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Understanding the Implications of Sand Mining: A Livelihoods Analysis in Coastal Cambodia

Tayler Lowe

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School of International Development & Global Studies

Faculty of Social Sciences

University of Ottawa

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Table of Contents

Acknowledgments.....	ii
Abstract.....	iii
List of Figures.....	iv
List of Tables.....	iv
<i>Part 1: Introduction</i>	1
1.1 Overview.....	1
1.2 Purpose of the Study.....	3
1.3 Research Objectives.....	3
<i>Part 2: Literature Review</i>	5
2.1 Sand Mining in Asia.....	5
2.2 Environmental Impacts in Asia.....	10
2.3 Impacts on Human Well-Being in Asia.....	15
2.4 Visibility of Sand.....	19
<i>Part 3: Methodology</i>	21
3.1 Measures.....	23
<i>Part 4: Cambodia Case Study</i>	27
4.1 Linking Singapore to Cambodia.....	29
4.2 Political Economy of Sand Mining in Cambodia.....	32
<i>Part 5: Livelihood Analysis</i>	36
5.1 Findings.....	37
5.2 Natural Capital.....	38
5.3 Financial Capital.....	42
5.4 Physical Capital.....	44
5.5 Human Capital.....	45
5.6 Social Capital.....	46
5.7 Discussions.....	49
<i>Part 6: Conclusions</i>	52
6.1 Overview.....	52
6.2 Opportunities.....	53
References.....	56
Appendix A.....	65

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Abstract

Sand mining has emerged as a timely yet under-researched area of study. With a growing demand for sand reflecting rapid urbanization and population growth in many parts of the world, regulation has proven difficult leading to exploitation with serious environmental and socioeconomic implications (Torres, Brandt, Lear, & Liu, 2017). This is particularly apparent in many parts of Asia where the increased need for sand has put a strain on the national deposits, forcing countries to source sand elsewhere. In the absence of global monitoring mechanisms and a lack of enforcement, it is hard to estimate the precise magnitude of sand mining. While a growing body of literature has emerged examining the environmental implications of sand mining, primarily in rivers, lakes and coastal waters, there remains a gap in knowledge regarding its socioeconomic implications, specifically on livelihoods.

In the past decade, sand mining has exploded in Cambodia with detrimental implications. In Cambodia's Koh Kong province, villagers have long complained of illicit mining in the mangrove rich estuaries and river systems, decimating fish and crab populations in a number of fishing communities along the coastline (Beiser, 2017). This paper examines the socioeconomic implications sand mining in the Koh Kong province using the media as a starting point. The media has played a critical role in Cambodia, giving a voice to local communities, yet much remains to be explored. This paper ultimately aims to demonstrate the dire need for further academic research in to order to better understand the socioeconomic implications of sand mining, specifically on livelihoods, and help bridge the gap in knowledge.

List of Figures

<i>Figure 1: World Cement Production in 2015 (Eastern and Southeastern Asia)</i>	6
<i>Figure 2: Cement production from 1995 to 2015 in billion metric tonnes</i>	7
<i>Figure 3: Map of Singapore’s land reclamation, 1973 - 2013</i>	8
<i>Figure 4: Map of India’s illegal sand mining activities</i>	9
<i>Figure 5: Sustainable Livelihoods Framework</i>	22
<i>Figure 6: The Asset Pentagon</i>	24
<i>Figure 7: Map of sand dredging sites within the Koh Kong province</i>	28
<i>Figure 8: Singapore Sand Imports, 2007 – 2016</i>	30
<i>Figure 9: Sand Dredging Sites in Koh Kong</i>	42

List of Tables

<i>Table 1: Definitions of sustainable livelihood capitals</i>	24
<i>Table 2: Distribution of selected articles for analysis</i>	26
<i>Table 3: Sand exports from Cambodia to Singapore, 2007 - 2016 (as reported by Cambodia)</i>	33
<i>Table 4: Imports of Cambodian sand into Singapore, 2007 - 2016 (as reported by Singapore)</i>	34
<i>Table 5: Discrepancies in sand trade figures between Cambodia and Singapore, 2007 - 2016</i>	34
<i>Table 6: Capitals identified in articles based on year of publications</i>	38

Part 1: Introduction

1.1 Overview

Sand is an essential component of development in the modern world. Used in everything from concrete to glass to asphalt to electronics, sand plays a key role in our daily lives (Delestrac, 2013). Every year, the global demand for sand continues to increase with the rise of urban development in many parts of world. Sand accounts for one of the largest volumes of natural material extracted worldwide (Peduzzi, 2014). Globally, an estimated 40 billion metric tons of sand is extracted every year and used in the construction industry and for glass manufacturing, among other uses, roughly half of which will never be replenished (Edwards, 2015). In the preparation of concrete, for each ton of cement, the construction industry needs approximately six to seven times more tons of sand and gravel (USGS, 2013). Since 1994, cement production has more than tripled from 1.37 billion metric tons to 4.1 billion metric tons in 2015 and it is estimated that these numbers will continue to rise at an annual rate of approximately 4 percent (USGS, 2016; The Freedonia Group, 2017). We can therefore estimate that between 24.6 billion and 28.7 billion metric tons of sand was used for making concrete in 2015 alone (USGS, 2016). The increased demand is thus putting a strain on sand deposits worldwide. As the rate and scale of extraction increases and surpasses the natural renewal rate, we are slowly beginning to run out of sand (Peduzzi, 2014).

Despite being valued as a US \$70 billion industry (Beiser, 2017) there is general lack of awareness surrounding the mass extraction of sand and limited global monitoring mechanisms. For the most part, sand has remained nearly invisible for the past several decades, all the while increased rates of extraction has led to exploitation with serious environmental and socio-

economic implications in many parts of the world. Sand exploitation is particularly apparent in Eastern and Southeastern Asia, servicing its construction boom (UNEP & CSIRO, 2011). Rapid urbanization is the main driver of this increasing demand, especially in countries that face the burden of limited space (Comaroff, 2014). Both construction and land reclamation markets mainly in China, India and Singapore are heavily dependent on sand as a result of their growth.

The demand has put a strain on national deposits, forcing countries to look elsewhere for sand. In response to the increased demand, many smaller nations have capitalized on the sand trade, offering sand from their coastlines and in-land riverbeds for extraction, often at the expense of the environment and livelihoods. Nowhere are the impacts of mass extraction more evident than in Cambodia, where, for the past decade, the country has been subject to increasing media attention and scrutiny in relation to its controversial exportation of sand to Singapore.

Remarkably, despite its relatively modest size and coastline, Cambodia is one of the top ten global exporters of sand worldwide and at the centre of the sand mining controversy (Thompson, 2017). With a growing industry and increasing demand for sand reflecting rapid urbanization, regulation and enforcement of sand mining has proven difficult (Torres, Brandt, Lear, & Liu, 2017). Regulation of coastal sand mining is limited in Cambodia and a number of discrepancies have been found in the country's trade figures in relation to sand exports, leading to accusations of fraud on behalf of the government (Thompson, 2017). The issue of mining is particularly apparent in Cambodia's Koh Kong province whereby there have been multiple reports of illicit sand mining and trade to Singapore (Thompson, 2017).

Overlooking the peninsula that links Cambodia and Thailand, Koh Kong is the most south-western province of Cambodia. Its coastline remains relatively undeveloped and is home

to one of largest and most intact mangrove estuary systems in Southeast Asia. Unfortunately, unregulated large scale sand dredging has been a major issue in the province since 2007. For years, villagers have complained of illicit mining in the mangrove rich estuaries of the province, decimating fish and crab populations along the coastline, despite government claims that dredging will benefit fishing communities (Beiser, 2017; Mother Nature Cambodia, n.d.). Sand mining continued in the province with little concern for its implications for nearly a decade and an overall lack of awareness and monitoring from the international community, leading myself to wonder how this could have happened and providing the starting point for this research.

1.2 Purpose of the Study

The purpose of this study is twofold. The first is to situate sand mining in the broader context of Asia, examining how sand has been discussed thus far in the literature and unpacking the issue of visibility surrounding sand mining. The second is to examine the socioeconomic implications of sand mining on livelihoods in the Koh Kong province in coastal Cambodia, based on a qualitative media analysis.

1.3 Research Objectives

While a growing body of literature has emerged remarking on the environmental implications of sand mining, little is understood of the socioeconomic implications, specifically on livelihoods. The term “livelihood” can be understood in a number of ways, however the most widely used definition is that put forward by Robert Chambers and Gordon Conway which states that “a livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living” (1991, p. 6). In particular, in Cambodia, where accusations of fraud and corruption are widespread and sand is subject to illegal extraction and

trade, the issue of sand mining only gained international attention in recent years. There has not yet been any detailed analysis examining the socioeconomic implications of sand mining on livelihoods in Cambodia. As such, this paper seeks to answer the following research questions:

Research Question 1: How has sand mining emerged in Asia?

Research Question 2: Given the value of sand as a commodity and the size of the industry, how is it possible that sand has remained nearly invisible as an object of study for the past several decades in Asia?

Research Question 3: What have been the implications of sand mining on livelihoods in the Koh Kong province in coastal Cambodia?

In an effort to answer these questions, this paper will begin with an overview of existing literature on sand mining in a broader context. Part 2 will examine how the sand mining industry has emerged in Asia, specifically, how it has been discussed thus far and what factors are driving the industry. In unpacking how sand mining has emerged as an object of study in Asia, my objective is to explore the ways in which sand is being discussed, while highlighting what is missing from the discussion. This prompts questions regarding the visibility of sand and the lack of general awareness of the issue.

As such, I seek to demonstrate that a review of the socioeconomic implications of sand mining is ultimately missing from the discussion, specifically, how sand mining impacts livelihoods, particularly for those not directly involved. Part 3 will discuss methodology for conducting a livelihood analysis and the concept of a “sustainable livelihood”. This provides an entrée for Part 4 where I will use Cambodia as a case study to examine how sand mining impacts the livelihoods of fishers in the Koh Kong province. I make note of the data discrepancies in

terms of reported exports and imports from Singapore and Cambodia, which prompt further questions regarding the visibility of sand in Asia. This will be followed by an analysis of livelihoods in Koh Kong in Part 5 using the media as a starting point. Ultimately, this paper will argue that further research is direly needed in order to understand the socioeconomic implications of sand mining activities, specifically on livelihoods of those impacted by the mass extraction of sand.

