

1 Climate Change, Justice and Adaptation
2 among African American Communities in the
3 Chesapeake Bay Region

4
5 Michael Paolisso (Corresponding Author)

6 Department of Anthropology,
7 University of Maryland, College Park, MD 20742;
8 mpaoliss@umd.edu

9 Ellen Douglas

10 Environmental, Earth and Ocean Sciences, University of
11 Massachusetts Boston

12 Ashley Enrici

13 Department of Geography, University of Maryland, College Park

14 Paul Kirshen

15 University of New Hampshire

16 Chris Watson

17 Environmental, Earth and Ocean Sciences, University of
18 Massachusetts Boston

19 Matthias Ruth

20 Center for Integrative Environmental Research,
21 University of Maryland, College Park

22
23 February 9, 2012

25

26 **Abstract**

27 In this paper we present results from a study of climate change and community adaptation,
28 focusing on two African American communities on the Eastern Shore of the Chesapeake
29 Bay. These two communities are representative of small, resource poor communities that
30 are particularly prone to increased flooding, storms and erosion accompanying climate
31 change. We frame our research within a focus on distributive and procedural justice,
32 including considerations of the role of adaptation capacity and vulnerability. We use
33 methods from cognitive environmental anthropology and psychometrics to ground a
34 participatory and multidisciplinary approach that emphasizes community participation and
35 the sharing of scientific and program information on climate change and adaptation. Our
36 results suggest that community members have a holistic understanding of climate change,
37 recognize a wide range of potential community and individual impacts, face specific
38 vulnerabilities, and are organized through their churches to engage in efforts to reduce the
39 impacts of increased flooding and storms on their communities.

40

41 **1. Introduction**

42 The impacts of climate change are often discussed at the global, continental or
43 national levels, but ultimately they are experienced at the local level (Paavola and Adger
44 2006). As a result, issues of justice, equity and inequality present difficulties for policy and
45 decision-makers because local communities experiencing climate change impacts have
46 different vulnerabilities within each country (O'Brien et al. 2004). To further complicate the
47 matter, often the most vulnerable have the least voice and lack equal protection of interests
48 from their national governments. Among the vulnerable, climate change may especially
49 burden those who already struggle with current climate variability and extreme weather
50 events (O'Brien et al. 2004; Adger et al. 2003; Wilson et al. 2010).

51 The impacts of climate variability and extreme weather events are often felt more
52 intensely in coastal areas because the coastal zone defines the confluence of both marine and
53 terrestrial processes. For instance, coastal communities are more vulnerable to increased
54 flooding due to both sea level rise and projected increases in precipitation and river flows as
55 a result of climate change (Kirshen et al. 2008; USGCRP 2008). It is estimated that over 50
56 percent of the population in the United States now live in coastal zones, and this number is
57 projected to increase (Wilbanks et al. 2008). This exposure to flooding is projected to
58 increase in the coming decades as a result of sea level rise due to climate change,
59 continued land subsidence, and probable increases in the intensity and frequency of
60 coastal storms (Thomas et al. 2009).

61 Research, environmental decision-making and governance focused on adaptation
62 to climate change impacts are strengthened by an explicit consideration of social justice

63 issues (Posner and Weisbach 2010). Differentiated access to information, variability in
64 risks of flooding and storms, restrictions on participation in adaptation programs, and
65 variability in vulnerabilities and adaptation goals will significantly shape the form and
66 ability to adapt to climate change impacts. Communities located in areas more prone to
67 flooding with fewer social, economic and political resources will almost certainly face
68 significant constraints in adapting to climate change impacts, which may be a
69 continuation of historical and cultural legacies of discrimination and inequalities (cf.
70 Wilson et al. 2010).

71 In this article we present results from a participatory and multidisciplinary study of
72 climate change impacts, vulnerabilities and adaptation for two African-American
73 communities on the eastern shoreline of the Chesapeake Bay. The Eastern Shore of the
74 Chesapeake Bay is particularly prone to the impacts of accelerated sea level rise because of
75 its low topography, hundreds of miles of coastline, and growing population (Cole 2008).
76 Given the low-lying topography and extensive shoreline of the Eastern Shore, most residents
77 are not too far from creeks, marshes, ditches, rivers, sounds or the Bay itself. State and
78 county governments are developing policies and programs to assist communities in adapting
79 to projected increases in flooding, storms, land erosion and salt-water intrusions to the
80 Shore's vast network of marshes (MCCC 2008). However, a challenge facing
81 governmental and local efforts to develop and implement adaptation programs is the
82 variability in community and local environmental conditions that create a wide range of
83 risks, vulnerabilities and adaptation capacity to climate change impacts. This diversity of
84 situations and needs raises questions of social justice regarding what is fair to expect from

85 local communities, what must be provided to them, who decides on adaptation needs and
86 services, and which vulnerabilities to climate change impacts should be prioritized.

87 Many African American communities on the Eastern Shore of Maryland today are
88 descendants of slaves, freed after the Civil War, and African Americans who later moved to
89 the Shore. Over the past century, members of these communities worked in agriculture and
90 commercial fisheries (Wennersten 1992). Our interest in African American communities'
91 vulnerability to climate change arises for a number of reasons. First, these communities
92 represent a socio-economic group that has not been studied sufficiently in terms of climate
93 change impacts (Wilson et al. 2010). Second, because of historical and racial barriers and
94 obstacles, African Americans have had fewer socioeconomic resources at their disposal to
95 respond to environmental and societal threats to their communities. Today, many of these
96 African American communities on the Eastern Shore are disappearing due to declines in
97 local job opportunities and migration of young adults to cities. Third, these communities are
98 often situated on low lying lands exposed to flooding, and with accelerated sea level rise and
99 increased flooding, storms, and erosion many of these communities could literally
100 disappear. Finally, these communities and their churches embody for many African
101 American Eastern Shore residents their history and heritage (Anderson 1998).

102 We present results from our research on climate change, justice and adaptation for
103 two African American communities on Maryland's Eastern Shore of the Chesapeake Bay¹.
104 Located in Dorchester County, Smithville is a dispersed community of residents descended
105 from workers in the agricultural, timber and seafood industries. The center of the

¹ The results of a parallel study of urban communities and environmental justice in Boston, Massachusetts is presented in Douglas et al. 2011.

106 community is the New Revived United Methodist Church. The community of Bellevue is
107 located in Talbot County and is comprised of descendants who worked in the seafood
108 industry (Anderson 1998). The center of Bellevue is St Luke United Methodist Church.
109 Though the communities share a common history they are also unique in their identities and
110 challenges in adapting to climate change. Both communities face increased threats of
111 flooding, yet the risks that flooding presents to each community is different, and each
112 community's capacity to adapt is also different, even though they share many broad cultural,
113 socioeconomic and historical characteristics.

114 We begin with a discussion of climate change impacts for Chesapeake Bay, and in
115 particular for the Eastern Shore, followed by a presentation of some connections among
116 distributive and procedural justice, adaptation and vulnerability that help justify our study
117 focus and specific research approaches. We then follow with a description of our
118 participatory and multidisciplinary approach, and the results from applying cognitive and
119 psychometric methods used to collect information on knowledge, interests, needs and values
120 related to climate change adaptation. We conclude with community specific adaptation
121 challenges and goals, and return to how our research fits within a distributive and procedural
122 justice approach.

123

124 **2. Climate Change and Adaptation for the Chesapeake Bay**

125 Assessments of climate changes in the Chesapeake Bay are fairly consistent in their
126 focus and direction – and rather dire in their predictions (Najjar et al. 2010). In particular,
127 the phenomena of sea level rise and associated changes -- erosion, flooding, and inundation -
128 - are very important for the Chesapeake Bay region. Accounting for only thermal expansion

129 and ice melt, sea level rise projections range from 0.8 to 2 meters (Pfeffer et al. 2008;
130 Katsman et al. 2008; Vermeer and Rahmstorf 2009). A recent state-of-the-science review
131 for climate change in the Bay estimates that in the 21st century relative sea level rise will be
132 approximately 0.7 to 1.6 meters – with variability across the Bay (Najjar et al. 2010; Pyke et
133 al. 2008). The consequences of accelerated sea level rise are dire for the low-lying areas
134 along of the Chesapeake Bay: permanent land loss due to inundation and accelerated
135 erosion; wetland accretion; migration or drowning; saltwater intrusion; and increased
136 frequency of storm flooding (Gesch et al. 2009). Tidal range and extreme wave height in
137 storms are expected to increase (Najjar et al. 2010).

138 While the extent and range of impacts may vary, it is generally agreed that the low-
139 lying Eastern Shore, and the counties of Dorchester and Talbot in particular, are in the high-
140 risk category, susceptible to erosion, flooding and inundation (Johnson 2000). Sea level
141 rise, in particular, will have dramatic effects on the region in and around Dorchester County.
142 Sea level rise modeling indicates that in the Blackwater National Wildlife Refuge, a vast
143 marsh and wildlife refuge in the heart of Dorchester County, will be largely underwater by
144 the year 2100, resulting in a loss of about 93 percent of its tidal marshes and swamps and
145 over 32,000 acres of undeveloped dry lands (National Wildlife Federation 2008; also see
146 Johnson 2000:4-5). Given that nearly half of the land area in Dorchester county lies below
147 1.5 m of sea level and is currently vulnerable to flooding from moderate storms (Cole 2008),
148 the outlook is bleak when considering the impacts of coastal flooding from future SLR and
149 its impacts. No significant research has yet investigated how climate change will impact
150 cultural and socioeconomic processes (and vice versa) across this region (Pyke et.al. 2008).

