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: กรณีศึกษาลุ่มน้ำเพชรบุรี ประเทศไทย



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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรดุษฎีบัณฑิต

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INTEGRATED ECOLOGICAL APPROACH FOR SUSTAINABLE WATERSHED
MANAGEMENT: A CASE STUDY ON PETCHABURI WATERSHED, THAILAND

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การศึกษานี้มีวัตถุประสงค์เพื่อค้นหาตัวบ่งชี้ทางนิเวศวิทยา และทางเศรษฐสังคมที่สามารถนำมาผสมผสานเพื่อเป็นแผนปฏิบัติการในการจัดการลุ่มน้ำที่ยั่งยืน โดยแบ่งลุ่มน้ำเพชรบุรีออกเป็น 3 ระบบย่อย คือ บริเวณลุ่มน้ำตอนบน บริเวณเขื่อนแก่งกระจานและบริเวณลุ่มน้ำตอนล่างจนถึงบริเวณปากแม่น้ำตามลำดับ ผลการศึกษาบ่งชี้ว่า ลุ่มน้ำทั้ง 3 ระบบย่อย มีสภาพทางนิเวศวิทยาที่แตกต่างกัน โดยอาศัยหลักการการนำเข้าและการส่งออก โดยพบว่า ลุ่มน้ำระบบย่อยที่ 1 และลุ่มน้ำระบบย่อยที่ 3 มีสารอาหารออกจากระบบเป็นปริมาณมาก พบว่า ปริมาณไนโตรเจน-ไนโตรเจนที่นำเข้าและออกจากระบบนิเวศย่อย มีความแตกต่างกันในแต่ละระบบนิเวศย่อยที่ 1, 2 และ 3 เรียงตามลำดับคือ 47.46 ± 44.04 และ 6.77 ± 6.72 , และ 6.77 ± 6.72 และ 4.50 ± 7.16 , 4.50 ± 7.16 และ $54.20 \pm 51.11 / 62.90 \pm 51.87$ ug/l ปริมาณฟอสเฟต-ฟอสฟอรัส ที่นำเข้าและออกจากระบบนิเวศย่อย มีความแตกต่างกันในแต่ละระบบนิเวศย่อยที่ 1, 2 และ 3 เรียงตามลำดับคือ 6.67 ± 5.44 และ 2.66 ± 2.24 , และ 2.66 ± 2.24 และ 1.99 ± 3.31 , 1.99 ± 3.31 และ $84.70 \pm 34.98 / 88.96 \pm 29.18$ ug/l ผลการศึกษาบ่งชี้ว่า สารอาหารที่เข้าสู่ระบบ และออกจากระบบของระบบนิเวศย่อยที่ 1 และ 3 ไม่สมดุลกัน ส่วนในระบบนิเวศย่อยที่ 2 สารอาหารที่เข้าสู่ระบบและออกจากระบบมีความสมดุลกัน เมื่อพิจารณาความเข้มข้นของคลอโรฟิลล์ เอ พบว่าปริมาณคลอโรฟิลล์ เอ มีความสัมพันธ์เชิงบวกกับปริมาณไนโตรเจน-ไนโตรเจนอย่างมีนัยสำคัญอยู่ที่ระดับ $p = 0.05$ โดยมีค่าความความเข้มข้นของคลอโรฟิลล์ เอ ที่จุดน้ำเข้า และออกจากระบบในระบบนิเวศย่อยที่ 1, 2 และ 3 เรียงตามลำดับคือ 1.33 ± 0.98 และ 9.77 ± 5.22 , 9.77 ± 5.22 และ 16.16 ± 9.69 , 16.16 ± 9.69 และ $93.58 \pm 28.91 / 44.35 \pm 18.34$ mg/m³ เมื่อพิจารณาระบบนิเวศลุ่มน้ำเพชรบุรีโดยรวมแล้วบ่งชี้ว่า ระบบสูญเสียปริมาณสารอาหารออกจากระบบเป็นปริมาณมาก ดังนั้น การใช้ปริมาณคลอโรฟิลล์ เอ ปริมาณไนโตรเจน-ไนโตรเจน และปริมาณฟอสเฟต-ฟอสฟอรัส จึงเป็นดัชนีที่สามารถใช้ตรวจสอบสถานะทางนิเวศวิทยาของลุ่มน้ำแต่ละระบบย่อย นอกจากนี้ ปริมาณไนโตรเจน-ไนโตรเจนและฟอสเฟต-ฟอสฟอรัส ยังสัมพันธ์กับแพลงก์ตอนพืชที่เป็นกลุ่มเด่น ตลอดจนค่าตะกอนแขวนลอย สามารถใช้พิจารณาร่วมกัน เพื่อการติดตามตรวจสอบสภาพของระบบนิเวศลุ่มน้ำ และระบบนิเวศลุ่มน้ำระบบย่อยได้ชัดเจนยิ่งขึ้น

