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AND TRAINING

MINISTRY OF NATURAL
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**VIETNAM INSTITUTE OF
METEOROLOGY, HYDROLOGY AND
CLIMATE CHANGE**

TANG THE CUONG

**RESEARCH ON MAINSTREAMING CLIMATE CHANGE
ISSUES INTO SOCIO-ECONOMIC DEVELOPMENT
MASTERPLAN OF THUA THIEN HUE PROVINCE
THROUGH STRATEGIC ENVIRONMENTAL ASSESSMENT**

Specialization: Management of Natural Resources and
Environment

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INTRODUCTION

1. Justification of research

Climate change (CC), along with resource degradation and environmental pollution, has become one of the biggest challenges for mankind in the 21st century. According to the scenarios on CC and sea level rise for Viet Nam, by the end of this century, mean temperature in Viet Nam would rise by between 2-3°C, total rainfall and rainy season rainfall would increase while dry season rainfall would decrease; sea level in the Mekong River Delta would rise by between 85-105cm compared to level of the 1980-1999 period. This change would produce a significant impact on socio-economic development of Viet Nam.

Mainstreaming CC issues into strategies and masterplans is a smart approach to achieve sustainable goals and develop solutions for responding to CC effectively. The promotion of strategic environmental assessment (SEA) application in mainstreaming CC issues into the development of strategies and masterplans represents an important solution to achieve targets set in the National Strategy on CC and the National Green Growth Strategy for sustainable development.

2. Scope of Dissertation

The Dissertation investigates the mainstreaming of CC issues into the socio-economic development masterplan of Thua Thien - Hue province through SEA with an aim at providing effective solutions for CC responses. Thua Thien – Hue province, considered as a locality seriously affected by CC, has its SEA approved for masterplanning its socio-economic development until 2020. The Dissertation, therefore, focuses only the mainstreaming CC adaptation, applying the existing SEA. Mitigation is not investigated within the Dissertation. CC impacts studied in the Dissertation are impacts of inundation. CC issues to be

mainstreamed include analysis and assessment on CC situation and tendency of future climatic factors, and impacts of CC on socio-economic development, vulnerability of society and economy due to CC, and response measures.

3. Objectives of research

- To investigate basic methodology for mainstreaming CC issues into socio-economic development masterplan by applying SEA; and
- To apply mainstreaming of CC issues into socio-economic development masterplan of Thua Thien – Hue province through SEA.

4. Academic and practical significance of Dissertation

4.1. Academic significance

- To provide scientific basis for policymakers at the national and provincial/city levels to mainstream CC issues into the preparation of socio-economic development masterplans; and
- To present a mainstreaming process with the application of clear, simple, and easy-to-apply vulnerability assessment tools.

4.2. Practical significance

To support local policymakers in adjusting socio-economic development masterplans in the context of CC.

5. New contributions of Dissertation

- The dissertation developed scientific basis for mainstreaming climate issues into socio-economic development masterplan through SEA basing on analyses of existing methodologies used internationally and concrete situation of Viet Nam;
- Basing on the scientific basis developed by the dissertation on mainstreaming CC issues into socio-economic development through SEA, the dissertation applies it for Thua Thien – Hue province in the context that the province has approved its SEA.

- The dissertation deployed the CC vulnerability assessment to evaluate the effectiveness of mainstreaming.
- The dissertation evaluated impacts of mainstreaming of CC issues into socio-economic development at provincial level.

CHAPTER 1. OVERVIEW OF RESEARCHES IN VIET NAM AND ABROAD

Overview of researches on mainstreaming CC issues into socio-economic development masterplans in Viet Nam and abroad shows that a 4-stage mainstreaming process is introduced by most researches. The steps include: (1) Classifying masterplans having significant interaction with CC; (2) Identifying CC impact scope; (3) Developing reports, including CC content; (4) Monitoring and evaluating the effectiveness of mainstreaming. However, the researches have not used vulnerability assessment as a tool for evaluating mainstreaming effectiveness.

Researches in Viet Nam have so far focused on vertical mainstreaming, that is mainstreaming of CC issues into of individual sector's strategies, masterplans or plans only. The mainstreaming of CC issues into socio-economic development strategies, masterplans and plans has not been given adequate attention yet. There are some unclarities and inadequacies in researches, including: (1) a focus on developing general and theoretical process due to a lack of researches presenting any concrete masterplans and plans mainstreamed with CC issues; (2) a lack of concrete process on investigating CC issues in SEA; and (3) no socio-economic development masterplans or plans examining interaction between socio-economic development and CC in SEA to evaluate effectiveness of mainstreamed response solutions.

The Dissertation research aims at developing a process of mainstreaming CC issues into socio-economic development masterplan

for Thua Thien - Hue province, applying SEA. Accordingly, CC vulnerability assessment plays an important role in evaluating impacts of CC on economic development and effectiveness of mainstreaming CC issues, applying SEA. The Dissertation does not examine disaster risks and their impacts, particularly the increase of disaster risks due to climate change.

CHAPTER 2. METHOD FOR MAINSTREAMING CLIMATE CHANGE ISSUES INTO SOCIO-ECONOMIC DEVELOPMENT MASTERPLANS THROUGH STRATEGIC ENVIRONMENTAL ASSESSMENT SEA

2.1. Necessity and role of mainstreaming of climate change issues into socio-economic development masterplans

Mainstreaming CC issues into development masterplans provides a higher effectiveness of the use of financial and human resources than taking only CC response measures independently from development activities. The projection of CC issues and potential impacts during masterplanning will help reduce costs for addressing consequences of impacts. Mainstreaming CC issues into relevant policies aims at securing responses to CC.

