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Slow Onset Climate Change Impacts in Maldives and Population Movement from Islanders' Perspective Brain

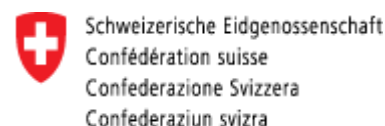
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Slow-Onset Climate Change Impacts in Maldives and Population Movement from Islanders' Perspective *

Robert Stojanov, Barbora Duží, Daniel Němec, David Procházka†

Abstract

This study covers outcomes from field research in Maldives, completed in 2013. The research focus is on two main questions. The first deals with islanders' perceptions of the impacts of climatic variability within the past few years, and whether they maintain the same sense of threat from future climate change. The second question focuses on the issue of out-migration from the islands. It assesses whether migration may be evaluated as an adaptation strategy and whether local people are willing to move outside Maldives to neighboring countries because of projected sea level rise impacts. Mixed methods were used during field research, comprising in-depth qualitative interviews with local stakeholders and quantitative questionnaires among the general islander population, mostly in the capital Malé and nearby islands.

The results suggest that respondents do not perceive sea level rise to be an actual environmental challenge for their households at the present time. But they admit it could become one of the key factors affecting Maldivian society and livelihoods in the future. Quantitative research further reveals that more than 50 percent of respondents considered out-migration to be a potential need or adaptation option in the future. However, many other factors (cultural, religious, economic, and social) play an important role in the decision of whether to migrate. Moreover, the interviewed experts who participated in the qualitative interviews expressed a more complex attitude toward the adaptation-migration issue and stressed that much will need to be done to increase adaptive capacity in situ before migration becomes necessary. They perceive out-migration to be the last option, to be undertaken only after other adaptation measures are exhausted and the islands are devastated by climate change impacts.

Key words: climate change impacts, Maldives, climatic variability, migration, adaptation

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1. Introduction

Maldives is one of the Small Island Developing State (SIDS)¹ and is generally known to be vulnerable to the potential impacts of predicted climate change. The combination of low elevation; the small size of its islands; its narrow width; and the country's environmental, economic, and population conditions places Maldives among the countries most vulnerable to existing natural hazards and future climate change impacts (Sovacool 2012; Julca and Paddison 2010).

This study analyzes Maldives' environmental challenges and suggested adaptation measures. It focuses specifically on migration, which could play a significant role in adaptation to climate change. Migration is an old phenomenon, but in this study migration is framed as a possible form of adaptation in response to climate change for inhabitants of small islands, particularly in Maldives.

The SIDS, and Maldives in particular, are vulnerable to the impacts of climate change because of a combination of specific factors. Ghina (2003) describes 21 factors, 7 of which are selected in this analysis to be the most serious: (1) geographical isolation and small size, (2) ecological uniqueness and fragility, (3) rapid population growth and density, (4) sensitivity and exposure to extremely damaging natural disasters, (5) limited natural resources, (6) small economies and high dependence on imports, and (7) dependence on external finance.

This study focuses on Maldivian adaptation strategies in response to environmental challenges, given that the country is one of the most vulnerable of the SIDS. The paper begins with a geographical, economic, and demographic description of Maldives. It discusses the main environmental challenges, especially those related to climate change. The paper later introduces adaptation theory and practice and the role of migration as a potential adaptation strategy. The study also briefly presents the development of adaptation strategies in Maldives, including key adaptation projects.

The core of this study is empirical research dealing with the islanders' perceptions of environmental change and challenges, including adaptation measures. Attention is devoted to current migration patterns and migration tendencies, including internal movement as well as out-migration. A mixed methodology was applied in the research, using both structured questionnaires for quantitative analysis and qualitative semi-structured interviews. The questionnaires contain a set of simple questions that were addressed to local inhabitants, focusing especially on the perception of environmental threats, livelihood conditions, and migration intentions and patterns. The semi-structured interviews with local stakeholders, including public administration representatives, comprised questions about long-term, in-depth issues such as the evaluation of adaptation and mitigation measures and the sensitive issues of dealing with out-migration caused by potential sea level rise.

1.1. Geography and Economy of Maldives

Maldives is an archipelago of 1,190 islands, grouped into 26 low-lying coral atolls, situated just south of India in the Indian Ocean. Approximately 360 islands are currently used primarily for human settlements,

1.SIDS are a group of states and territories facing specific social, economic, and environmental vulnerabilities; these states received special consideration at the United Nations Conference on Environment and Development (the Rio Conference) in 1992 (UN-OHRLS 2016).

infrastructure, and economic activities. About 200 of these islands are permanently inhabited, and 80 more are used as tourist resorts. The land area totals only 298 square kilometers, and no island is larger than 10 square kilometers. Most islands are flat, about 1 meter above sea level (Pernetta and Sestini 1989; MEEW 2007; World Bank 2007; Republic of the Maldives 2010). The soil is very young and is chemically alkaline as a result of the excess of calcium from basic coral rock and sand. These soil characteristics limit agricultural production and food security (Pernetta and Sestini 1989). Currently only about 23 percent of soil is used for agriculture (CIA 2015).

Figure 1.1 Maldivian Islands



Maldives has a tropical climate, with an annual mean temperature of 28°C, though the temperature varies from 23°C to 31°C. The weather is dominated by two monsoon periods, the southwest monsoon, which lasts from May to November, and the northeast monsoon, which lasts from January to March. An instrumental record of the meteorological situation has been recorded regularly, starting in the late 1940s. Continuous meteorological records are available at the National Meteorological Office. Annual average precipitation fluctuates around 2,000 millimeters per year, but some slight interannual variability occurs. For example, in 1989 1,950 millimeters of precipitation was recorded (Pernetta and Sestini 1989); more recent observations show annual precipitation of 2,124 millimeters (MEEW 2007), and 1,972 millimeters between 2010 and 2014 (World Bank 2015a).

Precipitation varies greatly within one year; the wettest months are May, August through September, and December, and the driest are January through April. Overall humidity ranges from 75 percent to 83 percent (Pernetta and Sestini 1989; CIA 2015; MEEW 2007).

The Maldivian economy was rather isolated and was based on fishing, shipping, and the cultivation of coconuts until the 1970s, with a small amount of international trade. This condition changed after the advent of tourism, which has stimulated new economic activities and investment. Now the economy depends heavily on tourism and fishing and produces low levels of agricultural goods, which means the country remains highly dependent on the importation of goods and services (CIA 2015). Overall, the Maldivian economy is highly vulnerable because of its dependency on imports and low level of exports (Julca and Paddison 2010; Ghina 2003).

Thus, the level of economic growth is influenced heavily by external factors and fluctuates significantly. For example, while the economy grew 19.6 percent in 2006, its growth rate dropped to -3.6 percent in 2009 because of the global economic crisis and reduction in tourism. In 2010, growth jumped again to 7.1 percent, while in 2013 it was only 3.7 percent (World Bank 2015b).

The high level of central government debt also makes the country economically vulnerable. At the beginning of the century, the level of debt remained quite stable at 40 percent of GDP, but after 2008 debt started to grow rapidly and rose to 73.5 percent of GDP in 2011 (World Bank 2015b). The 2013 World Bank-IMF Debt Sustainability Assessment ranked Maldives as being at "high risk" of debt distress; in 2014, debt was 86 percent of GDP (World Bank 2014).

