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Research article

Cultural dimensions of risk perceptions: A case study on cross-strait driftage pollution in a coastal area of Taiwan

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ABSTRACT

Constant exploitations of the ocean render numerous present challenges as the ocean is linked to human development. The study focused on cross-strait driftage pollution that poses a great threat to coastal environment under climate change. Several hundred packs of herbicides drifting across the Taiwan Strait were discovered along the coastline of Guanyin District of Taiwan. We compared risk perceptions of the local ethnic groups, Hakka and Fulao, residing in a coastal area of Taiwan and exposed to the herbicide coastal incident under climate change. It is of concern that society's response to every dimension of global climate change is mediated by culture. The Driver–Pressure–State–Impact–Response (DPSIR) cause-effect framework was applied in semi-structured interviews to explore coastal sensitivity and human adaptability. As a result, we indicated that despite the presence of two ethnic groups in the same place exposed to the incident they presented very different risk perceptions on both environmental degradation (ED) and adaptive capacity (AC) due to cultural values. We argued that the herbicide coastal incident involved people's risk perceptions and subsequently influenced their opinions and attitudes towards environmental problems. We concluded that the ethnic trait contributed to adaptive behaviors during environmental change. Culturally appropriate adaptations appeared to enhance risk perceptions and adaptation actions, suggesting a need for more rigorous cultural adaptation guidelines towards climate resilience when designing adaptation interventions for different ethnic groups.

1. Introduction

The ocean is inextricably linked to human development (Hudson, 2015). It is a habitat and breeding base for countless organisms and provides humans multifaceted functions. Diverse usage patterns have been developed in coastal areas. However, coastal pollution causes natural and living environments to deteriorate, destroys crucial biological habitats, and leads to a sharp decline in marine organisms. Moreover, climate change may increase the environmental risks in coastal areas, which host close land–ocean interactions. Taiwan is surrounded by an ocean abundant with marine resources. The coastline of Guanyin District of Taiwan holds ecologically rich mangroves and precious millennial algal reefs, which have been threatened by severe industrial pollution. In addition to these internal troubles, these natural assets are also faced with external threats. On March 31, 2012, coast guard patrols discovered approximately 20 bags of pesticides and herbicides on Guanyin Beach, hereinafter referred to as the herbicide incident (Fig. 1). We argue that people need to be aware of and adapt to a changing environment to ensure their quality of life. However, risk perception may be incomplete or ignored so that actions cannot be undertaken. That is, a stimulus is present in the environment, not strong enough so that a person could not perceive it; or the person does not pay attention to the stimulus that affects the person's behavior or thought process (Dewey, 2007).

The focus of this study was put on cultural dimensions of risk perceptions on coastal change induced by cross-strait driftage pollution, and in particular the adaptive capacities that enable people to lead meaningful and dignified lives, which are at risk from climate change (Brooks, 2003; Safi et al., 2012; Adger et al., 2013). Risk perception refers to subjective judgment of people about the characteristics and severity of a risk, that is, in this case, waste threats to coastal environments. We underlined that residents' risk perceptions about the coastal change addresses the social amplification of risk on cognitive transformation through a range of groups interested in the risk (Kasperson et al., 1988;

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Fig. 1. Coast guard patrols discovered approximately 20 bags of pesticides and herbicides on Guanyin Beach.

Mitchell, 2008), and such groups will distort aspects of the risk in support of their beliefs and values (Smallman and Weir, 1999). Perception is shaped by attitudes and values that vary widely from culture to culture (Hope and Jones, 2014), and is a series of perceptual and behavioral cycles generated when people interact with environments. It is of concern that actions are always initiated by risk perceptions (Wachinger et al., 2012; Brown, 2013; Mase et al., 2016), and society's response to every dimension of global climate change is mediated by culture (Adger et al., 2013). We underlined the importance of cultural dimensions in adaptive capacity (adaptability) and noted that it refers to a cultural process to achieve resilience and depends on ecological well-being and the extent of dependency on natural resources (Holling, 1973; Smit and Wandel, 2006; Adger et al., 2007; Henley, 2010; Engle, 2011; Nelson, 2011; Colombi and Smith, 2012; Lockwood et al., 2015).

