Influence of Vegetation and Elevation on Nest-Site Selection and Reproductive Success in American Oystercatchers (Haematopus palliatus)

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Influence of Vegetation and Elevation on Nest-site Selection and Reproductive Success in American Oystercatchers (*Haematopus palliatus*)

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Abstract.—Barrier island habitats are increasingly threatened by climate change, with potential consequences for the breeding success and habitat quality of beach-nesting birds. Understanding fine-scale habitat requirements is important for identifying risks and managing these environments to support reproductive success. We evaluated two key habitat features, vegetation density and elevation, to understand their influence on American Oystercatcher (*Haematopus palliatus*) nest-site selection, hatching success, and fledging success on two Virginia (U.S.A.) barrier islands (Assateague and Assawoman Island). Using long-term nest monitoring data (2007–2022) and three years of remotely sensed elevation and vegetation data (2015, 2016, and 2021), we found that American Oystercatchers consistently preferred nest sites with lower vegetation density and at higher elevation. However, neither factor predicted hatching or fledging success. These results suggest that vegetation encroachment may contribute to population declines not by reducing reproductive output directly, but by limiting the availability of suitable nesting habitat. Vegetation nonetheless plays a key role in stabilizing high-elevation dune systems. Effective beach management should prioritize the preservation and creation of sparsely vegetated, elevated sites to maintain nest-site availability under changing coastal conditions. *Received 27 Feb 2025, accepted 09 Oct 2025.*

Key words.—Barrier islands, Breeding productivity, Climate change, Elevation, Hurricane disturbance, Landsat, NDVI, Remote sensing, Reproductive success, Shorebirds

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Barrier islands are dynamic environments that can shift in form, vegetation density, and elevation over time due to accretion, erosion, and storms (Zinnert *et al.* 2016). Barrier island elevation is intertwined with vegetation and climate change. Vegetation plays a crucial role in consolidating sand and anchoring ecosystems, allowing barrier islands to increase in elevation. Increasing storm and hurricane activity due to climate change can clear beaches of vegetation and lead to decreases in island elevation (Vinent and Moore 2014; Camelo *et al.* 2020; Vinent *et al.* 2020). A lack of major storms and hurricanes may therefore lead to vegetation encroachment (Vinent and Moore 2014; Camelo *et al.* 2020; Vinent *et al.* 2020) and impact beach-nesting bird nesting habitat. Beach-nesting birds must respond to the changing nature of barrier islands in terms of vegetation, habitat size, water levels, and substrate, and alter their nesting behaviors as habitat availability changes (Walker *et al.* 2019).

American Oystercatchers (*Haematopus palliatus*) are large shorebirds breeding along beaches and saltmarshes of the Atlantic Coast of North America. The state of Virginia (U.S.A.) hosts the single largest population of breeding American Oystercatchers in the United States (Wilke *et al.* 2005). American Oystercatchers breeding in Virginia have experienced significant declines in breeding productivity (defined as the number of offspring fledged per pair each year; Davis *et al.* 2001; U.S. Fish and Wildlife Service 2023). While factors such as microclimate, tidal regime, sight lines, predation, and geomorphology may influence nesting outcomes (Maslo and Lockwood 2009; Dorsey *et al.* 2025), two variables are particularly suitable for land managers aiming to increase productivity: vegetation density and elevation profiles in nesting habitat. However, results vary regarding American Oystercatcher nest-site selection preferences for vegetation density and elevation, and their subsequent effects on breeding success. In New Jersey, American Oystercatchers select more vegetated nest sites (Grant *et al.* 2019) among those available. In North Carolina, American Oystercatchers nest exclusively on sand (with minimal vegetation), and in New York and New Jersey nest on sand, grass, and wrack (Lauro and Burger 1989). In Georgia, American Oystercatchers nested in areas with wrack and vegetation nearby, while elevation did not play a significant role (Sterling 2017). There are currently no published studies that assess the relationship between elevation and vegetation density, and their interaction, on American Oystercatcher nest-site selection. This regional variation suggests that American Oystercatchers are flexible in their nest-site choices, highlighting the importance of developing tailored conservation strategies.

