



Marsh Migration, Climate Change, and Coastal Resilience: Human Dimensions Considerations for a Fair Path Forward

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Abstract

Coastal regions worldwide will be dramatically reshaped by the impacts of sea-level rise. Of particular concern are impacts on coastal wetlands, the loss of which would have consequences for both human and ecological communities. The future of many coastal wetlands will depend greatly on their capacities to migrate into uplands. Coastal resilience work within wetland sciences has increasingly focused on developing strategies to promote marsh migration into rural uplands; however, less attention has been given to the impacts that migrating marshes have on people in these landscapes. In this paper, we share rural perspectives and experiences with marsh migration through three case-studies from collaborative research with rural, low-lying communities on the Chesapeake Bay, USA. These case-studies demonstrate the complexities of the challenges facing rural communities as a result of marsh migration, and reveal important issues of equity and injustice that need attention in future coastal resilience work. We draw upon a socio-ecological systems (SES) approach to highlight potential human-ecological misalignments that emerge with marsh migration and to offer future research questions to inform socially-just and resilient wetland migration planning in rural coastal areas.

Keywords Marsh migration · Coastal wetlands · Human dimensions · Rural landscapes · Socio-ecological systems · Coastal resilience · Climate change

Introduction

Coastlines worldwide are facing dramatic changes this century due to climate-driven sea-level rise (IPCC 2014). Already, low-lying coastal regions face more frequent and severe flooding events from storm and tidal surges. In the United States (US), 2015 and 2018 set historic records for the highest number of annual high-tide flood days along US coastlines since 1920 (Sweet et al. 2019). High-tide flood days are most prevalent on the Atlantic and Gulf Coasts (Sweet et al. 2019), with the Mid-Atlantic region experiencing some of the highest national tidal flood frequencies due to the compounding factors of land subsidence and ocean current shifts (Sallenger et al. 2012, Kopp 2013, Ezer and Adkinson 2014, Sweet et al. 2019). The Mid-Atlantic region includes the

Chesapeake Bay where, within the last century, water levels have risen by 30 cm (Titus and Strange 2008) and are projected to rise an additional 40–130cm above 2000 levels by 2100 (Boesch et al. 2018). These trends will have consequences for human communities and ecosystems alike as inundation rates increasingly affect the social and ecological conditions of coastal regions.

In particular, there are growing concerns regarding sea-level rise impacts on tidal wetlands, which provide critical ecosystem services in coastal areas, including as buffers against storms and floods (Arkema et al. 2013), regulators of greenhouse gases (Mitsch et al. 2013), habitat for wildlife and fisheries (Rewa 2007), and as natural filtration systems supporting water quality health (Gillum 1994). Blankespoor et al. (2014) estimate that a 1-m rise in sea levels will result in the loss of 68% of existing coastal wetlands worldwide — a \$703-million (US) global economic loss per year due to reduced wetland goods and services, such as flood and storm protection, recreational amenities, commercial fisheries, and water quality services. Others stress how these losses will exacerbate problems for already-vulnerable populations by reducing natural flood protections, resulting in a 30–60%

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increase in highly at-risk coastal communities (Arkema et al. 2013). Protecting coastal wetlands has therefore been advanced as a management priority for developing coastal resilience to climate change (Arkema et al. 2013, Reguero et al. 2018, Powell et al. 2019).

There has been growing interest in developing management strategies that promote wetland expansion through sediment deposition and upland migration (Fuller et al. 2011, Kirwan et al. 2016, Roman 2017, Thorne et al. 2018). Recent model projections estimate that management for wetland migration and sediment protection could result in up to 60% gains in global coastal wetlands under 21st century sea-level rise projections (Schuerch et al. 2018); however achieving such increases will require reducing coastal development practices that impede migration and sedimentation, such as shoreline hardening and coastal zone development (Torio and Chmura 2013, Kirwan et al. 2016, Schuerch et al. 2018). One strategy gaining traction among researchers and planners is the designation of marsh migration corridors — swaths of protected uplands to serve as wetland migration pathways (Lerner 2013, Enwright et al. 2016, Borchert et al. 2018, Everhart 2019). This strategy is viewed as particularly important in rural coastal areas, where future migration is largely unobstructed by built environments (Kirwan and Gedan 2019).

While there has been extensive research to model wetland movement for migration corridor designation (e.g., Lerner 2013, Enwright et al. 2015, Borchert et al. 2018) and to assess the implications for ecosystem services (e.g., Runting et al. 2017, Propato et al. 2018), less attention has been given to how marsh migration will directly impact people, especially in rural places where these changes will be experienced firsthand (Field et al. 2017). Attention to the human dimensions of these landscapes is necessary to ensure that the vulnerability of rural communities is not unfairly amplified in service to ecological resilience goals (Jurjonas and Seekamp 2020, Bhattachan et al. 2018). When wetland migration planning overlooks human dimensions, it can exacerbate local experiences of injustice (e.g., wetland health taking precedence over local people's wellbeing) and weaken adaptive capacities (e.g., ability to sell one's property due to its transition to marsh), in turn affecting the overall resilience of rural coastal places. Therefore, to successfully facilitate coastal resilience through wetland migration, wetland researchers and managers need to account for the ways that rural coastal areas with ecosystem potential for marsh migration are also important human landscapes. How these landscapes are managed for climate change will have real implications for the resilience of those who live and work within them.

