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# Kompleksowa analiza wylesiania w krajach tropikalnych - bezpośrednie czynniki wylesiania, emisje dwutlenku węgla i równowaga wartości usług ekosystemów

A comprehensive study on deforestation in the tropics - direct deforestation drivers, carbon emissions and ecosystem service value balance

Master's Thesis  
on the course of - Forestry

Thesis written under the supervision of  
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Research Domain II - Climate Climate Impacts & Vulnerabilities

Potsdam, 2018



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# Contents

1	Introduction	11
1.1	Tropical forest . . . . .	11
1.1.1	Current state . . . . .	11
1.1.2	Contribution to climate . . . . .	11
1.1.3	Forest definitions . . . . .	11
1.2	Deforestation . . . . .	11
1.2.1	Land use and land cover change . . . . .	12
1.2.2	Drivers of deforestation . . . . .	12
1.3	Emissions through deforestation . . . . .	12
1.3.1	Removal of AGB . . . . .	12
1.3.2	Soil organic carbon change and soil dynamics . . . . .	12
1.4	Ecosystem services . . . . .	12
1.4.1	Ecosystem service values . . . . .	12
1.5	Research objective and questions . . . . .	12
2	Data and methods	13
2.1	Data . . . . .	13
2.1.1	Spatial data . . . . .	13
2.1.1.1	Global Forest Change . . . . .	13
2.1.1.2	GlobeLand30 . . . . .	13
2.1.1.3	Intact Forest Landscapes . . . . .	13
2.1.1.4	Aboveground Woody Biomass . . . . .	13
2.1.1.5	Global Soil Organic Carbon . . . . .	13
2.1.1.6	Auxiliary . . . . .	13
2.1.2	Empirical data . . . . .	13
2.1.2.1	Soil Organic Carbon . . . . .	13
2.1.2.2	Ecosystem Service Values . . . . .	14
2.2	Methods . . . . .	14
2.2.1	Preprocessing . . . . .	14
2.2.2	Deforestation . . . . .	14
2.2.2.1	Forest definition . . . . .	14
2.2.2.2	Land use change driver . . . . .	14
2.2.2.3	Accuracy assessment . . . . .	14
2.2.3	Emissions . . . . .	14
2.2.3.1	Above ground biomass . . . . .	14
2.2.3.2	Soil organic carbon change . . . . .	14
2.2.4	Ecosystem service values . . . . .	14
2.2.4.1	Ecosystem service value loss . . . . .	14
2.2.4.2	Ecosystem service value gain . . . . .	14
2.2.5	Binning analysis . . . . .	14
3	Results	15
3.1	Forest definition and accuracy assessment . . . . .	15
3.2	Deforestation drivers . . . . .	16
3.3	Deforestation emissions . . . . .	21

3.4 Ecosystem service value balance . . . . .	21
4 Discussion	22
5 Conclusion	23
Acknowledgements	24
References	I
List of Figures	II
List of Tables	II
List of Abbreviations	II
Appendix	III

# 1 Introduction

## 1.1 Tropical forest

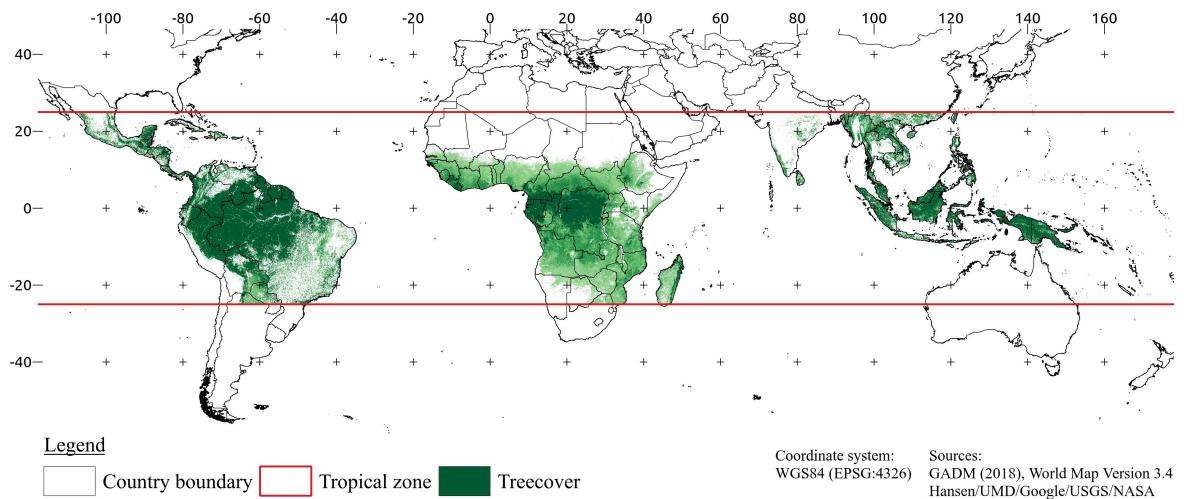


Figure 1: Geographic tropical zone framed red and the tropical forest

### 1.1.1 Current state

### 1.1.2 Contribution to climate

### 1.1.3 Forest definitions

## 1.2 Deforestation

Gaps no spatial explicit knowledge on direct deforestation drivers (amount, pattern, cattle ranching/cropland, urbanization) Contribution of deforestation drivers on ghg emissions, no knowledge on soil organic carbon emissions

