SOUTH EAST DEVON
HABITAT REGULATIONS
PARTNERSHIP

South East Devon Habitat Regulations Executive Committee

Dawlish Warren National Nature Reserve –
2023 trampling and nutrient enrichment assessment.

January 2024

East Devon

Exeter City Council

Teignbridge DISTRICT COUNCIL South Devon

Legal comment/advice:

There are no substantive legal issues to be added to this report.

Finance comment/advice:

No direct financial implication arise from the report other than any increase in surveying will incur/require increased funding.

Public Document: Yes
Exemption: None
Review date for release: None

Recommendations

It is proposed that the Executive Committee:

1. Notes the results of the trampling and nutrient enrichment assessment relating to impacts associated with human activity at Dawlish Warren NNR.
2. Receives an updated trampling and nutrient enrichment survey report as part of the ongoing monitoring programme in 2026.

Equalities impact: Low

Risk: Low

The attached report, included here as Appendix A, provides a detailed and updated methodology and baseline with which to assess future trends and patterns of impacts associated with human activity at Dawlish Warren NNR.

1. Summary

1.1 Dawlish Warren National Nature Reserve (NNR) comprises 505 acres centred on a 1.5 mile long, double sand spit extending out into the mouth of the Exe Estuary. The site is designated as a Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC) and is part of the Exe Estuary Special Protection Area (SPA) and Ramsar site.

1.2 In 2010, Teignbridge District Council (TDC) commissioned a report[1] to consider the impacts of recreation on Dawlish Warren and to identify the extent to which access was impacting the site.

1.4 That report, which later fed into the South East Devon European Site Mitigation Strategy, found that the impact of recreational pressure on Dawlish Warren was closely intertwined with other factors operating on the site, most notably coastal erosion, the presence of sea defences, the naturally dynamic state of sand dune habitats and management practices. The role of trampling (people treading on plants) in particular was ambiguous. In some places it contributed to maintaining the preferred habitat conditions, whereas in other places it was leading to significant erosion problems.

1.5 The report went on to state that, in the absence of significant rabbit grazing, trampling was playing a positive role in maintaining the short, open sward required by many of the characteristic plants of the fixed dune grassland at Dawlish Warren. However, the diffuse trampling required to do this is difficult to achieve and the level of visitor pressure which was creating a suitable sward in some places was also leading to significant wear and erosion in other places.

[1] *Lake, S. (2010) Assessment of recreational impacts on Dawlish Warren Special Area of Conservation. Teignbridge District Council/Footprint Ecology*

1.6 Trampling was found to play a similar role in the humid dune slacks (areas seasonally inundated with water), where a level of diffuse trampling is thought to create suitable conditions for specific communities and species. At the time of the report there was insufficient data available to establish the extent to which these communities benefited from trampling and when/where the tipping point was likely to be reached.

1.7 Separately, the report found that despite a "pick up" policy, nutrient enrichment, presumed from dog faeces, was evident near access points in the fixed dune grassland, where the characteristic dune grassland flora is in places replaced by coarser vegetation more likely to benefit from increased nutrient levels.

1.8 The last decade has seen substantial changes to the habitats and management of Dawlish Warren. Most significantly with the Dawlish Warren Beach Management Scheme (DWBMS), which during 2017 saw the removal of much of the hard engineering from the dunes along most of the frontage of the site and a beach recharge which allows a greater percentage of the site to become more dynamic. There has also been the continued use of winter Pony grazing, a scrub reduction programme and increased use of tractor mounted mechanised cutting devices.

1.9 The 2019 botanical survey was co-funded by Teignbridge District Council and the South East Devon Habitat Regulations Partnership (SEDHRP).

1.10 Following the timescales recommended in the 2019 report, a repeat survey was commissioned by SEDHRP in 2022 and, due to site conditions, carried out in 2023. A full botanical survey of the site (such as was carried out in 2019) is outside of the scope of the required survey and therefore no additional funding was sought from TDC.

1.11 The 2023 assessment is the first report since the baseline was established in 2019 and will contribute to ongoing monitoring to ensure that the site is in favourable conservation status and that national and international obligations are being met.

2. The survey

2.1 Devon Biodiversity Records Centre (DBRC) were again awarded the contract to carry out the survey and report work.

2.2 Main objectives of the survey in relation to human impacts on the site (and therefore within the scope of SEDHRP funding) were unchanged from 2019:

- Produce detailed, colour coded heat maps of areas of fixed dune and dune slack vegetation subject to significant trampling pressure.
- Identify, and list in order of severity, any areas of fixed dune and/or dune slack vegetation at risk of significant erosion from trampling pressure.
- Identify and map areas of fixed dune and/or dune slack subject to nutrient enrichment from dog fouling.