Part 2: Literature Review

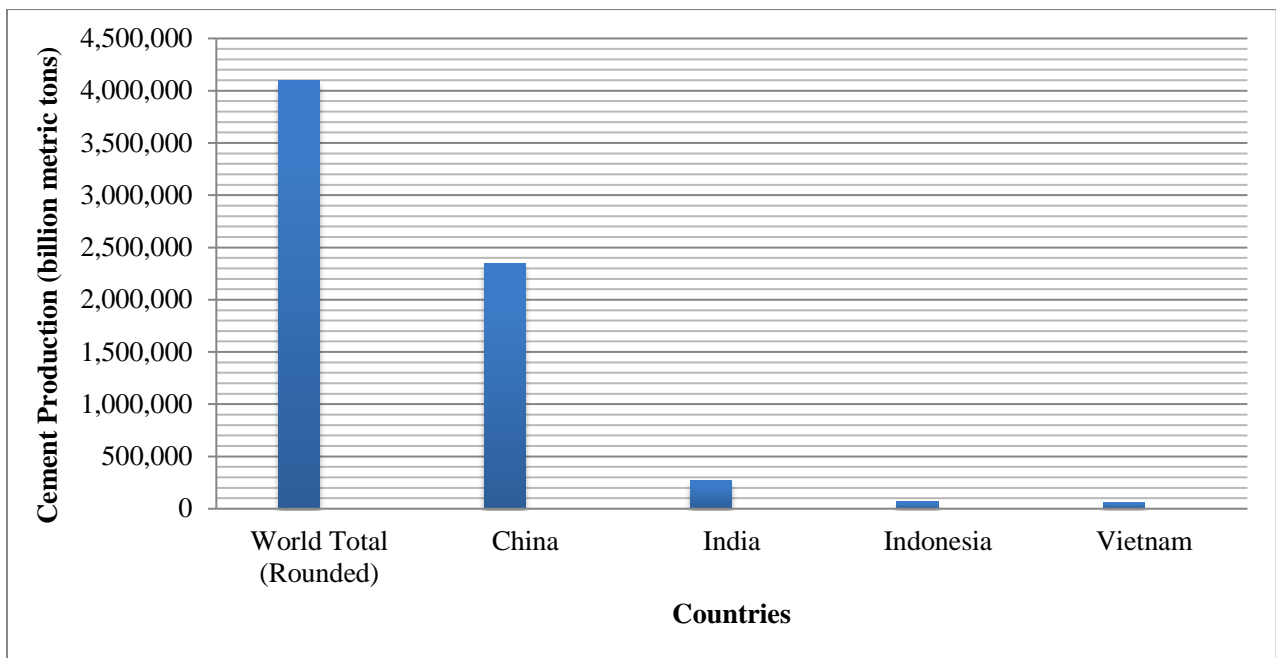
I begin this paper with an overview of the existing literature on sand mining, specifically looking at how it has emerged in Asia and the ways in which urbanization and construction are driving the industry. I highlight how sand mining has been discussed thus far primarily in China, India, and Singapore in order to demonstrate what is missing from the discussion. Most of the discussion has focused on sand through the lens of urbanization and construction in Asia, while the majority of literature looks at the environmental implications of sand mining on various depositional environments including riverine and coastal ecosystems. However, there is a lack of adequate scientific studies examining the adverse socioeconomic implications of sand mining on livelihoods, challenging regulatory efforts and awareness around the world.

2.1 Sand Mining in Asia

As a US \$70 billion industry (Beiser, 2017) that shows no signs of slowing down, sand mining has taken over many parts of Asia. In China, India and Singapore, the need for sand continues to grow as their construction industries are heavily dependent on concrete. In 2015, four countries in Asia (China, India, Indonesia and Vietnam), were responsible for producing an estimated 66% of the world's total cement (see Figure 1) while China alone produced an

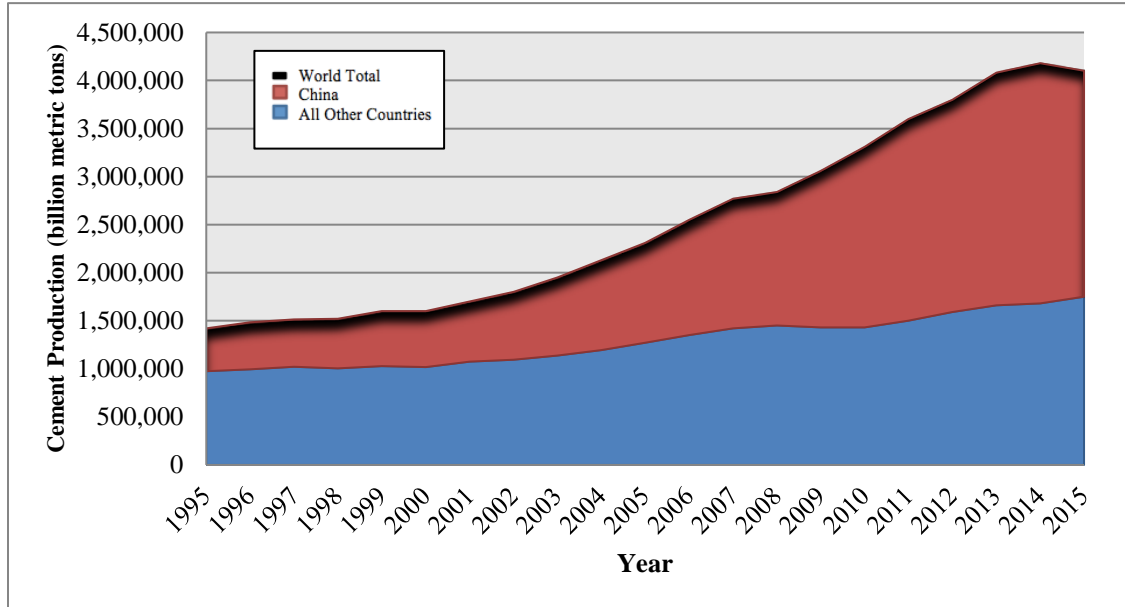
estimated 2.35 billion metric tons of cement in the same year (57% of the world’s total cement production) (see Figure 2) (USGS, 2016). The demand for cement in China has increased exponentially by 437.5% in 20 years and continues to increase with the need for new infrastructure such as buildings, bridges, roads and dams (Peduzzi, 2014). A cornerstone of China’s domestic infrastructure policy is to accelerate urbanization by connecting its remote areas with highly developed cities, both along its southern coastline and the Yangtze River (Hellwig, 2015). An astounding 7 million new residents have moved to Shanghai since 2000 and similar trends are noted in other urban centers (Beiser, 2017). The number of people living in urban areas, over half a billion, has more than tripled in the past 60 years, yet an estimated 65 million apartments remain empty in China’s urban centers (Graham, 2017). As China’s urban population continues to increase so too will the need for sand.

Figure 1: World Cement Production in 2015 (Eastern and Southeastern Asia)



Note: Data from U.S Geological Survey – Mineral Commodity Summaries: Cement Production from 2015 – USGS (2016)

Figure 2: Cement production from 1995 to 2015 in billion metric tonnes



Note: Total cement production from 1995 to 2015. Source: Data from U.S Geological Survey – Mineral Commodity

Summaries: Cement Production from 2015 – USGS (2016)

Singapore, the largest importer of sand worldwide, has been using sea sand for reclamation projects over the past 40 years (Peduzzi, 2014). Similarly, Singapore has experienced rapid population and urban growth in the past 20 years. As such, Singapore has had to build up and outwards in the search for space. Having imported an estimated 517 million metric tons of sand in the last 20 years, Singapore has increased its land surface area by more than 20 percent, or 130 square kilometers (see Figure 3) (Peduzzi, 2014). With a target of increasing its land area by 30 percent for 2030, the sand trade in Singapore shows no signs of slowing down (Comaroff, 2014; Peduzzi, 2014). The amount of sand needed to build out is astounding. For every 1 square kilometer of land reclaimed from the sea, up to 37.5 million cubic meters of sand are needed (Milton, 2010). As urban population growth continues in Singapore, the demand for aggregates, specifically river sand and sea sand continues to increase.

Figure 3: Map of Singapore's land reclamation, 1973 - 2013

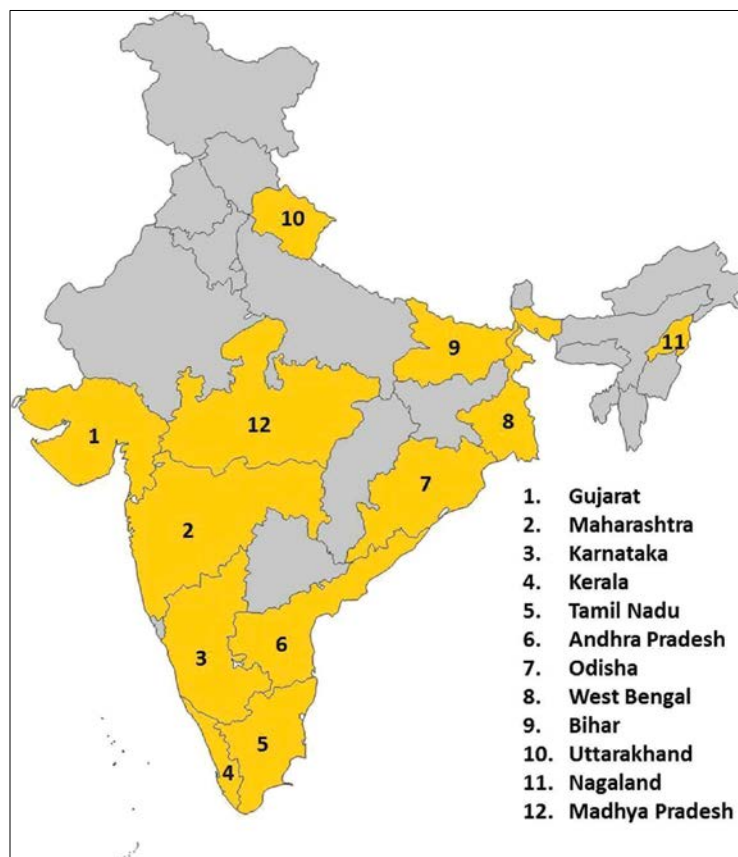


Note: Map of Singapore showing its land area increasing from 1973 to 2013. Source: UNEP/GRID-Geneva from UNEP's *Sand, rarer than one thinks* (2014).

The boom in the construction industry in the last decade has triggered a huge demand for sand in India as well. India's need for space and infrastructure is driven by its fast increasing population. Since 2000, India's population has increased over 300 million people, while its urbanization rate increased from 27.4% to 32.8% in 2017 (World Meters, 2018). In 2016, India, home to the world's third largest construction industry, announced its plans to invest \$500 billion in updating its inadequate infrastructure (Lakshmi, 2012). Sand has proven vital for the country's growing construction industry, which employs over 35 million people and is valued at \$126 billion (Hawley, 2017). Huge volumes of sand and gravel are extracted from India's river systems every year. It is estimated that the amount of sand used for construction in India has tripled since 2000 (Safi, 2017). Furthermore, a 2013 report by the Freedonia Group estimates that the demand for sand will continue to increase to 1,430 million tons by 2020 (as cited in Kukreti, 2017).

According to India's Construction Industry Development Council, the country produced close to 500 million tons of sand in 2017 and that is only what has been legally recorded (as cited in Grewal, 2017). In contrast, India's illegal mining business has emerged as one of the deadliest and most lucrative in the country (Beiser, 2015; Rege, 2016). While there are no official figures on the illegal mining of sand in itself, in 2015-2016, there were over 19,000 reported cases of illegal mining of minor minerals, which includes sand (Kukreti, 2017). As illustrated in Figure 4, illegal mining has taken over many parts of the country and has been widely reported in 12 states. It is estimated that the black market for sand is generating approximately US\$17 million in revenue each month, and, this number continues to increase (Rege, 2016).

