4 Anklamer Stadtbruch

Spontaneous mire regeneration after dike collapse

Introduction

The ‘Anklamer Stadtbruch‘ is a 2,000 ha large peatland complex near Anklam at the mouth of the Peene river. It consists of fen and bog woodlands (German: ‘Bruch‘) as well as fen grasslands and reeds. By accident it developed into the largest rewetting area in Germany. A Baltic Sea flood in the winter of 1995/96 destroyed the dikes and flooded large parts of the peatland. Since then, land use has ceased and vegetation is changing dramatically. Decreased subsidies for pumping station maintenance and waning interest in land use prevented renewed drainage of the area and ignited a controverse and highly emotional discussion about the future of the area between representatives of local and regional authorities, nature conservationists and residents.
Today, the Anklamer Stadtbruch is one of the most impressive restoration areas in Germany, with nutrient poor bog remnants, extensive commercial forests, peat cuttings and intensively used grasslands all transforming into eutrophic swamps. As rewetting was initiated by natural flooding, it is more adequate to call the process regeneration instead of restoration even if flooding is still managed. The Anklamer Stadtbruch is part of the special protected area (SPA) ‘Peenetal‘, of a proposed NATURA 2000 site and of a federal large-scale conservation project (German: ‘Naturschutzgroßprojekt‘; see chapter 2).

Site description

The Anklamer Stadtbruch is situated 10 km east of Anklam at the southern shore of the Oderhaff, a Baltic Sea lagoon. The mire developed in a glacial basin shaped during the last stages of the Weichselian glaciation.

The mire complex comprised three hydrogenetical mire types, (a) the (primary) coastal transgression mire periodically flooded by the Baltic Sea, (b) the (secondary) percolation mire, fed by percolating groundwater from the moraines and (c) the (tertiary) central bog, fed only by rain water (fig. 4.1 and 4.2). The substrate consists of alder, sedge, reed and – in the centre – *Sphagnum* peat, reaching an average thickness of 3 m.

Use and exploitation

By the end of the 17th century the Anklamer Stadtbruch was partly covered by open woodland used for grazing. Wet meadows persisted along the lagoon until the early 19th century when ditches were dug and peat cutting started in

Photo (K. Schulz 2003). Old forester‘s house at the channel ‘Zartenstrom‘.

the central part of the mire. Large-scale commercial peat extraction began around 1850 and boomed until 1880. The peat was transported via three main canals to the nearby town of Anklam and sold as fuel. After a short renaissance following World War II, peat cutting finally stopped in 1955. In the following decades, trees invaded most of the peat cuttings. Only the central part of the largest extraction site 'Große Kuhle' (fig. 4.3) remained open and was invaded by *Molinia caerulea* (Purple moorgrass).
In the early 20th century the northern lower parts of the mire were still affected by the Baltic Sea floods. In 1932/33 a dike and two pumping stations were built to protect the meadows from flooding. Nevertheless, parts of the area were inundated after heavy floods, e.g. in 1971, 1973 and 1978. To reduce the effect of flooding and to increase grassland yields, drainage was again drastically intensified in the mid 1970s. This drainage however also affected the central woodlands, which partly died from water shortage in summer.
The history of conservation and restoration is summarised in box 4.1. The newly established hydrology is determined by the height of the peatland surface (mean water levels) and water flow patterns during high tides (fig. 4.4).