2.3 The report in its entirety is included here as Appendix A. As described in sections 2.2 and 2.3 of the report, different methods were used to collect data in order to assess (a) trampling impact and risk; and (b) patterns of eutrophication (increased nutrient) impacts on the site's vegetation.

3 Trampling impact and risk.

3.1 Aligning with the Footprint study of 2010 and the 2019 botanical survey, the site was split into 25m x 25m grids via a computer Geographic Information System (GIS) and thereafter a 5-point scale was defined to estimate trampling intensity and erosion risk. This scale ranged from (1) Slight risk/impact areas to (5) Very high risk/impact areas.

3.2 The assessment of 573 cells was initially carried out by interpretation of high resolution, recent aerial photography. Seasonal variation in aerial imagery and the impacts of drought in the summer of 2022 meant that certain cells were considered ambiguous or determined with low levels of certainty. These areas were therefore included in the list of squares to be assessed in the field.

3.3 To "ground truth" the assessment, a sample of 183 cells were assessed onsite by the surveyors, with an independent re-assessment of the 5-point scale in the field. Of the ground-trothed cells, 39 were changed from the initial desk-based scoring, giving it an accuracy of around 79%

3.4 The report rightly states that sand dune systems are, by their nature, dynamic and there is a complex interaction between natural processes which cause erosion and changes caused by human activity. The independent reassessment of the situation on the ground was aimed at minimising this effect, which could result if only a desk-based study of aerial imagery was undertaken.

3.5 The data from these assessments were rendered as a "heatmap" (see Appendix B) covering the site, for visualisation of trampling impacts.

4. Eutrophication assessment.

4.1 To standardise the survey methodology on increased nutrient risk to the site's vegetation, the 2019 methodology was adapted. Cells from the 25m x 25m grid were selected for vegetation assessment based on the location of quadrats used in previous assessments. This selection was then expanded to provide a wider and representative coverage of the site.

4.2 As in the trampling assessment, the surveyor utilised GIS to determine the location of squares, and their own GPS position. The surveyor would then compile a species list from the centre of the square and take photographs of the vegetation present. Species abundance was estimated and noted using the DAFOR (Dominant, 1, Abundant, 2, Frequent, 3, Occasional, 4, Rare, 5) scale.

4.3 The DAFOR value was then weighted with a Fertility indicator score[2] against the number of species within a cell to calculate an overall score for that cell.

[2] *The Ellenberg score (Hill et al. 1999)*

4.4. A composite score for each quadrat was then calculated and used to generate a separate heatmap visualisation (see Appendix C) to indicate areas of enrichment from all sources.

4.5 All instances of dog (and other) waste encountered during surveying were recorded and superimposed on the heatmap. This was not a systematic survey but was considered helpful in terms of providing supplementary information about the distribution of excess nutrients as a result of recreational use of the site.

4.6 Analysis of composite fertility indicator scores does not in itself distinguish between nutrient enrichment caused by recreational use of the site and pockets of soil and habitat which have naturally developed fertility through autogenic processes (accumulation of soil organic matter, Nitrogen (N) fixation etc).

4.7 To go some way to remedy this, another stage of analysis was undertaken using the species list referred to in 4.2 (above). From this list, a subset of indicator species which are known to be indicative of soil "improvement" and enrichment from human-derived sources was established. These were either species of intermediate to high fertility scores or generalist species known to invade and out-compete specialist plants reliant upon low nutrient levels.

4.8 For each cell, a composite score based on the relative abundance of any of the indicator species present was calculated by summing their DAFOR values.

4.9 With these scores, a second heatmap was generated (see Appendix D), showing the relative concentration of these indicator species and annotated with records of recent dog fouling. This could then be used to aid interpretation of the indicative soil fertility map, focusing on specific, human-derived enrichment.

5. Results

5.1 As found in the 2019 survey, the pattern of trampling and erosion risk throughout the site remains complex. The majority of hotspots are centred around access points to the reserve, path nodes and corridors between the amenity beach and the interior of the site.

5.2 There has been significant coastal erosion around the edge of Warren Point. A large number of squares assessed in the previous survey no longer contain vegetation. The 2019 pattern of linear pressure from walkers that follow the edge of the beach and dunes around the point has simply been replicated along the newly eroded edges of established vegetation.

5.3 The results of the indicative soil fertility mapping show higher levels of fertility:

1. in and around the southern end of the site near the entrance gates and in a corridor between the entrance and the visitor centre.
2. in the dune slack to the west of the main trackway.
3. at the narrowing west of groynes 8 to 10.
4. in some diffuse areas within the Marram grassland on Warren Point

5.4 Looking at the results with a focus on species considered indicative of dog fouling indicates that 1 (above) is the key area of risk with some more moderate effects scattered along the back path and in the area of grassland between the main trackway/Greenland Lake and the dune ridge level with groynes 5 to 8.