151 Government and non-government policies and programs are emerging in response to
152 the ecological risks and community vulnerabilities for the Chesapeake Bay. President
153 Obama issued Executive Order 13508 on Chesapeake Bay Protection and Restoration that
154 included the goals to “assess the impacts of a changing climate on the Chesapeake Bay and
155 develop a strategy for adapting natural resource programs and public infrastructure to the
156 impacts of a changing climate on water quality and living resources of the Chesapeake Bay
157 watershed” (Obama 2009: 2). The state of Maryland formed an Adaptation and Response
158 Working Group (ARWG) of the Maryland Commission on Climate Change (MCCC) to
159 investigate short and long-term adaptation measures to address sea level rise and climate
160 change. Specific actions recommended include the promotion of programs and policies to
161 reduce impact to existing areas and future developments; a transition to more sustainable
162 economies and investments; improved preparedness and planning regarding human
163 population safety, health, and welfare; protection of the natural shoreline (MCCC 2008).
164 Additionally, the State of Maryland has developed the CoastSmart Communities Initiative, a
165 program that in partnership with NOAA will provide grants ranging from \$10,000 to
166 \$75,000 to coastal communities to support the planning and preparation needed to adapt to
167 climate related impacts and provide on-the-ground expertise, planning guidance, training
168 and tools to support local planning efforts (DNR 2012).

169 Multiple non-profit environmental and stewardship groups are recommending
170 specific policies and programs. For example, the National Wildlife Federation recommends
171 (a) requiring local governments to consider sea-level rise when amending their plans for
172 coastal land use; (b) expanding Maryland and Virginia’s 100-foot buffer zones and
173 increasing the enforcement of existing buffer zone areas; and (c) developing policies such as

174 rolling easements or mandatory setbacks to discourage new development in vulnerable
175 coastal areas (NWF 2008:10; see also Chesapeake Bay Foundation 2007). However, prior
176 to our study there had been no specific focus on coastal African American communities in
177 the region.

178

179 **3. Adaptation, Vulnerability and Justice**

180 Adaptation and vulnerability to climate change inherently raise issues of justice
181 (Posnor and Weisbach 2010). Broadly speaking, key justice dilemmas of adaptation
182 include responsibility for climate change impacts, the sharing of assistance to vulnerable
183 countries and communities for adaptation, and fair participation in planning and making
184 decisions on adaptation (Paavola and Adger 2006). These broad justice considerations are
185 empirically based on the fact that adaptation to climate change consists of individual and
186 group choices made in the context of present and predicted climate change impacts, societal
187 concerns and priorities, and existing institutional decision-making structures and processes
188 that bias particular distributions of resources, wealth and power (Paavola and Adger 2006).
189 These choices and decisions are often characterized by conflicts of values and interests, and
190 they cannot be reduced to technological solutions, market driven processes and cost–benefit
191 calculus (Bromley and Paavola 2002). Ultimately, these choices are moral in the sense that
192 they are informed by values that guide the comparison of alternatives choices and decisions.
193 Thus, the collective adaptive decisions need to strike a legitimate and just balance between
194 the different interests and values (Paavola 2005).

195 The concept of vulnerability is also central for climate justice because it further ties
196 the above concerns of adaptation to those of moral philosophy (Paavola and Adger 2006).

197 Research on adaptation to climate change defines vulnerability as a function of exposure,
198 sensitivity and adaptive capacity (Paavola and Adger 2006). Research on natural disasters
199 defines vulnerability as the characteristics of a person or group and their situation that
200 influence their capacity to anticipate, cope with, resist and recover from the impact of a
201 natural hazard (Wisner et al. 2004). This definition draws attention to factors such as assets,
202 sources of livelihood, class, race, ethnicity, gender and poverty that demarcate vulnerable
203 groups (Paavola and Adger 2006). For example, vulnerability is affected by the extent of
204 people's dependence on risky activities such as agriculture or fishing, and the ability of
205 communities to access health, education, and economic resources.

206 A focus on vulnerability is further justified given principles of distributive justice
207 (Kolm 1996; Rawls 1971). Distributive justice is comprised of normative principles
208 designed to guide the allocation of benefits and burdens in a society. A fundamental goal of
209 distributive justice is to develop principles that guide the fair and equal distributions of
210 goods and services among individuals and groups. A core principle of distributive justice is
211 strict equality. This egalitarian principle says that every person should have the same level
212 of material goods and services. The principle is most commonly justified on the grounds that
213 people are owed equal respect and that equality in material goods and services is the best
214 way to give effect to this ideal.

215 Equality is a reasonable theoretical and moral starting point for a focus on
216 vulnerability to climate change impacts. Equality can be considered just if there are no
217 compelling reasons to prefer an inegalitarian distribution. However, need and lack of
218 capacity are often considered to be such compelling reasons that would justify a deviation
219 from the norm of equality (Rawls 1971). Vulnerability can be considered comparable to

220 need and lack of capacity in providing a justification for favoring the most vulnerable in
221 distributive matters (Paavola and Adger 2006).

222 In addition to distributive justice, it is also important to focus on procedural justice.
223 Procedural justice is concerned with roles and positions of individuals or groups in the
224 planning and decision-making processes, and includes considerations of factors such as
225 recognition, participation and distribution of power (Tyler et al. 1997; Young 2000).

226 Importantly, procedural justice fosters legitimacy in that it helps assure those whose interests
227 are not supported by a specific decision that their interests have been considered and that
228 they there will be opportunities to be considered in future decisions (Paavola and Adger
229 2006). Procedural justice allows all stakeholders to express dissent or consent in a context
230 that legitimizes differences and conflicts in interests and values; some decisions will be
231 adopted, some not, but all will have equal and dignified consideration (Schlosberg, 1999)
232 Procedural justice is not independent of distributive justice. If stakeholders are not
233 recognized and thus cannot participate in planning and decision-making, for example
234 regarding adaptation, their interests and values will not inform plans and decisions, which
235 can aggravate inequality rather than reduce it (Paavola and Adger 2006).

236

237 **4. Study Communities**

238 The study communities of Smithville and Bellevue are both located on the Maryland
239 portion of the Eastern Shore of the Chesapeake Bay (Figure 1). Fishing, farming and
240 forestry are the keystones of the Eastern Shore economy and way of life. As Maryland's
241 most concentrated agricultural region, counties in the Middle Eastern Shore area (Queen
242 Anne's, Talbot, Caroline and Dorchester) account for almost one-third of Maryland's

243 agricultural land and produce over 50% of the state's major crops such as corn, soybean,
244 wheat and barley (ESLC 2002). The Eastern Shore possesses a distinct cultural identity
245 within the Chesapeake Bay region and the state of Maryland: those "born on the Shore" are
246 known to be independent, hard working, religious and politically conservative (Wennersten
247 1992).

248

249

Figure 1

250 *4a. Smithville*

251 The African-American community of Smithville is located in Dorchester County,
252 which refers to itself as the "heart of the Eastern Shore" because of its location in the middle
253 of the Shore and the county's boundaries form a heart-like figure (Figure 2). According to
254 the three-year estimates for the U.S. Census Bureau, Dorchester County in 2006 had a
255 population of 31,734, of which almost 28 percent was African American, compared to 12
256 percent, nationally. Dorchester is one of the poorer counties in Maryland, though in recent
257 years newcomers and tourists have discovered Dorchester County's open natural spaces and
258 lower cost of living. In 2007, per capita personal income (\$25,047) in Dorchester County
259 was 79 percent of statewide per capita income; and is expected to decline to 71 percent by
260 2030 (Maryland Department of Planning, Planning Services 2007). Unemployment in
261 Dorchester County is 10.1 percent, compared to Maryland's 7.3 percent average and the
262 U.S. national average of 9.4 percent (Bureau of Labor Statistics 2010).

263 The community of Smithville is located between Taylors Island and Blackwater
264 National Wildlife Refuge in southern Dorchester County. Based on interviews with
265 community residents, Smithville was formed in the early 20th century when a farmer (named

266 Smith) sold land to African Americans living and working on a nearby farm owned by white
267 farmers. The land sold was low lying and marshy, and not suitable for agriculture. By the
268 1910 to 1920 period there were already a number of African American families living in
269 Smithville, and by the 1940s the population had increased to perhaps 20 families located
270 along what today is Smithville Road. Informants do not know precisely how many people
271 lived in Smithville during the first half of the 20th century, but they remember that "you
272 couldn't get through here [Smithville] because of all the children and dogs." The
273 community, probably along with African Americans living on nearby Taylors Island, even
274 had a baseball team named The Lone Rangers. One informant remembered that when he
275 returned to Smithville after World War II there were maybe about 100 people living here.

276 Residents of Smithville worked in seafood processing on Taylors Island and at
277 white-owned farms and businesses harvesting and processing vegetables and fruits. Many
278 men also work in local sawmills. Today, there are only a handful of families residing in
279 Smithville. Young people have moved away because there were no jobs outside a few in
280 seafood and agriculture. Those who have moved have not, however, sold their property, and
281 still see themselves socially connected to Smithville. Many who have left relocated to the
282 nearby city of Cambridge but still attend church in Smithville.

283 In the past as today, church is the most important social institution in Smithville.
284 The New Revived United Methodist Church was built in 1925. Although the policy of the
285 United Methodist Church is to integrate whites and African Americans in its churches,
286 churches on the Eastern Shore in practice remain separated into white and black churches,
287 for historical, social and cultural reasons. Today, New Revived has about 30 active

288 members, as well as other members who support the church with donations and visit the
289 church during its annual homecoming.

290 *4b. Bellevue*

291 The community of Bellevue is located in Talbot County (Figure 2), north of
292 Smithville, along the Tred Avon River. Talbot County, with its almost 600 miles of
293 shoreline, is almost entirely surrounded by the waters of Chesapeake Bay and its
294 tributaries (Nuckols et al. 2010). Parts of Talbot County, because of its proximity to
295 Chesapeake Bay, are already subject to severe erosion caused by wind and wave action.
296 The population of Talbot County is approximately 36,000. In addition to long-term
297 residents, the county has become a retirement location. Almost 23 percent of Talbot County
298 residents are over the age of 65, contrasting with the national average of 12.6 percent.
299 Approximately 13 percent of the population is African American. In the nearby town of St.
300 Michaels the population is 1,193 and African Americans comprise 29.3 percent of the
301 population. In 2009, the per capita income in Talbot County was \$39,294 and the median
302 household income was \$59,633 (U.S. Census Bureau 2011). In 2009 the percentage of
303 people living below the poverty level in Talbot County was 8.8 (U.S. Census Bureau 2011).
304 The unemployment rate in Talbot County is 7.4 percent (Bureau of Labor Statistics 2010).

