TABLE OF CONTENTS

	Page
Acknowledgements	iii
Abstract (in English)	iv
Abstract (in Thai)	vi
Table of Contents	ix
List of Tables	xi
List of Figures	xiii
CHAPTER 1 Introduction and Literature Review	1
1.1 Global Warming Situation	1
1.2 Roles of Plantation Forests on Global Warming	1
1.3 Roles of Forest Soils	2
1.4 Nutrient Cycling in Forest Ecosystem	4
1.5 Research Objectives	£07 ~
CHAPTER 2 Tree Biomass in a Series of Pine Plantations and	272
Fragmented Forests	8
2.1 Introduction	8
2.2 Study Area	9
2.3 Materials and Methods	11
2.3.1 Vegetation Sampling	11 /
2.3.2 Physical Data of Sampling Plots	11//
2.3.3 Forest Biomass of <i>Pinus kesiya</i> Plantations	11
2.3.4 Forest Biomass of Fragmented Forests	11
2.4 Results	12
2.4.1 Biomass of Pine Trees in a Series of Pine Plantations	12
2.4.2 Biomass of Succession Tree Species in a Series of	
Pine Plantations	15
2.4.3 Biomass of Fragmented Forests	41
2.5 Discussion	45
CHAPTER 3 Biomass Carbon and Nutrients of Pine and Succession	
Trees in Pine Plantations and Fragmented Forests	46
3.1 Introduction	46
3.2 Materials and Methods	47
3.2.1 Vegetation Sampling	47
3.2.2 Plant Analysis	47
3.2.3 Calculation of Stored Nutrients in Succession Trees	48
3.3 Results	48
3.3.1 Biomass Carbon and Nutrients of Pine and Succession Trees	48
3.3.2 Stored Carbon and Nutrients in Fragmented Forest	192
3.4 Discussion	207

TABLE OF CONTENTS (CONTINUED)

	Page
CHAPTER 4 Ecosystem Carbon and Nutrient Accumulations of Pine	
Plantations and Fragmented Forests	209
4.1 Introduction	209
4.2 Materials and Methods	210
4.2.1 Soil Sampling	210
4.2.2 Soil Analysis	210
4.2.3 Nutrient Accumulations in Soils	211
4.2.4 Biomass and Nutrients in Organic Layer	211
4.2.5 Tree Biomass	211
4.3 Results	211
4.3.1 Soil Nutrient Compartment	211
4.3.2 Forest Floor Compartment	251
4.3.3 Ecosystem Carbon and Nutrient Storages	254
4.4 Discussion	258
CHAPTER 5 Conclusions and Recommendations	259
References Curriculum vitae	262 267
Curriculum vitae	207

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม Copyright[©] by Chiang Mai University All rights reserved

LIST OF TABLES

2-1 Plantation areas of Boakaew Watershed Managem	ent Station 9
2-1 I failtation areas of Doakaew watershed managem	
2-2 Pine growths in a series of pine plantations with di	fferent stand ages 12
2-3 Biomass of pine trees in a series of pine plantation	
2-4 Biomass of succession trees in a series of pine plan	
2-5 Total forest biomass in a series of pine plantations	16
2-6 Biomass of tree species in a series of pine plantation	ons 20
2-7 Tree biomass in fragmented forests	41
2-8 Biomass of tree species in fragmented forests	42
3-1 Stored biomass nutrients of pine trees in a series of3-2 Stored biomass nutrients of succession trees in a series	eries of pine
plantations	64
3-3 Total biomass nutrients of pine and succession tree	
pine plantations	65
3-4 Carbon storages of tree species in a series of pine p	
3-5 Nitrogen storages of tree species in a series of pine	
3-6 Phosphorus storages of tree species in a series of p	
3-7 Potassium storages of tree species in a series of pin	•
3-8 Calcium storages of tree species in a series of pine	•
3-9 Magnesium storages of tree species in a series of p	-
3-10 Variations of stored carbon and nutrients in bioma	
fifteen fragmented forests	194
3-11 Biomass carbon amounts of tree species in fragme	
3-12 Biomass nitrogen amounts of tree species in fragm	
3-13 Biomass phosphorus amounts of tree species in fra	_
3-14 Biomass potassium amounts of tree species in frag 3-15 Biomass calcium amounts of tree species in fragmo	
3-15 Biomass calcium amounts of tree species in fragme3-16 Biomass magnesium amounts of tree species in fragme	
4-1 Some soil physical properties in different age pine	_
4-2 Some soil chemical properties in different age pine	•
4-3 Stored carbon and nutrients in soils under different	•
4-4 Topography and development of soil profile under	0 1 1
4-5 Some soil physical properties in fragmented forest	C
4-6 Some soil chemical properties in fragmented fores	
4-7 Stored soil carbon and nutrients in fragmented force	
4-8 Carbon and nutrient contents in Ao layers	251
4-9 Dry matter of Ao layers in different age pine plant	
4-10 Accumulated carbon and nutrients in Ao layers of	
4-11 Dry matter of organic layers on forest floor in five	
4-12 Stored carbon and nutrients in organic layers in fra	•
4-13 Stored carbon in pine plantation ecosystems	254
4-14 Total stored nutrients in pine plantation ecosystem	

LIST OF TABLES (CONTINUED)

Table		Page
	Ecosystem stored carbon in five fragmented forests Ecosystem stored nutrients in five fragmented forests	255 256

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม Copyright[©] by Chiang Mai University All rights reserved

LIST OF FIGURES

Figure		Page
2-1	Location of research areas at Boakaew Watershed Management Station	10
2-2	Over views of pine plantations at Boakaew Watershed Management	
	Station	13
2-3	Allometric equations of a above-ground biomass of pine	14
2-4	Total forest biomass in a series of pine plantations	17
2-5	Tree biomass in pine plantations compared to the 1 st fragmented forest	41
2-6	Over views of fragmented forests at Boakaew Watershed Management	
	Station	44
3-1	Stored biomass nutrients in a series of pine plantations	62
4-1	Soil studies in pine plantations (upper) and fragmented forests (lower)	214
4-2	Storages of organic matter and nutrients in soils under pine plantations	223
4-3	Over views of soil profile for pedon 1 (The 1 st fragmented forest)	235
4-4	Over views of soil profile for pedon 2 (The 2 nd fragmented forest)	236
4-5	Over views of soil profile for pedon 3 (The 3 rd fragmented forest)	237
4-6	Over views of soil profile for pedon 4 (The 4 th fragmented forest)	238
4-7	Over views of soil profile for pedon 5 (The 5 th fragmented forest)	239
4-8	Stored nutrients along soil profiles under fragmented forests	250
4-9	Percentages of carbon stocks in pine plantation ecosystems	254
4-10	Percentages of carbon stocks in ecosystems of fragmented forests	256
4-11	Ecosystem carbon and nutrient accumulations in pine plantations and	
	fragmented forests	257
	12 1 29 2 1	

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม Copyright[©] by Chiang Mai University All rights reserved