

Part A
Description of Long-term Observation Sites

Chapter 1

General Description of Study Sites

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The three case studies provided in this book describe mature and almost pure beech stands (*Fagus sylvatica*) of 130–160 years old. They are located in the hilly country around Göttingen (Fig. 1.1) which was formed by different geological formations of Triassic limestone (Göttinger Wald site), and Triassic sandstone (Solling site), with locally interspersed tertiary volcanic stones (Zierenberg site) which are covered by loess of variable thickness. These sites cover a wide amplitude of beech forests under similar climatic conditions (Chap. 2, this volume). The sites differ considerably with respect to the acid–base status of the soils which affects the composition of the ground vegetation, the soil biota, litter quality and the surface humus type. These site differences have considerable implications for the nutrient status of these forests, the element cycling processes, the carbon and nitrogen sequestration, and the management options. The three sites have been included as intensive monitoring plots of the Forest Ecosystem Research Center of the University of Göttingen and are part of the Intensive Forest Monitoring Program (Level II) of the International Co-operative Program on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests) operating under the UNECE Convention on Long-Range Transboundary Air Pollution. Selected results from these sites have been published in several publications cited in the individual chapters and they contributed largely to the volumes of Ellenberg et al. (1986), Röhrig and Ulrich (1991), and Godbold and Hüttermann (1994). The main features of the sites are summarised in Table 1.1.

The beech forest at the Göttinger Wald site is situated close to the rim of the Triassic limestone plateau of the “Göttinger Wald” 8 km east of Göttingen (Fig. 1.1) at an elevation of about 420 m a.s.l. (Table 1.1). The almost pure beech (*F. sylvatica*) stand has a small admixture of ash (*Fraxinus excelsior*), maple (*Acer platanoides*, *Acer pseudoplatanus*), oak (*Quercus robur*, *Quercus petraea*), and elm (*Ulmus glabra*), and is about 130 years old (Chap. 5, this volume). A dense and diverse herb layer covers the soil surface in May each year which consists primarily of *Allium ursinum*, *Mercurialis perennis* and *Aconitum vulparia* (Chap. 10, this volume). These geophytes use the higher amount of radiation available on the organic layer during mid-March to May for photosynthesis and plant growth before the trees start developing their foliage. The soils at the site are shallow with a depth of between 20