Mainstreaming CC issues into socio-economic development masterplans through SEA is evaluating and analyzing CC impacts and vulnerability, recommending response solutions through SEA. The solutions recommended in SEA reports will be mainstreamed into socio-economic development masterplans.

2.2. Methods for mainstreaming climate change issues into socio-economic development masterplans through SEA

2.2.1. Strategic Environmental Assessment in Viet Nam

Different from environmental impact assessment (EIA), SEA process does not have a very clear starting and finishing points with a simply clear sequence of stages. In each stage of SEA, if any problems arise, a reassessment is conducted in the previous stages before moving forwards. SEA may have the following common stages: (1) Classifying SEAs; (2) Identifying scope of SEAs; (3) Identifying core environmental issues of SEA; (4) Evaluating conformity of views and objectives; (5) Forecasting and assessing environmental impacts; (6) Recommending comprehensive orientations and solutions and monitoring plans; and (7) Preparing SEA reports.

2.2.2. Methods for mainstreaming CC issues through SEA

Based on the existing SEA process, the Dissertation recommends a six-stage process for mainstreaming CC issues into socio-economic development masterplans through SEA (Figure 2-1).

Stage 1: Classifying masterplans needed to be mainstreamed with CC. To assess level of interaction between masterplan and CC, the issues needed to be clarified in this stage include: whether masterplans are impacted by CC; how long masterplans will exist; whether masterplans affect adaptive capacity or not? Whether masterplans are appropriate for the National Strategy on CC or not; in case of sectoral masterplans, whether sectors are CC sensitive or not; whether development activities of masterplans are CC sensitive or not; whether masterplans impact on locations and designs of new development activities, core infrastructure and public services for responding to CC. Any affirmative answer to these questions can be indicator on significant impacts of masterplans and vulnerability to CC and masterplans need to be mainstreamed with CC issues.

Stage 2: Evaluating tendencies and changes of climatic factors. It is

an important stage, providing a basis and information for mainstreaming into each content of SEA. Evaluation should be easy to understand and use. This include the past and present evaluation and future projection of CC. This part provides information about geographic locations, terrestrial and climatic features, past climatic tendencies, CC scenarios, past disaster risks, including already occurred disasters and their impacts.

Stage 3: Assessing CC impacts and vulnerability. CC impacts in the past and future will be assessed and projected and sectors and areas sensitive to CC will be identified. The objective of mainstreaming CC issues into socio-economic development masterplans is to reduce vulnerability to CC. Hence, CC vulnerability assessment plays a crucial role in the mainstreaming. There have been various approaches and tools for vulnerability assessment. At first, methods appropriate to the local conditions and capabilities, including human resources and data provision, and information dissemination. To assess vulnerability, it is necessary to identify a set of assessment indicators. The indicators have to meet the following requirements on representativeness, characterization, and scientific appropriateness and data transparency. In the context of Viet Nam, there have been shortcomings in terms of data accuracy and completeness. It is, therefore, necessary to review and sort data in order to eliminate incomplete and unsecured data, reducing calculation and assessment errors.

The stage also defines vulnerability assessment plans to highlight the effectiveness of the mainstreaming of CC issues. The possible plans include: (1) Vulnerability assessment based on the existing socio-economic and meteorological and hydrological conditions; (2) Future vulnerability assessment without CC taken into account; (3) Future vulnerability

assessment with CC taken into account; (4) Future vulnerability assessment with CC mainstreamed through SEA. In case that a SEA developed without mainstreaming CC issues, it is necessary to consider vulnerability assessment without CC taken into account.

Stage 4: Recommending CC response actions with two following sub-stages: (1) Recommending mitigation actions; and (2) Recommending adaptation actions. To identify adaptation actions, it is necessary to: (i) Identify adaptation needs; (ii) Identify criteria for selection of adaptation actions; (iii) Recommending adaptation actions; and (iv) Evaluating and selecting adaptation actions. Selection criteria include the existing technical and economic criteria, proper costs, effectiveness and feasibility.

Stage 5: Mainstreaming into SEA reports. The mainstreaming of CC issues into SEA reports is conducted as displayed in Figure 2-1.

Stage 6: Implementing mainstreamed masterplans and monitoring At the stage, objective indicators in SEA reports will be regularly used to monitor the implementation of mainstreamed masterplans.

2.3. Climate change vulnerability assessment method

2.3.1. Method

Vulnerability assessment is based mainly on the approach introduced by the Intergovernmental Panel on CC (IPCC). This is top-down approach, downscaling global climate models (GCM) to regional and national models to assess potential impacts of CC according to different scenarios. This approach's advantage is to assess CC impacts on natural and socio-economic conditions based on physics, CC and combination of integrated socio-economic conditions. The Dissertation uses modified top-down approach, taking into account adaptive capacity of localities to CC impacts. Vulnerability (VI) can be displayed as function of Exposure (E), Sensitivity (S), and Adaptive

Capacity (AC).