305 The village of Bellevue was founded in the early 20th century by African Americans
306 working in the seafood industry as shuckers of oysters, pickers of crabs or as watermen
307 "working the water." A seafood-processing factory that employed and housed African
308 Americans sold part of the adjoining land to African Americans. By the 1930s, the Bellevue
309 Seafood Company was African American owned and operated, and up until the 1970s there
310 were many African American watermen who worked the same areas as white watermen,

311 often on the same boats, and sold their catch to the same processors, with apparently little
312 racial discrimination present (Anderson 1998). Working the water was more profitable than
313 working on farms or in food processing. It is not clear what the population of Bellevue was
314 through the first half of the 20th century, though interviews and observations of the current
315 layout of the village suggest that there could have been 100 to 200 residents. Similar to
316 Smithville, Bellevue also had a baseball team. Today, the population of Bellevue is
317 probably close to 100 residents, mainly African American.

318 The center of Bellevue, in the past and today, is St. Luke United Methodist Church.
319 The church was built on its current location in the center of Bellevue in 1903. Today, the
320 church has between 30 and 40 active members, and a larger number of supporters who no
321 longer live in the community but return for the church's annual homecoming. The church is
322 also well known for its chicken barbecue, which is an important source of church funds.
323 During summer months, church members sell barbecued chicken from a nearby roadside
324 stand.

325 **5. Participatory Research Approach**

326 Our research approach reflects interests in both distributive and procedural justice.
327 In terms of distributive justice, we needed an approach that would identify community
328 residents' interests, values and needs affected by climate change, community capacity, and
329 vulnerabilities in meeting needs and sustaining values. In terms of procedural justice, we
330 needed an approach that was both participatory and inclusive, while capable of providing
331 information on interests, values and needs in a manner that created legitimacy and
332 ownership of the process and results by community members (Aylett 2010).

333 More specifically, we used theories and methods from cognitive-environmental
334 anthropology and psychometrics to engage community members in the collection and
335 analysis of their knowledge, interests, values and needs related to climate change impacts.
336 We also provided scientific information on climate change and predicted impacts to both
337 educate and generate community responses on adaptation goals, constraints and
338 opportunities. We also provided information on state-level programs that seek to work with
339 Maryland coastal communities to improve adaptation to predicted increases in storms and
340 flooding due to climate change induced sea level rise. Throughout our data collection and
341 analysis, we involved community members in order to better represent their understandings
342 of climate change, vulnerabilities to climate change impacts, and their values and
343 preferences in terms of adapting to climate change. We brought to this participatory
344 research process expertise from anthropology, hydrology, engineering, geography and
345 program management. Most of our community level information was collected during a
346 series of three workshops held in each community from 2009 to 2010, though we also
347 collected information from informal interviews and participant observation. The specific
348 methods and data collection activities used are described below under cultural analysis,
349 sharing the science, and sharing adaptation options.

350 Cultural Analysis of Community Understanding of Climate Change (Workshop 1)

351 Two key goals of the project were to 1) elicit community members' knowledge of
352 climate change as well as their experiences and observations of climate change impacts on
353 their communities and 2) identify opportunities and constraints to different adaptation
354 strategies that could reduce community vulnerability to climate change impacts, most

355 notably increased flooding due to sea level rise, increased storms, and changing precipitation
356 patterns.

357 Because climate science is complex, contains considerable uncertainty in terms of
358 local impacts, and the public and political discourse over climate change can be contentious
359 we anticipated a wide range of views and opinions on climate change among community
360 members. We thus theorized that community residents would draw upon a wide range of
361 information to interpret and make judgments about the source, veracity and utility of
362 information on climate change. As a result, we did not want to assume much about what
363 and how community members understand and think about climate change.
364 We did hypothesize that workshop participants would conceptualize climate change within
365 existing cultural frames of reference acquired through past, shared experiences. These
366 frames of knowledge could, for example, include religious beliefs and values that might lead
367 to the conclusion that climate change was in fact not occurring, or ideologies that
368 contextualized climate science within political agendas.

369 Our first research priority was to try to elicit these existing frames of cultural
370 knowledge for understanding climate change, including information on adaptation and
371 vulnerability. We used approaches familiar to cognitive and environmental anthropologists
372 for eliciting shared core knowledge of environmental phenomena (cf. Atran et al. 2005;
373 Kempton et al. 2005; Paolisso 2002, 2007; Shaffer and Naiene 2011). More specifically, to
374 elicit cultural knowledge about climate change we used cognitive and psychometric
375 approaches, specifically free listing, pile sorting and multidimensional scaling (MDS)
376 (Bernard 2006; Kruskal and Wishong 1978; Weller and Romney 1988). We first asked
377 participants to freely list the words that come to mind when they think about "climate

378 change." We then asked participants, individually, to identify the listed words that they felt
379 were "most important." Next, we identified words that were seen as "most important" by
380 two or more community members. This list represented words that the group shared to
381 some degree. We then had workshop participants organize these shared words (printed on
382 small slips of paper) into piles of terms (pile sort). The only instruction we provided was to
383 organize the words so that words more similar to each other were in the same pile, and
384 words more dissimilar were in different piles. Pile sorting is an easy and useful way for
385 collecting information on similarities and differences in knowledge and values (Weller and
386 Romney 1988). The first workshop concluded with some general discussion of what they
387 found interesting, difficult or confusing about the exercises, and what other thoughts
388 emerged about climate change as a result of the exercises. We analyzed the pile sorts using
389 multidimensional scaling (MDS).

390 MDS is a set of techniques that help researchers uncover the "hidden structure" of
391 data by analyzing proximities within the data itself (Kruskal and Wish 1978). A proximity
392 is a number or measure of how similar or dissimilar two objects are or perceived to be. The
393 most important output of MDS is a spatial representation of each data point in
394 configurations that suggest how similar or dissimilar the data are to each other (Kruskal and
395 Wish 1978). Visually, the more similar two points are perceived to be to each other, the
396 closer they will be represented in the spatial representation, and the opposite is also true: in
397 the case of our climate change words, the farther apart two words are in the spatial plotting,
398 the more dissimilar workshop participants thought the words were. MDS programs are
399 capable of plotting proximity data in "n" dimensions, though most researchers analyze data
400 using either two or three dimensions. In interpreting the MDS spatial representation, the

401 researcher, with assistance from community participants in our case, can focus on two
402 specific analyses: 1) identification and evaluation of the meaning associated with close
403 clusters of data (e.g., words about climate change) and 2) exploration of possible
404 explanations for the overall distribution of data in order to identify the hidden dimensions
405 underlying and organizing the data.

406 Sharing the Science of Climate Change (Workshop 2)

407 Following a discussion of the cultural knowledge of climate change, we shared
408 scientific information on the causes of climate change and the resulting effects on sea level
409 rise and coastal flooding. We explained how scientists know what past climates looked like
410 from ice core data and how we assess what future climates could look like from modeling
411 various CO₂ emissions scenarios. We presented digital maps showing different flooding
412 projections for Dorchester and Talbot counties depending on different sea level rise and
413 storm scenarios (Figures 2 and 3). Community residents were genuinely interested, asked
414 many questions, located their specific houses and local landmarks on the flood maps, and
415 were clearly valued learning what science offers and what it might mean for their
416 community.

417 Figure 2

418 Figure 3

419 Sharing Information on Adaptation Options (Workshops 2 and 3)

420 At the end of the second workshop, we presented four categories of adaptation:
421 protection, accommodation, evacuation and retreat. We then discussed with participants the
422 desirability and feasibility of these options for their communities. At the third and final

423 workshop in each community, we continued the discussion of adaptation options by
424 focusing on community incentives and obstacles to the specific adaptation options. A
425 representative from Maryland’s Department of Natural Resources joined us at the third
426 workshop and led a focused discussion of the adaptation options the State is developing to
427 address climate change impacts. These options include avoidance or prevention of
428 additional risks (e.g., zoning to restrict building in flood prone areas), accommodation (e.g.,
429 elevate homes, emergency management), protections (e.g., berms and sea walls), and finally
430 retreat. Participants formed small groups to discuss which options were feasible, or not, and
431 what were the opportunities and constraints to implementing any of the options.

432 **6. Results and Discussion**

433 Our research with Smithville and Bellevue provided a number of valuable insights
434 on community members' understanding of climate change, their needs, values and
435 vulnerabilities, and their adaptation goals. Both communities were enthusiastic about our
436 project and motivated to learn more about climate change and the implications for their
437 communities. We did not find any resistance to believing that climate change is occurring,
438 or support for any political or religious arguments against climate change. We present our
439 findings in two sections: 1) cultural knowledge of climate change, impacts and responses
440 and 2) justice and adaptation issues. We follow with some overall conclusions linking our
441 study to broader climate justice themes.

442 *6a. Cultural Knowledge of Climate Change*

443 We found that community members had robust and varied understandings of climate
444 change, based on both local experiences and information obtained from media sources.

445 These understandings or cognitive frameworks were first identified, and most clearly
446 captured, by the freelist, pile sorting and multidimensional scaling activities. The freelisting
447 exercise in Smithville elicited a total of 100 words in response to the concept of "climate
448 change." Fifty-six of those terms were mentioned by at least four or more participants.
449 These fifty-six terms were pile sorted by the 24 workshop participants, and the
450 multidimensional scaling results are presented in Figure 4. The freelisting exercise in
451 Bellevue elicited a total of 60 terms of which two or more individuals mentioned 35 terms.
452 These 35 terms were pile sorted by eight workshop participants, and the multidimensional
453 scaling results are presented in Figure 5.

