RESTORATION OF THE TIDAL LAGOON OF THE ZWIN

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Abstract: The tidal floodplain of the Zwin between Knokke (Belgium, Flanders) and Cadzand (Netherlands) is a border-crossing relic of the sound that once connected the medieval ports of Damme and Sluis with the North Sea and gave Bruges its golden age. Historic land reclaim, that only ended in 1872, reduced the Zwin to a tidal lagoon with a superficies of only 200 hectares, comprising salt marshes, mudflats, tidal gullies and coastal dunes. Once an important sanctuary for coastal bird-species, the Zwin is in both concerned European Union member states included in the European Natura 2000-network. Since the years 1980, accelerated silting up of the lagoon and gullies and encroachment of the salt marshes with *Elymus athericus* have resulted into a significant loss of biodiversity. The accelerated silting up is caused by the lack of dynamics in relation to the too small scale of the remaining sea-inlet. After the necessary hydrodynamic modelling and an Environmental Impact Assessment were carried out, it was decided that the floodplain of the Zwin should be enlarged with 120 hectares by moving the sea-retaining dike inland. The Agency for Nature and Forest (Flanders) has, together with the Province of Zeeland (Netherlands), also elaborated an arrangement-plan for the presently existing tidal site. This arrangement-plan prescribes rejuvenation of the salt marshes by cutting off sods and grazing by cattle and livestock as well as restoration of a tidal lagoon and expansion of the main sea-inlet by excavations.

Keywords: tidal areas, Atlantic salt marshes, Sea dunes, birds, *Bufo calamita*, change of natural dynamics, identifying appropriate conservation and restoration objectives, reclamation of former agricultural land

Introduction

The present-day Zwin consists of a tidal beach plain, located behind a range of high foredunes and still connected to the North sea by a tidal inlet running through those foredunes. The tidal flood plain covers a surface area of 160 ha, of which 130 ha are located on Belgian territory and 30 ha on Dutch territory. This tidal flood plain is a relict of the sound that once was used as the fairway of the medieval ports of Damme and Sluis and so contributed to the prosperity of Bruges. The sound of the Zwin was formed by a catastrophic storm in 1134 AD. The Zwin remained the south-westernmost channel of the estuary of the river Scheldt until 1800. Its initially vast tidal flood plain was gradually reduced by land reclamation that already started in the 12th Century and only reached its final stage in 1872 with the construction of the International Dike that embanked the Willem-Leopoldpolder. Until then, the tidal flood plain of the Zwin still reached up to the town of Sluis, at a distance of 9 km from the present-day coastline. Because of its beautiful scenery the Belgian part of the relict of the Zwin was already declared a protected landscape by Royal Decree of 7 April 1939. In the 1950's the extraction of sand that was used for the reinforcement of the International Dike created a lagoon in the westernmost part of the tidal flood plain. In this largely permanently inundated lagoon, a couple of small islets offered for decades secure nesting opportunity to quite large numbers of Common Tern (*Sterna hirundo*), Black-headed Gull (*Larus ridibundus*), Avocet (*Recurvirostra avosetta*), Redshank (*Tringa tetanus*) and Shellduck (*Tadorna tadorna*). During winter and migrating seasons the lagoon and its islands formed also safe foraging and sleeping sites for quite large numbers of Eurasian Spoonbill (*Platalea leucorodia*), Tundra Swan (*Cygnus colombianus bewickii*), White-fronted Goose (*Anser albifrons*), Hen Harrier (*Circus cyaneus*), Grey plover (*Pluvialis squatarola*), Dunlin (*Calidris alpina*), Ruff (*Philomachus pugnax*), Eurasian Curlew (*Numenius arquata*), Whimbrel (*Numenius phaeopus*), Bar-tailed Godwit (*Limosa lapponica*), and Marsh Owl (*Asio flammeus*). Many of these species are included in the Annex 1 of the European Birds Directive. As a consequence of its ornithological importance, the Zwin was designated subsequently by Royal Decree of 27 September 1984 as a wetland of international importance for waterfowl in the frame of the International Convention of Ramsar (Iran, 1971) on Wetlands of International Importance especially as waterfowl habitats and by