Figure 4: Map of India's illegal sand mining activities



Note: Publicly known mining hotspots in India. Source: Sambhav et al. (2012).

2.2 Environmental Impacts in Asia

In the past, sand was primarily extracted from surface gravel deposits, however, these deposits have been exhausted and new means for obtaining sand have been found (Delestrac, 2013). Increasingly, countries have begun extracting sand from oceans, seas and rivers using industrialized dredgers. While sand can be extracted from various sources, such as rivers, oceans, beaches, deltas, sand dunes, and lagoons (Fumbuka, 2017), this paper will only examine issues pertaining to the extraction of sand from oceans, rivers and beaches. The impacts of dredging in sea and riverbeds include, but are not limited to, habitat destruction, land loss, river and coastal erosion, removal of vegetation, salt-water intrusion and failing shoreline infrastructure (Peduzzi, 2014; Thompson, 2017). This is particularly apparent in areas where the sand mining industry is poorly regulated and weak governance and corruption has led to illegal mining (Peduzzi, 2014; Thompson, 2017).

A number of studies have emerged over the years remarking on the ecological impacts of sand mining in Asia (see Boyd & Rees, 2002; Desprez, Pearce, & Le Bot, 2010; Erfteimeijer & Robin Lewis, 2006; Jiang, Haibier, & Wu, 2013; Kondolf, 1997; de Leeuw et al., 2010; Padmalal & Maya, 2014). Extensive sand mining activities are responsible for considerable environmental damage in many parts of Asia, specifically in-land in rivers and along the coastline. However, rarely do any studies expand on their findings to examine whether or not there have been any cascading socioeconomic implications as a result of sand mining.

Most of the scholarly literature reviewing sand mining in China, while not exhaustive, examines mining in the context of its environmental implications primarily in the Nandu or Yangtze River or Poyang Lake, given that China is home to some of the largest river and lake

dredging operations in the world (Fumbuka, 2017). A number of studies argue that riverine dredging operations greatly impact riverbed morphology and in-land biodiversity, threatening the entire existence of river ecosystems (Peduzzi, 2014). One study by Jiang et al. (2013) considers the ecological impacts of sand mining in the Nandu River. Dredging operations were found to have changed the natural shape of the riverbed and its slope, negatively impacting its flood regulation capacity and having serious consequences for the surrounding area as a result of increased flood frequency and intensity (Jiang et al., 2013). However, it is not clear how increased flood frequency impacted surrounding communities and to what degree?

In China's Yangtze River, a similar study examined the impact of sand mining on the river's morphology which was found to have been exacerbated by the construction of dams upstream that obstruct sand replenishment downstream (Chen, 2017). According to Kondolf (1997), upriver dam development and mining activities disrupt the continuity of the river system in transporting sediments downstream and to coastal regions, leading the water to become sediment-starved (Kondolf, 1997). Sediment-starved channel beds and banks are then prone to erosion, producing channel incisions, coarsening of bed material, and resulting in the loss of spawning grounds for aquatic species as seen in the case of China's Yangtze River (Kondolf, 1997; Chen 2017).

Similar changes in river morphology were noted in India's Vembanad Lake through the creation of mining pits upriver (Padmalal, Maya, Sreebha & Sreeja, 2007). As the sediment-laden water passes downstream, gravel and sand are forced into the mining pits resulting in the removal of sediment from the water (Padmalal et al., 2007). Thus, the sediment-starved water leaving the pit causes erosion downstream, ultimately degrading the river channel and banks

(Padmalal et al., 2007; Kondolf, 1997). Yet again, it is not clear however, how those living near Vembanad Lake were impacted.

Coastal or soil erosion is another serious environmental impact from sand mining, the effects of which are rarely examined from a social standpoint. Poyang Lake, China's biggest freshwater lake, is regarded as the largest sand mine in the world (Lai et al., 2014; Beiser, 2017). It is recognized for its species richness, being home to millions of migratory birds and several endangered species (Lai et al. 2014). It plays an important role in floodwater storage and provides water for many cities and surrounding rural settlements (Shankman et al., 2006; Lai et al., 2014). It is estimated that the lake loses approximately 236 million metric tons of sand each year since the initiation of widespread dredging in 2001 causing its water level to drop (Peduzzi, 2014; Lai et al., 2014). Dredging of this magnitude has resulted in severe erosion of the lake's outflow channel, causing it to widen and deepen to the point that discharge into the Yangtze River was double the amount it has been compared to previous years (Peduzzi, 2014; Beiser, 2017). This has impacted the lake's water levels, which were found to have reached a historical low level in 2008 (De Leeuw et al., 2010). While research alludes to the socioeconomic functions of the lake, it prompts questions regarding the implications of lower water levels and the increased risk of drought for surrounding populations who depend on the lake for water and food (Lai et al., 2014).

The majority of research suggests that decreased water levels can have adverse effects on the river and lake ecosystems and overall water supply, in particular for aquatic life living in the lakes and rivers, yet this leaves unanswered questions regarding the impacts this could have on populations dependent on this wildlife. One study in China found that decreased water levels and habitat loss as a result of sand mining have directly impacted the distribution of endangered

animal species such as the Baiji, the Chinese sturgeon, the White sturgeon and the Yangtze finless porpoise living in Poyang Lake (Wu, Leeuw, Skidmore, Prins & Liu, 2007). Similarly, one study by Chen (2017) found that large-scale sand mining in the Yangtze River basin had destroyed crucial spawning and feeding grounds for a number of aquatic species, such as the now-extinct Yangtze River dolphin as well as the Yangtze finless porpoise thus affecting biodiversity hot spots. While the study examined the impacts on wildlife, it did not consider whether or not there had been any socioeconomic implications such as impacts on ecotourism in surrounding areas.

Sand mining in oceans and rivers both directly and indirectly affects overall ecosystem integrity, especially in the vicinity of sensitive marine environments, such as coral reefs and seagrass beds in Asia (Erfteimeijer & Robin Lewis, 2006; Torres et al., 2017). Both coral reefs and seagrass beds have important ecological and socioeconomic functions, the latter of which is rarely examined in sand mining literature. Coral reefs play an important role in protecting shorelines by absorbing wave energy, are home to a number of aquatic species, and provide food and livelihoods for millions of people (Mora et al., 2016). Meanwhile, seagrass beds, which cover approximately 0.1-0.2 percent of the global ocean floor, play a key role in preventing coastal erosion and siltation of coral reefs (Erfteimeijer & Robin Lewis, 2006). Sand mining degrades coral reef and seaweed through the process of direct removal, impacting the aquatic species living in this environment (Torres et al., 2017).

Scientists have argued that China's reclamation work in the South China Sea has severely damaged one of the most important coral reefs in Southeast Asia (South China Morning Post, 2015; Mora et al., 2016). Considered biologically diverse and home to over 6000 marine species, the Spratly reefs are increasingly threatened by China's sand mining activities (Mora et al., 2016)

yet questions remain regarding the impacts this loss would have for those socially and economically dependent on the reefs. In Malaysia, sand mining along the coast threatens the Sarawak coral reefs (Praveena, Siraj, & Aris, 2012). Most of the reefs are covered in macroalgae, the presence of which signals that the reefs are stressed by human activities from the shore (Praveena et al., 2012). Similar findings have also been found among coral reefs in the Riau Islands in Indonesia as a result of increased pollution and sediments in the water from sand mining (Dirhamsyah, 2004). In addition to coral reefs, sand mining impacts seagrass beds directly through the physical removal or burial of vegetation and fauna from the seabed (Erftemeijer & Robin Lewis, 2006).

Ocean and river sand mining operations can also lead to increased concentrations of suspended particulates and contaminants in the water and reduced water transparency through a mechanical disturbance in seabed sediments, blocking respiratory structures of fish and other aquatic species and leading to increased river and ocean pollution (Erftemeijer & Robin Lewis, 2006; Padmalal & Maya, 2014). During the process of extraction, sediments are released into the water through the overflow system and in some cases intentionally released during a screening process, whereby rejected sediments are returned to the water, thereby increasing turbidity (Desprez et al., 2010). In China's Nandu River, sand mining operations led to increased mud content and contaminants in the water, reducing transparency and water quality, thus affecting the habitat of many aquatic species (Jiang et al., 2013). Similarly, in Lake Poyang, Zhong and Chen (2005) noted that increased water turbidity and decreased habitat caused by dredging impacted fish growth and distribution in the lake (as cited in Wu et al., 2007). Yet it is unknown how this impacted fishers in surrounding areas dependent on fishing for their livelihoods.

In sensitive marine environments, such as sea grass meadows, high levels of suspended material and increased turbidity can be lethal for fauna as suspended material can clog their feeding mechanisms and even smother filter-feeding organisms such as oysters and mussels (Erfteimeijer & Robin Lewis, 2006). Similarly, among coral reefs, increased turbidity as a result of high levels of suspended material in extraction and disposal sites can obstruct light and compromise photosynthesis for vegetation (Torres et al., 2017). Emerging research also suggests that physical and biological effects occur beyond extraction sites as suspended sediments resulting from seabed extraction are in some cases transported to other locations on subsequent strong tides (Desprez, et al., 2010). This highlights that the impacts of sand mining can be felt way beyond the sites of extraction and prompts further questions regarding what this could mean for those living in the surrounding areas and beyond.

2.3 Impacts on Human Well-Being in Asia

While the majority of relevant literature explores the impacts of sand mining on the environment, its implications for livelihoods and human well-being remain underexplored. Most studies examining the effects of sand mining prompt additional questions regarding the role of the environment and sand in traditional livelihoods in many parts of Asia and how sand mining impacts the resources needed to sustain livelihoods. While studies do suggest that environmental impacts have additional cascading effects on human assets and capabilities, meaning the tangible and intangible resources which provide the material and social means to earn a living, thus impacting those living near marine and riverine extraction sites, there remains a gap in the discussion (Chambers & Conway, 1991). This section will explore what has been discussed thus

far regarding the impacts of sand mining on human well-being in an effort to demonstrate what is missing.

Coastal zones are now the most populated and preferred residential locations around the world (Jonah & Adu-boahen, 2016). Rapid coastal population growth means that there are more people living along the coastline who may be subject to the adverse effects of sand mining. For example, coastal and shoreline erosion as a result of marine sand mining can significantly undermine human resilience, meaning the ability to adapt in the face of adversity, trauma or significant sources of stress, to extreme weather events, specifically reduced protection from storms, tsunamis, and waves (American Psychological Association, 2018; Torres et al., 2017). Sand dunes, which are part of the beach system, play an important role as barriers against storms and erosion from waves (Pitchaiah, 2017). Ocean sand mining activities can seriously impact the sand dunes and lead to flooding of coastal lands (Pitchaiah, 2017). Additionally, riverbed sand mining can lead to increased flooding and have serious consequences for those living in the surrounding areas (Torres et al., 2017).

