Proc. 16th Europ. Coll. Arachnol.	113-126	Siedlce, 10.03.1997

Floodplain spider communities

Peter J. van HELSDINGEN

The Leiden Natural History Museum, Raamsteeg 2, NL-2311 PL Leiden, Netherlands.

Key words: floodplains, Ireland, nature conservation, nature development, Netherlands, spiders.

ABSTRACT

Floodplains are part of a river system. Most of the rivers in western Europe have lost their normal accompanying forest vegetation adapted to the river's dynamics, and the floodplains are nowadays used for farming. The spider fauna is expected to reflect the dynamics of the river system and the land-use. Three floodplain inventories in different river systems in western Europe have been carried out. The results are compared to the known ecology of the species. No typical floodplain spider community could be defined. A possible use of the results for nature conservation purposes is discussed.

INTRODUCTION

Floodplains are, under natural conditions, good examples of dynamic ecosystems because in the ecological sense they are part of living river systems. Originally, most rivers were bordered by alluvial forest, mainly consisting of tree species such as *Alnus glutinosa* and *A. incana*, *Populus alba* and *P. nigra*, and *Salix alba*. Usually the German term Auwald is used for this type of habitat. In western Europe attractive remnants of this type of vegetation are still found along the Danube river and the Rhine (Yon & Tendron 1981). However, in western Europe many rivers have been regulated by man and the floodplains have often been modified into grassland. Most alluvial wet forests which were submitted to periodic flooding have been cut long ago. The floodplains are used for grazing, usually intensively, or for hay making.

In flat countries without much relief (Netherlands, north-western Germany) the higher water levels in winter are kept within the limits of the winterbed by dykes. The so-called winter-dykes at some distance of the river form the boundaries of the actual river-bed and are high enough to protect inhabitants of the region against high water levels and possible flooding in the winter. Where the winterbed is wide, lower summer-dykes have been constructed between the channel of the river and the winter-dykes in order to prevent flooding of the floodplains during periods of high water level in the summer. Thus the dynamics of the river system are restrained.

The advantage of the flooding in winter is the deposit of new soil. When the water retreats to the summerbed in the spring the floodplain reappears with a covering layer of clay, a perfect soil for grassland and also a very useful raw material for brick production.

After several decades the water quality of the rivers on the European mainland became very bad, although it is slightly improving recently. The clay deposit became strongly polluted, a.o. with heavy metals, and although the land is still used for grazing, it is used with restrictions.

In Ireland summer-dykes are not found along the two rivers considered here and the floodplains are fully part of the dynamics of the river system.

The floodplains of both rivers in Ireland are flooded during high water levels in the winter and occasionally also in the summer. The water quality of either river is reasonably good. In summertime the floodplains are used by the farmers for hay-making or cutting of grass for ensilage. Extensive cattle grazing is another possibility.

MATERIAL AND METHODS

Under the auspices of the WWF Auen-Institut in Rastatt, Germany, the invertebrate fauna of two floodplains in Ireland, along the River Shannon at Clonmacnois and along the much smaller tributary river Little Brosna (both Co. Offaly), respectively, was inventoried. The two sites were inventoried in 1991-1992. In the Netherlands an inventory was carried out in 1989 in a floodplain site called 'De Blauwe Kamer' along the river Rhine in the province of Utrecht, a reserve owned by the provincial nature conservation society 'Utrechts landschap'. At all three sites the inventories were carried out with pitfalls, be it in different numbers.

Both inventories are used here to compare the spider faunas of these three floodplain sites. The method of collecting (pitfalls) was the same for all three sites, but the number of pitfalls used and the periods of collecting were different. In Ireland the pitfalls were placed in six groups of ten pitfalls on both sites mentioned during five days in August 1991. The inventory was repeated in the same way in June 1992. In 'De Blauwe Kamer' in the Netherlands 30 groups of five pitfalls were used during most of the year, but in order to allow a comparison with the Irish sites only two sampling periods are considered here, viz. one during the month of June and one during October, each covering a period of 30 days. For the sake of evaluation and analysis I have tried to make them as comparable as possible. For that purpose the total number of spiders collected at a site is divided by the number of pitfall traps multiplied by the number of collecting days, resulting in an index (Collecting Activity).

