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Key Findings:

- **Our implementation-focused partnership undertook key research efforts to identify ecologically critical locations for wetland restoration and to understand landowners' views related to restoration.**

- **Over 180 "priority" areas were identified, where wetland placement would maximize water quality and climate resilience benefits without hindering agricultural production on prime land.**

- **Delmarva priority landowners are primarily motivated to restore their lands for benefits related to wildlife, water quality, and for potential financial payments.**

- **Younger landowners are more motivated by restoration's ecological benefits and more concerned about its perceived impact on property value.**

- **65% of priority landowners report "never" being contacted about restoration before; 77% express interest in implementing restoration on part of their land.**

- **Targeting and tailoring engagement may accelerate landowner engagement and environmental outcomes while also undercovering additional barriers to accelerate implementation of wetlands**

Wetlands in the Chesapeake Bay Watershed

Wetlands are a vital part of the landscapes across the Chesapeake Bay Watershed. Our region's ecosystems and the people that depend on them are threatened by a nexus of environmental challenges, including degraded water quality, biodiversity loss, and climate change. While efforts to address these critical challenges must touch down in many places and in all sectors, wetlands are a key part of the solution. They provide a multitude of benefits. Wetlands are one of our best natural systems that cleanse water and deliver it to streams, and ultimately Chesapeake Bay. Wetlands also cleanse and recharge aquifers used in drinking water wells. Moreover, Wetlands are rich habitats for many species of birds, amphibians, reptiles, and mammals. The Bay watershed has experienced a dramatic loss of historical wetland coverage, estimated at about 50% or a loss of 1.5 million acres (Dahl 1990, Tiner 1986), and in consequence, the area and its people have also lost many of the associated ecosystem services.

To successfully address our interconnected environmental problems, it is widely recognized that we must restore a percentage of our lost wetlands. The current goal as part of the 2010 Chesapeake Bay Agreement is to restore 85,000 acres of wetlands, most of which will occur on agricultural lands across the watershed. While much progress has been made in recent years, implementation has been limited overall, with just over 9,000 acres being restored through 2017 (CBP n.d.).

Toward addressing persistent and emerging environmental challenges, the implementation rate of restored wetlands must accelerate. This depends on more effectively engaging private landowners to voluntarily restore wetlands on their property, which requires a better understanding of their views on restoration and wetlands specifically. At the same time, the ecological functions and benefits of wetlands depend greatly on their location in the landscape and on a particular property as wetland ecosystem services depend on water sources, surrounding land use, geology, climate, and other factors. For example, science developed by The Nature Conservancy found that restoring a wetland in the top 10% of ranked wetland restoration opportunities in the Pocomoke Watershed is predicted to reduce almost 4 times the amount of nitrogen than restoring a site in the top 50% of sites (Boomer in press). More wetlands are needed, and these wetlands must be placed on the most critical lands.

Our approach

The Delmarva Wetland Partnership is a collaborative effort between The Nature Conservancy, Ducks Unlimited, The United States Department of Agriculture's Natural Resource Conservation Service, United States Fish and Wildlife Service and Maryland Department of Natural Resources. Our programs have already collectively implemented over 4,000 acres of wetlands across Delmarva to date. Despite this success, our partnership felt there was an opportunity to accelerate our impact by taking a more strategic approach to landowner engagement. Our organizations co-developed a project toward this end, focused on the Maryland and Delaware portions of the Delmarva Peninsula. This area is a prime example of the region's historical loss of wetlands. Drainage projects and development have enabled agriculture to expand to new areas and for towns to spring up on formally marshy land. While this has provided numerous benefits to the area, it has also contributed to the loss of approximately 40% (Tiner 2005) of the historic extent of wetlands across the Peninsula. In addition to water quality benefits, wetlands on the Delmarva peninsula are especially important to waterfowl, wading birds, shorebirds, and songbirds moving up and down the Atlantic flyway.

Toward expanding our restoration efforts, our partnership undertook two related activities to improve our placement of and landowner engagement related to wetlands. First, we employed an ecological targeting model to identify lands across Delmarva where restoration would have the most significant environmental benefits for water quality and climate resiliency (both critical to restoring biodiversity in the Chesapeake Bay). Subsequently, our team co-developed a landowner social science survey focusing on understanding the views of the landowners of these priority lands.