Restoration

Woodlands and peat cuttings

In the early 1990s the main part of the peatland (1,270 ha) was covered by woodland, whereas the grasslands in the north and southwest (415 ha) and the wettest parts of the peat cuttings in the centre (< 100 ha) remained open. The sites the woodlands occupied varied from oligo- to eutrophic, alcalic to acidic and dry to permanently waterlogged, resulting in a high diversity of vegetation types. In the former bog area birch woodlands with *Betula pubescens* prevailed (fig. 4.3). In the peat cutting 'Große Kuhle' peat mosses (*Sphagnum fimbriatum*, *S. palustre*, *S. squarrosum*, *S. fallax*) were accompanied by wetland herbs (like *Hydrocotyle vulgaris* and *Thelypteris palustris)* and shrubs (*Myrica gale*, *Frangula alnus)*. Open places were characterised by *Molinia caerulea* and *Carex lasiocarpa*. In the small-scale peat cuttings a mosaic of vegetation types occurred. The largest area, however, was dominated by birch woodland rich in sedges. Small isolated sites that had never been affected by peat cutting were covered by birch woodlands (with *Vaccinium uliginosum*, *Myrica gale*, *Calluna vulgaris* and *Pleurozium schreberi*) and Spruce (*Picea abies)* plantations. Close to the Oderhaff carrs of Alder (*Alnus glutinosa*) and Ash (*Fraxinus excelsior*) dominated. Oak forests surrounded the centre like a belt.

The development of the woodlands after flooding was diverse and depended on the new water levels: the eastern part of the former bog was still protruding more than 10 cm above mean sea level. The woodlands there were thus less affected by higher water levels (fig. 4.1, 4.3). In the lower peat cuttings the birch woodlands nearly died off and reeds of *Phragmites australis* and *Typha latifolia* developed. Equally the oak, ash, birch and alder woodlands in the west and north became periodically or permanently inundated and were replaced by *Phragmites australis* and *Typha latifolia* reeds and willows (mainly *Salix cinerea*). Trees in the south and east suffered as well, but only partly died off. Locally, a regeneration of Ash and Alder can be observed.

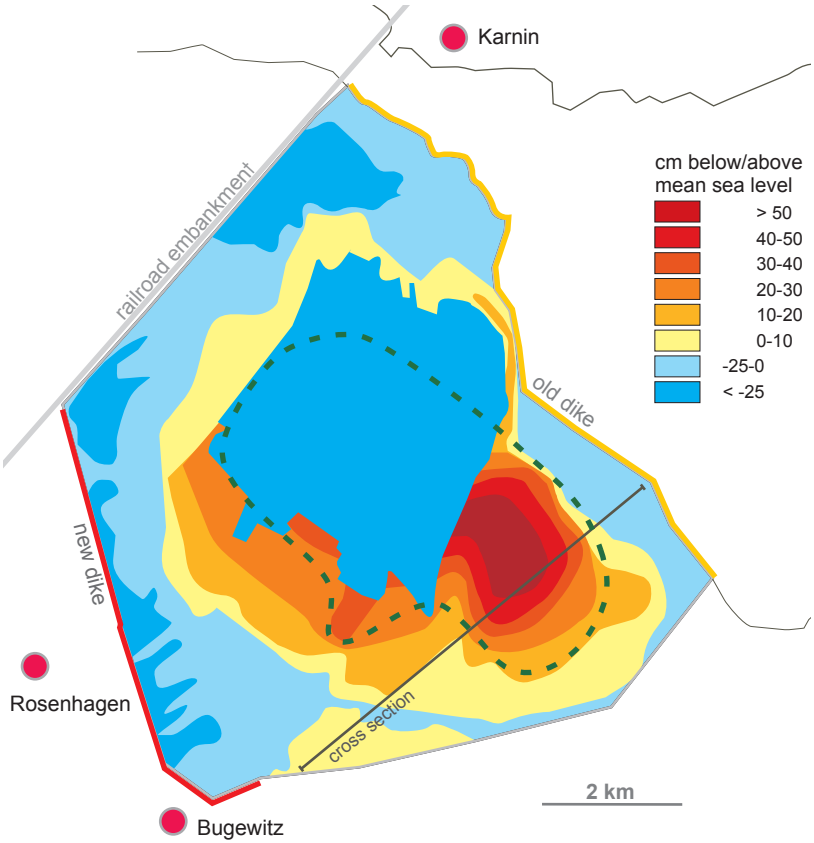

Figure 4.1. Recent elevation map of the Anklamer Stadtbruch, dashed area is the former bog cupola.

