

**Rising Tides Don't Lift All Boats: A Report on the Need for Disinvestment
from Maryland's Eastern Shore**

By Ryan Green

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Table of Contents

Executive Summary	3
Mandatory Disclaimer	4
Acknowledgements	4
The Issue at Hand	5
How does this relate to the client?	6
The Legal and Regulatory Environment	7
The Consequences of not Disinvesting	8
The Costs of not Disinvesting	10
Literature Review	12
Race and Sea-Level Rise	14
Case Study: Dorchester County, Maryland	16
Alternatives	19
Criteria	22
Findings	24
Outcomes Matrix	34
Recommendation	35
Implementation	35
Conclusion	38
Works Cited	39

Executive Summary

Maryland is one of the most vulnerable states to climate change. If the state doesn't change course from its current plan of action, Maryland will suffer billions in damages to property and hundreds, if not thousands, of people will be at risk of death. However, the cost of properly responding to climate change and sea-level rise has historically made such attempts unpopular, preventing real progress from being made.

The Eastern Shore Land Conservancy (ESLC) is a local conservation group in the Eastern Shore of Maryland that seeks to ensure the long-term safety of both the land and the people that inhabit it. This report was created to help them analyze options to facilitate coastal disinvestment along the Eastern Shore. These options include:

1. Expanding buy-outs of at-risk property in Dorchester County
2. Lobbying for the Deployment of Hybrid Infrastructure along Dorchester County
3. Expand the ESLC's Community-Oriented Awareness Campaigns

These alternatives were evaluated for their cost, administrative feasibility, and effectiveness at moving people away from at-risk coastal areas. After analyzing the options, this project ultimately recommends that the ESLC adopt Alternative 3: Expand the ESLC's Community-Oriented Awareness Campaigns. This report concludes with a discussion of possible considerations for implementation.

Mandatory Disclaimer

The author conducted this study as part of the program of professional education at the Frank Batten School of Leadership and Public Policy, University of Virginia. This paper is submitted in partial fulfillment of the course requirements for the Master of Public Policy degree. The judgments and conclusions are solely those of the author, and are not necessarily endorsed by the Batten School, by the University of Virginia, or by any other agency.

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The Issue at Hand

With over 3,100 miles of coastline, Maryland is uniquely vulnerable to sea-level rise (SLR). Without decisive government action, Maryland is set to experience a 50% increase in flooding and lose over \$9 billion dollars. Intermediate predictions of sea-level rise estimate that in the next 60 years, there will be break-even chances on record-breaking flooding in Baltimore and Annapolis. Other parts of the state will have less than 20 years to prepare (Strauss et al., 2014). Dorchester County, Maryland is referred to as “Ground Zero” for climate change as it is already under siege (Boesch et. al., 2016). Slower scenarios still predict record-breaking floods before 2100 and fast scenarios foresee flooding over 9 feet statewide as soon as 2030. Using this framework to estimate the damage inaction poses, estimates put \$19.6 billion in property value at risk, plus 41,000 homes and 55,000 residents (Strauss et al., 2014). Clearly, something must be done to prevent catastrophe.

Maryland’s response to climate change has been largely band aid solutions that treat symptoms of the problem, but not the underlying issue. For example, in 2018 a story published in the Capital Gazette noted that Maryland Route 450 had flooded over 60 times that year alone, rendering it unusable to the residents who lived there (Ferguson, 2019). Draining the road ignores the fact that this problem will only get worse in the future, both specifically in this case and across the state as a whole. As Figure A shows, large swaths of Maryland are in danger from sea-level rise. Fixing roads that are likely doomed to re-flood does nothing to stymie the underlying problem of worsening storms and rising tides and does not effectively reduce the risk of loss of life as people are kept exposed to rising tides (Woodruff et al., 2018). In September, a similar story was published by CBS Baltimore describing how numerous roads in the D.C. area were unusable as a result of flash flooding (CBS Baltimore, 2020). These stories highlight that

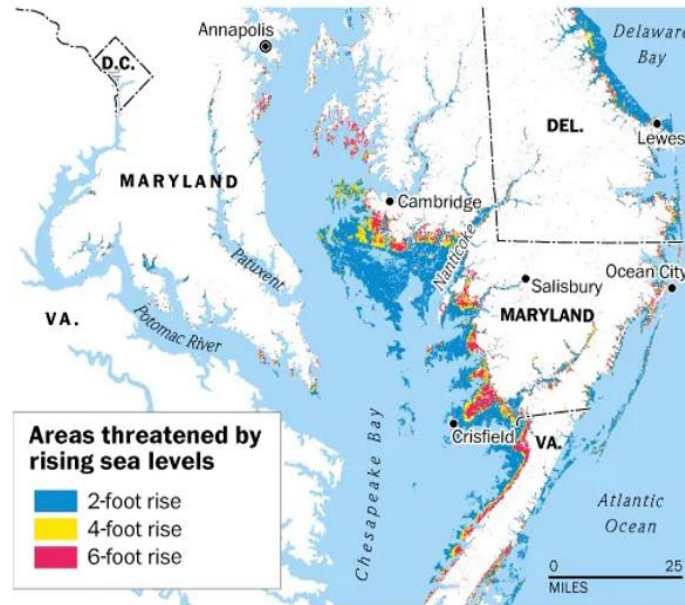
simply waiting for storms to pass and roads to drain is not enough; we need to embrace long term plans that serve the community and plan best for the future.

How does this relate to the client?

The ESLC is a local conservation group trying to protect the land on Maryland's Eastern Shore and the vibrant, thriving communities that grow there. As a stakeholder in the area, the ESLC is very interested in advocating for coastal disinvestment from the most vulnerable areas in the next several decades. Conducting an investigation into how this might be best conducted as well as how to best mobilize the political willpower to do so helps fulfill their mandate. In line with the mission of the Eastern Shore Land Conservancy (ESLC), I will seek to protect and maintain the land of the Eastern Shore. The prospective solutions identified in this project will meet the standards of the mission while operating within the confines of the legal, social, and political bounds of the region.

