

## The Forests of Atlantic Europe

EFIATLANTIC, a regional office of the European Forest Institute is based in Bordeaux. It seeks to promote the interests of forest research organisations and universities in the Atlantic region of Europe, from Scotland to northern Portugal. It does this through networking, coordination of research, advocacy and communication. Throughout the region, there is a focus on plantation forestry.

This is the first in a series of articles on forestry in Atlantic Europe. While production is the primary management objective throughout the region, forests are used for a variety of purposes. This article deals with the forests of coastal dunes in France and Portugal.



Maritime pine (*Pinus pinaster*) forest, Département des Landes, Aquitaine, France.

## Forests of soft coasts

Edward P. Farrell<sup>a\*</sup>

### Abstract

For centuries, forests have been established on coastal dunes in an effort to stabilise shifting sands which were making habitation of coastal areas difficult, if not impossible. The greatest area of coastal dunes in Europe is in Aquitaine, in south-west France. The paper describes techniques developed in the 19<sup>th</sup> century to stabilise mobile dunes and the contribution played by dune forests in the process. The practice developed in Aquitaine has been taken up in many other countries. Forests continue to play a role in dune stabilisation, but in a more site-specific manner, with greater concern for the conservation of the dune ecosystem. Over two centuries, the primary function of the coastal dune forests of south-west France has changed from coastal protection, to resin production, to wood production and in recent decades, to recreation.

**Keywords:** *Coastal forests, dune stabilisation, Aquitaine, the Landes, maritime pine.*

### Shifting dunes – a threat to coastal communities

The coastal dunes of the Atlantic Biogeographical Region are the most important dune systems in Europe (Houston 2005). Large dune systems occur on the west coast of Denmark, in Ireland and Scotland and in the Netherlands, but the most extensive are in south-west France, in the Bay of Biscay, on the coast of Aquitaine. Mobile dunes have presented a serious threat to coastal communities over many centuries. Forests have played and continue to play, an important role in the stabilisation of shifting sands.

Dunes have traditionally been used for a variety of purposes including sand extraction, cutting of dune grasses, cultivation and grazing. With proper management, most of these activities can be sustained but unregulated exploitation has often contributed to destabilisation (Blanchard 1926, Houston 2005). Mobile dunes and the subsequent sand invasion of farmland and villages were common problems for many centuries, not only in Aquitaine, but also in Brittany as well as Denmark, Scotland and Ireland. Houses, farms and even whole villages were buried. However, due to their poverty, the inhabitants of these regions could not survive without the grazing and the fuel, or the thatching material which the dunes provided, thus exacerbating the problem.

In the west of Ireland, shifting sands were responsible for the destruction of pasture land and burying villages (Kinahan and McHenry 1882). It is interesting to note that a stand of maritime pine, from seed imported from Bordeaux, was established on shifting sand dunes in Co. Sligo, in about 1840 and although “not of much value as timber”, was reported as being of “great benefit” forty years later (Kinahan and McHenry 1882).

<sup>a</sup> Sequoia, Mart Lane, Foxrock, Dublin 18.

\* Corresponding author: epfarrell@gmail.com

### The stabilisation of coastal dunes

Afforestation of coastal dunes has been employed as a means of stabilising mobile dunes for several centuries. The first attempts at stabilising the shifting sands of Aquitaine were undertaken in Bayonne, in the sixteenth century. Planting of dune vegetation was followed by afforestation with “sea pines”, presumably maritime pine (*Pinus pinaster* Aiton). In 1737, stone or umbrella pine (*Pinus pinea* L.) was planted to stabilise sand dunes in Doñana in southwest Spain (van der Meulen and Salman 1996).

The coastal dunes of Aquitaine stretch for 230 km from the Gironde estuary to the mouth of the River Adour, close to Bayonne (Figure 1). Since the Middle Ages, mobile dunes had made it almost impossible to inhabit the coast of Aquitaine as the sand frequently invaded villages (Cotton 1875), forcing their evacuation or relocation. The total area of the dunes is 124,000 hectares, 82,000 ha of which are classed as modern wooded dunes (Favennec 1998). Maritime pine makes up the vast proportion of these forests. In contrast to most of the artificial dune forests elsewhere in Europe, maritime pine is native to the area. This is the greatest area of coastal forest in Europe. Inland from the dunes, the great sandy plains of the moors of Gascony (*Les Landes de Gascogne*) were almost equally inhospitable. These marshy, infertile plains were thinly inhabited by shepherds, who lived frugally off the land.

