

Situation and Orientation issues in climate change adaptation urban planning research in coastal cities of Quang Ninh province

Thực trạng và những vấn đề định hướng trong quy hoạch đô thị thích ứng với biến đổi khí hậu nghiên cứu tại các đô thị ven biển tỉnh Quảng Ninh

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Abstract

In coastal areas of Vietnam, the climate change impact on urban planning is taking place more and more clearly, which is the cause of environmental pollution and affects urban sustainable development. Especially for sensitive areas such as coastal urban areas of Quang Ninh Province, where there are numerous opportunities and challenges for socio-economic development, climate change will have great impacts. In the framework of the scientific research project at the provincial level in Quang Ninh tested by the authors in 2019, the article presents the contents of the current situation in the coastal urban planning of Quang Ninh Province, including: planning method, planning management solution, urban spatial structure and urban technical infrastructure system in adapting to climate change. Based on the results, the article raises issues that need researching and orientating in urban planning for climate change adaptation, focusing on two directions: Orientation of landscape planning integrated with climate change adaptation and direction of transport planning, technical infrastructure - environment applicable to coastal urban areas in Quang Ninh Province.

Key words: Climate Change, Urban Planning, Coastal Urban

Tóm tắt

Tại khu vực ven biển của Việt Nam, tác động của biến đổi khí hậu đến công tác quy hoạch đô thị đang diễn ra ngày một rõ nét, là tác nhân gây ô nhiễm môi trường và ảnh hưởng đến sự phát triển bền vững của các đô thị. Đặc biệt đối với các khu vực nhạy cảm như các đô thị ven biển tỉnh Quảng Ninh, hiện đang có nhiều cơ hội và thách thức trong sự phát triển kinh tế xã hội, thì biến đổi khí hậu sẽ có nhiều tác động lớn đến khu vực này. Trong khuôn khổ đề tài nghiên cứu khoa học cấp tỉnh tại Quảng Ninh của nhóm tác giả đã nghiệm thu năm 2019, bài báo trình bày những nội dung về các vấn đề thực trạng trong quy hoạch đô thị ven biển của tỉnh Quảng Ninh, gồm: phương pháp quy hoạch, giải pháp quản lý quy hoạch, vai trò của cấu trúc phát triển không gian đô thị, hệ thống hạ tầng kỹ thuật đô thị trong thích ứng với biến đổi khí hậu. Trên cơ sở đó, bài báo đưa ra các vấn đề cần nghiên cứu, định hướng trong công tác quy hoạch đô thị thích ứng với biến đổi khí hậu, tập trung vào 2 hướng là: Định hướng quy hoạch cảnh quan lồng ghép thích ứng biến đổi khí hậu và Định hướng quy hoạch giao thông, hạ tầng kỹ thuật - môi trường áp dụng cho các đô thị ven biển tỉnh Quảng Ninh.

Từ khóa: Biến đổi khí hậu, quy hoạch đô thị, đô thị ven biển

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1. Introduction

The coastal and island areas of Quang Ninh province are mostly populated by urban and rural residents. In recent years, coastal and island urban areas have strongly developed in both quality and quantity; Economic and urban infrastructure system are gradually being developed and completed. The coastal urban system has made an important contribution to the development of the province towards industrialization and modernization. Furthermore, the urban construction planning is gradually consistent with the characteristics of a coastal urban area through the organization of functional zoning, space development, construction of social infrastructure works, and infrastructure. Engineering works, entertainment areas, tourist service works, greenery areas, protection of landscape, environmental resources in urban areas and residential areas. However, climate change has had direct or indirect impact on the entire physical and social environment, posing significant challenges for urban areas and coastal rural residential areas. Currently, in coastal urban areas of Quang Ninh province, the general construction planning has been approved and put into practice. However, in these projects, the integration of planning with climate change issues was not addressed or included in specialized planning projects to effectively adapt flooding and environmental protection for sustainable development in urban areas. The current issues and directions in urban planning to address the aforementioned issues are listed below.

2. Situation of coastal urbans planning in Quang Ninh

2.1. Expressions of climate change and planning work in Quang Ninh province

2.1.1. The manifestations of climate change

Quang Ninh province is geographically located in the Northeastern region, so the climate change scenarios for Quang Ninh to the Northeastern region. The main manifestations of climate change in the late 21st century are:

- Temperature: Table 1 shows the change in annual average temperature from the baseline period.

- Sea level rise scenarios: Table 2 depicts sea level rise in Quang Ninh province from Mong Cai to Hon Du.