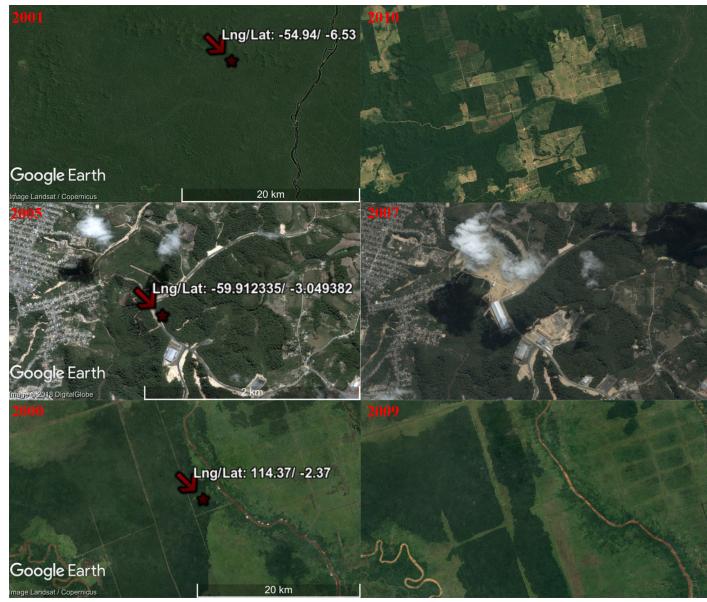


Figure 2: Upper Brazil agriculture, middle Brazil urbanization, lower Indonesia large scale palm oil plantations