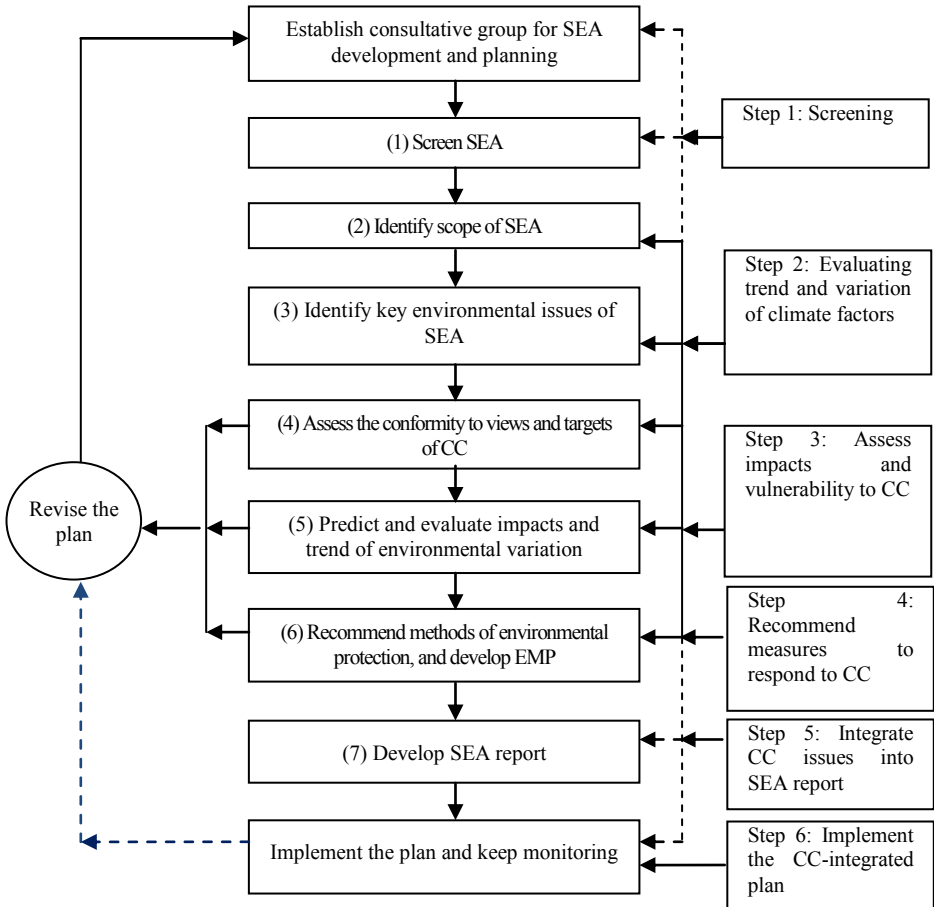


Figure 2-1. Mainstreaming climate change issues into implementing SEA

$$VI = f(E, S, AC)$$

Exposure (E) denotes the nature and level of contact between the model and significant changes of climate; Sensitivity (S) is the level of positive or negative impacts by CC; Adaptive capacity (AC) is an adjustment in the natural and human system to respond to present and

future climatic impacts, reducing losses or taking advantage of beneficial opportunities. The steps to calculate E, S, AC, VI index and unequal weight method by Iyengar and Sudarshan (1982) are shown in Figure 2-2.

2.3.2. *Criteria for selecting component indicators*

Socio-economic information used in vulnerability assessment is displayed as indicators. UNDP (2010) states that the selection of indicators must meet three criteria: (1) Overall, quantified and simplified information; (2) Reflection of areas of interest; (3) Information dissemination capacity.

2.3.3. *Development of sets of indicators for individual index*

1) *Exposure index (E)*

- Extreme weather events (E1): Annual average number of affecting tropical typhoons and cyclones (E1-1); Annual average number of tornadoes (E1-2); Annual average number of floods (E1-3);
- Climate variability (E2): Changes in annual average temperature (E2-1); Changes in annual rainfall (E2-2);
- Inundation (E3): Inundation by sea level rise (E3-1); Inundation by floods (E3-2).

2) *Sensitivity index (S)*

- Economic condition (S1): Irrigated agricultural land area (S1-1); Water needs of economic sectors (S1-2); Contribution rate of agricultural products to GDP (S1-3); Proportion of people working in agriculture (S1-4); Number of electricity generating establishments (S1-5); Number of industrial parks/ economic zones/ factories (S1-6).
- Population structure (S2): Population density in coastal areas (S2-1); Proportion of people living in rural areas (S2-2); Proportion of poor households (S2-3).

2) *Sensitivity index (S)*

Economic condition (S1): Irrigated agricultural land area (S1-1); Water needs of economic sectors (S1-2); Contribution rate of agricultural products to GDP (S1-3); Proportion of people working in agriculture (S1-4); Number of electricity generating establishments (S1-5); Number of industrial parks/ economic zones/ factories (S1-6).