In addition, coastal zones are socioeconomically beneficial, supporting a number of industries including fisheries, tourism and agriculture (Jonah & Adu-boahen, 2016). Many people living along the coastline depend on the surrounding environment for their livelihoods and well-being. Seabed sand mining activities resulting in coastal erosion and increased water turbidity can impact coastal habitats for a number of marine species, in particular fish, and disrupt the activities and livelihoods of small-scale fishers. For example, bottom disturbance as a result of mining in the seabed in the Gyeonggi Bay, South Korea, had a negative effect on fish stocks near the site of extraction, impacting local fishing activities (Hwang, Lee, Choi, Kim & Lee, 2014). Additionally, the degradation of rivers as a result of riverbed mining can seriously

impact crop fields inland (Torres et al., 2017). In Sri Lanka, for example, riverbed sand mining affected drinking water quality and crop production as a result of saltwater intrusion in a number of rivers (Torres et al., 2017).

Furthermore, fisheries and agriculture serve as important sources of food for many people in the surrounding areas. In disrupting the productivity of these industries, seabed and riverine sand mining threatens the food security for a number of people. The Mekong Delta in Vietnam, one of the world's largest deltas, is home to 20 million people and is crucial to food security in Southeast Asia (Beiser, 2018). The delta is the source of half of all the country's food and the majority of the rice that feeds the rest of Southeast Asia as well as being an active area for overall agriculture and animal husbandry (Anthony et al., 2015; Beiser, 2018). As such, human well-being and livelihoods are greatly dependent on the sustainability of the delta.

Since the early 2000s, spurred by increasing development pressures, large-scale riverine sand mining operations have increased in the beds of the Mekong River and its distributary channels in Vietnam and Cambodia. Mining operations along the Mekong delta have caused sand trapping in channel pits leading to the water supply becoming sediment-starved, resulting in delta erosion and increased instability of the delta's shoreline (Kondolf, 1997; Anthony et al., 2015). The issue has received international attention from the media who have noted that in towns and villages all along the Mekong River and other rivers around the country, banks have collapsed into the water, taking farm fields, fish ponds and homes with them (Beiser, 2018). In recent years, thousands of acres of rice farms in Vietnam have been lost and thousands of families have had to be relocated (Beiser, 2018). Furthermore, sand mining leads to increased salt-wedge intrusion and incisions along the channels which damages domestic water supply and increases salinization of cultivated land in the area (Anthony et al., 2015).

As mentioned above, the sand mining industry is also often subject to limited regulation which has led to corruption and illegal mining activities (Torres et al., 2017). With the demand for sand needed to sustain global population and urban growth higher than what is available through legal means, a number of criminal organizations who seek to control and profit from sand smuggling have emerged in at least a dozen countries (Aiyar, 2013; Delestrac, 2013; Beiser, 2015). These criminal groups are stealing sand from beaches and rivers and selling it in the black market for profit (Beiser, 2015).

Considered among the most dangerous and powerful criminal organizations in India, the “sand mafias”, as they have come to be known, are made up of individuals who control both construction companies and administration through their political contacts, making them one of the most impenetrable organized crime groups in India (Aiyar, 2013; Delestrac, 2013). Even a number of officials have been exposed in recent years for their involvement in illegal mining activities, accepting bribes in exchange for allowing groups to smuggle sand across borders (Beiser, 2015). The illicit nature of sand extraction threatens locals who not only depend on beaches and the surrounding environment for their livelihoods, but also risk getting caught in the middle of dangerous activities. In India, the “sand mafias” are reportedly responsible for the deaths of hundreds of people including police officers, government officials, and even ordinary people who advocate against these activities (Beiser, 2015). As such, where industry regulation is limited, illicit sand mining activities may seriously impact human well-being of anyone living in the area.

It is clear from the literature that sand mining does in fact impact human well-being. In many cases, sand mining affects food security and the safety of those living near the sites of extraction. Furthermore, a number of studies touch on the cascading effects from dredging both

in-land in rivers and along the coast. However, current research prompts more questions than it answers. Even in the broad literature examining sand mining in Asia, there remains no analysis of livelihood implications, despite a number of studies alluding to such impacts. This gap is likely exacerbated given the general lack of awareness and invisibility surrounding sand.

2.4 Visibility of Sand

In the past decade, sand mining has emerged as a timely, yet under-researched area of study. For the most part of the 1990s and early 2000s, sand remained nearly invisible. In many parts of Asia, sand plays a critical role in supporting urban development and population growth. It is also important for coastal and river ecosystems and resource-based livelihoods. However, there remains a knowledge gap in terms of the exact magnitude of sand mining and limited global monitoring mechanisms, making it difficult to control the industry. Furthermore, there is a general lack of awareness surrounding sand mining and limited academic literature available.

There is a dire need for further research in the field, yet the issue remains invisible to the public for a number of reasons. First, it is difficult to get a hold on the precise magnitude of the industry given the limited global monitoring mechanisms available. The industry itself continues to grow at such a rate that it is difficult to keep track of the sand trade, especially in the absence of global monitoring of sand extraction as seen in China, Singapore and India. Regulation efforts are few and expensive, especially in developing countries (Popescu, 2018). In countries such as India, researchers argue that the problem is not a lack of legislation, but rather enforcement (Popescu, 2018). The lack of monitoring mechanisms, enforcement, regulatory policies and environmental impact assessments has in many cases led to illegal and corrupt mining activities and undoubtedly contributed to the lack of awareness (Peduzzi, 2014; Torres et al., 2017). The

implementation of a global mechanism to monitor extraction and trade could shed light on the precise magnitude of sand mining and bridge both the current data and knowledge gaps.

The current trends in urbanization and the global boom in construction have also undoubtedly contributed to the mass exploitation of sand. It seems unlikely that sand mining will relent unless the issue is raised to the political level and methods for building with alternative materials are found. The public sector is currently the largest consumer of sand, yet there remains a general lack of awareness of sand mining (Delestrac, 2013). It is therefore crucial to raise this issue to the political level and encourage politicians to come together with scientists, engineers and architects (Delestrac, 2013). Sand itself is a seemingly common and abundant resource yet it is expensive to regulate, which has made it easy to exploit and illegally extract in many cases (Popescu, 2018; Peduzzi, 2014). In many developing countries, regulation is limited and is often established without the necessary scientific understanding of consequences (Peduzzi, 2014). As such, new laws, regulations, proper pricing and taxing and positive incentives based on scientific evidence are needed to discourage large-scale mining operations and encourage the increased use of recycled materials (Delestrac, 2013). These efforts can contribute to increased visibility surrounding sand mining and promote public awareness and action.

In addition, there is limited scientific research available on sand mining. The majority of literature examining sand mining focuses on its environmental implications, yet even this research is limited. The long-term environmental and socioeconomic implications of sand mining remain under-explored. The media has played a critical role remarking on sand mining internationally, yet there remains limited academic research available. This has helped perpetuate the limited visibility surrounding sand mining and the general lack of awareness. Further

scientific and evidence based research is needed to inform decision making at the political level in regards to laws, regulations and policies on sand mining.

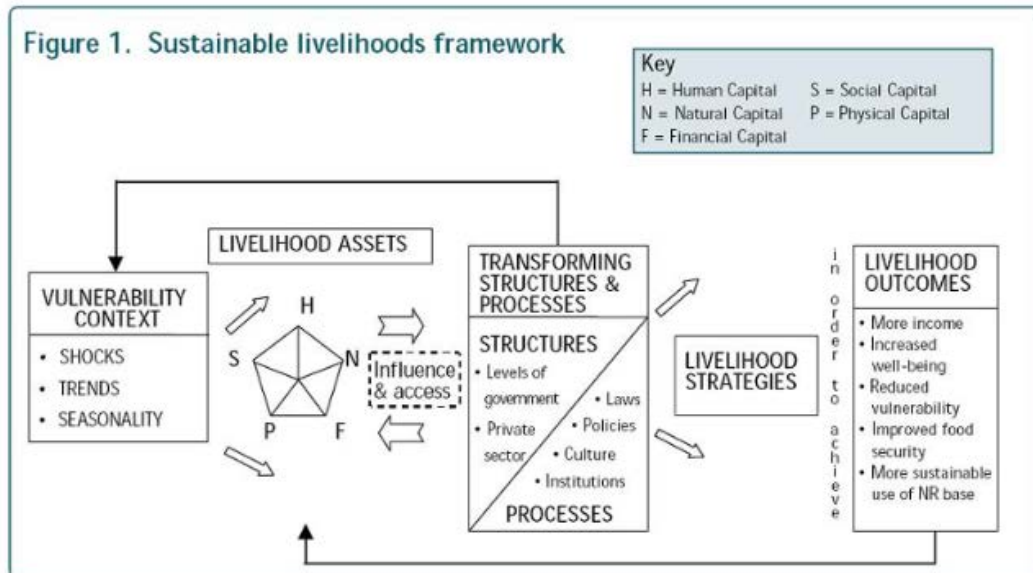
Part 3: Methodology

For my analysis, I will draw upon the commonly used sustainable livelihood framework in order to better understand the implications of sand mining on livelihoods in the Koh Kong province in Cambodia. This framework is useful for understanding how underlying constraints affect rural people's livelihoods and access to livelihood resources as well as understanding the roles and dynamics of rural institutions in providing an enabling environment for sustainable livelihoods. The concept of 'sustainable livelihoods' was first introduced by the Brundtland Commission on Environment and Development and then further expanded by The United Nations Conference on Environment and Development in 1992 (Krantz, 2001). Since then, a number of international agencies have adapted different models/approaches based on the concept (GLOPP, 2008).

One of the most widely used is the model developed by the Department for International Development (DFID) which was first integrated into development practice in 1997 (GLOPP, 2008). The framework is based on Chambers and Conway's definition of livelihoods which states that livelihoods consist of capabilities, assets – both material and social resources – and activities necessary for a means of living (Chambers & Conway, 1991). Livelihoods are considered sustainable when they can cope with and recover from stresses and shocks and maintain or enhance capabilities and assets while providing sustainable livelihood opportunities for future generations (Chambers & Conway, 1991).

The model adapted by DFID (see Figure 5) consists of a variety of capitals or assets – human, natural, social, physical, and financial – interacting with a series of structures and processes, upon which individuals draw to shape their livelihoods and convert them into positive livelihood outcomes (de Haan & Zoomers, 2005; Scoones, 2009). In comparison to other models adapted by CARE and the UNDP, which are used for facilitating planning of concrete projects and programmes, the DFID model consists of a basic framework used primarily for analysis (Krantz, 2001). This approach remains useful for understanding the ways in which livelihoods are dependent on access to specific capitals that interact with institutional processes and structures and how they cope with stresses and shocks in order to produce sustainable livelihood outcomes (Scoones, 2009).