Figure A¹

Projected Sea Level Rise in Maryland through 2100



The Legal and Regulatory Environment

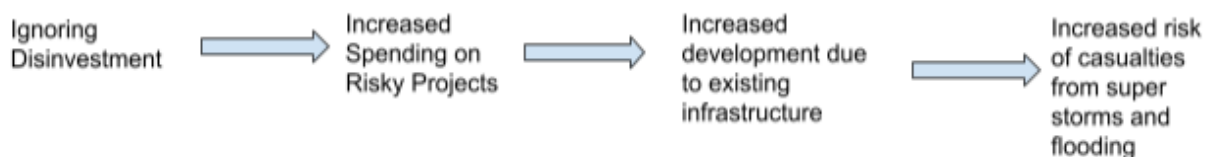
There are more than a handful of agencies and entities involved in this problem: the EPA, the Maryland Department of the Environment, Federal Emergency Management Agency (FEMA) are the main players, as well as nine counties that make up the Eastern Shore and the municipalities within them. One of the most important documents in the framework is a Flood Insurance Rate Map (FIRM), which helps inform a community about its risk of flooding and regulate development. The ESLC has proposed a number of changes for these previously, such as establishing a community-wide floodplain map to ensure all buildings in the area are flood-protected. Furthermore, strategies used to counter developing in high-risk areas like re-zoning

¹ Courtesy of the Washington Post: see Fears (2019)

could open the state (or municipality) up to being sued for violations of the 5th and 14th Amendments. The U.S. Army Corps of Engineers has also advocated recently for the increased use of eminent domain² to make federal buyout plans in the wake of disasters more effective (U.S. Army Corps of Engineers, 2015). Given the Supreme Court’s more liberal view of eminent domain in the wake of *Kelo v. City of New London* (2005), the state might be able to make effective use of the power to take land that is considered too dangerous for living in should inhabitants not want to leave willingly.

Consequences of not Disinvesting

The consequences of ignoring this problem are numerous: from increased spending on doomed projects to being forced to spend even more to clean up the mess, the state of Maryland has a lot to lose. To expand on those consequences, I developed three causal “chains.”

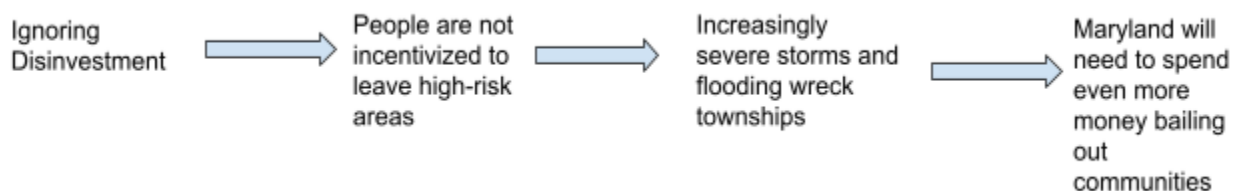


In the first chain, it is predicted that a failure to disinvest³ will generate far-reaching consequences that are ultimately lethal. For example, Maryland Route 450 flooded over 60 times in 2019 alone and the state is going to have to spend millions to stabilize a problem that won’t get better (Ferguson, 2019). Furthermore, by subsidizing the cost of living in flood-prone areas,

² The right of a government or to seize private property for public use, with payment of compensation.

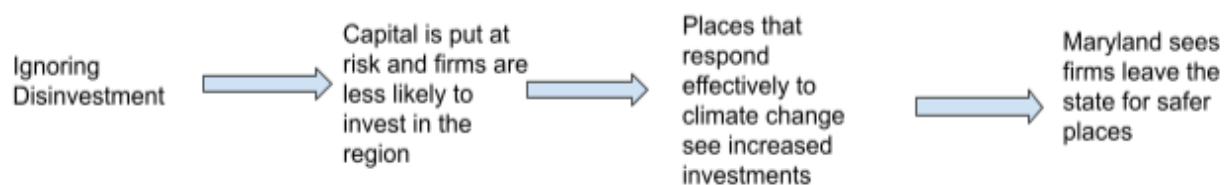
³ Disinvestment in general refers to a process of consciously allowing an infrastructure asset to “fall below previously accepted standards of condition or performance,” typically to be able to reduce long-term investment in the asset and prioritize resources elsewhere for disinvesting (Georgetown Law Climate Center, 2020)

the National Flood Insurance Program is declining to force residents in high-risk areas to internalize the true cost of living there. While this is not under Maryland's direct control, it is exacerbating the issue and there are steps that Maryland can take to counter this (an example would be to increase taxes on coastal developments). Due to subsidized development in risky areas and the state bailing out said developments, we will see an increase in development that will create a need for more infrastructure that the state will need to bail out. A report done by the University of Maryland Center for Environmental Science in 2018 found that surges from tropical storms and Nor'easters pose a significant threat to the people of Maryland and the infrastructure that sustains them (Boesch et al., 2018). The threat level, like the shore itself, will only rise in the future.



In the second chain, we predict that a failure to disinvest now will only magnify future costs to the state. While disinvestment may be expensive and inconvenient now, especially politically speaking, burying our heads in the sand exposes us to being drowned by the tides we ignore. As an example of increasingly severe flooding, Annapolis experienced “nuisance” flooding (high tide flooding) a few days a year in the 1950s. Today, Annapolis experiences said flooding over 40 times a year (Boesch et al. 2018; Fenston, 2018). These marked increases have needed more and more money to fix them while the fundamental issue at hand has been ignored (Boesch et al., 2018). Businesses in the area have also seen a 2% decline in revenue as a direct

result of the increase in nuisance flooding (Kusnetz, 2019). The Maryland Department of the Environment study from 2008 found that a 100-year flood exposed more than \$1 billion in assets statewide to damage and destruction (Joyce et al. 2005). If current trends continue, it is predicted that Maryland will spend more than \$27 billion in adaptive costs as a direct result of sea-level rise (Rodericks, 2019). Clearly, the bill will only rise as we continue to entrench ourselves and our communities in high-risk areas. While it might be expensive to disinvest, the alternative is far more costly. This chain is elaborated on and studied in depth by Woodruff *et. al* (2018) in this investigation's literature review.