6. Conclusion

6.1 The significant areas of risk from erosion from recreational trampling pressure are mostly associated with the frontal dune ridge. These are often in areas which technically belong to mobile dune vegetation types but are partially stabilised. Specifically for fixed dune and dune slack habitats the risk areas in order of decreasing severity are:

1. A small area of dune grassland at the extreme south end of the reserve next to the pedestrian entrance and adjacent to the buffer zone.
2. A particularly high density of path nodes and desire lines concentrates pressure on a relatively small area where the site narrows to the dune ridge level with groyne 8. Here there are a mixture of grassland types including dry and damp communities with the dune slack habitat reaching its northern limit flanked by areas of both fixed and semi-fixed turf.
3. The turf in a corridor on both sides of the main access track and footpath from the south end of the reserve to the visitor centre. Abrasion is frequent in these areas and is necessary to maintain the habitat suitable for some notable species present but risk of abrasion turning to net erosion and habitat loss is still significant.
4. The turf along the back path and in a corridor linking the back path and main trackway between the visitor centre and pond (i.e., along south edge of flood bank). Impacts are more diffuse in these areas but moderately high locally.

6.2 The impact of dog waste (including urine and faeces) deposited on the low nutrient soils of sand dune habitats is not well understood. There is little empirical evidence or research from which to draw on for mitigation or management strategies. Jones et al. (2004) found that the varying habitats and soils within a sand dune system responded to atmospheric N deposition in complex and non-linear ways.

6.3 The report notes that an assumption that dog fouling causes increasing levels of nutrient in the soil and is available to plants has been anecdotally connected to observations of the spread of generalist (or nutrient demanding) plants (at the expense of specialist less competitive species of more open habitats). Whilst N values have been used in the study as a proxy for mapping fertility, it should be noted that it is an untested assumption that a causal relationship between dog fouling and increased N values exists in dune vegetation.

6. 4 The map (Appendix C) therefore gives context on the distribution of species and vegetation associated with higher fertility soils but does not necessarily indicate human-derived nutrient enrichment (from recreational use and dog fouling). A further layer of interpretation drawing on the incidence of indicator species (Appendix D) has been applied to interpret the areas listed at 5.3 (above):

1. the southern end of the site near the entrance gates and in a corridor between the entrance and the visitor centre.

Although no systematic survey of dog use was undertaken, the occurrence of visible dog fouling was recorded during the survey, and this broadly coincided with the areas where dog faeces were most encountered and the highest recorded abundance of indicator species. It is also a high-pressure area for trampling.

2. the dune slack to the west of the main trackway.

Contrary to the map (Appendix D), indicator species were not abundant in this area. The vegetation data indicate that the apparent fertility here is more likely to be driven by autogenic ("natural") than anthropogenic (human derived) processes. However, it is possible that dog fouling does contribute and that nutrients deposited in adjacent areas of higher usage may collect here.

3. the narrowing west of groynes 8 to 10.

Although this is an area of higher trampling pressure (with the potential for dog fouling effects to be concentrated) the apparent fertility is thought to be related more to vegetation and disturbance history in this area than direct effects of dog fouling. This area has supported rank grassland and scrub in the past (Wheeler and Wilson 2013, DBRC 2020) and subsequent management or the persistence of woody vegetation may influence nutrient levels.

4. some diffuse areas within the Marram grassland on Warren Point.

It is unlikely that this is directly influenced by recreation, due to the limited footfall (and dog ban) within the area. When reviewing the species data of high scoring quadrats within Warren Point, the majority of them supported frequent populations of bramble and evening primrose, which both score 5 on the fertility indicator scale. The abundance of these species has weighted the scores towards the upper end of the scale and could suggest that the lack of disturbance or over stabilization of dune grassland in these areas is resulting in succession and accumulation of organic matter and nutrients.

6.5 Areas subject to high and moderate risk from dog fouling have been identified and recorded. An area of dune grassland approximately 0.25ha in size in the SE corner of the reserve is most prone to nutrient enrichment. The level of enrichment here is comparable with that in the buffer zone (towards the resort), immediately to the SE of this area.

6.6 The area of fixed dune grassland adjacent to the above (west of the main access path) and extending in a wedge shape northeast towards the visitor centre is not as severely affected but considered high-moderate risk and this also supports notable species.