The question posed here is: does there exist a spider fauna or spider community which is characteristic for this type of habitat, the largely treeless

alluvial floodplain along larger rivers. I tried to answer this question by analysing the spiders collected at the different sites and compare them with each other. Of course we should not forget that the method of collecting is selective and that the spiders sampled, therefore, are not representative for the spider fauna as a whole. With pitfalls one samples activity, while sedentary spiders may escape attention.

THE SITES

The three sites can be characterized as follows.

De Blauwe Kamer. Netherlands, Province of Utrecht, north bank of Rhine between Rhenen and Wageningen. Grid references UTM 31UFT7958. Mesotrophic grasslands behind a summer-dike, subject to periodic flooding in winter; ditches, permanent small lake (caused by extraction of clay by a former local brick factory); sandy strand with debris; hedges, trees (*Alnus*) along path, shrubs and trees (*Salix*) along small side stream; extensive grazing in summer.

Little Brosna. Ireland, Co. Offaly, north bank of river near Newtown. Grid references: M9910 (UTM: NU3). The site consists of unimproved grassland with flushes, springs, ditches, with permanent or temporary pools, and subject to flooding; some hedges dispersed over the area and trees (*Salix*) near the river's edge; ground vegetation dense, consisting of grass tussocks; other (local) features are the presence of herb layer litter, strand line debris, and some peat.

Clonmacnois. Ireland, Co. Offaly, west bank of River Shannon between Athlone and Shannonbridge. Grid references: N0232 (UTM NV4). Consisting of unimproved meadows and pastures with flushes, springs, ditches, and temporary pools in the open, and subject to flooding; some hedges at the upper sub-sites and trees (*Salix*) near the river's edge; ground vegetation dense, consisting of grass tussocks; other (local) features are herb layer litter and some peat.

RESULTS

The numerical data are shown in Tab. 1 and 2. On either Irish site 46 species were found, and with an overlap of 29 species the total number of species found on these two Irish floodplains amounts to 63. In the Nature Reserve 'De Blauwe Kamer' 65 species were found in the samples. Altogether 21 species are shared by all three sites. The total number of species found on the three floodplain sites together amounts to 95.

Tab. 1. Spider species collected at three floodplain sites in the Netherlands (De Blauwe Kamer) and Ireland (Little Brosna and Clonmacnois). Numbers refer to M/F.

Species	**Blauwe Kamer 1989**	**Little Brosna 1991 & 1992**	**Clonmacnois 1991 & 1992**
Zelotes pusillus (C. L. K.)	-	-	1/0
Clubiona corticalis (Wlk.)	1/0	-	-
Clubiona neglecta Cbr.	-	1/0	-
Clubiona phragmitis C. L. K.	5/1	-	-
Clubiona reclusa Cbr.	4/0	-	-
Clubiona stagnatilis Kulcz.	-	1/0	-
Phrurolithus festivus (C. L. K.)	2/0	-	-
Oxyptila praticola (C. L. K.)	1/0	-	-
Oxyptila trux (Blw.)	2/0	2/0	8/0
Xysticus cristatus (Cl.)	3/2	-	-
Xysticus kochi Th.	1/0	-	-
Alopecosa cuneata (Cl.)	1/0	-	-
Alopecosa pulverulenta (Cl.)	-	0/3	-
Arctosa leopardus (Snd.)	-	2/2	4/0
Pardosa amentata (Cl.)	173/212	67/13	12/3
Pardosa nigriceps (Th.)	-	-	0/1
Pardosa palustris (L.)	85/98	6/0	1/2
Pardosa prativaga (L. K.)	53/5	-	4/0
Pardosa pullata (Cl.)	1/1	71/38	12/2
Pirata hygrophilus Th.	22/9	-	1/0
Pirata latitans (Blw.)	-	10/3	-
Pirata piraticus (Cl.)	374/70	119/42	209/72
Pirata uliginosus (Th.)	-	-	6/0
Trochosa ruricola (Deg.)	75/23	-	-
Trochosa spinipalpis (Cbr.)	-	1/0	5/9
Antistea elegans (Blw.)	-	1/0	-
Robertus lividus (Blw.)	4/2	-	19/4
Pachygnatha clercki Snd.	385/280	6/5	4/4
Pachygnatha degeeri Snd.	76/39	61/25	6/1
Tetragnatha extensa (L.)	-	-	0/1
Agyneta subtilis (Cbr.)	0/1	-	0/1
Allomengea vidua (L.K.)	4/17	-	1/8
Baryphyma gowerense (Locket)	-	-	1/0
Baryphyma trifrons (Cbr.)	-	1/1	-
Bathyphantes approximatus (Cbr.)	58/15	4/0	-
Bathyphantes gracilis (Blw.)	437/112	23/22	27/27
Bathyphantes nigrinus (Wst.)	3/1	-	-
Bathyphantes parvulus (Wst.)	3/2	15/3	4/1?