Whether or not the government reacts to climate change, companies already are. The London School of Economics found in 2016 that ~\$2.5 trillion in corporate assets are at risk from climate change worldwide (Dietz et al., 2016). To save their bottom line and prepare for the future, companies will safeguard their valuable capital. Maryland ignoring disinvestment could easily signal to the private sector that protecting capital, or indeed the labor that sustains it, is not important (EY, 2016). As a result of this, we could easily see corporations flee to other areas that are more proactive in their climate approach. If the government is not willing to take climate change seriously, they stand to lose quite a lot.

Costs of not Disinvesting

The costs of failing to disinvest are quite high. However, the costs can vary depending on the assumed level of sea-level rise. We will assume that sea-level rise does not exceed the likely

range (66% probability) of 0.8-1.6 feet (Boesch et al., 2018). Starting with the costs of maintaining infrastructure and rebuilding in high-risk areas, I estimate a figure of \$5 billion dollars. This is based on historical amounts required to rebuild after flooding in Ellicott City as well as from the Maryland state and department of transportation budgets, extrapolated to 2050 (Logan, 2019; Milligan, 2019; Maryland Budget Highlights, 2020; Maryland Department of Transportation, 2019). Furthermore, the damages to farming from flooding are also quite high. In 2018, Maryland spent more than \$250,000 on rebuilding farms that were damaged from surges or rendered unusable by saltwater intrusion (Hogan, 2018). Extrapolating this out to 2050, we could expect Maryland to have to spend more than \$7.5 million on land that likely will only reflood again and again (Hogan, 2018; Spector, 2019). A 2019 report estimated the cost of adapting to sea-level rise in Maryland at around \$27 billion dollars (Rodericks, 2019). That figure doesn't include increased maintenance costs from storm surge as well as possible shifts in the tax base as migration increases (Rodericks, 2019). Because the \$27 billion dollar figure is only an estimate, it won't be counted as a strict "cost" of not disinvesting, but it is worth knowing what not doing so might cost us. Overall, the cost to infrastructure would be massive and risks catastrophe if ignored.

The costs to labor and productivity as the climate crisis accelerates are also expensive; a 2019 report from the International Labor Organization estimated a 2.2% reduction in working hours from climate change (International Labor Organization, 2019). In Maryland, the average hourly wage is \$28.95 and there are 3.0219 million workers, which works out to almost \$4 billion in lost wages/production (Bureau of Labor Statistics, 2020; Bureau of Labor Statistics, 2020). Further worsening the bill are decreases in consumption as markets become less usable due to sea-level rise. Using Annapolis markets as a sample for the state, we predict a 1% decline

per year. Extrapolating from current figures, this would mean \$611 million in lost sales (Kusnetz, 2019) in the next 30 years. It is also worth noting that as a result of the ongoing COVID-19 Pandemic, it is difficult to disentangle losses in shopping due to flooding compared to losses from pandemic-related causes. In total, the financial risk of not disinvesting over the next 30 years is roughly \$9,618,500,000 and this, too, likely severely underestimates the real damage a lack of disinvestment poses. This figure is also only accounting for the most-likely range of values for sea-level rise and this number could rise exponentially if climate change accelerates faster than predicted.

Literature Review

Communities facing sea-level rise often only have three options when it comes to dealing with climate change: retreat, accommodation, and protection (Butler et al., 2020). Retreat (also known as abandonment) works via forcing populations to move away from at-risk areas. Accommodation aims not to prevent sea-level rise, but to mitigate its negative impacts on coastal communities. Protection efforts establish barriers between the sea and shore, such as beach nourishment, to stem sea-level rise. Ultimately, retreat is the only viable option in the long term (Hino, 2017).

Generally, coastal communities have engaged in protection and accommodation efforts without retreat. One of the most popular measures, beach nourishment, calls for the placement of sand on eroded beaches and has been consistently used for decades (McNamara, 2011). However, this does not address the long-term causes of shore erosion or sea-level rise, nor is it a sustainable solution. Additionally, it has been found that beach nourishment is strongly tied to

local property values and programs do not last long in poor areas, raising strong ethical concerns (McNamara, 2011).

Such strategies as described above are not financially or environmentally sustainable in the long term. Research has found that investing more into high-risk areas is ultimately pointless and will only waste money. A 2018 cost analysis found that protecting against sea-level rise spurred more development in the area, increasing net risk (Woodruff et al., 2018; Armstrong et al., 2016). Furthermore, as the economic and cultural value of at-risk lands increase, so does the political desire to protect it. This creates a feedback loop akin to the sunken cost fallacy, where past investments justify future costs and one refuses to cut losses. (Woodruff et al., 2018). Because protecting an area increases its economic value, the justification to protect it also increases. This increases investment in an area by creating a “safe development” paradox, while also making areas without protection seem even more doomed. This cycle puts socioeconomically underprivileged Americans at an increasingly large disadvantage as SLR progressively gets worse (Martinich et. al, 2012). Research like this is generalizable to most coastal communities and reflects an increasingly united scientific community view: we need to retreat.

What retreat looks like is complicated. Roads that consistently flood and are extremely expensive to maintain could be considered critical⁴ and thus cannot simply be stripped or abandoned (Georgetown Climate Center, 2020). Avenues must be created for the people to leave before infrastructure can be removed. The social context of infrastructure plays a large role in informing how and when things can be disinvested from. While critical roads require finesse and extensive planning, non-critical roads and infrastructure do not (Georgetown Climate Center,

⁴ e.g., serving an important network function, providing sole access to critical goods and services, etc.

2020). Furthermore, zoning remains an extremely important tool at the municipal level that could advance disinvestment goals (Pfahl Johnson, 2000). For example, Transfer of Development Rights⁵ (TDR) programs provide a mechanism to restrict future development in high-risk sites (Center for Land Use Development, 2005). However, TDRs do not present meaningful solutions to current developments (Center for Land Use Development, 2005).