What we found

Using an ecological targeting approach, our team collaboratively developed a process to prioritize locations to restore lands to maximize water quality improvements and climate resilience benefits. We identified 964 restoration opportunities based on contiguous areas of non-developed land uses, exclusion of prime farmland and tidal wetlands, and a minimum of 150 acres that had potential to restore wetland function. We then prioritized these opportunities using seven criteria (listed in table 1).

Table 1: Ecological targeting model criteria	
Criteria	**Definition**
Total Nitrogen and Total Phosphorus	Modeled amounts of nutrient loads entering from upland land use sources.
Agricultural land use (AG)	Percent of total land use in the watershed of the restoration opportunity in agriculture.
Ecohydrologically active areas (EHA)	Areas within each restoration opportunity where there is interaction between the plant rooting zone and the groundwater table, assuming that wetland biogeochemical processes will occur.
Floodplains (FP)	Presence/ absence of a floodplain (FPs) in restoration opportunity. FPs have a higher retention rate for nitrogen and phosphorus.
Water storage capacity (WS)	Potential water storage and residence time within a restoration opportunity.
Climate flow (CF)	Area of restoration opportunity rated above average for supporting the potential plant and animal movement as a response to climate change pressures (Anderson et al. 2016)

We used the results of the ecological targeting model criteria and a multi-criteria decision analysis to identify 453 distinct "priority" restoration opportunities from our original 964 (Martin et al. 2022 and (Fig. 1).). Figure 1 graphically depicts these priority lands.
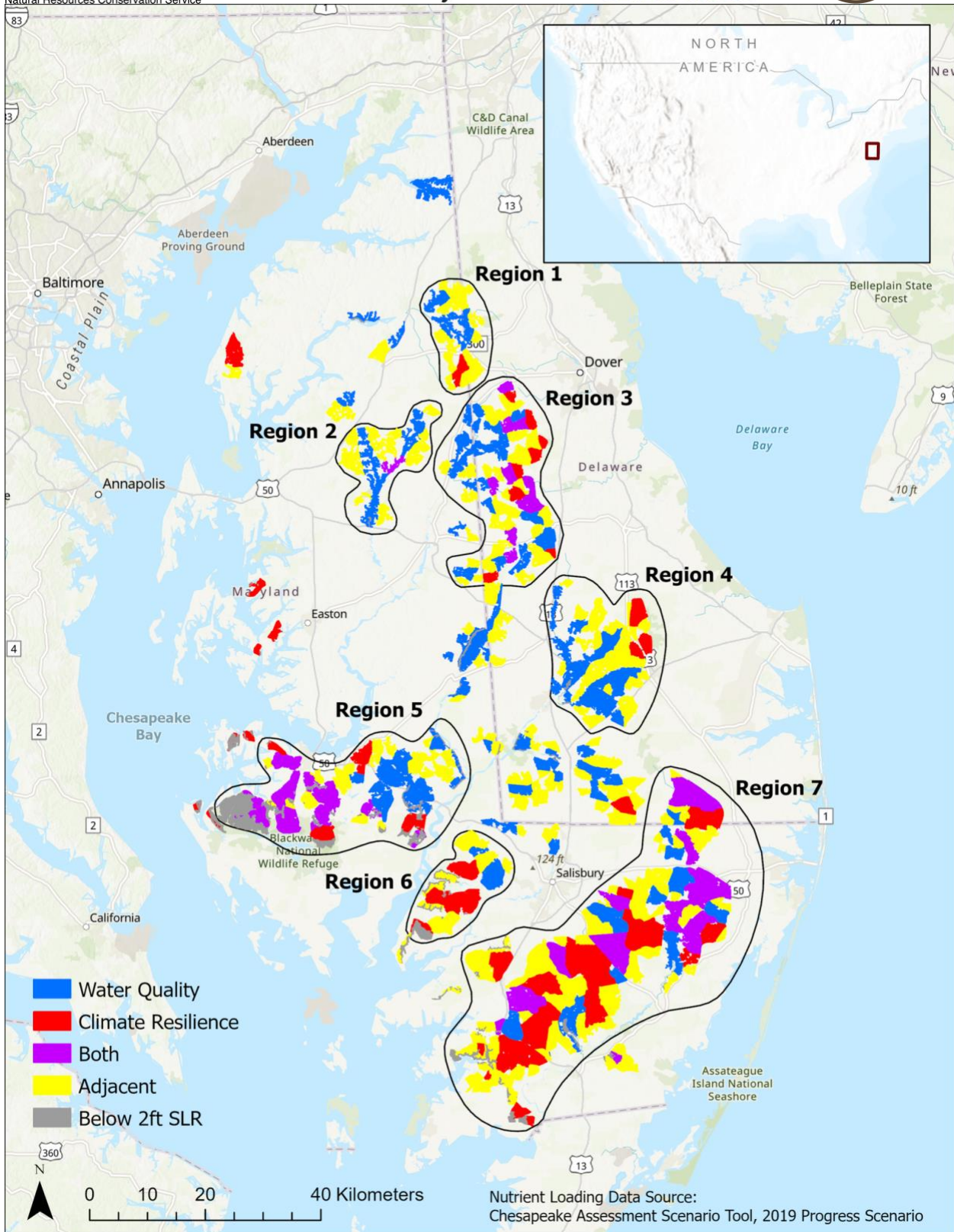
Figure 1: Map of ecologically targeted sites