Tab. 1 cont.

Species	Blauwe Kamer 1989	Little Brosna 1991 & 1992	Clonmacnois 1991 & 1992
Bathyphantes setiger (F. Cbr.)	-	-	1/0
Centromerita bicolor (Blw.)	6/19	-	-
Centromerus sylvaticus (Blw.)	1/3	-	-
Ceratinella brevipes (Wst.)	-	0/3	1/9
Collinsia distincta (Sim.)	689/71	-	-
Dicymbium brevisetosum Lckt	1/7	-	-
Dicymbium nigrum (Blw.)	0/5	0/7	1/5
Dicymbium tibiale (Blw.)	0/8	-	-
Diplocephalus cristatus (Blw.)	10/0	-	-
Diplocephalus permixtus (Cbr.)	-	0/1	0/7
Diplostyla concolor (Wid.)	113/58	-	1/1
Erigone atra (Blw.)	530/48	589/112	370/39
Erigone dentipalpis (Wid.)	429/38	183/30	133/9
Erigone longipalpis (Snd.)	667/348	5/6	13/12
Erigonella hiemalis (Blw.)	-	1/0	-
Erigonella ignobilis (Cbr.)	-	1/0	-
Gnathonarium dentatum (Wid.)	4/2	8/0	0/1
Gongylidiellum latebricola (Cbr.)	1/0	-	-
Gongylidiellum vivum (Cbr.)	-	2/0	1/0
Gongylidium rufipes (L.)	10/3	-	-
Hypomma bituberculatum (Wid.)	-	1/0	-
Kaestneria dorsalis (Wid.)	-	-	0/1
Lepthyphantes insignis Cbr.	9/6	-	-
Lepthyphantes mengei Kulcz.	1/0	-	0/1
Lepthyphantes pallidus (Cbr.)	2/0	-	-
Lepthyphantes tenuis (Blw.)	72/36	2/6	2/4
Lepthyphantes zimmermanni (Btk.)	2/0	-	-
Leptorhoptrum robustum (Wst.)	286/41	3/2	7/4
Lophomma punctatum (Blw.)	-	1/1	3/1
Maro sublestus Falc.	-	-	2/0
Micrargus herbigradus (Blw.)	11/0	1/0	-
Micrargus subaequalis (Wst.)	3/0	-	0/1
Microlinyphia pusilla (Snd.)	-	0/1	-
Neriene clathrata (Snd.)	1/1	0/1	-
Oedothorax apicatus (Blw.)	16/0	-	-
Oedothorax fuscus (Blw.)	3954/992	65/369	1/105
Oedothorax gibbosus (Blw.)	2/0	2/0	3/0
Oedothorax retusus (Wst.)	3665/1115	40/59	40/22
Ostearius melanopygius (Cbr.)	0/1	-	-
Pelecopsis mengei (Sim.)	0/2	-	-
Pelecopsis parallela (Wid.)	0/1	-	-
Pocadicnemis juncea L. *at* M.	2/1	6/0	2/7

Tab. 1 cont.

Species	Blauwe Kamer 1989	Little Brosna 1991 & 1992	Clonmacnois 1991 & 1992
Pocadicnemis pumila (Blw.)	-	0/1	-
Porrhomma microphthalmum (Cbr.)	50/15	-	-
Porrhomma montanum Jacks. ?	1/1	-	-
Porrhomma pygmaeum (Blw.)	4/1	2/1	7/2
Prinerigone vagans S. *et* A.	23/1	-	-
Saaristoa abnormis (Blw.)	1/0	-	-
Savignya frontata (Blw.)	-	29/48	11/16
Silometopus elegans (Cbr.)	-	16/4	66/49
Tallusia experta (Cbr.)	-	-	1/0
Tiso vagans (Blw.)	-	37/32	-
Tmeticus affinis (Blw.)	4/0	-	-
Trichopterna thorelli (Wst.)	-	0/1	-
Troxochrus scabriculus (Wst.)	19/10	-	-
Walcknaeria atrotibialis (Cbr.)	2/0	-	-
Walcknaeria nudipalpis (Wst.)	0/3	0/1	-
Thomisidae	-	**1**	**12**
Erigonidae	**337**	**161**	**69**
Linyphiidae	**6**	-	**20**
Lycosidae	**144**	**83**	**72**
Clubionidae	**2**	-	-
Tetragnathidae	**22**	**15**	-
Araneidae	-	**2**	**13**

Tab. 2. Summary of numbers of species and specimens for the different sites, and the data used for the calculation of the Collecting Activities at the three sites.

