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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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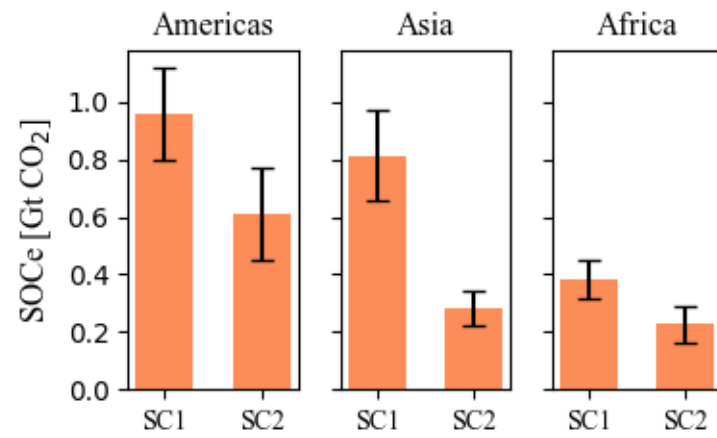


Figure 1: test

1 Introduction

1.1 Tropical forest

1.1.1 Current state

1.1.2 Contribution to climate

1.1.3 Forest definitions

1.2 Deforestation

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

1.4.1 Ecosystem service values

1.5 Research objective and questions

2 Data and methods

2.1 Data

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

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2.1.2 Numerical data

2.1.2.1 Soil Organic Carbon

2.1.2.2 Ecosystem Service Values

2.2 Methods

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

Table 1: Confusion matrix

		Reference											
	Cls	10	20	25	30	40	50	60	80	90	Tot	UAc	Om
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		

Table 2: Soil organic carbon emissions

Region	SC1			SC2			SC3		
	[Gt CO ₂]			[Gt CO ₂]			[Gt CO ₂]		
	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

2.2.4 Ecosystem service values

2.2.4.1 Ecosystem service value loss

2.2.4.2 Ecosystem service value gain

Table 3: Absolute in km²

Type	Class		Americas	Asia	Africa
Agriculture	Cropland	rel.	24.37	18.37	25.01
		abs.	95908	38719	44368
	Grassland	rel.	46.19	8.41	50.46
		abs.	181781	17726	89516
Forestry/Plantations	Regrowth	rel.	14.40	70.27	18.61
		abs.	56671	148111	33014
	Shrubland	rel.	12.69	1.11	3.77
		abs.	49941	2340	6688
Urban/Mining	Artificial	rel.	0.41	0.46	0.71
		abs.	1614	970	1260
	Bareland	rel.	0.10	0.03	0.09
		abs.	394	63	160
Natural	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

2.2.5 Binning analysis

3 Results

3.1 Deforestation drivers

3.2 Deforestation emissions

3.3 Ecosystem service value balance

4 Discussion

5 Conclusion

Acknowledgements

References

- Chen J., Chen J., Liao A., Cao X., Chen L., Chen X., He C., Han G., Peng S., Lu M., Zhang W., Tong X., and Mills J. *30-meter Global Land Cover Dataset - Product Description*. National Geomatics Center of China, May 2014.
- Hansen M. C., Potapov P. V., Moore R., Hancher M., Turubanova S. A., Tyukavina A., Thau D., Stehman S. V., Goetz S. J., Loveland T. R., Kommareddy A., Egorov A., Chini L., Justice C. O., and Townshend J. R. G. High-Resolution Global Maps of 21st-Century Forest Cover Change. *Science*, 342(6160):850–853, November 2013a. doi: 10.1126/science.1239552.
- Hansen M. C., Potapov P. V., Moore R., Hancher M., Turubanova S. A., Tyukavina A., Thau D., Stehman S. V., Goetz S. J., Loveland T. R., Kommareddy A., Egorov A., Chini L., Justice C. O., and Townshend J. R. G. Supplementary Materials for: High-Resolution Global Maps of 21st-Century Forest Cover Change. *Science*, 342(6160):1–32, November 2013b. doi: 10.1126/science.1244693.
- Hosonuma N., Herold M., De Sy V., De Fries R. S., Brockhaus M., Verchot L., Angelsen A., and Romijn E. An assessment of deforestation and forest degradation drivers in developing countries. *Environmental Research Letters*, 7(4):1–12, October 2012. doi: 10.1088/1748-9326/7/4/044009.

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List of Abbreviations

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

Appendix

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