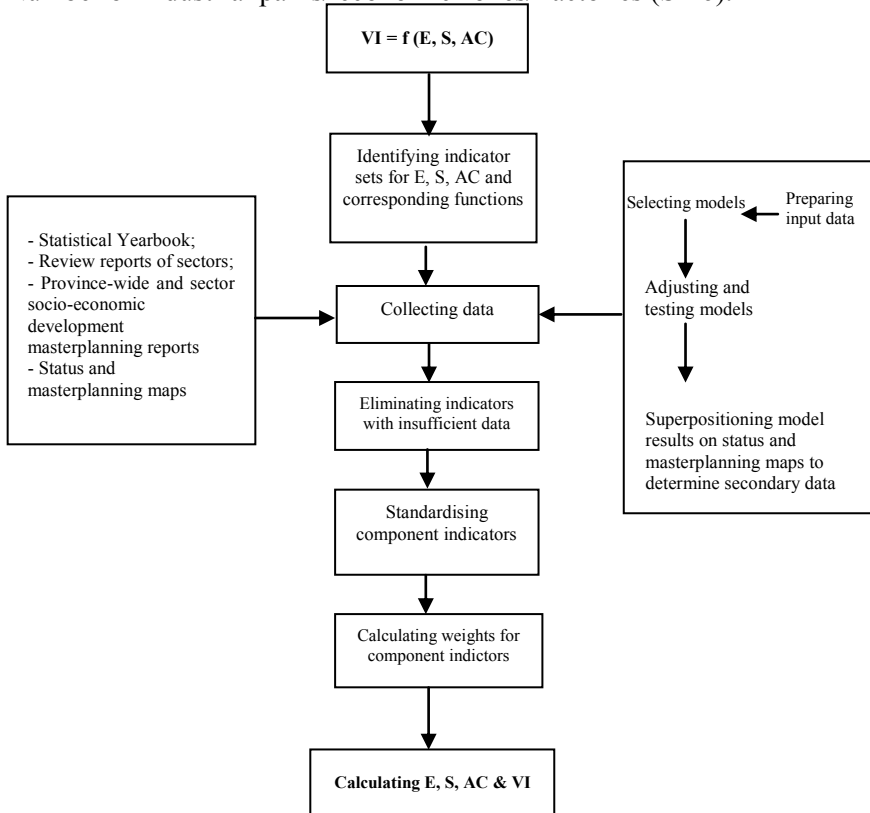


Figure 2-2. Stages for vulnerability assessment

- Population structure (S2): Population density in coastal areas (S2-1); Proportion of people living in rural areas (S2-2); Proportion of poor households (S2-3).

- Infrastructure (S3): Proportion of houses of grade 4 (S3-1); Design rainfalls in developing of drainage system (S3-2); Number of

hotels and restaurants in coastal areas (S3-3); Industrial park area (S3-4); Proportion of inundated land area (S3-5); Proportion of inundation-affected people (S3-6); Proportion of inundation-affected sea dykes (S3-7); Proportion of inundation-affected industrial park areas (S3-8); Proportion of inundation-affected low-voltage lines (S3-9); Proportion of inundation-affected high-voltage lines (S3-10); Proportion of inundation-affected asphalted roads (S3-11).

3) *Adaptive capacity index (AC)*

- Socio-economic (AC1): Number of people in households working in agriculture (AC1-1); Proportion of working age people in agriculture sector (AC1-2); Unemployment rate (AC1-3); Per capita income from agriculture (AC1-4); Economic structure of industry and construction sectors (AC1-5); Per capita GDP (AC1-6).

- Infrastructure (AC2): Number of medical establishments (AC2-1); Asphalted rural roads (AC2-2); Length of solidified dykes (AC2-3); Electricity – proportion of electricity using households (AC2-4); Built water supply and treatment facilities (AC2-5); Credit – proportion of credit accessing people (AC2-6); Proportion of reinforced urban roads (AC2-7); Length of river and sea dykes (AC2-8); Mangrove forest and protective forest area (AC2-9); Proportion of Internet using people (AC2-10); Number of schools (AC2-11).

- Education (AC3): Proportion of literate people (AC3-1).

2.3.4. *Calculating steps*

The calculation of vulnerability and component indices is conducted with four following steps: *Step 1*: Identifying sub-component indicators for E, S and AC indices; *Step 2*: Collecting, calculating and analyzing data, including the selection of models and preparation of input data; testing and calibrating models using monitored data and satellite images to assess the accuracy of the results; superpositioning layers of model results on land use maps and

sectoral status maps, masterplanning maps to determine secondary data for sub-component indicators; *Step 3*: Eliminating sub-component indicators with incomplete data; *Step 4*: Standardizing data. After standardizing points are calculated, indicators are developed with the using of weight for all sub-component indicators.

2.3.5. Inundation risk modelling

The following hydrological models: Model (NAM), and the basin water balance MIKE model (MIKE Basin) and hydrological MIKE 11 model are employed to assess impacts of CC and sea level rise on inundation in Thua Thien-Hue province. The historical flood in October 1999 is used as input for baseline scenario.

CHAPTER 3. MAINSTREAMING CLIMATE CHANGE ISSUES INTO SOCIO-ECONOMIC DEVELOPMENT MASTERPLANS THROUGH STRATEGIC ENVIRONMENTAL ASSESSMENT FOR THUA THIEN - HUE PROVINCE

Climate change issues are needed to be mainstreamed into SEA reports of Thua Thien-Hue province as displayed in Figure 3-1.

3.1. Assessing climate change impacts on Thua Thien - Hue province

3.1.1. Natural and socio-economic conditions of Thua Thien - Hue

1) Natural features

Among central coastal provinces, Thua Thien - Hue is considered seriously affected by CC due to its natural features with a long and narrow delta and the Bach Ma range having a latitudinal direction in the south. Thua Thien – Hue is located between north attitude of 16 and 17 and east longitude of 107 and 108. The province’s geographic location and terrestrial direction have formed a specific climate features in terms of rainfall, temperature and other climatic factors. This is one

of the areas having the highest rainfall in Viet Nam, which is measured at 3,000mm a year on average and unevenly distributed from 2,800 to 3,600 mm, or even to between 8,000 and 9,000 mm in some areas like Bach Ma.

