# Northeast USA Region-Wide Assessment of the Vulnerability of Coastal Forests to Sea Level Rise

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As sea levels rise along the northeastern US, coastal forest ecosystems are being impacted. To better enable climate-smart decision-making, the U.S. Department of Agriculture Northeast Climate Hub engaged researchers at Rutgers University to conduct a synthesis of the current state of knowledge concerning how northeastern U.S. coastal forests, specifically those in mid-Atlantic and southern New England states (VA, MD, DE, NJ, NY, CT, and MA), are responding to impacts from climate change. Drawing upon the scientific literature, expert interviews, and a January 2020 convening of scientists and land managers at the U.S. National Agricultural Library, Beltsville, Maryland, this synthesis identifies key knowledge gaps as well as potential management approaches (https://climatechange.rutgers.edu/resources/data-and-information/climate-change-and-northeastern-coastal-forests ). As a follow-up to this report, we undertook a geographic information system (GIS)-based analysis to map out those portions of the MidAtlantic-southern New England coastal forest most vulnerable to ongoing sea level rise (SLR). The analysis made use of best available data from NOAA, the US Forest Service and the US Geological Survey.

## Methods

We derived the future potential inundation zones from the marsh change data product developed by the NOAA Office for Coastal Management (as developed for the US Digital Coast Sea Level Rise Viewer https://coast.noaa.gov/digitalcoast/tools/slr.html). This NOAA product provides a region-wide consistent data set that is employed nationally for state to local scale planning and decision-making. The NOAA implementation employs a "modified bathtub" approach that incorporates local and regional tidal variation of mean higher high water (MHHW) (NOAA, 2017). MHHW or Mean Higher High Water is defined as the average height of the highest tide recorded at a tide station each day during the recording period.

We applied the consensus SLR estimates determined for New Jersey to choose the sea level rise (SLR) scenarios employed in this regional analysis (https://www.nj.gov/dep/climatechange/pdf/2019-stap-report-summary.pdf; https://climatechange.rutgers.edu/images/STAP_FINAL_FINAL_12-4-19.pdf ). Using the New Jersey consensus estimates (https://www.nj.gov/dep/climatechange/pdf/2019-stap-report-summary.pdf), coastal areas are likely to experience sea-level rise of 0.9 to 2.1 feet between 2000 and 2050. Under a low-emissions scenario, coastal areas are likely to see sea-level rise between 1.7 to 4.0 feet between the years 2000 and 2100. Under a high-emissions scenario, coastal areas are likely to see sea-level rise between 2.3 to 6.3 feet between the years 2000 and 2100. Based on this information, we chose to model between 1 and 6 feet of SLR.

We used the NOAA guidance 2017 document https://coast.noaa.gov/data/digitalcoast/pdf/slr-marsh-migration-methods.pdf) to delineate future inundation zones for 1-6' of SLR. A 'moderate' vertical accretion rate of 4mm $yr^{-1}$ was used based on best available information as to present rates of marsh accretion over the broader MidAtlantic region.

We used ESRI ArcMap geospatial analysis software to determine the amount and type of vulnerable forest area for each MidAtlantic state. The US Geological Survey (USGS) National Land Cover Database 2016 set (https://www.usgs.gov/centers/eros/science/national-land-cover-database?qt-science_center_objects=0#qt-science_center_objects) was used to map the following forest types: AU-41 Deciduous; AU-42 Evergreen; AU-43 Mixed Forest; AU-52 Shrub/Scrub; AU-90 Woody Wetlands). The USGS Protected Areas database (PADUS) (https://www.usgs.gov/core-science-systems/science-analytics-and-synthesis/gap/science/protected-areas) was used to map protected conservation-oriented lands. The following categories of protected lands, both fee simple and easement, were included: federal; state; non-governmental organization, local government, regional agency special district, private, unknown and American Indian Lands. Land areas not so identified were mapped as Other (i.e., not protected).