A socio-ecological system (SES) framework (Walker and Salt 2006, Bhattachan et al. 2018) is useful for examining the complex, co-dependent interactions between the ecological and human dimensions of wetland-dominated rural

landscapes that together determine a system's ability to successfully adapt to climate change. In this framework, ecological processes are not considered in isolation, but rather as intrinsically interconnected to social processes across temporal and spatial scales (Berkes and Folke 1998). An SES framework is particularly valuable for enabling researchers and managers to holistically map the complex human-environmental dynamics that facilitate the emergence of resilience and vulnerability across a system and to identify areas where mismatched goals may lead to unintended consequences (Berkes et al. 2003, Cotes and Nightingale 2012, Bhattachan et al. 2018).

In this paper, we argue that using wetlands to build coastal resilience necessitates a holistic approach such as SES to help define management strategies that support both human and ecological adaptation needs in these landscapes. More specifically, an SES approach can illuminate how rural areas being considered for future marsh migration pathways are richly layered with complex cultural meanings, political and economic dynamics, and human histories (Stevens and Ahmed 2011, Ogden 2011, Bhattachan et al. 2018, Jurjonas and Seekamp 2018). These human dimensions underpin local stakeholders' adaptive capacities and create the context in which marsh migration into rural landscapes may increase local (human) climate change vulnerabilities. This has important implications for environmental justice, which needs consideration in developing fair pathways forward.

Environmental justice is the principle that all people are entitled to equal protection from environmental harms (Mohai et al. 2009). Managing coastal resilience in environmentally-just ways requires recognizing that building resilience at one scale does not necessarily facilitate resilience at other scales (Ernstson 2013, Barnes 2015). It also necessitates a careful examination of the implicit assumptions framing what is environmentally beneficial and harmful, and how these assumptions may problematically undermine the lived experiences and needs of local stakeholders underrepresented in coastal resilience planning (Finan 2009, Maldonado 2014). For these reasons, resilience scholars increasingly argue that when managing for resilience, practitioners should ask, "resilience to what and for whom?" (Cotes and Nightingale 2012, Fabinyi et al. 2014, Cutter 2016, Adger et al. 2020). An SES framework can help practitioners integrate important human dimensions considerations into wetland migration planning to address potential socio-ecological misalignments for more robust and fair coastal resilience strategies.

We share three case-studies from rural wetland-dominated landscapes on Maryland's Eastern Shore of the Chesapeake Bay (USA) where marsh migration is occurring. These case-studies exemplify how rural coastal residents and governments experience marsh migration, illustrating how excluding local human dimensions considerations in wetland migration planning can cause this resilience strategy to become a climate

change vulnerability and threat to rural wellbeing. We then draw upon these case-studies in applying an SES approach to highlight key socio-ecological misalignments that can emerge when human dimensions are under-examined. Finally, we suggest future avenues of research to promote the integration of human dimensions perspectives into wetland research and planning to support more environmentally-just coastal resilience work in rural coastal areas.

Methods

Since 2012, the authors have undertaken long-term research on climate change impacts on rural coastal SES of the Chesapeake Bay (cf. Paolisso et al. 2012, Miller Hesed and Paolisso 2015, Miller Hesed 2016, Johnson et al. 2017, Van Dolah 2018, 2019, Miller Hesed et al. 2020). We are also part of the leadership and research components of the on-going Deal Island Peninsula Partnership (DIPP), a network of individuals from local communities, county and state government, universities, and regional non-governmental organizations focused on building socio-ecological resilience to climate change on Maryland's lower Eastern Shore. This long-term and continuing engagement has allowed us to build rapport and trust with multiple stakeholders in the region, including those whose perspectives are shared in the case-studies. This trust and rapport contributes to the reliability and validity of our findings (Bernard 2006).

Our research is conceptually and methodologically grounded in the social science subfield of environmental anthropology. Since the 1950s, environmental anthropologists have applied fundamental tenets of anthropology to holistically understand the dynamic interactions between humans and the environment (Haenn and Wilk 2006; Dove and Carpenter 2008). This requires a suite of qualitative and quantitative methods tied together into a coherent research strategy that is the broad, methodological framework of ethnography. Ethnography is an inductive and open-ended approach that prioritizes the collection of information significant to the community studied (in our case, a rural, coastal community of individuals, government natural resource managers, and academic researchers). Ethnography avoids the *a priori* development of hypotheses that focus data collection primarily on information needed to refute the stated hypothesis (Howell et al. 2018). Ethnographers do develop and test hypotheses, sometimes using the same parametric tests as natural scientists, but they do so based on inductively collected information with members of the study groups.

The ethnographic approach requires extensive fieldwork, and we have integrated a number of specific approaches to collect ethnographic data. These include participant observations (the authors have spent hundreds of hours since 2012 participating and observing in the study region) (Musante

2015); interviews (we have completed 200 + informal and semi-structured interviews with study participants regarding adaptation and resilience to climate change) (Levy and Hollan 2015); and surveys with closed-ended questions, sent to larger study populations to systematically and quantitatively identify patterns in climate change knowledge, values, and practices (we have completed five surveys with nearly 300 respondents) (Paolisso et al. 2012, Miller Hesed and Paolisso 2015, Miller Hesed 2016, Van Dolah 2018, Paolisso et al. 2019, Miller Hesed et al. 2020). The case-studies presented below emerged primarily from research conducted between 2018 and 2019, but they are generally informed and supported by our long-term research in the area, use of environmental anthropology conceptual framing, and our application of a multifaceted ethnographic approach.