In this study, we first assessed the extent to which Hurricane Sandy altered American Oystercatcher nesting habitat by examining vegetation upheaval and removal, aiming to understand how major storm events might affect habitat quality and availability. We then used long-term breeding data from two barrier islands to test whether vegetation density and elevation, quantified using remote sensing, impact where American Oystercatchers choose to nest and how successful those nests are. We predicted that: (1) American Oystercatchers would prefer nesting in areas with less dense vegetation, regardless of elevation, due to increased visibility to detect predators; (2) areas with less dense vegetation would have higher hatching and fledging success (again due to increased visibility); and (3) nesting habitat higher in elevation would have more nests, and greater hatching and fledging success as American Oystercatchers try to avoid the risks of overwash (high tides inundating nests) and increase sight lines for predator detection.

Methods

Study Area

We studied American Oystercatcher nest placement and reproductive success on Assateague Island (37° 54′ 28.80″ N, 75° 21′ 21.56″ W) and Assawoman Island, Virginia, U.S.A. (37° 49′ 19.20″ N, 75° 29′ 52.80″ W). The two islands are a part of Chincoteague National Wildlife Refuge and are managed by the U.S. Fish and Wildlife Service (Fig. 1). Assateague Island makes up approximately 400 ha of total beach habitat. Assawoman Island contains an additional 150 ha of protected beach nesting habitat (Fig. 1). The southern end of Assateague Island opens to expansive sandflats, receding with the low tide up to 400 m from the shoreline. On both islands, dunes border nesting habitat and vegetation becomes dense towards the western bayside. Dominant vegetation species in nesting habitat include cordgrasses (*Spartina* spp.) and marsh elder (*Iva frutescens*). Both islands have similar dune structures, but Assateague Island has more expansive sand flats low in elevation than Assawoman Island. These sandflats and dune systems form the nesting habitat for Virginia's barrier island American Oystercatchers, although they may also be found nesting in saltmarsh or dredge spoil islands (Parnell *et al.* 1986; Lauro and Burger 1989).

Data Collection

We monitored American Oystercatcher nesting on both Assateague Island and Assawoman Island between April and August from 2007–2022. Nest searching involved walking nesting habitat (Supplementary Fig. 1) with binoculars (8x to 10x magnification) and spotting scopes (20x to 60x magnification) while listening and looking for American Oystercatchers. Once found, we looked for nesting behaviour (incubation, scraping, flight displays, and agonistic interactions). We found nests by directly observing an American Oystercatcher incubating, or by generally walking known territories looking for eggs. Nest searching did not follow standardized routes. We then visited nests 2–3 times per week from incubation until failing or fledging (at least one chick reaching 35 days old) between the months of April to August. At each nest we recorded nest location using a handheld GPS unit or cellphone with ArcGIS Fieldmaps, nest fate, and number of hatched eggs. We returned to nests 2–3 times per week until the nest either hatched or failed. If a nest failed, we attempted to determine cause of failure. Cause of failure was assigned to red foxes (*Vulpes vulpes*) or raccoons (*Procyon lotor*) if tracks approached the nest throughout night or day prior to visit; avian depredation if eggs were visibly pierced inwards, often with yolk being consumed but eggshell still in places; or overwash/weather if there was clear evidence the tide or rain had inundated the nest through wet sand or wrack left behind. Infertile eggs were eggs which did not hatch and were not taken or otherwise destroyed and were lumped with abandoned eggs due to parental abandonment, as observers typically did not check unattended unbroken eggs for yolk. If there were no signs to indicate cause of failure, we recorded it as an unknown failure.