**Results**

The greatest amount of forest area at risk for dieback across all the states in the region (VA, MD, DE, NJ, NY, CT, and MA) is expected to occur with only 1' of SLR by 2100 (Figure 1). Nearly260,000 acres of existing forest land are potentially vulnerable to the effects of 1' of sea level rise and an additional 81,000 acres are vulnerable with 2' of SLR (Table1). Within the broader coastal vulnerability zone (i.e., up to 6' SLR by 2100), the states of Maryland and Virginia, and to a lesser extent New Jersey, have the highest amounts of forest land at risk for dieback with over 200,000 acres each in the case of Maryland and Virginia and nearly 100,000 acres for New Jersey (Table 1). It should be noted that the vast majority of these acres were mapped as woody wetlands rather than upland forest (89%, 94% and 97% in Maryland, Virginia and New Jersey, respectively).In the more southern states of Maryland and Virginia, a significant percentage of the mapped forest identified for potential dieback under 1' SLR are associated with tidal river systems such as the Nanticoke and Pocomoke Rivers in Maryland, and the James, North Landing and Northwest Rivers in Virginia. These riparian forests are largely comprised of freshwater tidal swamps (i.e., freshwater swamps that experience daily tidal swings and dominated by bald cypress, *Taxodium distichum,* and water tupelo, *Nyssa aquatica*) (Larsen, 1980). The degree to which these tidally influenced swamp forests will be affected by 1' of SLR as compared to other wetland forest types (i.e., non-tidal red maple or Atlantic white cedar dominated palustrine swamps) is not fully known. However, higher levels of SLR leading to extended periods of inundation and increasing saltwater intrusion is expected to pose a risk to even tidal swamp forests (Butler-Leopold et al., 2018; Zhai et al., 2018; Allen et al. 1996).

Table 1. Area of forest land (in acres) in potential future sea level rise inundation zones. Note: that the area in each SLR column is not cumulative. The 2' column represents the incremental forest loss expected to occur between 1' and 2'. To calculate the entire loss at 2' SLR add the 1' and 2' columns.

| | 1' | 2' | 3' | 4' | 5' | 6' | SUM |
|---|---|---|---|---|---|---|---|
| Virginia | 88,958 | 31,767 | 25,028 | 22,138 | 22,839 | 24,728 | 215,458 |
| Maryland | 99,222 | 28,046 | 21,404 | 20,888 | 23,745 | 22,274 | 215,579 |
| New Jersey | 41,684 | 12,212 | 11,469 | 11,133 | 11,012 | 10,334 | 97,844 |
| Delaware | 16,822 | 4,306 | 3,762 | 3,587 | 3,374 | 3,222 | 35,073 |
| New York | 4,552 | 2,424 | 2,369 | 2,219 | 2,052 | 1,998 | 15,614 |
| Massachusetts | 4,062 | 1,420 | 1,767 | 2,007 | 2,154 | 2,296 | 13,706 |
| Connecticut | 1,965 | 765 | 992 | 928 | 1,040 | 977 | 6,667 |
| Pennsylvania | 736 | 212 | 217 | 207 | 262 | 273 | 1,907 |
| Rhode Island | 191 | 196 | 278 | 372 | 420 | 403 | 1,860 |
| **Total (acres)** | **258,192** | **81,348** | **67286** | **63,479** | **66,898** | **66,505** | **603,708** |