In 2014, the estimated population was about 401,000 inhabitants (World Bank 2015c), dispersed throughout Maldives; several key centers, such as Malé, Addu City, and Fuvahmulah, are more heavily populated. Nearly one-third of the population lives in Malé, which is the capital of Maldives (UNDESA 2015). According to the 2014 census, 51 islands were inhabited by 1,999-1,000 registered people, 65 islands were inhabited by 999-500 people, and 51 islands had a population of fewer than 500 people. There are 20 islands with a population of more than 2,000 inhabitants in the administrative islands of the 20 Atolls (NBS 2015).

Demographic data show oscillation around an annual growth rate of 2 percent between 2010 and 2014 in Maldives (World Bank 2015d). This growth, however, is combined with a relatively high level of outmigration from Maldives; the current net migration rate is -12.67 migrants per 1,000 population (CIA 2015).

In sum, Maldives exemplifies the vulnerable small island country. General vulnerability is based on a combination of geographical location, size, low elevation, and exposure to natural hazards. Economic and social vulnerability are grounded in high dependence on external sources, import of goods, and the dismal state of public finances. Moreover, the distribution of the population across many islands creates pressure on the public budget in the fields of infrastructure and transport, health care, social services, and education. The combination of climate change projections and ongoing climatic variability impacts, and the country's resulting climate vulnerability, is capturing the attention of experts, policy makers, and islanders themselves, as described in section 2.

2. Climate Change Impacts and Adaptation in Maldives

Environmental and climate change-related risks in low-lying islands, including Maldives, have received attention from many international organizations, such as the UN Environmental Programme (UNEP). In the 1980s, UNEP launched the Ocean and Coastal Areas Program Activity Centre to assess potential impacts of climate change and to assist national governments in identifying and implementing sustainable policy options and adaptation measures. Experts from UNEP devoted special attention to Maldives and produced one of the first in-depth reports, edited by Pernetta and Sestini (1989). The study identified several key issues, such as islands' increased susceptibility to future climate change and sea level rise, with a combination of high population density and poor environmental management. The report provided the basis for further research and studies.

2.1. Climate Change Risks

Despite contributing less than 0.01 percent to global emissions of greenhouse gases, Maldives is among the countries most vulnerable to projected climate change and sea level rise (MHAHE 2001). Although Maldives is located out of the range of tropical cyclones, there is still a probability, although low, of such events, with the north being more at risk than the south. Maldives is also subject to other natural hazards. In 2004, for example, Maldives experienced a large tsunami, which destroyed several islands.

The islands' size, shape, elevation, and position on reef platforms have been changing over time (MEEW 2007). According to the latest reports released by the International Panel on Climate Change, general projections suggest sea level rise in the range of 300–1,000 millimeters globally by 2100, depending on a range of emissions scenarios (IPCC 2014). Given that 80 percent of Maldives' islands are less than 1 meter above sea level, the potential impact of sea level rise classifies Maldives as one of the most vulnerable states in the world.

Human settlements, public institutions, and critical infrastructure are located too close to the shoreline and are already affected by sea level rise impacts, especially inundation, beach erosion, storm surges, and high waves. According to Shaig (2006), more than 42 percent of the population and 47 percent of all housing structures lie within 100 meters of the coastline. Human activities seriously increase the vulnerability of the nation, specifically through overcrowding of several islands, poor infrastructure, and devastation of beach vegetation. Several kinds of solutions have been implemented, starting with individual-level programs; voluntary migration, resettlement projects (mainly after the 2004 tsunami), and related land reclamation projects have been carried out, even though their contribution to increased resilience is disputable. The largest projects are in Hulhumalé (1.89 square kilometers, 100 percent

reclaimed land), Malé (0.82 square kilometers, 41 percent reclaimed land), Maamigili (0.8 square kilometers, 51 percent reclaimed land), Hulhulé (0.76 square kilometers, 58 percent reclaimed land) (Shaig 2006).

To sum up, according to Pernetta and Sestini (1989), Kelman (2014), MEEW (2007), and many other expert studies, the main climate change threats to Maldives are the following:

- Sea level rise and its further consequences—an increased rate of coastal erosion and resulting salt water intrusion and threat to fresh water resources and to human settlements
- Increased global temperature, which may lead to increased demand for air conditioning and thus energy supply and threat to corals affected by related acidification, reducing protective capacity of reefs against storms and wave surges
- Increased climatic variability, which may lead to a deterioration of fresh water reserves and increased demand for water, as well as a further threat to food security.

2.2. Climate Change Adaptation and Its Relevance to Maldives

Generally speaking, adaptation is an adjustment of ecological, social, or economic systems in response to observed or expected changes in climatic stimuli and their effects and impacts to alleviate adverse impacts of change or take advantage of new opportunities (Adger, Arnell, and Tompkins 2005; IPCC 2007). Adaptation is mainly aimed at increasing resilience to climate-related risks. The National Adaptation Strategy of Maldives (MEEW 2007, 3) describes adaptation as “a multi-dimensional goal that aims to increase resilience of the vulnerable systems against climate hazards and risks to achieve sustainable development outcomes.”

When looking at particular adaptation measures and their practical implications, it is possible to distinguish between *hard* and *soft* measures. Soft measures are understood to be smaller scale, less-capital-intensive approaches and include ecosystem-based adaptation, whereas hard adaptation measures prefer construction solutions (see table 2.1). For example planting mangroves and protecting coastal vegetation are considered soft adaptation measure, while building structures, seawalls, and tetra pods, or implementing land reclamation projects represent hard ones (Sovacool 2012).

Table 2.1 Examples of Hard and Soft Coastal Adaptation Measures

Climate change impact	Hard measure	Soft measure
Sea level rise	Construction of seawall and tetra pods, erection of artificial islands such as Hulhumalé	Mangrove afforestation, beach nourishment
Water scarcity	Desalinization of water	Larger catchment areas for rainwater
Saltwater intrusion	Elevation of water tanks and storage systems	Thickening coastal vegetation
Tidal inundation	Land reclamation	Dune replenishment

Source: Adapted from Sovacool (2012).

The document that guides policy on these issues, the National Adaptation Programme of Action (NAPA), identifies the following key areas of climate change vulnerabilities (MEEW 2007):

- Land loss and beach erosion, a process that may pose a threat to human settlements located nearby
- Potential damage to critical infrastructure (including tourist resorts)
- Threat to coral reef biodiversity
- Impact on economy—restraint of fisheries and tourism
- Human health—focus on better availability and quality of health care
- Water resources—sources of fresh water and rain water availability are threatened
- Agriculture and food security—lack of locally grown food makes the country dependent on imported goods.

The concept of adaptation is further described in the Strategic National Action Plan for Disaster Risk Reduction and Climate Change Adaptation (SNAP) planned for 2010–20. The plan focuses on strategic steps that need to be taken to implement long-term adaptation to climate change risks and preparations that need to be made to address the impacts of potential significant disasters from natural hazards. SNAP aims to address three strategic areas: (1) enabling an institutional environment that promotes good governance; (2) empowering capable communities; and (3) increasing the presence of resilient communities with access to technology, knowledge, and other resources (Republic of Maldives 2010).

SNAP also integrates disaster risk reduction and climate change adaptation. This strategy combines long-term climate change adaptation with risk-reduction strategies in these key sectors: housing, construction, environment and health. Good governance and decentralization are critical to the success of risk reduction and adaptation (Republic of Maldives 2010).

2.3. Migration as Adaptation in Maldives?

As Maldivian society faces the entire spectrum of actual and projected climatic threats, could another adaptation strategy, such as migration, be feasible? Migration is an age-old phenomenon, and islanders have long migrated for economic, social, environmental, security, and other reasons (Kelman 2015). The variety of migration typologies is vast, based on which factors are taken into account, such as temporariness, voluntarism, planning, spontaneity, top-down, bottom-up, and others (see Stojanov et al. 2014).