To assess vegetation density at nests, we used remotely-sensed data and ground-truthed vegetation density with visual assessments. Ground-truthing involved categorizing vegetation density within 5 m of each nest in 2018 as none (no vegetation, 0% vegetated), sparse (some vegetation, but with exposed sand and vegetation growing sparsely, >0–20% vegetated), moderate (densely growing vegetation, with little sand exposed, >20–80% vegetated), and densely vegetated (>80–100% vegetated). For remotely sensed data, we used U.S. Geological Survey (U.S.G.S.) 30 m spatial resolution Landsat 7 and Landsat 8 aerial imagery accessed from U.S.G.S. EarthExplorer (https://earthexplorer.usgs.gov) to calculate the Normalized Difference Vegetation Index (NDVI), as per Pettorelli *et al.* (2005); Meyer *et al.* (2021); and, Ontiveros (2022). NDVI is defined as (near infrared−red)/(near infrared + red),

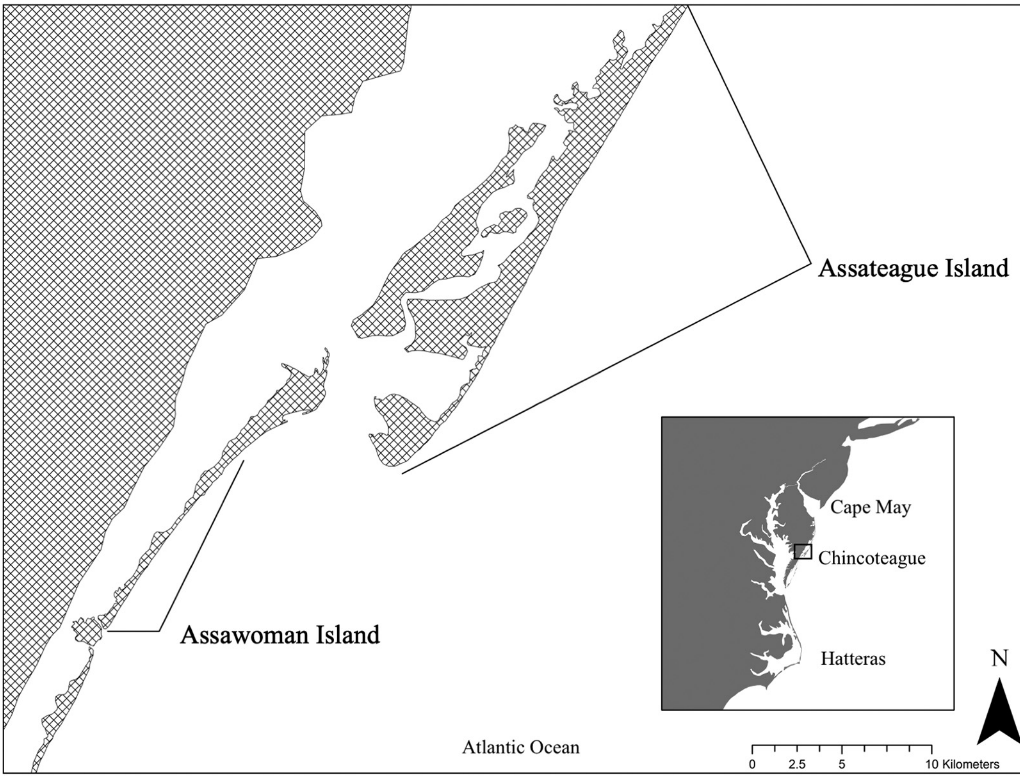

Figure 1. Map showing the two study islands, Assateague Island and Assawoman Island, Virginia (U.S.A.) where we studied beach-nesting American Oystercatchers (*Haematopus palliatus*). The insert places the study area relative to the Chesapeake Bay, Virginia, U.S.A.

with values ranging from −1 (no vegetation) to + 1 (dense vegetation). We did a raster analysis in ArcGIS Pro 3.2 (ESRI 2022) to calculate NDVI. A Landsat 7 instrument failure meant that we were missing data because of scanline errors. To minimize the effects of the instrumentation failure on Landsat 7, we used Landsat 8 imagery from 2013 onwards. For the years prior to 2013, we corrected for the instrument failure of Landsat 7 by taking an average value of two temporally similar (a maximum of 14 days apart) scenes covering the same area for imagery with missing data. NDVI imagery from the months of May and June were selected for nest vegetation densities to best represent the densities seen when the majority of nests are being incubated in Virginia, U.S.A. (American Oystercatcher Working Group 2020). Occasionally, cloud cover obstructed the NDVI calculations leading to erroneous values. In these cases, we used an alternative imagery date within the May to June window. We removed all NDVI values < 0 as those indicate cloud coverage or water cover. Finally, we standardized all NDVI layers by year for consistency.