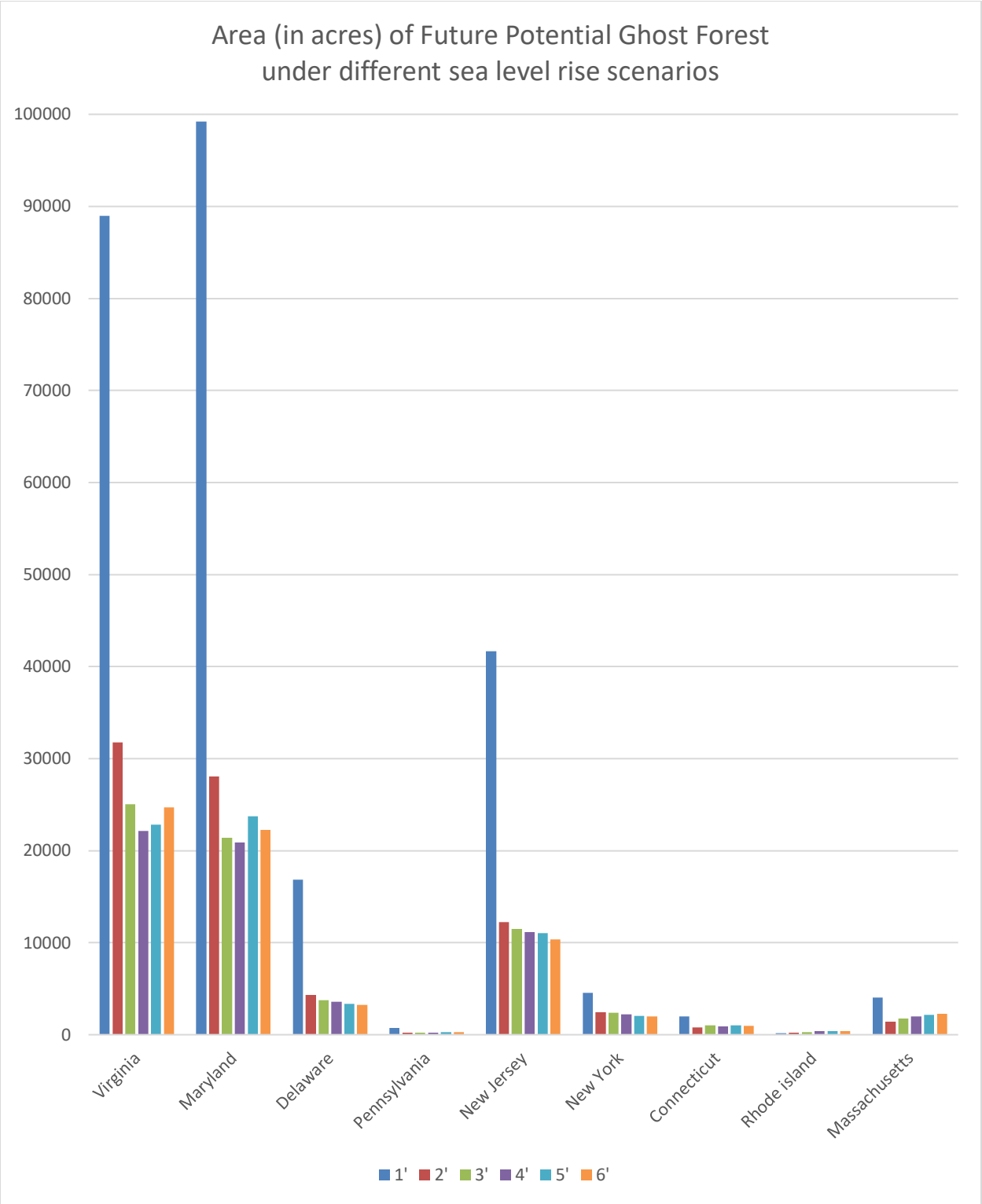


Figure 1. Area (acres) of forest land in potential future sea level rise inundation zones.

To inform possible management actions or at least provide a broader context for broader policy considerations, we evaluated whether the forest areas identified as vulnerable to 1-6' of SLR were in some form of conservation-oriented ownership using the USGS Protected Areas database. While Virginia has some of the highest amounts of forest area at risk, it also has the lowest amount of vulnerable forest land in public conservation ownership at less than 33% (Table 2). The states of Delaware, New Jersey and New York have some of the highest percentage of at risk forest lands in public conservation ownership at upwards of 40 to 50% (Table 2). Depending on whether the vulnerable forests are in public or private ownership will affect the range and scope of possible management actions and available funding mechanisms. This underlying mapped analysis was incorporated into NJForestAdapt to allow for closer inspection of the geographic context of vulnerable coastal forest lands and their ownership.

Table 2. Area of forest land (in acres and as %) in potential future sea level rise inundation zones broken out by private vs. public ownership (as mapped by the USGS PADUS Database).

| Owner | SLR 1 | | SLR 2 | | SLR 3 | | SLR 4 | | SLR 5 | | SLR 6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | acres | % | acres | % | acres | % | acres | % | acres | % | acres | % |
| CT: Private | 1229 | 62.5 | 475 | 62.2 | 531 | 53.5 | 583 | 62.8 | 657 | 63.2 | 647 | 66.2 |
| CT: Public | 736 | 37.5 | 290 | 37.8 | 461 | 46.5 | 345 | 37.2 | 383 | 36.8 | 330 | 33.8 |
| DE: Private | 6687 | 39.8 | 1835 | 42.6 | 1718 | 45.7 | 1742 | 48.6 | 1849 | 54.8 | 1844 | 57.2 |
| DE: Public | 10135 | 60.2 | 2471 | 57.4 | 2044 | 54.3 | 1845 | 51.4 | 1525 | 45.2 | 1378 | 42.8 |
| MD: Private | 58006 | 58.5 | 18865 | 67.3 | 14929 | 69.8 | 14204 | 68.0 | 16205 | 68.2 | 15944 | 71.6 |
| MD: Public | 41216 | 41.5 | 9181 | 32.7 | 6475 | 30.2 | 6684 | 32 | 7541 | 31.8 | 6330 | 28.4 |
| MA: Private | 2135 | 52.6 | 878 | 61.8 | 1047 | 59.2 | 1222 | 60.9 | 1348 | 62.6 | 1430 | 62.3 |
| MA: Public | 1927 | 47.4 | 542 | 38.2 | 720 | 40.8 | 785 | 39.1 | 806 | 37.4 | 866 | 37.7 |
| NJ: Private | 23588 | 56.6 | 6009 | 49.2 | 5960 | 52.0 | 5996 | 53.9 | 5967 | 54.2 | 1301 | 55.0 |
| NJ: Public | 18096 | 43.4 | 6203 | 50.8 | 5509 | 48 | 5137 | 46.1 | 3666 | 45.8 | 0 | 45 |
| NY: Private | 2291 | 50.3 | 1138 | 46.9 | 1106 | 46.7 | 1014 | 45.7 | 960 | 46.8 | 991 | 49.6 |
| NY: Public | 2261 | 49.7 | 1286 | 53.1 | 1263 | 53.3 | 1205 | 54.3 | 1092 | 53.2 | 1007 | 50.4 |
| PA: Private | 517 | 70.3 | 178 | 83.8 | 186 | 85.7 | 179 | 86.9 | 236 | 90.0 | 244 | 89.3 |
| PA: Public | 219 | 29.7 | 34 | 16.2 | 31 | 14.3 | 28 | 13.1 | 26 | 10 | 29 | 10.7 |
| RI: Private | 122 | 63.7 | 100 | 50.9 | 140 | 50.2 | 197 | 53.0 | 223 | 53.2 | 218 | 54.1 |
| RI: Public | 69 | 36.3 | 96 | 49.1 | 138 | 49.8 | 175 | 47 | 197 | 46.8 | 185 | 45.9 |
| VA: Private | 59502 | 66.9 | 23450 | 73.8 | 19883 | 79.4 | 17828 | 80.5 | 18362 | 80.4 | 19934 | 80.6 |
| VA: Public | 29457 | 33.1 | 8317 | 26.2 | 5145 | 20.6 | 4310 | 19.5 | 4477 | 19.6 | 4794 | 19.4 |

