

[Study area](#) [Sampling method](#)

[Flora of the Oker
system](#)

[Flora of the
Oker river](#)

[Alien plants](#) [References](#)

The riparian flora of the Oker river system

(Europe, Northern part of Germany)

by

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[Vegetation Ecology and experimental Plant Sociology](#)

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Introduction

Flora and vegetation of riverbanks are examined by us europewide with emphasis to the Weser and Elbe river. The riparian flora of the Oker and its major tributaries as a part of the Weser system were investigated most intensively by a standardized method. Species richness and most frequent species of different rivers just as different reaches of the Oker are compared with each other. Special attention was paid to spread and establishment of alien plants.

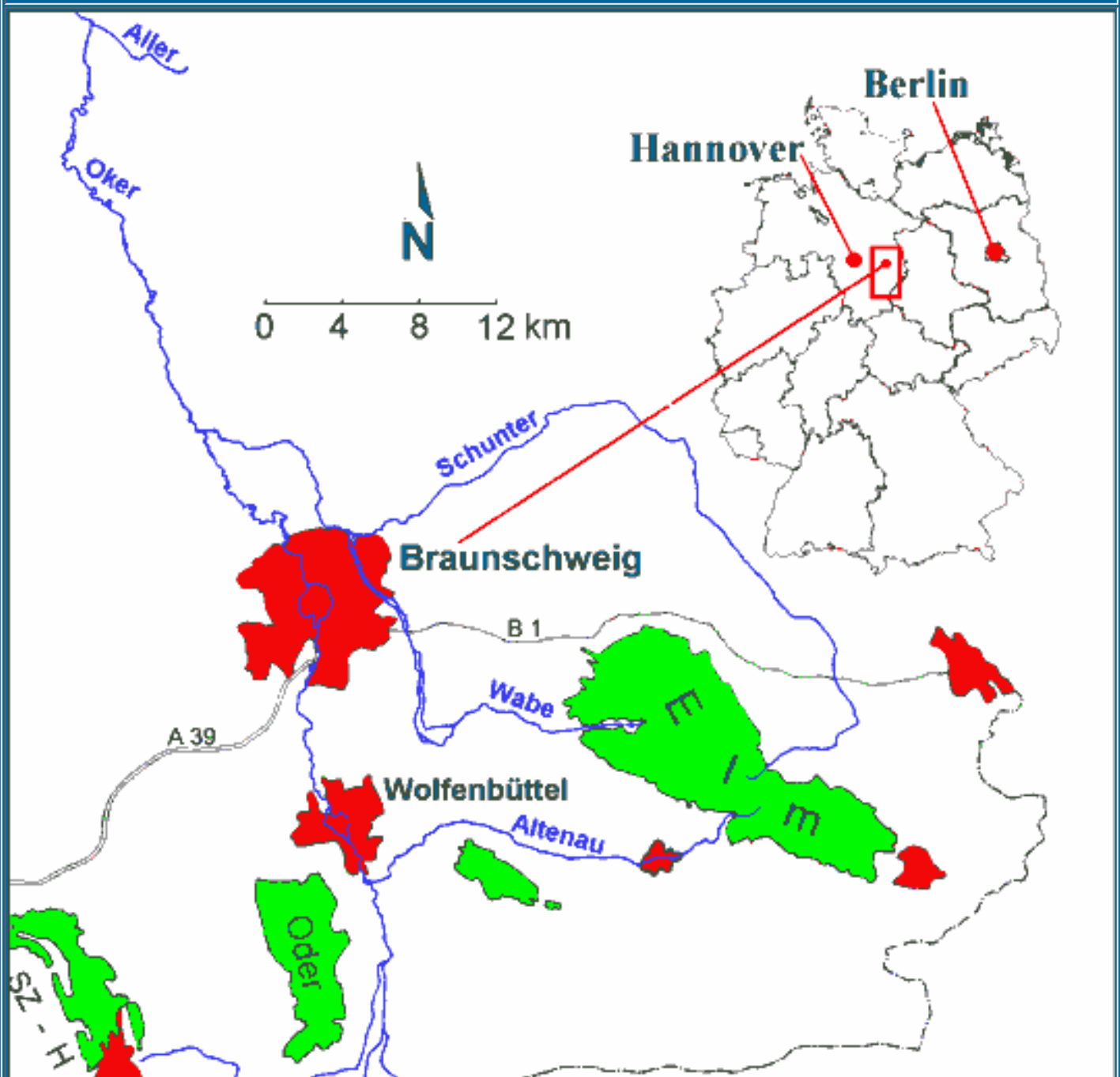
[Next](#)