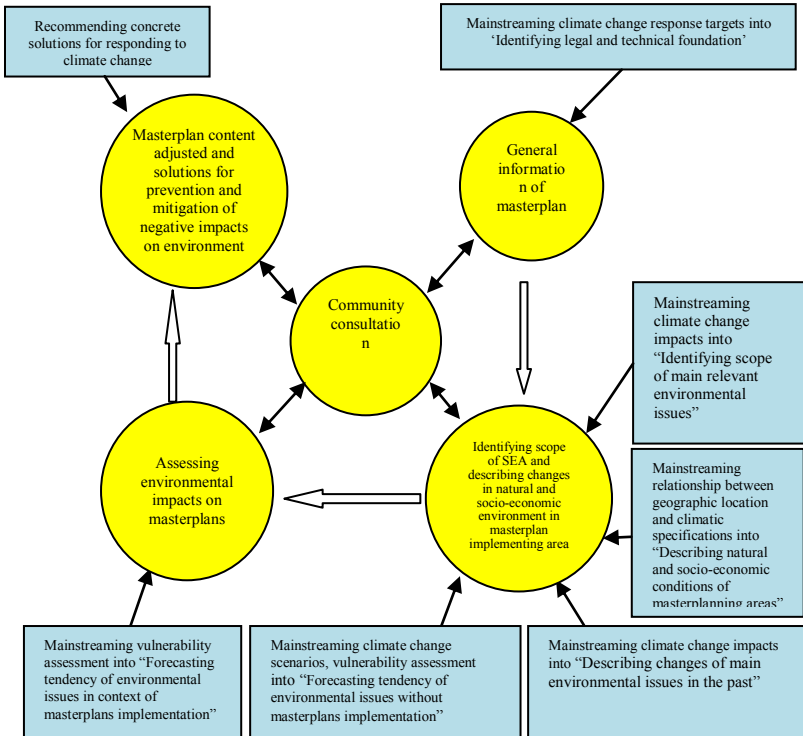


Figure 3-1. Chart for mainstreaming climate change issues into SEA reports.

Thua Thien - Hue has a dense network of rivers, mostly small river basin covering an area of between some tens and up to 3,000 km². Rivers distributed relatively evenly, but most are short, steep. They originate from the eastern side of Truong Son range, flowing into the East Sea. With topographical, climatic and river features, Thua Thien -

Hue is regularly affected by flooding. Flooding is often directly related to the heavy rain and undrained flood water. In the coastal deltas, flooding also occurs more seriously, especially with simultaneous occurrence of storm surges and tides.

2) Socio-economic features

Population in Thua Thien - Hue province is unevenly distributed, with the average population density of 250 people/km² in the east and less than 40 people/km² in the west (A Luoi and Nam Dong districts sparsely populated).

3.1.2. Climate change and sea level rise in Thua Thien – Hue

1) Climate change characteristics in Thua Thien – Hue

Temperature changes are not uniform in different periods of the year. Overall, annual average rainfall has tended to increase in recent years. The average sea level rise is about 2.8 mm / year along the coast of Viet Nam.

2) Climate change impacts on Thua Thien - Hue

Thua Thien – Hue province has been affected by such natural disasters as floods, storm surges, whirlwinds, flash floods, landslides, coastal erosion... The events affect primarily agriculture, infrastructure and tourism services.

The MIKE model is applied to model flooding for Thua Thien - Hue. Historical floods in 1999 are used in calculations for 2012 and 2020. Two scenarios considered include (1) socio-economic conditions of 2012; (2) socio-economic development masterplans up to 2020 and scenarios of CC and sea level rise in 2020 (Figure 3-2 and Figure 3-3).

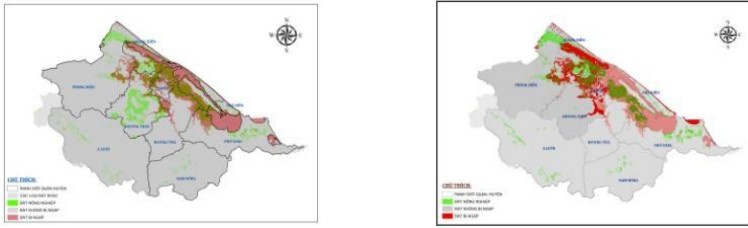


Figure 3-2. Inundated agricultural land areas in 2012 (left) and 2020 in consideration of CC and sea level rise (right).

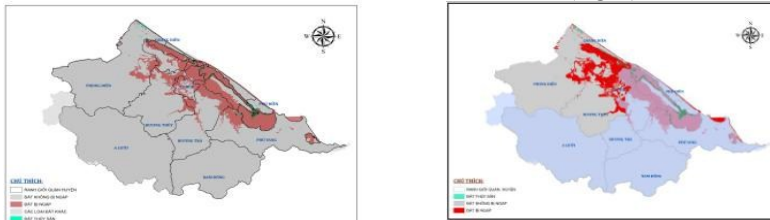


Figure 3-3. Inundated NTTS areas in 2012 (left) and 2020 in consideration of CC and sea level rise (right).