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Appendix A. Forest lands at risk in each state based on the National Land Cover Data.

| Connecticut | | | | | | |
|---|---|---|---|---|---|---|
| **categories** | **1'** | **2'** | **3'** | **4'** | **5'** | **6'** |
| | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** |
| AU-41 - Deciduous Forest | 454 | 214 | 257 | 282 | 299 | 312 |
| AU-42 - Evergreen Forest | 25 | 6 | 8 | 9 | 9 | 10 |
| AU-43 - Mixed Forest | 95 | 51 | 70 | 75 | 79 | 77 |
| AU-52 Shrub/Scrub | 12 | 8 | 9 | 9 | 10 | 7 |
| AU-90-Woody Wetlands | 1379 | 485 | 648 | 553 | 643 | 571 |
| **Total Forest** | **1965** | **765** | **992** | **928** | **1040** | **977** |

| Delaware | | | | | | |
|---|---|---|---|---|---|---|
| **categories** | **1'** | **2'** | **3'** | **4'** | **5'** | **6'** |
| | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** |
| AU-41 - Deciduous Forest | 498 | 229 | 277 | 294 | 292 | 297 |
| AU-42 - Evergreen Forest | 470 | 336 | 327 | 319 | 280 | 264 |
| AU-43 - Mixed Forest | 243 | 181 | 252 | 290 | 331 | 339 |
| AU-52 Shrub/Scrub | 90 | 47 | 42 | 41 | 43 | 45 |
| AU-90-Woody Wetlands | 15522 | 3515 | 2864 | 2641 | 2427 | 2277 |
| **Total Forest** | **16822** | **4306** | **3762** | **3587** | **3374** | **3222** |

| Maryland | | | | | | |
|---|---|---|---|---|---|---|
| **categories** | **1'** | **2'** | **3'** | **4'** | **5'** | **6'** |
| | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** |
| AU-41 - Deciduous Forest | 1561 | 712 | 746 | 853 | 982 | 1028 |
| AU-42 - Evergreen Forest | 6232 | 4819 | 3256 | 3106 | 4326 | 3592 |
| AU-43 - Mixed Forest | 1834 | 1167 | 1310 | 1473 | 1644 | 1744 |
| AU-52 Shrub/Scrub | 1329 | 623 | 367 | 315 | 346 | 316 |
| AU-90-Woody Wetlands | 88266 | 20725 | 15725 | 15140 | 16447 | 15594 |
| **Total Forest** | **99222** | **28046** | **21404** | **20888** | **23745** | **22274** |

| Massachusetts | | | | | | |
|---|---|---|---|---|---|---|
| **categories** | **1'** | **2'** | **3'** | **4'** | **5'** | **6'** |
| | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** |
| AU-41 - Deciduous Forest | 261 | 176 | 247 | 290 | 311 | 330 |
| AU-42 - Evergreen Forest | 201 | 141 | 195 | 238 | 281 | 304 |
| AU-43 - Mixed Forest | 264 | 167 | 226 | 295 | 357 | 401 |
| AU-52 Shrub/Scrub | 18 | 17 | 34 | 57 | 83 | 97 |
| AU-90-Woody Wetlands | 3318 | 920 | 1065 | 1128 | 1122 | 1164 |
| **Total Forest** | **4062** | **1420** | **1767** | **2007** | **2154** | **2296** |