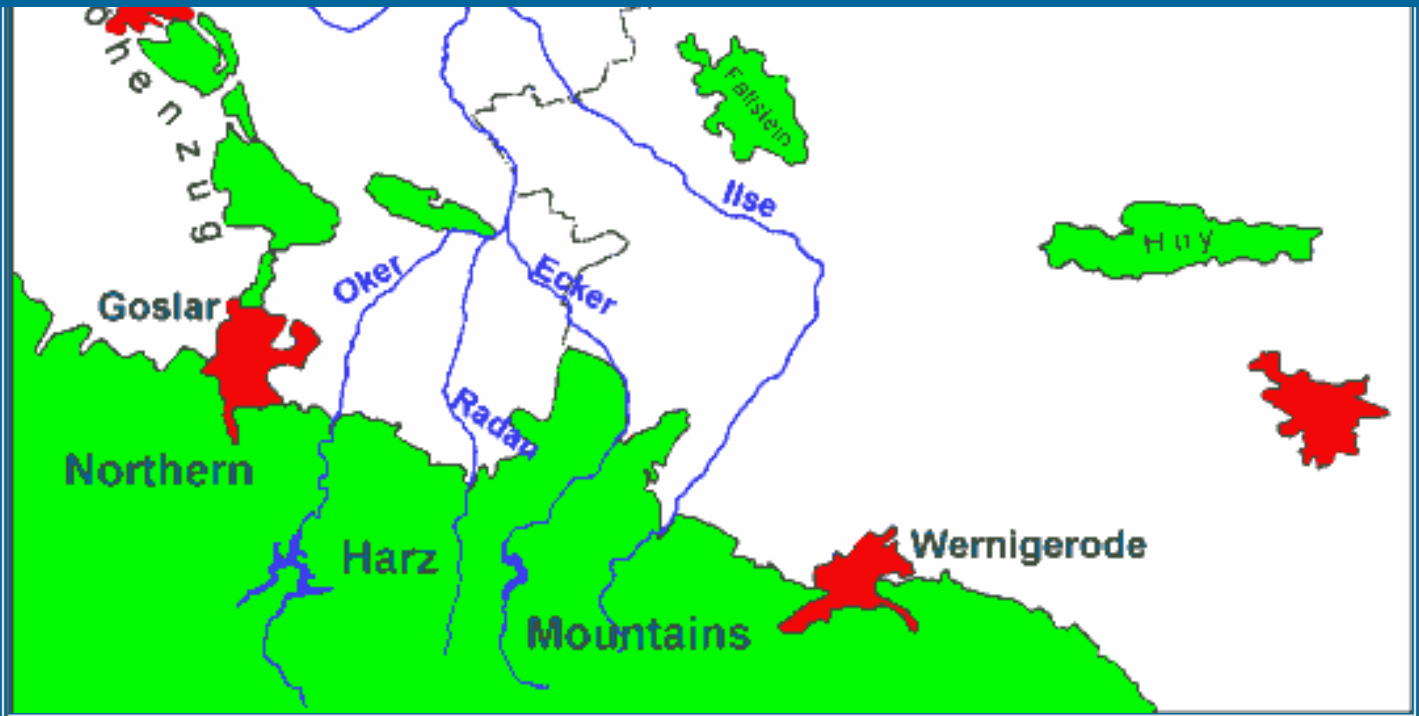
[Home](#) [Sampling method](#)[Flora of the Oker system](#)[Flora of the Oker river](#)[Alien plants](#) [References](#)

Study area

The Oker river and its major tributaries are draining the northern Harz Mountains and its foreland. The Oker drainage covers 1825 km². Its headwaters in the Harz Mountains are situated at an altitude of 900 m a.s.l. The hilly Harz foreland (100-200 m a.s.l.) is characterized by fertile loess soil and intensive agriculture. To the north of Braunschweig the loess layer is changing to sand soils of the Lower Saxonian Lowland. Braunschweig is the capital of this region in southeastern Lower Saxon. The average of annual precipitation is varying between 1300 mm (Harz) and 600 mm (Braunschweig), which is in a rain shadow produced by the Harz Mountains.

Study area and its position within the Federal Republic of Germany





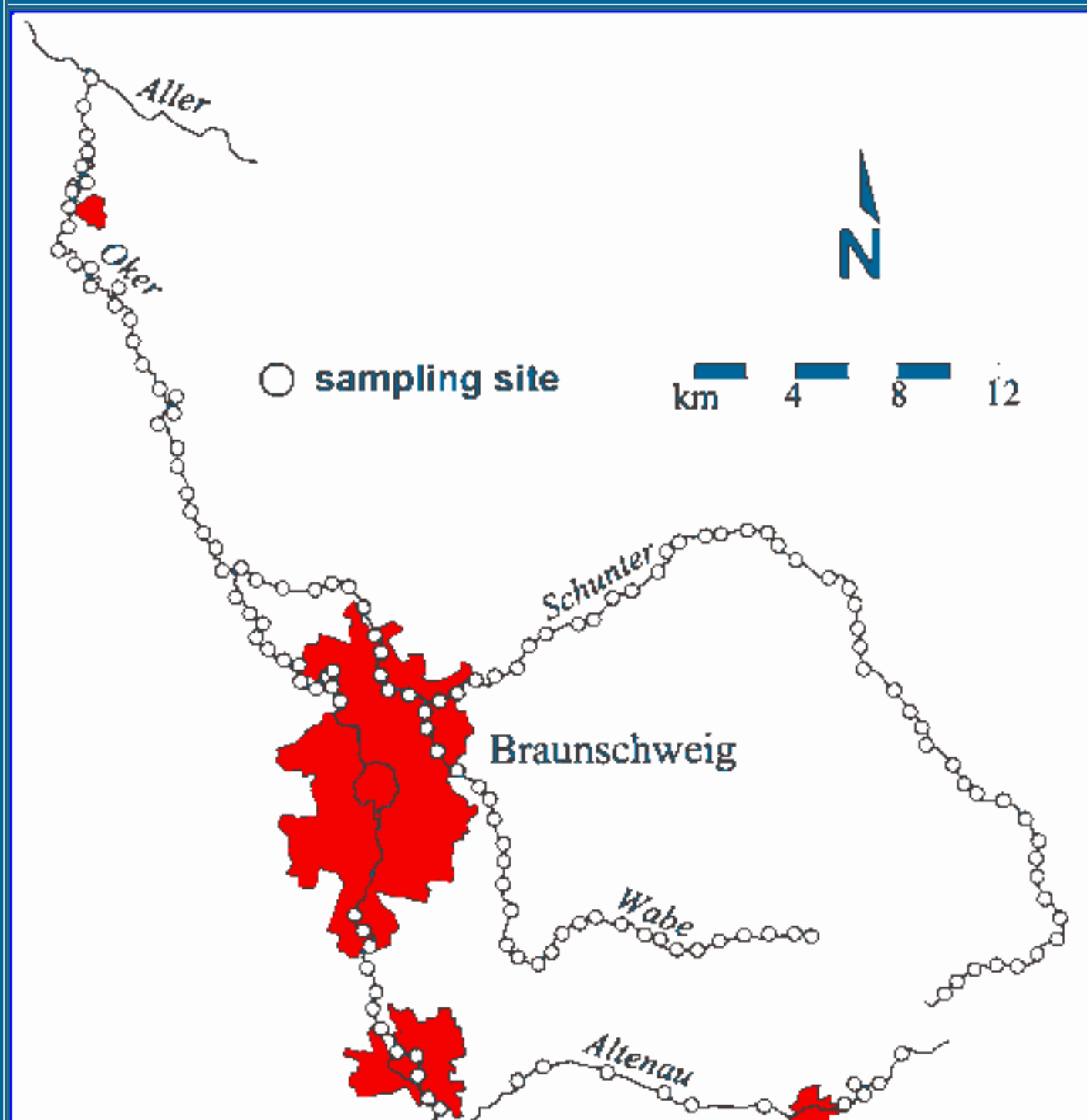
[Back](#)