3) Climate change scenarios for Thua Thien - Hue

According to the B2 scenario, the changes in temperature, rainfall and sea level rise in the 2020-2100 period against the 1980-1999 period are as follows: (i) Annual mean temperature increases by between 0.5 and 2,7⁰C; (ii) Annual mean rainfall increases by between 1.4 and 7.2%; (iii) Sea level rises by between 8 and 71cm.

3.1.3. Strategic environmental assessment (SEA) of Thua Thien – Hue

The SEA report for Thua Thien – Hue socio-economic development masterplan estimates that a 1% economic growth will lead to a double increase in environmental pollution. Based on this estimate, the SEA report recommends the second option with a focus on developing the industrial sector right in the first five years, and developing main industries and services, concentrating on developing coastal areas vulnerable to CC. However, CC issues have not been fully considered as the SEA report describes climatic specifications of the province only

without assessing impacts by CC on the recent socio-economic development and future impacts and vulnerable communities to recommend appropriate CC response measures.

3.2. Climate change vulnerability assessment

3.2.1. Selecting indicators for Thua Thien - Hue

Based on concrete conditions of Thua Thien – Hue province and the availability of information and data, the Dissertation selects the following indicators:

1) Exposure index (E)

- Extreme weather events (E1): Annual average number of affecting tropical typhoons and cyclones (E1-1); Annual average number of typhoons (E1-2); Annual average number of floods (E1-3);
- Climate variability (E2): Changes in annual average temperature (E2-1); Changes in annual rainfall (E2-2);
- Inundation (E3): Inundation by sea level rise (E3-1); Inundation by floods (E3-2).

2) Sensitivity index (S)

- Economic conditions (S1): Proportion of people working in agriculture and aquaculture (S1-1); Percentage of agricultural exports in GDP (S1-2).
- Population structure (S2): Population density in coastal areas (S2-1); Proportion of people living in rural areas (S2-2); Rate of poor households (S2-3).
- Infrastructure (S3): Proportion of houses of grade 4 (S3-1); Proportion of land affected by inundation caused by floods (S3-2); Percentage of population affected by inundation caused by floods (S3-3); Proportion of land affected by inundation caused by sea level rise (S3-4); Percentage of population affected by inundation caused by sea

level rise (S3-5); Design rainfalls in developing of drainage system (S3-6); Number of hotels and restaurants in coastal areas (S3-7).

3) Adaptive capacity index (AC)

- Socio-economic (AC1): Per capita GDP (AC1-1); Unemployment rate (AC1-2);

- Infrastructure (AC2): Number of medical establishments (AC2-1); Asphalted rural roads (AC2-2); Electricity – proportion of electricity using households (AC2-3); Number of schools (AC2-4); Proportion of reinforced urban roads (AC2-5); Length of river and sea dykes (AC2-6); Mangrove and protective forest areas (AC2-7); Proportion of Internet using people (AC2-8).

- Education (AC3): Proportion of literate people (AC3-1).

3.2.2. Assessing Thua Thien – Hue’s vulnerability under current conditions

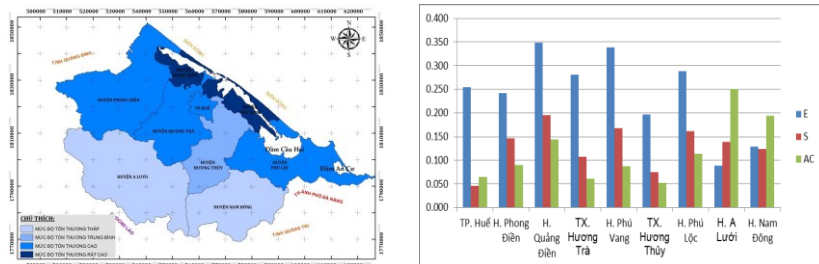


Figure Error! No text of specified style in document.-4. Vulnerability to CC and comparison of E, S and AC indices among districts and towns in existing conditions

Calculation results show that in the current climatic conditions and socio-economic development status, Thua Thien - Hue is highly vulnerable to CC. The districts of Phong Dien, Quang Dien and Phu Loc have the highest E index. The districts of Phu Loc, Phu Vang, Quang Dien have the highest S index (Figure 3-4).

3.2.3. Assessing Thua Thien - Hue’s vulnerability based on socio-economic development masterplan to 2020 without considering CC

1) Socio-economic development masterplan

Thua Thien - Hue province's socio-economic development masterplan to 2020 was approved by the Prime Minister under the Decision N⁰ 86/2009/QĐ-TTg dated June 17, 2009.

2) Assessing vulnerability based on socio-economic development masterplan to 2020 without considering CC issues

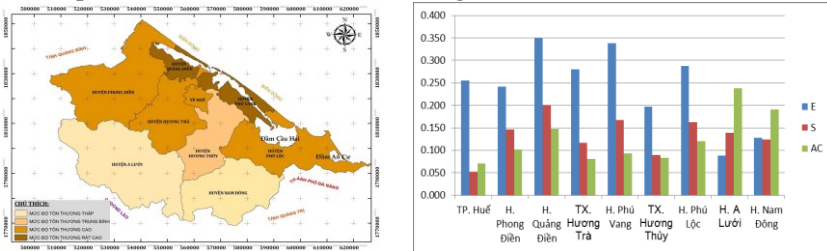


Figure 3-5. Vulnerability to CC and comparison of E, S and AC indices among districts in the socio-economic development condition without considering CC

Considering current climatic conditions, or not considering future CC, socio-economic development helps reduce sensitivity for some areas (Figure 3-5). However, overall the whole province still has a high vulnerability to climate variability.