### 1.2.1 Land use and land cover change

### 1.2.2 Drivers of deforestation

## 1.3 Emissions through deforestation

### 1.3.1 Removal of AGB

### 1.3.2 Soil organic carbon change and soil dynamics

## 1.4 Ecosystem services

till now only estimates of losses no balance estimate

### 1.4.1 Ecosystem service values

## 1.5 Research objective and questions

## 2 Data and methods

### 2.1 Data

#### table of datasets

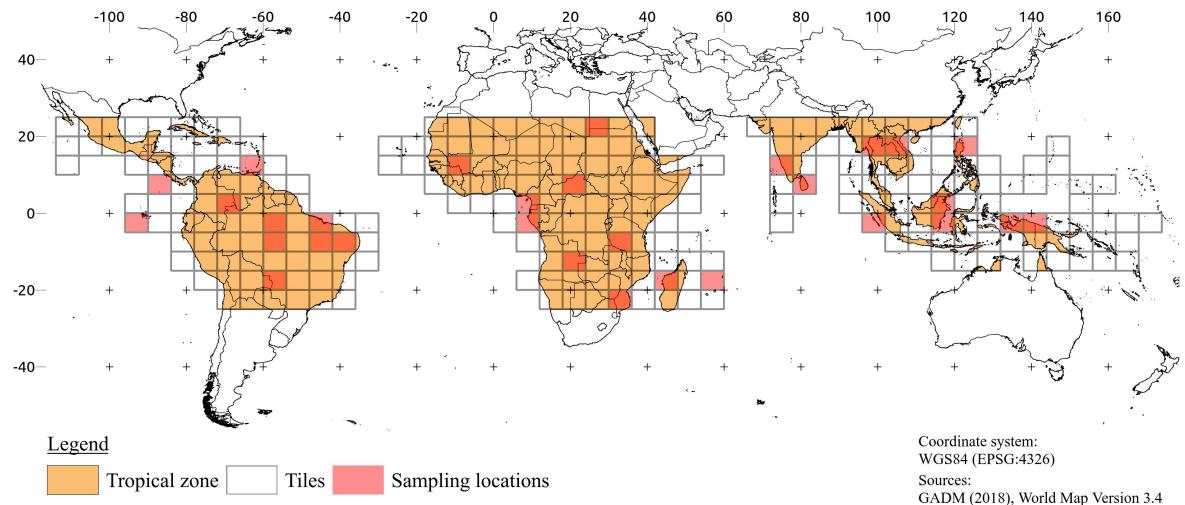


Figure 3: Study extent and raster image tiles

#### 2.1.1 Spatial data

##### 2.1.1.1 Global Forest Change

##### 2.1.1.2 GlobeLand30

##### 2.1.1.3 Intact Forest Landscapes

##### 2.1.1.4 Aboveground Woody Biomass

##### 2.1.1.5 Global Soil Organic Carbon

##### 2.1.1.6 Auxiliary

#### 2.1.2 Empirical data

##### 2.1.2.1 Soil Organic Carbon

### 2.1.2.2 Ecosystem Service Values

## 2.2 Methods

flowchart

### 2.2.1 Preprocessing

### 2.2.2 Deforestation

#### 2.2.2.1 Forest definition

#### 2.2.2.2 Land use change driver

#### 2.2.2.3 Accuracy assessment

### 2.2.3 Emissions

#### 2.2.3.1 Above ground biomass

#### 2.2.3.2 Soil organic carbon change

### 2.2.4 Ecosystem service values

#### 2.2.4.1 Ecosystem service value loss

#### 2.2.4.2 Ecosystem service value gain

### 2.2.5 Binning analysis

### 3 Results

#### 3.1 Forest definition and accuracy assessment

to appendix table of samples and Jaccard scores

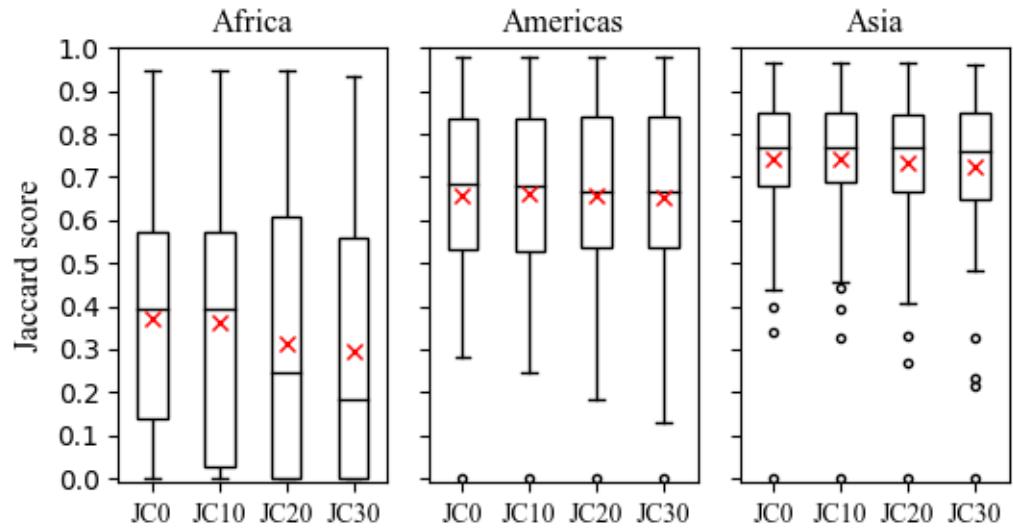


Figure 4: Jaccard score to determine tree cover similarity used to develop forest definition

Table 1: Confusion matrix for accuracy assessment

Cls	Reference									Tot	UAc	Om	
	10	20	25	30	40	50	60	80	90				
Prediction	10	732	38	62	15	16	2	3	5	0	.873	.84	.16
	20	42	751	57	189	31	12	0	17	4	1103	.68	.32
	25	29	202	1155	173	22	10	5	11	4	1611	.72	.28
	30	36	187	32	1466	73	21	0	17	0	1832	.80	.20
	40	14	21	4	41	352	1	1	2	1	437	.81	.19
	50	0	5	3	10	4	50	0	1	0	73	.68	.32
	60	2	1	0	3	0	2	18	2	0	28	.64	.36
	80	3	4	0	1	1	1	0	50	0	60	.83	.17
	90	0	0	0	1	0	0	0	3	5	9	.56	.44
Tot	858	1209	1313	1899	499	99	27	108	14	6026			
PAC	.85	.62	.88	.77	.71	.51	.67	.46	.36			OvAc	
Com	.15	.38	.12	.23	.29	.49	.33	.54	.64				.75