We assessed elevation at each nest using digital elevation models. We used three existing digital elevation models that each had a minimum spatial resolution of 1 m and occurred in 2015 (2015 U.S. Geological Survey Eastern Shore of Virginia [U.S.A.] QL2 LiDAR BAA), 2016 (2016 Maryland Six Inch Resolution Aerial Imagery), and 2021 (2021 Virginia [U.S.A.]) Base Mapping Program Digital Elevation Models). Because of the dynamic nature of barrier islands, we did not interpolate between years and only included data from 2015, 2016, and 2021 when assessing the influence of elevation on nest-site selection and reproductive success. We rescaled the spatial resolution of all digital elevation model (DEM) layers to match the spatial resolution of the NDVI layer (30 m grid) to allow for consistent comparison. To account for potential differences in accuracy between digital elevation models we standardized elevation values by year.

Statistical Analysis

To assess the suitability of using U.S. Geological Survey Landsat imagery for fine-scale spatial analysis of vegetation density at nests, we used a Spearman rank correlation coefficient comparing NDVI values centered at each nest found during the 2018 field season against their corresponding field assigned categories taken during that fieldwork season (2018). To visually assess the change in vegetation density across years within American Oystercatcher nesting habitat, we manually delineated nesting habitat (based on habitat surveyed by field technicians over the study period) in ArcGIS Pro (ESRI 2022) using each respective years' Landsat imagery and calculated mean vegetation density within the delineation. The bounds of habitat delineation were set by the ocean and area outlined in refuge survey protocols. Delineation was repeated for each month of the nesting season.

We used a logistic regression model to assess whether lower-elevation nests were more likely to fail due to overwash. The response variable was binary: 0 (hatched, fledged, or failed for other reasons) and 1 (failed due to overwash), predicted by standardized elevation.

To compare the NDVI value and elevation of real nests to randomly plotted pseudo-absences within the delineated nesting habitat we used a mixed-effects logistic regression from the package 'lme4' (Bates *et al.* 2015). We plotted two times the number of pseudo-absences as true nests consistent for each island and year. Pseudo-absences were plotted within the delineated nesting habitat described above using the 'create random points' function in ArcGIS Pro (ESRI 2022). To prevent pseudo-absences from overlapping with actual nests and sharing the same raster square, pseudo-absences were plotted a minimum of 30 m from one another and from actual nests. We first created one global model, which modeled nest occurrence (real [1] or pseudo-absence [0]) as a function of scaled NDVI, scaled elevation, and controlled for distance to shoreline (shortest haversine distance to shoreline using the 'near' function in ArcGIS Pro [ESRI 2022]) by including it as a fixed parameter. To consider the relationship between vegetation and sand accretion in coastal environments (Vinent *et al.* 2020), we tested an interaction term between NDVI and elevation. To account for potential spatial autocorrelation, we included a Matern spatial covariance structure using the package 'spaMM' (Rousset and Ferdy 2014). The estimated spatial variance component was near zero, so we proceeded with parsimonious models not accounting for spatial autocorrelation. Because American Oystercatchers have high nest-site fidelity and frequently return to the same nesting areas between years, we included year as a random intercept in all models. We checked for multicollinearity using the variance inflation factor (VIF) using the package 'car' (Fox and Weisberg 2019), which was not a concern (all VIFs were below 2.5, Supplementary Table 1; Johnston *et al.* 2018). Finally, to investigate if vegetation density and elevation influenced nest-site selection, we ranked all permutations of the global model according to their second-order Akaike Information Criterion values and considered only the most parsimonious model with ΔAICc < 2 (Burnham and Anderson 2002). To obtain odds ratios for each parameter estimate we exponentiated the log-odds output from the logistic regression.