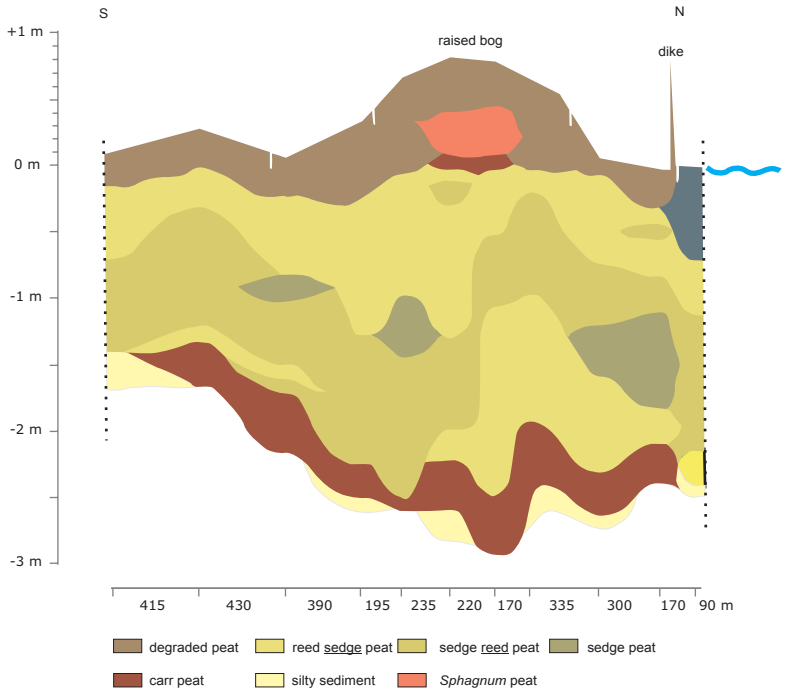

Figure 4.2. Cross-section through the Anklamer Stadtbruch, position of transect indicated in fig. 4.1 (redrawn from Grünbauer und Cheung 1994).

Grasslands

Until 1995 the grasslands were dominated by polytraphent and species-poor vegetation with *Phalaris arundinacea* (on wetter sites) and *Elytrigia repens, Dactylis glomerata*, *Urtica dioica*, *Juncus effusus* and *Poa* spp. (on drier sites). Only some small remnants of species-rich fen vegetation with e.g. *Dactylorhiza majalis* and *Gentiana pneumonanthe* remained in the west. Due to drainage and frequent ploughing, the most severe subsidence and peat degradation occurred at the species-poor grassland sites. After 1995, these lowest sites became most deeply flooded. During the first years of flooding the vegetation displayed a ‘chaotic‘ mixture of species from the former grassland vegetation and invading pioneers adapted to shallow water conditions like *Lemna minor*, *Bidens cernua* and *Typha latifolia*. Meanwhile, after eight years of flooding, the vegetation is clearly differentiated along a wetness gradient.

Box 4.1. The history of conservation and restoration.

1920s: Two ha of the meadows with a species-rich Lepidoptera fauna are designated as nature reserve.

1967: Also the central bog area (~ 500 ha) and a surrounding buffer zone are designated as nature reserve (in total 1,200 ha). Some ditches, especially in the bog area, are closed. Although the situation slightly improves, a revitalisation of the mire does not occur.

Early 1990s: After the end of the GDR the intensity of grassland use rapidly declines. In 1992, the progressive reduction of subsidies for the pumping station is announced.

November 1995: One of the heaviest floods of the 20th century hits the coast of Mecklenburg-Vorpommern: dunes, cliffs and beaches are washed away, piers, harbours and boats are destroyed. In the Oderhaff, the water remains about 1 m above the mean sea level for 25 hours. The whole Stadtbruch, except for the central bog remnant, is flooded.

1995-99: Unclear situation: Different interest groups are strongly disputing the future of the Stadtbruch. Options under discussion range from spontaneous regeneration to the complete reconstruction of the drainage system. Most residents prefer to rebuild the dikes and to drain the area again. They fear that future floods would affect houses, attract mosquitoes and promote malaria. They furthermore want to maintain the opportunity of hunting and recreation and dislike 'dying forests and rotting swamps'. Conservationists, on the other hand, plea to take the chance of mire regeneration.