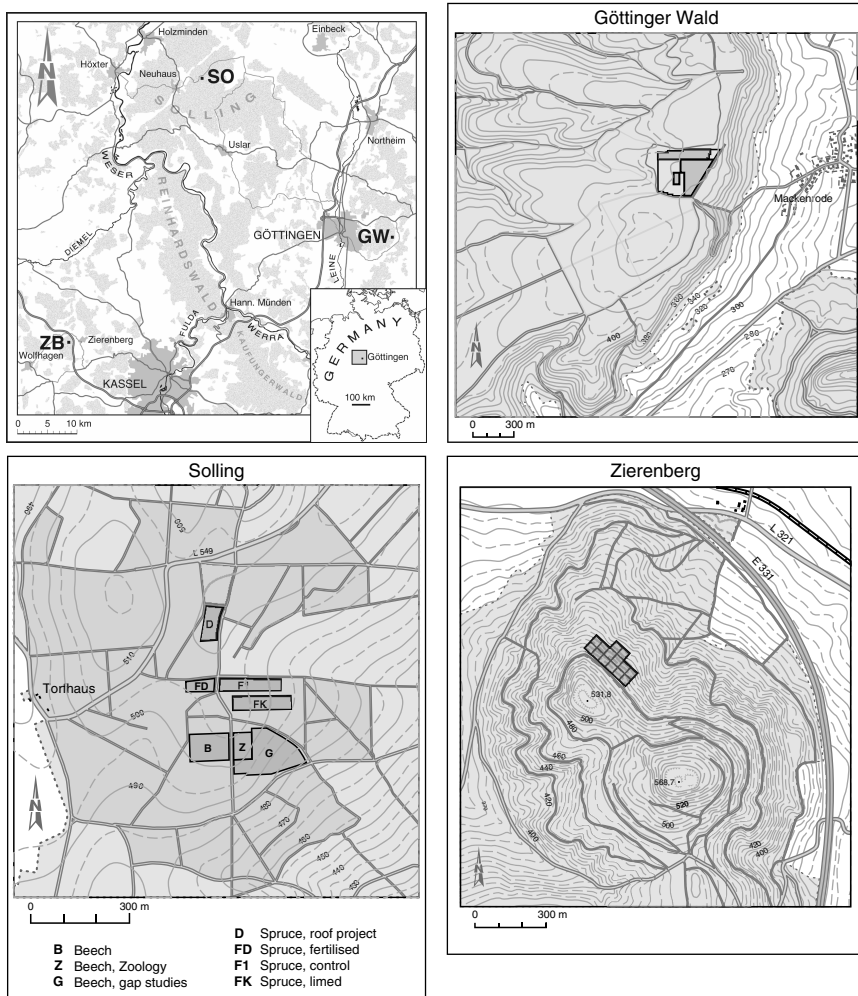


Fig. 1.1 Locations of the three beech sites in Germany (drawn by Tambour)

and 50 cm, have high soil pH(H₂O) of 5.5–7.4 (0–20 cm), and are rich in base cations and carbonate content (Chap. 3, this volume). The soil parent material is calcareous bedrock with a calcite content of about 95%. The biological activity in this soil is very high (Chaps. 6 and 7, this volume) and has caused the development of a mull type litter layer and a humus-rich surface mineral soil. This site was established in 1980 for an intensive monitoring programme and has been included as an intensive permanent soil monitoring plot in the soil protection programme of the state of Lower Saxony.

The beech forest site at Zierenberg is located on the north-eastern slope of the “Kleiner Gudenberg” 50 km south-west of Göttingen in the north of Hesse State

Table 1.1 Description of study sites (climate for 1990–2002)

	Unit	Göttinger Wald	Zierenberg	Solling
Latitude	(°)	51°32'N	51°22'N	51°46'N
Longitude	(°)	10°03'E	09°16'E	09°34'E
Elevation	(m) a.s.l.	420	450	504
Slope	(°)	0–3	15	0–3
Aspect		Plain	North-east	South
Stand age (2000)	(years)	132	156	153
Stand density (2000)	(trees ha ⁻¹)	245	132	199
Mean diameter (2000)	(cm)	46	60	47
Mean height (2000)	(m)	34	37	30
Timber volume (2000)	(m ³ ha ⁻¹)	686	595	519
Natural vegetation		Hordelymo-Fagetum	Hordelymo-Fagetum	Luzulo-Fagetum
Bedrock		Limestone	Basalt over limestone	Sandstone with loess cover
Soil type FAO		Rendzic Leptosol/ Calcaric Cambisol	Eutric Cambisol	Dystric Cambisol
Humus type		F-Mull	F-Mull	Typical Moder
Precipitation	(mm)	709	754	1,193
Precipitation (May–Oct.)	(mm)	410	406	553
Mean temperature	(°C)	7.4	6.9	6.9
Mean temperature (May–Oct.)	(°C)	12.6	11.9	12.0

(Fig. 1.1). The “Kleiner Gudenberg” is part of a hilly landscape with elevations of 200–550 m a.s.l. Small hills were created through volcanic activity during the Tertiary period. Basaltic material (Limburgite) at the hilltop of the “Kleiner Gudenberg” overlies middle Triassic limestone. Basaltic debris of about 90 cm depth covers the limestone at the mid region of the slope (the so-called ‘Basalt site’) (450 m a.s.l.) where the main research area of the study site is situated. For some of the investigations, two other neighbouring sites have been included which are located below the main research area. The sites are distinguished as a limestone-dominated site at the lower part of the hill (Limestone site), and a transitional site which is located between the Limestone and Basalt sites. The sites carry almost pure beech (*F. sylvatica*) stands of about 160 years old. A dense and diverse herb layer covers the soil. It is dominated by *M. perennis* or *Urtica dioica* which grow up to 1 m high during the summer. The soil at the main research area (Basalt site) has high pH(H₂O) between 5.2 and 5.7 (0–20 cm), is free of lime and rich in magnesium and phosphorous. The biological activity in the soil is very high. The surface organic layer is F-mull type. Surface mineral soil is rich in organic matter. The experimental monitoring was started in 1989 as an intensive study site of the Forest Ecosystems Research Center of the University of Göttingen and of the Forest Ecosystem Study Hesse (Waldökosystemstudie Hessen WÖSSH).