Next, we investigated the influence of vegetation density and elevation on hatching success and fledging success following the same logistic-regression framework, with slight modifications. Because nest success differs between the islands, we now included island as an additional random effect, which was retained for all subsequent models. Because American Oystercatchers are semi-precocial and can disperse from nest sites shortly after hatching (Schulte 2012), we included a 60 m buffer around the nest site to capture nearby usable and easily accessible habitat only when investigating fledge success. For these models, a 1 represents a nest which hatched or fledged, and a 0 represents a nest which did not hatch or hatched but did not fledge. All analyses were performed in R (V.4.3.1; R Core Team 2025) with the package 'tidyverse' (Wickham *et al.* 2019). All data and code can be accessed from the following repository: https://osf.io/32uty/?view_only=86c96f6f811d435b9d1b659525665190.

RESULTS

Between 2007 and 2022, the number of nests with known locations (214 nests had no associated GPS coordinates) was similar between Assawoman Island (469 nests) and Assateague Island (378 nests). Average number of yearly nesting attempts across the two islands was 66 ± 25 (SD) throughout the duration of the study period (Fig. 2). The average number of eggs hatched per year was 39 ± 27 (SD) across Assateague Island and Assawoman Island. The average number of chicks fledged per year was 17 ± 18 across both Assateague Island and Assawoman Island. Across both islands, 75.4% of all nests failed to hatch. On Assateague Island, 41.9% of nest failures were due to predation by birds or mammals, including Great Horned Owls (*Bubo virginianus*), Peregrine Falcons (*Falco peregrinus*), raccoons, and red foxes, while on Assawoman Island, 34.8% were due to predation by the same suite of predators (Great Horned Owls, Peregrine Falcons, raccoons, and red foxes). Overwash and inclement weather accounted for 29.3% of nest failures on Assateague Island and 46.2% on Assawoman Island. Unknown causes accounted for 27.4% of nest failures on Assateague Island and 17.1% on Assawoman Island. The remaining nest failures were due to abandonment or infertility, which accounted for 1.4% on Assateague Island and 2.0% on Assawoman Island.

In total 121 nests (with 242 corresponding pseudo-absences) had both elevation and NDVI data for the years 2015, 2016, and 2021. The maximum NDVI value for American Oystercatcher nests was 0.11 ($\bar{x}$ = 0.06, σ = 0.02), while that of pseudo-absences was 0.36 ($\bar{x}$ = 0.11, σ = 0.06). Vegetation density assessed at nest sites in 2018 was significantly