	Blauwe Kamer		Little Brosna		Clonmacnois	
Number of species	65		46		46	
Shared by Irish sites			------ 29 -----			
Shared by all three sites	---------- 21 ----------					
Specimens (incl. juvs.)	16,602		2,490		1,618	
Number of series (a)	30		6		6	
Number of pitfalls/series (b)	5		10		10	
Number of collecting days (c)	60		10		10	
Collecting Activity (a x b x c)	9,000		600 [550]		600	
Number of specimens/day/trap	1.85		4.53		2.70	
	June	**October**	**June**	**August**	**June**	**August**
N. of specimens	6,632	9,470	1,705	785	1,332	286
Collecting Activity	4,500	4,500	300	250	300	300
N. of specimens/day/trap	1.47	2.10	5.7	3.2	4.4	0.95

Tab. 3. Species shared by the 'De Blauwe Kamer' and the 'Irish sites' (total numbers of specimens; numbers for the 'De Blauwe Kamer' re-calculated for the sake of comparison).

	Blauwe Kamer	**Blauwe Kamer**	**Little Brosna**	**Clonmac-nois**
Collecting Activity	9,000	600	600	600
Oxyptila trux (Blw.)	2	-	2	8
Pardosa amentata (Cl.)	385	26	80	15
Pardosa palustris (L.)	183	12	6	13
Pardosa prativaga (L.K.)	58	4	-	4
Pardosa pullata (Cl.)	2	-	109	14
Pirata hygrophilus Th.	31	2	-	-
Pirata piraticus (Cl.)	444	30	161	281
Robertus lividus (Blw.)	6	-	-	23
Pachygnatha clercki Snd.	665	44	11	8
Pachygnatha degeeri Snd.	115	8	86	7
Agyneta subtilis (Cbr.)	1	-	-	1
Allomengea vidua (L.K.)	21	1	-	9
Bathyphantes approximatus (Cbr.)	73	5	4	-
Bathyphantes gracilis (Blw.)	549	37	45	54
Bathyphantes parvulus (Wst.)	5	-	18	5
Dicymbium nigrum (Blw.)	5	-	7	6
Diplostyla concolor (Wid.)	171	11	-	2
Erigone atra (Blw.)	578	39	701	409
Erigone dentipalpis (Wid.)	467	31	213	142
Erigone longipalpis (Snd.)	1,015	68	11	25
Gnathonarium dentatum (Wid.)	6	-	8	1
Lepthyphantes mengei Kulcz.	1	-	-	1
Lepthyphantes tenuis (Blw.)	108	7	8	6
Leptorhoptrum robustum (Wst.)	327	22	5	11
Micrargus herbigradus (Blw.)	11	-	1	-
Micrargus subaequalis (Wst.)	3	-	-	1
Neriene clathrata (Snd.)	2	-	1	-
Oedothorax fuscus (Blw.)	4,946	330	434	116
Oedothorax gibbosus (Blw.)	2	-	2	3
Oedothorax retusus (Wst.)	4,780	319	99	62
Pocadicnemis juncea L. *et* M.	3	-	6	9
Porrhomma pygmaeum (Blw.)	5	-	3	9
Walcknaeria nudipalpis (Wst.)	3	-	1	-

As usual many species occur in low numbers (or are sedentary and do not move around much). In fact such species represent about half of the 95 species listed for the three floodplain sites.

Table 2 shows the accumulated results of the three inventories. At the two Irish sites the number of specimens captured in June was appreciably higher than in August, which is in agreement with general collector's experience. However, on the Dutch site the June catch appeared to be lower than that of October. This is caused mainly by the presence of two species in the samples, *Oedothorax fuscus* (Blackwall) and *O. retusus* (Westring), which, with 9,758 specimens (June and October taken together), represent 58.5 % of the total catches on the site. Both species were most abundant in October (7,102 specimens, as opposed to 2,656 in June), and the results, therefore, are clearly distorted by these two species. The extreme abundance of these two *Oedothorax* species probably reflects the human interference in 'De Blauwe Kamer' (intensive grazing, over-fertilisation etc.).