6.7 The survey has attempted to provide a comparable dataset to the previous assessments of trampling and eutrophication, to help managers and decision makers visualise and understand the possible impacts that they have had over time. Additionally, the survey sought to develop a means of data collection that can be relatively easily repeated. Monitoring the effects of nutrient enrichment does however pose significant challenges.

6.8 71% of the area has not changed in terms of its trampling assessment (319 of 447 squares). Approximately 20% of the area is assessed as experiencing higher trampling pressure and risk than in 2019 and 9% with some relaxation of trampling.

6.9 93 squares (21% of the area) changed to a minor degree of one scale increment (for example the assessment score altered from 2 to 3 or 5 to 4 between 2019 and 2023). Only 8% of the area (35 squares) changed by 2 or more increments.

6.10 The net increase in trampling risk and pressure over the whole site (the sum of all changes to individually assessed squares) equates to a mean increase in the trampling index of 16%. This figure is derived from the qualitative 5-point scale used in the assessment and it is not suggested to demonstrate an absolute index of recreational pressure. Nevertheless, it suggests a small but significant increase since the previous assessment.

6.11 The assessment finds that the overall spatial pattern of trampling risk has, unsurprisingly, not changed since 2019 and the heatmaps produced for 2019 and 2023 are very similar. However, there is evidence that some pressures have been slightly redistributed within the site.

6.12 The principal areas of change are:

1. The southern end of the site between the beach, pedestrian entrance and visitor centre. A new path and fencing has been installed. This may have encouraged greater use of the path for visitors wishing to access the amenity beach via the nature reserve, but it has also provided an obstacle to using some of the adjacent parts of the site for recreation. Thus, some mitigation of trampling pressure in this area seems to have been achieved, although it remains the highest risk part of the reserve for fixed dune habitats.

2. The vegetated margins of Warren Point. The mapped increase in pressure here is caused by a reduction in the extent of habitat due to coastal erosion, so that the route navigated by walkers passes through squares which were formerly in the interior of the dunes and less accessible.

6.13 121 squares showed an apparent increase in trampling and erosion. However, 78 of those are located around the northern edge of warren point and are likely to be attributed, predominantly at least, to natural processes. The other 43 squares are predominantly located along the edge of the main path through the dunes, which is more susceptible to erosion from footfall and environmental conditions. Another cluster of squares are also located within the centre of the site at a main pinch point between those accessing the beach and the central areas of the reserve.

6.14 Although the survey's objectives were focused on erosion caused locally by visitors, it has effectively 'logged' the scale of natural erosion occurring around the northern extent of Warren Point, with many of the previously surveyed squares no longer existing, or now being occupied by beach sand or bare mobile sand. The current beech-vegetation front around Warren Point is still mapped as high risk for trampling.

6.15 Although this part of the system may have the appearance of being under control of natural processes, even relatively low levels of trampling in this area have potential to impact the dune habitat succession profoundly. There is evidence that past trampling pressure on the Point has interfered with or prevented the initiation of embryo dunes around the strandline (de Lemos 1992, Lake 2010).

6.16Trampling of the circuit around Warren Point is still evident and to what extent historical trampling has affected the resilience of the habitats to storm damage or impacted the ability of the dune system to migrate is unknown. The report suggests that a neat disentanglement of coastal erosion processes and trampling impact on the embryo and foredune habitat is probably not possible.

6.17 Analysis of change in the effects of nutrient enrichment since 2019 is more limited as no absolute comparison is possible between the 2019 and 2023 datasets.

6.18 The broad scale pattern shown on indicative fertility maps produced in 2019 and 2023 is very similar. Small differences are as likely to stem from differences in the way the data were collected (derived from vegetation data collected for other purposes in 2019 and the result of a more limited but purposely collected dataset in 2023) as change.

6.19 The only significant discrepancy between these maps is that in 2019 the reedbeds are shown as a fertility hotspot but show as a neutral area in 2023. This is because they were sampled for NVC work in 2012 and 2019 but not prioritised under the objectives of the present survey.

6.20 The best judgement from the available data in the current survey is that the spatial distribution of nutrient enrichment effects from dog fouling is substantially the same as in 2019. These data do not allow an assessment of whether there have been any significant changes in severity, either at individual locations or for the whole site.

6.21 The ecology of dog-fouling derived nutrient inputs in sand dunes is complex and not yet well studied. A future assessment employing the same approach as used in the present survey could be capable of detecting changes if they were sizeable.

6.22 However, the survey suggests that it is likely that a more labour-intensive design of study, possibly employing direct measurement of nutrient loads and probably entailing a more complete inventory of the vegetation, would be needed to meaningfully monitor these impacts. This would increase the funding required due to the increased complexity and labour-intensive nature of the study.

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Natural England comment: Natural England have reviewed the report and have no further comment.