The relationship between climate change and population movement has received attention from academia, the nonprofit sector, and policy makers in the past several decades (El-Hinnawi 1985; Myers 1993; Piguet 2008; Black, Adger, et al. 2011; Government Office for Science 2011). If climate change is indeed a major contemporary push factor for migration, then the scale of future movements could outstrip all historical examples and contexts. The potential for these mass movements largely springs from high population numbers and densities in areas most affected by phenomena such as sea level rise inundating low-lying coastal zones. In addition to such direct effects, climate change can affect migration indirectly through economic drivers, such as crop failures and reduction in livestock and fisheries productivity, and political drivers, such as conflict related to competition over scarce resources (Stojanov et al. 2014).

One single factor is rarely sufficient for the migration decision. Climate change adds to already increasing levels and complexities of population mobility (de Sherbinin et al. 2011; Government Office for Science 2011; Hugo 2011). To understand the scope of the impact of climate change on mobility choices, more empirical studies examining motivations for migration have been undertaken, aiming to disaggregate the push and pull factors and to provide empirical evidence from migrants regarding their perceptions of the situation. Examples include a focus on migration within and from drought-affected areas (Findley 1994; Rain 1999; Henry, Schoumaker, and Beauchemin 2004); migration-related interests in the context of projected sea level rise from small island communities (Kothari 2014; Kelman 2015); and migration responses to floods and storms (de Sherbinin et al. 2011; McLeman and Hunter 2010).

The treatment of human–climate change interaction is variable in the current scientific discussion, which places migration into different perspectives and frames. Media, politicians, and other groups may also present climate change–migration issue in extreme ways, distort situations, and use the label “climate refugees.” This term does not fit in a scientific framework and is criticized by many authors as not adequate, politically motivated, and artificially constructed (Hartmann 2010; Kelman 2015). Moreover, some authors point out that climate change hazards affecting islands are overemphasized and may even distract attention from more immediate development challenges (Kelman 2014).

Some authors, however, frame climate change migration positively. Black, Bennett, et al. (2011) argue that migration may be the most effective way to allow people to diversify income and build resilience where environmental change threatens livelihoods. According to Birk and Rasmussen (2014) migration could improve access to financial and social capital, reduce pressure on natural resources, and make island communities less vulnerable to extreme weather events and other shocks—all factors that contribute positively to adaptive capacity. Thus, voluntary out-migration may play a particularly positive role in adaptation to climate change in exposed atoll communities.

Tacoli (2009) agrees that human mobility probably plays an increasingly crucial role in adaptation to climate change and contributes to increasing individual and household resilience. In addition, McLeman and Smit (2006) consider human migration to be a reasonable response to environmental risk exposure, such as climate change. According to King et al. (2014) relocation is a strategy available to some as part of an extensive range of responses to extreme weather events, but unsupported resettlement is not always an option for many reasons, such as family commitment, livelihood opportunities, financial constraints, and the like. They conclude that those who remain in and those who leave a hazard-prone location may both demonstrate a capacity for adaptation and resilience. Barnett and Webber (2010) also regard migration as a feasible strategy for adapting to climate change, but they stress the need to develop adequate policies that help migrants minimize the costs and risks associated with migration. They also point out that community relocation and other forms of involuntary migration should not be used unless they are absolutely necessary.

For several reasons, the Maldivian case is worthy of study. The situation in the Maldives is not currently an imminent problem. The islanders do not depend on their environment directly as producers, except in the fishing industry, thanks to the vast importation of goods and the nature of their livelihoods, and they are not currently threatened by climate variability. Some commentators, such as Kumar (2014), do not consider individual migration from small islands in the Indian Ocean to be the solution to natural resource shortage and overpopulation, nor does Kumar see planned relocation of whole communities to purchased land a likely option. He argues that relocated inhabitants would not have electoral rights and would lose their culture and language, and potentially may contribute to religious conflicts.

Nevertheless, the slow-onset environmental changes that are under way, specifically the gradual process of sea level rise, mean that migration may well be needed in the future. Understanding the migration issue from the islanders' perspective is essential. For example, Arnall and Kothari (2014) reveal discrepancies among islanders regarding their attitudes to the link between climate change and migration. Their research shows that many ordinary Maldivians (non-elites) did not see sea level rise as a sufficient reason to migrate should it occur in the near- to medium-term future because they believed they had other ways and means to adapt. Arnall and Kothari (2014) point out that elites and non-elites report understanding the timescale of climate change—and related ideas of urgency and crisis—differently. Specifically, elites tend to focus on a distant future, which is generally abstracted from the reality of people's everyday lives. Arnall and Kothari (2014) also identify a generation gap between older and younger populations discernible in relation to perceptions of any climate change-induced migration that might eventually occur. In general, older interviewees preferred to stay where they were but were also relatively open to the prospect of relocating provided that the national government covered the full costs of resettlement. In contrast, many younger interviewees viewed climate change-induced migration as a potential opportunity to secure a better life elsewhere.

The government is already considering a number of strategies to address the impacts of climate change, some of which have migration implications.

2.4. Safer Island Strategies

The government is already considering a number of strategies to address the impacts of climate change, some of which have migration implications. In particular, an important adaptation strategy that would involve movement of people is the development of “safer islands.” This approach arose from a preference to make islands more resilient to external threats and was based on the assumption “that any island could be made safer using appropriate technology” (Republic of Maldives 2010, 47). This concept was developed in the national adaptation strategy documents (MEEW 2007; Republic of Maldives 2010). The feasibility of making islands safer has been subject to criticism with regard to governance and implementation. The safer island strategy is focused on hard adaptation and structural engineering solutions, such as land reclamation and rising islands. The strategy, which is not new in Maldives but has changed across years and governments (Kothari 2014), is a controversial policy because it entails internal displacement and population consolidation. It has also been widely criticized for not fully considering environmental and other hazards (Elrick-Barr, Glavonic, and Kay 2015).

These strategies are more precisely known as the National Safer Island Strategy and the Safer Island Development Program. Generally, the term “safe islands” refers to Maldives’ larger islands, which will be better adapted to provide a safer environment and conditions for people who are threatened and forced to migrate as a result of natural disasters (Islam, Hove, and Parry 2011; Kothari 2014). These programs are built upon reclamation measures based on technical and engineering methods. Discussion about these practices focuses on two key issues: (1) threats to the local environment and biodiversity, and (2) sensitive issues surrounding the relocation of local inhabitants and the extent to which these actions are voluntary.

In 2010, a project called Integrating Climate Change Risks into Maldives Safer Island Development, supported by the Least Developed Countries Fund of the Global Environment Facility, reflected a transition and change to the adaptation framework, focusing on applying soft adaptation strategies such as empowering local communities, natural infrastructure, decentralization of decision making, and other tools (Sovacool 2012; Elrick-Barr, Glavonic and Kay 2015; GEF 2009).

Sovacool (2012) argues that future climate change threats and economic and development motivations may be among the strongest drivers for preferring hard solutions, especially relocation of people into the new artificial islands (called designer islands). Hulhumalé island, located in Malé Atoll, is the most visible example.² Another example is Dhuvaaafaru island in Raa Atoll, which was inhabited in 2009 by residents from the island Kandolhudhoo, which had been destroyed by the 2004 tsunami (Sovacool 2012).