454 Figure 4

455 Figure 5

456 A number of patterns and results in the multidimensional scale plot in Figures 4 and
457 5 warrant discussion. There are differences between the two communities in the number of
458 terms, which is partially accounted for by the larger number of Smithville participants, and
459 the terms themselves, which as explained below reflects each community's different
460 environmental situations and past historical experiences with flooding and storms. What is
461 most noteworthy in the MDS plots is the general clustering of terms into three large groups.
462 A first large cluster, on the left side of each MDS plot, is a large number of words for
463 **environmental impacts of climate change**. For Smithville, examples of these
464 environmental impacts of climate change are sea life, forest fires, drought, melting ice,
465 rising tides, flood, hurricane, storms, earthquake and disaster. The 24 terms for
466 environmental impacts listed by Smithville residents cover a wide range of natural impacts

467 and vary in terms of specificity (e.g. crabs versus disasters) (Figure 4). In discussing these
468 terms with Smithville community members in workshop two, they clearly saw these words
469 as capturing the "catastrophic natural events" the "main 'frontal' issues one thinks of in terms
470 of climate change, the "immediate impacts" that need to be "dealt with first."

471 A very similar pattern can be found in the Bellevue MDS plot. For example,
472 workshop participants mentioned 17 words for environmental impacts of climate change,
473 such as volcanic ash, temperature, atmosphere, tsunami, loss of habitat, storms, flooding
474 land erosion, fish kills and declining animal population (Figure 5). These words are similar
475 in terms of breadth and variability to the terms elicited from Smithville community
476 members. In discussion with Bellevue workshop participants, they had little problem
477 relating how each of the environmental impact terms might be related to climate change,
478 though they readily admitted that they were not always "100 percent sure" but that they had
479 "read or heard things." For Bellevue, as well as Smithville, the breadth of the words
480 mentioned for the environmental impacts of climate change is quite impressive, and they
481 include environmental impacts that are of immediate concern to them, such as flooding,
482 storms, land erosion, as well as broader global impacts. They did not claim to fully
483 understand how climate change was linked to all these impacts, and they were open to
484 "being corrected."

485 A second cluster of terms that appears in both MDS plots represents what workshop
486 participants believed were some of the **individual and community impacts of climate**
487 **change**. In the Smithville MDS, examples of these 21 human-impact words include fuel
488 prices, jobs, starvation, poverty, hunger, high depression, stress, isolation, and diseases
489 (Figure 4). Workshop participants quickly identified this cluster of terms and referred to

490 them as "vulnerabilities," commenting, for example, that "if the climate changes and it is too
491 hot or cold, crops may not grow and result in starvation, hunger and poverty," and that
492 "climate change will make it more difficult to make a living off the water" (watermen), and
493 most importantly that the "aged are more susceptible than younger people." They also
494 thought that changing weather, particularly if cloudy or stormy for long periods of time,
495 would cause some people to be fearful, depressed, isolated, and stressed, and cited examples
496 of people they knew who get depressed when the weather is cloudy for a long time. They
497 also thought changes in weather caused more people to get allergies, again with personal
498 testimonies (Figure 4).

499 In Bellevue there was a more limited number of terms for individual and community
500 impacts. These terms are infrastructure, diseases, genocide, fear, famine, death and food
501 (Figure 5). Bellevue workshop participants echoed much of the commentaries made by
502 Smithville community members about how climate change could cause individuals to be
503 fearful, result in increased diseases and create food shortages leading to famine. Of special
504 note for Bellevue participants was their concern about climate change impacts on
505 infrastructure. Here participants expressed both concerns about the impacts of erosion on
506 the land surrounding the community, and the consequences of flooding on highways and
507 roads that would be used to evacuate residents in the case of storms and floods.

508 The third and final large cluster of terms evident in both MDS plots represent
509 **responses to the environmental and human impacts of climate change**. Differences in
510 each of the two communities' current vulnerabilities to flooding and storms account for
511 differences in the words elicited. For Smithville, a total of 13 terms trending toward the
512 right side of the MDS plot represent response or adaptation to the environmental and human

513 impacts (Figure 4). Moreover, there are important sub-clusters within these terms that
514 suggest different strategies. For example, for Smithville a cluster of terms suggest
515 individual household or community responses, such as relocating, shelters, family members,
516 self-preservation, and even knowledge and understanding (need to know more). Other
517 responses mentioned involve emergency response and dealing with the impacts after they
518 have done damage (rescue vehicle, emergency response, doctors and hospitals). These
519 words represent responses or adaptations familiar to community members, or generalized
520 responses that cover a wide range of individual or community impacts. Contrastingly, the
521 words federal government, politics and national security form a tight cluster of terms
522 (meaning participants saw them as similar) that is relatively distant from other terms,
523 suggesting that community members did not consistently agree with how "government" is
524 associated with other responses as well as the other listed climate change impacts (Figure 4).

525 For Bellevue, the MDS plot produced a cluster of terms for responses, along the
526 right side of the plot (Figure 5). Similar to Smithville, these responses are relevant,
527 applicable to the situation in Bellevue. Workshop discussion revealed that Bellevue
528 residents are motivated by preserving the community and church (self preservation) and
529 want to be prepared. Since the community and church are on relatively high grounds, they
530 are less concerned about flooding of the community, which in their collective memory has
531 not occurred, but that flooding elsewhere and storms in general will result in an evacuation
532 of the entire area. This concern explains why they listed words such as transportation,
533 communication, emergency warning, and family separation, and possibly looting (in the
534 community while they were evacuated) (Figure 5). They expressed numerous times their

535 concerns about evacuation bottlenecks, and their fears that lower-lying communities would
536 be evacuated first, and the roads would be blocked, necessitating police enforcement.

537 A couple of final observations and interpretations of the MDS plots in Figures 4 and
538 5. First, we were interested in the role of religion in terms of understanding and adapting
539 to climate change impacts. Only Smithville community members mentioned any term with
540 a direct religious reference. Five of the workshop participants marked the term God as
541 important. In the Smithville MDS, the term God appears close to clusters of words
542 representing human impacts and responses. Graphically, the term appears in the center of
543 the plot (Figure 4). From a MDS perspective, this center location of the term is not
544 analytically significant. However, for workshop participants, upon seeing the term God in
545 the center, interpretations were offered such as "he's in the middle of the mix" or the "wheel
546 in the middle of the wheel."

547 Second, what is absent from the MDS plots are terms that suggest a scientific
548 understanding of climate change and the physical and ecological processes that increase
549 environmental impacts, most notably sea level rise. Based upon our presentation on climate
550 change and sea level rise in the second workshop, it became clear that almost all the
551 participants did not understand the linkages between CO₂ and atmospheric warming that
552 lead to many of the environmental impacts they mentioned (e.g. melting ice, storms).
553 However, they were very interested in our presentations on climate change and sea level
554 rise, and asked many good questions. Also of note is they did not mention the term "sea
555 level rise," though they did mention rising tides, flooding, storms, and erosion, which were
556 very salient in their collective thinking, as evidenced by workshop discussion and the rating
557 of these terms as important during the free listing exercise. From our observations and

558 discussions, it became clear that workshop participants had not connected climate change to
559 accelerated sea level rise and increases in rising tides, flooding, storms and erosion. Finally,
560 they did not mention any county or state government agency that is engaged in developing
561 climate change adaptation policies and programs, suggesting that community members do
562 not readily think of external agencies or institutions as resources to assist them in adapting to
563 climate change.

564 *6b. Justice and Adaptation Issues*

565 A number of salient themes emerged from the discussion of adaptation options that
566 are applicable to both communities. First, both communities expressed a strong desire to
567 acquire more information on climate change and its impacts for their areas. Workshop
568 participants expressed an even stronger desire to learn about the state and county programs
569 that support communities in their adaptation to climate change. We heard participants say
570 "we need to get educated and connected" to the organizations that "can help us." Overall,
571 participants thought that the worst thing they could do is to "live with it [climate change]"
572 and that "the worst we can do is to do nothing."

573 Second, participants offered carefully worded references to the influence of power
574 and money in terms of supporting communities to prepare for climate change. Questions
575 were asked about "how was it that some communities know this, are already involved in
576 these efforts, and we are only just now learning." Another comment referred directly to the
577 power of money to get support, and without it you are "kinda behind the 'eight ball,'
578 helpless." Very interestingly, one participant asked whether "the environmentalists have any
579 constraints on what some do that harms others?" She believed that some groups or

580 organizations were acting in ways that were causing her community to be at environmental
581 and social risk. Participants also recognized that their relative poverty, small size and
582 isolation were disadvantages, and that they very easily could get overlooked, or not
583 included. We did not hear any explicit reference to racial discrimination as a factor that had
584 resulted in them not knowing earlier the information we presented. Many of the
585 participants were seniors, who had surely experienced racial discrimination in their lifetime,
586 and all knew the segregated history of their parents and grandparents. Still, at least
587 explicitly, racial discrimination did not surface during the workshops or interviews as a
588 reason for why they had not been included in previous efforts to learn about adaptation to
589 climate change.

590 Third, of the adaptation plans discussed in the third workshop, the communities
591 differ in their preferences. Bellevue wants to accommodate. Since they are on higher land,
592 they are not prone to flooding. What they are vulnerable to is flooding in nearby low-lying
593 areas that would result in the community being isolated or trapped during a storm, unable to
594 evacuate (as was discussed above in the MDS). As one workshop participant said, "we are
595 on a peninsula here, you can't go a few miles without running into water." Their needs are
596 to integrate with county and state emergency planning efforts. Bellevue residents also
597 concerned about erosion from storms, because that would lead, over many years, to them
598 being directly vulnerable to flooding in Bellevue proper and the church in particular.