Race and Sea-Level Rise in the Literature

While it is true that all of Maryland is exposed to increased sea-level rise, not all communities are facing the same risk, even if they're close together. Research has found that government responses to help African-American communities are delayed much longer than for white communities (Miller Hesed and Paolisso, 2015). Additionally, minority communities in the state have complained that government aid is also hard to reach or inadequate (Miller Hesed and Paolisso, 2015). These findings are replicated at large in the academic world. For example, one study from 2017 found that “colorblind adaptive” strategies reinforce existing social inequality by ignoring racial disparities (Hardy et al., 2017). Furthermore, rising sea levels are primarily affecting “racialized land,” as vulnerability to sea-level rise cannot be functionally disentangled from historical racism and socioeconomic inequality (Hardy et al., 2017). To combat this, a field of “abolition ecology” has been created, which directly incorporates antiracist, postcolonial and indigenous theory (Heynen, 2016). Abolition ecology calls for democratized solutions to sea-level rise and the recognition of racial coastal formations. Additionally, researchers have called

⁵ A zoning technique that allows development in more urban areas at the cost of forsaking all future developments on a particular plot of land, typically rural and of environmental importance.

for the explicit inclusion of “multiple forms of knowledge” (Hardy et al., 2017) to overcome racial boundaries to successful adaptation.

While abolition ecology is useful for framing the larger issue of environmental justice (also called environmental racism), in practice its solutions have been vague or too large-scale for communities to implement by themselves. For example, abolition ecology posits that capitalism and climate change are inextricably linked and so to attack one would also attack the other (Heynen, 2016). While to some extent that is no doubt true, as many climate change solutions currently in practice conflict with capitalist “best-practices,” for example subsidies for renewable energy could be seen as distorting the current market for energy, it is extremely unlikely that communities in Eastern Maryland will be able to (assuming they are also willing) distance themselves from capitalism to address climate change more systematically. While it is not a “pragmatic” solution, abolition ecology does highlight key problems present in the current status quo that we will need to address in the long term, such as the conflict between industry profits and the continued wellbeing of the globe, as well as crony capitalism’s influence on government (Heynen, 2016).

Complicating this further is the link between capitalism, racism, and climate change (Davis, 2020). Environmental justice has seen new peaks in popularity and awareness in the wake of disasters like in Flint, Michigan. The extent to which capitalism is considered a racist ideology is generally low, but scholars on the subject of historical marginalization of oppressed groups note that the basis of capitalism was rooted in slavery and this foundation continues to support socioeconomic inequality (Davis, 2020). This is not to say that we should overthrow the status quo in the U.S. but simply to acknowledge that oppressed groups in the U.S. could

disproportionately suffer (as they already do) if we are not actively conscious of the role race plays in the policy process.

Case Study: Dorchester County, Maryland

Dorchester County, Maryland is located on Maryland's Eastern Shore. Relative to the rest of the state, Dorchester County is rural and less wealthy (Woodruff et al., 2018). The lack of wealth and political power severely restrict Dorchester County's ability to respond effectively to sea-level rise. Because of this, it occupies a unique place in coastal research and serves as a case study from which we can extract key insights for the future of the state as a whole.

Most of Dorchester County lies in the 100-year floodplain (Woodruff et al., 2018). Due to the flat nature of the county, even a 7.6 cm (3 inch) increase in the sea-level would result in inundation more than 100 meters (~330 feet) inland (Woodruff et al., 2018). With current estimates of sea-level rise around 110 cm, shores may end up being more than 10 km (~6 miles) inland by the end of the century (Boesch et al., 2013; Miller Hesed and Paolisso, 2015). The economic toll on the county is abundant. Roads routinely flood as do homes, rendering them unusable; septic tank failures are common and drive down home prices, reducing the ability of residents to leave; abandoned homes are not uncommon, as shown in Figure B (Woodruff et al., 2018).

Compounding all of this is the social and political isolation the county faces, further reducing adaptive ability (Miller Hesed and Paolisso, 2015). Local action has been limited and relatively unsuccessful. There have been four attempts since 1990 to require higher elevation in new construction projects and all have failed (Woodruff et al., 2018). The repeated failures to disinvest in Dorchester represent the same tensions in the country as a whole. Successful

disinvestment raises questions of migration, wide scale economic readjustment, and possible social chaos as entire cultural regions shift. Furthermore, the cost of maintenance (let alone adaptation) far exceeds the value of the property in the area (Woodruff, 2018). Consistently, the scientific community has spoken in unison about the solutions to sea-level rise and the greater need for disinvestment, but it remains to be seen how to best package that so politicians will listen. The research paints a dire picture for the county, but if Dorchester can successfully disinvest, it can be a model for how to do the same statewide.

The research is imperfect here, however. Modeling is often used in SLR research to determine which areas can be saved and which can (or should) not and many of the models currently used in academia suffer from assuming certain characteristics of the area, for example demographic and socioeconomic data, will remain fairly stationary over time. (Woodruff, 2018). As a result of this, many models undervalue the future economic shifts caused by disinvestment and continued sea-level rise. Kashem *et. al* (2016) showed that such models can lead to poor outcomes. The models used in Woodruff *et. al* (2018) to predict Dorchester's future are novel with strong methodology. By accounting for the time delay between perceived risk increase and the subsequent change in migration patterns and infrastructure investment (which previous studies in the area have not), Woodruff *et. al* (2018) is able to posit that traditional cost-benefit analysis often undervalues the true damage of sea-level rise and exposes areas to unnecessary risk.

Figure B: Flooding in Dorchester County, Maryland



Flooding like this is not uncommon in Dorchester County, as this footage from the film “High Tide in Dorchester” shows (Goldman, 2011).



The flooding shown here occurred in 2007 and was detailed in *Sea Level Rise: Technical Guidance For Dorchester County*, a report to the Maryland DNR Coastal Zone Management Division. Since then, it has only become more frequent and more severe (Wingate, 2018).

Alternatives

Status Quo

The ESLC would not lobby for a different course of action from the Maryland government. The status quo in Maryland would mean a continuation of band-aid relief in response to sea-level rise. Examples of band-aid relief would include building code and/or zoning changes that reduce the effects of sea level rise but do not address its cause or exposure to sea-level rise.

Developing a Resettlement Plan

The threat that climate change poses to the Maryland coast is undeniable. With that in mind and with the ultimate battle being possibly unwinnable, we should strongly consider the buying out of large swaths of Maryland's coast. To that end, the ESLC should lobby the Dorchester County government to develop and implement a buy-out plan. Even within those areas, however, who is offered (and indeed whether or not residents are allowed to stay) could create many challenges in the planning and legal arenas. For an example of how a successful resettlement could occur, we should model our program off the resettlement of Isle de Jean Charles, Louisiana. There, the state government got funding from the Department of Housing and Urban Development to allow for island residents to leave and live elsewhere. This was a product of intense community work and engagement, and so we should expect a similarly intense input of work along the Eastern Shore. Furthermore, the Isle de Jean Charles does not have even 1/10th of the population of the affected areas in the Eastern Shore so a drastic scaling of the project would be a necessity. While the Louisiana resettlement was a strong example of a

community-oriented, equitable solution, there are likely large issues with ramping up a project like that to a much more populous Eastern Shore.