Yet concerns about land reclamation development activities in which reef flats are filled in go back at least two decades. Pernetta and Sestini (1989), for example, claim that some flood events occurred because of land reclamation and the construction of seawalls at the edge of the island’s outer reef.

Because of the criticisms leveled at the program, enticements for participation in relocation could shift from the climate change discourse to the program’s contributions to better provision of social services,

2 .Hulhumalé island is one of the most ambitious land reclamation projects undertaken by the government of Maldives, realized by Housing Development Corporation Ltd. The main vision is to relieve congestion in the capital Malé and to promote urban development. This island is projected to be inhabited by 100,000 new inhabitants in 2030. About 30,000 inhabitants have settled the island at the end of 2013 (see www.hdc.com.mv).

transport, and economic benefits (for example, President Nasheed's strategy for the Resilient Islands [see Kothari 2014]). As of mid-2015, however, the future of the Safer Island Strategy is not clear.

3. Methodology

The empirical part of this study applied a mixed-method approach, using both quantitative and qualitative tools during the field research. Between August and November 2013, quantitative questionnaires were administered, mostly with ordinary people (N = 347), in the Northern Maldives, primarily in the islands of Malé, Villingili, and Hulhumalé.

The quantitative questionnaires were addressed to local inhabitants; selection of respondents was limited by cultural and religious differences, time, and financial and human capacity. We undertook accidental sampling partly autonomously, and partly with the assistance of local people from nongovernmental organizations and a local school.

Although an attempt was made to select respondents representing a wide range of ages, education, gender, and employment, ultimately mostly a younger population was covered. People who were willing to participate in face-to-face interviews were addressed in public; residential places, streets, schools, and other environments were selected. Thus, we are aware of the limited representativeness of our research, but it still provides very useful results and shows important findings about respondents' attitudes toward a wide range of issues dealing with their livelihoods and environmental threats. It is one of the first attempts to provide a comprehensive and deeper understanding of the situation in Maldives from the perspective of the local inhabitants, combining both qualitative and quantitative information. It can serve as the basis for further research from the environmental sociology perspective.

The questionnaires contained a simple set of questions that focused on perceptions of environmental threats and challenges, including climate change, livelihood conditions, and migration intentions and patterns. Several simple questions were included dealing with respondents' attitudes toward the potential need to migrate as a result of future sea level rise.

The main research topic focused on islanders' perspectives on the interest in the climate change–migration link. The principal research questions were established as follows:

- (1) How do local residents perceive the current manifestations and impacts of climatic variability, and their potential threat in the future?
- (2) Do they consider out-migration from the islands to be a potential adaptation strategy in the future due to sea level rise impacts?

Qualitative interviews served as additional sources of information, providing a deeper understanding of selected issues included in the questionnaires and helping augment simple statistics, where single numbers do not provide sufficient answers for such complex issues. Semi-structured interviews were completed with 14 local stakeholders from several expert fields, such as nongovernmental environmental organizations, the education sector, business representatives, and politicians and governance representatives. Questions were particularly focused on long-term issues requiring in-depth analysis. The most relevant questions dealt with environmental challenges, climate change perceptions, and adaptation

measures to climate change; more sensitive questions dealt with the potential necessity of out-migration caused by sea level rise impacts in the future.

3.1. Quantitative Methods

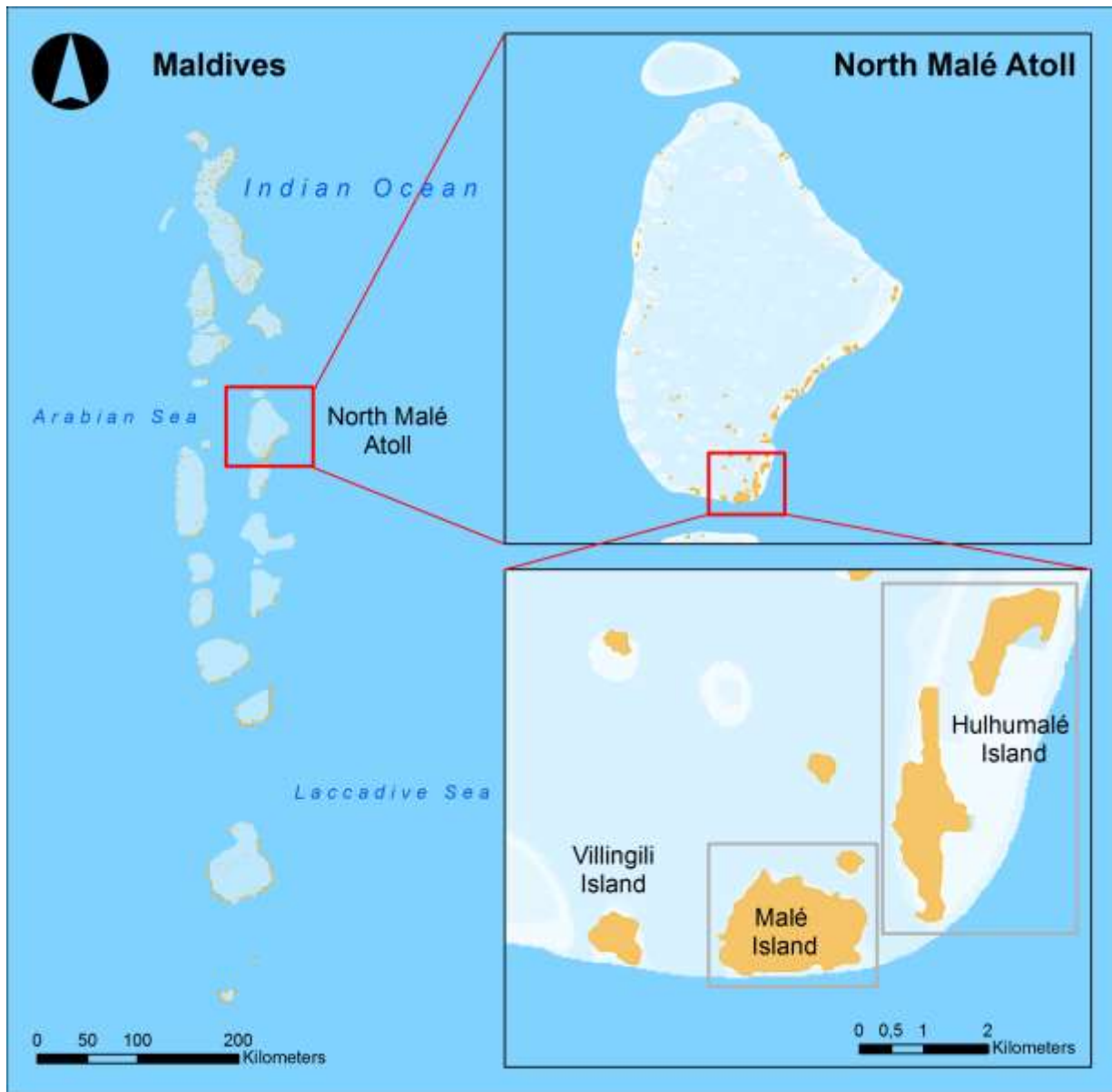
In total, 347 usable questionnaires were obtained between August and November 2013. The questionnaires were completed by the face-to-face method, which means that the researcher completed the questionnaire with one adult member of the household age 18 or older on the street or in any public room. Questionnaires were conducted with respondents on three nearby islands—Malé, Villingili, and Hulhumalé—using random selection. The study focused on an analysis of the adaptive behavior of households to environmental change impacts and their consequences for the population, especially population dynamics.

