ARTICLE IN PRESS

Coastal Engineering xxx (2017) 1–9

Contents lists available at ScienceDirect

Coastal Engineering

journal homepage: www.elsevier.com/locate/coastaleng

Testing RISC-KIT's integrated approach for assessing Disaster Risk Reduction measures on the coast of Kristianstad, Sweden

Karina Barquet[a,*], Sarah K. Dickin[b], Jan Jaap Meijer[b], Ali Dastgheib[c]

[a] Stockholm Environment Institute, Linnégatan 87D, 115 23, Stockholm, Sweden
[b] Stockholm Environment Institute, Sweden
[c] IHE Delft, The Netherlands

ARTICLE INFO

Keywords:
Disaster Risk Reduction
Integrated approaches
Vulnerability assessment
Coastal Risk Assessment Framework
Multi-Criteria Assessment
Sweden

ABSTRACT

This article reflects upon the experiences of testing the Resilience-Increasing Strategies for Coasts – toolKIT (RISC-KIT), an integrated approach composed of five different methodologies, in the municipality of Kristianstad, Sweden. The aim of this article is to highlight both the importance and complexities of integrated approaches in coastal management. The experiences documented through the case of Kristianstad highlight the benefits of combining hazard estimations and participatory approaches to understand risk, impacts of coastal hazards, and potential solutions; and the challenges of mainstreaming risk assessment approaches across contexts. We argue that integrated approaches can be effective for triggering local dialogue, disseminating information, and achieve greater ownership and local acceptance of Disaster Risk Reduction measures, but that involvement of local actors requires careful design and planning. The experiences documented when pilot-testing RISC-KITs integrated approach argue for increased co-production of knowledge in coastal management projects.

1. Introduction

With a move away from security-based and structural approaches to flood protection within Europe towards more integrated, risk-based approaches (Löschner et al., 2016), there is a need for science-based strategies for prevention and mitigation, preparation, response and recovery within this risk-based paradigm. This paper reflects on the implementation of the Resilience-Increasing Strategies for Coasts – toolkit (RISC-KIT), an interdisciplinary project combining engineering approaches with participatory methodologies that seeks to integrate the technical and social approaches in Disaster Risk Reduction (DRR). We discuss the implementation of the project's toolkit at the coast of Kristianstad in Sweden, one of the ten European case-studies in RISC-KIT. The municipality of Kristianstad is located in the northeastern part of Sweden's southernmost region Skåne (Scania). The case study focuses on the coastal area of Kristianstad, which covers about 40 km of coastline. Drawing on this case study, we present learning experiences that highlight the advantages and constraints of this integrated approach in the context of floods. We conclude with recommendations for future applications of integrated approaches that bring together technical and social considerations in DRR.

1.1. Integrated approaches to Disaster Risk Reduction

Historically, research into environmental hazards was primarily undertaken by those in physical science and engineering disciplines, e.g. geomorphology and hydrology (Gaillard et al., 2007; Mercer et al., 2007), with much emphasis placed on the “understanding, development, and application of engineering solutions” (Tansel, 2005, p. 95). In the case of flood management, this centered on controlling flood waters through the use of technical solutions. But for the past 50 years, research in Disaster Risk Reduction (DRR) has increasingly highlighted the need to take social, economic, and political dimensions into account. White, 1945 work on how people perceive and respond to hazards provided the basis for the development of the “hazard paradigm”. According to this paradigm, societies with low risk perception were assumed to adjust poorly to hazards, whilst those with higher risk perception were assumed to adapt better and behave in an anticipatory way (Burton et al., 1993). The consequence of this paradigm was an emphasis on technical and structural solutions to deal with disasters that continued to be seen as the results of ‘natural’ processes. This ultimately ignored how responses might be constrained by the wider historical and social dimensions of a hazard that individuals are often not able to control.

* Corresponding author.
E-mail address: karina.barquet@sei-international.org (K. Barquet).

http://dx.doi.org/10.1016/j.coastaleng.2017.08.007
Received 6 February 2017; Received in revised form 29 May 2017; Accepted 7 August 2017
Available online xxxx
0378-3839/

Please cite this article in press as: Barquet, K., et al., Testing RISC-KIT's integrated approach for assessing Disaster Risk Reduction measures on the coast of Kristianstad, Sweden, Coastal Engineering (2017), http://dx.doi.org/10.1016/j.coastaleng.2017.08.007

More recently, other researchers have emphasized the need to broaden the hazard-focused approach to include analysis of other characteristics like economic and political forces that shape how exposed populations may be negatively affected by a particular hazard (Blaikie et al., 1994; K, 1983; Wisner, et al., 2004). For instance, O'Keefe et al. (1976) argued that disasters are largely due to socioeconomic vulnerability rather than inevitable ‘natural’ factors, with disproportionate impacts on certain populations who have limited access to resources to mitigate or respond to hazards. An example of this is the case of Hurricane Katrina, where certain groups such as the poor, African American, elderly, or residents without their own means of transport were trapped in New Orleans during the flooding (Cutter and Emrich, 2006).

There is now wider acknowledgement that those most affected or vulnerable to the impacts of an environmental hazard tend to be people who are geographically, socially, or politically marginalized (Gaillard et al., 2007). Despite such recognition, there is still a tendency to focus either on the technical aspects of natural hazards, or on social aspects, such as examining unequitable access to resources within society, with little integration between these two approaches. The risk of not addressing this complexity within DRR has the potential to increase impacts and perpetuate poor disaster management (Culwick and Patel, 2016). Despite this, implementation of DRR strategies that include hazard assessments, socio-economic factors and decision-making processes into an integrated framework are rare (Mercer et al., 2008). This is also reflected in scientific research where interdisciplinary and integrated frameworks that incorporate ‘scientific’ knowledge as well as local and indigenous knowledge in the assessment of hazards, their impacts, and possible solutions are only starting to emerge.