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ลายมือชื่อนิติ.....
 ลายมือชื่ออาจารย์ที่ปรึกษา.....

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KEY WORDS: Integrate, sustainable, watershed management, ecological approach.

CHATNAREE MEESUKKO: INTEGRATED ECOLOGICAL APPROACH FOR SUSTAINABLE WATERSHED MANAGEMENT: A CASE STUDY ON PHETCHABURI WATERSHED, THAILAND. THESIS ADVISOR: ASSOCIATE PROFESSOR DR. NANTANA GAJASENI, THESIS COADVISOR: DR. ALEXEY VOINOV, 357 pp. ISBN 974-17-5845-6.

This study aims to search for potential ecological and socio-economic indicators that are able to integrate for the conceptual plan for sustainable watershed management. The area of study was Phetchaburi Watershed divided into three subsystems; the upstream of watershed, the Kaeng Krachan Reservoir, and the downstream of watershed, respectively. The results indicated that the three subsystems had different in existing ecological conditions which the analysis is based on "Input-Output Approach". Allocthonous nutrient loading, the inputs and outputs of nitrate-nitrogen contents of subsystem I, II and III were 47.46 ± 44.04 and 6.77 ± 6.72 , and 6.77 ± 6.72 and 4.50 ± 7.16 , 4.50 ± 7.16 and $54.20 \pm 51.11 / 62.90 \pm 51.87$ ug/l, respectively. While, phosphate-phosphorus contents of subsystem I, II and III were 6.67 ± 5.44 and 2.66 ± 2.24 , and 2.66 ± 2.24 and 1.99 ± 3.31 , 1.99 ± 3.31 and $84.70 \pm 34.98 / 88.96 \pm 29.18$ ug/l, respectively. These indicated that nutrients in the subsystem I and subsystem III were imbalance while subsystem II was balance in nutrients flux. In considering of chlorophyll *a* content, it found that chlorophyll *a* contents had positive correlation with nitrate-nitrogen concentration at the $p = 0.05$. Chlorophyll *a* contents were presented different in each subsystem. Chlorophyll *a* content of the inputs and outputs of subsystem I, II and III were 1.33 ± 0.98 and 9.77 ± 5.22 , 9.77 ± 5.22 and 16.16 ± 9.69 , 16.16 ± 9.69 and $93.58 \pm 28.91 / 44.35 \pm 18.34$ mg/m³, respectively. In relation to the whole Phetchaburi Watershed, it was indicated that the watershed lost numerous nutrients from its system. The chlorophyll *a* content, nitrate-nitrogen and phosphate-phosphorus can be an adequate ecological indicator for monitoring the ecological condition of the watershed ecosystem even in subsystem. Furthermore, nitrate-nitrogen and phosphate-phosphorus concentrations related to the dominance of phytoplankton group as well as suspended solids were potential ecological indicators for monitoring in each watershed subsystem.

The important problems in the watershed are water and soil quality degradation, over fertilization use, which cause by agriculture, soil erosion and increasing human encroachment in upstream from the watershed. To solve these problems, the socio-economic data and land use patterns were considered to integrate base on holistic approach. The socio-economic interviewed 409 respondents focusing natural resource use attitudes, concerns and knowledge of the stakeholders in the Phetchaburi watershed. Finally, the results of study integrated ecological and socio-economic indicators and land use patterns to propose the conceptual plan which is appropriate and applicable for sustainable watershed management of the Phetchaburi watershed.