DISCUSSION

Does there exist a floodplain spider community? The number of species shared by the two Irish floodplains (29 out of 63) demonstrates an overall resemblance of 0.46. For 'De Blauwe Kamer' and Little Brosna we have calculated an overall resemblance of 0.29 (25 out of 85 species), while for 'De Blauwe Kamer' and Clonmacnois we have found an overall resemblance of 0.35 (29 out of 82 species). For all three floodplains together we find an overall resemblance of 0.22 (Fig. 1A). It is evident that the spider faunas of the two Irish sites are more similar to each other than that of 'De Blauwe Kamer' is to either one. This certainly is related to the distances between the different sites, the Irish sites lying closer to each other than to the Dutch site 'De Blauwe Kamer', the latter moreover being situated on the European mainland.

The two sites in Ireland are situated within the same county and are roughly comparable as to the habitat they offer. If we consider the two Irish (sub)sites constitute one site (they also lie not far from each other, ca 20 km) we can compare the 63 species collected there with the 65 found at the 'De Blauwe Kamer'. They share 33 species, resulting in an overall resemblance of 0.35 (33 out of 95 species) (Fig. 1B), which is the same as that between Clonmacnois and the 'De Blauwe Kamer'. Figure 1B thus appears to be a realistic approach.

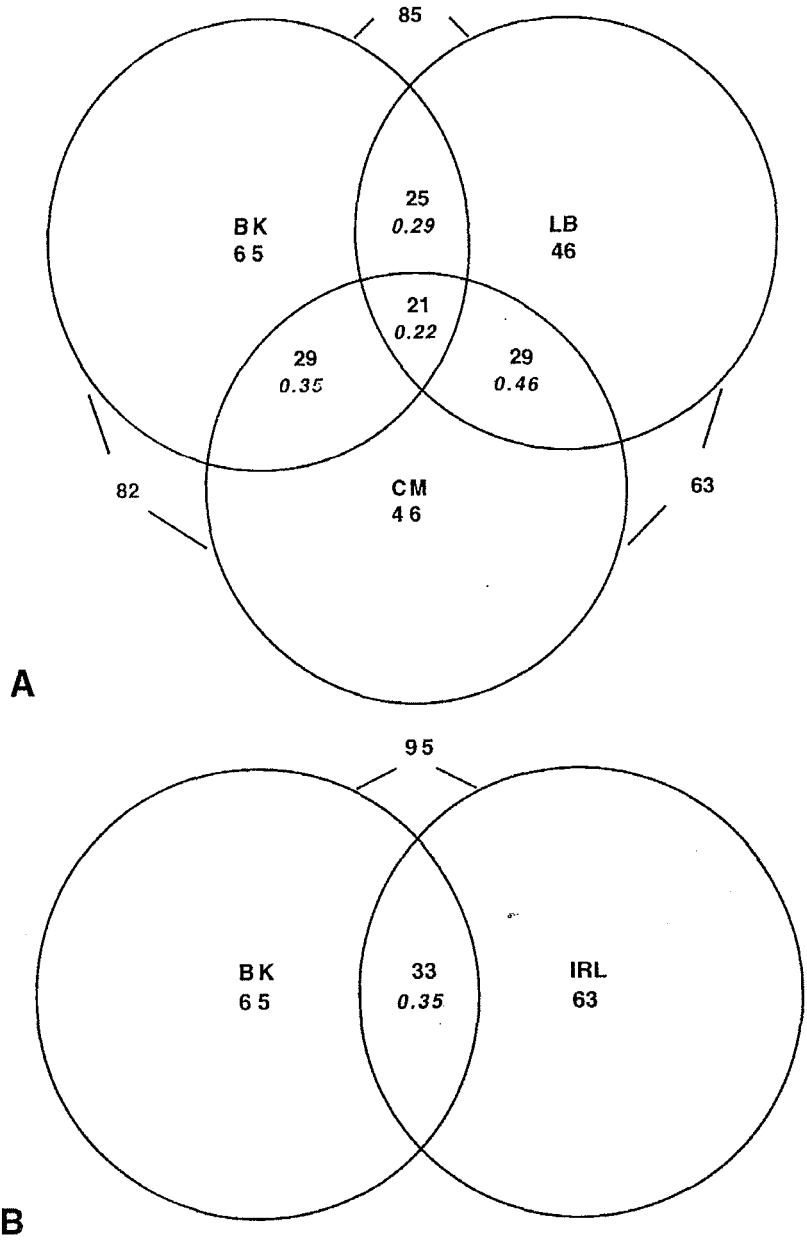

Fig. 1. Numbers of species collected at the three sites investigated, the numbers of species shared with each other, and the overall resemblances between the sites (*in italics*). A: three sites as separate identities; B: two Irish sites combined [BK = De Blauwe Kamer, LB = Little Brosna, CM = Clonmacnois, IRL = the two Irish sites together].

