

QUỸ PHÁT TRIỂN KHOA HỌC  
VÀ CÔNG NGHỆ QUỐC GIA

VIỆN ĐỊA LÝ TÀI NGUYÊN  
TP. HỒ CHÍ MINH

# CAREES 2019

**KỶ YẾU HỘI NGHỊ**  
**NGHIÊN CỨU CƠ BẢN TRONG**  
**“KHOA HỌC TRÁI ĐẤT VÀ MÔI TRƯỜNG”**  
**NHỮNG KẾT QUẢ NGHIÊN CỨU MỚI**

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## ASSESSING THE IMPACTS OF CLIMATE CHANGE ON WATER RESOURCES OF DONG NAI PROVINCE AND PROPOSAL OF ADAPTIVE SOLUTIONS

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### ABSTRACT

Dong Nai Province has abundant surface and groundwater resources. However, in recent years, due to the impact of climate change, there have been unusual changes, hot weather has occurred in the rainy season, rainfall has been distributed. Climate change strongly affects water resources in all aspects: flooding, changing water levels, saline intrusion ... Changes in water resources will affect related areas: changes in exploitation, using and managing, adjusting and changing policies and laws related to water resources. In order to minimize the impact of climate change and change water resources for people as well as the process of socio-economic development, it is necessary to assess the impact of climate change on water resources of the regime and needs. Water demand of related industries; master planning of water resources, building reserve systems; the construction of dams and reservoirs to calculate water to avoid affecting the main flow.

**Keywords:** Dong Nai Province, water resources, climate change, solutions.

### 1. INTRODUCTION

Dong Nai is a province with abundant surface water, provided by the main system of rivers and streams, which are Dong Nai, La Nga, La Buong, Ray, Mango and Thi Vai Rivers. The water flow depends on the season, often concentrated in the rainy season, in the dry season, only about 20 % of the total water volume in the year.

The density of rivers and streams in the province is about 0.5 km/km<sup>2</sup> but uneven distribution. Most rivers and streams concentrate in the North and along the Dong Nai River to the Southwest. The total amount of water is 16.82 billion m<sup>3</sup> per year, of which the rainy season accounts for 80%, the dry season accounts for 20 %.

Groundwater resources: the underground water source is abundant and unevenly distributed, mainly concentrated in the west of the province and Long Khanh town, the water quality is quite good, it can be exploited for domestic use and production.

However, in recent years, Dong Nai province, due to the impacts of climate change and weather in the province, has unusual changes such as: hot weather has occurred in the rainy season, rainfall has been distributed. Irregularly according to the law, causing local flooding... affecting industrial development, agricultural production, people's life and daily life. In particular, climate change and sea level rise have a strong impact on the water resources of the province causing the following phenomena: saline intrusion, affecting river water flow in the seasons... Therefore, the study of the climate change impacts on water resources in DongNai Province and the proposed adaptation measures are necessary.

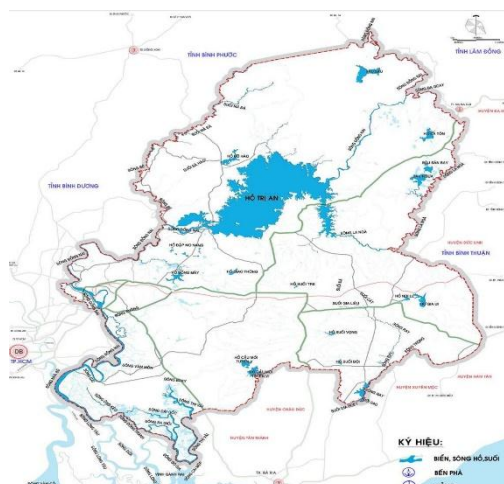


Figure 1: Dong Nai River system

## 2. METHOD OF ASSESSING IMPACTS OF CLIMATE CHANGE

This is a main method used to assess the impact of climate change on the fields, sectors, natural and social environments. The process of assessing impacts of climate change is as follows:

Step 1: Identify climate change and sea level rise scenarios

Step 2: Identify sectors and priority subjects and scope of assessment

Step 3: Assess the impact of climate change and sea level rise according to the scenario

Step 4: Assess the level of risk of damage caused by climate change impacts

Step 5: Evaluate the ability to adapt to risks and offer solution.

## 3. RESULTS

### 3.1. Effects of climate change

- Flooding: The main flooded areas are Nhon Trach District, a part of Long Thanh District and Bien Hoa City, in addition to a small part in Vinh Cuu and Trang Bom districts. The flooded area in all scenarios fluctuates in the range from 1.56% to 1.68%, corresponding to the flooded area of about from 92.21 to 99.09 km<sup>2</sup>. Sea level rise flooded many areas of production land, traffic will directly affect the people living in the localities prone to climate change in the province. At the same time, climate change also threatens the port system of the province due to rain and abnormal floods causing landslides and natural disasters to destroy infrastructure.

- Saline intrusion: Saline sea encroaches into the mainland, areas with high saline intrusion potential in Phuoc An commune (Nhon Trach District), Phuoc Binh commune (Long Thanh District). Increased salinity affects the quality of water sources and aquaculture areas, reduces productivity and limits certain types of seafood in the wild. In the worst case, the salinity boundary of 2 ‰ is about 25 km, the salinity boundary of 4 ‰ goes 30 km. Surface water salinity 2 in 2020 is about 68-69 km<sup>2</sup> depending on the scenario, about 2100 about 77-80 km<sup>2</sup>.

- Water flow is affected: River areas are sensitive to climate change such as: Dong Nai River in the confluence of Be River - Dong Nai River, the area flows through Bien Hoa City and Thi Vai River. The areas are depleted of water in the dry season such as Rieng stream and streams in Cam My district, Gia Huynh stream in Xuan Loc district. Situation of inundation and saline intrusion affect water supply for Long Thanh district, Nhon Trach district, Trang Bom district, Vinh Cuu district and Bien Hoa City.