The large forested area of the Solling is enclosed by the basins of the river Weser to the west and the river Leine to the east covering heights of 250 to over 500 m a.s.l. (Fig. 1.1). The Solling massive consists of Triassic sandstone, locally known as “Solling-Folge”, which is covered with 60 to 80 cm thick solifluction layers of loess material. The study site is located at the centre of the Solling plateau at 504 m a.s.l. about 33 km northwest of Göttingen. The pure beech (*F. sylvatica*) stand is about 150-years-old (Table 1.1). The soil is covered by a sparse herb layer, dominated by *Oxalis acetosella* and *Luzula luzuloides*. The soil is very acid with pH(H₂O) values of 3.4–4.0 (0–20 cm), and has a low base saturation of < 7%. The soil biological activity is very low and has developed a thick moder-type surface organic layer. Monitoring on this site was initiated in 1966 as part of the international biological programme (Ellenberg 1971). There are two main sites: Beech stand (B1) and an adjacent spruce stand (F1). A number of additional plots were

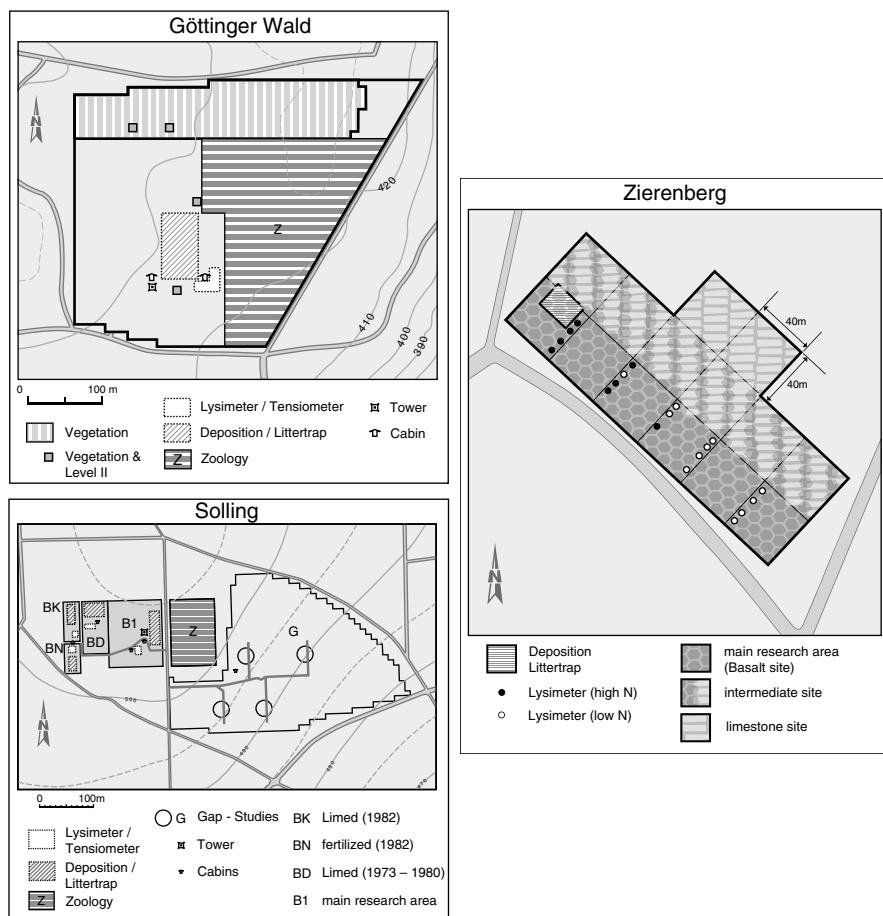


Fig. 1.2 Plot design of the three beech sites in Germany (drawn by Tambour)

established in the neighbourhood; of special interest are two which were established in 1982, the first was limed with 30 Mg per ha of finely ground dolomitic limestone (BK plot), and the second was fertilised annually with 140 kg N ha⁻¹ with solid ammonium sulfate from 1982 until 1993 (BN plot) (Fig. 1.2). The two main sites, B1 and F1, have been included as intensive permanent soil monitoring plots in the soil protection programme of the state of Lower Saxony since 1992. A comprehensive summary of the results collected from 1966 to 1986 at the B1 and F1 sites and other stands of the Solling area was published by Ellenberg et al. (1986).

References

- Ellenberg H (1971) Integrated experimental ecology – Methods and results of ecosystem research in the German Solling Project. Ecological Studies 2. Springer, Berlin
- Ellenberg H, Mayer R, Schauermann J (1986) Ökosystemforschung: Ergebnisse des Solling-Projekts. Ulmer, Stuttgart
- Godbold DL, Hüttermann A (1994) Effects of acid rain on forest processes. Wiley, New York
- Röhrig E, Ulrich B (1991) Temperate deciduous forests. Ecosystems of the World 7. Elsevier, Amsterdam