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CONTENTS

	Page
THAI ABSTRACT.....	iv
ENGLISH ABSTRACT.....	v
ACKNOWLEDGEMENTS.....	vi
CONTENTS.....	vii
LIST OF TABLES.....	xiii
LIST OF FIGURES.....	xvi
ABBREVIATIONS.....	xxiii
CHAPTER I: INTRODUCTION.....	1
1.1 Overviews of the Study.....	1
1.2 Objectives of the Study.....	2
1.3 Hypothesis of the Study.....	3
1.4 Scopes of the Study.....	3
1.5 Organization of the Dissertation.....	6
CHAPTER II: LITERATURE REVIEWS.....	8
2.1 Watershed Ecosystem.....	8
2.2 River Ecosystem.....	11
2.3 Lake Ecosystem.....	12
2.4 Watershed management.....	14
2.5 Watershed Management in Thailand.....	18
2.6 Reviews of the Study.....	29
2.6.1 Reviews of the watershed management.....	29
2.6.1.1 River and Stream projects.....	30
2.6.1.2 Lake projects.....	37
2.6.1.3 Estuary projects.....	39
2.6.2 Socio-Economic Aspect of Watershed Management.....	40
2.7 Overview of the Phetchaburi Watershed.....	42
2.7.1 General of the Phetchaburi Watershed.....	42
2.7.2 Land Use Patterns.....	46

CONTENTS (Continued)

	Page
2.7.3 Resource Management in Phetchaburi Watershed.....	47
2.7.3.1 Ecological Studies.....	47
2.7.3.2 Socio-economic Studies.....	55
CHAPTER III: MATERIALS AND METHODS.....	60
3.1 Study Area and Study Sites.....	60
3.1.1 Materials.....	61
3.1.2 Methods.....	62
3.1.3 Study Sites.....	67
3.2 Ecological Methodology.....	75
3.2.1 Water Sample Collection.....	75
3.2.2 Water Analysis of Ecological Parameters.....	77
3.2.2.1 Physical and Chemical Parameters.....	77
3.2.2.2 Biological Parameters.....	78
3.2.3 Socio-Economic Parameters.....	80
3.3 Data Analysis.....	81
CHAPTER IV: RESULTS AND DISCUSSION.....	82
4.1 The Climate.....	82
4.2 Land Use Patterns.....	86
4.3 Ecological Relationships of Subsystem I.....	90
(Upstream of Phetchaburi Watershed)	
4.3.1 Physical Parameters.....	90
4.3.1.1 Depth.....	90
4.3.1.2 Transparency Depth.....	91
4.3.1.3 Water Temperature.....	92
4.3.1.4 Suspended Solid.....	93
4.3.2 Chemical Parameters.....	94
4.3.2.1 pH.....	94
4.3.2.2 Dissolved Oxygen.....	95
4.3.2.3 Nitrate-Nitrogen.....	97

CONTENTS (Continued)

	Page
4.3.2.4 Nitrite-Nitrogen.....	98
4.3.2.5 Ammonium-Nitrogen.....	99
4.3.2.6 Phosphate-Phosphorus.....	100
4.3.2.7 Silica-Silicon.....	101
4.3.3 Biological Parameters.....	102
4.3.3.1 Species Composition.....	103
4.3.3.2 Dominant Species and Phytoplankton Diversity...	105
4.3.3.3 Phytoplankton Density in Subsystem I.....	107
4.3.3.4 Chlorophyll <i>a</i>	111
4.3.3.5 Shannon-Wiener's Index of phytoplankton.....	112
in subsystem I	
4.3.4 The Correlation between Ecological Parameters in.....	113
Subsystem I	
4.4 Ecological Relationships of Subsystem II.....	116
(Kaeng Krachan Reservoir)	
4.4.1 Physical Parameters.....	116
4.4.1.1 Depth.....	116
4.4.1.2 Transparency Depth.....	118
4.4.1.3 Water Temperature.....	120
4.4.1.4 Suspended Solid.....	120
4.4.2 Chemical Parameters.....	121
4.4.2.1 pH.....	121
4.4.2.2 Dissolved Oxygen.....	123
4.4.2.3 Nitrate-Nitrogen.....	124
4.4.2.4 Nitrite-Nitrogen.....	125
4.4.2.5 Ammonium-Nitrogen.....	126
4.4.2.6 Phosphate-Phosphorus.....	128
4.4.2.7 Silica-Silicon.....	129

