Healthy Estuaries 2020 Toolbox Explained

http://publications.naturalengland.org.uk/publication/4734703644966912

The **Heathy Estuaries 2020 Toolbox** (HET) is an approach that focuses on the longer-term sustainability of estuary systems to address coastal squeeze in particular and inform management decisions. HET will enable more effective and consistent advice to the Environment Agency on intertidal habitat creation needed by 2020 to address coastal squeeze. The aim is to understand the requirements that will move the intertidal habitat and estuary features towards favourable condition within the Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) and their underpinning SSSIs in order to meet national and international obligations for biodiversity.

The science behind the tool is referred to as **Regime Theory**, which is the empirical relationship between tidal prism and cross section area. An empirical relationship is one that is borne from observation and measurement in the field. **Tidal prism** is the amount of water entering an estuary with the **cross sectional area** taken from a point or points along the estuaries reach.

The seminal paper on **Regime Theory** is O'Brien (1931)[1] following this work data for tidal prism and cross sectional area has been collected and analysed globally, reflecting the relationship between **tidal prism** and **cross sectional area**. The data for UK estuary prism-area (Figure 1) illustrates the strong positive relationship between the two variables, i.e. greater cross sectional area = greater tidal prism.

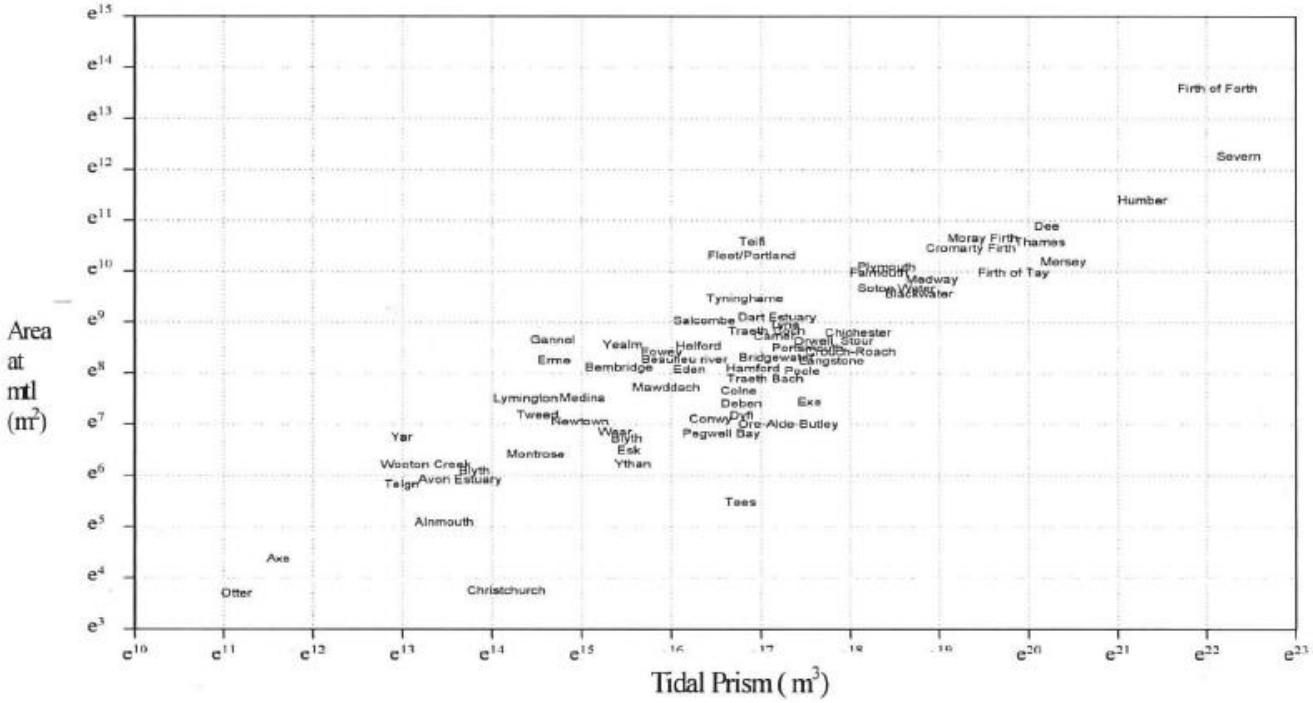

Figure 1. UK estuary prism-area data http://eprints.hrwallingford.co.uk/283/1/TR111.pdf#page=99