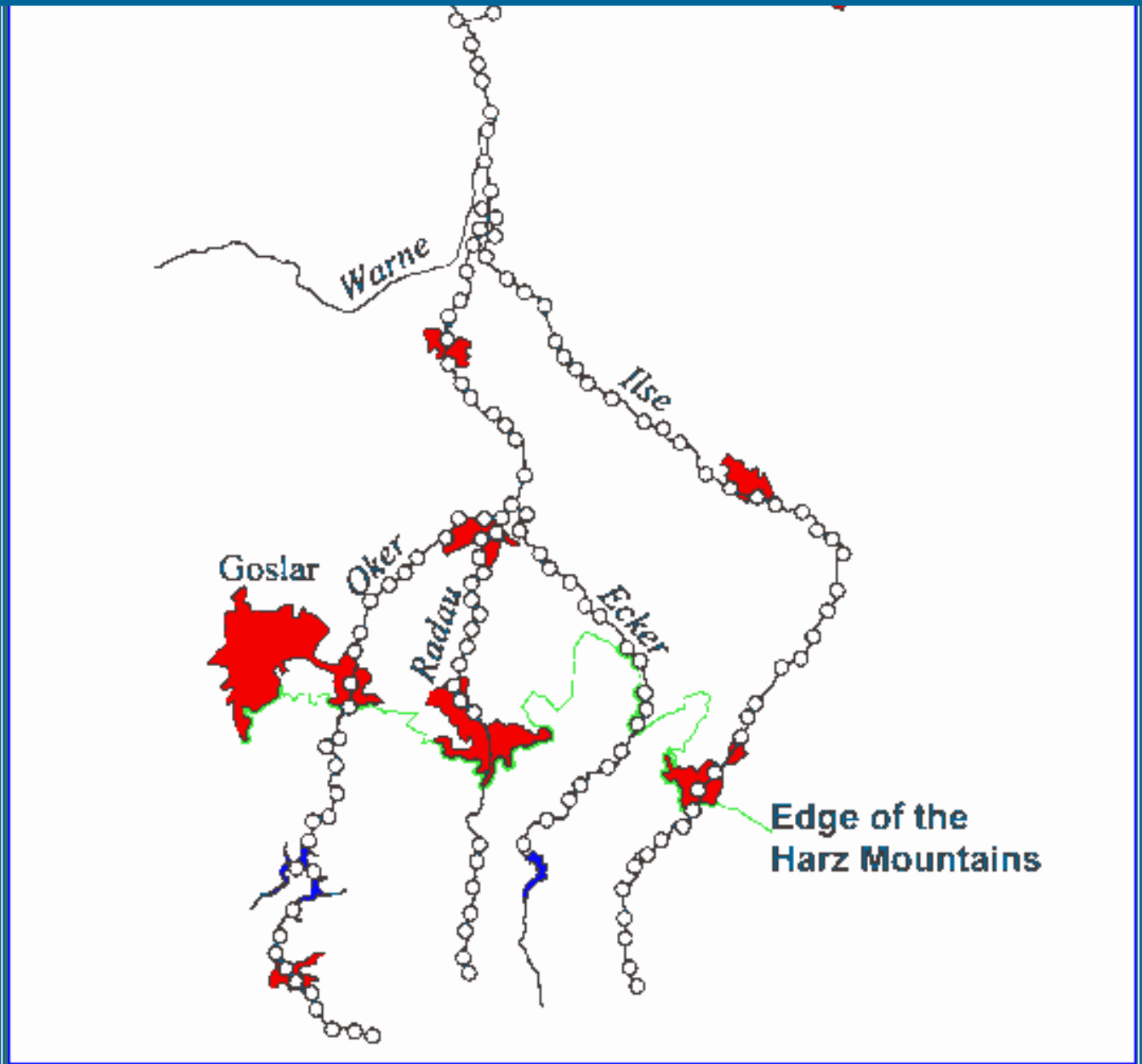
[Next](#)

Sampling Method

Over a length of 315 km 284 sampling sites are scattered usually 1 km in a distance from each other. Because of variable width sampling plot size differs by a constant length of 50 m. All vascular plants from waterline to neighbouring areas were recorded. Plants occurrence in sampling sites are represented by frequencies in percent or with Roman numerals according to the classification of plant sociology. In addition random sampling along the river banks was carried out to provide a complete record of species present.