599 For Smithville, their adaptation priority is different: protect the church and
600 cemetery, and make sure that the few seniors living in the community can be reached when
601 there is a storm. To preserve Smithville, it is about protecting the church and cemetery, and
602 protecting property (not houses, most of which are not occupied). In Smithville, they would

603 want to protect for as long as possible and only as a last resort retreat and relocate the
604 church. Bellevue is also against retreat and relocations. In Smithville, the biggest problem
605 is finances to protect the church and cemetery.²

606 **7. Conclusions**

607 Our participatory research with the communities of Smithville and Bellevue
608 provides valuable insights on their interests, values, vulnerabilities and adaptation goals, all
609 of which confront new challenges due to accelerated sea level rise and increased flooding
610 and storms associated with climate change. Community members were unfamiliar with
611 science-based information on climate change and the projected impacts for their
612 communities, and information on state and county programs that could assist them in
613 adapting to these changes. However, we also found community-based opportunities that
614 with support and assistance could significantly improve adaptation to climate change.
615 Members of both communities are highly motivated and interested in learning more about
616 climate change and its potential impacts for their communities. The MDS results suggest
617 that study participants are already conceptualizing climate change in holistic frames that
618 include causes, impacts, vulnerabilities, and possible adaptation responses. Science-based
619 information on climate change and more information on government adaptation plans would
620 expand their current knowledge while continuing the community's participation in the
621 decision that affect the survival of their communities.

² At the time of the writing of this article, the Maryland Department of Natural Resources was in discussions with Smithville community members about the possibility of building a berm around or elevating the church.

622 Perhaps the most important resource available to each community is their church,
623 and utilization of church-based networks will be key to adaption plans for the future.
624 Throughout the Eastern Shore local churches anchor communities and provide a social
625 institution that motivates, organizes and mobilizes individuals to work toward common
626 goals. These churches have the ability to involve distant members in, for example, climate
627 change discussions and adaptation planning, which extends community capacity beyond
628 local residents. Very importantly, churches reinforce communities' collective motivation to
629 respond and work together to address challenges to the community sustainability, which
630 now on the Eastern Shore include increased risks of flooding, storms and erosion. As
631 members of both Bellevue and Smithville told us, "we are people of faith;" they truly
632 believe sustaining their communities and adapting to climate change are possible. Finally,
633 the New Revived and St. Luke churches are representative of many other small churches,
634 African American and White, spread across the Eastern Shore landscape that can organize
635 communities confronting new environmental and social challenges brought on by climate
636 change.

637 The results of our study remind us that the impacts of climate change are more than
638 just flood maps under different sea level rise scenarios, modeled predictions of changing
639 rainfall and storms, and estimates of shoreline erosion. Adaptations to these impacts will
640 require more than just policy and planning documents at the county or state levels. The
641 scientific understanding of climate change and its impacts, and comprehensive planning for
642 adaptation are vitally necessary and need further refinement and development at both
643 regional and community scales. As the science and policymaking on climate change and
644 adaptation proceed, it is also essential to better understand how climate change and policy

645 become situated in communities that face different risks and social vulnerabilities.
646 Adaptation will be site specific; it will ultimately be a human endeavor of social
647 relationships with exchanges of information and resources. The results of this study have
648 shown for two, generally-similar African American communities on the Eastern Shore there
649 can be quite different adaptation goals: one is to save the church for an extended
650 community for as long as possible, and then relocate if necessary; the other is to ensure
651 evacuation from storms and prevent long-term shoreline erosion. Both of these adaptation
652 goals should be achievable, using a mix of community and governmental support.

653 We hope our research contributes to the large and growing literature focused on
654 environmental justice that seeks to understand the complex relationships between culture,
655 society, economy, race, ethnicity, and environmental change and hazards (cf. Bryant 1995;
656 Checker 2005; Johnston 2011). Among this literature, are a growing number of studies
657 focusing on racial and economic injustices in response to natural disasters, including those
658 related to climate and weather (cf. Allen 2007; Elliot and Pais 2006; Oliver-Smith 2009;
659 Pezzolli et al. 2007; Wilson et al. 2010).

660 More broadly, our participatory research with the Smithville and Bellevue
661 communities is an attempt to put into practice some of the fundamental principles of
662 distributive and procedural justice. We used cognitive-environmental approaches to elicit
663 community interests and values in a highly participatory manner. The elicited information
664 on community impacts and responses and our discussions of the science of climate change
665 and program options for adaptation provided very useful insights into specific adaptation
666 interests and values (e.g., save the church, avoid isolation during evacuation) and
667 community vulnerabilities (e.g., lack of information, resources, connection to emerging

668 adaptation programs). Our use of workshops prioritized community participation, and
669 involved Maryland officials who are developing climate adaptation policies and programs.
670 Supported by the cognitive analysis of interests and values (e.g., MDS), these workshops
671 helped us move toward the goals of procedural justice. Ultimately, the legitimacy of the
672 adaptation decisions affecting Smithville and Bellevue will rest both on their distributive
673 outcomes and their procedural justice implications.

674 **Acknowledgements:** This research was funded by a grant from the NOAA Sectoral
675 Applications Research Program (SARP; NAO08OAR4310722). We gratefully acknowledge
676 the assistance and participation of the members of the New Revived United Methodist
677 Church and St Luke United Methodist Church, Ms. Gwen Shaughnessy, formerly of the
678 Maryland Department of Natural Resources, and Ms. Katie Clendaniel, an applied
679 anthropologist working in Dorchester County. We also thank the anonymous reviewers of
680 the first version of this article. Their comments were extremely useful to this paper and our
681 future research.

682 **References**

- 683 Adger, W. N., 2001: Scales of governance and environmental justice for adaptation and
684 mitigation of climate change. *Journal of International Development*, **13**, 921–931.
- 685 Adger, W.N., 2003. Social capital, collective action and adaptation to climate change.
686 *Economic Geography* **79**, 387–404.
- 687 Allen, B. L., 2007: Environmental justice and expert knowledge in the wake of a disaster.
688 *Social studies of science*, **37**, 103–110.
- 689 Anderson, H., 1998: Black Men, Blue Waters: African Americans on the Chesapeake. *Marine*
690 *Notes*, March-April, 1-3.

691 Atran, S., D. Medin, and N.O. Ross, 2005. The Cultural Mind: Environmental Decision
692 Making and Cultural Modeling Within and Across Populations. *Psychological Review*,
693 *112*, 744-776.

694 Aylet, A., 2010. Participatory Planning, Justice, and Climate Change in Durban, South Africa.
695 *Environmental Planning*, *42*, 99-115.

696 Beach, D., 2002: *Coastal sprawl: the effects of urban design on aquatic ecosystems in the*
697 *United States*. Pew oceans commission,.

698 Bernard, H. R., 2006: *Research methods in anthropology: Qualitative and quantitative*
699 *approaches*. Altamira press.

700 Bromley, D.W. and Paavola, J., 2002. Economics, ethics and environmental policy. In: D.W.
701 Bromley and J. Paavola, eds. *Economics, ethics, and environmental policy: contested*
702 *choices*. Malden, MA: Blackwell, 261–276.

703 Bryant, B. I., and B. Bryant, 1995: *Environmental justice: Issues, policies, and solutions*. Island
704 Press.

705 Bureau of Labor Statistics, 2010: Unemployment by County in Maryland.
706 <http://www.bls.gov/ro3/mdlaus.htm> (Accessed June 26, 2011).

707 Checker, M., 2005: *Polluted promises: environmental racism and the search for justice in a*
708 *southern town*. NYU Press,.

709 Chesapeake Bay Foundation, 2007: *Climate Change and the Chesapeake Bay: Challenges,*
710 *Impacts, and the Multiple Benefits of Agricultural Conservation Work*.
711 <http://www.google.com/url?sa=t&source=web&cd=1&ved=0CBsQFjAA&url=http%3A%2F%2Fwww.cbf.org%2FDocument.Doc%3Fid%3D140&rct=j&q=Climate%20Change%20and%20the%20Chesapeake%20Bay%3A%20Challenges%2C%20Impacts%2C%20and%20t>

714 he%20Multiple%20%20%20%20Benefits%20of%20Agricultural%20Conservation%2
715 0Wor&ei=EnAHToPIE4H10gHf9tnZCw&usg=AFQjCNEDIFtBQTyoW27vxxI8EYEo58p
716 AwA&cad=rja (Accessed June 26, 2011).

717 Cole, W. D., M. D. of N. Resources, M. C. Z. M. Division, C. Z. M. P. (Md.), M. E. S. R.
718 Conservation, U. S. O. of Ocean, and C. R. Management, 2008: *Sea Level Rise: Technical*
719 *Guidance for Dorchester County*. Maryland Eastern Shore Resource Conservation &
720 Development Council,.

721 Congressional Black Caucus Foundation, Inc., and (CBCF 2004), 2004: *African Americans*
722 *and Climate Change: An Unequal Burden*. Redefining Progress and Congressional Black
723 Caucus Foundation, Oakland, Calif,.

724 Douglas, E. P. Kirshen, M. Paolisso, C. Watson, J. Wiggin, A. Enrici and M. Ruth, 2011:
725 Coastal Flooding and Environmental Justice: Identifying Potential Strategies for Adapting
726 to Climate Change in Two Urban Communities in the Boston Metropolitan Area,
727 Massachusetts. *Mitigation and Adaptation Strategies for Global Change*. Forthcoming.

728 Elliott, J. R., and J. Pais, 2006: Race, class, and Hurricane Katrina: Social differences in human
729 responses to disaster. *Social Science Research*, **35**, 295–321.

730 (ESLC) Eastern Shore Land Conservancy, and J. Hicks, 2002: *Eastern Shore 2010: A Regional*
731 *Vision*.