| New Jersey | | | | | | |
|---|---|---|---|---|---|---|
| **categories** | **1'** | **2'** | **3'** | **4'** | **5'** | **6'** |
| | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** |
| AU-41 - Deciduous Forest | 713 | 285 | 310 | 357 | 384 | 403 |
| AU-42 - Evergreen Forest | 101 | 110 | 177 | 239 | 273 | 317 |
| AU-43 - Mixed Forest | 198 | 179 | 237 | 295 | 351 | 410 |
| AU-52 Shrub/Scrub | 153 | 73 | 85 | 97 | 113 | 118 |
| AU-90-Woody Wetlands | 40519 | 11564 | 10659 | 10146 | 9891 | 9087 |
| **Total Forest** | **41684** | **12212** | **11469** | **11133** | **11012** | **10334** |

| New York | | | | | | |
|---|---|---|---|---|---|---|
| **categories** | **1'** | **2'** | **3'** | **4'** | **5'** | **6'** |
| | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** |
| AU-41 - Deciduous Forest | 1398 | 1029 | 1124 | 1114 | 1080 | 1053 |
| AU-42 - Evergreen Forest | 59 | 59 | 90 | 92 | 89 | 90 |
| AU-43 - Mixed Forest | 185 | 157 | 208 | 223 | 228 | 237 |
| AU-52 Shrub/Scrub | 164 | 123 | 129 | 115 | 98 | 107 |
| AU-90-Woody Wetlands | 2746 | 1056 | 817 | 675 | 558 | 510 |
| **Total Forest** | **4552** | **2424** | **2369** | **2219** | **2052** | **1998** |

| Pennsylvania | | | | | | |
|---|---|---|---|---|---|---|
| **categories** | **1'** | **2'** | **3'** | **4'** | **5'** | **6'** |
| | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** |
| AU-41 - Deciduous Forest | 124 | 45 | 45 | 45 | 54 | 47 |
| AU-42 - Evergreen Forest | 0 | 0 | 0 | 0 | 0 | 0 |
| AU-43 - Mixed Forest | 2 | 1 | 1 | 1 | 1 | 1 |
| AU-52 Shrub/Scrub | 12 | 9 | 7 | 7 | 7 | 5 |
| AU-90-Woody Wetlands | 598 | 158 | 165 | 154 | 200 | 220 |
| **Total Forest** | **736** | **212** | **217** | **207** | **262** | **273** |

| Rhode Island | | | | | | |
|---|---|---|---|---|---|---|
| **categories** | **1'** | **2'** | **3'** | **4'** | **5'** | **6'** |
| | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** |
| AU-41 - Deciduous Forest | 71 | 65 | 96 | 115 | 133 | 145 |
| AU-42 - Evergreen Forest | 10 | 3 | 4 | 6 | 8 | 9 |
| AU-43 - Mixed Forest | 32 | 28 | 44 | 64 | 73 | 78 |
| AU-52 Shrub/Scrub | 3 | 5 | 5 | 6 | 7 | 8 |
| AU-90-Woody Wetlands | 75 | 94 | 130 | 180 | 199 | 163 |
| **Total Forest** | **191** | **196** | **278** | **372** | **420** | **403** |

| Virginia | | | | | | |
|---|---|---|---|---|---|---|
| **categories** | **1'** | **2'** | **3'** | **4'** | **5'** | **6'** |
| | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** | **Acres** |
| AU-41 - Deciduous Forest | 505 | 356 | 401 | 427 | 438 | 464 |
| AU-42 - Evergreen Forest | 2810 | 3783 | 4306 | 3936 | 3954 | 4234 |
| AU-43 - Mixed Forest | 1820 | 1040 | 1254 | 1478 | 1706 | 1900 |
| AU-52 Shrub/Scrub | 376 | 533 | 473 | 389 | 356 | 329 |
| AU-90-Woody Wetlands | 83447 | 26055 | 18594 | 15908 | 16384 | 17800 |
| **Total Forest** | **88958** | **31767** | **25028** | **22138** | **22839** | **24728** |

Appendix B. Forest lands at risk for Sea Level Rise 1-6' scenarios broken out by ownership category based on USGS PADUS Data.