Developing a buy-out plan would likely entail working with the Maryland state government, the county and/or city government of the desired areas to buy-out, and numerous federal bodies such as the Department of Housing and Urban Development (HUD), the Environmental Protection Agency (EPA), and the U.S. Army Corps of Engineers' (USACE) North Atlantic Division. Using Community Development Grants from HUD to fund resettlement has proven successful in the past (Louisiana Office of Community Development, 2020). A similar experiment was conducted in the Philippines, in the coastal city of Iloilo (See & Wilmsen, 2020). Key takeaways from that experiment suggested that without precaution and significant, committed government oversight, poorer households were significantly worse off in the aftermath than their wealthier counterparts. It also suggested that exodus could be maladaptive, and so the choice for resettlement would be exceedingly important. I will look to other studies such as the Moving to Opportunity to model where in Maryland resettlement would end.

Develop and Deploy a Hybrid Infrastructure Approach

This alternative would call for a mixture of both natural and built infrastructure to protect the Eastern Shore. Lobbying the government to increase funding for this style of project could yield large benefits such as capitalizing on the natural characteristics of the shoreline, innovation in designing coastal protection systems, and this approach could be used in areas where there isn't the space for natural systems (Sutton-Grier, A. E., Wowk, K., & Bamford, H., 2015). For example, natural infrastructure can help weather storms and protect the shorelines, as well as

provide natural resources and improve local water quality (Sutton-Grier, A. E., Wowk, K., & Bamford, H., 2015). This would allow Maryland to take advantage of the strong, known benefits of both hard and soft coastal protection measures. While this approach could combine the best of the two systems, there are significant downsides such as having little data on what a hybrid model looks like, limited expertise in the coastal development community, and the permitting process could add significant time delays to the project, lowering effectiveness (Sutton-Grier, A. E., Wowk, K., & Bamford, H., 2015). Like the above two options, how large this approach could significantly depend on the state's willingness to deploy protection along the coast, as well as if it was handled from the state, county, municipal, or even housing unit level.

Engage in a Community Awareness Campaign

A lot of communities in Maryland are facing severe dangers from flooding, inundation, storm surges, and might not be fully aware of how dire the predictions are for the near future. This policy option entails directing resources to the most at-risk and marginalized communities in Maryland to help them understand how sea-level rise will impact their lives. This could be implemented via a facilitated discussion for each at-risk group, local political and civil rights leaders, as well as other interested parties. By leveraging the ESLC's local political and social capital, these meetings could help convince others that change is necessary. Furthermore, by engaging with the community in this manner, we can ensure that the solutions developed are community-based and oriented which can make the process more equitable. Town managers and city councils could prevent new projects from being built within high-risk areas and stop new developments. Because the ESLC has a lot of land planning expertise, this policy option fits strongly within their skill set and could be implemented quickly and easily. This option could

also be reframed as a large grassroots advocacy campaign about how to realistically prepare for sea-level rise.

Criteria

Cost

Cost will be defined as the amount of money required to build (and maintain if applicable) the policy option. This will be applied to the particular level of government that each alternative applies to. For instance, building a large sea wall across the coast of Dorchester County would likely be a County-level project, though it might also see state and/or federal input depending on the channels taken to acquire necessary funding. It will be measured through the resources required to launch the project (ex. 100 miles of sea walls made of concrete that are 10x10x3 ft.) as well as maintenance costs for 10 years after completion. Measuring for 10 years post completion serves to balance against options that might have low initial costs but are expensive to keep. To elaborate on the sea wall example, this means accounting for the raw materials, labor, any costs for permitting, and legal fees, etc. This information will be gathered by looking to previous projects and estimating costs as well as consulting with subject experts.

Administrative Feasibility

Administrative feasibility will be defined as the ease of implementation and maintenance, taking into account financial and managerial factors of the policy option from the government perspective. We will measure administrative feasibility through analyzing the complexity and timing of implementation of the chosen policy option, legal, jurisdictional, or commercial restrictions, and the fiscal impact on the government. Administrative feasibility is important

because highly complex, draining options are unlikely to yield the best result. Taking into account the steps required for an alternative to be completed, the duration of the alternative, and the approval levels (both from the public, and in terms of permits etc.), I will rate the alternatives on a 1 to 5 scale. A one means that a particular alternative is exceedingly difficult to accomplish as it requires large-scale coordination between multiple levels of government, and a 5 would indicate it is likely very easy for the desired level of government to accomplish independently, without significant investments required to maintain it.

Effectiveness

Effectiveness will be defined as the extent to which a policy option encourages coastal disinvestment. This will be a scale from 1-5 for that gauges the propensity of the alternative to facilitate disinvestment. This will be analyzed through economic behavior analysis as well as looking at the intentions of the alternative. Having established already in my literature review that protective and adaptive strategies ultimately encourage more investment and thus increase net risk, strategies that encourage moving away from the coastlines will be deemed more effective than those not. We will gain a more accurate measure of effectiveness by analyzing predicted behavioral patterns in the wake of the chosen policy options and seeing how migration patterns change. Admittedly, this method might fail to account for people lying to surveyors and so estimates could be inaccurate.

Findings

As an overarching note: the following analyses were conducted assuming a 66% probability of sea-level rise as the base case. While the future could be much worse than predicted, it is highly unlikely to be better (LeRoy & Chinowsky, 2019).

Alternative 1: Expanding buy-outs of at-risk property in Dorchester County

Description: This alternative calls for the ESLC to lobby the Dorchester County government to formulate a comprehensive plan to begin buy-outs of at-risk property. Historically, such a plan was in the works until 2018, when newly elected County Councilors aborted the plan (Dance, 2020). It's been two and a half years since then, and Dorchester has not improved its climate situation significantly. As this project has already detailed, increasing investments into at-risk areas does not serve long term public safety interests nor does it ease coastal disinvestment. With more than two feet of sea-level rise projected to occur in Dorchester County alone by 2050, the time to act is now.