CONTENTS (Continued)

	Page
4.4.3 Biological Parameters.....	130
4.4.3.1 Species Composition.....	130
4.4.3.2 Dominant Species and Phytoplankton Diversity.....	133
4.4.3.3 Phytoplankton Density in Subsystem I.....	135
4.4.3.4 Chlorophyll <i>a</i>	142
4.4.3.5 Shannon-Wiener's Index II.....	144
4.4.4 The Correlation between Ecological Parameters in.....	145
Subsystem II	
4.5 Ecological Relationships of Subsystem III (Downstream.....	150
from Kaeng Krachan Reservoir to the River Mouths)	
4.5.1 Physical Parameters.....	150
4.5.1.1 Depth.....	150
4.5.1.2 Transparency Depth.....	153
4.5.1.3 Water Temperature.....	155
4.5.1.4 Suspended Solid.....	157
4.5.2 Chemical Parameters.....	159
4.5.2.1 pH.....	159
4.5.2.2 Dissolved Oxygen.....	161
4.5.2.3 Salinity.....	164
4.5.2.4 Nitrate-Nitrogen.....	166
4.5.2.5 Nitrite-Nitrogen.....	169
4.5.2.6 Ammonium-Nitrogen.....	171
4.5.2.7 Phosphate-Phosphorus.....	173
4.5.2.8 Silica-Silicon.....	175
4.5.3 Biological Parameters.....	177
4.5.3.1 Species Composition.....	177
4.5.3.2 Dominant Species.....	179
4.5.3.3 Phytoplankton Density.....	183
4.5.3.4 Chlorophyll <i>a</i>	192
4.5.3.5 Shannon-Wiener's Index of phytoplankton.....	194

CONTENTS (Continued)

	Page
4.5.4 The Correlation between Ecological Parameters in..... Subsystem III	195
4.6 Comparison of Land Uses and some Ecological Parameters in.... Four Subwatersheds on the Phetchaburi Watershed	203
4.7 Ecological Condition of the Whole Watershed.....	209
4.8 Socio-Economic Parameters.....	218
4.8.1 Socio-Economic Parameters of Population in..... Subsystem I (Upstream)	219
4.8.1.1 Socio-Economic Characteristic of Population..... Samples in Subsystem I	219
4.8.1.2 The General Knowledge in Phetchaburi..... Watershed Management and the Participation of People on the Conservation of Phetchaburi Watershed	222
4.8.1.3 Willingness to Pay to Support the Sustainable..... Watershed Management	223
4.8.1.4 The Relationships of the Socio-Economic..... Parameters of Subsystem I	224
4.8.2 Socio-Economic Parameters of Population in..... Subsystem II (Kaeng Krachan Reservoir)	228
4.8.2.1 Socio-Economic Characteristic of Population ... Samples in Subsystem II	228
4.8.2.2 The General Knowledge in Phetchaburi Watershed Management and the Participation of Local	232
4.8.2.3 Willingness to Pay to Support the Sustainable..... Watershed Management	233
4.8.2.4 The Relationships of Socio-Economic..... Parameters of Subsystem II	234

CONTENTS (Continued)

	Page
4.8.3 Socio-Economic Parameters of Population in.....	238
Subsystem III (Downstream from Kaeng Krachan Reservoir to the River Mouths)	
4.8.3.1 Socio-Economic Characteristic of Local.....	238
People in Subsystem III	
4.8.3.2 The General Knowledge in Phetchaburi.....	243
Watershed Management and the Participation of Local	
4.8.3.3 Willingness to Pay to Support the.....	244
Sustainable Watershed Management	
4.8.3.4 The relationships of the Socio-Economic.....	245
Parameters of Subsystem III	
4.9 Integrated Ecological condition and Socio-economic with.....	249
Land use patterns on Phetchaburi Watershed	
CHAPTER V: CONCLUSIONS AND RECOMMENDATIONS.....	257
5.1 Conclusions.....	257
5.2 Recommendations.....	264
REFERENCES.....	265
APPENDICES.....	287
BIOGRAPHY	