In 2018–2019, we researched the roles of churches to improve connectivity between underserved rural communities, researchers, and government for enhanced climate change resilience in rural coastal places (Miller Hesed et al. 2020). We selected churches because they are trusted social institutions in rural communities that provide important social support structures, particularly for those with limited access to government services (Greenberg 2000, ARDA 2012, Rivera and Nickels 2014, Miller Hesed 2016); yet rural communities are limitedly engaged in climate change adaptation planning due to differential knowledge (e.g., scientific versus faith-based, local, or traditional knowledge), institutional barriers, and issues of government mistrust (e.g., Green 2009). We hypothesized that developing collaborative local-governmental-research networks through rural churches would increase knowledge exchange and improve trust and rapport, in turn creating new resource channels and improved adaptation support (Berger and Neuhaus 1977, Berkes 2007, Norris et al. 2008, Paolisso et al. 2019). While the topic of marsh migration was not the focus of this project, it emerged as a prominent theme in collaborative discussions about rural climate change challenges.

Research was conducted with individuals who live or work in Dorchester, Wicomico, or Somerset Counties (Fig. 1), three Maryland counties that are particularly vulnerable to sea-level rise due to low elevation (Titus and Wang 2008). Furthermore, these counties have large rural populations in unincorporated areas that lack sufficient access to resources for addressing climate change challenges. We used a purposive sampling approach (Guest et al. 2006 1) to recruit 25 government representatives and 81 church members representing 12 churches from Somerset County's Deal Island Peninsula, Wicomico County's West Side area, and lower Dorchester County (see Fig. 1). Many of these individuals were recruited from our prior research projects as part of continuing work to improve rural coastal resilience. Government representatives included staff from associated county governments and from the State of Maryland's

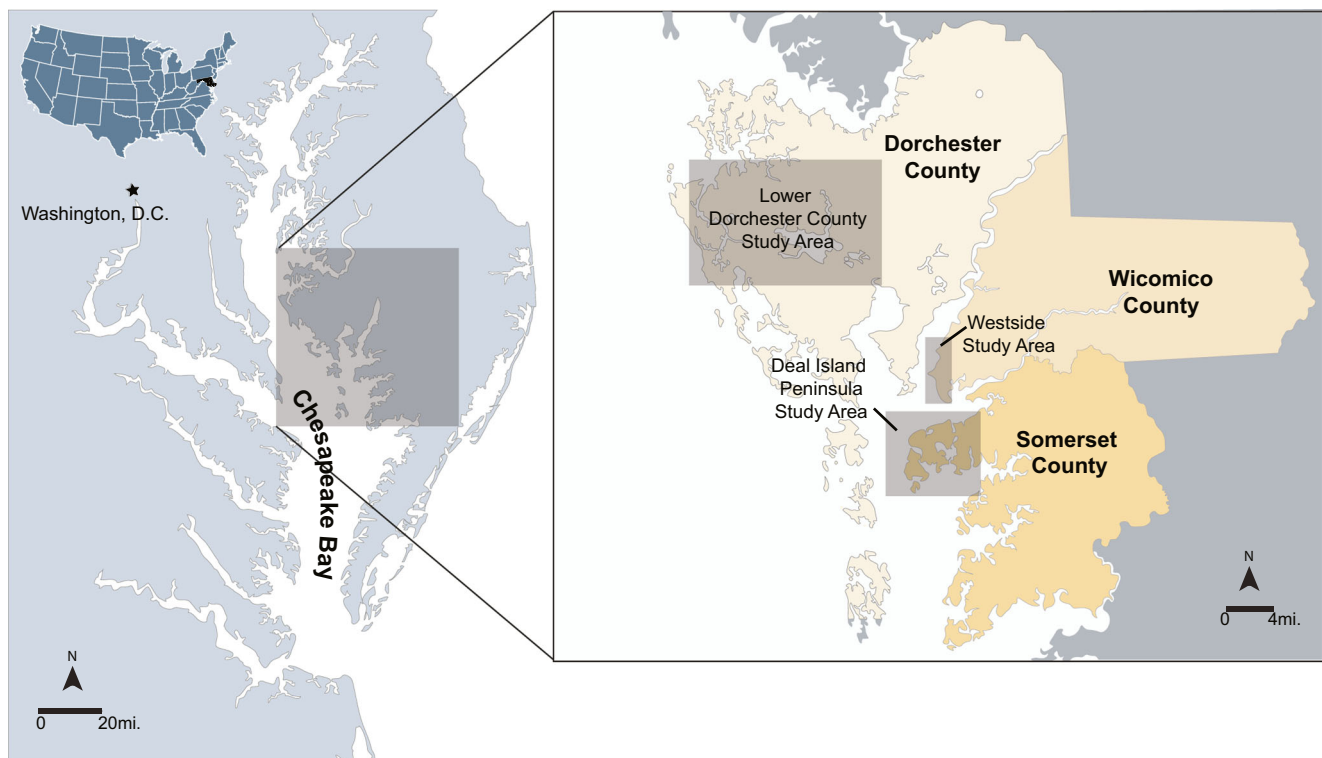


Fig. 1 The project study areas on Maryland's Eastern Shore of the Chesapeake Bay. Chesapeake Bay map adapted from T. Saxby (2003 and 2011); County map adapted from d-maps.com (2007–2019a, b, c)

Department of Natural Resources (MD-DNR), Department of the Environment (MDE), and Department of Planning. Twenty-eight researchers and technical service providers also participated, including social and natural scientists, extension agents, and non-governmental organization staff.