Some comments on extreme water levels: in the coastal area from Quang Ninh to Thanh Hoa, the highest storm surge that has occurred is 350cm, under climate change conditions, storms are likely to intensify, and the water level can rise to over 490cm; Flood risk corresponding to 100cm sea level rise: 4.79% of Quang

Table 1. Changes in annual average temperature, annual rainfall compared to the baseline period in Quang Ninh province [1]

Scenarios	RCP4.5			RCP8.5			
	Years	2016-2035	2046-2065	2080-2099	2016-2035	2046-2065	2080-2099
Temper-ature (°C)		0,7 (0,4÷1,1)	1,6 (1,1÷2,3)	2,1 (1,5÷3,0)	0,9 (0,6÷1,4)	2,0 (1,5÷3,0)	3,6 (2,9÷4,8)
Annual rainfall (%)		20,4 (6,5÷33,4)	19,1 (11,7÷26,9)	29,8 (19,8÷40,9)	14,8 (6,4÷23,4)	24,0 (14,7÷33,0)	36,8 (25,9÷46,5)

Table 2. Sea level rise in Quang Ninh province [1]

Scenario	The milestones of the 21st century			
	2030	2050	2070	2100
RCP2.6	13 (8 ÷ 19) cm	21 (13 ÷ 31) cm	30 (18 ÷ 44) cm	44 (27 ÷ 65) cm
RCP6.0	12 (8 ÷ 17) cm	21 (14 ÷ 31) cm	33 (21 ÷ 48) cm	54 (35 ÷ 79) cm
RCP8.5	13 (9 ÷ 18) cm	25 (17 ÷ 35) cm	41(28 ÷ 57) cm	72 (49 ÷ 101) cm

Ninh province is at risk of flooding. The tidal extreme data (amplitude and phase) play an important role in the design of the coastal structures as well as in the development of the coastal flood risk maps. The sea area from Quang Ninh to the northern half of Thanh Hoa has regular diurnal tides; The tidal range has a strong distribution, the area with the largest tidal range is coastal Quang Ninh: 219cm. In the case of storm surge combined with tides, the total water level during the storm with a repeat cycle of 200 years in the coastal plain from Quang Ninh to Nghe An can be between 450 and 500cm.

2.1.2. Situation of planning work

With a relatively fast growth rate compared to other localities of the country, in recent years, Quang Ninh province has formulated many new planning projects and planning adjustment projects to meet the socio - economic development requirements with environmental protection and sustainable development, building urban centers on the trend of green, smart and modern urban. As of August 2020, the system of planning projects of the province had been approved and implemented quite fully and synchronously, from the provincial level to urban areas, border gate economic zones, Ha Long Bay, ..., including: master plan on socio-economic development, industrial development planning, health system planning, tourism planning; general construction planning; environmental planning; Specialized master plans on transportation systems, water supply systems, water drainage systems and solid waste management, ... with the main term up to 2030, with a vision to 2050 [3]

2.2. Assessment of the status of urban planning in Quang Ninh Province

In recent years, a summary of urban planning in Quang Ninh has been approved, demonstrating that shortcomings have not been studied and resolved, including:

(1) Solutions to design and implement climate change adapting urban planning on the provincial and urban scale are still in the research phase, incomplete, lack of integration. The content of adaption design and planning must clarify the criteria appropriate to natural geographical regions with different climatic conditions: coastal, highland, sea level

rise, storm surge. , hot and humid, hot and dry, geology, hydrology, ...

(2) The method for integrating planning has yet to be defined. The current approach of urban planning is mainly monophyletic, making it difficult to meet the requirements of urban development in the context of climate change. Therefore, it is necessary to develop tools to integrate multiple sectors into a unified planning framework for urban development and to clarify the role of urban planning with climate change adaptation goals.

(3) The importance of urban spatial structure in the natural conditions of the coastal urban areas has not been clearly established; coastal urban structure has not yet been linked synchronously with land use solutions, urban spatial organization and infrastructure in the context of climate change.

(4) The role of the urban economy and the core value of the technical infrastructure system in meeting the requirements of urban environmental protection has not been comprehensively evaluated, in parallel with the technical and organizational art. space of urban planning. This is also the key in terms of climate change adaption planning. The current urban planning approach is mainly focused on urban development, increasing land use, etc. but not paying attention to other important factors such as environmental protection, conservation of the natural framework associated with sustainable urban development.

(5) The majority of urban planning projects approved in Quang Ninh do not take climate change into account. Current regulatory urban planning projects typically have a time frame of 10-25 years and a vision of 50 years, whereas in the climate change scenario, the impacts of climate change are calculated for each period and have a clear impact after 50-100 years.

(6) Measures to cope with natural disaster risks such as storms, inundation, high tide, saline intrusion ... have also been set out when implementing some urban planning but there is no strict system from the Legal versions, standards to approach. Project methodology is not comprehensive in the context of climate change.