Distribution of sampling sites within the Oker system





[Back](#)

[Next](#)

Riparian flora of the Oker system

Riverbanks are characterized by high species richness, which is mainly based on habitat diversity in cross-section and periodic disturbances, such as floods. Total species richness of a given river depends on the habitat diversity in longitudinal direction also. For example 546 vascular plant species were found along the Oker river (cf. [Flora of the Oker River](#)). This number represents nearly a third of the Lower Saxonian Flora. Only 80 to 90% of species of the Oker tributaries are present at the Oker too. Therefore 700 species at least occur at the riverbanks of the Oker system. The lower factor of community "Jaccard-Index" results from the exclusive occurrence of many species at the Oker riverbanks.

Species richness of the riparian flora

River:	Length in [km]	Number of sampling sites	Number of species	Common species with the Oker	Factor of community
Oker	125	107	546	[546]	[100%]
Radau	21	19	292	255 (87,3%)	43,7
Ecker	19	18	255	229 (89,8%)	40,0
Ilse	42	41	380	332 (87,4%)	55,9
Altenau	23	12	167	151 (90,4%)	26,9
Wabe	28	28	367	296 (80,7%)	48,0
Schunter	57	59	420	336 (80,0%)	53,3

The following table consists 77 species which were recorded in more than 60% of sampling sites of one river at least. The species are sorted according to total frequency. Only *Urtica dioica*, *Ranunculus repens*, *Dactylis glomerata* and *Galium aparine* were found with high frequency in sampling sites of all rivers. Most species are showing a frequent occurrence only at one or few rivers. In some cases the calculated species frequencies revealed floristic differences for the different rivers.

High frequent species of the Oker system

River:	Oker	Radau	Ecker	Ilse	Altenau	Wabe	Schunter
Number of sampling sites:	107	19	18	41	12	28	59
<i>Urtica dioica</i>	91%	95%	72%	93%	92%	100%	100%
<i>Ranunculus repens</i>	90%	79%	83%	83%	75%	96%	93%

Poa trivialis	91%	79%	56%	59%	92%	100%	100%
Dactylis glomerata	70%	63%	67%	73%	92%	100%	98%
Galium aparine	69%	74%	61%	73%	67%	96%	95%
Arrhenatherum elatius	79%	32%	28%	76%	92%	93%	92%
Agrostis stolonifera agg.	94%	53%	67%	44%	42%	89%	95%
Heracleum sphondylium	67%	53%	33%	68%	75%	85%	90%
Alliaria petiolata	45%	68%	50%	80%	42%	96%	88%
Lamium maculatum	59%	68%	28%	78%	50%	81%	88%
Calystegia sepium	73%	32%	28%	59%	83%	85%	88%
Aegopodium podagraria	45%	68%	50%	71%	42%	81%	85%
Artemisia vulgaris	84%	53%	39%	71%	33%	63%	78%
Stachys sylvatica	19%	68%	89%	61%	75%	59%	32%
Elymus repens	72%	11%	17%	46%	75%	89%	93%
Glechoma hederacea	75%	58%	44%	54%	8%	74%	85%
Epilobium hirsutum	58%	32%	22%	39%	75%	74%	92%
Phalaris arundinacea	66%	21%	28%	54%	58%	63%	93%
Lapsana communis	17%	32%	50%	68%	58%	67%	83%
Anthriscus sylvestris	69%	11%	22%	63%	42%	81%	78%
Cirsium arvense	49%	16%	22%	63%	58%	63%	86
Geum urbanum	9%	68%	44%	61%	33%	89%	37%
Taraxacum officinale agg.	30%	79%	0%	49%	8%	81%	88%
Geranium robertianum	13%	79%	78%	37%	42%	63%	22%
Holcus lanatus	66%	47%	56%	24%	17%	48%	69%
Fraxinus excelsior	20%	47%	44%	49%	67%	67%	32%
Ranunculus ficaria	17%	68%	33%	15%	0%	93%	98%
Rumex obtusifolius	67%	53%	44%	59%	0%	26%	61%
Scrophularia umbrosa	49%	16%	28%	27%	92%	41%	53%
Stellaria aquatica	64%	47%	39%	61%	8%	26%	59%
Silene dioica	77%	79%	56%	66%	17%	0%	8%
Valeriana officinalis agg.	30%	42%	56%	2%	50%	52%	66%
Stellaria media	36%	53%	22%	59%	8%	41%	78%
Veronica hederifolia	15%	63%	11%	46%	0%	81%	76%