During the spring of 2018, we conducted hour-long semi-structured interviews with a sub-sample of 23 project participants (including church members and government representatives), each of whom were previously identified for their knowledge of and experience with adaptation efforts, challenges, and opportunities within their jurisdiction or community during informal recruitment interviews. Semi-structured interviews were guided by 12 open-ended questions on climate change, resilience, vulnerability, and the role of churches, faith, and government in adaptation. A semi-structured format was used to give interviewees flexibility in their responses while maintaining comparability across interviews (Bernard 2006). Interview transcriptions were analyzed using content analysis and grounded-theory approaches in Atlas.ti text analysis software (Wutich et al. 2015, Atlas.ti 2019). Content analysis is used to deductively test hypotheses by studying the text to determine where it supports preconceived ideas, while grounded-theory treats the text inductively, allowing new hypotheses, ideas, and insights to emerge (Bernard 2006).

Themes identified using this hybridized text analysis informed the development and organization of nine collaborative workshops hosted between June 2018–March 2019. At the introductory workshop, participants learned about project goals; listened to and discussed faith-based, governmental, and scientific perspectives on climate change; and identified focal areas for county-level workshop discussions. We then hosted two to three workshops in each county, where participants discussed a range of topics, including flood projections, adaptation needs, goals, and challenges, as well as potential adaptation strategies relevant for each county focus area. Workshop discussions were structured using a collaborative learning approach, where participants were invited to teach and learn from one another to facilitate knowledge-sharing and increase trust and rapport (Miller Hesed et al. 2020). A final workshop reconvened participants to share what they learned and discuss opportunities and challenges for collaborations that support rural coastal resilience. Throughout the workshops, we also gathered data through participant observation, workshop transcriptions, structured questionnaires, and follow-up interviews to garner insights on knowledge exchange, increases in trust and rapport, collaborative network dynamics, and emergent adaptation needs. Thematic analyses of these data using the aforementioned text analysis approach yielded themes relevant to rural concerns about wetland migration.

Results: Rural Experiences with Marsh Migration

To illustrate rural marsh migration concerns, we present three case-studies below, which provide ethnographic “snapshots” from interviews and workshop discussions. These snapshots reveal how people living and working in rural coastal communities experience wetland change, and illustrate the extent to which their vulnerabilities are socially- and environmentally-configured. Our intent in presenting the data this way is to empower local voices in articulating their concerns about coastal vulnerabilities in wetland-dominated landscapes. Importantly, these case-studies capture the holistic linkages between wetlands and people, illustrating how these landscapes are complex SES with important human dimensions to consider.

Saving New Revived United Methodist Church

New Revived United Methodist Church is located in the small, rural African-American community of Smithville in lower Dorchester County. Smithville was established around 1886 by several African-American families who were newly freed from slavery (Miller Hesed 2016); a Methodist church was established the following year. While historical records on Smithville are sparse, the first residents likely faced similar challenges to other newly emancipated people on the Eastern Shore: how to earn a living without the necessary land, tools, or training while facing persistent racism, which denied them their full rights of citizenship and created new forms of racial prejudice and violence (McConnell 1971, Andersen 1998). Additionally, Smithville residents had to contend with the challenges of living on marginal land, which was located near the flood-prone wetlands of present-day Blackwater National Wildlife Refuge (established in 1933 as a waterfowl sanctuary). Smithville persisted despite these hardships, drawing strength from the church, which has been central to the community’s resilience throughout its history. Formerly known as Jefferson Methodist, the church was relocated and rebuilt in 1925 after the original building caught fire, and renamed New Revived after several local congregations merged in 2003. Despite these changes, the church remains a vital source of strength and adaptive capacity for the community; it not only provides spiritual guidance, it embodies their history and heritage, fosters social connections, and addresses material needs. Most importantly, the church crystalizes and reinforces local residents’ faith in God’s knowledge and plan for them, which includes making a living from and living with a changing coastal landscape.

Like many small rural communities, Smithville is much diminished from its once vibrant past, as many residents left

for continued education or to find suitable employment. While hundreds of people may have inhabited Smithville in the 1960s, the number of year-round residents today is significantly reduced, with just two homes now occupied. Many community members now live in the nearby city of Cambridge, while others live in Baltimore, Maryland and Atlanta, Georgia. Yet, Smithville and New Revived remain an important home to the dispersed community. Local and nearby community members continue to gather at the church each Sunday, and those who have more permanently left still own property in Smithville, participate in local family and community decision-making, and monetarily support the church. Though few remain in Smithville, the church remains a spiritual and familial home for those who grew up in or are descended from the community.

During the summer of 2018, about 200 descendants of the original Smithville families gathered at New Revived to raise money to protect the church cemetery from flooding. Within the last several decades, the land behind the church and cemetery has become increasingly wet and marshy. Church elders recall running across a grassy field behind the church as children. Within their lifetime, they have watched this land slowly convert into wetlands. In 2003, Hurricane Isabel flooded the property, including the church hall. Today, only 15 feet of soggy lawn separate the church and cemetery from the marsh. The church’s primary concerns are the potential impacts that encroaching wetlands will have on their cemetery, where generations of Smithville families are buried, and which continues to represent a cornerstone of local heritage and identity. The church grounds also importantly symbolize the community’s historic resilience in the face of racial adversities. As described by one community member, who flew from Atlanta, Georgia to participate in a project workshop on how to protect the church, “we do what we need to do to preserve what our ancestors fought so hard for. It wasn’t easy for them. And if you have a heart, and a soul, you understand that we cannot just let [this place] go.”

The dispersed Smithville community has been working for years to address these threats. Some of these efforts include: participating in university studies to better understand the projected impacts of climate change; working with a local erosion group to explore how others are dealing with similar issues; applying for adaptation project funding; and contacting elected officials and the Maryland governor’s office to voice their concerns. Despite their persistence, New Revived remains in a perilous situation. Though the church has recently worked with the County to obtain permission to remove invasive *Phragmites australis* and apply dirt to grade the land away from the church foundation, no feasible solution has been identified to protect the cemetery and church buildings from the continual creep of the marsh and tidal waters.

