GIS systems with appropriate simple and practical GIS tools to support city government agencies and companies (DUMs and URENCOs) in implementing newly issued Decree No. 64/2010/ND-CP. There are still a number of challenges (both technical and institutional) hammering the urban green development in Vietnam. Lessons learnt in integrated urban infrastructure management using GIS in Ha Tinh and Tra Vinh case studies will be discussed at the workshop.

REFERENCES

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SỬ DỤNG GIS TRONG QUẢN LÝ CÂY VÀ KHÔNG GIAN XANH TẠI CÁC ĐÔ THỊ VIỆT NAM

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TÓM TẮT

Các đô thị Việt Nam đang phát triển nhanh chóng với dân số đô thị tăng 8.9% mỗi năm trong giai đoạn 2000 – 2010 đang yêu cầu Chính phủ ngày càng nỗ lực thêm để có thể cải thiện điều kiện sống cho dân cư đô thị. Mặc dù, chính phủ đang có nhiều chương trình đầu tư cải thiện hạ tầng kỹ thuật và môi trường đô thị, không gian xanh đô thị chưa được chú trọng đúng mức trong quy hoạch và quản lý đô thị. Thông qua 2 ứng dụng GIS thí điểm quản lý cây và không gian xanh đô thị tại 2 thành phố Hà Tĩnh và Trà Vinh, bài báo trình bày và thảo luận khả năng và những thách thức khi ứng dụng công nghệ GIS trong quản lý hạ tầng đô thị tại Việt Nam.