Among the 33 species shared by all three sites (Tab. 2) there are a number of species of moist or wet habitats which were found commonly in all three ((*Pardosa amentata* (Cl.), *P. palustris* (L.), *Pirata piraticus* (Cl.), *Pachygnatha clercki* Snd., *P. degeeri* Snd., *Bathyphantes gracilis* (Blw.), *Erigone atra* (Blw.), *E. dentipalpis* (Wid.), *E. longipalpis* (Snd.), *Lepthyphantes tenuis* (Blw.), *Leptorhoptrum robustum* (Wst.), and the extremely abundant (see above) *Oedothorax fuscus* (Blw.), and *O. retusus* (Wst.)), while some occur commonly on two sites but were found only in low numbers on the third, viz. *Pardosa pullata* (Cl.) at the two Irish sites, of which only two specimens were found at 'De Blauwe Kamer', probably being replaced there by *Pardosa prativaga* (L. K.), *Robertus lividus* (Blw.), *Bathyphantes parvulus* (Wst.) and *Diplostyla concolor* (Wid.). The other species occur in low numbers in 'De Blauwe Kamer' and in one or both Irish sites. None of these species are rare in Western Europe, to the contrary, some of them can be quite common in certain habitats, but apparently they occurred in low densities in the floodplains studied. Considering the composition of the list of 33 shared species we can say that all species are hygrophilous or moisture-tolerant and therefore not typical for floodplains.

Maybe we have to look for typical floodplain spiders among the eight spiders shared by the Little Brosna and Clonmacnois sites, but not occurring in 'De Blauwe Kamer'. The Irish sites are more natural, undisturbed floodplains than 'De Blauwe Kamer', because in the latter summer-dykes prevent the water from flooding the area at medium high levels of the river in summertime or early winter, while the same dyke holds back the water on the floodplain for a prolonged period after the river has already gone back to the normal level. On the Irish sites there are no dykes and the floodplains are inundated according to the dynamics of the river. The eight extra species shared by the two Irish sites are *Arctosa leopardus* (Snd.), *Trochosa spinipalpis* (Cbr.), *Ceratinella brevipes* (Wst.), *Diplocephalus permixtus* (Cbr.), *Gongylidiellum vivum* (Cbr.), *Lophomma punctatum* (Blw.), *Savignya frontata* (Blw.), and *Silometopus elegans* (Cbr.). Only *Savignya frontata* (Blw.) and *Silometopus elegans* (Cbr.) were found in larger numbers, 104 and 135, respectively. The other species occurred in smaller numbers, less than 15. Among the species found in 'De Blauwe Kamer' and not on the two Irish sites are few which were found in larger numbers: *Trochosa ruricola* (Deg.) (98), *Centromerita bicolor* (Blw.) (25), *Collinsia distincta* (Sim.) (760), *Oedothorax apicatus* (Blw.) (916), *Porrhomma microphthalmum* (Cbr.) (65), *Prinerigone vagans* S. *et* A. (24), and *Troxochrus scabriculus* (Wst.) (29); all others again occur in lower numbers.

Evaluation of the species recorded is possible with the synopsis of ecological preferences of spider species provided by Hänggi *et al.* (1995). Flood plains in their terminology is called 'Alluvial areas, regularly flooded'.

Trochosa ruricola (Deg.) (98) (Dutch site only) - An example of a very wide variety of types of habitats where the species has been found. The largest numbers of references are in the categories 'Cultivated grasslands' and 'Cereal fields', which are hardly comparable with floodplains. There are a few records from 'Alluvial areas etc.' but the ecological preferences clearly are too diverse to seriously consider *T. ruricola* as a typical species of flood plains. It is an eurytopic species.