732 IPCC 2007, L. Bernstein, O. Canziani, Z. Chen, R. Christ, O. Davidson, W. Hare, S. Huq, D.
733 Karoly, V. Kattsov, Z. Kundzewicz, J. Liu, U. Lohmann, M. Manning, T. Matsuno, B.
734 Menne, B. Metz, M. Mirza, N. Nicholls, L. Nurse, R. Pachauri, J. Palutikof, M. Parry, D.
735 Qin, N. Ravindranath, A. Reisinger, J. Ren, K. Riahi, C. Rosenzweig, M. Rusticucci, S.
736 Schneider, Y. Sokona, S. Solomon, P. Stott, R. Stouffer, T. Sugiyama, P. Bosch, R. Swart,

737 D. Tirpak, C. Vogel, G. Yohe, and T. Barker, *Climate Change 2007: Synthesis Report*.
738 http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf (Accessed June 19, 2009).

739 Kempton, W., J.S. Boster, and J. A. Hartley, 1995. *Environmental Values in American*
740 *Culture*. The MIT Press.

741 Johnson, Z. P., 2000: *A sea level rise response strategy for the state of Maryland*. Maryland
742 Dept. of Natural Resources, Coastal Zone Management Division.

743 Johnston, B. R., ed., 2011: *Life and death matters: human rights and the environment at the*
744 *end of the millennium*. 10th ed. AltaMira Press,.

745 Katsman, C. A., W. Hazeleger, S. S. Drijfhout, G. J. van Oldenborgh, and G. Burgers, 2008:
746 Climate scenarios of sea level rise for the northeast Atlantic Ocean: a study including the
747 effects of ocean dynamics and gravity changes induced by ice melt. *Climatic change*, **91**,
748 351–374.

749 Kirshen, P., C. Watson, E. Douglas, A. Gontz, J. Lee, and Y. Tian, 2008: Coastal Flooding in
750 the Northeastern USA under High and Low GHG Emission Scenarios, Mitigation and
751 Adaptation Strategies for Global Change, *Mitigation and Adaptation Strategies for Global*
752 *Change* **13**:437–451.

753 Kolm, S.C., 1996. *Modern Theories of Justice*. The MIT Press.

754 Kruskal, J. B., and M. Wish, 1978: *Multidimensional Scaling. Number 07–011 in Sage*
755 *University Paper Series on Quantitative Applications in the Social Sciences*. Sage
756 Publications, Beverly Hills,.

757 MCCC (Maryland Commission on Climate change Adaptation and Response Working Group)
758 2008: *Comprehensive Strategy for Reducing Maryland’s Vulnerability to Climate Change*.
759 Maryland Department of Planning & Maryland Department of Natural Resources &

760 Maryland Department of the Environment,
761 [http://www.google.com/search?q=maryland+comprehensive+sea+level+rise&ie=utf-](http://www.google.com/search?q=maryland+comprehensive+sea+level+rise&ie=utf-8&oe=utf-8&aq=t&rls=org.mozilla:en-US:official&client=firefox-a)
762 [8&oe=utf-8&aq=t&rls=org.mozilla:en-US:official&client=firefox-a](http://www.google.com/search?q=maryland+comprehensive+sea+level+rise&ie=utf-8&oe=utf-8&aq=t&rls=org.mozilla:en-US:official&client=firefox-a) (Accessed June 27,
763 2011).

764 Maryland Department of Planning and Planning Services, 2007: Historical and Projected Per
765 Capita Personal Income for Maryland's Jurisdictions.

766 Najjar, R. G., C. R. Pyke, M. B. Adams, D. Breitburg, C. Hershner, M. Kemp, R. Howarth, M.
767 R. Mulholland, M. Paolisso, and D. Secor, 2010: Potential climate-change impacts on the
768 Chesapeake Bay. *Estuarine, Coastal and Shelf Science*, **86**, 1–20.

769 NWF (National Wildlife Federation 2008), P. Glick, A. Staudt, and B. Nunley, 2008: *Sea Level*
770 *Rise and Coastal Habitats of The Chesapeake Bay: A Summary*. National Wildlife
771 Federation,.

772 Norgaard, K. M., 2006: We Don't Really Want to Know. *Organization & environment*, **19**,
773 347.

774 Nuckols, W. H., P. Johnston, D. Hudgens, and J. G. Titus, "Maryland" *The Likelihood of*
775 *Shore Protection along the Atlantic Coast of the United States. Volume 1: Mid-Atlantic*.
776 U.S. Environmental Protection Agency, Washintgon, D.C.,.

777 Obama, B., 2009: Executive Order 13508-Chesapeake Bay Protection and Restoration.
778 [http://www.google.com/search?q=May+2009+Executive+Order+13508&ie=utf-8&oe=utf-](http://www.google.com/search?q=May+2009+Executive+Order+13508&ie=utf-8&oe=utf-8&aq=t&rls=org.mozilla:en-US:official&client=firefox-a)
779 [8&aq=t&rls=org.mozilla:en-US:official&client=firefox-a](http://www.google.com/search?q=May+2009+Executive+Order+13508&ie=utf-8&oe=utf-8&aq=t&rls=org.mozilla:en-US:official&client=firefox-a) (Accessed June 26, 2011).

780 O'Brien, K., Leichenko, R., Kelkar, U., Venema, H., Aandahl, G., Tompkins, H., Javed, A.,
781 Bhadwal, S., Barg, A., Nygaard, L.P., West, J., 2004. Mapping vulnerability to multiple

782 stressors: climate change and globalization in India. *Global Environmental Change* **14**, 303–
783 313.

784 Oliver-Smith, A., 2009: Climate Change and Populations Displacement: Disasters and
785 Diasporas in the Twenty-First Century. *Anthropology and Climate Change. From*
786 *Encounters to Actions*, pp. 116–136.

787 Paavola, J., 2005. Interdependence, pluralism and globalisation: implications for environmental
788 governance. In: Paavola, J., Lowe, I. (Eds.), *Environmental Values in a Globalising World:*
789 *Nature, Justice and Governance*. Routledge, London, pp. 143– 158.

790 Paavola, J. and W. N. Adger, 2006. Fair Adaptation to Climate Change. *Ecological*
791 *Economics*, **56** 594– 609

792 Paolisso, M., 2002: Blue Crabs and Controversy on the Chesapeake Bay: A Cultural Model for
793 Understanding Watermen’s Reasoning about Blue Crab Management. *Human*
794 *Organization*, **61**.

795 [http://sfaa.metapress.com/media/804t6y88tk1qyvfdjmfk/contributions/2/d/c/5/2dc5c4gxap2f](http://sfaa.metapress.com/media/804t6y88tk1qyvfdjmfk/contributions/2/d/c/5/2dc5c4gxap2f6nwv.pdf)
796 [6nwv.pdf](http://sfaa.metapress.com/media/804t6y88tk1qyvfdjmfk/contributions/2/d/c/5/2dc5c4gxap2f6nwv.pdf) (Accessed June 19, 2009).

797 Paolisso, M., 2007: Taste the Traditions: Crabs, Crab Cakes, and the Chesapeake Bay Blue
798 Crab Fishery. *American Anthropologist*, **109**, 654-665.

799 Pezzoli, K., R. Tukey, H. Sarabia, I. Zaslavsky, M. L. Miranda, W. A. Suk, A. Lin, and M.
800 Ellisman, 2007: The NIEHS Environmental Health Sciences Data Resource Portal: Placing
801 Advanced Technologies in Service to Vulnerable Communities. *Environmental health*
802 *perspectives*, **115**, 564.

803 Pfeffer, W. T., J. T. Harper, and S. O’neel, 2008: Kinematic constraints on glacier contributions
804 to 21st-century sea-level rise. *Science*, **321**, 1340.

805 Posner, E. A., and D. Weisbach, 2010.

806 Posner, E. A., and D. Weisbach, 2010. *Climate Change Justice*. Princeton University Press.

807 Pyke, C., R. Najjar, M. B. Adams, D. Breitburg, M. Kemp, C. Heshner, R. Howarth, M.

808 Mullholland, M. Paolisso, D. Secor, K. Sellner, D. Wardrop, and R. Wood, 2008: Climate

809 change and the Chesapeake Bay: State-of-the-science review and recommendations. A

810 *Report from the Chesapeake Bay Program Science and Technical Advisory Committee*, **301**,

811 802–9832.

812 Rawls, John. 1971. *Theory of Justice*. Harvard University Press.

813 Resnik, D. B., and G. Roman, 2007: Health, justice, and the environment. *Bioethics*, **21**, 230–

814 241.

815 Schaffer, L.J. and L. Naiene, 2011. Why Analyze Mental Models of Local Climate Change?

816 A Case from Southern Mozambique. *Weather, Climate and Society*, **3**, 223-237.

817 Schlosberg, D., 1999. *Environmental Justice and the New Pluralism: the Challenge of*

818 *Difference for Environmentalism*. Oxford University Press.

819 Thomas, R. K, J.M. Melillo and T.C. Peterson, eds., 2009. *Global Climate Change Impacts in*

820 *the United States*. Cambridge University Press.

821 Tyler, T.R, Boeckmann, R.J., Smith, H.J., Huo, Y.J., 1997. *Social Justice in a Diverse Society*.

822 Westview Press.

823 U.S. Census Bureau, 2001, State and County QuickFacts. *U.S. Census Bureau State & County*

824 *QuickFacts*,. <http://quickfacts.census.gov/qfd/index.html> (Accessed June 26, 2011).

825 U.S. Climate Change Science Program (USCCSP), 2008. Weather and Climate Extremes in a

826 Changing Climate, Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific

827 Islands, T. R. Karl, G. A. Meehl, C. D. Miller, S. J. Hassol, A. M. Waple, and W. L.

828 Murray, eds., Report by the U.S. Climate Change Science Program and the Subcommittee
829 on Global Change Research, Washington, DC.

