

Cottbuser Schriften

zu Bodenschutz und Rekultivierung

Band 24

Wolfgang Schaaf

Development of element cycling in
forest ecosystems after anthropogenic
disturbances – case studies
at long-term atmospheric polluted
and at post-mining sites

Table of contents

| | |
|--|----|
| Preface | IV |
| 1. Introduction | 1 |
| 1.1 Background: ecosystem disturbance and ecosystem development | 1 |
| 1.2 Objectives | 1 |
| 1.2.1 Ecosystem disturbance by atmogenic deposition | 1 |
| 1.2.2 Ecosystem disturbance by surface mining | 2 |
| 1.3 Special aspects of the sites | 2 |
| 1.3.1 Pollution history in eastern Germany, differences to western Europe | 2 |
| 1.3.2 Lignite mining in Lusatia | 5 |
| 1.3.3 Aims and methods of “recultivation”/restoration on ecosystem scale | 8 |
| 1.4 Hypotheses | 9 |
| 2. Material and methods | 11 |
| 2.1 Methodological approaches | 11 |
| 2.1.1 Element budget studies | 11 |
| 2.1.2 Chronosequences studies | 11 |
| 2.2 Sites | 12 |
| 2.3 Field measurements | 16 |
| 2.4 Microcosm experiments | 17 |
| 2.5 Analytical methods | 19 |
| 2.5.1 Routine analyses | 19 |
| 2.5.2 Methodical problems | 20 |
| 2.6 Models | 27 |
| 2.6.1 SOIL | 27 |
| 2.6.2 PHREEQC | 27 |
| 3. Soil solution chemistry and element budgets of three Scots pine ecosystems along a deposition gradient in north-eastern Germany | 28 |
| 3.1 Introduction | 28 |
| 3.2 Materials and methods | 28 |
| 3.3 Results and discussion | 30 |
| 3.3.1 Deposition load | 30 |
| 3.3.2 Soil solution chemistry | 30 |
| 3.3.3 Element budgets | 31 |
| 3.4 Conclusions | 33 |
| 4. Forest soil reaction to drastical changes in sulfur and alkaline dust deposition in three Scots pine ecosystems in NE-Germany | 34 |
| 4.1 Introduction | 34 |
| 4.2 Materials and methods | 36 |
| 4.3 Results | 36 |

| | | |
|-------|---|-----|
| 4.3.1 | General soil physical and chemical properties | 36 |
| 4.3.2 | Inorganic sulfate fractions | 38 |
| 4.3.3 | Soil solution composition | 39 |
| 4.3.4 | Element fluxes | 42 |
| 4.4 | Discussion | 43 |
| 4.4.1 | Element budgets and proton loads of the humus layers | 43 |
| 4.4.2 | Sulfate dynamics and element budgets of the Bw horizons | 48 |
| 4.5 | Conclusions | 55 |
| 5. | Changes in top soil properties of forest soils in north-eastern Germany due to long-term element accumulation | 56 |
| 5.1 | Introduction | 56 |
| 5.2 | Materials and methods | 58 |
| 5.3 | Results | 60 |
| 5.4 | Discussion | 64 |
| 6. | Temporal and spatial development of soil solution chemistry and element budgets in different mine soils of the Lusatian lignite mining area | 67 |
| 6.1 | Introduction | 67 |
| 6.2 | Materials and methods | 68 |
| 6.3 | Results | 69 |
| 6.4 | Discussion | 74 |
| 6.5 | Conclusions | 77 |
| 7. | Leaching induced changes in substrate and solution chemistry of mine soil microcosms | 78 |
| 7.1 | Introduction | 78 |
| 7.2 | Materials and methods | 79 |
| 7.3 | Results | 80 |
| 7.4 | Discussion | 85 |
| 7.5 | Conclusions | 88 |
| 8. | What can element budgets of false-time series tell us about ecosystem development on post-lignite mining sites? | 89 |
| 8.1 | Introduction | 89 |
| 8.2 | Materials and methods | 90 |
| 8.3 | Results | 90 |
| 8.4 | Discussion | 94 |
| 8.5 | Conclusions | 97 |
| 9. | Synthesis | 99 |
| 10. | Zusammenfassung | 101 |

| | |
|------------------|-----|
| 11. References | 104 |
| Acknowledgements | 116 |
| Appendix | 118 |