LIST OF TABLES

		Page
Table 2.1	Thailand's surface water resources.....	20
Table 2.2	Description of water provision and water demand in the 25 river basins of Thailand	22
Table 3.1	Water samples collection in the different depth	77
Table 3.2	Methodology of water analysis.....	78
Table 4.1	Land use classification of Phetchaburi Watershed.....	87
Table 4.2	List of species of phytoplankton survey in subsystem I.....	104
Table 4.3	Phytoplankton density in subsystem I.....	109
Table 4.4	Shannon-Wiener's Index of phytoplankton in subsystem I.....	113
Table 4.5	List of species of phytoplankton survey in subsystem II.....	132
Table 4.6	Biovolume of phytoplankton species in subsystem II	136
Table 4.7	Phytoplankton biovolume in subsystem II.....	140
Table 4.8	Shannon-Wiener's Index of phytoplankton in subsystem II.....	144
Table 4.9	Comparison of physico-chemical and biological..... characteristics (annual averages) and dominant groups in lentic ecosystem from mesotrophic to hypereutrophic lakes and reservoirs and in the tropical region	147
Table 4.10	List of species of phytoplankton survey in subsystem III.....	178
Table 4.11	Phytoplankton density in subsystem III	184
Table 4.12	Shannon-Wiener's Index of phytoplankton in subsystem III	194
Table 4.13	Comparison of some physico-chemical and biological	199
	characteristics (annual averages) and dominant groups in river and river mouth ecosystems in the tropical region	
Table 4.14	Land use classification of four subwatersheds.....	206
Table 4.15	Comparison of some ecological parameters in four..... subwatersheds	208
Table 4.16	Comparison of the average values of some ecological	210
	parameters inputs and outputs in three subsystems of Phetchaburi Watershed	

LIST OF TABLES (Continued)

		Page
Table 4.17	Comparison of the Standard Surface Water Quality Classification and trophic status of three subsystems on Phetchaburi Watershed	215
Table 4.18	The population sample of Phetchaburi people.....	218
Table 4.19	Socio-economic characteristic of respondents in Subsystem I...	220
Table 4.20	Percentage of the level of knowledge, the participation of..... people on conversation and want of participation in Phetchaburi Watershed management of Phetchaburi Watershed in Subsystem I	223
Table 4.21	The willingness to pay to support the activity for Phetchaburi Watershed management in Subsystem I	224
Table 4.22	The correlation of socio-economic parameters in subsystem I...	227
Table 4.23	Socio-economic characteristic of respondents in Subsystem II..	230
Table 4.24	Percentage of the level of knowledge, the participation..... of people on conversation and want of participation in Phetchaburi Watershed management of Phetchaburi Watershed in Subsystem II	233
Table 4.25	The willingness to pay to support the activity for Phetchaburi Watershed management in Subsystem II	234
Table 4.26	The correlation of socio-economic parameters in subsystem II..	237
Table 4.27	Socio-economic characteristic of respondents in Subsystem III.	240
Table 4.28	Percentage of the level of knowledge, the participation of..... people on conversation and want of participation in Phetchaburi Watershed management of Phetchaburi Watershed in Subsystem III	243
Table 4.29	The willingness to pay to support the activity for Phetchaburi... Watershed management in Subsystem III	244
Table 4.30	The correlation of socio-economic parameters in..... subsystem III	247

LIST OF TABLES (Continued)

		Page
Table 5.1	Some ecological parameters of three subsystems on..... Phetchaburi Watershed	258
Table 5.2	The Surface Water Quality Classification and trophic..... status of the three subsystems on Phetchaburi Watershed	259