| Connecticut | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Owner** | **SLR 1** | | **SLR 2** | | **SLR 3** | | **SLR 4** | | **SLR 5** | | **SLR 6** | |
| | acres | % | acres | % | acres | % | acres | % | acres | % | acres | % |
| Other | 1229 | 62.5 | 475 | 62.2 | 531 | 53.5 | 583 | 62.8 | 657 | 63.2 | 647 | 66.2 |
| Federal | 43 | 2.2 | 11 | 1.4 | 12 | 1.3 | 13 | 1.5 | 16 | 1.6 | 16 | 1.6 |
| State | 326 | 16.6 | 128 | 16.7 | 271 | 27.3 | 153 | 16.5 | 195 | 18.7 | 150 | 15.3 |
| NGO | 153 | 7.8 | 54 | 7.0 | 62 | 6.2 | 52 | 5.6 | 47 | 4.5 | 36 | 3.7 |
| Local | 158 | 8.0 | 71 | 9.4 | 78 | 7.8 | 73 | 7.9 | 70 | 6.7 | 85 | 8.7 |
| Regional | 1 | 0.1 | 2 | 0.3 | 2 | 0.2 | 3 | 0.4 | 3 | 0.3 | 2 | 0.2 |
| Private | 42 | 2.1 | 22 | 2.8 | 34 | 3.5 | 48 | 5.2 | 51 | 4.9 | 40 | 4.1 |
| Unknown | 12 | 0.6 | 2 | 0.2 | 2 | 0.2 | 1 | 0.1 | 1 | 0.1 | 2 | 0.2 |
| Am Ind. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Joint | 1 | 0.0 | 0 | 0.1 | 1 | 0.1 | 1 | 0.1 | 0 | 0.0 | 1 | 0.1 |
| **Total** | **1965** | **100** | **765** | **100** | **992** | **100** | **928** | **100** | **1040** | **100** | **977** | **100** |

| Delaware | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Owner** | **SLR 1** | | **SLR 2** | | **SLR 3** | | **SLR 4** | | **SLR 5** | | **SLR 6** | |
| | acres | % | acres | % | acres | % | acres | % | acres | % | acres | % |
| Other | 6687 | 39.8 | 1835 | 42.6 | 1718 | 45.7 | 1742 | 48.6 | 1849 | 54.8 | 1844 | 57.2 |
| Federal | 3166 | 18.8 | 482 | 11.2 | 346 | 9.2 | 277 | 7.7 | 222 | 6.6 | 192 | 6.0 |
| State | 4323 | 25.7 | 1320 | 30.7 | 1128 | 30.0 | 1117 | 31.1 | 972 | 28.8 | 920 | 28.6 |
| NGO | 1525 | 9.1 | 368 | 8.6 | 325 | 8.6 | 230 | 6.4 | 120 | 3.6 | 90 | 2.8 |
| Local | 938 | 5.6 | 214 | 5.0 | 211 | 5.6 | 202 | 5.6 | 193 | 5.7 | 162 | 5.0 |
| Regional | 8 | 0.1 | 1 | 0.0 | 1 | 0.0 | 2 | 0.1 | 2 | 0.1 | 2 | 0.1 |
| Private | 175 | 1.0 | 86 | 2.0 | 33 | 0.9 | 17 | 0.5 | 15 | 0.4 | 13 | 0.4 |
| Unknown | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Am Ind. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Joint | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| **Total** | **16822** | **100** | **4306** | **100** | **3762** | **100** | **3587** | **100** | **3374** | **100** | **3222** | **100** |

| Maryland | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Owner** | **SLR 1** | | **SLR 2** | | **SLR 3** | | **SLR 4** | | **SLR 5** | | **SLR 6** | |
| | acres | % | acres | % | acres | % | acres | % | acres | % | acres | % |
| Other | 58006 | 58.5 | 18865 | 67.3 | 14929 | 69.8 | 14204 | 68.0 | 16205 | 68.2 | 15944 | 71.6 |
| Federal | 11685 | 11.8 | 2364 | 8.4 | 1183 | 5.5 | 1241 | 5.9 | 1128 | 4.8 | 492 | 2.2 |
| State | 21730 | 21.9 | 4547 | 16.2 | 3778 | 17.7 | 3992 | 19.1 | 5084 | 21.4 | 4646 | 20.9 |
| NGO | 6654 | 6.7 | 1751 | 6.3 | 1018 | 4.8 | 938 | 4.5 | 862 | 3.6 | 752 | 3.4 |
| Local | 1133 | 1.1 | 514 | 1.8 | 491 | 2.3 | 510 | 2.4 | 463 | 2.0 | 437 | 2.0 |
| Regional | 13 | 0.0 | 3 | 0.0 | 2 | 0.0 | 2 | 0.0 | 1 | 0.0 | 1 | 0.0 |
| Private | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Unknown | 2 | 0.0 | 3 | 0.0 | 2 | 0.0 | 2 | 0.0 | 3 | 0.0 | 3 | 0.0 |
| Am Ind. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Joint | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| **Total** | **99222** | **100** | **28046** | **100** | **21404** | **100** | **20888** | **100** | **23746** | **100** | **22274** | **100** |