Understanding landowners

Using public tax records, we generated a mailing list of 2,294 landowners in priority restoration opportunity areas with parcels >10 acres. Between February and April, we mailed surveys out to this respondent list. In total, 373 landowners completed and returned a survey, for approximately 16.3% respondent rate. This response rate accords well with other recent surveys of related populations.

Respondents owned lands across almost every county on Delmarva**.** Over 60% of respondents live on Delmarva full-time, and the average amount of land owned was 236 acres. Forested and cropland were dominant landscape features on respondents' land, with approximately 70% and 85% reporting owning at least some of these land types, respectively. Respondent's ages ranged from 29 to 95 years old, with an average of 66 years.

Our survey suggests that Delmarva landowners face a complex set of challenges when it comes to land management decisions (Figure 2), but that they also see land restoration as able to address some of these concerns (Figure 3). The ***dominant motivation to voluntarily restore land is the opportunity to see more wildlife.***

When it comes to specific types of land restoration projects, landowners reported largely positive associations with wetlands. Approximately ***75% agreed wetlands help reduce the impact of flooding, 84% felt they were beautiful, and over 94% agreed that wetlands can help protect wildlife***. *A smaller but substantial percentage expressed concerns that wetlands hurt property values (42%).*
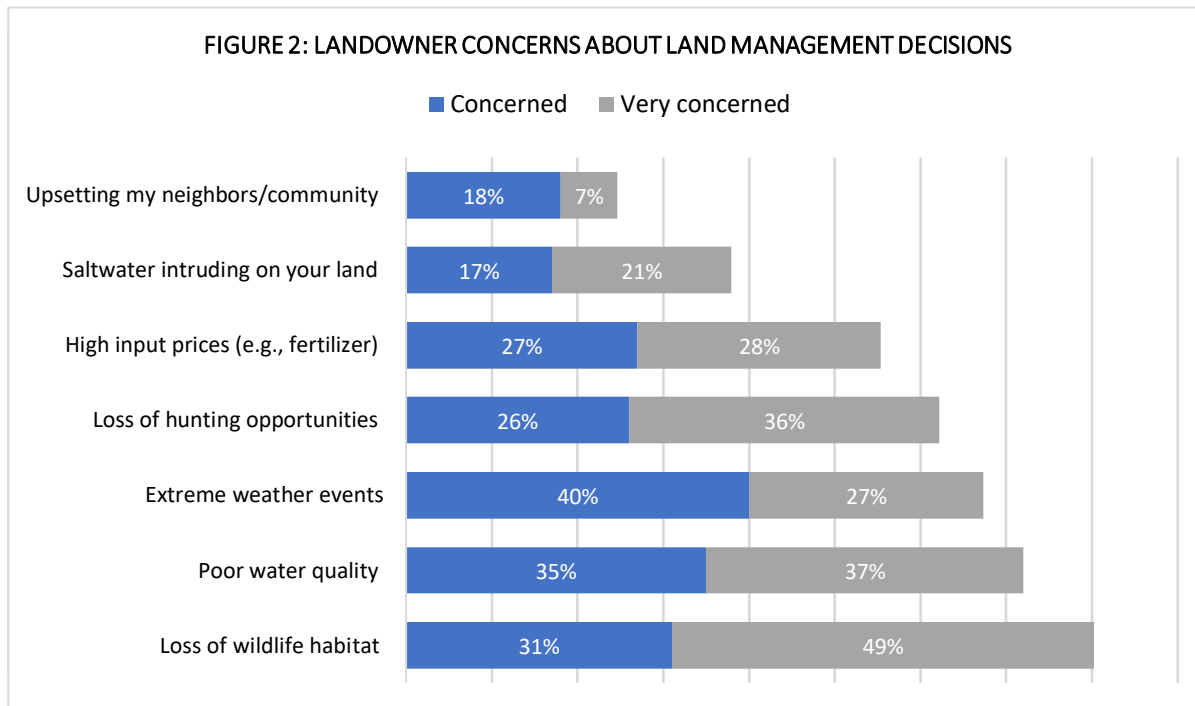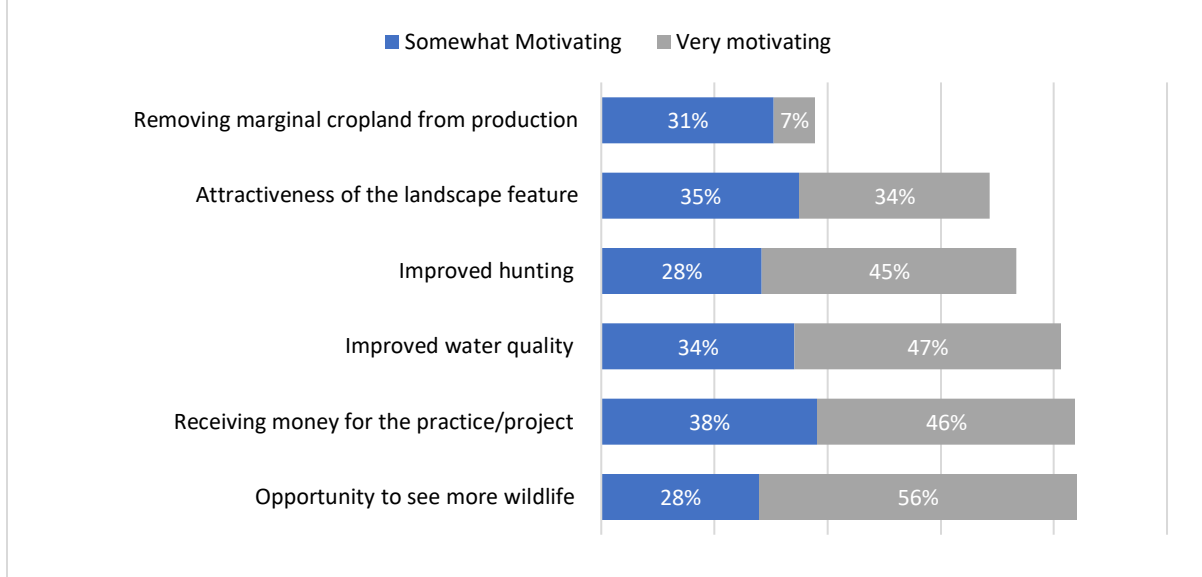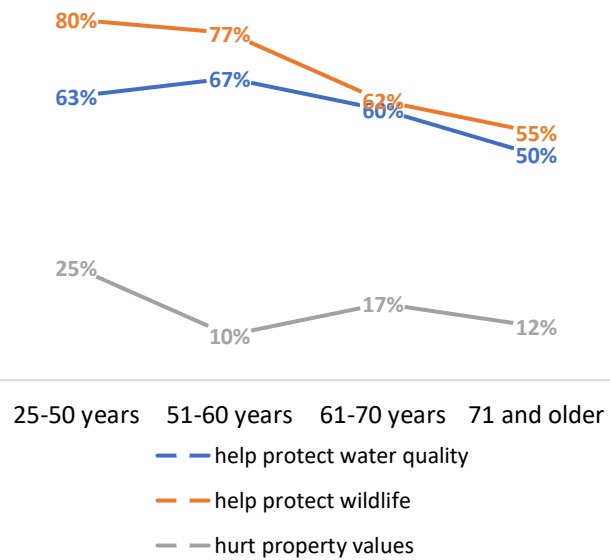