LIST OF FIGURES

		Page
Figure 1.1	Map of Thailand and the study area.....	4
Figure 1.2	Topographic Map of the Phetchaburi Watershed.....	5
Figure 1.3	A conceptual framework of the study.....	7
Figure 3.1	Location Map of Phetchaburi Watershed.....	61
Figure 3.2	Flow chart of the boundary definition.....	62
Figure 3.3	Location Map of the Subsystem on Phetchaburi Watershed.....	64
Figure 3.4	Soil Series Map of Phetchaburi Watershed.....	65
Figure 3.5	Land Use Map of Phetchaburi Watershed.....	66
Figure 3.6	Topography of sampling station in Phetchaburi Watershed.....	67
Figure 3.7	Location Map of Sampling Station on Phetchaburi Watershed.....	69
Figure 3.8	The area of station P1 is the primitive forest area..... at the headwater, Phetchaburi River, the headwater of Phetchaburi River in the dry season (A) and the wet season (B). Other photograph show station P1 in the dry season (C) and the wet season (D)	70
Figure 3.9	The geographical position of station P2 as agricultural area at..... the headwater, Mae Pradon subwatershed, Phetchaburi Watershed	70
Figure 3.10	The geographical position of station P3 as the agricultural area at the headwater, Phetchaburi River, preparing culture (A) and banana orchard (B)	71
Figure 3.11	Map of substations in Kaeng Krachan Reservoir.....	71
Figure 3.12	The geographical position of station P4a as water inlet from..... the upstream, lemon orchard (A) and lots of cattle on the island at the middle of the water inlet (B)	72
Figure 3.13	The geographical position of station P4b as the water in the..... reservoir	72
Figure 3.14	The geographical position of station P4c as the downstream..... water outlet from the reservoir	72

LIST OF FIGURES (Continued)

		Page
Figure 3.15	The geographical position of station P5 as the upstream of..... Phetchaburi River from the Kaeng Krachan Reservoir	73
Figure 3.16	The geographical position of station P6 as proposed reservoir..... in Huai Pak Subwatershed, Phetchaburi Watershed	73
Figure 3.17	The geographical position of station P7 as proposed reservoir..... in Mae Prachan Subwatershed, Phetchaburi Watershed	73
Figure 3.18	The geographical position of station P8 as agriculture area at..... the downstream, Phetchaburi River	74
Figure 3.19	The geographical position of station P9 in domestic and..... industrial areas, Amphoe Maung, Phetchaburi Province	74
Figure 3.20	The geographical position of station P10 in an aquaculture area... at Ban Lam Estuary	74
Figure 3.21	The geographical position of station P11 in an aquaculture area... at Bang Taboon Estuary	75
Figure 3.22	Water samples being collected for biological analysis	76
Figure 3.23	Sampling process of phytoplankton.....	79
Figure 4.1	Monthly temperature of Phetchaburi Province in	83
	December 2001 to December 2002	
Figure 4.2	Average monthly temperature of Phetchaburi Province from..... 1981 to 2001	83
Figure 4.3	Monthly relative humidity of Phetchaburi Province in.....	84
	December 2001 to December 2002	
Figure 4.4	Average monthly relative humidity of Phetchaburi Province..... from 1977 to 2001	84
Figure 4.5	Monthly rainfall of Phetchaburi Province in December 2001 to... December 2002	85
Figure 4.6	Monthly rainfall of Phetchaburi Province from 1981 to 2001.....	85

LIST OF FIGURES (Continued)

		Page
Figure 4.7	Percentage of land use patterns in the subsystem I (A), the..... subsystem II (B) and the subsystem III (C)	88
Figure 4.8	Percentage of the water demands in Phetchaburi Watershed based on Phetchaburi Province	89
Figure 4.9	BOD loading by municipality and sanitary district based on..... Phetchaburi Watershed	89
Figure 4.10	The maximum depths in subsystem I (upstream) of Phetchaburi..... Watershed	91
Figure 4.11	Average of transparency depth in subsystem I (upstream) of..... Phetchaburi Watershed	92
Figure 4.12	Average of water temperature in subsystem I (upstream) of..... Phetchaburi Watershed	93
Figure 4.13	Average of suspended solid in subsystem I (upstream) of..... Phetchaburi Watershed	94
Figure 4.14	Average of pH in subsystem I (upstream) of Phetchaburi..... Watershed	95
Figure 4.15	Average of dissolved oxygen in subsystem I (upstream)..... of Phetchaburi Watershed	97
Figure 4.16	Average of nitrate-nitrogen in subsystem I (upstream) of..... Phetchaburi Watershed	98
Figure 4.17	Average of nitrite-nitrogen in subsystem I (upstream) of..... Phetchaburi Watershed	99
Figure 4.18	Average of ammonium-nitrogen in subsystem I (upstream) of..... Phetchaburi Watershed	100
Figure 4.19	Average of phosphate-phosphorus in subsystem I (upstream) of... Phetchaburi Watershed	101
Figure 4.20	Average of silica-silicon concentration in subsystem I..... (upstream) of Phetchaburi Watershed	102

