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ANALYSIS OF THE BRAZILIAN COAST VULNERABILITY: AN INTEGRATED METHODOLOGY PROPOSED

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This study is a contribution to this knowledge, as it defines the vulnerability level of the Brazilian coastal zone based on a combination of environmental, social, and technological standards set forth in Macrodiagnóstico da Zona Costeira e Marinha (MDZCM) by the Ministry of the Environment in 2008. Low-lying, densely populated, socially underprivileged regions with intricate technological networks are the most vulnerable and require a prioritized integrated action from policymakers. Throughout the entire country, several areas were rated as vulnerable or highly vulnerable, particularly the metropolitan regions of Belém, capitals of the Northeast, Rio de Janeiro, and Santos. Its potential to cause economic and social impacts is considerable, as it directly affects standards of living of coastal populations. This challenge can only be overcome through integrated actions taken by various sectors of society and supported by a deep knowledge of current and expected scenarios. The MDZCM diagnosed the main aspects on the Coastal and Marine Zone, mostly the changes in the energy policy, which led to a considerable increase in oil drilling, development, and extraction in this part of the territory, particularly after the state monopoly was broken up. The current and potential dimensions of the urban-manufacturing facilities and their interaction with other activities also went into this diagnosis, which included information on infrastructure, household and industrial wastewater, and toxic elements present in coastal municipalities, among others. The sources are identified by geographic type of receiving bodies (estuaries, bays, beaches, etc.). By combining a broad array of information, environmental hazard figures were generated which, in turn, measure threats to the living standards of Coastal and Marine Zone populations. Locations with a flooding potential, social risk potential, and technological risk potential could thus be identified (Nicolodi & Zamboni, 2008.)

This paper attempts to identify, based on data generated by MDZCM, the regions in the Brazilian coastal zone most vulnerable to the effects of climate change and thereby provide support for a thorough assessment of the country's vulnerability. According to IOC (2009) proposed methodology, five stages are necessary to make national and regional climate change adaptation plans: 1) Identifying and quantifying the hazards; 2) Measuring vulnerability; 3) Assessing the risk; 4) Enhancing awareness and preparedness; 5) Mitigating the risk. This study addresses stages 1 and 2, which are the basis of the necessary knowledge to define the other stages. Information generated by MDZCM was used to prepare the overview map on the vulnerability of the Brazilian coastal zone with relation to natural risk, social risk, and technological risk. To the crossing of such results were added spatial information on population dynamics, geomorphology, use and occupation of the Exclusive Economic Zone (EEZ) and biodiversity. In all cases, specific geoprocessing routines were resorted to, along with IDRISI and ARCGIS 9 software. The analysis scale of the issues addressed in MDZCM and the vulnerability analyses of the coastal zone proposed by this paper is 1:1,000,000. This scale corresponds to the scope of the area of study and enables practically all existing map bases to be included in the analysis context. Figure 1 illustrates the method used and shows the vulnerability map of Salvador, Bahia region. The Coastal Zone is the most dynamic geographical area in the country, since the time when the country was a colony of Portugal, and connections from structural centers directed internal flows directly to seaports, next to which the first urban centers were established (Moraes, 1999.) The analysis of the combination between a likely unchanging tendency of this scenario in the near future and the context of global climate changes, points inevitably to the importance of undertaking a realistic coastal management, with priority actions, and human and financial resources. Knowing about the mesoregions more or less vulnerable to the impacts of the direct effects of climate change is essential for the public authorities to make their decisions. These effects are directly linked to three major types of causes, defined in this paper as natural risk, social risk, and technological risk. The combination of these concepts, when applied to the national

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territory have enabled the definition of the five levels of vulnerability used, illustrating the scene presented as a challenge to be faced by integrated coastal management in Brazil, especially in the current context of climate change.
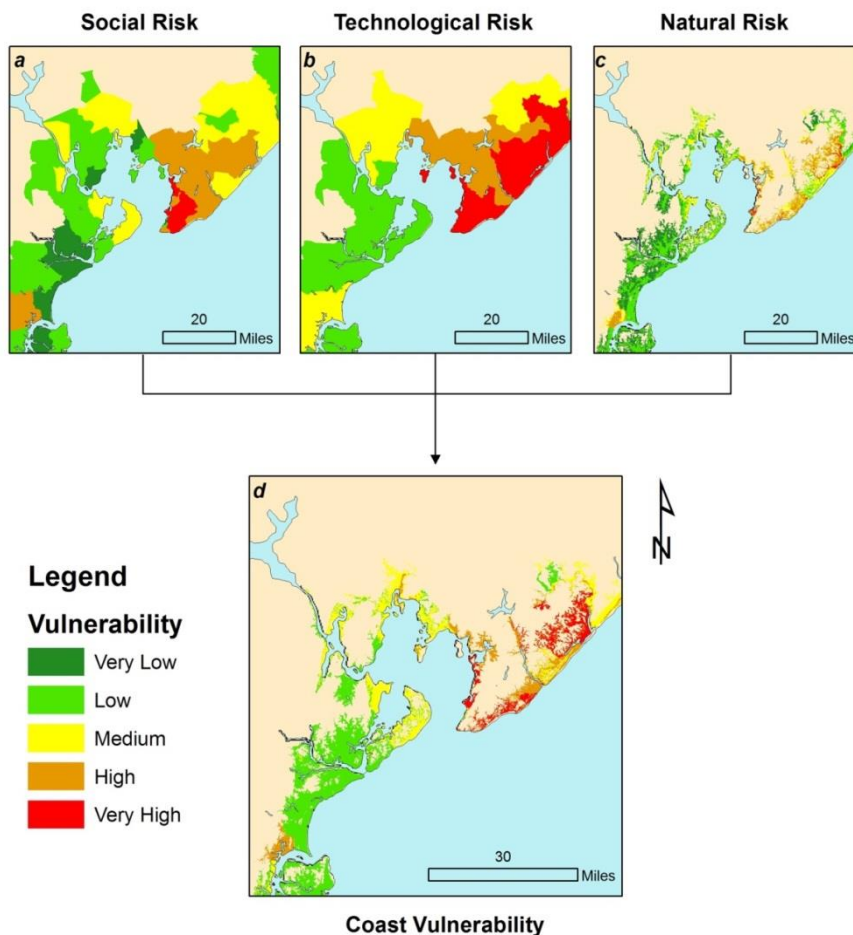

Figure 1. The spatial crossing made between the three risk types: (a) Natural Risk; (b) Social Risk; and (c) Technological Risk. The result is shown by (d) Coast vulnerability, obtained by simple average.

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