Questionnaires were divided into four main sections:

- Household characteristics
- Current living conditions
- Perception of socioeconomic and environmental changes, including climatic variability
- Migration patterns, tendencies, and perception of migration due to future sea level rise impacts

Descriptive statistics and other tools of statistical analysis were applied to characterize the data sample and to calculate the statistical implications for the entire population of Maldives. To reveal the factors influencing households' migration patterns and their opinion on "need to move" as an adaptation strategy, standard logit models were estimated (logistic regression). This approach allows the sociodemographic and environmental factors determining the probability to migrate and the opinion on general migration strategies to be estimated.

Figure. 3.1. North Malé Atoll and Detail of Malé, Villingili, and Hulhumalé Islands



3.2. Qualitative Methods

The semi-structured interviews with 14 local experts in several fields sought to cover a wide range of opinions of relevant stakeholders and to tap their deeper understanding of the environmental and social challenges in Maldives. Before the interviews, they were contacted in advance by e-mail, and they provided contact information for other recommended experts through the interview process.

The interviews were organized around several main issues:

1. Perception of environmental change, including of climate change—

Which environmental challenges did respondents believe to be the most serious, from their point of view?

2. Knowledge of and evaluation of adaptation strategies to climate change—

Were respondents familiar with adaptation opportunities, and how did they evaluate their effectiveness?

3. Migration patterns (internal and international) and attitudes toward a vision of migration as a potential adaptation measure to climate change and sea level rise—

This set of questions was the most important. What are the main reasons for migration and what destinations outside Maldives are considered? What are the migration tendencies? How do the respondents incorporate climate change migration into their thinking and how do they see the future of Maldives society just from the perspective of climate change impacts such as sea level rise.

Table 3.1 shows occupational fields and number of interviewed respondents in each field.

Table 3.1 Characteristics of Interviewed Experts

Field	Number
Nonprofit organizations	4
Academia and scholars	5
Local government	3
Business or private sector	2

4. Findings

4.1. Quantitative Descriptive Statistics

4.1.1. Perception and Understanding of Environmental Change Impacts

In an effort to determine how Maldives respondents perceive and understand environmental changes and climate change impacts, the most relevant questions dealing with the paper’s research topic were selected:

Experience with some extreme natural events in past, level of damage, and alleviation

More than 60 percent of respondents had experienced an extreme natural event in the past, and more than half of them were affected by the 2004 tsunami (51 percent). Respondents mainly mentioned damage to houses and infrastructure (25 percent) and to harvest (12 percent). They dealt with the damage through house reconstruction (almost 10 percent) and a set of adaptation measures such as drainage systems, hydro-isolation of the house and walls, water management of the plot or terrain, and vegetation adjustments (6 percent). Seven percent of respondents chose migration from the damaged place (table 4.1).

Table 4.1 Experience with Extreme Natural Events in the Past

	Frequency	Relative frequency (percent)
Extreme natural events		
0. Not classified	4	1.15
1. Flood	10	2.88
2. Tsunami	176	50.72
3. Tidal waves	8	2.31
4. Others (extreme precipitation, cyclones, storms, and the like)	11	3.18
Damage		
1. No damage	29	8.36
2. Deaths	24	6.92
3. Flood	24	6.92
4. Damaged houses	86	24.78
5. Harvest	40	11.53
6. Others (erosion, animals, access to water, and so on)	73	21.04
Solutions		
1. Migration	25	7.20
2. House reconstruction	33	9.51
3. Adaptation measures	22	6.34
4. Nothing to do, do not know	21	6.05
5. Others (warning systems, compensation from government, official development assistance, and so on)	36	10.37

Perception of climatic variability

A high proportion of respondents (71 percent, or 247 respondents) observed some shifts and changes in weather patterns¹ within the most recent 10–15 years. Only 8 percent of them observed no change. The remaining respondents were not able to answer this question. As for the main perceived changes,

3. Weather and climate are understood to be synonymous according to Maldives questionnaire respondents.

respondents mentioned that the summer monsoons were hotter (53 percent) and arriving sooner (31 percent). Respondents also said the winter monsoons were hotter (48 percent) and had less rain (38 percent) (table 4.2).

Table 4.2 Perception of Climatic Variability

Changes		Frequency	Relative frequency (percent)
Weather change observed		247	71.18
Summer monsoons, wet	Sooner	106	30.55
	Later	64	18.44
	Hotter	185	53.31
	Colder	43	12.39
	More rain	114	32.85
	Less rain	108	31.12
Winter dry, wet	Sooner	78	22.48
	Later	71	20.46
	Hotter	165	47.55
	Colder	40	11.53
	More rain	62	17.87
	Less rain	131	37.75

Questions dealing with perception and understanding of environmental change

The other set of questions dealt with environmental challenges in the present and the future. Altogether, 37 percent of respondents worried about environmental challenges, such as lack of space for living and population overgrowth, climate variability or dry weather, and water shortages and the impacts of sea level rise and soil erosion. It is interesting that the perception of other future challenges, such as job availability (10 percent), higher crime rates (4 percent), political instability and conflicts (5 percent), and low quality of health care and education (4 percent), are not viewed as seriously as the environmental issues (table 4.3)

Table 4.3 Perception of Various Challenges by Local Inhabitants

Challenges	Frequency	Relative frequency (percent)
0. Not able to specify any challenges	35	10.09
1. Environmental change (as a sum of particular challenges below)	129	37.18
<i>Sea level rise and soil erosion</i>	25	7.20
<i>Lack of space and population overgrowth</i>	62	17.87
<i>Dry weather and water shortage</i>	13	3.75
<i>Climate variability</i>	19	5.48
<i>Pollution of environment</i>	10	2.88
2. Job availability	36	10.37
3. Higher crime rates	13	3.75
4. Political instability, conflicts	16	4.61
5. Low quality of health care and education	14	4.03
6. Others	104	29.97

4.1.2. Migration Patterns

Reasons for internal migration—Malé as destination

From the perspective of internal migration, the hope for better education, economic opportunities, and living conditions is an important factor in the decision-making process, mentioned by 44 percent of respondents who moved from another Maldives islands to North Malé Atoll. Just 2 percent of respondents cited poor environmental conditions or natural disasters as the main factors for this internal movement; the remainder of the respondents mentioned other reasons.

Intention to move away and factors triggering migration

More than half of the respondents (53 percent, or 183 respondents) plan to move abroad, mainly for better livelihood prospects than in the place of origin. Only 6 percent of respondents cited poor environmental conditions, and 5.2 percent of the respondents mentioned threat of sea level rise.

Table 4.4 Intentions and Reasons to Move Away

Reasons to migrate	Frequency	Relative frequency (percent)
Better education, economic, and living conditions	105	30.35
Poor environmental conditions	21	6.07
Environmental disaster	5	1.45
Development displacement	2	0.58
Threat of sea level rise	18	5.20
Other reasons	61	17.63
Total	183	52.89

When taking into account the maximum level of education reached in the respondents' households, the survey shows that respondents who obtained a higher education level preferred out-migration. The higher the education level obtained, the stronger the preference to migrate out of Maldives. For example, 48.8 percent of respondents with secondary education intend to migrate (38.2 percent prefer to migrate out of Maldives), compared with 60.6 percent of respondents with a university degree (54.1 percent prefer to migrate out of Maldives).

The main factors triggering and influencing decisions for out-migration are poor availability of health care, education, and living conditions (26 percent); the influences for nonmigration are family, nationality, and religion (20 percent). Environmental factors might also play some role in migration decision making; specifically the environmental changes listed in table 4.1 were mentioned by 13 percent of respondents.