Figure 5: Sustainable Livelihoods Framework



Note: Sustainable livelihoods framework as adapted by DFID (1999a)

However, it is important to be mindful that the sustainable livelihood framework does have some limitations and has come under scrutiny as a result of the complexity of implementing

this framework (Scoones, 2009). The approach itself has been criticized for emphasizing micro-level livelihood capitals and neglecting to account for macro-levels of governance, including politics and power relations at play within society (de Haan & Zoomers, 2005). While the DFID model captures the role of institutions within transforming structures and institutional processes in the wider sustainable livelihoods framework, in actual practice, Scoones (1998) notes that investigating each aspect of the framework with an institutional lens may be insufficient to capture all elements of a sustainable livelihood.

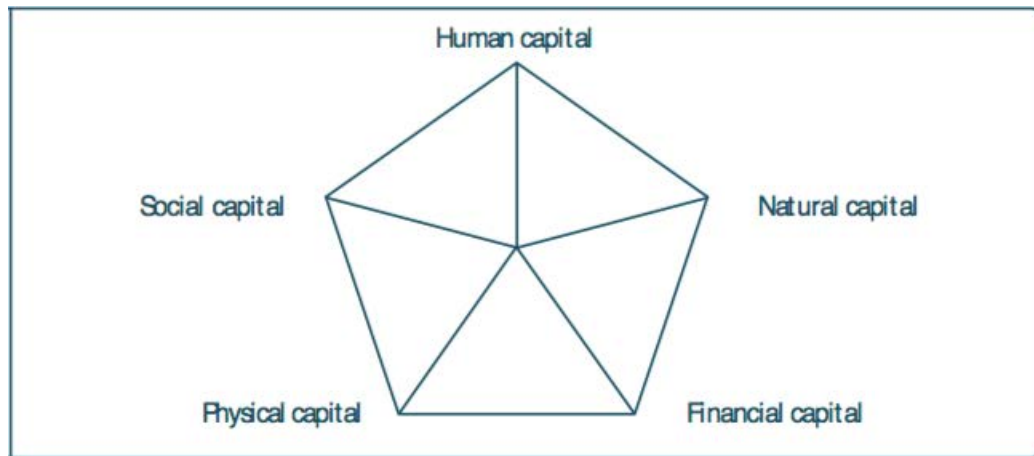
Furthermore, de Haan and Zoomers (2005) argue that power relations are not properly captured within transforming structures and processes within the framework, specifically the various layers of power and how they shape access to livelihood resources. This might include, as referenced in de Haan and Zoomers (2005) ‘power within’, including one’s confidence, ‘power to’, which could include improving one’s skills, ‘power with’, which includes one’s ability to network with others and challenge existing power structures, and finally, ‘power over’, meaning power against domination. While these different layers of power are not captured within the framework, as argued in de Haan and Zoomers (2005), they impact the accessibility of livelihood resources and therefore should be considered.

3.1 Measures

In employing this framework for my case study of Cambodia, my goal is to better understand the underlying resources supporting livelihoods in order to analyze how sand mining impacts these resources. It is for this reason that I have chosen to explicitly draw upon the DFID model, which consists of the variety of capitals or assets, and limit my use to the pentagon of capitals (see Figure 6) as a tool for understanding the dynamic and complex nature of livelihoods

and the resources needed to support them. I have limited the parameters of my analysis to this strand of the framework given the limited scope of this paper and the data available at this time, which will be discussed further during the case study section.

Figure 6: The Asset Pentagon



Note: The livelihood framework identifies five core assets or types of capital. Source: DFID (1999a)

According to the DFID model, people require access to a range of 5 capitals - human, natural, financial, physical, and social (see Table 1 for definitions) to achieve positive livelihood outcomes and this is particularly apparent for poor people who may have limited access to different categories of capitals (DFID, 1999a). As a result they have to come up with innovative ways to combine capitals in order to ensure their survival and/or enhance their livelihoods (DFID, 1999a). It is important to note that the capitals interact in a number of ways and a single capital can generate multiple benefits (DFID, 1999a). The relations between capitals will be further examined for the case study to fully understand how they interact and how they act as the foundation for sustainable livelihoods.

Table 1: Definitions of sustainable livelihood capitals

Capitals	Definitions
Natural	Natural resources stocks such as land, wildlife, forests, water quality
Human	Good health, knowledge, skills and ability to labour
Physical	Basic infrastructure and producer goods such as water, energy, transport, communications and housing
Financial	Financial resources available such as income, savings and access to credit
Social	Social connections which people draw upon such as relationships of trust, networks and connectedness

Source: DFID's sustainable livelihoods guidance sheets (1999a)

This paper is based on a document analysis of secondary sources from newspapers and the media in Cambodia. Document analysis was an appropriate research method for this study for several reasons. First, it was an ideal method for conducting an exploratory study, making it appropriate to study the under researched socioeconomic implications of sand mining.

In addition, the media has played an important role in bringing the voices of those impacted by sand mining in the Koh Kong province in Cambodia to the forefront of the conversation. There is an overall lack of data available from other sources in Cambodia. In many cases, the media can be useful for telling a story, especially when no other data is available (see Schoenberger, 2017). In the Cambodia case, it was through the media that villagers from Koh Kong who earn a living working along the coastline in the sites of extraction were able to share their stories. Given that there has not yet been a detailed academic livelihood analysis examining how the extraction of sand impacts livelihoods, the media has proven essential for building out the story in this paper.

Using the capital pentagon from the livelihood framework as a tool, my aim was to conduct a qualitative media analysis in order to unpack the ways in which sand mining impacted the underlying resources needed to sustain a livelihood. The 38 articles reviewed were selected

from a variety of newspapers (see Table 2), however the majority were from *The Phnom Penh Post*, which until recently, has been one of the leading newspapers following the issue of sand mining in Cambodia. I limited my focus to articles published between 2009 and 2018 given that sand mining first gained attention in Cambodia during this period. The articles selected were those that centered on sand mining in the Koh Kong province. Furthermore, no articles published after March 2018 were selected given the loss of several independent media outlets in 2017 including *The Cambodia Daily* newspaper, and *Radio Free Asia Cambodia* (Schoenberger, Beban & Lamb, 2018) and most recently *The Phnom Penh Post* in early 2018. In addition, 4 interviews featured in the book *Life, Fish and Mangroves: Resource Governance in Coastal Cambodia* (Marschke, 2012) were also selected for analysis given their relevance to the subject.

Table 2: Distribution of selected articles for analysis

Newspaper	Number of Articles
<i>New Internationalist</i>	1
<i>The Phnom Penh Post</i>	17
<i>The Cambodia Daily</i>	5
<i>Khmer Times</i>	1
<i>Christian Science Monitor</i>	1
<i>The New York Times</i>	1
<i>Radio Free Asia</i>	2
<i>IRIN</i>	1
<i>The Guardian</i>	1
<i>The Telegraph</i>	1
<i>Geographical</i>	1
<i>National Geographic</i>	1
<i>BBC News</i>	1
<i>The Associated Press</i>	1
<i>Reuters</i>	2
<i>Transborder News</i>	1
Total:	38

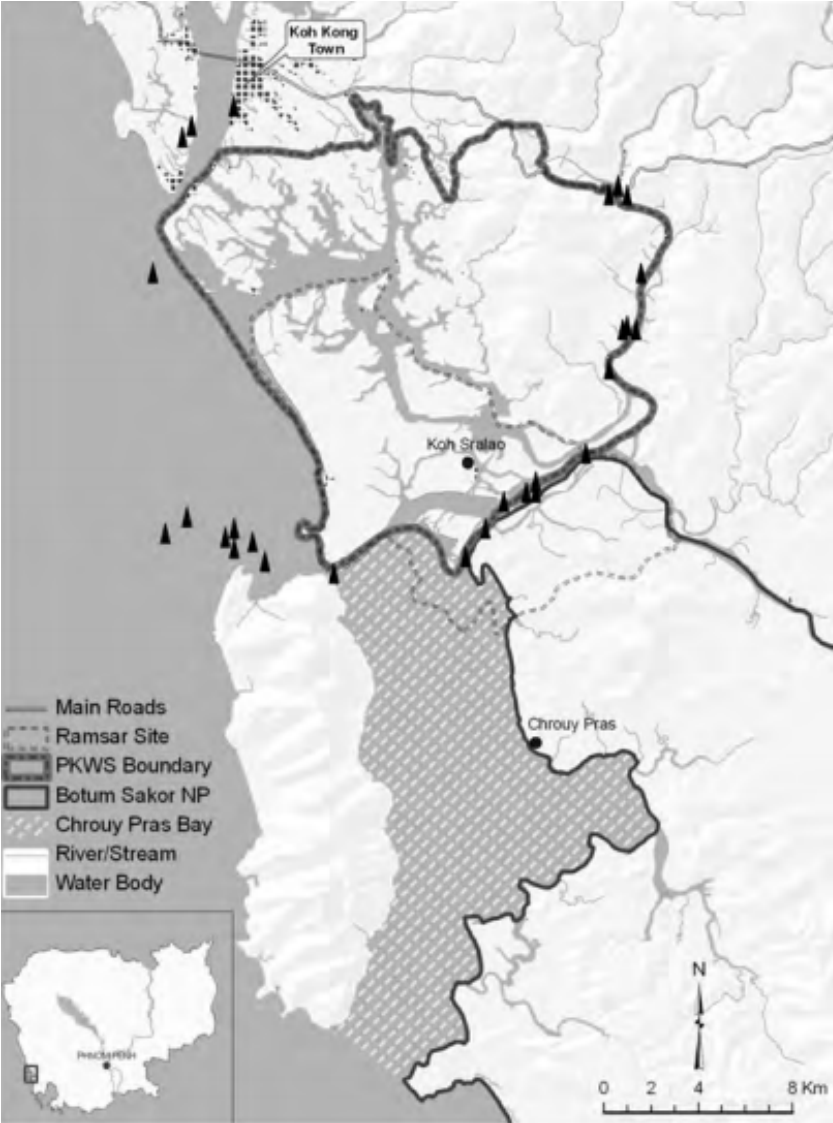
Part 4: Cambodia Case Study

Cambodia is among the largest exporters of sand worldwide with sand mining operations first beginning in 2007 and continuing almost relentlessly well into 2017 (Mother Nature Cambodia, n.d.). With a growing demand for sand from Singapore driving the industry and little to no enforcement of regulation in many areas of the country, Cambodia's coastal provinces became the epicentre of corrupt, ecologically and socially devastating sand mining operations. After years of remaining nearly invisible, sand mining came under heavy international scrutiny in 2016 from both environmental organizations and the media, in particular the environmental network Mother Nature Cambodia. These organizations argued that the past decade of sand mining has had serious environmental implications in Cambodia, ranging from, but not limited to, coastal erosion to habitat destruction (Mother Nature Cambodia, n.d.; Thompson, 2017). Furthermore, large-scale operations along the coastline and inland in rivers, resulting in the loss of fish and crab populations as well as beaches, were detrimental for local livelihoods and ecotourism in the surrounding areas (Mother Nature Cambodia, n.d.).