Order of the Flemish Government of 17 October 1988 as a Special Protection Area in the frame of the European Bird Directive 79/409/EEC. In the frame of the European Habitat Directive 92/43/EEC, the Belgian part of the Zwin is since 2004 included in the Site of Community Interest 'Dunes including the Yzer-estuary and Zwin'. Also the Dutch part of the Zwin is included in the Natura 2000 – network in execution of both the European 'Birds' and 'Habitat' Directives. Finally the Zwin is part of the Flemish Ecological Network in Belgium and of the Ecological Main Structure of the Netherlands on Dutch territory. Since the 1980's the Zwin has suffered a dramatic loss of biodiversity. Sand deposit has led to the gradual filling up of the lagoon, causing loss of safe breeding opportunities and sleeping sites for the birds as the former islets are now connected to the mainland and accessible to ground-predators such as Fox and Stone Marten. Sand deposit and the development of vegetation have also led to the loss of the habitat-type '1140. Mudflats and sandflats not covered by seawater at low tide', that was of great importance as foraging habitat for wading birds. The lack of grazing of the salt marshes and the dunes has led to dominance of Sea Couch (*Elymus athericus*) and Wood Small-reed (*Calamagrostis epigejos*) over a large part of the site, causing important loss of biodiversity, especially within the habitat-types '1330 *Glauco-Puccinellietalia*', '2190. Humid dune slacks' and '*2130 Fixed dunes with herbaceous vegetation or 'grey dunes'. Finally the overgrowing by willows and reeds of fresh and brackish waterponds and the accumulation of litter have led to the disappearance of the Natterjack toad (*Bufo calamita*), an amphibian specie of the Annex 4 of the European Habitat Directive.