3. Issues that need research and orientation in urban planning to adapt to climate change in Quang Ninh province

3.1. Land use planning, spatial organization, urban landscape architecture integrated with climate change adaptation

In the context of climate change, the main challenge for planning is the reduction of built up land due to sea level rise, inundation, saline intrusion and drought. As the result, the general direction and solution are as follows:

For the purpose of land use planning:

- For the land at risk of flooding, it is possible to change functions, restructure land use, use mixed land or use land for green trees, amusement parks, resort tourism; Seafood Aquaculture. Specifically, in 2030, with an average sea level rise of 12 to 13 cm, saltwater intrusion will be concentrated in the following localities: Mong Cai, Hai Ha, Dam Ha, Tien Yen, Quang Yen... with about 1,800ha of saline-infested land needs to be converted to use purposes.

- Coordinate land use planning with urban technical infrastructure planning to improve the efficiency of urban functional areas.

- Increase "compression" capacity of urban centers to reduce construction costs of technical systems, loss and consumption of transmission energy in urban areas.

- Reserve the urban land fund to build storm-avoidance and flood-avoidance areas and plan to form a unified and rational system.

- Review, supplement and adjust agricultural land planning, industrial planning, irrigation planning, salt flood control planning; propose a production model that uses less land to save a land fund without flooding.

For the organization of urban space, architecture and landscape:

About landscape:

- Landscape zoning must pay attention to features of natural landscape and environment, respect of landscapes of rivers, lakes and mangrove areas;

- Deploy green urban models;

- Development of water storage areas, buffer zones and green belts;

- Design a flexible and resilient urban structure in natural harmony and harmony of the urban landscape

- Urban restructuring

Architecture

- Encourage the construction of high-rise buildings to reduce the construction area, increase the area of green space and empty space.

- Develop towards green architecture, architecture and energy saving.

A common vision for the coastal urban planning model in Quang Ninh province is to create an urban spatial structure oriented toward sustainable and ecological development for the purpose of climate change adaptation. Model the rational urban spatial structure for climate change adaptation and mitigation with solutions for rational urban functional zoning among the main components: urban centers, residential areas, green spaces, traffic, and production areas are linked to controlling high, medium and low land use densities for optimal adaptation to climate change. Coastal urban structure

is one of the basic characteristics of the organization of urban space. The orientation of landscape planning integrated with climate change adaptation in coastal urban areas of Quang Ninh is as follows [3]:

- Low hilly landscape: Orientation of spatial planning plan in 2 directions including: Space to prioritize the development of models of forest gardens to adapt to climate change ; Priority space for urban improvement, development of integrated agricultural - forestry models at the household scale to adapt to climate change. Solutions to improve the adaptability of these landscape models include: planting and regenerating forests in bare lands to protect soil and water resources; expanding the area of plant species and indigenous trees with a wide ecological amplitude; afforestation according to belts and pillows, alternating after exploitation phases; exploiting in waves, preventing erosion during storms; propagate and disseminate knowledge about climate change to households participating in afforestation.

- Central urban landscape: Spaces prioritize improving the quality of urban areas, developing household scale models that adapt to climate change; The space prioritized for new and modern urban development with infrastructure for disaster prevention and climate change adaptation. The tidal flat was leveled to build a new urban area. Along with urban construction activities, the construction of drainage systems, daily-life solid waste collection systems, infrastructure construction, traffic, ... should pay attention to the impacts of gas change. post-production happens in the future. Short-term solutions to apply include: reinforcing the house before storms, environmental sanitation after storms; Long-term solutions include: building rescue roads, planning associated with climate change, building early warning system of tsunami, landslides.

- Coastal island landscape:

- + Space for economic development of seaports and infrastructure to adapt to climate change: bring into full play the advantages of seaport economy; prevent directly wastewater from going into the sea; carry out waste collection; prohibit littering into the sea; actively manage waste, especially hazardous waste.

- + New urban development space and climate change adaptive infrastructure: sea encroachment area for urban expansion, with priority given to the development of a modern ecological urban center, with appropriate spatial architecture, creating points press on urban architecture. Priority is given to the construction of drainage systems, wastewater treatment, solid waste management systems, and new urban construction, and should pay attention to future climate change RCP4.5 scenarios.

- + Development space is limited to aquaculture models while focusing on climate change adaption solutions: prioritizing the development of seaport economies, waterway transportation, and the establishment of marine aquaculture models. It is necessary to consider solutions to improve the adaptability of the models to climate change: the raft should be located in the waist, bay or the back of the island, avoiding strong waves and strong winds; avoid oil pollution, toxic waste pollution, domestic wastewater and the port change area where many boats moor, reinforce cages before the rainy season.