Spring 1996: The water is pumped out and meadows partly recover. As the dike is not repaired, the Anklamer Stadtbruch is again flooded in the winter of 1996/97.

1997: The federal state Mecklenburg-Vorpommern announces to repair the dikes only if the meadows are used for at least another 10 years. Facing increasing costs, the land users refuse to give such guaranties. Consequently, pumping stations are switched off and grassland use stops.

1998: Most parts of the area situated below mean Baltic Sea level (fig. 4.1) are flooded for the first time during the whole year and many trees die.

1999: The regional water association initiates the building of a new dike at the southwestern border of the Stadtbruch to protect the villages Rosenhagen and Bugewitz.

Box 4.2. Vegetation zonation in 2003/2004.

Non- and rarely inundated

(median winter water level: < 0 cm)

Only marginal areas were not flooded. Here, highly productive tall species, e.g. *Phragmites australis, Phalaris arundinacea, Solanum dulcamara, Glyceria maxima, Juncus effusus, Agrostis stolonifera, Carex riparia, C. acuta and C. disticha,* as well as nitrophilous species, e.g. *Urtica dioica* and *Cirsium arvense* dominate.

Long-term shallow inundated

(median winter water level: 0 to +30 cm)

After flooding the open muddy sites were rapidly occupied by *Typha latifolia*. Presently tall sedges slowly spread; *Carex paniculata*, *C. riparia* and *C. pseudocyperus* occupy the polytrophic, *Carex acuta*, *C. disticha* and *C. acutiformis* the eutrophic sites. At some sites also *Phragmites australis* spreads enormously. From the ancient vegetation solely *Phalaris arundinacea* could persist, but only at sites that regularly fall dry in summer. At sites flooded also in summer *P. arundinacea* is replaced by *Carex riparia*, *Typha latifolia*, *Phragmites australis* or *Glyceria maxima*.

Permanently shallow inundated

(median winter water level: +30 to +60 cm)

After flooding, the old vegetation was completely replaced by drifters (*Ceratophyllum submersum*, *C. demersum*, *Lemna* species and *Spirodela polyrhiza*) and aquatic weeds (*Potamogeton natans*, *P. berchtoldii*, *Myriophyllum verticilliatum*). Also weeds that can germinate under water expanded rapidly, e.g. *Typha latifolia*, *T. angustifolia* (in water deeper than 25 cm), *Sparganium erectum* and *Eleocharis palustris*. *Phragmites australis*, *Carex riparia* and *C. acutiformis* slowly expand vegetatively from former stands along ditch margins. On shallower spots also *Acorus calamus* and *Glyceria maxima* spread from ditch margins and more sedges (*Carex acuta*, *C. disticha*, *C. pseudocyperus*) and *Schoenoplectus tabernaemontani* invade.