Protecting Residential Property on the Deal Island Peninsula

Marsh encroachment is also a concern on the Deal Island Peninsula in nearby Somerset County, a 26-square-mile area of low-lying coastal islands, interconnecting marsh, and small unincorporated communities with strong ties to Chesapeake watermen¹ traditions. Approximately 1,000 people live on the Peninsula, including watermen families, retirees, and part-time residents with vacation homes (Johnson 2016). Landscape change has been a fact of life for local residents, many of whom have familial roots dating to the 19th century or earlier when the Peninsula was an important commercial watermen hub on Maryland's Eastern Shore (Johnson 2016, Van Dolah 2018). Locals who identify with the watermen's way of life celebrate their ability to be highly adaptive in the face of dynamic environmental change — an attribute inherited through their daily practice and generational knowledge of working the water (Van Dolah 2018). However, residents have also noticed increases in the pace of change within the last decade, particularly among marsh-front property owners whose once-dry upland properties are being overtaken by tidal wetlands.

For many Peninsula residents — particularly those from lower socio-economic brackets — property is their primary financial asset, and marsh migration is impacting property values. Many yards are noticeably soggy with wetland grasses beginning to encroach onto structures, including occupied houses. For-sale signs are common features in front yards. In some of the worst cases, properties have been altogether abandoned (see Fig. 2). For many locals though, relocation is not a viable option due to the extreme financial hardship it poses for those whose property represents a significant portion of their wealth. Without the capacity to sell their property for pre-marsh-encroachment value, relocation becomes infeasible. Furthermore, relocation is not desirable for many because of strong generational attachments to the local landscape, communities, and way of life. Nevertheless, residents are frustrated by these impacts, as expressed by one resident at a project meeting: “If I could sell [my property] and get what I need for it so I could go somewhere else, I would. I'm being honest about that. I'm sick and tired of it!”² These factors have led some residents to take actions to protect their property, such as adding dirt to elevate areas that have transitioned to wetland, only to learn such practices on converted uplands are



Fig. 2 A for-sale sign on an abandoned house on the Deal Island Peninsula. Encroaching *Phragmites australis* surround the property (photo: E. Van Dolah)

prohibited under state tidal wetland regulations. Residents have become discouraged by — some even fearful of — environmental regulations that govern how they can protect themselves. In discussions with residents, it is clear that many find regulations difficult to understand, challenging to navigate, and costly — both in terms of associated fees and potential property losses incurred while waiting for permit approvals. Most importantly, regulations leave many feeling that they are losing control of decisions that impact their wellbeing. Regulatory restrictiveness, whether real or perceived, hinders local adaptability and highlights new challenges as climate change increasingly puts wetland protection and property rights into conflict.

These frustrations are further exacerbated by local perceptions that governments and environmentalists prioritize protecting wetland over their families' and communities' wellbeing. During a collaborative workshop, this was made palpable by one resident following a presentation by a representative from the MD-DNR, which is the largest landowner on the Deal Island Peninsula (owning two marsh-dominated properties managed as a wildlife management area and National Estuarine Research Reserve). The presenter shared ongoing marsh resilience research being conducted on these properties, which include thin-layer placement studies to understand how dredged material can be reused to elevate and regenerate marshes that are becoming fragmented by rising sea-levels (e.g., Ford et al. 1999). The resident responded to the presentation, saying:

I appreciate your passion for marshes, but then as a property owner, when we ask if we can put some dirt in [on our property], we're told, well it's considered wetland. We can't do anything for you. And that's the frustrating part that I have as a property owner — that I

¹ Traditional fishers who make a living from the water, primarily through harvesting oysters (*Crassostrea virginica*).

and blue crab (*Callinectes sapidus*). Watermen industries in the Chesapeake Bay date to the 1700s and have importantly shaped the region's strong cultural ties to seafood (Paolisso 2002).

² At many other points this individual has stressed that he has no intention of relocating, so this statement is evidence of the great extent to which tidal impacts and marsh migration are wearing on residents.

can't do anything to bring in dirt to build my property up to minimize the saltwater levels when we do have these [tidal] surges. I hear so much about [protecting] the marsh, but as property owners, there's nothing being addressed as far as [helping] property owners minimize the problems that we're having.

His comment prompted additional discussion with state agency representatives in the room. One representative offered her advice on how much fill-dirt would be permitted on his property: enough to promote marsh enhancement, but not enough to convert the now-wetland areas of his property back to upland, which Maryland's regulations prohibit. With no viable solution, the property owner exasperatingly responded, "Eventually I will be fined for everything that happens on this island because of [rising waters]! You know, it's a real problem! It's an issue!"

