THE USE OF REMOTE SENSING AND GIS FOR DETECTING THE EFFECT OF LAND COVER CHANGE ON INUNDATION IN CAN THO CITY, VIETNAM

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INTRODUCTION

- Can Tho City: one of the rapidly growing urban centers in the Vietnam Mekong Delta.
- Filling up of natural water channels and water bodies for residential and commercial purposes cause induced encroachment of flood plains.
- Investigating impact on the natural hydrographic network and evaluate the relationship between landcover changes and flood inundation in Cai Rang and Ninh Kieu districts areas that are undergoing rapid urbanization.
- The results: appreciable changes in landcover and natural hydrography in Ninh Kieu District as compared to Cai Rang district.

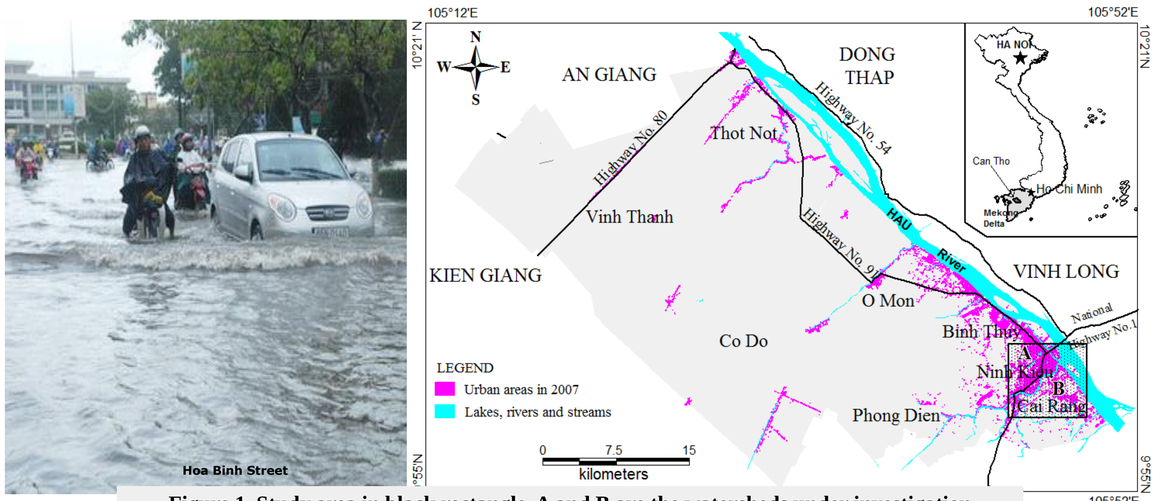

Figure 1. Study area in black rectangle, A and B are the watersheds under investigation (Urban areas based on Pham *et al.*, (2010))