Galeopsis tetrahit	70%	68%	61%	78%	8%	<21%	<21%
Poa pratensis	33%	5%	0%	37%	42%	81%	81%
Scrophularia nodosa	76%	53%	72%	24%	8%	15%	31%
Galium album	64%	16%	28%	39%	42%	30%	46%
Festuca rubra	61%	21%	17%	24%	33%	41%	58%
Festuca gigantea	4%	74%	67%	49%	25%	19%	17%
Alnus glutinosa	37%	58%	89%	37%	33%	v	v
Lamium album	70%	11%	6%	63%	0%	33%	69%
Bromus sterilis	7%	32%	6%	46%	8%	78%	73%
Poa nemoralis	7%	63%	83%	39%	8%	26%	8%
Deschampsia cespitosa	41%	79%	72%	17%	25%	v	v
Elymus caninus	5%	79%	67%	32%	25%	22%	2%
Lycopus europaeus	74%	16%	33%	22%	8%	30%	49%
Carduus crispus	64%	16%	33%	41%	17%	4%	53%
Achillea millefolium agg.	75%	11%	22%	49%	17%	11%	41%
Myosotis palustris agg.	46%	16%	22%	12%	25%	63%	41-60%
Lolium perenne	25%	26%	11%	37%	8%	63%	41-60%
Acer pseudoplatanus	15%	37%	61%	34%	8%	44%	20%
Epilobium ciliatum	63%	47%	28%	17%	8%	32%	20%
Impatiens parviflora	7%	47%	61%	46%	17%	21%	10%
Solanum dulcamara	61%	5%	22%	37%	42%	<21%	41-60%
Poa annua	17%	16%	11%	51%	17%	74%	21-40%
Poa palustris	20%	21%	17%	7%	17%	37%	80%
Brachypodium sylvaticum	0%	58%	83%	17%	25%	7%	7%
Alopecurus pratensis	34%	0%	6%	2%	42%	37%	71%
Senecio ovatus	19%	84%	83%	2%	0%	v	3%
Stellaria holostea	1%	63%	44%	39%	17%	15%	14%
Tripleurospermum perforatum	71%	11%	22%	37%	0%	7%	39%
Plantago major	25%	32%	22%	61%	25%	41-60%	21-40%
Bromus inermis	13%	0%	6%	39%	33%	<21%	86%
Rumex conglomeratus	6%	11%	22%	22%	8%	33%	66%
Rubus ideaus	15%	47%	72%	12%	17%	v	v
Luzula sylvatica	7%	63%	78%	12%	0%	0%	0%

Stachys palustris	70%	0%	6%	5%	8%	19%	47%
Chaerophyllum hirsutum	12%	74%	67%	0%	0%	0%	0%
Impatiens noli-tangere	9%	47%	67%	15%	8%	4%	3%
Rubus fruticosus agg.	13%	26%	67%	24%	8%	v	v
Athyrium filix-femina	14%	47%	61%	12%	0%	v	3%
Mycelis muralis	11%	32%	61%	17%	0%	11%	2%
Rumex sanguineus	1%	11%	6%	2%	33%	74%	<21%
Polygonum cuspidatum	13%	63%	17%	15%	0%	0%	0%
Bidens frondosa	61%	0%	17%	5%	0%	0%	8%
Galium sylvaticum	1%	0%	67%	0%	0%	4%	2%

[Back](#)

[Next](#)

Riparian flora of the Oker river

The Oker river flows through several different landscapes by a relative short length of about 125 km. From the source to the mouth it covers a change of altitude of 850 m. The riparian flora along the Oker is changing too. On basis of floristic similarity the river has been divided into eight different reaches. Species whose occurrence is mainly limited to one specific reach of the river are called "index-species". Often they are indicators for natural environment, geology, hydraulic engineering or agricultural exploitation.

Harz Mountains

- I.** Oker above Altenau
- II.** Oker within Altenau
- III.** Oker dam
- IV.** Oker between dam and the edge of the Harz

Hilly Harz foreland

- V.** Oker between the edge of the Harz and Vienenburg
- VI.** Oker between Vienenburg and Schladen
- VII.** Oker between Schladen and Braunschweig