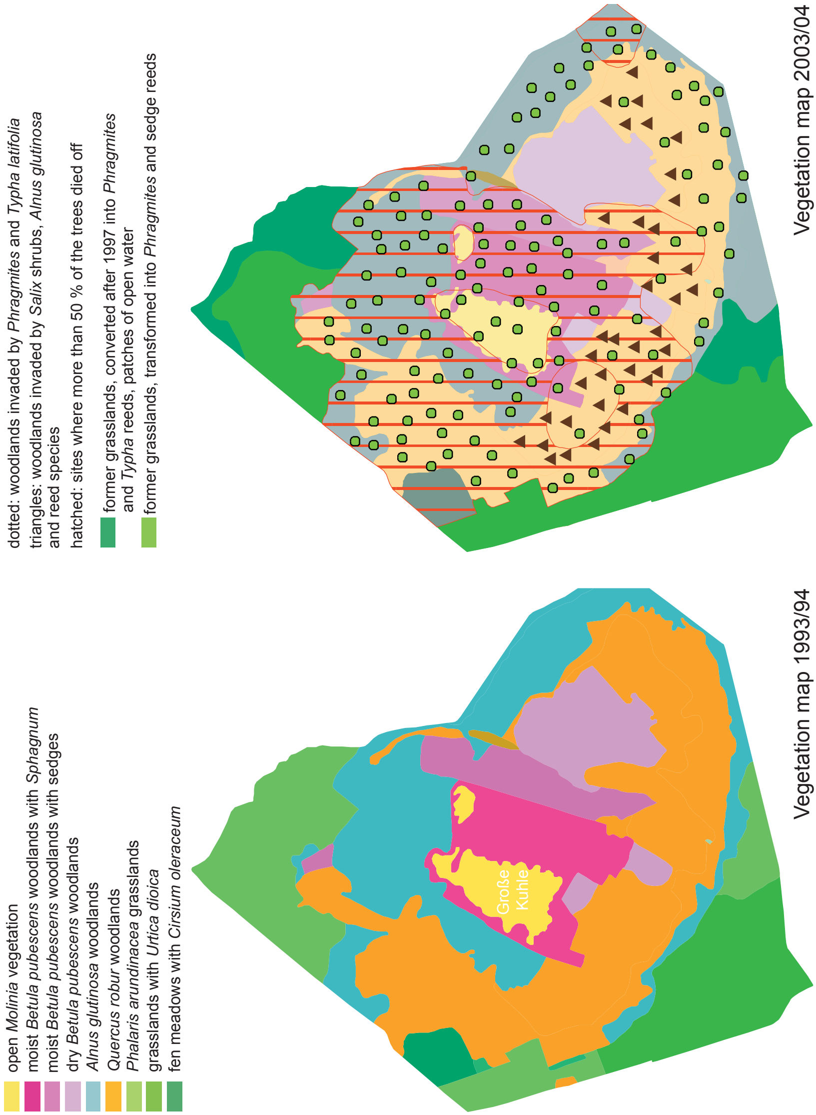

Figure 4.3. Vegetation zonation of the Anklamer Stadtbruch before (1993) and after rewetting (ca. 2003), redrawn from Gremer et al. 2000, simplified after Baron von Schilling 2003, Grünbauer & Cheung 1994, Voigtländer 1994, Prager 2000 and Schulz 2005.

Box 4.3. Hydrological system of the Anklamer Stadtbruch.

Currently the remnant of the bog cupola (1) is the sole part of the mire that is not inundated during Baltic Sea floods (fig. 4.4). The surrounding and interconnected basins (2-6) are succesively filled when floods reach levels exceeding 0.2 m asl. Flood events of such intensity occur on an average of 20 days per year.

The in- and outflow occurs primarily via the main channel between basins 3 and 4. Inundation waters reach the basins via the dense net of channels and surface flow in the following sequence: 3 > 4 > 2 > 5 > 6. In Basin 3 the largest hydrological dynamics prevail (water level amplitude, frequency and velocity of water exchange) whereas Basin 6 is highly buffered.