In Methods section we elucidate the ocean drift and its cross-strait coastal pollution incident that had occurred on the Guanyin coastline where the drifting herbicide packages were found and had been reported by the newspapers. We underscored the social amplification of risk (Kasperson et al., 1988). Driver–Pressure–State–Impact–Response (DPSIR) causal framework (EEA, 2007) was used in semi-structured interviews to explore the risk perceptions of respondents on the coastal change in a changing climate. We examined the risk perceptions of two local ethnic groups, Hakka and Fulao residing in the coastal area of Guanyin District, whether they perceived the change thereof differently, and whether ethnic trait is one of the factors influencing risk perceptions. Chiang et al. (2014) indicated that in comparison with the Fulao people, characterizes Hakka's cultural process to achieve resilience in coping with difficult living conditions and is regarded as one of their ethnic characteristics. This argument provides key insights into the cultural differences with which most people mark the Hakka.

As a result, we indicated that the perceptions of local Fulao residents (F-residents) and Hakka residents (H-residents) on environmental degradation (ED) were identical. The H-residents presented the best human adaptive capacity (AC). None of F-residents presented positive risk perception while H-residents presented positive risk perceptions. Ethnicity was found as key in guiding perceptions of the respondents in terms of cultural perception. In Discussions section, it is noted that the environmental impact of the herbicide incident refers to people's awareness and perceptions of environmental change, and the adjustments they make, that is their adaptive capacities to maintain and ensure a satisfactory environmental quality. Conclusions section summarizes the insights of this paper, concludes with a perspective on the risk perceptions among local population, and proposes recommendations for ameliorating cross-strait coastal pollution. It is argued that human risk perceptions and behaviors are inseparable portions of the coupled human–environment system.

2. Methods

2.1. Cross-strait driftage

The aforementioned herbicide incident was traced back to the event that a ship ran aground and sank off the coast of Fuzhou on March 15, 2012, when 61 containers containing highly toxic and hazardous caustic soda and herbicides dropped into the ocean. A computer-simulated experiment indicates the incident is referred to the cross flows in the Taiwan Strait and the strengths and variation of northeast monsoons affect the directions of the cross-strait flows (Oey et al., 2014) and may refer to climate change. That is, the herbicide incident occurred during the season of northeast monsoon in the coastal areas of Taoyuan County and climatic factors may increase the variability of similar cross-strait pollution incidents. An annual investigation conducted by the Taiwan Environmental Information Center (2013) on 338 coastal points in Taiwan indicated that the coastline conditions of Taiwan obtained the poorest ratings in industrial effluent and marine debris items. This result revealed the severe impact of marine debris on coastal environments, which was the focus of this study.

Based on the point of origin of the herbicide packages and scientific simulation results regarding ocean drift, cross-strait ocean drift from China may have occurred in the coastal area, under climatic influences, where the herbicides were found, exposing the coastal area of Guanyin District in Taiwan to risks of cross-strait pollution. The perceptions and behaviors of local residents toward climatic change are worth investigating. In particular, Guanyin District is characterized by both Hakka and Fulao culture. We underlined that culture is often closely tied to places that are given meaning by people (Adger et al., 2013). Culture may also be a generator of useful coping strategies in the context of environmental change (Heyd and Brooks, 2009) and can help communities mitigate drivers and pressures in a timely and dynamic manner (Chiang et al., 2014). As climate may influence the coast and the community, we scope the study site, which covered the coastal area (Fig. 2), and provided place suitable for conducting ethnic comparisons on risk perceptions and adaptive capacities of the local residents in a changing climate.

2.2. DPSIR framework

The herbicide incident addressed human–climate interplay that takes place in coastal area and forms risky environment. Analysis applying a causal framework facilitates determining problems in each segment and provides a reference for suitable recommendations and policies for local sustainable development. The Driver–Pressure–State–Impact–Response (DPSIR) causal framework was adopted in the study to explore human-environment interactions focusing on both environmental degradation and human adaptive capacity (Fig. 3; Fig. 4). The DPSIR framework emphasizes that when environmental conditions change, the society must respond to the resulting impacts exerted on the people and ecologies; finally, humans adapt behaviors to environmental change because of their risk perceptions, thereby mitigating impacts, effectively inducing positive human–environment interactions towards resilience. Positive outcome after experiencing such a risk may be viewed as evidence for resilience (Seery, 2011). The DPSIR