830 U.S. EPA, 1998: *Guidance for Incorporating Environmental Justice in EPA's NEPA*
831 *Compliance Analysis*. United States Environmental Protection Agency, Washington, D.C.,.

832 Vermeer, M., and S. Rahmstorf, 2009: Global sea level linked to global temperature.
833 *Proceedings of the National Academy of Sciences*, **106**, 21527.

834 Weller, S. C., and A. K. Romney, 1988: *Systematic data collection*. Sage Publications, Inc.,

835 Wennersten, J. R., 1992: *Maryland's Eastern Shore: a journey in time and place*. Tidewater
836 Pub.,.

837 Wilbanks, T. J., P. Kirshen, D. Quattrochi, P. Romero-Lankao, C. Rosenzweig, M. Ruth, W. D.
838 Solecki, J. Tarr, P. Larsen, and B. Stone, 2008: Chapter 3: Effects of global change on
839 human settlements. *Analyses of the Effects of Global Change on Human Health and Welfare*
840 *and Human Settlements*.

841 Wilson, S. M., R. Richard, L. Joseph and E. Williams, 2010. Climate Change, Environmental
842 Justice. *Environmental Justice*, **3**,12-19.

843 and Vulnerability: An Exploratory Spatial Analysis

844 Young, H.P., 1994. *Equity: In Theory and Practice*. Princeton University Press, Princeton.

845 Young, I.M., 2000. *Inclusion and Democracy*. Oxford University Press, Oxford.