FIGURE 2: LANDOWNER CONCERNS ABOUT LAND MANAGEMENT DECISIONS

■ Concerned   ■ Very concerned

Category	Concerned	Very concerned
Upsetting my neighbors/community	18%	7%
Saltwater intruding on your land	17%	21%
High input prices (e.g., fertilizer)	27%	28%
Loss of hunting opportunities	26%	36%
Extreme weather events	40%	27%
Poor water quality	35%	37%
Loss of wildlife habitat	31%	49%

FIGURE 3: LANDOWNER MOTIVATIONS FOR RESTORING THEIR LAND

■ Somewhat Motivating ■ Very motivating

Motivation	Somewhat Motivating	Very motivating
Removing marginal cropland from production	31%	7%
Attractiveness of the landscape feature	35%	34%
Improved hunting	28%	45%
Improved water quality	34%	47%
Receiving money for the practice/project	38%	46%
Opportunity to see more wildlife	28%	56%

Interestingly, *younger respondents generally were more likely to see environmental benefits from wetlands, but also more likely to express some concerns (Figure 3).* Participation in voluntary restoration: *Nearly a quarter (22%) of survey respondents were already enrolled in some type of restoration program*, with the most reported program being the Conservation Reserve Program (CRP) (14%). *However, the majority of landowners reported never having been contacted about the potential to enroll their land in a voluntary restoration program (65%).*
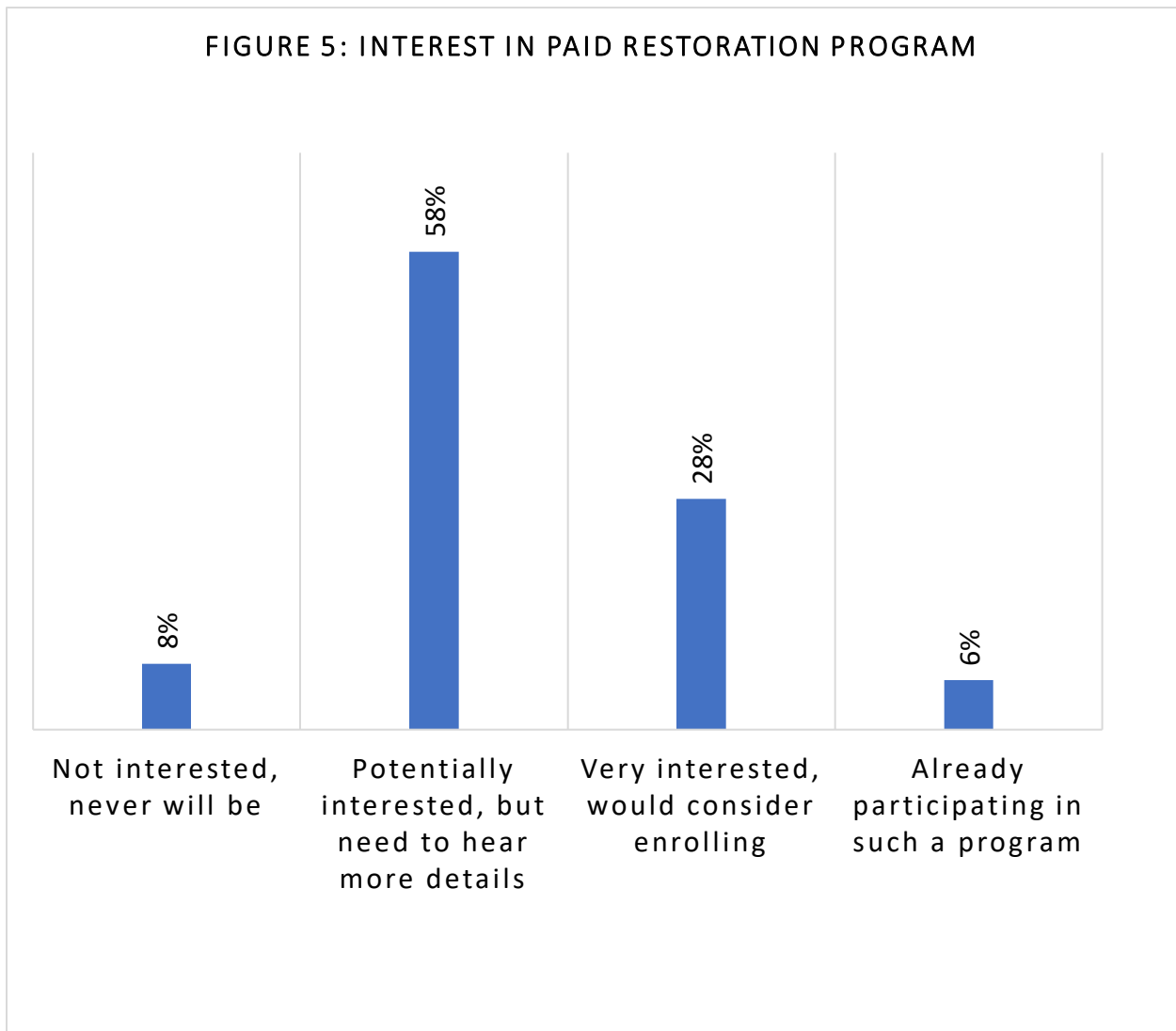
FIGURE 4: PERCEIVED BENEFITS AND CONCERNS OF LANDOWNERS BY AGE