METHODOLOGY

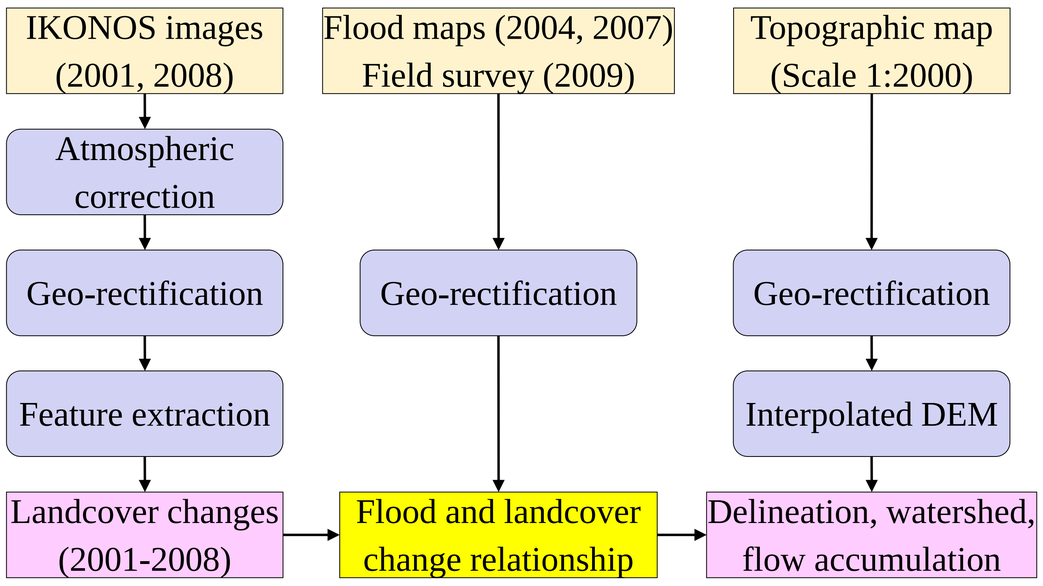

Figure 2. Flow chart of workflow

Data used

- IKONOS: acquired on 21st Nov 2001 and 19th Jun 2008
- Flood inundation maps for year 2004, 2007 and 2009
- Topographic maps scale 1/2000.

Processing

- Atmospheric correction (FLAASH module -ENVI)
- Landcover classification (Fx-Feature extraction module-ENVI); 5 classes: built-up, water bodies, bare, wet vegetation, dry vegetation.
- Terrain and watershed:
  - ✓ DEM: B-cubic Spline interpolation algorithm (Nonogaki *et al.*, 2008)
  - ✓ Watershed and stream networks: *r.watershed* commands of GRASS software

Table 1. Area of landcover changes of watershed A

No.	Landcover change classification	Area (ha)	Percentage
1	Dry vegetation → Built-up	14.49	**45.8**
2	Bare → Built-up	6.18	**19.5**
3	Built-up → Dry vegetation	5.46	17.2
4	Dry vegetation → Water bodies	2.88	9.1
5	Others	2.66	8.4
	Total of changed area	31.67	100

Table 2. Area of landcover changes of watershed B

No.	Landcover change classification	Area (ha)	Percentage
1	Dry vegetation → Built-up	32.50	**35.8**
2	Dry vegetation → Bare	28.15	**31.0**
3	Bare → Dry vegetation	6.84	7.6
4	Water bodies → Dry vegetation	6.26	6.9
5	Others	16.96	18.7
	Total of changed area	90.71	100

RESULTS

- Watershed A-Ninh Kieu District: the center of economic and commercial
  - ✓ Serious inundation phenomenon
  - ✓ The significant increase of built-up area - percolation zone (65.3% of total change areas to built-up landcover), water accumulation into built-up areas, topography and lack of drainage.
  - ✓ Watershed is isolated from the biggest Hau River and Can Tho River and the accumulation lines also drain into the sewing pipes and require pumping to appropriate outlets, do not drain water into these rivers.
- Watershed B - Cai Rang District: newly developing area
  - ✓ Some segments of Nam Song Hau Street experience flood inundation.
  - ✓ Low-lying area (compared with A watershed).
  - ✓ In the period 2001 to 2008: changed significantly, 3 times higher than of watershed A.
  - ✓ Have better network of natural drainage with numerous small streams and rivers draining into the Hau River.