The HET has been developed using GIS software (ESRI ArcMap) the data input requirements are whole estuary LiDAR and Bathymetry shapefiles. **LiDAR**, which stands for Light Detection and Ranging, is a remote sensing method, measuring distance to the Earth. Where **Bathymetry** is the measurement of the depth of water in oceans, estuaries and rivers. These two sets of shapefiles are digitally stitched together to form a complete picture of the estuary form (Figure 2).

[1] O'Brien, M.P. 1931. Estuary tidal prism related to entrance areas. Civil Engineering, 1, 738-739.

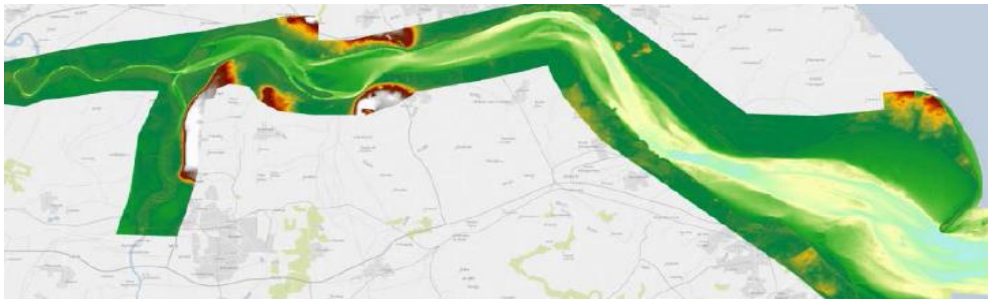

Figure 2. A section of the Humber data, displaying the combined LiDAR and Bathymetry.

To understand the Tidal Prism component of the estuary, **Tidal Datum** is required from **Admiralty Tide Tables** to define various parameters[2]. This informs the HET and enables a digital picture of the water coming into and out of the estuary to be realised. Figure 3 is an example from the Humber.

Figure 3. Tidal datum surfaces in the Humber Estuary. MHWS, MHWN, MLWS.

Subsequently periodic cross sections are chosen for the length of the estuary (Figure 4). These cross sections are used in the HET to understand the relationship between prism and area producing a comparison between the *measured* **observed estuary form** (i.e. what the current state of the estuary is) against the *predicted* **expected estuary form** (i.e. what the regime theory relationship suggests the estuary should look like).

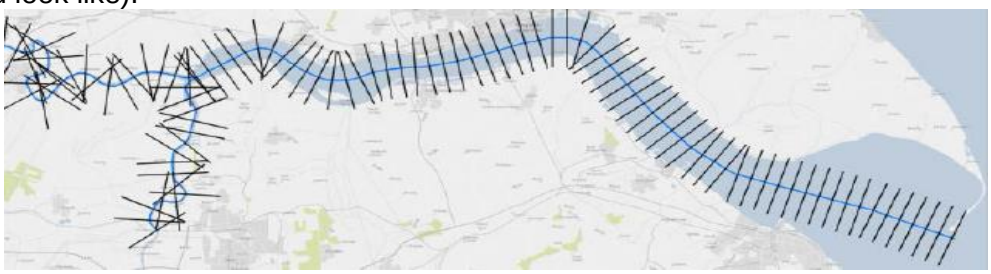

Figure 4. Automatic positioning of sections in the Humber Estuary.

Once these cross sections of observed and expected are plotted and digitally stitched together (Figure 5), you can begin to deduct reaches of the estuary that are too wide or too narrow. This evidence will then be used to inform management decisions, such as advising the Environment Agency on areas of intertidal habitat creation needed by 2020 to address coastal squeeze.

Figure 5. Comparison of *measured* **observed estuary form** and *predicted* **expected estuary form** widths in the Humber Estuary.

[2] MHWS = Mean High Water Spring. MHWN = Mean High Water Neap. MLWS = Mean Low Water Spring.