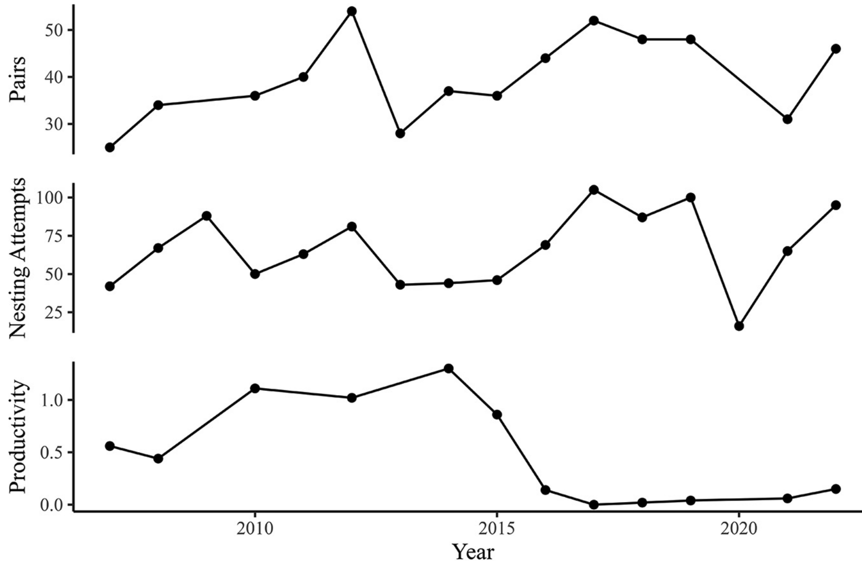

Figure 2. Summary of number of nesting pairs, number of nesting attempts, and productivity (number of chicks fledged per pair) annually for American Oystercatchers (*Haematopus palliatus*) nesting in Chincoteague National Wildlife Refuge, Virginia, U.S.A.

positively correlated with NDVI values (Spearman's ρ = 0.48, $n = 77$, $P < 0.001$; Supplementary Fig. 2). Vegetation density in nesting habitat on Assateague Island and Assawoman Island remained stable between 2007 and 2012, then steeply declined after Hurricane Sandy hit in 2012, and then gradually increased from 2013–2018, before again reaching stability (Supplementary Fig. 3). Within years, mean NDVI increased between April and June and peaked in mid-July before declining in August and September. Across years, vegetation density for all four months followed consistent patterns.

The most parsimonious model where ΔAICc was less than two predicting American Oystercatcher nest-site selection only included elevation and vegetation density, with no interaction term (Table 1, Supplementary Table 2). American Oystercatchers selected for nests at higher elevation (odds ratio [OR] = 1.28) and in less dense vegetation (OR = 0.12) compared to pseudo-absences (Table 1, Fig. 3). For both the hatching success and fledging success models, the top ranked models were the null models including no covariates (Table 1, Supplementary Tables 3 & 4). Neither vegetation density nor elevation were significant predictors for reproductive success in American Oystercatchers. There was no significant difference in elevation between nests which failed due to overwash and nests that either did not fail or failed due to predation or abandonment. Breeding productivity was not directly affected by elevation or vegetation density through nest failure or chick death.

Discussion

Nest-site Selection and Reproductive Success

Nest-site selection in American Oystercatchers at Assateague Island and Assawoman Island depends on both elevation and vegetation density (NDVI). American Oystercatchers preferred nesting at higher elevation sites and in areas with lower vegetation density, as predicted. Neither vegetation density nor elevation significantly affected American Oystercatcher hatching or fledging success. Vegetation encroachment ensued for the three years following Hurricane Sandy before stabilizing, indicating the hurricanes may act to increase the amount of suitable nesting habitat for American Oystercatchers breeding on barrier islands.

Table 1. Summary of standardized log-odd estimates and standard errors for logistic mixed-effect models predicting drivers of nest-site selection (real nest or pseudo-absences), hatch probability (hatched at least one egg or did not hatch), and fledge probability (fledged at least one individual or hatched at least one chick but no chicks fledged) for American Oystercatchers (*Haematopus palliatus*) on Assateague Island and Assawoman Island, Virginia, U.S.A. All models include year as a random intercept. The full model represents the model with all parameters included, and the top model represents the most parsimonious model where delta AICc < 2.

Model	Intercept	Shoreline Distance	DEM	NDVI	DEM x NDVI	*k*	logLik	AICc	ΔAICc	Weight
Nest Occurrence										
Top	−1.47 ± 0.21	—	0.24 ± 0.12	−2.16 ± 0.33	—	5	−184.05	378.27	0.00	0.33
Full	−1.45 ± 0.25	−0.13 ± 0.15	−0.03 ± 0.25	−2.13 ± 0.34	−0.50 ± 0.39	7	−182.97	380.26	1.99	0.12
Hatch Probability										
Top	−0.52 ± 0.93	—	—	—	—	3	−31.56	69.58	0.00	0.36
Full	−0.62 ± 1.45	−0.26 ± 0.37	−0.69 ± 1.72	0.03 ± 1.98	−2.12 ± 3.33	7	−30.65	77.59	8.01	0.01
Fledge Probability										
Top	1.32 ± 0.56	—	—	—	—	3	−9.78	27.16	0.00	0.39
Full	4.33 ± 2.45	0.09 ± 1.07	−7.59 ± 4.85	2.59 ± 1.96	−8.21 ± 5.49	7	−6.53	37.25	10.09	0.00