In the late eighteenth century, the early afforestation efforts in Bayonne were renewed with experiments conducted in the vicinity of Arcachon, close to Cap Ferret. Although interrupted by the Revolution, these trials were successful and the stabilisation of the dunes by afforestation then became a national initiative.

In the 1820s, it became clear that these coastal plantations were themselves being threatened by the continuous advance of the dunes and by the salt spray. At this time, fore-dunes (the area directly behind the beach) did not exist as strong onshore winds removed more sand than could be trapped by the vegetation (Paskoff 2001). An



**Figure 1:** Map of France and Iberian peninsula.



**Figure 2:** *Artificial dune in Aquitaine, France.*

artificial dune, a palisade of planks augmented by wattles and bundles of brushwood, was constructed over most of the length of the coastline. The primary purpose of this was to protect the forest. The surface of the dune was planted with marram grass (*Ammophila arenarea*) and covered in branches taken from the forest to reduce the movement of the sand. Pine, in mixture with broom (*Cytisus* spp.) was established by direct seeding. Cotton (1875) gives a highly detailed account of the procedure. This technique proved very successful. By 1862, the entire coastline was protected by these dunes. The fact that essentially the same techniques are currently in use is testament to the innovation and ingenuity of those who developed them 200 years ago (Figure 2).

The artificial dune requires regular attention. It was well maintained until the beginning of the twentieth century (Barrère 1992), but subsequently underwent long



**Figure 3:** *Dune forest in Aquitaine, France.*



**Figure 4:** *Production forest in Leiria, Portugal.*

periods of neglect. It was damaged by storms and suffered severely during the Second World War, when the coastline was a restricted military area.

Although blowouts and incidents of invasion still occur, the coastal sands have now been stabilised and the whole region is now forested (almost entirely with maritime pine). The dune forests are located on the inland dunes (Figure 3). The non-wooded coastal dunes are still mobile, under the influence of the wind and the sea, which are constantly remodelling the coastline. The main threats to the dunes now are rapid marine erosion, intense aeolian dynamics and tourist pressure (Paskoff 2001).

The afforestation of the coastal dunes of Aquitaine coincided with a much larger project, *Reboisement* – the reforestation of France. As part of this, the great inland forest of *Les Landes de Gascogne* was established. This was quite separate from the coastal afforestation, although it was facilitated both by the stabilisation of the coastal dunes and the experience gained in their afforestation.

The work on the stabilisation of the dunes of Aquitaine subsequently inspired a similar approach in several other countries including the United Kingdom (MacDonald 1954), Denmark (Skarregaard 1989) and New Zealand (Gadgil and Ede 1998). Dune protection in the National Forest of Leiria (*Mata Nacional de Leiria*) in Central Portugal (Martins 1989), modelled directly on French practice, commenced in 1900. The forest is 11,000 ha in extent. It is composed of almost entirely of maritime pine, and although the great proportion of the area is managed as a production forest (Figure 4), it is truly multifunctional. There is a distinct protection area, with an artificial dune, and inland of it, a shrub zone of *Acacia horrida*, *Ulex* spp., *Erica* spp., *Corema album* and *Myrica faya* (Figure 5). Resin is still produced, although on a very small scale. The forest is heavily used for recreation; beekeeping, mushroom picking and hunting are also practised.



