Valuing the Nitrogen, Phosphorous and Carbon Sequestration Potential of Coastal Habitats

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1 Introduction

Integrating the value of **natural capital** within economic and environmental management systems is gaining increasing attention and interest from international governments, regulators, and companies. However, future coastal management interventions to improve **water quality** and set targets on **Net Zero** are often confounded by an inability to understand natural capital in terms of the **function of critical habitats**. Using the Solent region of the UK as a case study, we adopted a three-step approach to assess the contribution of marine habitats to remediating **nutrient and CO_2** impacts. This critical evidence base will provide evidence to support local policy decisions (e.g**., Net Gain, nitrogen neutrality**), but will also provide a repeatable methodology that can be applied to other temperate coastal marine systems.

2. Methods

1) Information on EUNIS habitat extent for six main habitats (littoral sediments, sublittoral sediments, saltmarsh, seagrass beds, water-fringing reedbeds (*Phragmites australis*) and native oyster beds (*Ostrea edulis*) were collated into maps using GIS for the Solent (Figure 1)

2) We then combined measurable biophysical rates for nitrogen (N), and phosphorus (P) and carbon (C) removal, as a function of denitrification and burial in soils and sediments. Rates were quantified from previous studies and literature reviews (see Watson *et al.,* 2020) for coastal and estuarine habitats similar to those in the Solent.

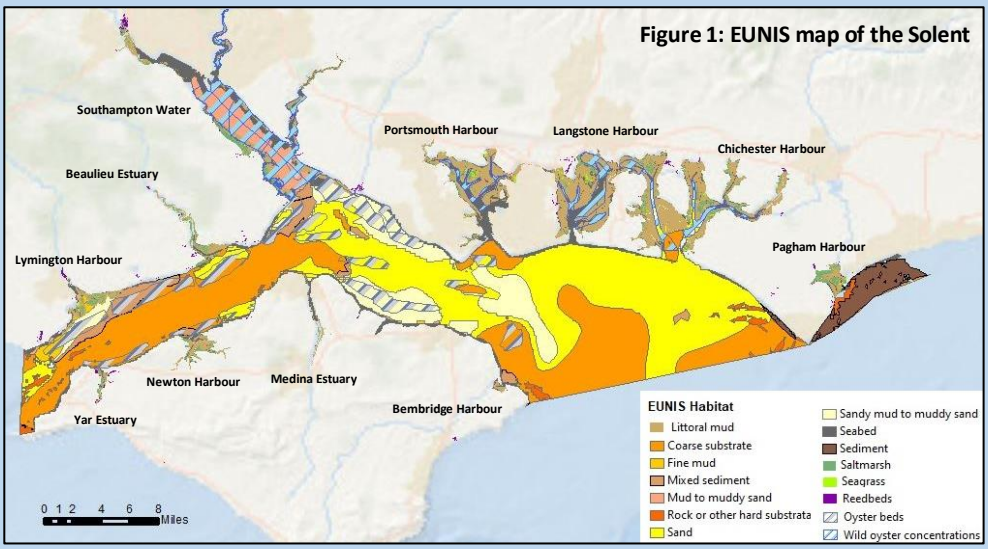
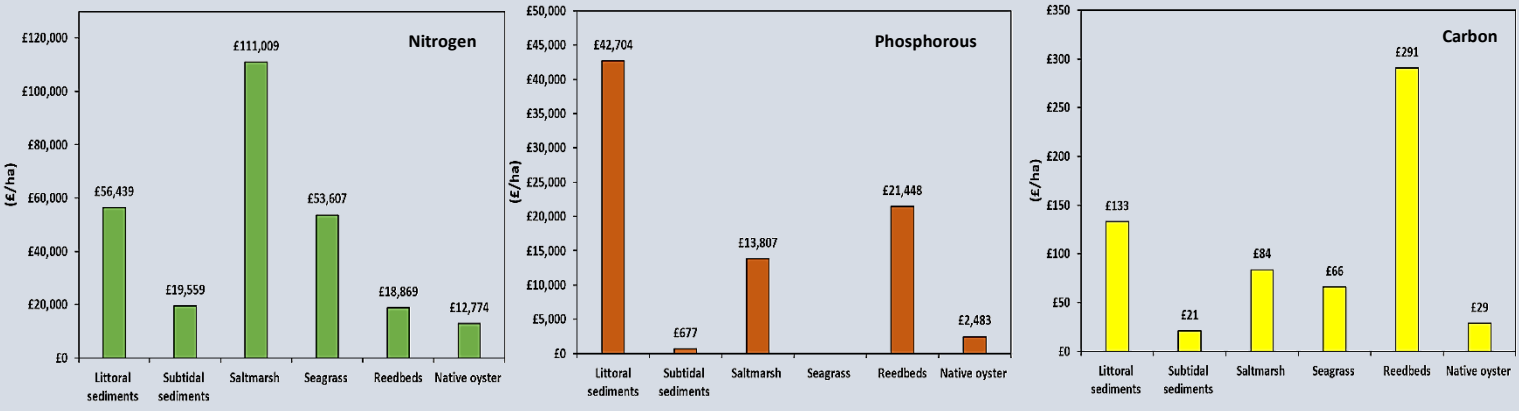


Figure 1: EUNIS map of the Solent

3) To estimate the economic value associated with nitrogen and phosphorous storage we used a replacement cost valuation method using actual costs of nutrient reduction measures undertaken on the UK's southwest coast. Average abatement and replacement costs of reducing N, P and C are estimated here as £295 kg^{-1} for N, £282 kg^{-1} for P and £60 ton^{-1} for C.

3. Results



4. Conclusions

1) The N, P and C removal valuations provide compelling evidence that the natural environment of the SEMS provides significant and sustained economic value (potentially billions of £) to society. Many of these regulating ecosystem services have traditionally been unvalued in respect to land use/coastal planning.

2) We found high rates of N sequestration (on a per ha basis) in coastal vegetated habitats such as saltmarshes and seagrass while littoral sediments were highly valued (£) for N, P and C sequestration. P and C sequestration was also very high in reedbed (*Phragmites australis*) habitats.

3) Given the continuing need to reverse historic environmental declines and prepare for new developments and climate change, this work shows where investment will enhance the nutrient and CO_2 removal services provided by the Solent's waterbodies; and thus, increase the SEMS (and indeed the UK's) overall natural capital.

5. References

Watson, S.C.L., Preston, J., Beaumont, N.J. and Watson, G.J., (2020). Assessing the natural capital value of water quality and climate regulation in temperate marine systems using a EUNIS biotope classification approach. Science of the Total Environment, 744, p.140688

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