

Table of contents

Abstract	IX
Zusammenfassung	XI
Abbreviations	XV
I Introduction	1
1.1 Scientific background	1
1.1.1 Permafrost in the Northern Hemisphere	1
1.1.2 The permafrost carbon climate feedback	2
1.1.3 Rapidly changing, deep permafrost environments	4
1.2 Aims of this dissertation	6
1.3 Investigated study areas	7
1.4 Basic method overview	10
1.4.1 Field work in the Arctic	10
1.4.2 Laboratory procedure	11
1.4.3 Analysis of landscape-scale carbon and nitrogen stocks	14
1.5 Thesis organization	14
1.6 Overview of publications	15
1.6.1 Publication #1 – Yedoma landscape publication	15
1.6.2 Publication #2 – Thermokarst lake sequence publication	16
1.6.3 Publication #3 – North Alaska Arctic river delta publication	17
1.6.4 Extended Abstract – Western Alaska river delta study	17
1.6.5 Appendices – Supplementary material and paper in preparation	18
II Carbon and nitrogen pools in thermokarst-affected permafrost landscapes in Arctic Siberia	19
2.1 Abstract	19
2.2 Introduction	20
2.3 Material and methods	22
2.3.1 Study area	22
2.3.2 Field Work	24
2.3.3 Laboratory analysis	25
2.3.4 Landform classification and upscaling C and N pools	26

2.4 Results.....	29
2.4.1 Sedimentological results	29
2.4.2 Sampling site SOC and N stocks	31
2.4.3 Upscaling: Landscape SOC and N stocks	32
2.4.4 Radiocarbon dates	33
2.5 Discussion.....	37
2.5.1 Site specific soil organic C and N stock characteristics.....	37
2.5.2 Upscaling of C and N pools	39
2.5.3 Sediment and organic C accumulation rates	40
2.5.4 Characterizing soil organic carbon.....	41
2.5.5 The fate of organic carbon in thermokarst-affected yedoma in Siberia.....	41
2.6 Conclusions.....	42
III Impacts of successive thermokarst lake stages on soil organic matter, Arctic Alaska.....	45
3.1 Abstract.....	45
3.2 Plain language summary	46
3.3 Introduction.....	47
3.4 Study site.....	49
3.5 Methods.....	52
3.5.1 Core collection	52
3.5.2 Biogeochemical analyses	54
3.5.3 Study area OC and N calculation.....	55
3.6 Results.....	56
3.6.1 Biogeochemistry	56
3.6.2 Sediment organic carbon and nitrogen stocks.....	57
3.6.3 Radiocarbon dates and carbon accumulation rates	58
3.6.4 Landscape C and N budget	61
3.7 Discussion.....	62
3.7.1 Impact of thermokarst lake dynamics on organic matter storage.....	62
3.7.2 High organic C and N stocks on the ACP.....	64
3.7.3 Landscape chronology	65
3.7.4 Organic matter accumulation	68
3.7.5 Future development.....	69
3.8 Conclusions.....	70

IV Sedimentary and geochemical characteristics of two small permafrost-dominated Arctic river deltas in northern Alaska	73
4.1 Abstract	73
4.2 Introduction	74
4.3 Study area	75
4.4 Material and Methods	77
4.4.1 Soil organic carbon and soil nitrogen storage	77
4.4.2 Radiocarbon dating and organic carbon accumulation rates	78
4.4.3 Grain size distribution	79
4.4.4 Scaling carbon and nitrogen contents to landscape level	79
4.5 Results	80
4.5.1 Carbon and nitrogen contents	80
4.5.2 Radiocarbon dates and accumulation rates	82
4.5.3 Grain size distribution	84
4.5.4 Arctic river delta carbon and nitrogen storage	88
4.6. Discussion	90
4.6.1 Significance of carbon and nitrogen stocks in Arctic river deltas	90
4.6.2 SOC and SN distribution with depth	91
4.6.3 Sedimentary characteristics	93
4.6.3.1 Accumulation rates	93
4.6.3.2 Sediment distribution	94
4.6.4 Impacts of future changes	95
4.6.5 Significance of remotely sensed upscaling results	96
4.7 Conclusions	96
V Soil carbon and nitrogen stocks in Arctic river deltas – New data for three Western Alaskan deltas	99
5.1 Abstract	99
5.2 Introduction	100
5.3 Study sites	100
5.4 Methods	100
5.5 Results and discussion	101
5.5 Conclusions	102