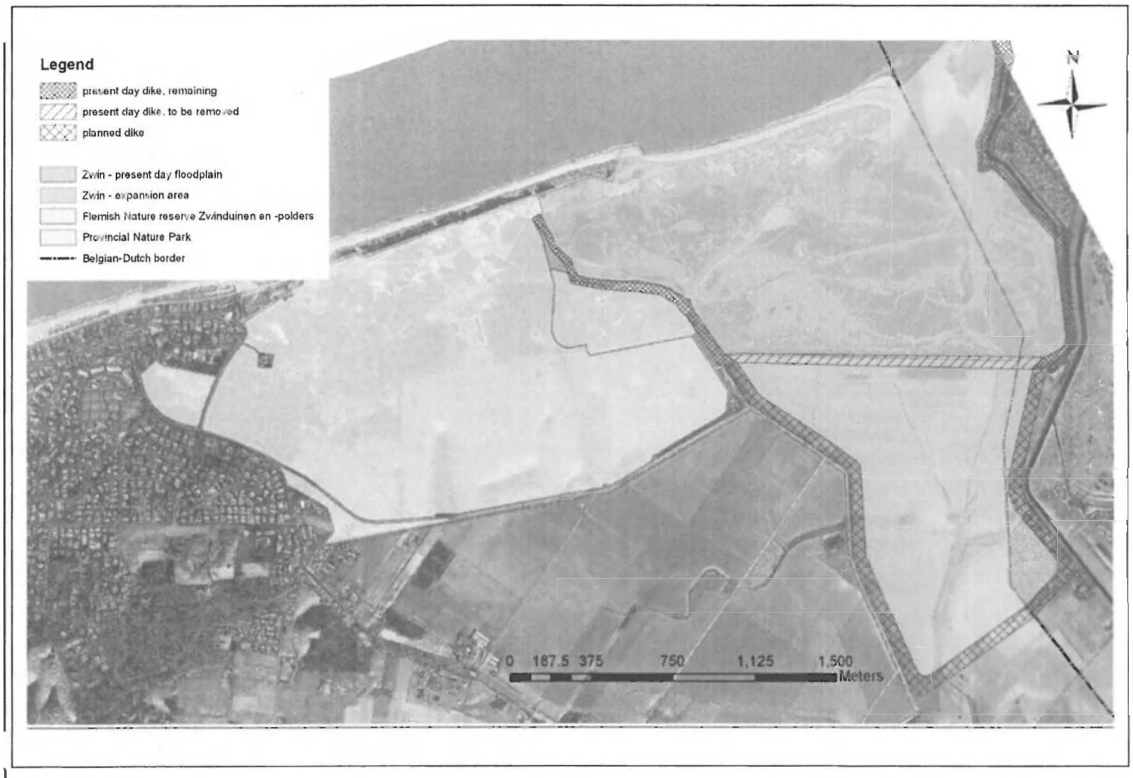

Figure 1. Location of the present day Zwin and the planned expansion area of the tidal flood plain in the Willem-Leopoldpolder

Restoring the biodiversity of the presently existing Zwin relict

The Belgian part of the present day border straddling Zwin relict was the private property of a real estate company, that since 1953 managed the site as a private birds reserve. Only on 28

August 2006 the site was purchased by the Flemish Region. Since 2007 small scale nature management measures have been taken with encouraging results, such as the introduction of grazing by cattle during the summer, autumn and early winter of a limited part of the tidal flood plain. The Dutch part of the Zwin has been the property of the Dutch state for a very long time. From 1 January 2011 to 31 December 2015, the Agency for Nature and Forests of the Flemish Government and the Dutch Province of Zeeland will carry out the LIFE+ Nature project 'Zwin Tidal Area Restoration', abbreviated as 'ZTAR', in order to restore the biodiversity within the presently existing relict of the Zwin. The total budget of this LIFE+ Nature project is 4.135.521 Euro, of which 50 % is provided by the European Union, 40,92 % by the Agency for Nature and Forests and 9,08 % by the Province of Zeeland. The main actions on the field are:
1) The restoration of the habitattype '2190 Humid duneslacks' and the aquatic biotope for the Natterjack toad (*Bufo calamita*) by excavating 6 depressions in the contact-zones between fresh and brackish groundwater;
2) The rejuvenation of salt-marsh and initiation of a new vegetation-succession from pioneering conditions (habitattype '1310 *Salicornia* and other annuals colonising mud and sand') to highly developed '1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)' over a superficies of 8 hectares by cutting off sods from an area that is strongly encroached with *Elymus athericus*;
3) The restoration of opportunities for nesting, foraging and resting for coastal bird species, safeguarded from terrestrial predators (Fox and Stone Marten) by restoring the western saltwater – lagoon (surface-area: 9 hectares) with its 'bird-islets' (3 hectares), by means of excavating the silted up depression, improving its irrigation with seawater and preventing its actually too fast and too strong drainage by placing a sluice on the gullies that connect the lagoon with the sea;
4) The reversing of the encroachment of the salt – marshes and dunes with *Elymus athericus* and *Calamagrostis epigejos*, in order to restore the habitat-types '1140 Mudflats and sandflats not covered by seawater at low tide', '1310 *Salicornia* and other annuals colonising mud and sand', '1330 Atlantic salt meadows', '2120 Shifting dunes along the shoreline with *Ammophila arenaria*' ('white dunes'), '*2130 Fixed coastal dunes with herbaceous vegetation' and '2190 Humid duneslacks', by introducing grazing with cattle and livestock over two areas of respectively 80 hectares and 9 hectares, which needs placing tide-proof fences;
5) The improvement of the supply of salt seawater in the tidal floodplain by enlarging the tidal inlet through the foredunes, so improving dynamics in the tidal gullies and slowing down the sand deposit in those tidal gullies, the western lagoon and on the salt marshes.