% who "strongly agree" wetlands do the following…

Age	help protect water quality	help protect wildlife	hurt property values
25-50 years	63%	80%	25%
51-60 years	67%	77%	10%
61-70 years	60%	62%	17%
71 and older	50%	55%	12%

- - help protect water quality
- - help protect wildlife
- - hurt property values

Upon reading a description of restoration programs—and the potential to be paid to support wildlife and environmental quality through such programs—many survey-takers expressed interest in participating (Figure 4). Indeed, ***225 respondents requested that we follow up with them to provide more information about these programs and their land's eligibility for participation.*** Of the 65% of landowners never contacted before about restoration, 77% requested a follow-up email or phone call to discuss their land's eligibility (*Figure 5*).

FIGURE 5: INTEREST IN PAID RESTORATION PROGRAM

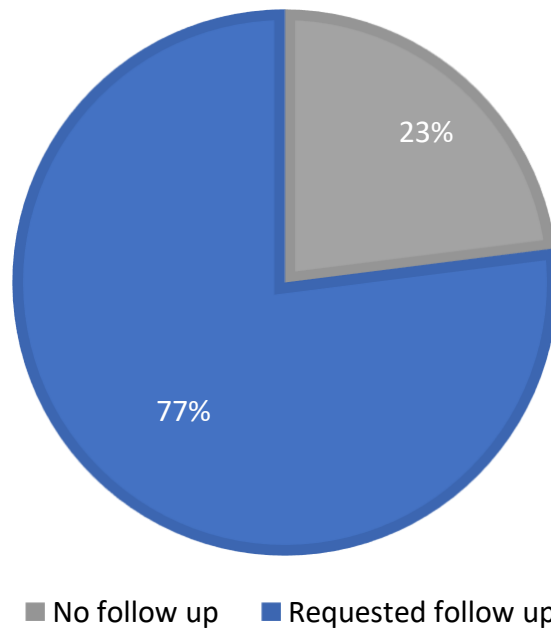| Not interested, never will be	Potentially interested, but need to hear more details	Very interested, would consider enrolling	Already participating in such a program
8%	58%	28%	6%

Key Implications

While some concerns about land restoration projects exist, our partnership's work suggest that many of the owners of Delmarva's ecologically critical lands are supportive of restoration and its benefits. Specifically, the opportunity to see more wildlife, support water quality, and earn money from a restoration program are the top three motivations for respondents to pursue restoration. Emphasizing the potential to achieve these outcomes in future engagement and communication efforts may increase landowner interest and ultimately the implementation of restoration projects across the peninsula.