Centromerita bicolor (Blw.) (25) (Dutch site only) - Again an eurytopic species, scoring high for 'Moist meadows', 'Cultivated grasslands', 'Perennial rye-grass pastures, fertilized pastures', 'Saline inland areas', 'Alder carr, willow shrub mire', and 'Cultivated spruce forest'. A low score for 'Alluvial areas etc.'. Not a typical flood plain species.

Collinsia distincta (Sim.) (760) (Dutch site only) - Apparently there were few data available. Most records refer to 'Reed beds', others to 'Litter meadows', 'Moist littoral areas', and 'Cereal fields'. An eurytopic species. It is, so far, not known from Ireland (van Helsdingen 1996).

Oedothorax apicatus (Blw.) (916) (Dutch site only) - The majority of the references concern 'Shores' and 'Cereal fields', while no reference is made to 'Alluvial plains etc.'.

Porrhomma microphthalmum (Cbr.) (65) (Dutch site only) - The majority of the records relate to 'Saline grasslands' and 'Cereal fields'. It is an eurytopic species.

Prinerigone vagans S. *et* A. (24) (Dutch site only) - 'Reed beds' and 'Cereal fields' were found in the literature as the most frequented habitats. It is an eurytopic species.

Savignya frontata (Blw.) (104) (on the two Irish sites) - Most references relate to 'Moist littoral areas' and 'Reed beds', while the species is listed in 50 % of the examined surveys of the spider fauna's of 'Shores' and 'Moist *Calthion* meadows'. The last type of habitat comes closest to flood plains. There is no score in 'Alluvial areas etc.' This is a general wetland species.

Silometopus elegans (Cbr.) (135) (on the two Irish sites) - A large number of references for 'Sedge swamps', slightly less for 'Rushes', 'Moist meadows', and 'Reed beds'. Fifty percent or more of the examined surveys of 'Sedge swamps' and 'Rushes' list *S. elegans* as occurring in that type of habitat. Again, it is a general wetland species.

Troxochrus scabriculus (Wst.) (29) (Dutch site only) - 'Coastal dunes' and 'Lawns in parks', the most frequently mentioned habitats, are far from the flood plain type.

None of the above eight species scores significantly for 'Alluvial areas'. I assume that 'Reed beds', 'Rushes', 'Sedge swamps', 'Litter meadows', 'Moist littoral areas', 'Moist *Calthion* meadows', and 'Moist meadows' all can be found in flood plains. In fact they form nothing more than a selection of

hygrophilous, or at least hygro-tolerant, species and not a series of spider species typical of floodplains. Still *Savignya frontata* (Blw.), *Silometopus elegans* (Cbr.), and *Collinsia distincta* (Sim.) might be the more exclusively floodplain adapted species.

As said earlier, many species were found in low numbers. Deletion from the list of 95 species all those which are represented by five specimens or less on any of the sites further reduces the list to 48 species, containing all the species of Tab. 3 and those successively dealt with. However interesting the rarer species may be, it is assumed here that typical floodplain species should not be looked for amongst these.

The present study does not reveal anything about the strategies followed to survive the periodic submersion by the river. It is clear that flooding must have a selective effect on the fauna. The spider fauna will consist of those species which can survive submersion, in any of their life-cycle stages, or which can re-colonise the area from neighbouring sites. Given the dominance of hygrophilous species sampled at the three sites a nearby source of hygrophilous species is postulated for all three sites, which is not evident in all three cases. The effects of temporary flooding of a forest by a river on the spider fauna is dealt with by Uetz (1976).

NATURE DEVELOPMENT POSSIBILITIES

Holland is an overpopulated, overcrowded country. We believe we are known as very active people which use every corner of our country. Recent political developments have brought environment and nature protection higher up on the list of our priorities. Our Ministry of Agriculture and Fisheries now has a separate section on Nature Management. Our private Society for Nature Conservation 'Natuurmonumenten' has grown over the last five years to more than 800,000 members (5 % of the Dutch population, many of them being the head of a family, so the percentage is even higher). The effects of this situation are clear: there is (some, never enough) political and financial support for nature protection and development. We are developing an ecological network by creating ecological corridors between existing important natural areas, often reserves or otherwise protected areas. A lot of money is involved with the purchase of such connecting areas, which usually are former farm-lands taken out of production. Giving back farm-land to nature is a process called nature development. The negative effects of former exploitation are undone (e.g. removal of the top-layer of over-fertilized soil) and the area is then left to natural developments.