LIST OF FIGURES (Continued)

		Page
Figure 4.21	Dominant phytoplankton species in subsystem I (upstream) of Phetchaburi Watershed, <i>Oscillatoria</i> sp. (A), <i>Navicula</i> sp. (B), <i>Tabellaria</i> sp. (C), <i>Surirella</i> sp. (D), <i>Botryococcus braunii</i> (E), <i>Peridinium</i> sp. (F), <i>Nitzschia</i> sp.1 (G) and <i>Microcystis aeruginosa</i> (H)	106
Figure 4.22	Number of phytoplankton species of subsystem I (upstream) of Phetchaburi Watershed	107
Figure 4.23	Seasonal variation of phytoplankton density (unit/m ³) and portion of the taxonomic groups in station P1 (A), station P2 (B), station P3 (full scale) (C) and station P3 (reduced scale) (D)	110
Figure 4.24	Average of chlorophyll <i>a</i> concentration in subsystem I (upstream) of Phetchaburi Watershed	112
Figure 4.25	Average of depth in subsystem II (Kaeng Krachan Reservoir) (A) and water volume in Kaeng Krachan Reservoir in 2001 -2003 (B)	118
Figure 4.26	Average of transparency depth in subsystem II (Kaeng Krachan Reservoir)	119
Figure 4.27	Average of water temperature in subsystem II (Kaeng Krachan Reservoir)	120
Figure 4.28	Average of suspended solid in subsystem II (Kaeng Krachan Reservoir)	121
Figure 4.29	Average of pH in subsystem II (Kaeng Krachan Reservoir)	122
Figure 4.30	Average of dissolved oxygen in subsystem II (Kaeng Krachan Reservoir)	124
Figure 4.31	Average of nitrate-nitrogen in subsystem II (Kaeng Krachan Reservoir)	125
Figure 4.32	Average of nitrite-nitrogen in subsystem II (Kaeng Krachan Reservoir)	126
Figure 4.33	Average of ammonium-nitrogen in subsystem II (Kaeng Krachan Reservoir)	127

LIST OF FIGURES (Continued)

		Page
Figure 4.34	Average of phosphate-phosphorus in subsystem II..... (Kaeng Krachan Reservoir)	129
Figure 4.35	Average of silica-silicon concentration in subsystem II..... (Kaeng Krachan Reservoir)	130
Figure 4.36	Dominant phytoplankton species in subsystem II..... (Kaeng Krachan Reservoir) of Phetchaburi Watershed, <i>Microcystis</i> <i>aeruginosa</i> (A and B), <i>Oscillatoria</i> sp. (C), <i>Botryococcus braunii</i> (D), <i>Staurastrum</i> sp. (E) and <i>Peridinium</i> sp. (F), scale bar — = 10 micron	134
Figure 4.37	Number of species composition of subsystem II..... (Kaeng Krachan Reservoir)	135
Figure 4.38	Seasonal variation of phytoplankton biovolume (mm^3/m^3) and..... portion of the taxonomic groups in station P4a (A), station P4b (B) station P4c (C) and total biovolume of dominant species using 10% of the total species of phytoplankton (D)	141
Figure 4.39	Average of chlorophyll <i>a</i> in subsystem II..... (Kaeng Krachan Reservoir)	143
Figure 4.40	Average of depth in subsystem III..... (downstream from Kaeng Krachan Reservoir to the river mouths)	152
Figure 4.41	The transparency depth in subsystem III..... (downstream from Kaeng Krachan Reservoir to the river mouths)	154
Figure 4.42	Average of water temperature in subsystem III..... (downstream from Kaeng Krachan Reservoir to the river mouths)	156
Figure 4.43	Average of suspended solid in subsystem III..... (downstream from Kaeng Krachan Reservoir to the river mouths)	158
Figure 4.44	Average of pH in subsystem III..... (downstream from Kaeng Krachan Reservoir to the river mouths)	160
Figure 4.45	Average of dissolved oxygen in subsystem III..... (downstream from Kaeng Krachan Reservoir to the river mouths)	163

LIST OF FIGURES (Continued)