Despite American Oystercatcher preferences for high elevation and low-vegetated sites, hatching success in our study was not influenced by elevation or vegetation density. Overwash remains the primary cause of nest failure at the two study islands, and our results show that there are no differences in elevation between nests that failed due to overwash versus those that did not. This suggests that nesting higher might not sufficiently mitigate the risk of overwash and highlights how forceful these events can be in coastal environments. Vegetation density and elevation may also not sufficiently mitigate other drivers of nest failure, such as predation pressure or stochastic environmental events (e.g., heavy rain). Dense vegetation can reduce visibility and impair predator detection (Whittingham et al. 2002), while sparse vegetation may make nests more visible for an already conspicuous species. Higher elevations may provide useful vantage points for predator detection, while simultaneously placing individuals closer to dune systems and forests where predators are more abundant (Hackney *et al.* 2013).

The lack of an effect on fledging success may also reflect the biology of American Oystercatchers. Because they are semi-precocial, chicks leave the nest soon after hatching and are able to move with their parents to other areas. This means that once a chick hatches, its survival may depend more on conditions after leaving the nest than on the characteristics of the nest site itself. For example, chicks might move to more sheltered or open areas depending on where they can find food or avoid predators. As a result, elevation and vegetation at the nest site may not be strongly linked to fledging success.

Previous studies found strong avoidance of vegetated sites by American Oystercatchers (Lauro and Burger 1989; Grant *et al.* 2019), but our findings indicate more flexibility at lower elevations than anticipated. One potential explanation is that nest predation rates in our study area may be lower than in Grant *et al.* (2019) and Lauro and Burger (1989), which could reduce selective pressure against vegetated sites. Another possibility is intra-specific competition, where high nesting densities and limited high-elevation habitat may force less

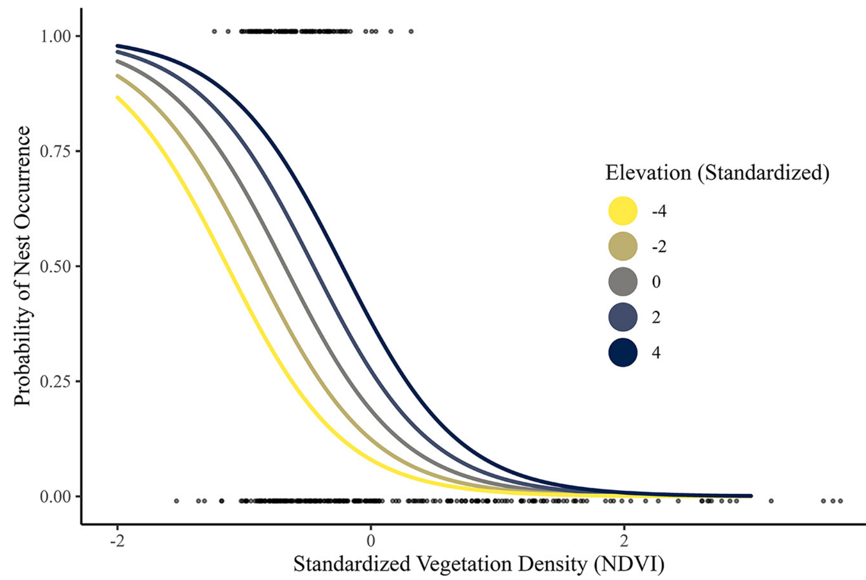

Figure 3. Predicted odds of an American Oystercatcher (*Haematopus palliatus*) nesting as standardized vegetation density (NDVI) increases across standardized elevation profiles in Assateague Island and Assawoman Island, Virginia (U.S.A.). Elevation is shown in standard deviations centered around mean height from sea level in meters. American Oystercatchers select for areas with less dense vegetation and at higher elevations.

competitive individuals into lower-elevation sites with denser vegetation. Differences in nesting densities and competition levels across studies may explain variation in nest-site selection patterns, especially given that less ecologically fit individuals are often forced to nest in poorer quality habitats (Kokko 2002).