**Figure 5:** *Shrub zone, Leiria, Portugal.*

### **Dune afforestation in Ireland**

There are a number of dune forests in Ireland, notably in Donegal (Murvagh, Ards Forest Park and Horn Head) and in Wexford (Raven Nature Reserve). Perhaps the best known is the Raven, at Curracloe, in Wexford (Figure 6). The land in this property is owned by the National Parks and Wildlife Service, but the forest stands are in Coillte ownership (Kilbride Forest). The property (217 ha) was acquired by the State in 1931 and afforested with a range of species including maritime pine, Scots pine (*Pinus sylvestris* L.), radiata pine (*P. radiata* D. Don) and alder (*Alnus glutinosa* L.). Deasy (1946), who described the establishment procedures and early performance in detail, refers to the “afforestation of wasteland”. While there is little doubt that knowledge of the French experience gave a measure of confidence that the venture could succeed and also influenced the selection of species, notably maritime pine, it is clear that the primary management objective was not coastal protection. Indeed, despite the history of shifting sands, improved dune management and conservation have greatly reduced the problem and although recreational pressures have caused significant damage in some areas, large scale dune movement has not been a serious issue in recent decades. Given its current popularity for recreation, it is interesting to note that Deasy believed that the forest enhanced the landscape, stating that “the plantation already has an aesthetic value” contributing to the “improvement of the amenities of this stretch of coast”.

Coillte have recently prepared a management plan (2011-2015) for Kilbride Forest (Coillte Forest 2011). The Raven is designated as a conservation area. According to the plan, 15 ha per year will be clearfelled and replanted, but to date, no felling has taken place as discussions on the future management of the reserve are ongoing between Coillte and the National Parks and Wildlife Service.





**Figure 6:** *The Raven, Co. Wexford.*

### **The future of coastal forests**

The coastal forests of Aquitaine have protected the whole of the Landes de Gascognes for almost 200 years (Bartet 1997). However, the attitude to coastal dunes in general and to dune forests, in particular, has changed radically over the past 30 years. Awareness has grown that dunes are geomorphologically active environments and that the plants and animals which inhabit the dunes have evolved strategies to cope with the stress and disturbance brought about by the shifting sands, violent winds and salt deposition (Godfrey and Godfrey 1974). Concern for the conservation of the dune ecosystem has grown and with it the realisation that, rather than stabilising the dunes, their mobility should be promoted (Wanders 1989). Mobile dunes, if allowed to take on their natural forms of least wind resistance, will stabilise at a certain distance from the coastline. Where human settlements are threatened and stabilisation is necessary, the challenge is to achieve it without detracting from biodiversity and landscape values (Houston 2005). The ONF (Office National des Forêts), who manage much of the coast of Aquitaine, have been innovative in their approach to the management of coastal dunes. They have responsibility for the management of both the beach and the dunes and treat both as a single management unit. Dune mobility is promoted wherever it is reasonable to do so. Felling coupes are small, natural regeneration is encouraged and where this is not feasible, direct seeding is used. The wealth of habitats and species in inner dunes requires protection from mobile dunes on the ocean side and from anthropogenic influences on the land side. The coniferous forest provides an environment that favours the growth of native broadleaved species, such as pedunculate oak (*Quercus robur* L.), cork oak (*Q. suber* L.), olm oak (*Q. ilex* L.) and the strawberry tree (*Arbutus unedo* L.). The management objective is to move slowly towards a mixed pine-oak forest, so these species are promoted.

Management strategies have also been developed for the protection of other plant species, in particular very rare orchids (summer lady's tresses, *Spiranthes aestivalis* and the fen orchid, *Liparis loeselii*). The recreational pressures on the vulnerable dune ecosystems require careful management. Access to the beach is limited to managed footpaths, stabilised where necessary by wooden walkways. The public are made aware of the fragile nature of the dunes, by means of an educational programme including posters designed to inform without insisting on compliance.

Stands of maritime pine have had a long history of multiple use. The changing management objectives of the Forest of Lège, at Cap Ferret, Aquitaine, illustrates this (S. Métayer, ONF, pers. comm.). Originally, the forest was seen as having two functions, dune stabilisation and resin production. It was only in the 1930s that wood production was considered a management objective. By the 1950s, it had become the major objective. Commercial resin production ceased in 1974. In 1975, the forest was opened to the public with the construction of the first car park. Hunting also became important around this time. Recreation is the primary function and biodiversity is considered an additional function of the forest. The emphasis on production increases on a coast-inland gradient. Close to the coast, ecological, protection and recreational functions predominate.