This section will examine Cambodia as a case study for analyzing the impacts of sand mining on livelihoods. Cambodia, specifically the Koh Kong province, was chosen as the case site for analysis given how it exemplifies the ways in which sand mining has remained nearly invisible for the most part of the past decade. As a result, there has not yet been a detailed analysis examining the socioeconomic implications of sand mining in the country. This section will first provide an overview of sand mining in Cambodia, linking it to Singapore's increasing demand in order to understand the reasons why sand, despite its value as a commodity, managed to remain nearly invisible for the most part of a decade. This will be followed by the main analysis of this paper, which seeks to examine the socioeconomic implications of sand mining,

specifically on livelihoods in the Koh Kong province in Cambodia which has been the site of major sand mining operations in the country (see Figure 7).

Figure 7: Map of sand dredging sites within the Koh Kong province



Note: Sand dredging sites (black triangles). Map adapted from Global Witness (2010) and Marschke (2010) field observations. Source: Marschke (2012)

4.1 Linking Singapore to Cambodia

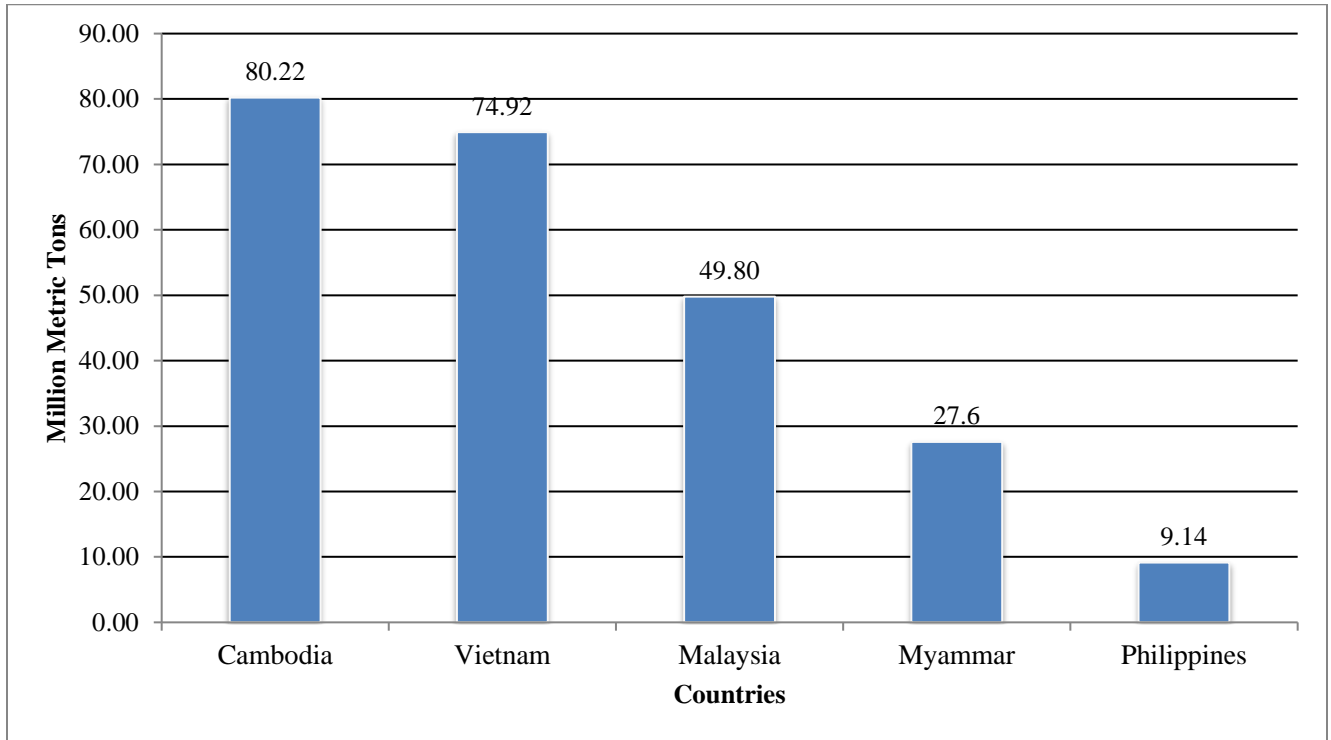
As mentioned, Cambodia first came under international media attention and scrutiny in 2016 in relation to its controversial exportation of sand to Singapore. Remarkably, despite its relatively modest size and coastline, Cambodia is one of the top ten global exporters of sand, most of which is imported by Singapore (Thompson, 2017). Singapore, the largest importer of sand worldwide, has been using sea sand for land reclamation projects and construction over the past 40 years and shows no signs of slowing down (Comaroff, 2014; Peduzzi, 2014). Singapore's choice to construct buildings using resource-intensive concrete rather than using other materials such as steel or glass has also driven the increased demand for sand (Marschke, 2012).

Having exhausted its own reserves, Singapore has turned to its surrounding countries in search for new deposits of sand (Global Witness, 2010). However, as Singapore's demand for sand increased, it has proved more difficult to find sources of sand. Since the late 1990s, a number of surrounding countries have either ceased or limited their exports of sand to Singapore (Global Witness, 2010). Malaysia first ceased shipments of sand to Singapore in 1997¹, while Indonesia followed suit and instituted a similar export ban in 2007 after claims that several of its Riau Islands had disappeared (Comaroff, 2014). Since then, trade moved primarily to Cambodia, Vietnam, and Myanmar (see Figure 8). In 2009, Vietnam also suspended dredging operations² amid increasing environmental concerns (Comaroff, 2014). While Cambodia announced a moratorium on the export of river sand in 2009 (Global Witness, 2010), export licenses for sea sand were issued along Cambodia's coastline, primarily in the Koh Kong province, until 2017.

¹ However, evidence from UN Comtrade suggests that the cease of shipments has not been effective as Malaysia continues to export sand to Singapore (UN Comtrade, 2017).

² Again, evidence from UN Comtrade suggests this did not have an impact as Vietnam continues to export sand to Singapore (UN Comtrade, 2017).

Figure 8: Singapore Sand Imports, 2007 – 2016



Note: Data from Singapore sand imports from 2007 – 2016 from United Nations Comtrade: International Trade Statistics (2017)

Large-scale mining operations first began in the Koh Kong province in 2008, which would eventually become the epicentre for sand mining in the Cambodia (Global Witness, 2009). Most operations began in the estuarine systems in western Koh Kong and the sea off the coast of southern Cambodia where sand was then exported to Singapore for use in construction and land reclamation (Global Witness, 2009). Throughout 2009 and 2010, sand mining expanded along Cambodia’s coastline and in October 2009, it was publicly announced that 14 companies had been given concessions in Koh Kong, Preah Sihanouk and Kampot provinces (Global Witness, 2010). The monthly extraction rate for the L.Y.P. Group concession area alone was an approximate 300,000 tonnes in 2009 (Global Witness, 2010). Environmentalists estimate that more than 500 million tons of sand has been removed from Koh Kong's estuaries and sent to

Singapore since 2009 (Murdoch, 2016). When sand mining began in 2009, the annual value of trade from Koh Kong was an estimated US\$248 million in value in Singapore (Global Witness, 2010).

From the time that sand mining operations first began in the Koh Kong province, they continued almost relentlessly until the moratorium in 2017 with clear disregard for environmental and socioeconomic implications, while communities tried their best to work around the activities. Despite local efforts to lobby against the government, advocacy work remained ineffective until recent years. The issue of sand mining first gained attention when Global Witness, an international environmental NGO, published two reports in 2009 and 2010, one exposing the ways in which Cambodia's elite had captured the country's extractive industries (Global Witness, 2009) and the other examining how Singapore's demand for sand is driving the industry in Cambodia (Global Witness, 2010). While both reports received some media attention, the issue largely fell on deaf ears and sand mining operations did not stop in Koh Kong.

Countrywide media exposure on sand mining began in 2016 when Mother Nature Cambodia released documents exposing discrepancies in the country's trade figures, suggesting Singapore had imported far more sand than Cambodia had reported. (Mother Nature Cambodia, n.d.). The UN Commodity Trade statistics highlighting these discrepancies proved essential this time, as several international media outlets including *The Guardian* and *The Economist* picked up the issue. While the Ministry of Mines and Energy (MINE) announced a temporary halt on sand mining in Koh Kong in November 2016 in response to these claims, villagers noted that sand-dredging boats continued to appear off the coast of the province following the ban (Sineat

& Amaro, 2017). Finally, in July 2017, the MINE announced an official ban on the export of sand, ending the sale of sand to Singapore (Thul, 2017).

4.2 Political Economy of Sand Mining in Cambodia

Given the sheer scale of sand mining operations in Cambodia and scrutiny from civil society and the media, it is hard to imagine how sand mining remained nearly invisible for the most part of a decade. With the growing industry and increasing demand for sand reflecting rapid urbanization and the need for space, regulation and enforcement of sand mining proved difficult in Cambodia. In many cases, this has led to exploitation and environmental degradation as the industry is often subject to corruption and illegal mining (Torres et al., 2017). Regulation of coastal sand mining is limited in Cambodia and a number of discrepancies have been found in the country's trade figures in relation to sand exports leading to accusations of fraud and corruption on behalf of the government (Thompson, 2017). Furthermore, the government has been accused of granting sand mining licences to members of the ruling elite and, in a number of cases, failing to conduct the necessary environmental or social assessments prior to granting licenses (Global Witness, 2010).

It has become clear that there is a complete lack of transparency and accountability in the industry, which has helped cover up corrupt activities and facilitate increased mining, even in protected areas in Cambodia (Global Witness, 2010). In 2016, Mother Nature Cambodia released documents exposing the government of Cambodia's fraud and tax evasion in relation to the country's sand exports (Mother Nature Cambodia, n.d.). A number of discrepancies had been found in relation to the country's trade figures (see Tables 3 and Table 4) whereby the majority of sand that had been exported to Singapore was not recorded in official government documents

(Mother Nature Cambodia, n.d; UN Comtrade Statistics, 2017). Out of US\$776 million worth of sand Singapore reported importing from Cambodia, the Cambodian government had only recorded exporting US\$5.5 million or 0.7 percent (Thompson, 2017; UN Comtrade Statistics, 2017). Table 5 quantifies the discrepancies between both datasets based on the import and export logs from Cambodia and Singapore. Overall, there was a US\$771 million discrepancy according to the trade figures from both countries (UN Comtrade Statistics, 2017). These findings point to an overall lack of transparency and fraud relating to the amount of sand being exported from Cambodia. Limited regulation and the absence of global monitoring mechanism helped facilitate indiscriminate mining in Cambodia.