3.2.4. Assessing Thua Thien - Hue's vulnerability based on socio-economic development masterplan to 2020 with considering CC

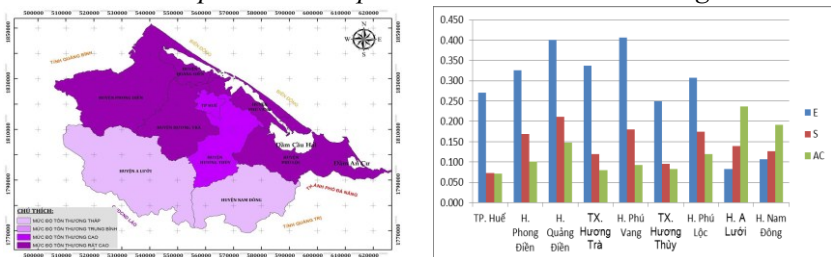


Figure 3-6. Vulnerability to CC and comparison of E, S and AC indices among districts/towns under the socio-economic development condition with considering CC issues

With the 2020 socio-economic development scenario with considering CC, the number of districts and towns having high exposure to inundation risks increases, sensitivity also rises so vulnerability of the whole province and individual district and town is very high. Value of vulnerability index is much higher than the existing scenario, except the two mountainous districts of A Luoi and Nam Dong (Figure 3-6).

3.3. Mainstreaming climate change issues into socio-economic development plans through SEA

3.3.1. Vulnerability assessment with implementation of SEA not mainstreamed with climate change issues

Calculation results of implementation of SEA measures not mainstreamed with CC issues show that even though some measures have been taken, vulnerability of districts is still very high. Vulnerability of the whole province and district Phu Loc decline to high level (see Figure 3-7).

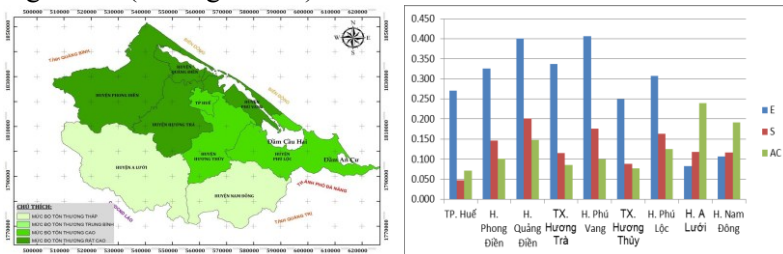


Figure 3-7. Vulnerability to CC and comparison of E, S and AC indices among districts and towns under the socio-economic development conditions with SEA not mainstreamed with CC issues

3.3.2. Recommending mainstreaming of climate change issues through SEA

Calculation results of the implementation of SEA measures without considering CC under the conditions now and until 2020 shows that if

CC issues are not mainstreamed into socio-economic development masterplans, vulnerability of seven out of nine districts and towns, particularly Phong Dien, Quang Dien and Huong Tra town, is between the high and very high levels. This means that CC response measures identified in SEA are not adequate. Apart from non-structural measures, including the increase of upstream and coastal forest areas, it is necessary to combine structural measures to reduce impacts of flash floods, inundation and coastal erosion,... Since the Dissertation focuses only on impacts of inundation caused by CC and sea level rise, mainstreaming solutions recommended will mainly focus on responding to the impacts of the kind.

CC issues considered for mainstreaming include: CC state, tendencies of future climatic factors, CC impacts on socio-economic development and vulnerability to CC and response measures.

Concrete content recommended for mainstreaming into socio-economic development masterplan of the province through SEA include: promotion of education and responsibility and awareness raising on CC; mangrove and protective forest plantation in coastal areas and lagoons; upstream forest plantation in mountainous districts; River and sea dyke building and strengthening; Reservoir operation procedure application for flood regulation; Road elevation raising, particularly in low land areas; reduction of number of temporarily built and semi-durable houses; change of design rainfall in designing water drainage systems; upgrade of natural resources and environment monitoring network; Availability of vehicles and boats for emergency response due to disasters and CC. Also, some concrete targets are recommended for adjustments.

3.3.3. Assessing impacts of mainstreaming of CC issues into socio-

economic development masterplan of Thua Thien – Hue through SEA

1) Assessing vulnerability with implementation of SEA mainstreamed with CC issues

The calculation results show that with the mainstreaming of CC issues into SEDP through SEA, the number of districts and towns having high and very high vulnerability declined significantly (four out of nine districts/towns). Sensitivity has decreased in some districts/towns while adaptive capacity has risen in most of districts and towns (Figure 3-8).