Overall, while elevation and NDVI appear to influence where birds choose to nest, they may not be good predictors of nest success in this system. This is likely because the main risks to nest and chick survival come from predation and weather, which are not directly related to the nest-site characteristics we measured.

Barrier Island Dynamics and Climate Change

With the expected increase in sea level rise and frequency and severity of storms due to climate change (Camelo *et al.* 2020), nests at lower elevation may be at greater risk of flooding. However, nests that failed due to overwash were not at significantly lower elevations than other nests. It is possible that low-elevation nests are more likely to be lost to predators if overwash does not occur. Observations support this, as many low-elevation nests either hatched successfully or were taken by predators, but more data would be useful to better understand this relationship. American Oystercatchers selecting nests at high elevations may reflect a need to adapt to the dynamic nature of barrier islands. For example, reproductive success of American Oystercatchers in North Carolina (U.S.A.) increased significantly following Hurricane Isabel, which stripped the beach of vegetation and returned the habitat to an early successional stage, the preferred state for nesting (Schulte and Simons 2016). However, the increase in breeding productivity may have been better explained by a concurrent decline in predator activity rather than vegetation removal alone (Schulte and Simons 2016). Furthermore, Eurasian Oystercatchers (*H. ostralegus*) in the Wadden Sea of the Netherlands have gradually increased the elevation at which they nest over the last 30 years, and this increase in elevation is associated with higher reproductive success (Bailey *et al.* 2019). The willingness of American Oystercatcher to choose areas at higher elevations may play a key role in their ability to tolerate and rapidly adapt to climate change. While vegetation plays a critical role in trapping sand

and building stable, high-elevation dunes that may reduce the risk of nest flooding, excessive vegetation may reduce visibility and hamper adults' ability to detect predators. This may lead to conflict of interest between avoidance of dense vegetation despite its role in building preferred taller dune environments.

Management and Future Directives

Effective beach management for American Oystercatchers should focus on maintaining and enhancing higher-elevation nesting areas (e.g., the tops of dunes), as elevation influences nest-site selection. Since our findings indicate that vegetation density also affects site selection but does not improve hatch or fledge success, management strategies should carefully balance elevation enhancement with vegetation control. One potential approach is the strategic planting of native dune-building vegetation to facilitate dune stabilization and natural accretion processes over time (Sabo *et al.* 2024). These plant species can trap sand and gradually increase elevation, expanding the availability of higher, more stable nesting sites. Additionally, minimizing anthropogenic disturbances that contribute to dune erosion such as vehicle traffic, beach raking, and poorly placed development can help sustain suitable nesting habitats (Defeo *et al.* 2009). Vegetation removal through hand-pulling could create the open, low-density vegetation conditions preferred by American Oystercatchers, but the necessity of vegetation remains in creating nesting areas higher in elevation. Strategic vegetation management may keep enough vegetation to stabilize dune environments while also being careful to not exceed the density in which American Oystercatchers willingly nest in. Prioritizing actions that enhance natural dune dynamics and protect existing high-elevation sites may be the most effective long-term strategy.

Future studies might investigate the feasibility of beach nourishment (using dredged sand to increase elevation of beaches to mitigate the effects of major storms and sea level rise) from flooding American Oystercatcher nests. Another potential mitigation measure might be to add structures to the beach to boost elevation. In 2022, a pair of American Oystercatchers on Assateague Island nested in a washed-up car tire, which provided enough protection from a nor'easter to prevent it from flooding compared to other nearby nests that were flooded. Future studies could predict how invasive plant species (*Carex* spp., *Vitex* spp., *Phragmites* spp.) will affect vegetation dynamics and the nesting response of American Oystercatchers.

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