Making a plan for buy-outs would likely entail working with the Maryland state government, city governments within the county, and numerous federal bodies such as the Department of Housing and Urban Development (HUD), the Environmental Protection Agency (EPA), and the U.S. Army Corps of Engineers' (USACE) North Atlantic Division. Using Community Development Grants from HUD to fund buy-out has proven successful in the past (Louisiana Office of Community Development, 2020). A similar experiment was conducted in the Philippines, in the coastal city of Iloilo (See & Wilmsen, 2020). Key takeaways from that experiment suggested that without precaution and significant, committed government oversight, poorer households were significantly worse off in the aftermath than their wealthier counterparts.

It also suggested that resettlement could be maladaptive, and so the choice for resettlement would be exceedingly important.

The schedule for this alternative would be as follows:

1. Survey the county and use ArcGIS or similar software to map the county's elevation, cross-referenced with the county's tax base.
2. Identify all properties considered "at-risk" using FEMA guidelines and rank them in terms of how likely they are to be partially or fully submerged based on current sea-level rise estimates.
3. Apply for grant funding for the project, or create a funding source to facilitate the buy-outs.
4. Begin the buy-outs, starting with the most at-risk properties as identified in step 2.
5. Adopt zoning changes to prohibit new development in areas where the county has bought land to facilitate neighborhood departure.
6. Continue with buy-outs until the risk has been minimized and the people are safe.

Cost: The cost of this alternative is relatively expensive. On the scale of 1-5 for cost, it was found to be a 2. The primary strategy the county should employ would be to buy-out property in the area starting with the highest risk property, and tie the money given to property owners to riders preventing resettlement within a certain range of the property⁶. Such strategies have not been historically successful, as New York saw in the wake of Hurricane Sandy in 2010, however the increasing effects of climate change may spur a change in willingness to sell. Using the

⁶ Research on the specific radius is unclear and are often highly dependent on the specific location of the property.

average home value in Dorchester County to calculate the cost to the state to implement this approach, it would cost \$2,502,435,375 (Dorchester County, 2019). However, this approach assumes 100% compliance with state-backed financial offers and does not interact with non-residential property such as businesses or recreational facilities. It is also worth noting that project costs would rise due to inflation as the timespan of the project increases. Furthermore, this project would negate the need for continued spending on infrastructure projects that are in areas that are to-be bought-out. Cost savings from this approach would save the county approximately \$6.5 billion dollars over the next thirty years.

If we adopt a compliance rate of 75%, similar to the “success rate” of the New Jersey Blue Acres Program⁷, we should expect to see the program cost \$1,876,826,531.25 if it all occurred within the same year (New Jersey Department of Environmental Protection, 2021). The timeline for this buy-out would likely stretch across three years with the most buy-outs happening in year two. Factoring inflation into the analysis, the final cost of this alternative is predicted to be \$1,973,118,824 over three years.

Administrative Feasibility: The administrative feasibility of this alternative is relatively low. On the scale of 1-5 for administrative feasibility, it was found to be a 1. Referring back to the definition of administrative feasibility as “the ease of implementation and maintenance, taking into account financial and managerial factors of the policy option from the government perspective,” this task would require significant coordination among a variety of governing bodies. This would be a massive government project, likely subject to stringent federal

⁷ The Blue Acres Program is the part of New Jersey’s Green Acres Program that purchases flood prone properties in the wake of Superstorm Sandy.

regulation such as HUD funding guidelines as well as the Fair Housing Act, FEMA guidelines for Hazard Mitigation Assistance funding, the Maryland state government, the Dorchester County government, and every municipality within the county. Furthermore, depending on the specific legal strategy used by the acting governmental body, we could expect to see significant numbers of lawsuits questioning the legality of the plan. Going further, the buy-out plan would also require safe locations where the property owners could resettle. This should be a community-oriented process and as such, this paper will not speculate on the best places to house the former property owners. By allowing the residents to fully decide on their final or transitory destinations, we can create community buy-in, as well as ultimately leading to the best place(s) for community resettlement.

The process by which this would take place would also be exceedingly complex. To minimize administrative burden and cut down on program timeframes, the county (or leading body) should pursue a strategy of conditional cash buy-outs. The best example would be for the leading body to buy the land from the owner on the condition that they resettle in lower risk areas, similar to FEMA HMA funding. This presents significant issues with compliance, as significant resources would be required to ensure participants resettle in approved areas. Furthermore, the time delay between when the funds are sent out and the time participants move could be large if participants struggle to find new housing. To remedy this, it is recommended that the state include housing counseling as an opt-in sub-program. While HUD does currently offer free housing counseling for free or low prices to all, the stress that the sudden influx of participants could risk an overwhelming of the system.

Effectiveness: The effectiveness of this alternative is predicted to be moderate. On the scale of 1-5 for effectiveness, it was found to be a 3.5. Even with lower estimates of project participation, we still see large reductions in populations at risk. This project is backed by the latest coastal resiliency research and does not fall into the trap of investing into high-risk areas which only increases net loss when the inevitable effects of climate change can no longer be fought off. By relocating at-risk communities away from the shore, we can reduce exposure to harmful sea-level rise.

Alternative 2: Lobbying for the Deployment of Hybrid Infrastructure along Dorchester County

Description: This alternative would call for a mixture of both natural and built infrastructure to protect the Eastern Shore. Lobbying the government to increase funding for this style of project could yield large benefits such as capitalizing on the natural characteristics of the shoreline, innovation in designing coastal protection systems, and this approach could be used in areas where there isn't the space for natural systems (Sutton-Grier, A. E., Wowk, K., & Bamford, H., 2015). For example, natural infrastructure can help weather storms and protect the shorelines, as well as provide natural resources and improve local water quality (Sutton-Grier, A. E., Wowk, K., & Bamford, H., 2015). This would allow Maryland to take advantage of the strong, known benefits of both hard and soft coastal protection measures. While this approach could combine the best of the two systems, there are significant downsides such as having little data on what a hybrid model looks like, limited expertise in the coastal development community, and the permitting process could add significant time delays to the project, lowering effectiveness (Sutton-Grier, A. E., Wowk, K., & Bamford, H., 2015). Like the above option, how large this

approach could significantly depend on the state's willingness to deploy protection along the coast, as well as if it was handled from the state, county, municipal, or even housing unit level.