The success of plantations in stabilising mobile dunes led to the indiscriminate planting of dunes whether or not they needed to be stabilised (van der Meulen and Salman 1996). Sometimes dunes were afforested purely for economic reasons with little or no consideration of a protective function. Geelin (2001) maintains that in the past there was an excessive concern for stopping blowouts and stabilising moving dunes. Some ecologists have called for the removal of dune forests, maintaining that the pine plantations eliminate most of the indigenous flora and fauna, as lowering of the water-table results in the loss of rare plants and the development of scrub. It is important that this momentum is tempered by a clear view of the objectives of such removals and a realistic assessment of the feasibility of achieving them. It is also important that the recreational and amenity functions that these forests perform today be recognised. Public opinion might prove to be a much bigger obstacle to large-scale clearance of dune forests, which have become very popular for recreation. Enlightened forest management might well prove a more realistic and effective solution. Rather than clearfelling extensive areas of dune forest, it may be preferable to favour broadleaves, preferably native species, gradually converting pine monoculture to mixed forest (Houston 1989) to increase ecological diversity.

The Council of Europe has published a code of conduct for coastal zones (Council of Europe 1999). They point to the economic importance of coastal forests for tourism and recreation. While the environmental benefits of native forests are recognised, the negative impacts of intensive forest management, particularly with introduced species, are considerable. Nevertheless, while rehabilitation, including forest clearance is an option, the contribution of these long-established forests to biodiversity has to be acknowledged.

## Conclusions

The practice of establishing forests on coastal dunes goes back almost 200 years.



Originally established with the single objective of stabilising shifting sands, they have become multifunctional in character. The goods and services which they provide could never have been envisaged at the time they were established. Sand stabilisation is often now unnecessary or may even be considered undesirable. Resin production has ceased or declined to insignificance. Recreation is now the major function of many of these forests. The ecological importance of the dunes is now recognised. The conservation of the dune ecosystems may necessitate the removal of forests in certain places but, whatever their origins, the forests established on the soft coasts of Atlantic Europe have become a permanent feature of the dune landscape, providing multiple benefits which are valued by society.

### Acknowledgements

My thanks are due to Jean-Michel Carnus, INRA, Pierroton, Aquitaine and Margarida Tomé, Instituto Superior de Agronomia, Technical University, Lisbon, for facilities and support in France and Portugal respectively. Many people provided information and advice and help in field visits. In France, these include Christophe Orazio, EFIATLANTIC, Pierroton, Yves Lesgourgues and Remi Rodriguez, CPRF, Bordeaux and Jean-Pierre Duval and Sylvie Métayer, ONF. In Portugal, I want to thank particularly José Tomé who was extraordinarily helpful in locating contacts and bringing me to field sites. Thanks are also due to Rita Gomes who brought me on a guided tour of the National Forest of Leiria.

### References

- Barrère, P. 1992. Dynamics and management of the coastal dunes of the Landes, Gascony, France. In *Coastal Dunes. Geomorphology, Ecology and Management: Proceedings of the Third European Dune Congress*. Galway, Ireland. Eds. R.W.G. Carter, T.G.F. Curtis and Sheehy-Skeffington, M.J., Rotterdam, Balkema: 25-32.
- Bartet, J.-H. 1997. Gestion durable des forêts littorales. In *Biodiversité et Protection Dunaire*. Eds. Favennec, J. and Barrère, P., Paris, Lavoisier: 175-180.
- Blanchard, W.O. 1926. The Landes: Reclaimed waste lands of France. *Economic Geography* 2(2): 249-255.
- Clout, H.D. 1983. *The land of France 1815-1914*. London, George Allen and Unwin.
- Coillte Forest. 2011. [http://www.coillte.ie/fileadmin/user\\_upload/FMP-2011/wx07-killbride.pdf](http://www.coillte.ie/fileadmin/user_upload/FMP-2011/wx07-killbride.pdf) [Accessed August 2012].
- Cotton, F. 1875. Notes on the works of sowing and consolidation of the dunes or coast sand-hills of Gascony, containing information obtained from M.A. Cherot, a French economist, with a view to the introduction of similar works on the sand-drifts that are rapidly advancing over and threatening eventually to destroy the city of Beirut. *Journal of the Royal Agricultural Society of England* 2 (of second series): 435-442.
- Council of Europe. 1999. Committee for the Activities of the Council of Europe in the field of biological and landscape diversity. *European Code of Conduct for Coastal Zones*. S.G.D. o. E. a. L. Authorities, Council of Europe, pp 98.
- Deasy, J.J. 1946. Some notes on coastal afforestation in Co. Wexford. *Irish Forestry* 3(1): 29-39.
- Dorlanne, D. 1991. L'Evolution de la sylviculture du pin maritime dans le Massif Gascon. *Comptes Rendus de l'Academie d'Agriculture de France* 77: 27-40.
- Favennec, J. 1998. The dunes of the Atlantic Coast of France, typology and management. *Coastline* (1): 14-16.