Table 3: Sand exports from Cambodia to Singapore, 2007 - 2016 (as reported by Cambodia)

Period	Trade Flow	Reporter	Partner	Commodity Code	Trade Value (US\$)	Net weight (Weight in kilogram)
2007	Export	Cambodia	Singapore	250590	\$149,602.00	30,245,800
2008	Export	Cambodia	Singapore	250590	\$1,281,673.00	707,197,600
2009	Export	Cambodia	Singapore	250590	\$1,819,656.00	932,774,800
2010	Export	Cambodia	Singapore	250590	\$588,462.00	269,600,000
2011	Export	Cambodia	Singapore	250590	\$708,774.00	377,675,000
2012	Export	Cambodia	Singapore	250590	\$457,647.00	206,920,000
2013	Export	Cambodia	Singapore	250590	\$405,713.00	186,585,033
2014	Export	Cambodia	Singapore	250590	\$70,884.00	32,400,000
2015	Export	Cambodia	Singapore	250590	\$28,694.00	11,000,000
2016	Export	Cambodia	Singapore	250590	\$41,507.00	14,800,000

Note: Data for sand exports from Cambodia to Singapore from 2007 – 2016 as reported by Cambodia, from United Nations Comtrade: International Trade Statistics (2017)

Table 4: Imports of Cambodian sand into Singapore, 2007 - 2016 (as reported by Singapore)

Period	Trade Flow	Reporter	Partner	Commodity Code	Trade Value (US\$)	Net weight (Weight in kilograms)
2007	Import	Singapore	Cambodia	250590	\$2,655,817.00	124,173,672
2008	Import	Singapore	Cambodia	250590	\$60,827,906.00	3,846,458,112
2009	Import	Singapore	Cambodia	250590	\$221,469,366.00	13,430,422,528
2010	Import	Singapore	Cambodia	250590	\$62,036,552.00	4,263,020,544
2011	Import	Singapore	Cambodia	250590	\$90,897,549.00	7,600,799,744
2012	Import	Singapore	Cambodia	250590	\$69,286,517.00	6,677,181,680
2013	Import	Singapore	Cambodia	250590	\$80,485,820.00	9,709,735,328
2014	Import	Singapore	Cambodia	250590	\$127,635,680.00	16,937,916,800
2015	Import	Singapore	Cambodia	250590	\$36,073,253.00	10,967,644,160
2016	Import	Singapore	Cambodia	250590	\$25,630,531.00	6,569,671,040

Note: Data for sand exports from Cambodia to Singapore from 2007 – 2016 as reported by Cambodia, from United Nations Comtrade: International Trade Statistics (2017)

Table 5: Discrepancies in sand trade figures between Cambodia and Singapore, 2007 - 2016

Period	Commodity Code	Trade Value Discrepancy (US\$)	Net Weight Discrepancy (Weight in Kilograms)
2007	250590	\$2,506,215.00	93,927,872
2008	250590	\$59,546,233.00	3,139,260,512
2009	250590	\$219,649,710.00	12,497,647,728
2010	250590	\$61,448,090.00	3,993,420,544
2011	250590	\$90,188,775.00	7,223,124,744
2012	250590	\$68,828,870.00	6,470,261,680
2013	250590	\$80,080,107.00	9,523,150,295
2014	250590	\$127,564,796.00	16,905,516,800
2015	250590	\$36,044,559.00	10,956,644,160
2016	250590	\$25,589,024.00	6,554,871,040

Note: Data for sand trade discrepancies from 2007 – 2016 as reported by Cambodia and Singapore, from United Nations Comtrade: International Trade Statistics (2017)

Two individuals, Senator Mong Reththy and Senator Ly Yong Phat, primarily control Cambodia's sand mining industry, further highlighting its corruption. Both are senators of the ruling Cambodian People's Party (CPP) with close ties to Prime Minister Hun Sen (Global Witness, 2010). Mong Reththy and Ly Yong Phat own Mong Reththy Group Co. Ltd., and L.Y.P. Group Co. Ltd., two businesses accused of breaking national laws and forcibly evicting local residents to make way for land development and sand mining projects in Koh Kong (Global Witness, 2010). The Mong Reththy Group Co. Ltd. was first granted a sand-dredging license for the Prek Thmor Rieng area of Sre Ambil, in Koh Kong in September 2009 (Radio Free Asia, 2010). Similarly, the L.Y.P. Group had initially been issued licenses by Cambodia's Ministry of Industry, Mining and Energy in 2007 and 2008 for operation in the Sre Ambil, Ta Tai, and Koh Por rivers in Koh Kong (Radio Free Asia, 2010). Additionally, in July 2009, just months after the government had issued a nationwide ban on sand dredging in rivers, L.Y.P. Group Co. Ltd. received special permission from the Committee for Sand Resources Management to resume sand operations for export, leading to further accusations of corruption (Radio Free Asia, 2010). Given the lack of transparency in relation to concession allocation, it is not clear why and how certain companies were given lucrative opportunities and special permissions, in particular L.Y.P. Group Co. Ltd, over others.

The government of Cambodia has also been accused of granting dredging licences without following legal requirements to carry out the necessary environmental impact assessments (EIAs) and social assessments (Titthara & Pye, 2015). Activists from the NGO Mother Nature Cambodia had long claimed that two other companies dredging in Koh Kong, International Rainbow Company Ltd. and Direct Access Ltd., began dredging without first examining potential impacts on habitats and fishing communities (Titthara & Pye, 2015;

Sengkong & Kossov, 2016; Penna, 2016). While The Phnom Penh Post was able to obtain an EIA from 2009 as well as a 2013 study conducted by International Rainbow Company Ltd., there were a number of discrepancies in the findings (Sengkong & Kossov, 2016). According to the Phnom Penh Post, part of the EIA admitted that large-scale dredging operations could negatively impact fishing communities, which comprise a large part of the province's population (Sengkong & Kossov, 2016). Furthermore, fishers living on Koh Kong's estuaries denied that the companies adequately interviewed them in regards to environmental implications, contradicting the EIA, which stated that communities had been consulted (Sengkong & Kossov, 2016; Penna, 2016). Overall, evidence suggests that the villagers were largely removed from the process and rarely consulted by the organizations.

Part 5: Livelihood Analysis

Sand plays a crucial role in sustaining the livelihoods of local fishers who are dependent on the coastal waters for their fishing grounds. In a number of small communities in Koh Kong, sand mining affects the distribution of fish and crab populations, impacting migration routes as a result of increased water turbidity (Marschke, 2014). It is also damaging to mangrove-estuary areas, in many cases ripping out trees and further destroying aquatic habitat (Marschke, 2014). Despite the value of sand for traditional livelihoods, this has often been overlooked in favour of its production value as a commodity for export.

For the most part of the past decade, little attention was given to understanding the ways in which villagers were directly and indirectly impacted by the mass extraction of sand in the province. Only once environmental organizations and the media began investigating sand mining in Koh Kong were local people brought to the forefront of the controversy and given a voice to

share their stories. Through the media, local villagers have been able to tell their stories and speak of the ways that sand mining has dramatically altered their lives in Koh Kong. However, even with emerging media coverage, there has not yet been a detailed and thorough analysis examining the full implications on livelihoods in Koh Kong.

As mentioned in the methodology section, I intend to draw upon the sustainable livelihoods framework to examine the direct and indirect socioeconomic impacts of sand mining on livelihoods in the Koh Kong province. I will draw upon the pentagon of capitals in order to understand how local villagers living in Koh Kong depend on the livelihood resources available to them and the ways in which sand mining has impacted these resources. Capitals are considered the building blocks of a sustainable livelihood, they help individuals and households cope with the challenges they encounter and help them meet their needs on a sustained basis (Vibrant Communities Canada, 2011). The framework draws attention to the 5 capitals (natural, physical, human, social and financial), which contribute to making a livelihood sustainable and to ways in which they are interdependent (Vibrant Communities Canada, 2011).

5.1 Findings

This section is based upon findings from a qualitative media analysis of the 38 articles from selected media and 4 interviews from the book, *Life, Fish and Mangroves: Resource Governance in Coastal Cambodia* (Marschke, 2012) detailed in the methodology section. In analyzing each of the articles and interviews, my aim was to examine the ways in which sand mining impacted local livelihoods from a local perspective, by identifying how sand mining has impacted livelihood resources (i.e. capitals) of those living in Koh Kong. Table 6 includes the breakdown of the articles by year of publication and the number of times an implication on a livelihood capital was identified in an article during that year. It is clear that the majority of

articles analyzed made reference to the ways in which sand mining operations in Koh Kong impacted aspects of natural capital, in particular the natural resources, such as fish and land, needed to sustain local livelihoods. Furthermore, the impacts on livelihood capitals are more pronounced following 2014 as media exposure increased and the implications of sand mining became increasingly apparent. A full analysis of each article using the sustainable livelihood framework as a tool can be found in Appendix A.

Table 6: Capitals identified in articles based on year of publications

	Year of Publication									
Capitals	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Natural	I	III	III	III			IIII	IIIIII	IIIIII IIIII	II
Financial		I		I			II	III	II	
Social		I	I	I			IIII	IIII	IIII	
Physical	I			I				I	I	
Human		I		I			I	III		

Note: The table includes a break down of articles by year of publication and the 5 livelihood capitals from DFID's sustainable livelihood framework.

5.2 Natural Capital

The majority of villagers interviewed in the articles identified the ways in which sand mining impacted natural capital, specifically the quantity and quality of resources available including land and wildlife. Many of the people living in coastal communities in the Koh Kong province are dependent on fisheries and the availability of fish and crab populations to earn their

livelihoods (Marschke, 2012). In the absence of these resources, the livelihoods of fishers are greatly impacted.

Hum Saroeun, a fisher from Koh Kapi, noted that most of the villagers depend on fishing to earn a living (Hul Reaksmey, 2015). Since mining operations first began in the Koh Kong province many fishers argued that catches have decreased significantly. One fisher, Som Chhorn, noted how four years ago, the family would pull in a 20 kilogram catch a day, in comparison to today where Chhorn brings back just 5 kilograms if he is lucky (Turton & Seangly, 2016). “Before, I spent less on petrol and caught a lot of fish; now I spend a lot on petrol and catch less fish,” according to Chhorn (Turton & Seangly, 2016). Another fisher, Hie Nary, stated that four years ago his family would get about 20 kilograms a day, while “today, we have about 3 kilograms” (Turton & Seangly, 2016). Similarly, fisher Matt Sen said before dredging began, he could net 100 kilograms in just two hours, however after two years of dredging, he would regularly spend up to seven hours on the water for catches of 2 kilograms or less (Strangio & Sokheng, 2010).

According to many fishers the decrease in fish and crab populations is a direct result of habitat destruction from sand mining in the province. One fisher living in Koh Kong, Phen Sophany, noted that the water level dropped from 2 metres prior to dredging to 5 to 8 metres in some areas resulting in a decrease in crabs given that they need shallow water for breeding (Harbinson, 2017). One of the reasons for this is that dredging upstream leads to muddy water flowing downstream, killing the crab populations who are unable to live in the dirty water (Harbinson, 2017). While another villager, Mut Sopha, a community representative from Koh Salao village in the Koh Kong district, noted that sand dredging “affects the community

nearby...when they start washing the sand, [the] water will get dirty and [will] kill life in the water” (Sineat & Amaro, 2017).