2. Description of the case study

With an area of 1346 km^2, Kristianstad is the biggest municipality in Skåne. In 2016, there were 83 191 inhabitants, with a majority of these (over 37 000) concentrated in the main city also called Kristianstad and 9,722 in Åhus (Kristianstads Kommun, 2015).[1] The municipality is a former sea bay at the lower end of the Helge River. In fact, Sweden's lowest point is just outside the city of Kristianstad at 2.41 m below sea level (SMHI, 2014a). The municipality is a focal point for food-and beverage production, with over 1 600 such companies and hundreds of other companies providing supporting services. There are also several sites of regional importance, including the harbor area of Åhus which consists of the port facility and important industries; Ramsar sites with wetland areas of international value and UNESCO-recognized biosphere reserves; and areas important for tourism and recreation like Östra Sand/Täppet and Äspet (Fig. 1).

The landscape south of the Helge river mouth at Åhus is uniform, relatively flat, and dominated by a dune landscape creating the longest continuous sandy beach in Skåne. The size and height of the dunes varies; in some areas dunes can be between 2 and 3 m high with low-lying areas behind the dunes, whilst occasionally the dunes can reach heights up to 15–20 m (Rydell, 2008). Many of the dunes in the Northern parts of the coast are largely covered by pine forests planted to prevent sand drift, which was a significant problem during the 1700s. The pine forest extends almost all the way along the coast. Parts of the agricultural land along the coast are low-lying areas which are embanked and often drained with pumps. For instance, the sandy beach and dune landscape are particularly valuable for their flora and fauna. The inner dune area is dominated by heath vegetation and large portions of land with lichen. Closer to the sea, some sand dunes are protected by marram grass and lyme grass (Stadsbyggnadskontoret, 2009).

Äspet is located between the southern part of Åhus and the river mouth of Helge. Here, there are 35 ha of beach, with shallow lagoons and sandbanks off the pine planted dunes. The area is an important resting place for many bird species and in recent years has become an important site for species' breeding. The dune landscape is enclosed by Kristianstad's large-scale agricultural landscape, which is also flat and sandy (Stadsbyggnadskontoret, 2009). Along the coast, rooted eel-fishing is practiced, visible due to eel-huts, labelled as cultural heritage features, and located closest to the beach shore. Also in this area, there was extensive establishment of holiday homes during the 1960s and 1970s throughout the coast, south of Åhus. Many of these holiday homes gradually became permanent accommodation, which in turn, increased the rate of urban development and decreased some of the protective vegetation along the dunes. Today, both the eel huts and holiday houses are highly exposed to coastal processes of erosion and floods (Stadsbyggnadskontoret and C4 Teknik, 2007).

Generally, coastal erosion is divided into two types: structural erosion and dune erosion. Along the coastline of Kristianstad both types are active. Structural erosion transports sediment northward due to gradients in alongshore sediment transport and acts over longer time scales. In Kristianstad, conditions for erosion exist along the entire coast from Östra Sand towards the south of the municipality (and also in parts of the coast to the north), but over time erosion has been minor. In contrast, during the winter-spring season in 2007, extensive erosion occurred on the beaches and dunes at Östra Sand and Southern Äspet. Both occasions were linked to high waves and high water levels (Stadsbyggnadskontoret and C4 Teknik, 2007).

Dune erosion caused by a combination of high water levels and high waves (generally during the winter) has a much shorter timescale (e.g. storm duration) and a more cross-shore character, where sand from the dunes is taken and deposited in the surf zone. At calmer times (e.g. during the summer) waves transport sediment back towards the shore which help the dunes recover. Erosion increases the risk that seawaters reach inland and flood the low-lying areas behind the dunes. According to Rydell (2008), erosion in current climate conditions could gradually reduce the width of the beach along large parts of the coastline of Kristianstad. During high water level and/or high wave storms, dunes may erode in areas with a typical dune landscape.

Flooding generally occurs during storm surges in combination with high waves. During storms wind pushes water (storm surges) in the direction of the wind. Most frequently storms come from the West - South West (W-SW), and as highlighted by Hanson and Larson (2008), this leads to water being pushed northward due to the geometry of the Baltic Sea. On Sweden's south coast this leads to favorable conditions with low water levels during extreme wave events. However, the coastline of Kristianstad is not south-facing but rather located towards the East – South East, which is where the second largest storms originate. These storms do not occur as frequently as the ones from the W-SW, but are similar in strength. Storms from the East can lead to joint occurrence of high water levels and high waves. Water level variations in the Baltic Sea are a combination of wind-set up and to a lesser extent barometric variations (Larson and Hanson, 1992). The astronomical tidal range is only a few centimeters.

3. The RISC-KIT toolkit

RISC-KIT is composed of a set of five open-source and open-access tools demonstrated in ten case study sites along European coasts with diverse geomorphic settings, land use, hazard types and socio-economic, cultural and environmental characteristics (Van Dongeren et al., 2014). The first tool is a Storm Impact Database that traces the impacts of previous events in a particular location; second is the Coastal Risk Assessment Framework (CRAF) that identifies hotspots, which are areas particularly at risk of coastal hazards, for example erosion or inundation; third, is the Web-based Management Guide that presents a comprehensive compilation of cases, examples and solutions to coastal hazards

[1] The city of Kristianstad has the greatest flood risk in Sweden, in terms of the number of persons potentially at risk within the area of a worst case scenario (MSB, 2012). In response to this, a 10 km embankment along Lake Helge in the city perimeter was built, representing Sweden's most costly measure in modern history to meet a flood challenge.