		Page
Figure 4.46	Average of salinity in subsystem III..... (downstream from Kaeng Krachan Reservoir to the river mouths)	165
Figure 4.47	Average of nitrate-nitrogen in subsystem III..... (downstream from Kaeng Krachan Reservoir to the river mouths)	168
Figure 4.48	Average of nitrite-nitrogen in subsystem III..... (downstream from Kaeng Krachan Reservoir to the river mouths) c Phetchaburi Watershed	170
Figure 4.49	Average of ammonium-nitrogen in subsystem III..... (downstream from Kaeng Krachan Reservoir to the river mouths)	172
Figure 4.50	Average of phosphate-phosphorus in subsystem III..... (downstream from Kaeng Krachan Reservoir to the river mouths)	174
Figure 4.51	Average of silica-silicon concentration in subsystem III..... (downstream from Kaeng Krachan Reservoir to the river mouths)	176
Figure 4.52	Dominant phytoplankton species in subsystem III..... (downstream from Kaeng Krachan Reservoir to the river mouths), <i>Oscillatoria</i> sp. (A), <i>Tabellaria</i> sp. (B), <i>Navicula</i> sp. (C), <i>Nitzschia</i> sp. (D), <i>Surirella</i> sp.(E), <i>Microcystis</i> sp.(F), <i>Gyrosigma</i> sp.(G), <i>Pleurosigma</i> sp. (H), <i>Coscinodiscus</i> sp. (I), <i>Rhizosolenia</i> sp. (J), <i>Chaetoceros</i> sp. (K), <i>Skeletonema</i> sp. (L) and <i>Cyclotella</i> sp. (M)	180
Figure 4.53	Number of species composition of subsystem III..... (downstream from Kaeng Krachan Reservoir to the river mouths)	182
Figure 4.54	Seasonal variation of phytoplankton density (unit/m ³)x10 ⁶ and... portion of the taxonomic groups in station P5 (A), station P6 (B), station P7 (C), station P8 (D), station P9 (E), station P10 (F) and station P11 (G)	185
Figure 4.55	Average of chlorophyll <i>a</i> in subsystem III..... (downstream from the Reservoir to the river mouths)	193
Figure 4.56	Location Map of the four subwatersheds on Phetchaburi..... Watershed	204

LIST OF FIGURES (Continued)

		Page
Figure 4.57	Land Use Map of the four subwatersheds on Phetchaburi Watershed.....	205
Figure 4.58	Percentages of land use patterns in four subwatersheds on Phetchaburi Watershed, Phet-Bang Kloy Subwatershed (A), Mae Pradon Subwatershed (B), Huai Pak Subwatershed (C) and Mae Prachan Subwatershed (D).....	207
Figure 4.59	Nutrients flow from subsystem I (upstream) to subsystem III (downstream) of the watershed.....	212
Figure 4.60	Comparison percentage of Thailand water quality between year 2001 and 2002.....	216
Figure 4.61	Percentage of Thailand coastal water qualities in year 2002.....	217
Figure 4.62	Land utilization of Phetchaburi Province in 1991 - 1998.....	254
Figure 4.63	Utilization of farm holding land in Phetchaburi Province in 1998.....	255
Figure 4.64	An Adaptive Model of Phetchaburi Watershed Management.....	256
Figure 5.1	Conceptual plan for sustainable watershed management.....	261

ABBREVIATIONS

cm	=	Centimeter
DO	=	Dissolved Oxygen
EIA	=	Environmental Impact Assessment
EPA	=	Protection Agency
FAO	=	Food and Agriculture Organization
GIS	=	Geographic Information System
H'	=	Shannon-Wiener index
ha	=	Hectare
IUCN	=	The World Conservation Union
km	=	Kilometer
l	=	Liter
m	=	Meter
mm	=	Millimeter
ND	=	Non-detectable
$\text{NH}_3 - \text{N}$	=	Ammonia-nitrogen
$\text{NO}_2 - \text{N}$	=	Nitrite-nitrogen
$\text{NO}_3 - \text{N}$	=	Nitrate-nitrogen
$\text{PO}_4 - \text{P}$	=	Phosphate-phosphorus
SiO_2	=	Silica
sq. km	=	Square Kilometer
WQI	=	Water Quality Index
EPA	=	Environmental Protection Agency
RFD	=	The Royal Forest Department
WMD	=	Watershed Management Division
NGOs	=	Non Government Organizations