

TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	Background of the study	1
1.2	Land use and land cover: definitions and concepts	4
1.3	Importance of land use and land cover	6
1.4	Degradation of vegetation	12
1.4.1	Causes of deforestation and degradation of woodland	13
1.4.2	Effects of deforestation.....	13
1.5	Need for land use and land cover mapping	17
1.6	Remote sensing and land use and land cover mapping.	18
1.7	Remote sensing and land use/land cover change detection	20
1.8	Ecological factors and land use/land cover change	21
1.9	Land use and land cover mapping in Ghana	22
1.10	Problem of land use and land mapping in Ghana	23
1.11	Objectives	26
1.11.1	General objectives.....	26
1.11.2	Specific objectives	26
1.12	Research questions	27
1.13	Hypotheses	27
2	LITERATURE REVIEW	29
2.1	Image type and land use/ land cover mapping	29
2.1.1	LANDSAT images (MSS and TM 4 and 5 Systems)	31
2.1.2	Mapping capabilities of MSS and TM data	34
2.1.3	Spatial and temporal resolutions (LANDSATs 1-5).....	36
2.1.4	LANDSAT 5 Thematic Mapper (TM).....	36
2.1.5	LANDSAT 7.....	37
2.1.6	Seasonality of images.....	38
2.1.7	Band combinations for displaying TM data.....	39
2.2	Classification scheme	40
2.3	Geometric correction of images	44
2.3.1	Satellite type and magnitude of distortion	45
2.3.2	Geometric correction techniques	45
2.3.3	Accuracy of spatial registration	47
2.4	Atmospheric correction of images	48
2.5	Field campaign	49
2.6	Image stratification	49
2.7	Digital classification	52
2.7.1	Unsupervised classification.....	53
2.7.2	Supervised classification	55
2.7.3	The hybrid classification technique	57
2.7.4	Training samples	58
2.8	Post classification enhancement	59
2.9	Accuracy assessment	60
2.9.1	Statistical methods for thematic accuracy.....	60
2.10	Change detection	63

2.10.1	Image overlay.....	64
2.10.2	Image differencing	64
2.10.3	Change vector analysis.....	65
2.10.4	Classification comparisons	66
2.10.5	Principal component analysis	66
2.10.6	Use of vegetation indices	66
2.10.7	Factors affecting vegetation indices.....	69
2.11	Rainfall and vegetation	75
2.12	Soil fertility and vegetation	79
3	BIOPHYSICAL AND SOCIO-ECONOMIC ENVIRONMENT.....	82
3.1	The biophysical environment	82
3.1.1	Location and extent of the Upper West Region	82
3.1.2	Climate	83
3.1.3	Geology and physiography	84
3.1.4	Vegetation.....	86
3.1.5	Soils	93
3.2	Socio-economic environment	95
3.2.1	Economic development of the Upper West Region.....	95
3.2.2	Population	96
3.2.3	Land use and farming systems.....	103
3.2.4	Settlements and infrastructure.....	108
4	LAND USE AND LAND COVER CLASSIFICATION	110
4.1	Materials	110
4.1.1	Data type	110
4.1.2	Seasonality of images.....	111
4.1.3	Classification scheme	111
4.2	Methods	114
4.2.1	Band combinations for displaying TM Data.....	115
4.2.2	Geometric correction.....	116
4.2.3	Atmospheric correction or normalization of images	118
4.2.4	Field reconnaissance visit	119
4.2.5	Image stratification	119
4.2.6	Classification.....	121
4.2.7	Post-classification enhancement	128
4.2.8	Accuracy assessment	128
4.3	Results and discussion	129
4.3.1	Classification results	129
4.3.2	Extent of land use and land cover classes.....	137
4.3.3	Accuracy of the classification: 2000.....	139
4.3.4	Distribution of land use/land cover categories.....	141
5	LAND USE AND LAND COVER CHANGE ASSESSMENT.....	144
5.1	Change detection methods	144
5.2	Results and discussion	145
5.2.1	Farmland/bare land or constructed surface	146

5.2.2	Closed woodland/riparian vegetation.....	148
5.2.3	Open savannah woodland with shrubs and grasses	149
5.2.4	Mixture of grasses and shrubs and scattered trees	150
5.2.5	Water body	152
5.3	Dynamics of land use and land cover change	154
6	ASSESSMENT OF CAUSES OF LAND USE AND LAND COVER CHANGE.	
	156
6.1	Methods	156
6.1.1	Soil sampling and analysis	156
6.2	Results of soil fertility assessment	159
6.2.1	Soil chemical properties: Closed savannah woodland.....	161
6.2.2	Soil chemical properties: Open savannah woodland	162
6.2.3	Soil chemical properties: mixture of grasses and shrubs	163
6.2.4	Soil chemical properties: Farmland	164
6.3	Comparison of the soils under the different land cover types	166
6.4	General fertility status of the soils	170
6.5	Analysis of the rainfall of the Upper West Region	173
6.6	Rainfall and soil fertility evaluation for crops grown in the Upper West Region (Sys, 1985)	177
6.7	Population and land use and land cover of the Upper West Region	180
6.8	Causes of decline of savannah woodland	186
7	SUMMARY, CONCLUSION AND RECOMMENDATIONS	194
7.1	Summary	194
7.2	Conclusion	199
7.3	Recommendations	201
8	REFERENCES.....	203
9	APPENDICES.....	221