The magilligan foreland

Science, Geology

The Magilligan Foreland is situated in the North West of Northern Ireland and comprises a triangular beach ridge plain that stretches from Downhill in the North East to Magilligan Point, which is the northernmost spit of the Foreland (Tillmann et al, 2015). It is the ‘ largest coastal accumulation feature’ in Ireland (Wilson & Bateman 1987) covering an area of approximately 32 km² (Wilson 1996).

To the north is the Atlantic Ocean wherethe beachridge plain ends in a series of dunes. Over the past fifty years extensive research has been undertaken and published on the archaeological, ecological, hydrological, geomorphological, pedological aspects of the Magilligan coastal system making it one of the most intensively studied Holocene coastal site in Ireland.

The Holocene geomorphological development of the area has been intensively reviewed and modelled by Carter (1975, 1982, 1986); Carter et al (1982) and Wilson and Carter (1984) with research undertaken on pedogenesis by Wilson and Bateman (1986); Wilson (1987) and Wilson and Farrington (1989). In recent years a more integrated approach to investigating the origins, characteristics and management requirements of the complex has been undertaken by Carter and Wilson (1990), Orford et al (2003) and Tillmann et al (2015).

Factors that Influenced the Formation

During the post-glacial transgression (8000 to 9000 years B. P.) the sea flooded into the Foyle Valley. As the sea level fell due to isostatic and eustatic adjustment it initiated a major phase of coastal sediment deposition.

The reduced wave base resulted in the onshore transfer of sand and this, together with a gradual reduction in the tidal regime of the Lough, caused the formation of a series of Atlantic shore parallel beach ridges. As the site grew with the addition of more beach ridges, the ridge depressions stabilised and peat and podzolic soils formed between 2500 and 1000 years B. P. creating a land surface which indicate a significant period of stability (Figure xx).

With the stabilizing sea level, the ridge building slowed and the Foreland began to be eroded on the Lough Foyle side which released sediment for redistribution by aeolian processes. These covered most of the inner surface of the foreland area. Along the northeast coast the dunes developed as sand was released by erosion of the beach ridge/dune system and was moved forward by onshore winds.

Temporal and Spatial Historical Changes

Carter and Stone (1989) have reviewed how a 15-year programme monitoring dune recession at Magilligan has highlighted both temporal and spatial contrasts in processes and morphology. The soft sedimentary coastal landscape system found at Magilligan represents a fast-responding and mobile geomorphic system that is highly sensitive to environmental change. Hansom (2001) has reviewed how the development of coastal systems similar to that found at Magilligan can be related to " fundamental changes over the Holocene and can be demonstrated at a variety of scales".

It has been argued by landowners and others that over the years severe erosion has affected much of the Lough Foyle shore of the Magilligan

Foreland with more intense erosion taking place on the Atlantic shore west of Benone. This has resulted in calls for engineered interventions to protect property. However, at the same time, photographic evidence has indicated that the distal extremity of the system at Magilligan Point is prograding with new foredune ridges developing.

Variations in the erosion of the Magilligan shore over short time periods are due to a complex interplay of climatic factors, particularly storm frequency and wind direction, tidal levels and wave refraction characteristics. Data from the Marine Institute’s East Atlantic SWAN wave model show the monthly mean wave period (seconds) for the area around Lough Foyle, Greencastle, Magilligan, and Benone for the period September 2016 to August 2017 reflects the two distinct wave/tide climates referred to in Carter (1975) (Figure xx) and described by Carter et al (1982).

This has strongly influenced the morphological development of the site contributing to the negative feedback experienced with the region sediment budget and in particular influencing the erosion/accretion model of the subtidal ebb shoal (Figure xx). This supported by Carter (1979) who has detailed how the " beach ridge and dune development are directly related to erosion of the adjoining coastline and the efficiency of the sediment transport system".

This evidence supports that the system at Magilligan experiences both spatial and temporal negative feedback whereby erosion is balanced out by accretion over a 30 to 40-year cycle (Carter et al 1982) resulting in a state of equilibrium – in the absence of new external factors (for example rising sea

level as a result ofglobal warming) this is likely to remain the case with the existing sediment budget continuing to be recycled.