Recent problems with very high winter levels of the main rivers in the Netherlands have emphasized the necessity to give rivers more possibilities for unrestrained transport of water. This coincides with already existing plans and projects already underway of nature development along the rivers. At several

places in the Netherlands the summer-dykes have been cut and the floodplains have been given back to the river, while at some such places old, secondary river-channels have been restored. At the same time agricultural activities were brought to a stop. This is not a change as big as it may look at first sight, because a general reduction of farmland is taking place presently. In the river systems it certainly causes a change in the water regime: high summer levels now can enter the area between the summer-dykes and winter-dykes unimpeded, but this occurs only rarely. High winter levels will enter the area much sooner, which means that the period of flooding is prolonged. The water masses on the floodplains now also become an integral part of the flowing water masses, while in the earlier days the water behind the summer-dykes was inactive, hampered as it was by the summer-dykes.

Grazing by cattle often is replaced by extensive grazing, for nature management purposes, by horses (Tarpan) or 'wild' cattle (Heck, Scottish Highlanders). We have no natural grazers in those areas, not yet. They can stay outside during the winter and are a semi-natural element in the reserve. Their role is to prevent the forest (*Salix* species, *Populus nigra*, and *Alnus glutinosa*) from growing over the whole area. The animals maintain open spaces and a diversity of habitats by their movement, their grazing, and the spreading (cows) or accumulating of dung (horses). It is obvious that mosaic patterns of vegetation are preferred over monotonous alluvial forest. Such nature development projects in the Netherlands are all very young and there is not much to say about the results at this moment. Such projects are long-term developments and we have to wait another generation before we can evaluate.

In order to establish how important a site is for protection of fauna and flora it is necessary to find out what species occur there. Management of sites for protection of flora and fauna is, or should be, equally dependent upon a knowledge of the species found there, their requirements and how the site may be improved for the benefit of any target species identified. Site species lists are thus one of the basic necessities of nature conservation. The same holds true for nature development projects such as the restoration of natural floodplains. One has to know what one gives up before one decides to start a new development. The Nature Conservation Society which owns 'De Blauwe Kamer' was well aware of this and had the area inventoried before the first spadefull of earth was turned. They have planned to monitor the area for certain groups of organisms.

What will be the fate of the spider fauna at this and comparable sites? It is not easy to predict the changes. In the long run the diversity in habitats will certainly become higher because the extensive grazing will lead to mosaic vegetation patterns. Spiders are dependent on the structure and micro-climate offered by the vegetation more than on the plants themselves. In normally developed floodplains there is a variety of soils, a gradient from the river-bed

towards the dyke, because the heavier particles (sand) are deposited close to the bed and the smallest and lightest particles farthest away from the bed. A variety in soils will cause a variety in types and densities of vegetation. The sand deposited close to the river will form sandy banks or even dune-like structures.

Will some spider species disappear and others come in? The most important change, of course, will be the increase in the land surface covered by trees and shrubs, because that is what one expects to happen and wants to regulate through admitting some large grazers. The spider community thus might develop in the direction of the 'auenwald' as described and analysed by Thaler and Steiner (1987). Another change will be that species which up to now benefited from human interference and the resulting nivellating effects (*Oedothorax fuscus*, *Pardosa amentata*, *Erigone* species) may become much less abundant, because the spreading of dung and the mowing of grassland have stopped. On the other hand we should not forget that the dynamics of the living river will have a selective effect on the spider community, because of the flooding of large parts of the area during longer or shorter periods in winter, and occasionally also in summer.

REFERENCES

Hänggi A., Stöckli E. & Nentwig W. 1995. Lebensräume mitteleuropäischer Spinnen - Habitats of Central European spiders. Misc. Faun. Helvet., **4**: 1-459.

Helsdingen P. J. van (in press). The county distribution of Irish spiders, incorporating a revised catalogue of the species. Irish Nat. J., Suppl.

Thaler K. & Steiner H. M. 1987. Fallenfänge von Spinnen in abgedämmten Donau-Auen bei Wien (Österreich). Sitzungsberichten der Österreichische Akademieder Wissenschaften (Math.-naturw. Klasse) I, **196 (5) (10)**: 323-339.

Uetz G. W. 1976. Gradient analysis of spiders communitiesin a strimside forest. Oecologia, **22**: 373-385.

Yon D. & Tendron G. 1981. Alluvial forests of Europe. Council of Europe, Nat. Envir. Series, **22**: 1-65.