The planned expansion of the tidal flood plain

The International Zwin Commission, composed of representatives of all concerned Flemish and Dutch public authorities and its commissioned scientists and engineers studied since 1987 the decrease in biodiversity of the Zwin. To maintain the Zwin relict as a tidal flood plain, a sand trap was first put in the tidal channel that connects the flood plain to the sea and had subsequently been dredged regularly. But this initial measure did not offer a sufficient nor sustainable solution. In 2003 the International Zwin Commission came to the conclusion that the main cause of the silting up of the flood plain was the lack of a sufficient tide storage, resulting in a lack of dynamics. This deficient tide storage is on its turn a consequence of the too strongly reduced dimensions of the remaining tidal flood plain since the embankment of 1872. The International Zwin Commission recommended amongst other measures to examine the possibility of the expansion of the tidal flood plain of the Zwin with 120 ha of the adjacent Willem-Leopoldpolder, that until 1872 had been part of the tidal inlet and flood plain.
In the same period the Development Sketch 2010 for the Scheldt-Estuary was elaborated by the Flemish and Dutch Governments. Its 3 main objectives are: 1) the enhancement of the nautical conditions for navigation and the accessibility of harbours, amongst others the port of Antwerp; 2) the enhancement of the security against flood risks; 3) the restoration of estuarine nature.
As the Zwin is located in the south-westernmost part of the river-mouth of the Scheldt, the expansion of the tidal flood plain of the Zwin with a minimum of 120 ha and a maximum of 240 ha by the displacement inland of the International dike became one of the targets of the

estuarine nature restoration component of the Development Sketch for the Scheldt – Estuary. The expansion of the Zwin was included in the treaty between the Flemish Region and the Kingdom of the Netherlands of 21 December 2005 concerning the execution of the Development Sketch for the Scheldt-Estuary.
In 2007 an international Environmental Impact Assessment of the structural measures for the sustainable maintenance and expansion of the Zwin as a natural tidal area was commissioned by the Coast Division of the Agency for Maritime Services and Coast of the Flemish Government and the Dutch Province of Zeeland. This EIA examined 5 scenarios: the expansion of the tidal flood plain with 120 ha (scenario 1) or with 180 ha (scenario 2) of the Willem-Leopoldpolder by the displacement inland of the sea-retaining dike; the creation of a Reduced Tidal Area in 120 ha (scenario 3) or in 180 ha (scenario 4) of the Willem-Leopoldpolder (with maintenance of the sea-retaining dike on its original present day location); the creation of 2 Reduced Tidal Area's in sites that are located laterally relative to the present Zwin tidal flood plain (scenario 5).
Finally the Flemish Government decided on 13 March 2009 to execute the scenario of the expansion with 120 ha of the Willem-Leopoldpolder by the displacement 1,5 km inland of the sea-retaining dike, because of its still significantly beneficial effects for fauna and flora and its lesser negative impact on agriculture and cultural heritage, compared to the 180 ha scenario. Of the 120 ha of the border-straddling Willem-Leopoldpolder that will be subjected to the tide again 105 ha is located on Flemish territory and 15 ha on Dutch territory. On the Dutch side a camping has to be removed. The 105 ha on the Flemish side consists of 84 ha of cropland and 21 ha of a brackish water creek, reed marshes and recently planted woodland. Fortunately the Flemish expansion area contains no buildings. As the ground level of the Willem-Leopoldpolder lies at least 1 meter below the ground level of the present day Zwin, the expansion area will, in the first years after the displacement of the dike, probably mainly consist of a permanently inundated coastal lagoon (code *1150) and mudflats and sandflats not covered by sea water at low tide (code 1140). These habitats are expected to attract large numbers of waders and waterbirds. Because of the touristic and recreational importance of the Zwin and its hinterland the new sea-retaining dike around the expansion of the Zwin will also abundantly be provided with cycle paths and other recreational facilities such as lookout points and benches. The Flemish Government offers supporting measures in favour of the farmers that will loose land as a consequence of the expansion of the Zwin. In 2010 negotiations between the Flemish Land Agency and the landowners and users of the concerned part of the Willem-Leopoldpolder are still taking place.