- + Priority space for rocky mountain landscape protection: prioritize protection of landscapes and biodiversity for tourism, conservation of archaeological relics, and protection

of marine environment.

+ The space to prioritize the development and expansion of highly efficient aquaculture models that adapt to climate change.

3.2. Traffic, infrastructure engineering and environment planning

The main challenges in transportation planning, technical infrastructure and the environment are: flooding causes road landslides, traffic congestion, environmental pollution, impacts on the quality of water supplies for urban areas. Therefore, the general solution in the planning is: (i) Urban technical infrastructure planning must be based on data such as: safe altitude areas, unfavorable areas due to climate change, water caused sea level rise in the area map; (ii) Identify technical infrastructure systems threatened by climate change and sea level rise for treatment; (iii) Technical infrastructure corridors must be built on areas not threatened by flooding. Depending on the impacts of climate change with different coastal cities to have appropriate plans to protect the urban environment, prevent erosion, landslides, storms, storm surges, floods, ... Balance optimal construction density, land use coefficient to increase surface water permeability, ventilation, natural lighting and reduce urban heat island effect. On that basis, the specific orientations are as follows [2]:

- Orientation of technical infrastructure planning according to the climate change scenario, for example, in order to meet the milestones of sea level rise in each phase in the scenario, it is necessary to have corresponding solutions in each phase such as: urban foundation, building foundation, drainage capacity, traffic use range, and so on. Especially, urban infrastructure should be in the direction of green infrastructure to minimize climate change (storage and carbon consumption, fossil fuel replacement) and adaptation (management of temperature rise, water supply management, coastal and riparian flood management, surface water management, soil erosion reduction).

- Urban traffic system planning: strengthen the public transport system, limit the number of vehicles that cause environmental pollution. Halong city: raising the elevation of road surface at locations where local flooding occurs at Highway 18, Highway 279, Provincial Road 337, Provincial Road 336 and Provincial Highway 328; raising embankment crest and increasing the protection coverage of embankments at Cai Lan port and B12 oil port need to raise embankment peak; Lang Khanh port could not overcome the need for relocation; other works that are not affected need to ensure compliance with the plan; Cam Pha City: ensure good implementation of the plan; Mong Cai city: elevation of road level at some points at risk of flooding due to sea level rise on national highway 18, highways of Ha Long - Mong Cai and some coastal roads, raising foundation for Van port Low ground elevation should be required, other port areas not affected just ensure good implementation of the plan; Quang Yen town has many roads and railways affected on a large scale, and the plan needs to be changed. [5]

- Urban leveling planning: upgrading sea dyke system to elevation of 5.0 - 6.0m, average width of 4.0 - 6.0m; it is necessary to adjust the alignment, build a closed local route at dikes Tien To and Dai Yen; Enhance the land and houses in the coastal area with the foundation from 3 - 3.5m.

- Urban water supply and drainage planning: Planning for water storage and water storage reservoirs for coastal

cities can help mitigate climate change impacts on water resources; Priority should be given to surface water sources and limited groundwater. Drainage planning is a decisive factor in the adaptation of sea level rise, storm surge and flooding in the coastal area: Planning the location and size of the drainage pump system for flood management; The planning orientation for sustainable rainwater drainage is slow drainage, using regulating lakes on the rainwater collection and transmission area to store water, increasing the natural permeability of rainwater to the ground through green grass. and non-concreting of drainage basins while improving landscape and microclimate regulation; The planning orientation for the scattered wastewater drainage system suitable for the natural conditions of the coastal area, especially for new urban areas located along the coast and rivers, in suburban areas, in rural areas: on-the-spot solutions with individual households in remote urban areas, peri-urban and rural areas or with cluster-dispersed solutions with urban areas allowing on-site reuse of treated wastewater for washing, irrigation, replenish groundwater, reuse split nutrients to fertilize plants [4].

- Urban environmental planning: Determining the causes of climate change will help shape an urban development strategy with basic criteria for urban environmental protection: Carbon society; Low CO2 emissions. The example is shown in infrastructure planning, energy use planning, focusing on local development around traffic hubs to reduce travel consumption and save more land for green spaces in places. other; To protect urban ecosystems, promote green spaces covered from the smallest buildings to large spaces to reduce urban heat islands and global warming; The city coexists with the natural framework, promoting biodiversity in the urban area, circulating water saving and storing surface water.

4. Conclusion

From the current state of urban planning and the increasingly clear and serious context of climate change impacts, local authorities must plan ahead of time to make adjustments to urban planning projects, specialized infrastructure engineering planning, and environmental planning. The content of the planning should provide appropriate preventive and response solutions for the more effective implementation of the plan, contributing to ensuring the socio-economic sustainable development of coastal cities in Quang Ninh province in the future./.

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