County Government Vulnerabilities to Marsh Migration

Rural county governments³ also face challenges as tidal and wetland changes increasingly affect their capacity to serve constituents. Rural coastal counties struggle financially to manage increasing environmental impacts of rising tides to transportation infrastructure, utilities, properties, industries, and human health and safety (Bhattachan et al. 2018). County staff in this project reported that roadways are sinking and crumbling with increasingly soggy ground; nuisance flooding more frequently submerges roads, preventing school busses and emergency services from accessing neighborhoods; drainage ditches are channeling tidal waters farther inland and altering farm soil composition; and wetlands are moving inland. These financial struggles are partially attributed to the nature of rural economies, which tend to be strongly linked to natural resources and less economically diverse than urban areas, leaving rural counties more vulnerable to these environmental changes (Hales et al. 2014). Furthermore, US rural populations are declining in general, resulting in reduced tax bases that limit rural governments' capacities to secure the necessary funding, staffing, and resources to address these impacts (Romsdahl et al. 2013, Hales et al. 2014). According to participants in this study, this becomes especially challenging when rural counties must compete with more urban counties for federal and state grants, which often require applicants to demonstrate that protection benefits meet or exceed project costs or provide funding matches. These requirements are hard to meet for rural county governments, where potential population and infrastructure benefits are much smaller by comparison and the funding matches more difficult to meet. Staffing and funding limitations are already affecting the three counties involved in

this study, which acknowledge their struggles to maintain and repair drainage ditches, roadways, and dams. As reported by one participant: "We're trying to change our maintenance programs; we're trying to get proactive, but every time we try to get proactive, we're too busy being reactive." The resilience of rural coastal county governments will likely continue to decline as migrating wetlands increase vulnerability and swallow taxable real estate.

Rural county governments face additional complications as a result of environmental regulations mandating that modifications to tidal wetlands pass a state-approved permitting process before projects can be implemented. While county staff recognize the value of wetland regulatory protections, several participants highlighted emergent challenges that these regulations present with increased upland marsh migration and tidal flooding. During one workshop, a county staff member shared:

Another issue that we fight here is the permitting. It used to be that you could get a blanket permit to clean [tidal] ditches whenever you wanted to as long as it didn't have phragmites or cattail or whatever in it. Now, because the tide is coming up, we have more phragmites and cattail throughout the County. That's an automatic MDE permit. It's now 9–18 months to get the permits. This is holding us up from getting stuff done that we need to get done now.

At a second workshop, a staff member from a different county expressed similar frustrations in navigating wetland regulations:

The general feeling is, "Hey, it's wetland, stay away! That tree there, that's part of a natural process. Leave it alone." And that's great and all, but again, from a Public Works standpoint, my view is drainage is critical to us to prevent loss of life, loss of property, and let's do what we can to make the environment a place where we all want to be around. On the regulatory side though, the environment and the loss of property have gotten flip-flopped a little bit, and that's a challenge I'm trying to deal with.

Both of these individuals highlight a need to rebalance wetland and human protection goals within current regulatory frameworks, which are increasingly at odds as a result of climate-driven coastal landscape changes.

Discussion

These case-studies underscore important human dimensions considerations for marsh migration planning. These include

³ While this case-study focuses on county-level government concerns, these challenges would also be relevant for municipal governments.

cultural dimensions that affect how people in rural places value and experience wetlands, including wetland migration into culturally significant places. They also include how migrating marshes affect key pillars of local socio-economic health (e.g., real estate values, livelihoods) that in turn shape the adaptive capacities of both rural residents and governments. And they include complex political dimensions (e.g., regulations, environmental governance) that empower certain environmental values, visions, and voices over others in defining resilience strategies. Below we discuss the value of incorporating these human dimensions into marsh migration planning, and draw upon an SES approach to develop future research questions for more robust and equitable rural coastal resilience work.

Cultural Dimensions

As much as wetlands are ecological, they are also cultural landscapes – spaces imbued with cultural meanings woven into the natural world through human practices and environmental engagement over time (Cronon 1996, Schaich et al. 2010, Pleininger and Bieling 2012, Adger et al. 2013). These cultural meanings shape how individuals perceive, value, use, and move through the landscape (Ingold 1993, Nuttall 2009, Ogden 2011). Cultural understandings of the environment become rooted through the process of place-making and identity construction (Ingold 1993, Davenport and Anderson 2005, Fresque-Baxter and Armitage 2012, Stevens and Ahmed 2011). For the case studies' rural communities, the marshy landscapes that they call home connect them to specific practices, kin networks, and other tangible and intangible cultural identity markers (Brace and Geoghegan 2011). Maintaining these cultural ties to the landscape is important for their social resilience (Nuttall 2009, Salmón 2012, Marino 2015).

For the members of New Revived United Methodist Church, the church and its marshy site are physical and spiritual manifestations of their resilience in the face of generations of racialized hardships. The church building and cemetery ground their sense of community, both as a place to gather in celebration of their faith and to remember ancestors who furthered their perseverance. For the Deal Island Peninsula communities, marshes are intimately entangled with watermen heritage and importantly shape their understandings of and relationships to the landscape, cementing their identity as people who “work the water” and whose livelihoods depend upon living near the marsh (Paolisso 2002, Johnson 2016, Van Dolah 2018).

As climate change accelerates environmental change in rural coastal places, communities face increasingly difficult circumstances that threaten their ability to maintain these key human-environmental relationships (Adger et al. 2011, Fresque-Baxter and Armitage 2012, Masterson et al. 2017). These circumstances become especially challenging in the

context of marsh migration as environmental regulations and regional interests in rural lands for marsh migration corridors seemingly give precedence to wetlands over people. When marsh migration is promoted with little concern for the resulting rural cultural losses, it can leave those who stand to lose important parts of their identity experiencing a real injustice, particularly as significant investments are made to protect urban areas from climate impacts (Graham et al. 2018).

Economic Dimensions

The impacts of wetland migration on the economic health of coastal areas also needs attention. When only ecological goals are considered, preserving wetlands by facilitating natural inland migration makes economic sense; the cost and effort of implementing this plan is relatively small, and the benefits provided to wildlife habitat, ecotourism, and as natural buffers against inland flooding are considerable (Barbier et al. 2011). However, these economic advantages are not realized at the local level where those wetlands are encroaching (Field et al. 2017, Jurjonas and Seekamp 2020); rather, these areas experience a direct financial loss from wetland migration.