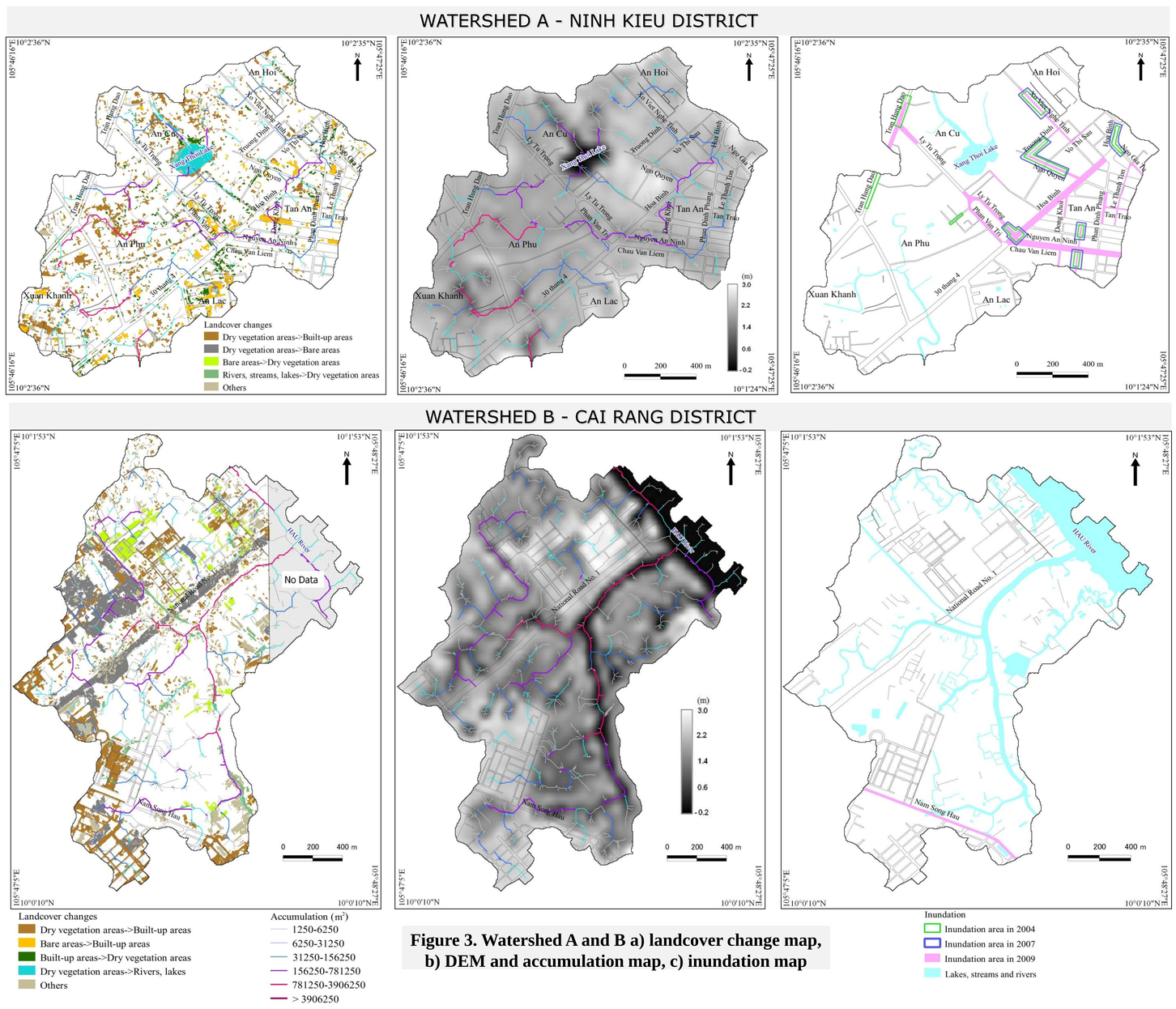

Figure 3. Watershed A and B a) landcover change map, b) DEM and accumulation map, c) inundation map

CONCLUSION

- There is the strongly relationship between landcover change, topography, flow accumulation and flood inundation.
- Isolated watershed, the sharp increase of built-up area and filling-up of natural water channels in Ninh Kieu watershed have caused the increased incidents of inundations.
- Civil measures such as restoration of percolation zones and dredging of clogged water channels is suggested in Ninh Kieu watershed.
- Generation of high resolution DEM: to design drainage system to mitigate flood inundation especially in low-lying areas.
- The Cai Rang watershed has the main accumulation lines which concentrate or connect to the rivers and the natural drainage in watershed B is relatively preserved.
- Further studies: carrying for whole city in order to formulate an effective master plan for sustainable development of Can Tho City.