The environmental reasons for out-migration were then compared with respondents' highest level of education. Environmental factors (such as poor environmental conditions, environmental disasters, or threat of sea level rise) are perceived to be more serious by respondents with secondary education or a university degree. However, just 10 percent of respondents (15 percent of respondents intending to move away) from households with a university degree mentioned these environmental reasons, while 7 percent of respondents (15 percent of respondents intending to move away) with secondary education mentioned environmental reasons. Only 4 percent of respondents (8.5 percent of those intending to move away) with less than a secondary degree mentioned environmental factors as a reason to migrate. No one mentioned dry weather or water shortage as the potential reason for the migration decision. Differences in relative frequencies between the low-educated group (less than secondary degree) and the high-educated (at least secondary education) group of respondents are not statistically significant (with one-sided p -value of 0.2).

Respondents mentioned various preferred countries and regions. More general clusters were created to synthesize destinations and distinguish them geographically and economically. Cluster 1 consists of Asian countries located close to Maldives—India, Sri Lanka, Malaysia, Indonesia, and other neighboring countries. Cluster 2 is made up of two nearby economically developed countries, Australia and New Zealand. Cluster 3 consists of other economically developed countries that were mentioned, but that are

rather distant from Maldives, such as European Union countries and the United States. Cluster 4 indicates intentions to migrate within Maldives.

According to the data, respondents prefer to migrate to relatively close Asian countries (38 percent). Among developed countries, respondents prefer Australia and New Zealand (37 percent), and Europe and the United States (26 percent) (table 4.5⁴). Migration to developed regions was preferred by 62 percent of respondents, whereas 54 percent cited a preference for developing regions.

Table 4.5 Preferred Migration Destinations According to Regional Clusters and Maximum Level of Education in Respondents' Household

Percent

Destination	Relative frequency (total)	Secondary and higher^a education (relative frequency)	University education^b (relative frequency)
Asia	38.32	34.94	43.21
Australia, New Zealand	36.53	32.53	39.51
Europe, United States	25.75	22.89	29.63
Maldives	15.57	21.69	9.88
Unknown	25.75	25.30	38.27

Note: Relative frequencies are computed as a ratio of respondents preferring corresponding destinations to all respondents intending to move away (in total or within corresponding education group).

a. Completion of secondary school, no university degree.

b. Bachelor's degree and higher

Table 4.6 describes migration destinations in more detail and includes individual countries. Relatively close countries comprise the most preferred out-migration destinations. Respondents prefer to move to Australia (14 percent), Malaysia (8 percent), Sri Lanka (4 percent), and India (3 percent). It is interesting that only three respondents cited the United States as a preferred destination even though it has the largest number of foreign nationals from anywhere.

4. The sums from tables 4.5 and 4.6 differ because some respondents mentioned destinations from different clusters.

Table 4.6 Preferred Migration Destinations

Destination	Relative to all respondents who intend to move from Maldives (percent)	Relative to all respondents thinking "people need to move because of climate change impacts such as sea level rise" (percent)
Unknown	25.68	25.27
Anywhere	18.58	18.28
United States	1.09	1.08
Maldives	14.21	13.98
Australia	14.21	13.98
France	1.09	1.08
Malaysia	7.65	7.53
Switzerland	0.55	0.54
United Kingdom	1.09	1.08
Europe (any country)	1.09	1.08
Asia (any country)	0.55	0.54
Germany	0.55	0.54
India	3.28	3.23
New Zealand	1.09	1.08
Turkey	0.55	0.54
Qatar	0.55	0.54
Russian Federation	1.09	1.08
Singapore	2.73	2.69
Sri Lanka	3.83	3.76
Ireland	0.55	0.54
TOTAL (respondents from households)	183	186

About 39 percent of household members (25 respondents) who cited environmental reasons for migration prefer to move to Australia (and New Zealand), while preferred destinations of respondents focusing on social and economic reasons are almost equally shared between two clusters of countries: 52 respondents for Asia and 48 respondents for Australia and New Zealand (table 4.7).

Table 4.7 Reasons for Migration According to Clusters of Countries

Reasons	Intended destination of migration				
	Cluster 0 (unknown)	Cluster 1 (Asia)	Cluster 2 (Australia, New Zealand)	Cluster 3 (Europe, United States)	Cluster 4 (Maldives)
Better education, economic, and living conditions	21	52	48	41	7
Environmental conditions, disasters, threat of sea level rise	15	12	25	8	4
Other	19	15	14	7	16

When the level of education in the household is related to migration destinations, some differences are found. About 25 percent of respondents with university education prefer migration to another island in Maldives (10 percent) or to another Asian country, especially to Malaysia (19 percent), Sri Lanka (4 percent), and India (3 percent), while 16 percent of respondents prefer moving to Australia. Respondents with a secondary-level education prefer to migrate to other Maldivian islands (22 percent) or to other Asian developing countries such as India (4 percent), Malaysia (9 percent), and Sri Lanka (8 percent), and to Australia (15 percent), New Zealand (3 percent), and the United States (1 percent) (table 4.8).

Table 4.8 Preferred Destinations According to Maximum Level of Education in Respondents' Households

Destination	Maximum level of education in the household	
	Secondary and higher education (relative frequency; (percent)	University education (relative frequency; (percent)
0 (unknown)	25.30	25.93
1 (anywhere)	15.66	22.22
United States	1.20	0.00
Maldives	21.69	9.88
Australia	14.46	16.05
France	1.20	1.23
Malaysia	8.43	8.64
Switzerland	0.00	0.00
United Kingdom	1.20	2.47
Europe (any country)	1.20	2.47
Asia (any country)	0.00	1.23
Germany	1.20	1.23
India	3.61	2.47
New Zealand	2.41	1.23
Turkey	1.20	0.00
Qatar	0.00	1.23
Russian Federation	2.41	0.00
Singapore	2.41	3.70
Sri Lanka	3.61	3.70

Potential out-migration of whole Maldivian society due to threat of sea level rise

In contrast to most other questions, this query was formulated as an open-ended question so that respondents could express their attitudes toward this issue. Their answers were concise and clear enough, enabling us to create simple coding. Several main categories of answers naturally arose. The main purpose was to find out whether respondents mentioned the need to migrate and what their main opinions were.

Nearly 52 percent of respondents cited future out-migration as a potential necessary survival strategy for their nation: in particular, 47.8 percent agreed without reservation, 3.2 percent admitted they would have to move in the future, and 0.58 percent believed that only people from some islands would have to move. However, almost 18 percent of respondents disagreed that people from Maldives would need to move and 5.2 percent referenced the need for adaptation in situ (table 4.9).

Table 4.9 Respondents Opinions on Displacement from Maldives Because of Sea Level Rise

Respondents opinions	Frequency	Relative frequency (percent)
Nothing, do not know	21	6.05
Yes, agree, we will have to move	166	47.84
Not now, but perhaps in the future	11	3.17
Yes, some islands, but not Maldives as a whole	2	0.58
No, disagree, do not believe	61	17.58
It is necessary to adapt	18	5.19
Indecisive	3	0.87
No answer	65	18.72
TOTAL	347	100

4.1.3. Migration Patterns—Standard Logit Models

Of the available 347 observations, 295 were used for the regression analysis; the remainder were discarded because values were missing for some explanatory variables. Of the 295 observations, 159 respondents (households) intended to move, and 136 did not intend to move. Maximum likelihood estimates are presented in table 4.10.