Lowland

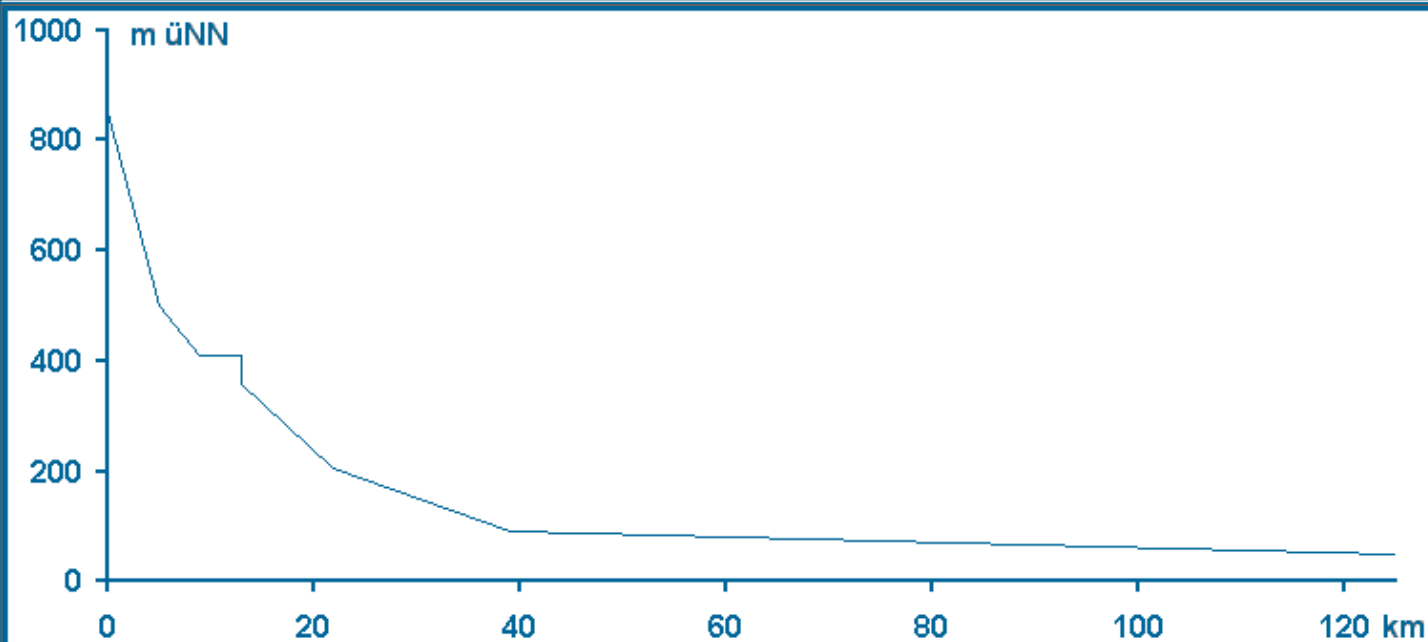
- VIII.** Oker between Braunschweig and the mouth

"Index-" species of the Oker reaches

Species / Reaches:	I	II	III	IV	V	VI	VII	VIII
<i>Vaccinium myrtillus</i>	V	.	.	II	.	.	.	.
<i>Dryopteris dilatata</i>	IV	.	.	II	.	.	.	.
<i>Calamagrostis villosa</i>	IV	.	.	I	.	.	.	.
<i>Trientalis europaea</i>	IV	.	.	I	.	.	.	.
<i>Geranium sylvaticum</i>	.	V	.	.	.	.	.	.
<i>Polygonum bistorta</i>	.	IV	.	.	.	.	.	.
<i>Vicia sepium</i>	.	IV	.	II	.	.	.	.
<i>Poa chaixii</i>	.	IV	.	I	.	.	.	.
<i>Phyteuma spicatum</i>	I	V	.	II	.	.	.	.
<i>Alchemilla vulgaris</i> agg.	I	V	.	I	.	.	.	.
<i>Chelidonium majus</i>	.	IV	.	.	.	.	I	I
<i>Anthoxanthum odoratum</i>	II	V	.	.	.	I	.	I
<i>Ranunculus ficaria</i>	I	IV	.	.	.	II	I	I
<i>Veronica chamaedrys</i>	.	V	.	I	I	.	II	I
<i>Lapsana communis</i>	.	V	II	.	.	II	I	I
<i>Gnaphalium uliginosum</i>	.	.	V	.	.	.	.	.
<i>Spergularia rubra</i>	.	.	IV	.	.	.	.	.
<i>Juncus filiformis</i>	.	.	IV	.	.	.	.	.
<i>Carex ovalis</i>	.	.	V	I	.	.	.	.
<i>Rumex acetosella</i>	.	.	V	.	.	.	.	I
<i>Alopecurus aequalis</i>	.	.	V	.	.	.	.	I
<i>Galium uliginosum</i>	.	.	IV	.	.	.	.	I
<i>Rorippa palustris</i>	.	.	V	.	I	.	.	I
<i>Rumex crispus</i>	.	.	V	.	.	.	I	I
<i>Polygonum persicaria</i>	.	.	V	I	.	.	I	I
<i>Senecio viscosus</i>	.	II	IV	.	II	I	.	I
<i>Polygonum lapathifolium</i>	.	.	V	.	.	.	II	II
<i>Cardamine amara</i>	.	.	.	V	II	II	.	.

<i>Luzula luzuloides</i>	.	II	.	IV	.	.	.	.
<i>Carex remota</i>	I	II	II	IV	.	.	.	.
<i>Geranium robertianum</i>	I	II	.	V	.	II	I	I
<i>Silene vulgaris</i>	.	II	.	I	IV	II	.	.
<i>Armeria halleri</i>	.	.	.	.	IV	I	.	.
<i>Festuca ovina</i> agg.	.	II	.	.	V	III	.	I
<i>Impatiens glandulifera</i>	.	.	.	I	I	IV	.	.
<i>Mentha aquatica</i>	.	.	.	.	II	IV	II	I
<i>Viola tricolor</i>	.	II	.	.	I	IV	II	I
<i>Veronica hederifolia</i>	.	.	.	.	.	V	II	I
<i>Solidago gigantea</i>	.	.	.	I	.	IV	II	I
<i>Papaver rhoeas</i>	.	.	.	.	II	I	IV	.
<i>Angelica archangelica</i>	.	.	.	.	.	.	.	V
<i>Festuca arundinacea</i>	.	.	.	.	.	.	I	IV
<i>Rorippa amphibia</i>	.	.	.	.	.	.	II	IV
<i>Atriplex prostrata</i> agg.	.	.	.	.	.	.	III	V