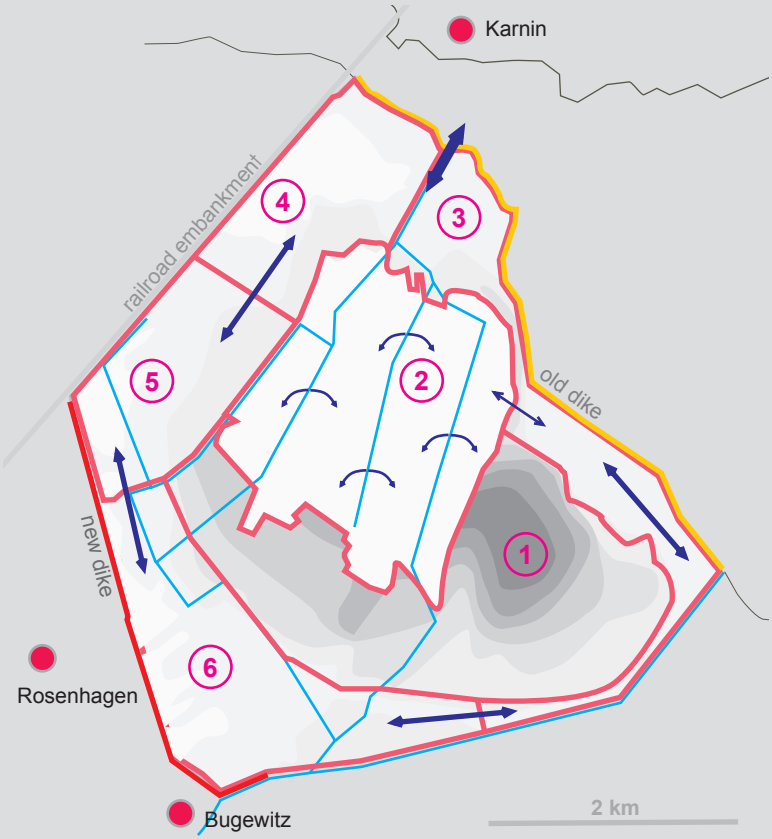

Figure 4.4. Water flow patterns during high tide (after Schulz 2005).

The 0.2 m threshold retards the discharge of the brackish water after flood events (‚bath tub effect' / German: ‚Badewannen-Effekt'). The presence of this extra water might facilliate mire regeneration in this area where precipitation hardly exceeds evapotranspiration.

Perspectives

The future of the area depends on the changing amplitudes and frequencies of water level fluctuations. In the long run, the 'bath tub effect' ('Badewannen-Effekt') of the dike remnants mitigating the fluctuations of the Baltic Sea will decrease due to the progressive degeneration of the dikes. This will enhance the amount and frequency of in- and outflowing water and lower the mean water levels. Scientists and managers are presently discussing to keep the outflow threshold at a stable height of 5-10 cm asl. This would stop peat mineralization, enhance the growth of peat forming plants like *Carex* species and *Phragmites australis*, preserve open water patches for rare birds and minimise nutrient losses with the outflowing surface water.

Further reading

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Box 4.4. Selected bird species of the Anklamer Stadtbruch.
Status of occurrence: b- breeding season, m- migration, w- wintering

Scientific name	English name	Occurence
Himantopus himantopus	Black-winged stilt	b
Jynx torquilla	Wryneck	b
Lanius collurio	Red-backed shrike	b
Chlidonias hybridus	Whiskerd tern	b, m
Chlidonias niger	Black tern	b, m
Circus pygargus	Montague's harrier	b, m
Grus grus	Common crane	b, m
Larus melanicephalus	Mediterranean gull	b, m
Luscinia svecica	Bluethroat	b, m
Phylloscopus sibilatrix	Wood warbler	b, m
Porzana porzana	Spotted crake	b, m
Botaurus stellaris	Bittern	b, m, w
Haliaeetus albicilla	White-tailed eagle	b, m, w
Phalocrocorax carbo	Great cormorant	b, m, w
Dendrocopos medius	Middle spotted woodpecker	b, w
Panurus biarmicus	Bearded tit	b, w
Acrocephalus paludicola	Aquatic warbler	m
Anser brachyrhynchus	Pink-footed goose	m
Anthus cervinus	Red-throated pipit	m
Aquila pomarina	Lesser spotted eagle	m
Aythya marila	Greater scaup	m
Aythya nyroca	Ferruginous duck	m
Calidris minuta	Little stint	m
Calidris temminckii	Temminck´s stint	m
Chlidonias leucopterus	White-winged tern	m
Larus cachinnans	Caspian gull	m
Larus michahellis	Yellow-legged gull	m
Limicola falcinellus	Broad-billed sandpiper	m
Phalaropus lobatus	Red-necked phalarope	m
Philomachus pugnax	Ruff	m
Podiceps auritus	Horned grebe	m
Recurvirostra avosetta	Avocet	m
Stercorarius longicaudus	Long-tailed skua	m
Stercorarius parasiticus	Arctic skua	m
Sterna paradisaea	Arctic tern	m
Sterna sandvicensis	Sandwich tern	m
Upupa epops	Hoopoe	m
Xenus cinereus	Terek sandpiper	m
Anthus petrosus	Rock pipit	m, w
Anthus spinoletta	Water pipit	m, w
Lymnocryptes minimus	Jack snipe	m, w
Mergus albellus	Smew	m, w

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