846

847

848

849

850 Figures

851 Figure 1: Location of Smithville and Bellevue

852 Figure 2: Smithville: 10 Year Flood at Mid Century Under Different Sea Level Rise

853 Scenarios

854 Figure 3: Bellevue: 10 Year Flood at Mid Century Under Different Sea Level Rise

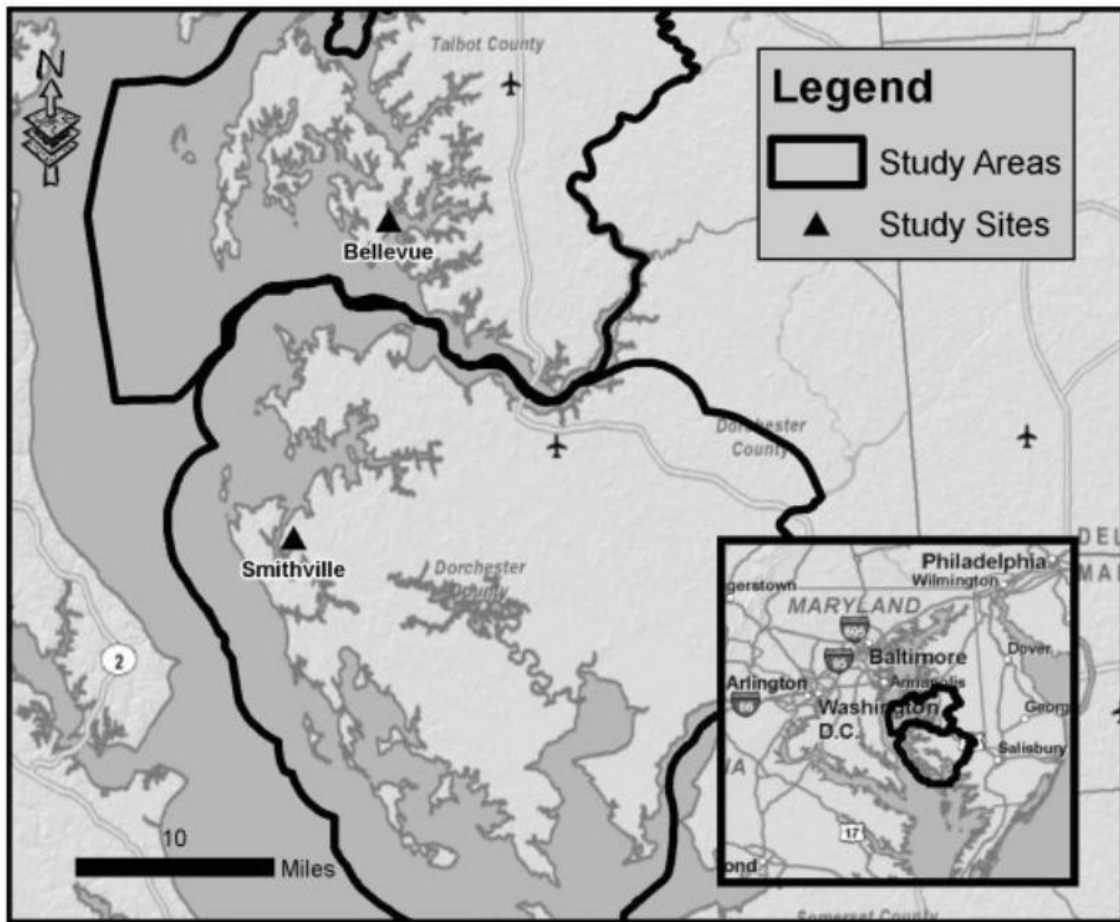
855 Scenarios

856 Figure 4: Smithville MDS Plot of 56 Terms for Climate Change (plot stress 0.18)

857 Figure 5: Bellevue MDS Plot of 35 Terms for Climate Change (plot stress 0.11)

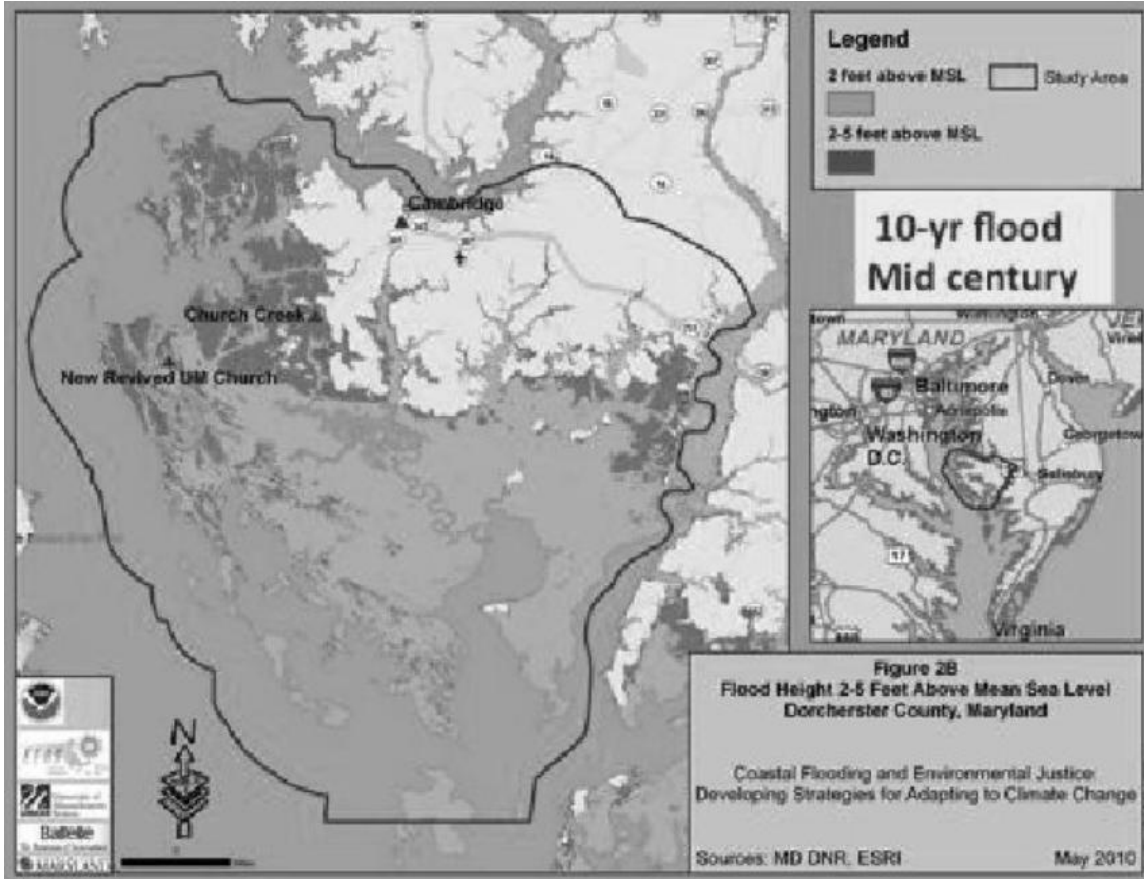
858

859 Figure 1: Location of Smithville and Bellevue



860

861 Figure 2: Smithville: 10 Year Flood at Mid Century Under Different Sea Level Rise
862 Scenarios



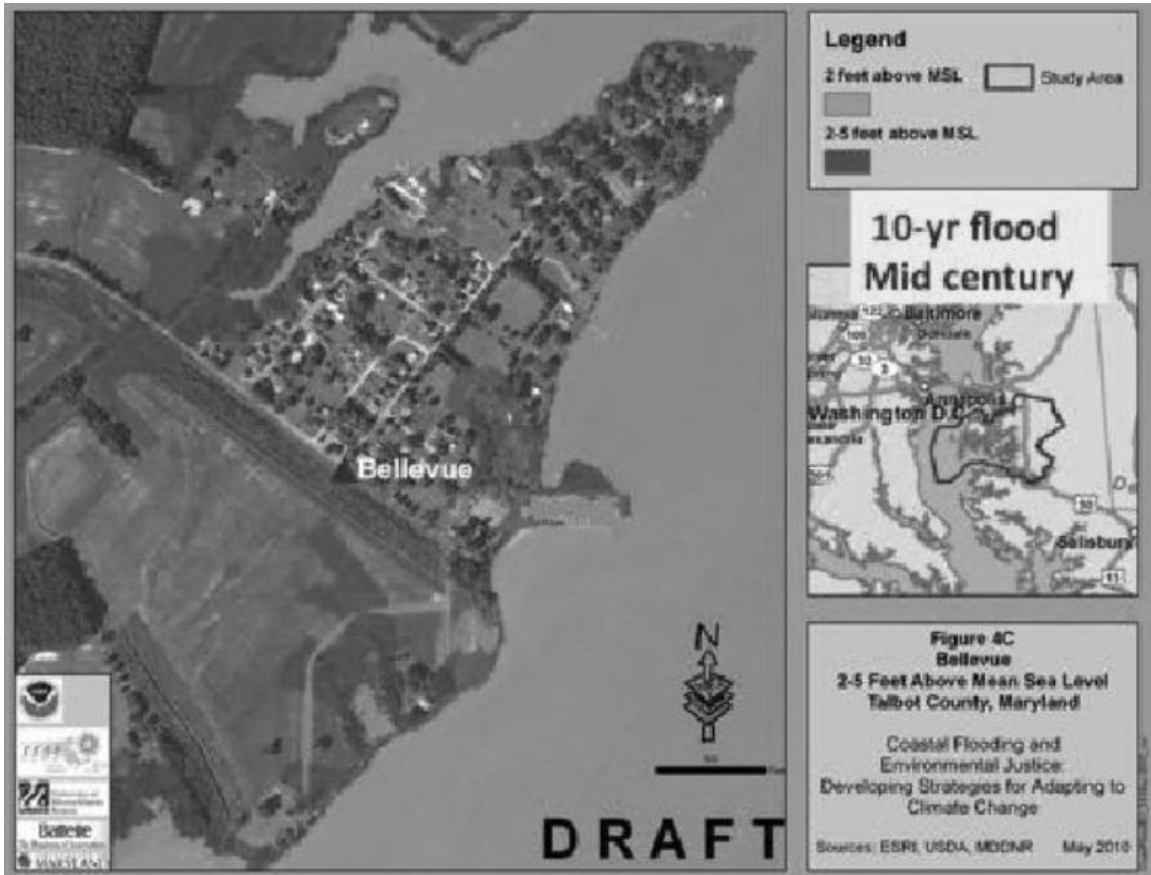
863

864 Figure 3: Bellevue: 10 Year Flood at Mid Century Under Different Sea Level Rise

865 Scenarios

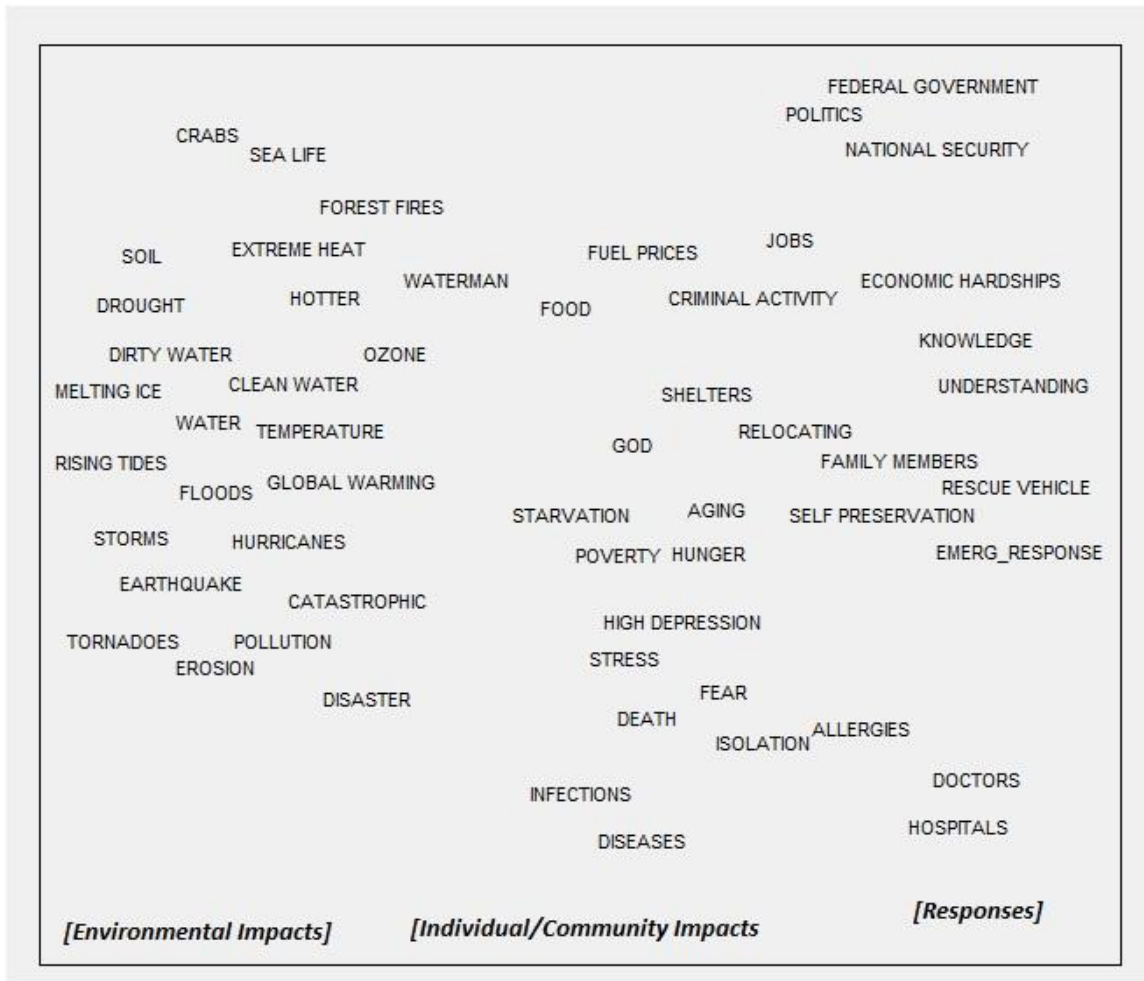
866

867



868

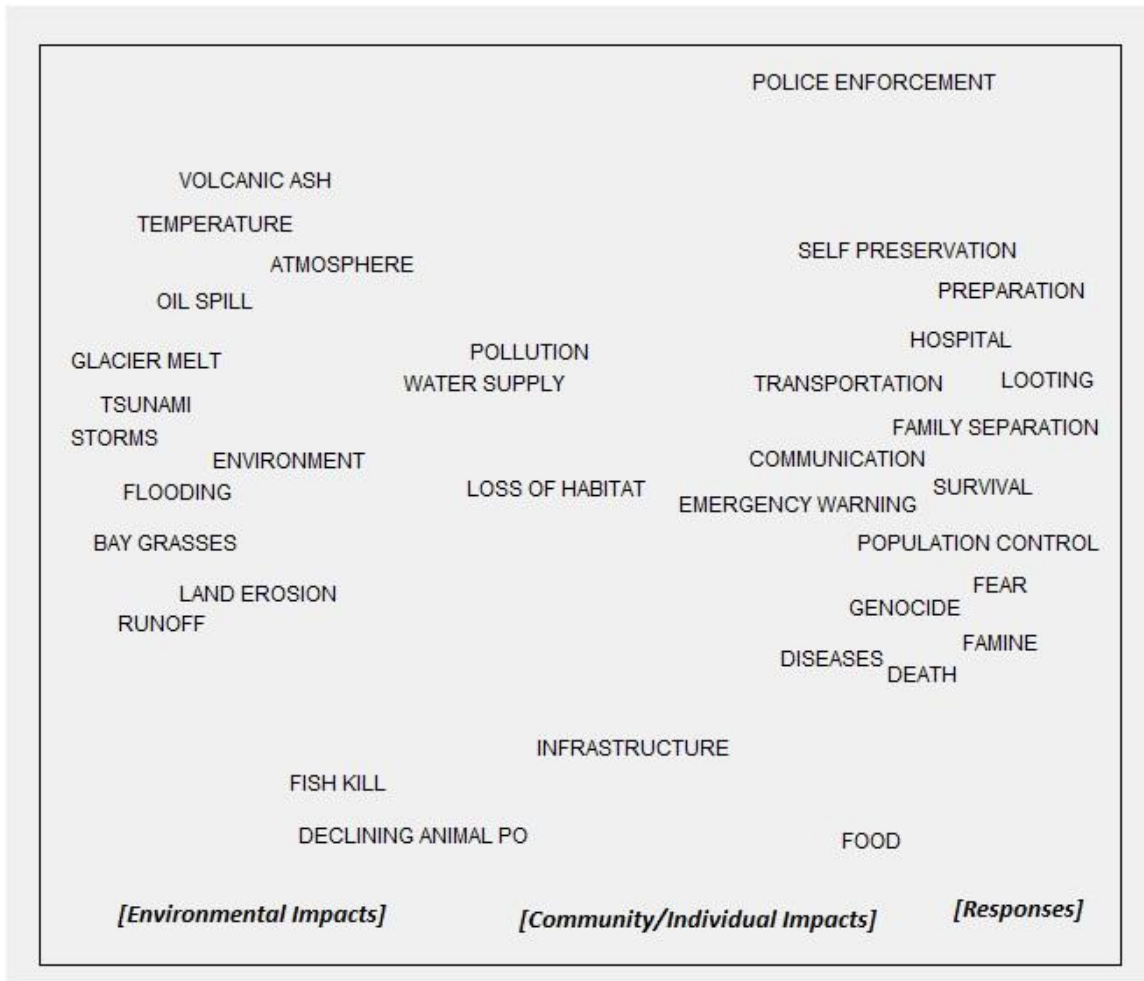
869 Figure 4: Smithville MDS Plot of 56 Terms for Climate Change (plot stress: 0.18)



870

871

872 Figure 5: Bellevue MDS Plot of 35 Terms for Climate Change (plot stress 0.11)



873

874

875

876

877

878

879

880