| Massachusetts | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Owner** | **SLR 1** | | **SLR 2** | | **SLR 3** | | **SLR 4** | | **SLR 5** | | **SLR 6** | |
| | acres | % | acres | % | acres | % | acres | % | acres | % | acres | % |
| Other | 2135 | 52.6 | 878 | 61.8 | 1047 | 59.2 | 1222 | 60.9 | 1348 | 62.6 | 1430 | 62.3 |
| Federal | 521 | 12.8 | 47 | 3.3 | 54 | 3.1 | 68 | 3.4 | 68 | 3.2 | 69 | 3.0 |
| State | 171 | 4.3 | 109 | 7.7 | 153 | 8.7 | 161 | 8.0 | 156 | 7.2 | 172 | 7.5 |
| NGO | 463 | 11.4 | 218 | 15.3 | 308 | 17.4 | 340 | 16.9 | 348 | 16.2 | 332 | 14.5 |
| Local | 768 | 18.9 | 166 | 11.7 | 197 | 11.2 | 211 | 10.5 | 229 | 10.7 | 288 | 12.6 |
| Regional | 0 | 0.0 | 0 | 0.0 | 1 | 0.1 | 2 | 0.1 | 2 | 0.1 | 2 | 0.1 |
| Private | 4 | 0.1 | 3 | 0.2 | 7 | 0.4 | 3 | 0.2 | 2 | 0.1 | 3 | 0.2 |
| Unknown | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Am Ind. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Joint | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| **Total** | **4062** | **100** | **1420** | **100** | **1767** | **100** | **2007** | **100** | **2154** | **100** | **2296** | **100** |

| New Jersey | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Owner** | **SLR 1** | | **SLR 2** | | **SLR 3** | | **SLR 4** | | **SLR 5** | | **SLR 6** | |
| | acres | % | acres | % | acres | % | acres | % | acres | % | acres | % |
| Other | 23588 | 56.6 | 6009 | 49.2 | 5960 | 52.0 | 5996 | 53.9 | 5967 | 54.2 | 1301 | 55.0 |
| Federal | 2990 | 7.2 | 1493 | 12.2 | 1383 | 12.1 | 1308 | 11.8 | | 12.5 | 1301 | 12.6 |
| State | 8865 | 21.3 | 3226 | 26.4 | 2746 | 23.9 | 2603 | 23.4 | 2534 | 23.0 | 1301 | 22.1 |
| NGO | 2365 | 5.7 | 591 | 4.8 | 548 | 4.8 | 449 | 4.0 | 374 | 3.4 | 1301 | 3.0 |
| Local | 3769 | 9.0 | 887 | 7.3 | 829 | 7.2 | 772 | 6.9 | 753 | 6.8 | 1301 | 7.2 |
| Regional | 101 | 0.2 | 4 | 0.0 | 2 | 0.0 | 2 | 0.0 | 2 | 0.0 | 1301 | 0.0 |
| Private | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1301 | 0.0 |
| Unknown | 6 | 0.1 | 1 | 0.0 | 1 | 0.0 | 2 | 0.0 | 2 | 0.0 | 1301 | 0.0 |
| Am Ind. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1301 | 0.0 |
| Joint | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1301 | 0.0 |
| **Total** | **41684** | **100** | **12212** | **100** | **11469** | **100** | **11133** | **100** | **9633** | **100** | **1301** | **100** |

| New York | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Owner** | **SLR 1** | | **SLR 2** | | **SLR 3** | | **SLR 4** | | **SLR 5** | | **SLR 6** | |
| | acres | % | acres | % | acres | % | acres | % | acres | % | acres | % |
| Other | 2291 | 50.3 | 1138 | 46.9 | 1106 | 46.7 | 1014 | 45.7 | 960 | 46.8 | 991 | 49.6 |
| Federal | 235 | 5.2 | 175 | 7.2 | 188 | 7.9 | 208 | 9.4 | 223 | 10.9 | 223 | 11.2 |
| State | 1244 | 27.3 | 622 | 25.7 | 507 | 21.4 | 458 | 20.7 | 379 | 18.5 | 299 | 14.9 |
| NGO | 200 | 4.4 | 109 | 4.5 | 103 | 4.4 | 93 | 4.2 | 83 | 4.0 | 74 | 3.7 |
| Local | 478 | 10.5 | 354 | 14.6 | 425 | 17.9 | 410 | 18.5 | 370 | 18.0 | 369 | 18.5 |
| Regional | 0 | 0.0 | 1 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 0.0 | 1 | 0.0 |
| Private | 95 | 2.1 | 11 | 0.5 | 11 | 0.5 | 10 | 0.5 | 10 | 0.5 | 9 | 0.5 |
| Unknown | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Am Ind. | 6 | 0.1 | 12 | 0.5 | 26 | 1.1 | 22 | 1.0 | 25 | 1.2 | 30 | 1.5 |
| Joint | 2 | 0.1 | 3 | 0.1 | 3 | 0.1 | 2 | 0.1 | 2 | 0.1 | 1 | 0.1 |
| **Total** | **4552** | **100** | **2424** | **100** | **2369** | **100** | **2219** | **100** | **2052** | **100** | **1998** | **100** |

