



TABLE OF CONTENTS

1	INTRODUCTION.....	1
1.1	Ecological importance of genetic diversity.....	1
1.1.1	Genetic diversity and ecosystem functioning.....	2
1.1.2	Study approaches.....	4
1.2	Poplars as model tree species.....	5
1.3	The Göttingen Poplar Diversity Experiment (POPDIV).....	6
1.4	<i>Populus tremula</i> L. & <i>Populus tremuloides</i> Michx.....	7
1.4.1	Ecology and distribution.....	7
1.4.2	Ecologically important tree species.....	8
1.4.3	Genetic variation.....	9
1.5	Assessment of genetic diversity.....	10
1.5.1	Nuclear microsatellites.....	10
1.5.2	Amplified fragment length polymorphism.....	11
1.6	Parentage analysis.....	11
1.7	Research questions and hypotheses.....	13
2	MATERIALS AND METHODS.....	15
2.1	The poplar diversity experiment (POPDIV).....	15
2.2	Sampling and DNA extraction.....	18
2.3	Microsatellite analyses.....	18
2.3.1	Multiplex polymerase chain reaction (PCR) development.....	18
2.3.2	PCR reaction and program.....	19
2.4	AFLP analyses.....	20
2.5	Statistical analyses.....	20
2.5.1	Clonal structures.....	20
2.5.2	Genetic diversity and differentiation of demes.....	21
2.5.3	Genetic diversity and differentiation of the sampled plots.....	22
2.5.4	Modelled genetic diversity within all plots in the POPDIV experiment.....	23
2.5.5	Parentage analysis.....	23
3	RESULTS.....	26
3.1	Clonal structures.....	26
3.2	Genetic diversity within demes.....	28
3.2.1	SSRs.....	28
3.2.2	AFLPs.....	28
3.2.3	Comparisons between SSRs and AFLPs.....	29



3.3	Genetic difference between demes	31
3.3.1	Genetic differentiation among demes.....	31
3.3.2	Genetic distance between demes	34
3.4	Genetic diversity within the sampled plots	35
3.5	Genetic differentiation among the sampled plots	36
3.6	Genetic diversity within all plots in the POPDIV experiment	39
3.7	Parentage analysis	42
3.7.1	Paternity estimation	42
3.7.2	Sibship reconstruction	44
4	DISCUSSION	46
4.1	Clonal structures in the POPDIV experiment	46
4.2	Genetic diversity within demes.....	47
4.3	Genetic differentiation among demes	49
4.4	Genetic diversity within plots in the POPDIV experiment.....	51
4.4.1	Genetic diversity and differentiation of the sampled plots.....	51
4.4.2	Modelled genetic diversity for all plots in the POPDIV experiment	52
4.4.3	The comparison between the observed and modelled genetic diversity within the sampled plots	54
4.4.4	Applications of genetic diversity within plots to ecosystem properties	55
4.5	Parentage analysis of demes	56
4.5.1	Paternity analysis.....	56
4.5.2	Sibship reconstruction	58
5	CONCLUSIONS AND OUTLOOK.....	60
6	SUMMARY	62
7	ZUSAMMENFASSUNG	66
8	REFERENCES	70
9	APPENDICES	83