Cost: The costs for this project are ultimately quite high in the long run. On the scale of 1-5 for cost, it was found to be a 1. Base estimates for the cost of fully protecting Dorchester County using built infrastructure run around \$6.5 billion dollars (LeRoy & Chinowsky, 2019).

Furthermore, that price tag doesn't include the costs of upgrading existing infrastructure or maintenance over the longer term. State-wide, conservative estimates of the cost of developing infrastructure statewide are around \$27.4 billion dollars, the fifth-most for any state in the nation (Rodericks, 2019). While built infrastructure already exists in the state, and will need repairs as storms continue to get worse, the expansion of natural infrastructure can help reduce overall expenses. A 2016 study from UNC Chapel Hill found that natural infrastructure can withstand storms about as well as hardened shorelines (bulkheads) can, and it's been found that for every \$1 invested in natural protection, \$7 in "flood reduction benefits" can be achieved (Smith et. al 2016; EESI, 2019). To fully estimate the costs of deploying natural infrastructure, we have to identify the way(s) we want to enhance our shore lines. For this project, I will analyze the costs of restoring oyster reefs in Dorchester County and leave the other methods for later projects. A 2010 meta-analysis showed that per-hectare of oyster reef restored, approximately \$80-190 thousand would need to be spent (Bayraktarov et. al, 2010). The Harris Reef Oyster Restoration Project was launched by the Maryland state government in 2013 and cost \$31 million dollars to restore 377 hectares of natural infrastructure (Maryland Department of Natural Resources, 2013; Viviano, 2018). Combining meta-analytical cost rates with projected built infrastructure costs along the County's shore line, the total cost of this option is estimated to be \$7 billion dollars before 2050.

Administrative Feasibility: The administrative feasibility of this option is moderate. On the scale of 1-5 for administrative feasibility, it was found to be a 3. The existing legal framework for the expansion of natural and built infrastructure is already largely in place. Maryland has conducted similar projects before, as the case with Harris Creek demonstrates, so this would not require a significant expansion of governmental authority (Maryland Department of Natural Resources, 2013). While fundraising for the project might be exceedingly difficult given the high price tag, this would be spread over a relatively long period of time (30 to 70 years) so the funds would not all be required at once. Furthermore, federal governmental intervention and subsidy would cheapen the project to the state government, increasing overall feasibility.

Effectiveness: Effectiveness, being defined as the propensity of an alternative to facilitate coastal disinvestment, was found to be low for this alternative. On the scale of 1-5 for effectiveness, it was found to be a 1. As discussed in the literature review, investing in shoreline protection increases investment in the community, increasing net exposure to rising tides (Woodruff et al., 2018). Sinking ~ \$7 billion into defending Dorchester County would have the opposite of the desired effect, as the county would seem safer and inspire increased development. While it might allow the state to have more time to consider its options, this would only serve to waste money delaying the inevitable.

Alternative 3: Expand the ESLC's Community-Oriented Awareness Campaigns

Description: A lot of communities in Maryland are facing severe dangers from flooding, inundation, storm surges, and might not be fully aware of how dire the predictions are for the near future. This policy option entails directing resources to the most at-risk and marginalized communities in Maryland to help them understand how sea-level rise will impact their lives. This

could be implemented via a facilitated discussion for each at-risk group, local political and civil rights leaders, as well as other interested parties. By leveraging the ESLC's local political and social capital, these meetings could help convince others that change is necessary. Furthermore, by engaging with the community in this manner, we can ensure that the solutions developed are community-based and oriented which can make the process more equitable. Town managers and city councils could prevent new projects from being built within high-risk areas and stop new developments. Because the ESLC has a lot of land planning expertise, this policy option fits strongly within their skill set and could be implemented quickly and easily. This option could also be reframed as a large grassroots advocacy campaign about how to realistically prepare for sea-level rise.

Cost: The cost of this option is fairly low, especially compared to the other two. On the scale of 1-5 for cost, it was found to be a 4. The ESLC could approach this through a variety of ways, including entirely independent of government input. The key “prongs” to this strategy that will largely inform cost are as follows: informing (and confirming to) residents of the danger that is awaiting them over the next 30 years, and following that information up with how they can escape the danger. Getting the message out can be done through a mailing campaign or billboards in urban centers. Estimating the costs of billboard advertising varies significantly depending on size of the board and duration of the messaging, as shown in Appendix A (Billboard Advertising Direct, 2021). With minimum durations of one month cost estimates for such advertising range from \$285.56 per week to \$28,555.55. Mailing campaigns can cost around \$1,200 to mail a postcard to 2,500 residents, factoring in average copy-editing and postage costs. If we scale this up for Dorchester County, we should expect an average price tag of \$14,400 to simply mail the residents of the county a very short informative postcard about the

danger they face. This does not factor in labor costs to determine what information is put on the card. The Nonprofit Leadership Center estimates the average value of one hour of volunteer labor as \$27.20, slightly less than the average hourly wage for Marylanders which is \$28.95, according to the Bureau of Labor Statistics (NLC, 2020; BLS, 2019). Data from marketing campaigns suggest that messaging campaigns would likely take around 40 hours of work on average to complete, adding \$1,088 to the total (Nanji, 2019). For the first “prong” of the alternative, we estimate a price tag of \$15,488.

The second prong of the campaign would entail face-to-face meetings designed to facilitate community conversations about what the future means and what can be done about it⁸. The length of this second part of the campaign strongly informs the cost, as data suggests that for every participant, programs can cost as much as \$47 (Biggs, 2016). To engage a “significant” percentage of the population of the county (~1,050 residents) we estimate a final price tag for the second prong of \$49,350 (Robson, 2019). Combining this with the first prong, we estimate the total cost of this alternative (at a minimum) of \$64,838.

Administrative Feasibility: The administrative feasibility of this option was found to be high. On the scale of 1-5 for administrative feasibility, it was found to be a 4. Similar to the previous option, the framework for this sort of alternative already exists. Furthermore, this kind of work fits in with the ESLC’s pre-existing social engagement campaigns. The difficulty that could entangle this option lies in identifying key community leaders to help facilitate these meetings,

⁸ Not literally, as the ongoing COVID-19 Pandemic reduces the ability for face-to-face outreach. Video communication technologies, like Zoom, would likely be used instead.

and making sure that attendees truly understand the material. The ongoing pandemic makes learning more difficult, despite the widespread transition to Zoom (and similar technologies).