| Pennsylvania | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Owner** | **SLR 1** | | **SLR 2** | | **SLR 3** | | **SLR 4** | | **SLR 5** | | **SLR 6** | |
| | acres | % | acres | % | acres | % | acres | % | acres | % | acres | % |
| Other | 517 | 70.3 | 178 | 83.8 | 186 | 85.7 | 179 | 86.9 | 236 | 90.0 | 244 | 89.3 |
| Federal | 153 | 20.8 | 16 | 7.7 | 186 | 85.7 | 11 | 5.5 | 9 | 3.4 | 8 | 2.9 |
| State | 24 | 3.2 | 8 | 3.6 | 14 | 6.3 | 6 | 2.8 | 8 | 3.0 | 11 | 4.0 |
| NGO | 1 | 0.1 | 0 | 0.1 | 6 | 2.7 | 0 | 0.2 | 0 | 0.1 | 0 | 0.1 |
| Local | 41 | 5.6 | 10 | 4.9 | 0 | 0.1 | 10 | 4.7 | 9 | 3.5 | 10 | 3.7 |
| Regional | 0 | 0.0 | 0 | 0.0 | 11 | 5.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Private | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Unknown | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Am Ind. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Joint | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| **Total** | **736** | **100** | **212** | **100** | **217** | **100** | **207** | **100** | **262** | **100** | **273** | **100** |

| Rhode Island | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Owner** | **SLR 1** | | **SLR 2** | | **SLR 3** | | **SLR 4** | | **SLR 5** | | **SLR 6** | |
| | acres | % | acres | % | acres | % | acres | % | acres | % | acres | % |
| Other | 122 | 63.7 | 100 | 50.9 | 140 | 50.2 | 197 | 53.0 | 223 | 53.2 | 218 | 54.1 |
| Federal | 6 | 3.2 | 12 | 6.0 | 11 | 3.8 | 13 | 3.5 | 18 | 4.4 | 20 | 5.1 |
| State | 20 | 10.2 | 18 | 9.4 | 28 | 10.1 | 41 | 10.9 | 50 | 12.0 | 55 | 13.6 |
| NGO | 8 | 4.3 | 11 | 5.5 | 15 | 5.4 | 15 | 4.1 | 23 | 5.5 | 23 | 5.7 |
| Local | 27 | 14.0 | 41 | 20.7 | 62 | 22.3 | 83 | 22.4 | 85 | 20.2 | 66 | 16.5 |
| Regional | 4 | 2.2 | 8 | 3.9 | 12 | 4.2 | 10 | 2.7 | 10 | 2.4 | 12 | 3.0 |
| Private | 4 | 2.3 | 7 | 3.6 | 11 | 4.1 | 13 | 3.5 | 10 | 2.4 | 8 | 2.1 |
| Unknown | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Am Ind. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Joint | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| **Total** | **191** | **100** | **196** | **100** | **278** | **100** | **372** | **100** | **420** | **100** | **403** | **100** |

| Virginia | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Owner** | **SLR 1** | | **SLR 2** | | **SLR 3** | | **SLR 4** | | **SLR 5** | | **SLR 6** | |
| | acres | % | acres | % | acres | % | acres | % | acres | % | acres | % |
| Other | 59502 | 66.9 | 23450 | 73.8 | 19883 | 79.4 | 17828 | 80.5 | 18362 | 80.4 | 19934 | 80.6 |
| Federal | 5287 | 5.9 | 1713 | 5.4 | 949 | 3.8 | 572 | 2.6 | 405 | 1.8 | 313 | 1.3 |
| State | 10522 | 11.8 | 3017 | 9.5 | 1882 | 7.5 | 1661 | 7.5 | 1806 | 7.9 | 1471 | 6.0 |
| NGO | 9128 | 10.3 | 2655 | 8.4 | 1655 | 6.6 | 1437 | 6.5 | 1495 | 6.6 | 2011 | 8.1 |
| Local | 3856 | 4.3 | 843 | 2.7 | 591 | 2.4 | 553 | 2.5 | 683 | 3.0 | 883 | 3.6 |
| Regional | 166 | 0.2 | 43 | 0.1 | 35 | 0.1 | 54 | 0.3 | 75 | 0.3 | 102 | 0.4 |
| Private | 10 | 0.0 | 7 | 0.0 | 13 | 0.1 | 18 | 0.1 | 3 | 0.0 | 3 | 0.0 |
| Unknown | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Am Ind. | 487 | 0.6 | 41 | 0.1 | 20 | 0.1 | 14 | 0.1 | 9 | 0.0 | 9 | 0.0 |
| Joint | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| **Total** | **88959** | **100** | **31767** | **100** | **25028** | **100** | **22138** | **100** | **22839** | **100** | **24728** | **100** |