Longitudinal profile of the Oker river and its reaches



7%	2%	0,54%	0,05% average fall		
rock	detritus/shingle		alluvial loam	(loamy) sand	sand
Mittelharz	Harzrandmulde		Ostbraunschweigisches Hügelland	Burgdorf - Peiner Geestplatten	Aller-Niederung
I	II	III	IV	V	VI
moss-communities		Ranunculo-Sietum	Ranunculetum fluitans		change to Nupharetum

(changed and supplemented after WEBER-OLDECOP 1969)

[Back](#)

[Next](#)

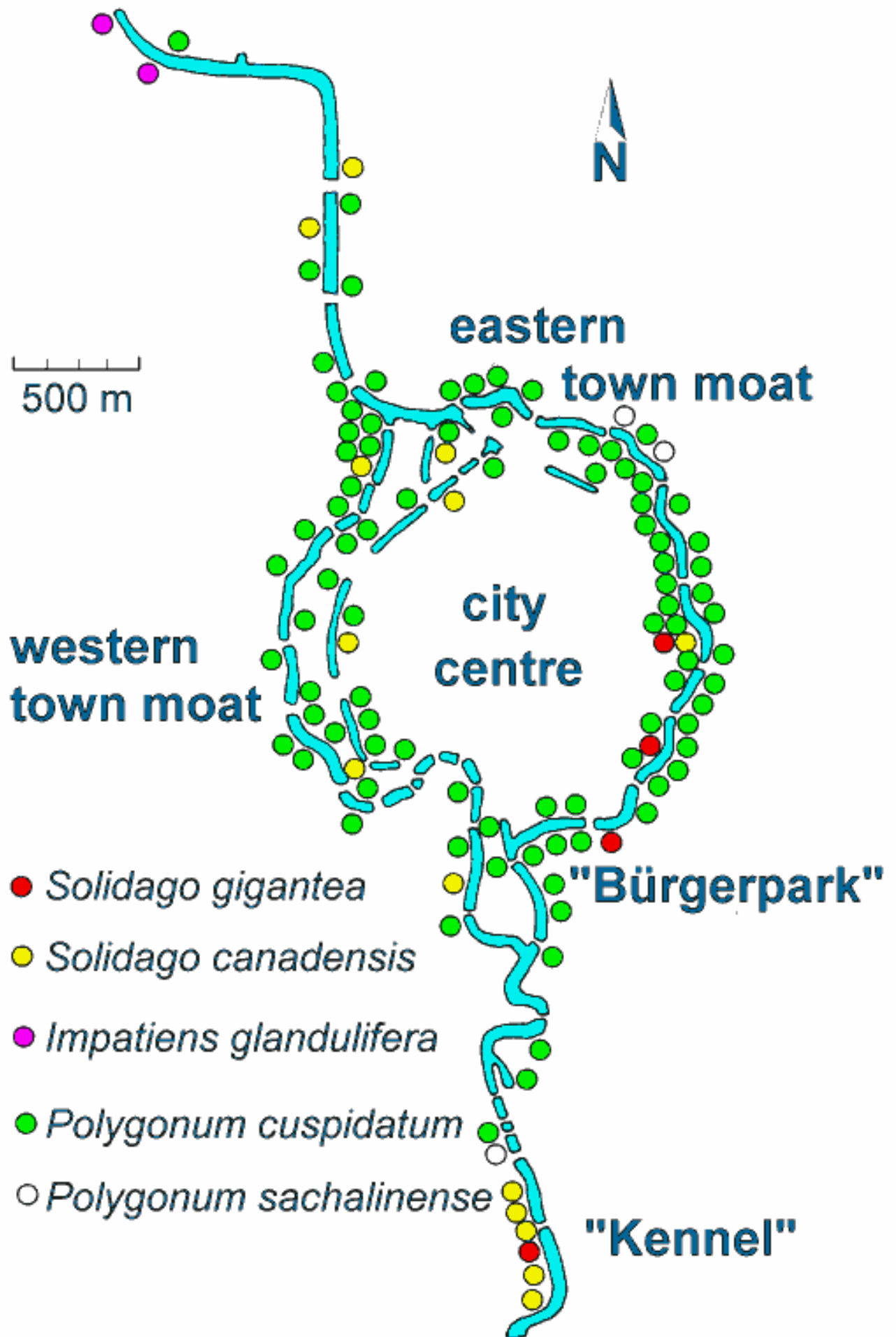
Alien plants

Most of the frequent alien species of the Oker system are escaped ornamental plants. The input of these species or their diaspores comes from adjacent gardens. This influence becomes clearly visible by the alien flora along the town moats of Braunschweig too. With the exception of *Bidens frondosa* most alien species of annual ruderal vegetation, which are common along the Weser or Elbe riverbanks, are missing at the smaller Oker.