### 3.2 Deforestation drivers

global drivers as bar graph drivers per country

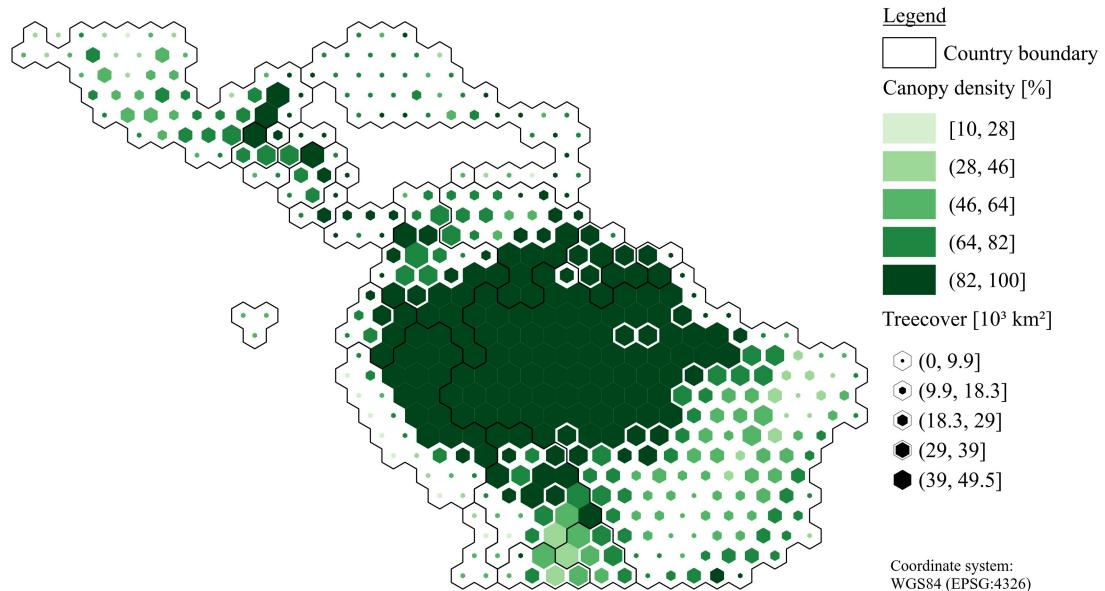


Figure 5:

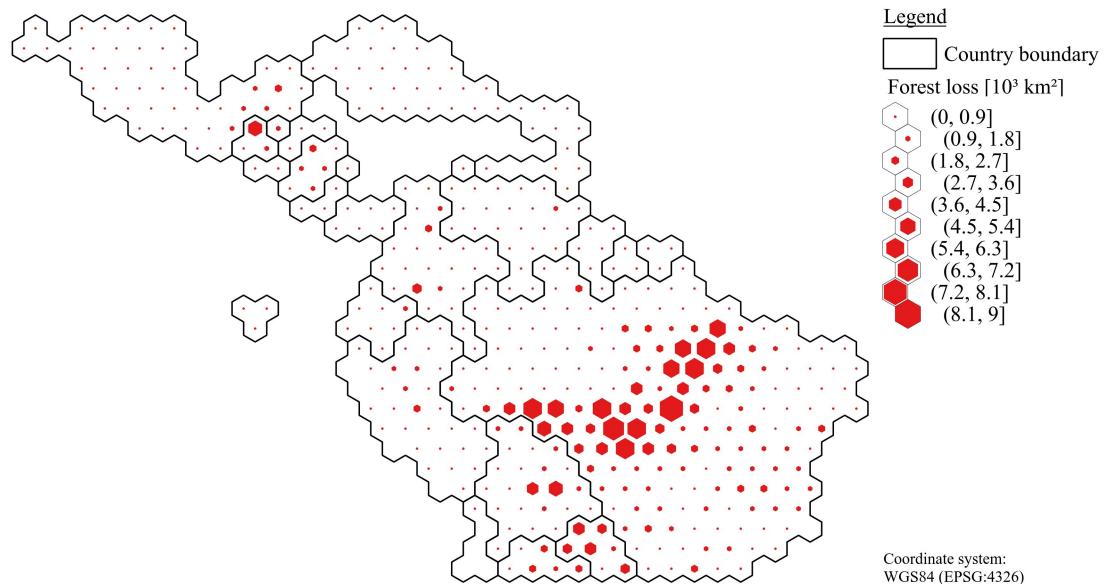


Figure 6:

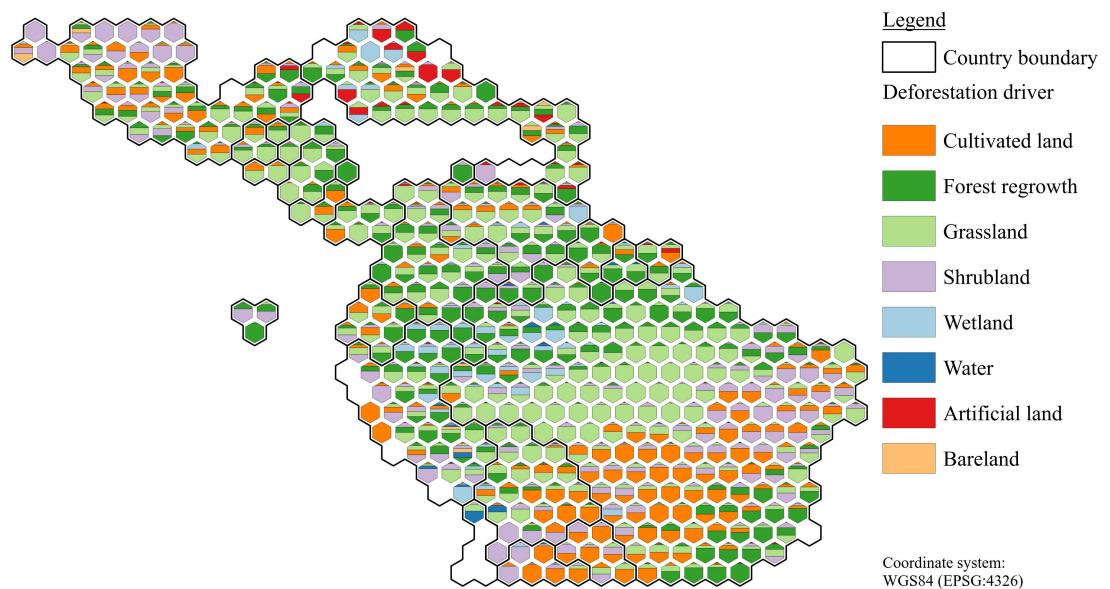


Figure 7:

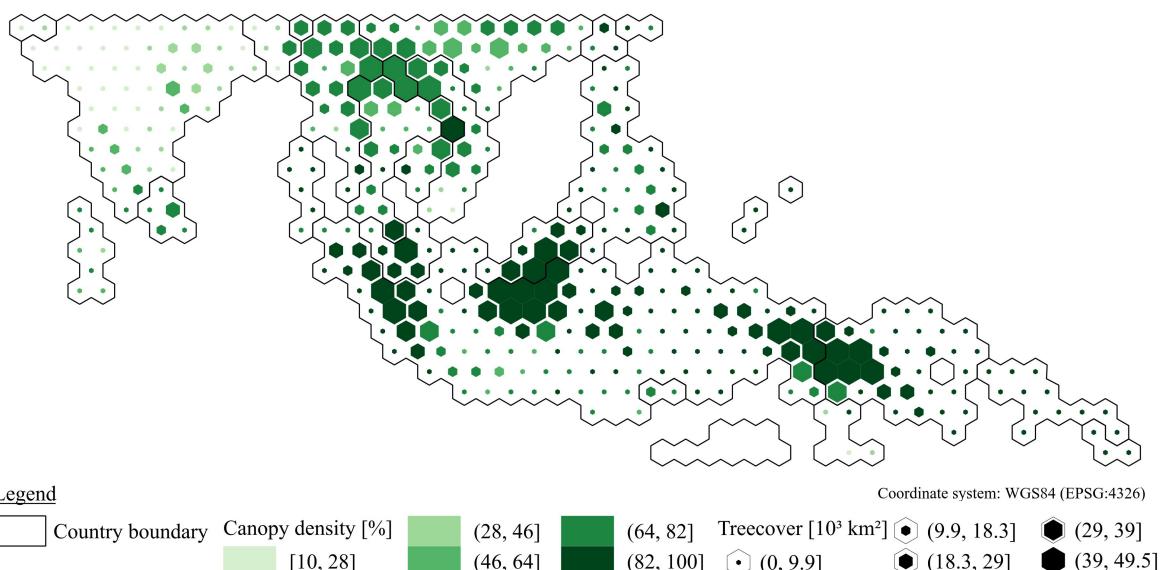


Figure 8:

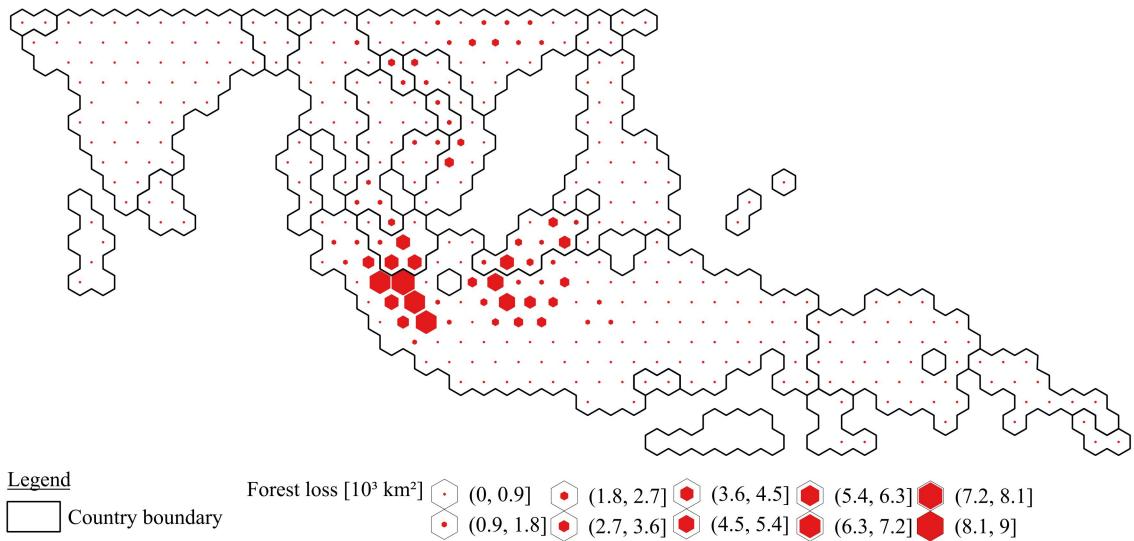


Figure 9:

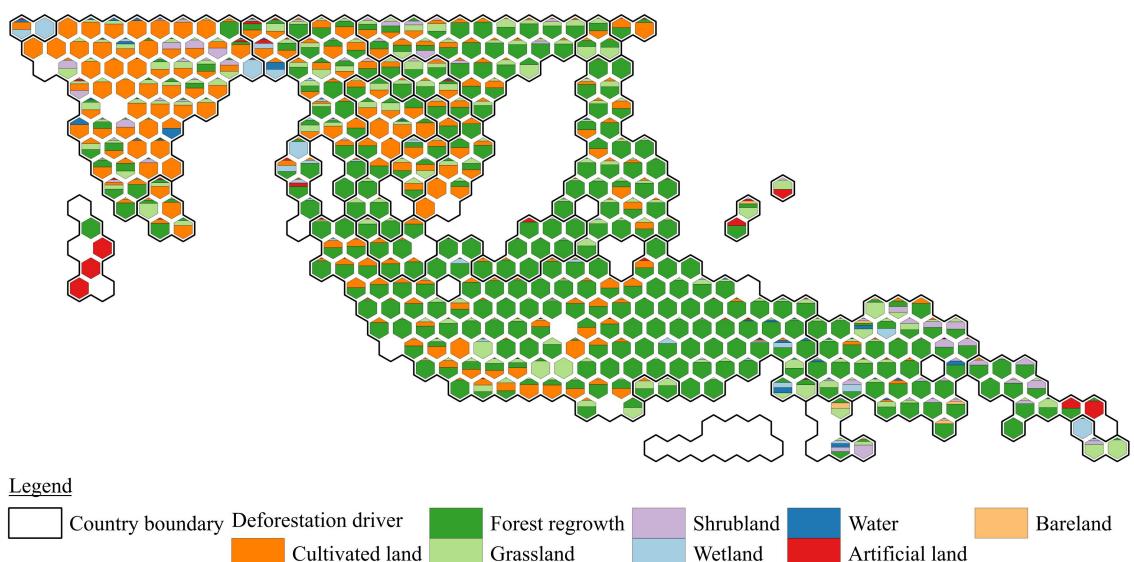


Figure 10:

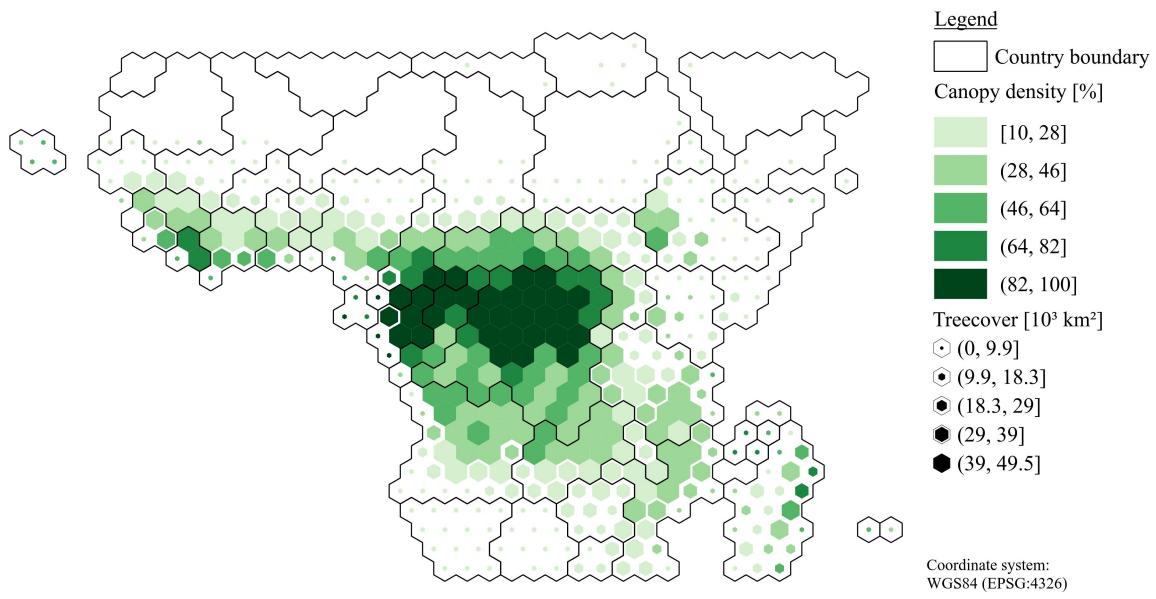


Figure 11:

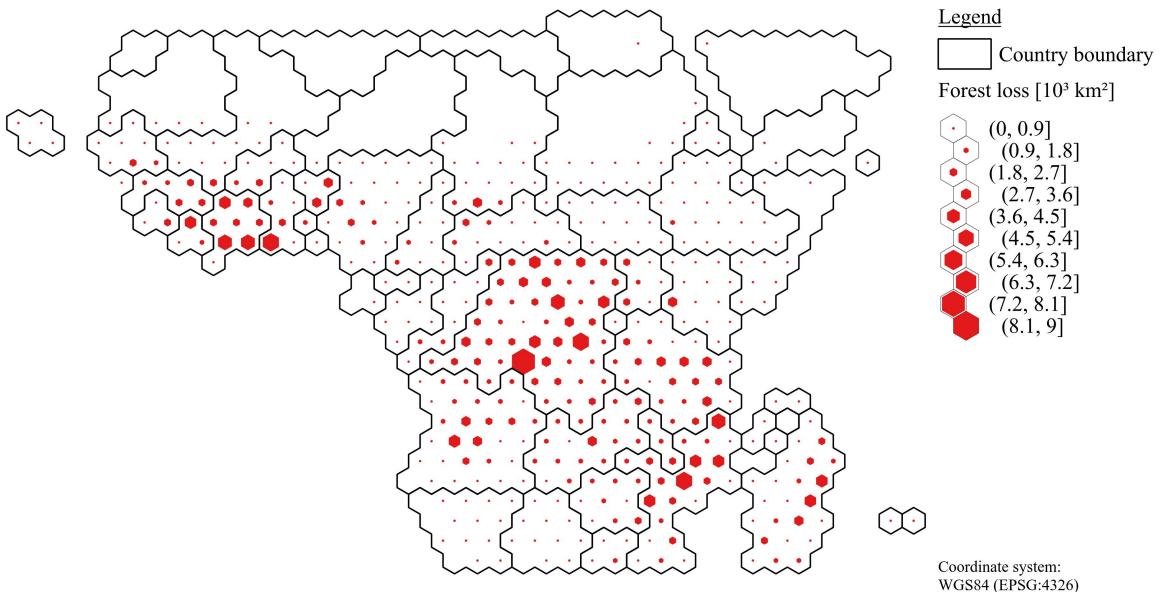


Figure 12:

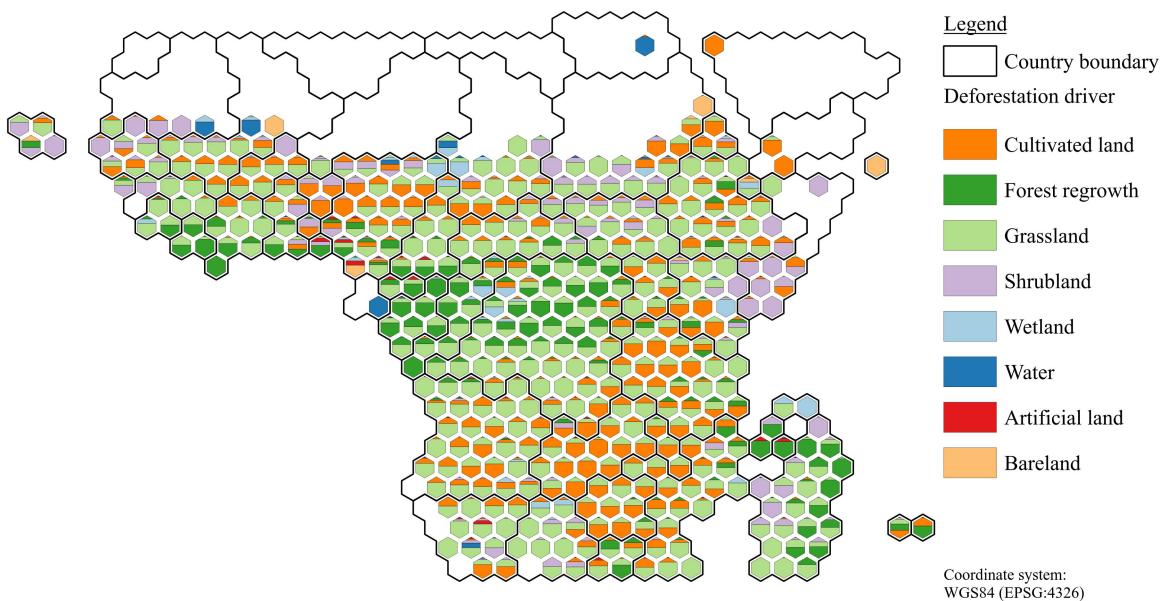


Figure 13:

Table 2: Absolute in km<sup>2</sup>

Type	Class	Americas	Asia	Africa
Agriculture	Cropland	rel. 24.37	18.37	25.01
		abs. 95908	38719	44368
Forestry/Plantations	Grassland	rel. 46.19	8.41	50.46
		abs. 181781	17726	89516
Urban/Mining	Regrowth	rel. 14.40	70.27	18.61
		abs. 56671	148111	33014
Natural	Shrubland	rel. 12.69	1.11	3.77
		abs. 49941	2340	6688
	Artificial	rel. 0.41	0.46	0.71
		abs. 1614	970	1260
	Bareland	rel. 0.10	0.03	0.09
		abs. 394	63	160
	Wetland	rel. 1.50	0.97	1.23
		abs. 5903	2045	2182
	Water	rel. 0.32	0.38	0.13
		abs. 1259	801	231
Forest loss	rel.	3.87	4.68	1.69
	abs.	393550	210774	177400
Forest cover	abs.	10223187	4457940	10496591

### 3.3 Deforestation emissions

table agbe emissions, graph agbe per driver, graph socce per driver, merge socce and agbe in one graph drivers per country