- Gadgil, R.L. and Ede, F.L. 1998. Application of scientific principles to sand dune stabilization in New Zealand: past progress and future needs. *Land Degradation and Development* 9: 131-142.
- Geelin, L.H.W.T. 2001. Habitat restoration and public relations: a restoration project in the Amsterdam watersupply dunes. *Coastal Dune Management. Shared Experience of European Conservation Practice*. J. A. Houston, S. E. Edmondson and P.J. Rooney. Liverpool, Liverpool University Press.
- Godfrey, P.J. and Godfrey, M.M. 1974. An ecological approach to dune management in the national recreation areas of the United States East Coast. *International Journal of Biometeorology* 18: 101-110.
- Houston, J. 1989. The Sefton coast management scheme in North-West England. In *Perspectives in Coastal Dune Management*. Eds. van der Meulen, F., Jungerius, P.D. and Visser, J.H., SPB Academic Publishing, Den Haag, pp 249-253.
- Houston, J. 2005. The conservation of sand dunes in the Atlantic Biogeographical Region: the contribution of the LIFE programme. In *Proc.Dunes and Estuaries 2005: International Conference on Nature Restoration Practices in European Coastal Habitats*, Koksijde, Belgium, 19-23<sup>rd</sup> September 2005. Eds Herrier, J.L., Mees, J., Salmanet, A., et al. Publ. Vlaams Instituut voor de Zee (VLIZ), pp 29-44.
- Kinahan, G.H. and McHenry, A. 1882. *A Handy Book on the Reclamation of Waste Lands, Ireland*. Hodges Figgis and Co., Dublin.
- MacDonald, J. 1954. Tree planting on coastal sands in Great Britain. *Advances in Science* 11: 33-37.
- Martins, F. 1989. Morphology and management of dunes at Leiria District (Portugal). In *Perspectives in Coastal Dune Management*. Eds. van der Meulen, F., Jungerius, P.D. and Visser, J.H., SPB Academic Publishing, Den Haag, pp 81-88.
- Paskoff, R. (2001). Dune management on the Atlantic coast of France: A case study. In *Coastal Dune Management*. Eds. Houston, J.A., Edmondson, S.E. and Rooney, P.J., Liverpool University Press, Liverpool, pp 34-40.
- Skarregaard, P. 1989. Stabilisation of coastal dunes in Denmark. In *Perspectives in Coastal Dune Management*. Eds. van der Meulen, F., Jungerius, P.D. and Visser, J.H., SPB Academic Publishing, Den Haag, pp 151-161.
- Sutton, K. 1977. Reclamation of wasteland during the eighteenth and nineteenth centuries. In *Themes in the Historical Geography of France*. Ed. Clout, H.D. Publ. London, Academic Press, pp 247-300.
- van der Meulen, F. and Salman, A.H.P.M. 1996. Management of Mediterranean coastal dunes. *Ocean and Coastal Management* 30(2-3): 177-195.
- Wanders, E. 1989. Perspectives in coastal-dune management towards a dynamic approach. In *Perspectives in Coastal Dune Management*. Eds. van der Meulen, F. Jungerius, P.D. and Visser, J.H., SPB Academic Publishing, Den Haag, pp 141-148.