### 3.2. Climate change scenario

- According to the project “Assessing the impacts of climate change and sea level rise, building scenarios of climate change and sea level rise for Dong Nai province till 2100”, there are 3 scenarios of average temperature in the area. Dong Nai province in the period of 2020 - 2100 includes: Low emission scenario (B1), average emission (B2) and high emission (A1F1), in which the provincial temperature increases steadily over the years.

- Rainfall scenario: Average rainfall increases gradually through stages and under the emission scenario. Average annual rainfall in Dong Nai province in low-trend scenarios in the region behind inland. From 2020 to 2100, rainfall increases gradually towards the mainland.

**Table 1:** Average temperature (°C) in Dong Nai province through scenarios

Scenario	2020	2030	2050	2070	2100
B1	26.54	26.72	27.11	27.49	27.79
B2	26.55	26.76	27.45	28.00	28.48
A1F1	26.57	26.87	27.78	28.90	30.21

### 3.3. Proposing some response solutions

Climate change strongly affects water resources in all aspects. Changes in water resources will affect related areas: change in exploitation, use and management, adjustment, change of policies and laws related to water resources.

To minimize the impacts of climate change and changes of water resources on people as well as the process of socio-economic development, two activities to adapt and mitigate impacts of climate change need done simultaneously. Solutions to adapt to climate change include adapting to the increase in temperature, rainfall, intensity and frequency of extreme weather phenomena and supporting solutions.

**Table 2:** Average rainfall (mm) through scenarios in Dong Nai province

Scenario	2020	2030	2050	2070	2100
B1	2233	2244	2265	2286	2302
B2	2234	2250	2285	2320	2340
A1F1	2236	2252	2301	2363	2434

#### 3.3.1. Adapt to temperature rise

- Strengthen scientific research and technological development on investigation, survey, observation and evaluation of water resources and capacity to adapt to climate change.
- Evaluate the impact of climate change on water resources (including reserves, quality), the regime and water demand of related sectors.
- Promote scientific, technical and technological research and apply advanced technologies in investigation, survey, monitoring, supervision, protection and assessment of water resources.
- Research and apply integrated management methods of water resources, prevent and overcome consequences of natural disasters caused by water in the context of climate change.
- Change the habit of using water, raising people's awareness of rational and economical use of water.

#### 3.3.2. Adapting to the increase in rainfall

- Effectively managing water resources in the context of climate change: Regulating and distributing water resources in river basins, ensuring the rational allocation, exploitation and use among water-using branches and localities in storage Dong Nai, La Nga, La Buong, Ray, Xoai and Thi Vai Rivers.
- To consolidate, upgrade and perfect systems of works for exploitation and use of water sources (irrigation reservoirs and hydropower plants), irrigation canals and underground water exploitation projects (dug wells and drilled wells), boreholes, tanks and water systems).

#### 3.3.3. Adapting to the increase in intensity and frequency of extreme weather events and disasters

- Master planning of water resources, building reserve systems; the construction of dams, reservoirs to calculate water to avoid affecting the main flow.
- Investing in the construction of dyke protection and drainage systems in areas at risk of flooding and flash flooding, taking into account the increase in population there.

#### 3.3.4. Support solutions

In addition to the above solutions, financial investment, equipment and human resources; Completing institutions and organizations are solutions to actively support adaptation to climate change impacts on water resources.

#### **4. CONCLUSION**

The research results show that Dong Nai province, due to the impacts of climate change and weather in the province, has experienced abnormal changes, the hot weather phenomenon takes place in the rainy season, the rainfall is unevenly distributed according to rules (two seasons), causing local flooding ... affecting industrial development, agricultural production, people's lives and activities. In particular, climate change and sea level rise have a strong impact on the water resources of the province causing the following phenomena: saline intrusion, affecting river water flow in the seasons... Therefore, the overall planning water source, build reserve system; the construction of dams, reservoirs to calculate water to avoid affecting the main flow; to invest in the construction of protection and drainage systems in areas prone to flooding, taking into account the increase in population there; applying climate change adaptation measures, changing living habits to minimize the impact of climate change is essential

#### **Acknowledgment**

This work was supported by the Domestic Master/ PhD Scholarship Programme of Vingroup Innovation Foundation.

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**KỶ YẾU HỘI THẢO CAREES 2019  
NGHIÊN CỨU CƠ BẢN TRONG LĨNH VỰC  
KHOA HỌC TRÁI ĐẤT VÀ MÔI TRƯỜNG**

**Viện Địa lý và Tài nguyên TP. Hồ Chí Minh  
Quỹ Phát triển Khoa học và Công nghệ Quốc gia**

*Chịu trách nhiệm xuất bản*  
**Giám đốc, Tổng biên tập**  
**TRẦN VĂN SẮC**

<i>Biên tập:</i>	<b>Lê Phi Loan, Đinh Như Quang</b>
	<b>Nguyễn Văn Vĩnh, Nguyễn Thị Chiên</b>
<i>Trình bày kỹ thuật:</i>	<b>Hồng Ngân</b>
<i>Trình bày bìa:</i>	<b>Hồng Ngân</b>

**ISBN: 978-604-913-958-1**

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In 500 đĩa, khổ 19x27 cm, tại Viện Địa lý và Tài nguyên Tp. Hồ Chí Minh.

Số xác nhận đăng ký xuất bản: 4910-2019/CXBIPH/01-76/KHTNVN.

Số quyết định xuất bản: 112/QĐ-KHTNCN, cấp ngày 28 tháng 11 năm 2019.

In xong và nộp lưu chiểu quý IV năm 2019.