Table 4.10 Model: Factors Influencing Migration Patterns

Parameter	Estimate	Standard error	Wald Chi-square	Pr > ChiSq
Intercept	-3.7159	1.2248	9.2049	0.0024
max_educ	0.2493	0.145	2.9562	0.0856
Conditions_sum	0.2092	0.1009	4.3031	0.038
Conditions × Conditions ₁	-0.0044	0.00254	3.0073	0.0829
Changes_num	0.1537	0.1832	0.7038	0.4015
Changes_n Changes_nu	× -0.0402	0.0274	2.1531	0.1423
Migr_opinion_dum	1.0197	0.252	16.3789	<.0001

Estimated coefficients may be interpreted in the following way:

Households that noticed more kinds of weather changes (of a maximum of 12 possible kinds of changes) in the last 10–15 years (Changes_num) are more likely to intend to move than households that noticed fewer changes in weather. This positive effect on probability of intending to migrate decreases with the absolute value of the number of changes noticed (negative coefficient at quadratic term). This finding means that the probability to migrate has a turning point at which an increasing number of changes leads to a decreasing probability to migrate. To be more precise, the estimated coefficients of the variable indicating number of noticed weather changes suggest that households noticing two kinds of weather changes have the highest probability to migrate (assuming other factors remain unchanged). It should be noted that both variables (in level and in squared terms) should be taken jointly; individual statistical insignificance results from the multicollinearity problem among these variables.

The households agreeing with the statement that people might need to move because of changes in the weather (or climate) (Migr_opinion_dum) are more likely to intend to migrate than the households disagreeing with this statement. This result seems to be intuitive. However, it should be noted that the household’s migration intentions and its opinion about migration as a general strategy resulting from weather changes are two different phenomena. There may be households that intend to migrate involuntarily because of dramatic unfavorable climatic changes only. Their overall opinion about the “need to move” strategy may thus be negative. The results of this questionnaire suggest that this is not the case. The respondent households think that the “need to move” might be a feasible strategy for dealing with climatic changes and this fact would help them in their decision to migrate.

The second model also uses 295 observations out of the 347 available observations because of missing values. Of the 295 observations, 160 respondents (households) agreed with “the need to move because of the weather changes,” and 135 disagreed. A logit model was estimated using the maximum likelihood method. Maximum likelihood estimates are presented in table 4.11.

Table 4.11 Model: Opinion on “Need to Move” Strategy

Parameter	Estimate	Standard error	Wald Chi-square	Pr > ChiSq
Intercept	1.2214	1.0558	1.3384	0.2473
Lived_y	-0.0244	0.0106	5.3574	0.0206
age	-0.1107	0.0605	3.3496	0.0672
Age × age	0.00122	0.000803	2.3065	0.1288
Move_from_2	-1.9829	1.1538	2.9537	0.0857
Migration	0.8663	0.282	9.4333	0.0021
Migr_dest_C0	-0.6324	0.3966	2.5423	0.1108
Migr_other_dest_C0	0.8039	0.3288	5.9781	0.0145
Migr_other_dest_C2	0.5389	0.3153	2.9213	0.0874
Change_level_sum	0.0267	0.0101	6.9496	0.0084

Estimated coefficients may be interpreted in the following way:

Negative experiences with environmental changes (and the increase in resulting damage) (Change_level_sum) tend to increase the probability that the household will agree with the “need to move strategy” (in comparison with the opinions of households facing less negative experiences).

Households living at one residence (island) for a longer period (variable Lived_y measures the number of years for which respondents have been living at their place of residence) are less likely to agree with the “need to move strategy.” Older respondents (age) are less likely to agree with the “need to move strategy” than younger ones. This negative marginal effect rises with the age of the respondent.

Households who know people who had moved away (final destination was unknown or Asia) (Migration_other_dest_C0, Migration_other_dest_C2) are more likely to agree with the “need to move strategy” than those who know people who had moved to Europe, the United States, the United Kingdom, Australia, or New Zealand, or stayed on Malé. This disparity may be explained by the fact that those moving to Europe, the United Kingdom, the United States, Australia, or New Zealand may be more affected by “pull” factors than “push” ones, moving to these countries primarily for better educational opportunities. In contrast, migration to Asia may be the result of push factors, including weather changes and as an adaptation strategy. More research would be needed to confirm this hypothesis.

4.2. Qualitative Analysis

This study evaluates and interprets 14 semi-structured interviews with experts based on three topics: (1) perceived environmental challenges, (2) knowledge and evaluation of adaptation strategies, and (3) potential migration due to sea level rise.

4.2.1. Environmental Challenges

All respondents expressed keen awareness of some environmental challenges and were able to describe them, especially respondents from environmental nonprofit organizations. Their perceptions varied according to their expertise and experiences, and they mostly mentioned specific, practical, and urgent challenges.

For example, all four nonprofit representatives mentioned “poor waste management, pollution of environment,” especially “air and water pollution.” One of them also mentioned “inadequate development” of Maldives and “uncontrolled migration” to the capital Malé. Two respondents from academia further mentioned the problem of “food insecurity,” worsening fisheries, and “vulnerability to extreme weather events.” Another respondent from the local government sector expressed rather general statements, such as “global warming beyond control,” but without further description.

Respondents who discussed climate change impacts mainly mentioned already experienced “climatic variability,” not long-term predictions. Several respondents experienced some of the most visible trends in weather patterns—“shift of seasons,” delayed arrival of wet season, “longer drier periods,” and more “unpredictable weather.” An environmental activist from a nonprofit organization stated, “We have to re-evaluate monsoon patterns, we indicate more days of drought.” It is interesting that the topic of weather and climate was relevant even for representatives of business: “Timing is very different, it looks like that it is not going to be rain, but it suddenly rains... it is more surprising ... before we used to know about it, but now we cannot expect when rains come or not.”

4.2.2. Knowledge of and Evaluation of Adaptation Strategies

More diverse attitudes were adopted with regard to adaptation strategies. Environmental activists from nonprofit organizations were especially suspicious of hard adaptation measures, such as land reclamation and the concept of safe islands; in particular, they worried about destruction of the environment. However, they also indicated that they do not have sufficient information and data dealing with specific issues. They also pointed out the unequal development of selected parts of Maldives, including adaptation measures, especially around Malé. On the other side, representatives of the government pointed out that they cannot afford to protect all of Maldives. They adopted more sober attitudes and were willing to support the idea of artificial islands. However, no clear-cut conclusion arose from this section dealing with the evaluation of adaptation, suggesting that the issue of adaptation is not discussed as intensely as it deserves to be in Maldives.

Generally, the research showed that “adaptation issue and possibilities,” including the sensitive issue of artificial safe islands and potential relocation, “were not properly discussed with local communities,” and dialogue needed to be more open. Mainly respondents from academia and the nonprofit sector mentioned the “need for further research” and “an increase in public awareness about environmental

issues” and the practical “environmental projects.” For instance, one respondent from a nonprofit organization stated, “I do not know what to do with climate change, we have to find solution. We need other research.” A second one expressed the need for solutions in advance: “We need to understand what adaptation is, it is not just doing nothing, but to do something in advance. We need some plans, some strategies.”

4.2.3. Migration as a Response to Sea Level Rise

One of the most important issues covered in the interviews was international migration due to sea level rise. Respondents generally expressed that even though they were aware of sea level rise and the potential submerging of Maldives, they would not admit to an actual need for out-migration to surrounding countries. They prefer adaptation on existing islands and perceive migration to be a last option, after all other possibilities are exhausted and the islands are so devastated that they have become uninhabitable.