This loss was illustrated in the Deal Island Peninsula case-study, where marsh encroachment degrades private property values and impacts property owners' abilities to recoup their investments. In such instances, there is understandably a strong desire to protect personal property. Yet, few financially-feasible adaptation options beyond managed retreat are available for people in these circumstances (Jurjonas and Seekamp 2020), which is particularly problematic for those seeking to adapt-in-place (Graham et al. 2018). As wetlands migrate farther onto properties, many households will likely have to relocate and endure a reduced economic return on their property investments (Feagin et al. 2010). Household-level financial losses and broader out-migration will, in aggregate, affect the socio-economic health of rural coastal areas (Lal et al. 2011, McLeman et al. 2015), many which already struggle as a result of an aging and more disadvantaged demographic (Miller Hesed and Paolisso 2015, Hardy et al. 2017), industry declines (McManus et al. 2012, Hales et al. 2014), and limited access to social services and government support (Francis 2002, Jurjonas and Seekamp 2018).

These local-level costs will gradually impact higher scales. As discussed in the third case-study, local property losses further diminish rural county tax bases and rural government's adaptive capacity (Lal et al. 2011, Jurjonas and Seekamp 2018). For people living with these changes in rural coastal places, the seeming lack of concern for their socio-economic wellbeing from those promoting coastal wetland resilience is often identified as another form of injustice, where the health of marshes appears to take precedence. This perceived lack of concern highlights a need for more effective community

engagement in wetland resilience work, which can be supported by further considerations of local-level human dimensions such as the socio-economic conditions of rural coastal places.

Political Dimensions

Political dimensions underpin how coastal resilience priorities are defined, establishing who ultimately is empowered and benefits in climate adaptation planning (Marino 2018). Rural communities have relatively limited political power since they tend to be poorer, more isolated and depopulated, and have less access to education than their urban counterparts (Bhattachan et al. 2018, Jurjonas and Seekamp 2018, Johnson and Lichter 2019, Jurjonas and Seekamp 2020). These factors hinder rural stakeholders' participation in decision-making processes, such as those affecting tidal wetland regulations (Paavola and Adger 2007). Without political pathways to integrate rural voices into wetland migration planning, rural needs go unmet, thereby exacerbating the injustices and disparities that frame rural vulnerabilities (Marino 2015 and 2018, Jurjonas and Seekamp 2020).

Those who have been systematically marginalized on the basis of race and ethnicity tend to be the most politically disempowered (Baird 2008). Systematic exclusions have profoundly affected the adaptive capacity of African Americans (Paolisso et al. 2012, Miller Hesed and Paolisso 2015, Hardy et al. 2017, Jurjonas 2018), including the New Revived Church community highlighted above. In the southern US, many African-American communities can be found in some of the most flood-prone areas due to the legacies of discriminatory practices and policies that relegated them to the most marginal lands (Ueland and Warf 2006). This includes communities in low-lying areas of Maryland's Eastern Shore (Paolisso et al. 2012, Miller Hesed 2016) whose lands are projected to transition to wetlands in the coming decades and, as such, are increasingly of interest to groups seeking to create marsh migration corridors (e.g., Lerner et al. 2013). With climate change, racial injustice merges with environmental injustice, placing those communities with less responsibility for climate change at greatest risk to its impacts (Hardy et al. 2017).

Over generations, these same communities have been denied equal access to education and employment opportunities, while also being discouraged from engaging with government, hindering their ability to have a voice in the governance of socio-ecological changes (Paolisso et al. 2012, Miller Hesed 2016), such as marsh migration into rural lands. While some government agencies have increased efforts to engage African-American communities, historic deafness to African-Americans' concerns has led some to feel that engaging with government is futile. Furthermore, these communities have deep and arguably well-founded suspicions that government entities would rather push them out to expand wetlands that serve migratory birds and eco-tourists (Miller Hesed

2016). Improving understandings of these types of injustices is imperative for developing adaptation strategies to effectively address the socio-ecological vulnerabilities of coastal landscapes.

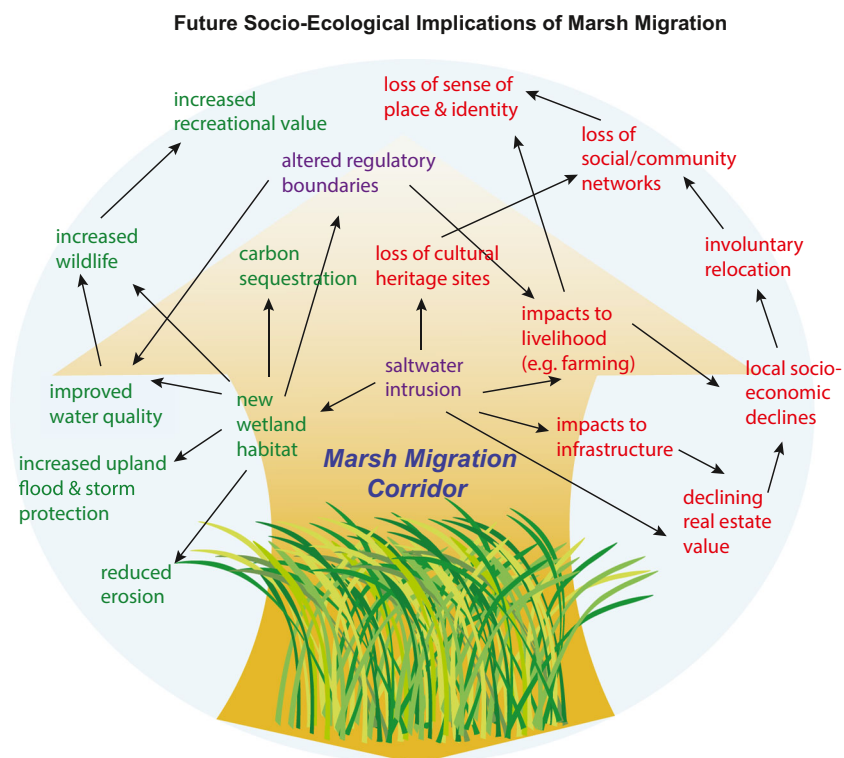
Working Towards Socially-just Coastal SES Resilience