Effectiveness: The effectiveness of this alternative is ultimately moderate. On the scale of 1-5 for effectiveness, it was found to be a 3. While this does not directly facilitate coastal disinvestment like the first alternative, it does help make future resettlement and disinvestment initiatives easier as the residents will be much more likely to support measures they understand and see the need for. From a cost-effectiveness standpoint, the return-on-investment on mailing campaigns and billboards are quite low. Averages are around the 0.5-2% range for mailing campaigns, which might make it not the best option for delivering messages to the residents of the county (Richards, 2019).

Outcomes Matrix

	Cost (.2)	Administrative Feasibility (.3)	Effectiveness (.5)	Total Score
Developing a Buy-Out Plan for Dorchester County	2	1	3.5	2.45
Deploying hybrid infrastructure to Dorchester County	2	3	1	1.8
Expanding the ESLC's community awareness campaigns	4	4	3	3.5

Recommendation:

Ultimately, I recommend Alternative #3: Engaging in a community-focused awareness campaign to fully educate the residents of Dorchester County on the danger awaiting them in the next several decades and on how they can get away from that danger. While this option is not the most effective, it is not nearly as expensive as the other two and combining that with its relatively high administrative feasibility makes it the best option for the ESLC going forward. Furthermore, this campaign could lay the groundwork for future resettlement efforts to eventually be successful if the residents understand that they do truly need to leave.

Implementation

Simply put, Dorchester County is in grave danger. Like the rest of the state of Maryland, it is threatened by sea-level rise and total inundation in the near future. For many residents of the county, these issues are happening now. Whether or not they are aware of the dangers of sea-level rise and how they can manage that are key factors that will strongly affect measures the state takes to deal with climate change. The ESLC should help fill the knowledge gap and step up to engage the masses.

A Multi-Pronged Approach

There is no one way to best engage with the people of Dorchester County. Many already know that something is wrong, independent of whether or not they are willing to label the culprit as sea-level rise. To best approach this, we should have multiple avenues of access. I propose that the ESLC have four “prongs” with which they will approach the issue: public messaging via localized social media and/or billboard advertising, connecting with local community leaders and leveraging ESLC’s social credit to instill the message, sending information cards via mail to

residents of Dorchester County, and finally expanding the ESLC's online presence to create informative, plebeian videos for Maryland residents about the dangers of sea-level rise and how they can get involved in the policy process. This presupposes the current messaging from the ESLC does not need to be updated, however delivering it through various lens' adds dimensional challenges. Communicating through a video is different from a tweet and so on.

Foreseeable Issues

While this policy option might be the best among the current selection, it is far from perfect. If the ESLC does use social media to engage with the public via targeted, localized ads, there are several lurking issues. First, it's possible that the cost to do this has been underestimated and exceeds the available budget. Because of the auction nature of online ads, there's a risk of inconsistent costs (WebFX, 2021). Secondly, social media has a lower conversion rate than other forms of advertising (Gotter, 2019). This begs the question of whether or not a different media campaign of simply promoting the ESLC's social media pages would be more effective in the long run. Finally, the ongoing COVID-19 Pandemic has reduced transportation across demographic groups across the county. This means that physical advertising will likely be less effective, raising more questions about advertising (Witkin, 2020).

The COVID-19 Pandemic also raises issues with connecting with community leaders. While Zoom and other forms of video conference systems have become more ubiquitous than ever, certain communities remain systemically underserved by these systems. Making matters worse, the groups that have the least ability to connect via Zoom etc. are also the most at-risk from climate change.

Mailing campaigns, like social media campaigns, are expensive and inefficient if you want to ensure engagement. The word mailing here could refer to physical mailing, or mass-

emailing if that information could be acquired. Issues inherent to this are obvious, as it is indeed expensive and could become logistically complex. Furthermore, there is no guarantee the knowledge is absorbed or even glanced over, which would be a failure given the magnitude of the issue at hand.

Finally, high quality video production is difficult independent of content. This is magnified when the content is critical for viewers to see and understand. However, by expanding its blog and news section, the ESLC could easily tie this into its other scheduled content. One lurking issue is the difference between ensuring people see the link to your content and ensuring people actually watch (or read) the content. This is similar to issues inherent to social media campaigns and may be solved by treating it the same way (Teixeira, 2017).

Stakeholders

The stakeholders here are straightforward. We have the ESLC (as well as allied groups), the various levels of government involved here (ranging from municipalities within the county to the state government, or federal depending on how solutions are ultimately implemented), residents of the county, the community leaders the ESLC will identify and work through, business owners with assets in Dorchester County (and developers), as well as politicians who represent the area. The roles that these stakeholders play are complex. Community leaders will need to be able to communicate effectively with their circles while also not isolating people. Furthermore, roles might overlap and incentives might differ, which will be addressed below.

How might stakeholder perspectives conflict?

I predict that groups with the largest financial assets in the area will be the most strongly opposed to action. The inundation of the area kills financial value and prevents reselling. It's possible that reframing the use of land is a key topic the ESLC will need to address.

Furthermore, residents might be opposed because they are scared of what the future means. Flooding is scary and the idea that they will very likely need to leave is hard. Generations of people have lived in the area and seemingly abandoning tradition is emotionally complex. Walking them through that process is key to turning fear into understanding. Exercising informal authority to neutralize discontent will be critical to achieving success.

How do we move forward?

Moving forward means identifying the exact slate of options that the ESLC intends to pursue. This also means finalizing messaging once we know the vehicles by which we intend to deliver them with. Beyond those two key steps, in that specific order, the ESLC should be ready to follow through on the policy alternative.

Conclusion

Climate change is one of the greatest challenges Maryland will face this century. Many of the worst effects predicted to hit the state by 2050 are already happening in Dorchester County. To protect its people and land, the ESLC should take action and expand its messaging campaigns. The ESLC can leverage its social credit in the area to create connections and ensure that county residents are truly informed of what the future holds, laying the social groundwork for future coastal disinvestment.

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