Specifically, 11 respondents expressed that they did not intend to migrate. They stressed the need for adaptation in situ and sustainable development so they could remain in Maldives. Only one respondent agreed that one day the residents of Maldives would have to move. Two respondents leaned in that direction but were hesitant about this position.

Most respondents mentioned that many people have already migrated for several reasons, mainly education, better paying employment, and better livelihood possibilities overall. However, they also stressed the voluntariness of migration and the prevalence of individual or family migration, but not community relocation.

One environmental activist from a nonprofit organization highlighted the sensitivity of this issue: “People have to do strange things when they are in danger. But, are we willing actually to lose our nation, our culture, tradition and history? If we immigrate due to SLR [sea level rise], we lose our nation, our history... But, at one stage in future, we may have to leave.” One respondent from academia also stressed the Maldivian identity: “We believe SLR [sea level rise] is a risk. But I do not think we would be under water now... but no matter where we live, we need to be prepared. Being Maldivian is our identity. We should know about these things, maybe something may happen that force me to leave, but it is important for everyone to know the roots of his country. No matter where we live, we are still Maldivians.”

Another respondent from academia stated, “Migration alone is not solution for us, we have to take into account all these social aspects, it would create so many conflicts, our culture will be lost...” Additionally, a representative of the local government sector expressed the desire to stay in Maldives as long as possible: “Migration is not an option. We do not want to leave our islands. We want to stay here.” A member of parliament mirrored this tendency to stay: “We should still try to remain here, unless they find that damage is so serious and islands are getting uninhabitable.”

To sum up, the semi-structured qualitative interviews revealed deeper and often ambiguous feelings from respondents about out-migration as a feasible adaptation solution to sea level rise. Most respondents perceive out-migration to be the last option. They prefer to use other adaptation measures and ensure the sustainable development of Maldives first. They do not agree with some published statements about out-migration to other countries and find them unrealistic. They also mention Maldivians’ strong national feelings and point out that migration will cause cultural, historical, and national erosion. They perceive

Maldives to be a unique country, rich in its particular history, culture, and environment, which are worth protecting for the future. According to most respondents, migration out of Maldives will occur only if there is no other possibility or choice.

5. Conclusion

This research has focused on islanders' perspectives about climate change impacts and the potential for different forms of migration. The results show that respondents to the quantitative questionnaire feel current trends of climate variability very strongly. About 71 percent of respondents observed some shifts and changes in weather patterns within the most recent 10–15 years. However, environmental and climatic threats are not felt as acutely as other socioeconomic problems. For example, 37 percent of respondents worried about environmental changes and half of them (about 18 percent of all respondents) mentioned lack of space and population overgrowth, while only 9 percent of respondents worried about climate variability or dry weather and water shortages, and 7 percent of respondents were concerned about sea level rise and soil erosion.

The second research topic dealt with a sensitive issue, specifically whether out-migration from the islands is seen as a potential adaptation strategy to the effects of sea level rise. More than half of the respondents to the questionnaire stated that future out-migration is a necessary survival strategy for their nation, and fewer than one-quarter rejected this idea. The largest numbers prefer to migrate to relatively close Asian countries, mostly Malaysia, Sri Lanka, and India, or to Australia and New Zealand. Respondents expressed no significant preference between developed and developing regions as destinations. Although the questionnaires showed relatively high recognition of the possibility of migration due to future climate change, the in-depth qualitative interviews revealed respondents' ambivalent and complicated feelings about migration as a potential adaptation measure. Respondents prefer adaptation measures that will allow them to remain in Maldives. Indeed, they perceive migration to be the "last option," after all other measures and strategies have failed. They also point out that Maldivian people feel a strong national sentiment and express worries about the erosion of cultural, historical, and national values if vast out-migration were to occur. They perceive Maldives to be a unique country, one that should be protected to ensure a sustainable future for as long as possible. This finding also corresponds to qualitative research by Arnall and Kothari (2015), who point out that islanders express a strong sense of belonging to the place of origin, and research by Kelman (2014), who suggests that migration as a response to climate change is a very difficult decision for islanders and should not be separated from other social, environmental, and development issues. It is interesting to note that islanders currently do not perceive out-migration to be an actual solution, in contrast to the writings of many authors who theorize that migration is a potential feasible adaptation option (Birk and Rasmussen 2014; Barnett and Webber 2010; Tacoli 2009; McLeman and Smit 2006).

6. Policy Recommendations

The following policy recommendations derive from these findings.

Environmental management and infrastructure

This research reveals that respondents perceived selected environmental issues as highly topical. A solution dealing with current environmental challenges, such as beach erosion, waste management and

sewage systems, and air and sea pollution, is urgently needed. Consideration should also be given to strengthening and building infrastructure in informal urban settlements, where newly arrived migrants often live.

Based on observations in Maldives and inspired by the study of Kuruppu and Liverman (2011) from Kiribati, we recommend that planners provide water-management interventions and develop forecasting and warning capacity for the growing urban populations. Policy makers in the water sector should pay increasing attention to water scarcity issues. All policy making should take into account community perceptions and preferences so that adaptation processes will be effective.

Adaptation strategies and development

These findings show that if Maldivians do not intend to migrate, they need to find ways to adapt. Many respondents do not see migration as an option because they are afraid of losing their culture, religion, and other national attributes. For these reasons, attention and financial support should be targeted to improving adaptation measures in Maldives, accompanied by environmental impact assessment. The National Adaptation Program for Action (MEEW 2007), created in 2007, should be revised, and feasible adaptation projects should be implemented.

Perceived changes in weather patterns and local population vulnerability can be alleviated by improving water collection systems and housing and by partly decreasing dependence on imported food, goods, and energy. Warning systems for natural disasters should also be improved.

Experts mentioned lack of finances as one of the most substantial obstacles to large-scale adaptation measures. Thus, we recommend applying a “special adaptation tax” to collect financial resources for the realization of the most necessary adaptation measures, to ensure a sustainable future for and the continuation of Maldives. The tax of US\$1 per day would be paid by each tourist during her or his stay in Maldives. Resort and airline companies could be charged at the same or a higher level for all guests and passengers. In fact, the application of effective adaptation measures would benefit business and investment and enable commercial operations to continue in the future. One respondent, a member of the Maldives parliament, confirmed that no other similar tax (except a tourist tax) is applied in the country, and it is an interesting and feasible idea for the realization of Maldivian adaptation measures.

Tax revenue would become a source for a special “Maldivian Adaptation Fund” and would serve as a financial resource for research, tenders, and practices focusing on investigation and realization of best available adaptation measures. Fund management would be under the independent review of an international organization or an international panel composed of nonprofit organizations, businesses, and other bodies to ensure the effective use of the funds and prevent corruption. This oversight role has to be carried out independently by any institution or body depending on the Maldivian government. The Maldivian government would only be responsible for tax collection and sending a representative to the fund board. The board would be responsible for allocation of grants and tenders.

Migration policy

The results imply that migration (internal or international) is not new phenomenon in Maldives. Nevertheless, migration as adaptation is a policy area that must be given more consideration. Specifically,

policy makers should consider how they can assist people who wish to move away from risky areas but are trapped by increasing poverty and livelihood degradation. And mechanisms for funding adaptation to climate change also need to account for migration as a way of building resilience in some islands. Furthermore, migrants from islands to Malé may be socially and economically excluded and therefore will need special attention and support.

A better understanding of the extent to which environmental change influences migration patterns of local communities is required; therefore, financial support for further research dealing with population movement, adaptation, and the environment is crucial. This knowledge must be based on local empirical research, environmental and meteorological observation, and longitudinal data on migration flows.

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