An SES framework can help reveal how these human dimensions are intricately linked to ecological dimensions of wetland-dominated landscapes (Walker and Salt 2006, Bhattachan et al. 2018). It can also illuminate how overlooking human needs in developing coastal resilience strategies can result in socio-ecological misalignments that unintentionally exacerbate vulnerabilities for rural coastal people. Drawing upon the above case-studies, we propose an SES approach to examine human-environmental linkages within a marsh-dominated SES where human considerations have been largely under-examined in efforts to promote marsh migration. Figure 3 illustrates where coastal resilience work primarily driven by ecosystem goals may compromise efforts to develop a truly resilient coastal system, i.e. one that attends to both human and wetland needs. Specifically, we highlight how limiting one's scope to wetlands' ecological needs can result in an unbalanced distribution of climate change adaptation support within an SES, where benefits are weighted more heavily towards protecting local wetlands than the people who live next to them. This, in turn, results in coastal management practices that exacerbate vulnerabilities for people in these places, creating or perpetuating injustices for those on the front lines of climate change. Figure 3 also provides a starting point for developing an SES framework for future wetland migration considerations, showing where human dimensions research would be most beneficial in re-balancing rural coastal adaptation support. We suggest avenues for future research to facilitate more robust and just wetland management and planning for coastal resilience.

First, there is a significant need for more cultural analyses of the communities living and working around wetlands to facilitate meaningful and culturally sensitive engagements with people in these places. This could include research to better understand how people come to know, value, and relate to wetlands, which will help illuminate where wetland research and planning can better incorporate local cultural needs in building SES resilience. This research could also investigate the cultural assumptions that are used to define benefits and opportunities for coastal regions where wetlands are anticipated to migrate inland. This can help reveal if and how these assumptions problematically exclude other important values, uses, and needs within the SES.

Second, research is needed to understand the economic implications of wetland migration, such as how marsh migration affects the socio-economic health of rural coastal places, and what the resilience implications are for local and regional

Fig. 3 This diagram illustrates the complex network of socio-ecological dimensions that are potentially affected by the construction of marsh migration corridors. Green denotes dimensions where marsh migration increases socio-ecological resilience, while red denotes the emergence of new vulnerabilities; purple denotes dimensions that could be considered beneficial or harmful to coastal resilience depending on one's perspective (e.g. as a rural resident or wetland specialist)



interests. Research is also needed to develop effective distributive justice policies to address the widening economic disparities between urban and rural communities as rural communities are asked to make room for wetlands. This work is particularly important for addressing the racial injustices that affect many rural coastal areas.

Third, more research is needed to understand the legal and political dimensions (e.g., regulations, environmental policies) that affect human adaptive capacities in rural coastal places. This could include examination of current legal and policy frameworks to understand how they may favor certain resiliency needs at the expense of others, and can be improved to accommodate environmental protection and community adaptation goals. Additionally, research is urgently needed to identify equitable decision-making processes that are more inclusive of marginalized voices in shaping marsh migration planning. These three areas of research present great opportunities for interdisciplinary collaboration with the social sciences and for fostering more productive engagement with local stakeholders. Their contributions will improve our understanding of how coastal resilience can be developed to support a range of socio-ecological needs.

Conclusions

To value the human dimensions of marsh migration you need more than flat, descriptive facts about people. You need to know their history, values, successes, and on-going challenges

to draw upon their examples of adaptation and resilience in coastal resilience planning. These communities are more than demographic aggregations on a map. Their presence brings value to coastal SES, and they have rights, responsibilities, and a great deal at stake as participants in these SES.

In this paper, we have explored a range of issues for people who live in areas where marshes are migrating. The human dimension of marsh migration is clearly an under-studied topic. The approach used was anthropological and ethnographic, attempting to provide a broad holistic understanding of the issues and challenges, including those of justice and equity. We provide illustrative case-studies that show the complexity of the challenges and people's efforts to understand and adapt to a changing marsh. We hope these examples and our suggestion of an SES framework will be useful for others working to promote social and ecological resilience.

Wetland migration has been promoted at least in part because of the ecosystem services that marshes provide people (Lerner et al. 2013, Yoskowitz and Russell 2014, Association of State Wetland Managers 2015); however, if marshes migrate to the detriment of rural coastal communities, these services are at least partly negated. If wetlands are going to be sustained over the long-term, environmental goals must not directly conflict with local needs. The good news is that these rural coastal communities are motivated and committed to finding climate solutions. Furthermore, they can contribute considerably to wetland planning as local knowledge experts, citizen scientists, stakeholders, and collaborators, providing opportunities to improve socio-ecological understandings,

identify shared adaptation goals, and develop fair and ecologically-sound approaches for wetland migration. These are significant contributions toward achieving coastal socio-ecological resilience. Is that not good adaptive news?

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