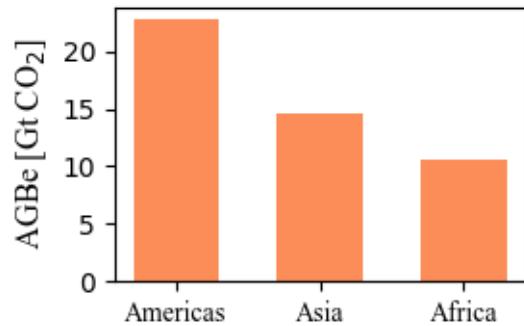


Figure 14:

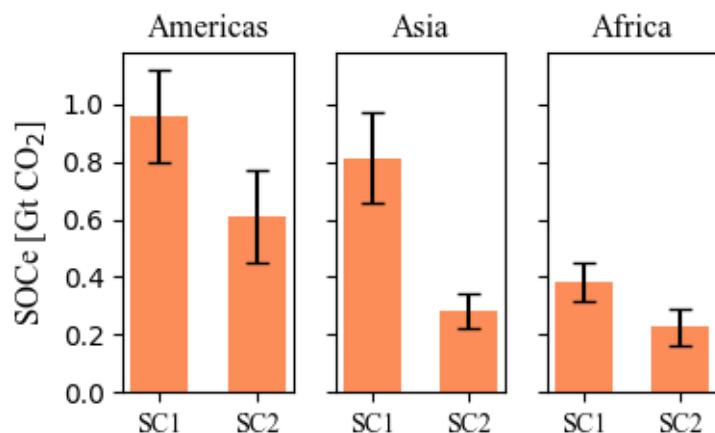


Figure 15:

Table 3: Soil organic carbon emissions

Region	SC1			SC2			SC3		
	[Gt CO <sub>2</sub> ]			[Gt CO <sub>2</sub> ]			[Gt CO <sub>2</sub> ]		
	min	mean	max	min	mean	max	min	mean	max
Americas	0.80	0.96	1.12	0.45	0.61	0.77	0.43	0.59	0.76
Asia	0.66	0.81	0.97	0.22	0.28	0.34	0.22	0.28	0.33
Africa	0.32	0.39	0.45	0.17	0.23	0.29	0.16	0.23	0.29

### 3.4 Ecosystem service value balance

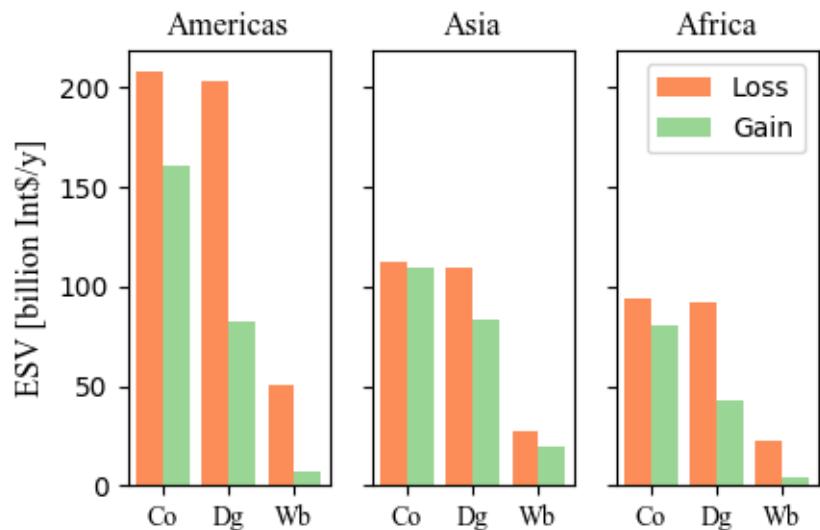


Figure 16:

## 4 Discussion

## 5 Conclusion

## Acknowledgements

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## List of Figures

1	Tropical zone . . . . .	11
2	Deforestation examples . . . . .	12
3	Study extent . . . . .	13
4	Boxplot of Jaccard scores . . . . .	15
5	Ecosystem service values . . . . .	16
6	Ecosystem service values . . . . .	16
7	Ecosystem service values . . . . .	17
8	Ecosystem service values . . . . .	17
9	Ecosystem service values . . . . .	18
10	Ecosystem service values . . . . .	18
11	Ecosystem service values . . . . .	19
12	Ecosystem service values . . . . .	19
13	Ecosystem service values . . . . .	20
14	Ecosystem service values . . . . .	21
15	Ecosystem service values . . . . .	21
16	Ecosystem service values . . . . .	22

## List of Tables

1	Accuracy assessment . . . . .	15
2	Deforestation driver . . . . .	20
3	Soil organic carbon emissions . . . . .	21

## List of Abbreviations

<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>GFC</b>	Global Forest Change
<b>GIS</b>	Geographic Information System
<b>GLC30</b>	GlobeLand30
<b>GTiff</b>	Geo-Tiff
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>LULC</b>	Land Use/Land Cover
<b>POK</b>	Pixel-Object-Knowledge
<b>R-PIN</b>	Readiness Plan Idea Note
<b>R-PP</b>	Readiness Preparation Proposal
<b>UTM</b>	Universal Transverse Mercator
<b>WGS84</b>	World Geodetic System 1984

## Appendix

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