Most frequent alien species of the Oker system

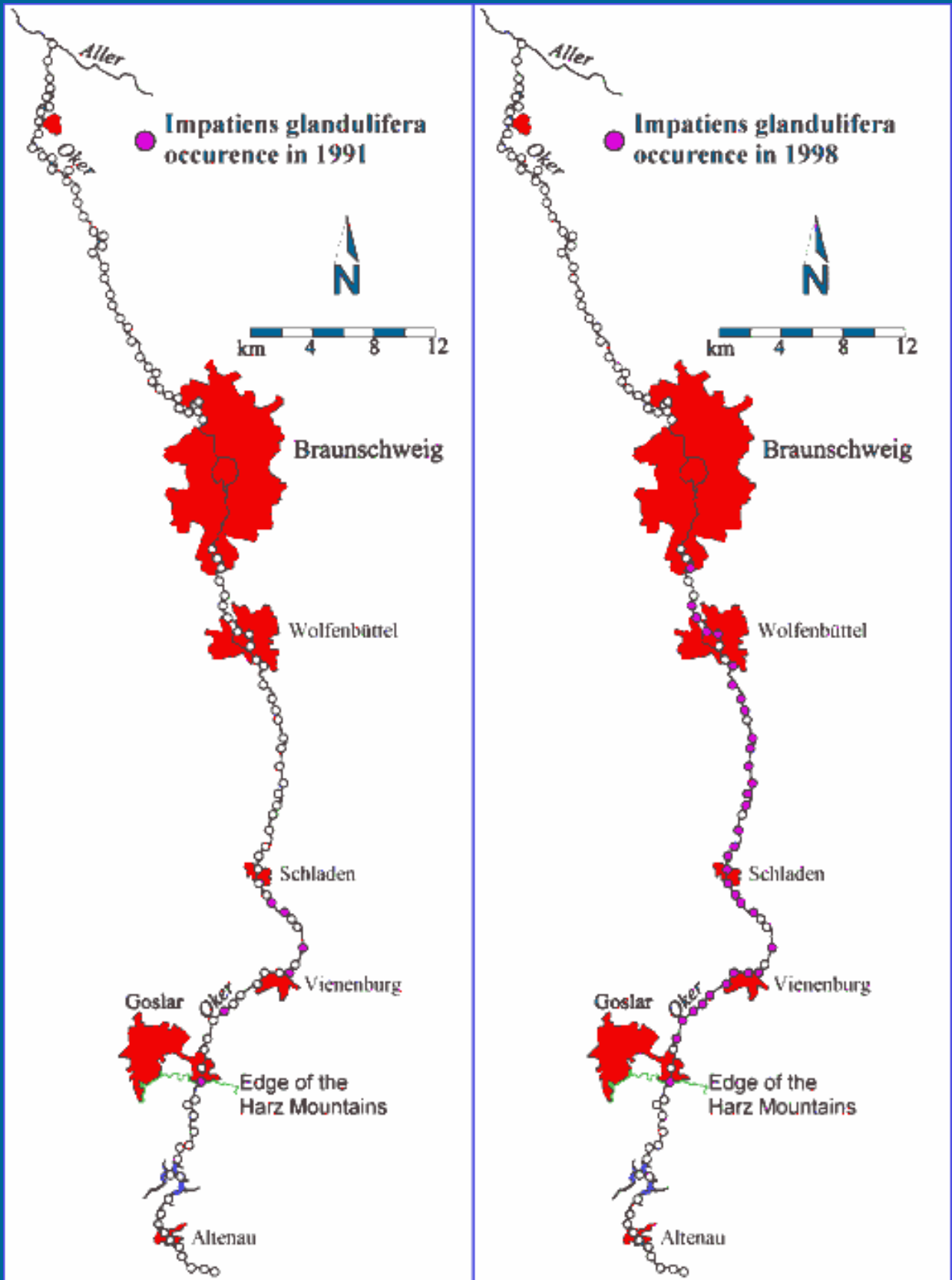
River:	Oker	Radau	Ecker	Ilse	Altenau	Wabe	Schunter
Number of sampling sites:	107	19	18	41	12	28	59
<i>Bidens frondosa</i>	61%	0%	17%	5%	0%	0%	8%
<i>Epilobium ciliatum</i>	63%	47%	28%	17%	8%	32%	20%
<i>Polygonum cuspidatum</i>	13%	63%	17%	15%	0%	0%	0%
<i>Impatiens parviflora</i>	7%	47%	61%	46%	17%	21%	10%
<i>Galanthus nivalis</i>	0%	58%	6%	0%	0%	4%	2%
<i>Impatiens glandulifera</i>	7%	47%	0%	20%	0%	0%	0%
<i>Armoracia rusticana</i>	2%	0%	0%	10%	42%	18%	22%
<i>Geranium pyrenaicum</i>	0%	5%	0%	32%	0%	7%	12%
<i>Veronica persica</i>	0%	0%	0%	10%	8%	21%	19%
<i>Solidago gigantea</i>	21%	21%	11%	0%	0%	14%	12%
<i>Conyza canadensis</i>	10%	5%	11%	20%	0%	11%	19%
<i>Heracleum mantegazzianum</i>	10%	21%	11%	0%	0%	7%	2%
<i>Polygonum sachalinense</i>	0%	21%	0%	2%	0%	0%	0%
<i>Matricaria discoidea</i>	3%	5%	6%	20%	8%	11%	15%
<i>Galinsoga ciliata</i>	0%	11%	0%	20%	0%	0%	3%

Dispersion of alien plants along the town moats of Braunschweig



(changed after GROTHE & BRANDES 1991)

Only few occurrence of *Impatiens glandulifera* were recorded by extensive investigations of the Oker river in 1991. Between Schladen and Braunschweig the whole Oker was examined by boat and no occurrence of this species was noticed. Since 1994 *Impatiens glandulifera* shows a remarkable spreading along the Oker river. In 1998 the same sampling sites as 1991 were examined between Braunschweig and the Harz Mountains in connection with occurrence of *Impatiens glandulifera*. The extent of the spreading is shown in following maps.



[Back](#)

[Next](#)

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[Back](#)

[Home](#)