Maybe more than anything else, our results speak to the need for more landowner engagement. Our survey respondents are "priority" landowners, yet most have never been contacted about restoration opportunities. Moreover, the vast majority of these "never contacted" before group provided their personal contact information and requested follow-up communication. **Together, this information suggests that a significant portion of our target audience has yet to be informed about restoration potentials and that many of these individuals may hold pre-existing interest in these efforts. In short, future efforts** would likely benefit by focusing on increasing landowner awareness about the existence of restoration programs and support from restoration practitioners to assist in selecting the best program to meet their goals.

FIGURE 6: "NEVER CONTACTED" LANDOWNERS INTERESTED IN RESTORATION

23%

77%

■ No follow up ■ Requested follow up

Next Steps

Increase priority landowner engagement: Our next steps will focus on continuing to develop innovative ways to engage priority landowners in restoration, while also working to understand how we can facilitate greater use of restoration programs by a wider, more diverse set of the landowners.

Identify needs and increase capacity to accelerate progress: Related to increasing engagement, dedicating capacity to advance wetland restoration projects is critical to increase progress toward the Bay Program's wetland goal.

The Delmarva Wetland Partnership has shown that dedicating funds to increase capacity to perform outreach and follow-through with interested landowners increases enrollment in restoration programs. Our findings here suggest there is even more opportunity than was previously acknowledged, and more funding should prioritize supporting strategic engagement efforts and the staff who perform this critical work. Our partnership has already begun to act on the foundational efforts outlined here, and our preliminary efforts have indicated that more outreach and engineering capacity is needed to design wetland restoration projects and prevent projects from being delayed and losing landowner interest.

Refine outreach and engagement strategies based on landowner interests and feedback. In our coming work, we will track outreach and engagement with priority landowners across the Delmarva Wetland Partnership members to continue to improve our strategies. For example, we have learned that when practitioners are knowledgeable and can assist landowners in enrolling in a variety of restoration programs rather than only selling one program with their individual organization, more landowners advance projects. Therefore, increasing cross-trainings on available restoration programs is important for new practitioners.

Expand our target and tailor model: Moving forward, we intend to apply our stakeholder-driven ecological targeting and social science research approaches to new locations across the Chesapeake Bay Watershed, as well as other critical areas for restoration in the United States. Our lessons learned and the benefits of our framework generally may help to accelerate restoration in other critical watersheds.

References:

[CC] Chesapeake Conservancy. 2018. Land Use Data Project 2013/2014. The Chesapeake Conservancy. Available at: https://www.chesapeakeconservancy.org/conservation-innovation-center/high-resolution-data/land-use-data-project/

[CBP] Chesapeake Bay Program. No date. Wetlands. Chesapeake Bay Program. Available at: https://www.chesapeakebay.net/issues/wetlands#:~:text=As%20part%20of%20the%20Chesapeake,of%20degraded%20wetlands%20by%202025.W

Dahl , T.E. 1990. Wetlands losses in the United States ~ 1780's TO 1980's. U.S. Department of the Interior, Fish and Wildlife Service Washington. D.C. 13pp.

Martin DM, Jacobs A, McLean C, Canick M, Boomer K. 2022. Comparing normative and descriptive methods for multi-criteria decision analysis: A case study evaluating wetland restoration opportunities in the Chesapeake Bay watershed, USA. Environmental Science & Policy. Available at: https://doi.org/10.1016/j.envsci.2022.02.

Tiner, R. W., Jr. and J. T. Finn. 1986. Status and Recent Trends of Wetlands in Five Mid-Atlantic States: Delaware, Maryland, Pennsylvania, Virginia, and West Virginia . U.S. Fish and Wildlife Service, Region 5, National Wetlands Inventory Project, Newton Comer, MA and U.S. Environmental Protection Agency, Region III, Philadelphia, PA. Cooperative publication. 40 pp.

Tiner, R.W. 2005. Assessing cumulative loss of wetland functions in the Nanticoke River watershed using enhanced national wetlands inventory data. Wetlands:25(2) pp. 405-419.