Conclusions

Tidal inlets with transitional environments between tidal salt marshes and coastal dunes occur at only five sites along the 155 km stretch of coast between Breskens (Netherlands) and Calais (France). Because of the rarity and specificity of these transitional environments, those sites should also be given special protection and care. Hopefully the set of measures that was agreed upon after two decades of study and discussion will allow the sustainable preservation and expansion of the Zwin as one of the best known tidal inlets of north-western continental Europe.

References

Anselin, A., Jacob, J.-P. & Van Den Bossche, W. (2000) Belgium, pp. 103 – 122 in M.F. Heath & M.I. Evans, eds. Important Bird Areas in Europe: Priority sites for conservation. 1: Northern Europe. Cambridge, U.K.: BirdLife International (Birdlife Conservation Series No 8).

Bot, J. (2007). Vogelrichtlijngebied BE2501033 - Het Zwin. Instandhoudingsdoelstellingen voor het Vogelrichtlijngebied Het Zwin (en het Zwin in het bijzonder). Ongepubliceerd rapprot van het Agentschap voor Natuur en Bos van de Vlaamse Overheid, Brussel, Belgium, 82 pp.

Bot, J. (2007). Habitatrichtlijngebieden BE2500001 Duingebieden inclusief IJzermonding en Zwin en BE2500002 Polders. Instandhoudingsdoelstellingen voor het Zwin en achterligende Willem-Leopoldpolder in het kader van de Habitatrichlijn. Ongepubliceerd rapport van het Agentschap voor Natuur en Bos van de Vlaamse Overheid, Brussel, Belgium, 65 pp.

De Wolf, P. (2003). Naar een oplossing voor het verzandingsprobleem ? Pp. 1-6 in Mees, J., Seys, J., Haspeslagh, J. & Struyf, K. (Eds.): Feestzitting ter afsluiting van het jubileumjaar 50 jaar Zwin – Het Zwin van gisteren naar morgen. Knokke-Heist, Belgium, 21 maart 2003. VLIZ Special Publication, 13. Vlaams Instituut voor de Zee / Compagnie Het Zoute, Oostende, Belgium

Herrier, J.-L. (2003). Het Zwin in de context van het Europees en Vlaams natuurbeleid. Pp. 1-7 in Mees, J., Seys, J., Haspeslagh, J. & Struyf, K. (Eds.): Feestzitting ter afsluiting van het jubileumjaar 50 jaar Zwin – Het Zwin van gisteren naar morgen, Knokke-Heist, Belgium, 21 maart 2003. VLIZ Special Publication, 13. Vlaams Instituut voor de Zee / Compagnie Het Zoute, Oostende, Belgium

Parent, G.H. & Burny, J. (1981). Esquisse écologique de la reserve naturelle du Zwin (Knokke-Heist, Belgique): évolution dynamique du tapis vegetal et relations entre l'avifaune et la vegetation, 1. Les Naturalistes Belges 62 (3-4): 49 – 86.

Parent, G.H. & Burny, J. (1981). Esquisse écologique de la reserve naturelle du Zwin (Knokke-Heist, Belgique): évolution dynamique du tapis vegetal et relations entre l'avifaune et la vegetation, 2. Les Naturalistes Belges 62 (9-10): 210 – 231

Projectdirectie Ontwikkelingsschets Schelde-estuarium (ProSes) (2004). Ontwikkelingsschets 2020 voor het Schelde-estuarium. Technische Scheldecommissie.

Ryckaert, M. (1985). Het ontstaan van het Zwin. Pp 17 – 25 in Welvaert, F., Dierickx-Visschers, F. (Eds.): 2000 jaar Zwinstreek. Mappamundi: Brugge, Belgium