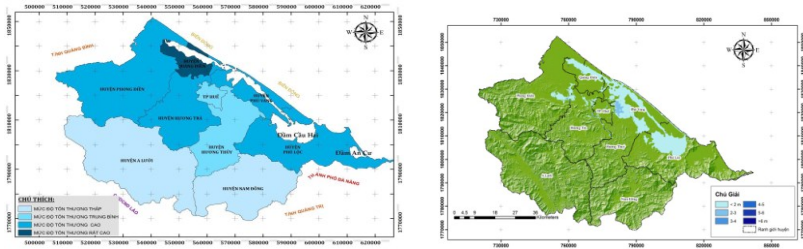
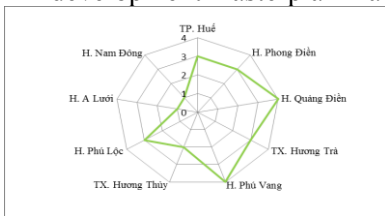
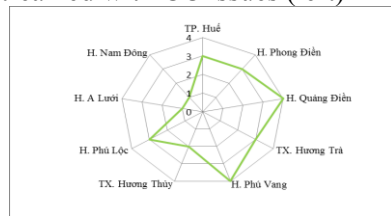


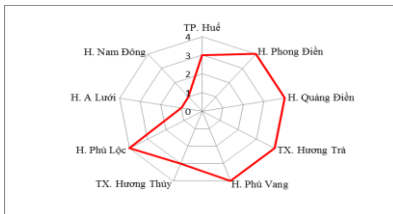
Figure 3-8. Inundation map in 2020 after mainstreaming CC through SEA (right) and vulnerability to CC under condition of socio-economic development masterplan mainstreamed with CC issues (left)



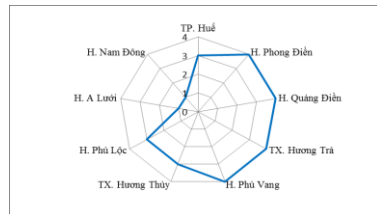
Socio-economic development under current climatic conditions



Socio-economic development without CC issues

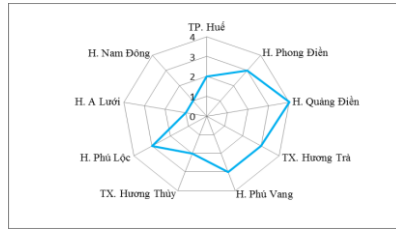


Socio-economic development without mainstreaming with CC



Socio-economic development adjusted in accordance with

SEA in the context of CC



Socio-economic development adjusted in accordance with SEA mainstreamed with CC

Figure 3-9. Comparison of VI values among scenarios

2) Issues arising from mainstreaming CC

Some issues may arise while mainstreaming CC issues into development masterplans. These include the establishment of new agencies/departments, making the apparatus bulkier, administrative procedures more complicated and workload higher. In some cases, time for implementing plans may become longer, reducing effectiveness of mainstreaming, increasing investments and operation costs of new apparatus; adjusting taxes and fees, increasing burdens of businesses and agencies.

CONCLUSION AND RECOMMENDATIONS

A. Conclusion

1. Mainstreaming CC issues into development strategies and masterplans aims at stabilizing investment activities and reducing vulnerability of socio-economic sectors to CC impacts. This approach aims at achieving sustainable development and developing effective CC response measures. The existing researches in Viet Nam focus only on vertical mainstreaming without concentrating on mainstreaming into socio-economic development masterplans and plans.

2. On the analysis of methods and experiences of foreign countries and conditions of Viet Nam, the Dissertation develops a 6-stage

method on mainstreaming CC issues into socio-economic development masterplan through SEA. Vulnerability assessment is used to evaluate effectiveness of mainstreaming. Method of uneven weights is used to calculate indicators for identifying vulnerability. Vulnerability assessment results show the appropriateness of the method and provide a scientific basis for mainstreaming. This is useful tool for evaluating effectiveness of mainstreaming into socio-economic development master plan.

3. Mainstreaming of CC issues is conducted in every stage of preparation of SEA, from classifying to perfecting reports and monitoring. Given the set targets and features of Thua Thien - Hue province, whose SEA for socio-economic development masterplans is approved, the Dissertation concentrates on applying stage 5 of the process. Within its research cope, the Dissertation investigates adaptation only, mitigation and natural disaster risks and their impacts are not examined. The research results show that for SEA not mainstreamed with CC issues, no CC response related solutions are recommended since the preparation of SEA did not consider CC issues. For mainstreamed SEA reports, CC impacts and vulnerability of socio-economic development are considered, appropriate responses are recommended. By assessing vulnerability, the effectiveness of mainstreaming of CC issues into socio-economic development masterplans is clearly shown. In case that socio-economic development masterplans not mainstreamed with CC issues are implemented in the context of future CC, the province's vulnerability is highest. Vulnerability reduces significantly with the mainstreaming of CC issues. Since socio-economic development and CC are inevitable process in the future, if socio-economic development masterplans are

not mainstreamed with CC issues, development efforts may be hampered or become ineffective. The Dissertation's results provide important scientific basis for examining and implementing the mainstreaming of CC issues into socio-economic development in Viet Nam.

B. Recommendations

1. Approaches and methods for mainstreaming CC issues into socio-economic development masterplan of Thua Thien-Hue province developed in this Dissertation can be applied widely for other localities in Viet Nam. For provinces with geographic locations (coastal location) and terrestrial conditions (mountainous and steep in the east) similar to Thua Thien – Hue, same set of indicators can be used. However, some stages may be adjusted to fit specific conditions of each individual locality, for example, for those provinces not having implemented SEA for socio-economic development masterplans yet; all six stages should be conducted.

2. The Dissertation only considers impacts of inundation caused by CC, sea level rise. Other factors including flash floods and salty intrusion need to be further investigated for a more comprehensive assessment for both mountainous and coastal areas.

3. This Dissertation introduces a set of component indicators for assessing vulnerability to further increase the effectiveness of assessment methods. For mountainous areas, it is necessary to add other indicators on flash floods, landslides, upstream forest coverage, while for the delta areas, such indicators of droughts, water drainage and water supply should be added./.

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