These claims were echoed by a number of villagers in Koh Kong, including Vey Van Ning, a fisher who said that dredging near his village had completely decimated his fishing prospects because of increased turbidity in the water (David, 2015). He claimed that “the water is so dirty now and there [were] less fish” (David, 2015). This is quite common during the process of sand extraction, whereby sediments are released into the water through the overflow system and in other cases intentionally released during a screening and washing process, thereby increasing turbidity (Desprez et al., 2010). This leads to increased mud content and contaminants in the water, reducing transparency and water quality, thus affecting the habitat for a number of aquatic species (Jiang et al., 2013). As a result of habitat loss of aquatic species, fishers are no longer able to earn a living.

Other fishers noted the impact of sand mining on vital mangrove forests in the province arguing that mining had caused lines of mangroves to collapse into the water (Turton & Seangly, 2016). Mangrove forests are home to a variety of aquatic species such as shrimp and crabs who seek refuge in the muddy bottom feed on mangrove leaves and home to a number of endangered species, including royal turtles and Irrawaddy dolphins (IDRC, 2011; Marschke, 2012; Rathavong, 2017). The mangroves are important for ecotourism in the area and materials from the forests are often used for food, fuel, medicine and building tools (IDRC, 2011). Without the mangrove forests, the livelihood security of many villagers is at risk.

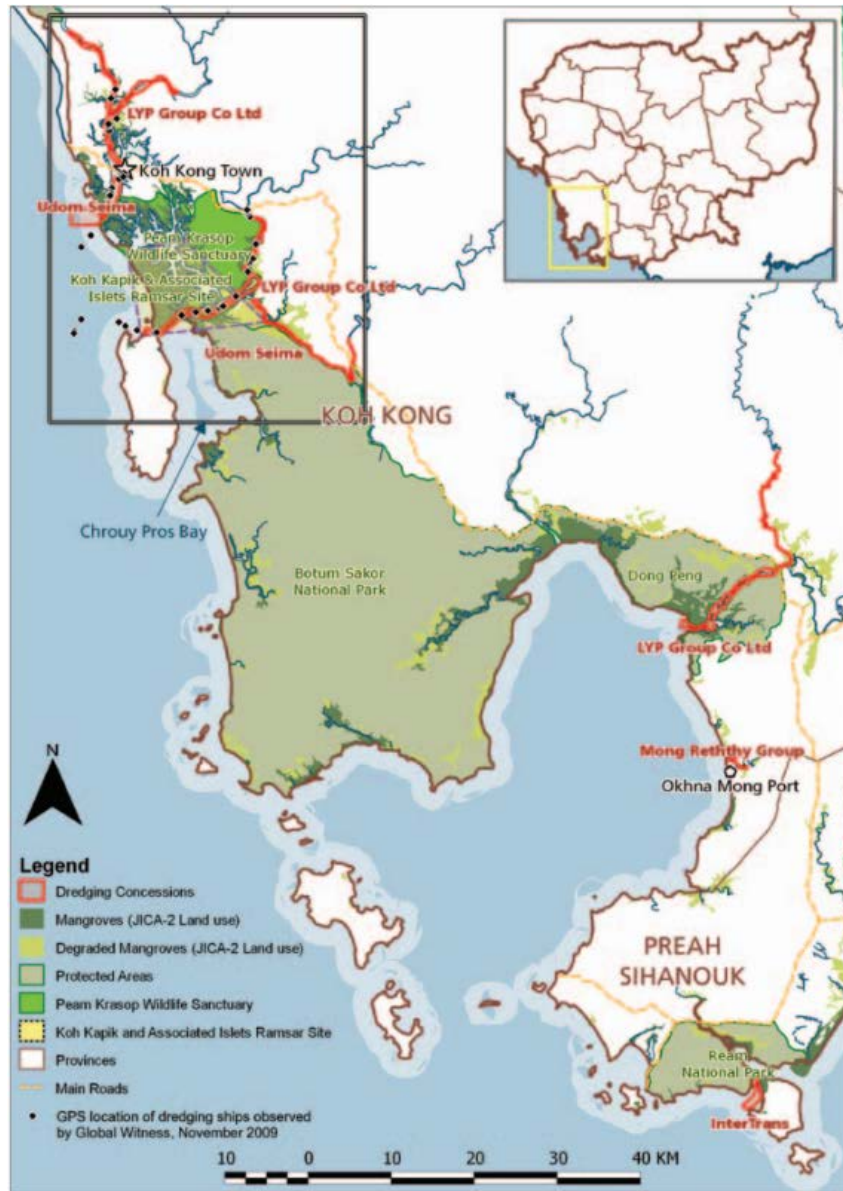
When asked about the impact of sand mining on mangrove forests, Sun Mala, an environmental activist from Mother Nature Cambodia, said the “mangrove forest is a habitat for

aquatic lives, if the dredging barges came and disgorging tonnes of sands, their habitats and spawning ground are destroyed; how would they survive and our fisheries are impacted” (Transborder News, 2016). One fisher, Hum Saroeun, stated that International Rainbow was just one among many dredging companies that had been working around Koh Kapi for the past 10 years in the mangrove forests and argued that “[the] big ships pump out sand and cause the mangrove trees to fall down” (Hul Reaksmeay, 2015). Tourism operators and representatives of communities affected by the dredging in Koh Kong have also claimed the operations caused the release of foul smelling gasses that threatened mangrove ecosystems (Sokha & Boyle, 2011).

Companies were also found illegally dredging in protected areas (see Figure 9) including Koh Kong’s Peam Krasaop Wildlife Sanctuary, which is protected under the Ramsar Convention (Penna, 2016) and encompasses mangroves that are among the world's last intact ecosystems of their kind (Strangio & Sokheng, 2009). However, at least 2 hectares of flooded mangrove forest in the Peam Krasaop Wildlife Sanctuary were filled with sand from illegal dredging nearby according to Oul Rann, director of the sanctuary (Seangly, 2017).

Additionally, activists from Mother Nature Cambodia and locals claimed that a company was dredging within the protected Tatai Wildlife Sanctuary in Koh Kong, despite the ban on sand exports from companies operating in coastal areas (Amaro & Seangly, 2017). Fisher In Sophany said sand dredging vessels were spotted in the vicinity of a sand-processing facility located inside the Tatai Wildlife Sanctuary and while he had not seen dredging during the day, he had seen piles of sand at the facility, leading him to believe dredging was happening at night (Amaro & Seangly, 2017).

Figure 9: Sand Dredging in Protected Sites in Koh Kong



Note: Sand dredging sites and protected areas in the Koh Kong Province in Cambodia from Global Witness:

Shifting Sand (2010)

5.3 Financial Capital

Not only does sand mining impact the natural capital local residents living in the Koh Kong province need to sustain their livelihoods, it also indirectly impacts their financial capital,

primarily their source of income. Given that many villagers earn a living fishing, as the fish and crab populations decrease as a result of sand mining, so do their incomes. According to Louk Pou, a fisher from Koh Sralau in Koh Kong, before dredging operations began, he would earn more than \$50 a day fishing from his boat (Arsenault, 2016). However, now his daily income is less than \$10 a day and he can no longer afford to send his children to school; claims echoed by a number of other villagers (Arsenault, 2016).

Similarly, Thy Rya, a villager from Koh Sralav, noted that her husband had to leave Koh Sralav in order to find work elsewhere because he could no longer earn an income from fishing (Penna, 2016). Before the dredgers arrived, Thy noted that her fisher father could make the equivalent of \$12 a day, however after dredging operations began, their family income had decreased to a small fraction of that (Penna, 2016). You Samith, a broker also working in Koh Sralav told interviewers that “in the past, I used to buy about 10,000 baht³ [about \$283] of produce a day, now it’s about 1,000 baht,” he says, adding that he personally knew at least 30 to 40 people who left to Thailand in search of income opportunities (Turton & Seangly, 2016).

Other villagers talked about how they could no longer earn an income from fishing as a result of sand mining leaving them heavily in debt, with one resident, Hie Nary, telling interviewers that she was \$3000 in debt (Turton & Seangly, 2016). These claims were echoed by other villagers including Ek Sophal, who noted "families are borrowing a lot of money and going into debt because there isn't enough fish" (Arsenault, 2016), while villager Khieu Khit stated that most of the fishers in the area were in debt (Turton & Seangly, 2016).

³ The Thai baht is the official currency of Thailand.

5.4 Physical Capital

While the majority of articles examine the implications of sand mining on natural and financial assets, sand mining also impacts physical capital, including basic infrastructure and the tools and equipment needed for production. Several of the villagers in the Koh Kong province noted the impacts of sand mining on their equipment thereby making it difficult for them to fish and earn an income. According to some fishers, dredging machines and sand barges would dump all of their waste directly into the river leaving “sticky oil” that covers their nets and in some cases breaks them, making it impossible to fish (Arsenault, 2016). Other fishers have stated that sand mining has caused infrastructure in surrounding areas to collapse thereby impacting their means to go fishing (Beiser, 2017). Similarly, fisher Mat Sok told the interviewer “[there] are now more people interested in our fishing grounds . . . bigger fishing boats and barges that carry sand . . . and sections of my nets are destroyed each year” (Excerpts from interviews as cited in Marschke, 2012, p. 57).

Tith Seour, a 48 year-old fisher angling off the coast of Koh Kong, also worried how sand mining had impacted the ground on the shoreline and what would happen in the absence of sand to protect villages from big waves (Strangio & Sokheng 2009). He stated “[for] ocean fishermen, I am concerned there will be big waves when the ground surface collapses due to the dredging of the sand” (Strangio & Sokheng, 2009). This is a valid concern given that sand mining can often lead to coastal and shoreline erosion that can significantly undermine human resilience to extreme weather events, specifically reduced protection from storms and waves (Torres et al., 2017).

5.5 Human Capital

A number of the articles reviewed also identified the ways in which sand mining impacts human capital, for example one's health, skills and ability to work. Poor health or lack of education are often regarded as core dimensions of poverty and thus can adversely impact one's livelihood (DFID, 1999a). A number of people living in the province spoke of the ways in which sand mining was directly affecting their ability to work and their food security and thus indirectly their health. A study conducted by the FAO in 2013 in Cambodia found that fish provide around 75% of national animal protein intake and thus play an important role as a source of food for many people living in Koh Kong (FAO, 2013).

Hum Saroeun, a fisher from Koh Kapi, argued that sand mining was killing off the vital fish and crab habitat that the community has depended on for decades as a source of food, stating that “we have relied on the coast for the past 30 years to feed ourselves” (Hul Reaksmeay, 2015). Other fishers echoed these claims speaking to the importance of fish as a source of food for communities in Koh Kong. According to Thith Kun, fish is an important source of food and without it “[it] is really difficult to live. I have four children and I do not know how to feed them” (Penna, 2016). Similarly, fisher Matt Sen attested to the importance of fish to his family as a source of nutrition in order to properly function in their daily lives stating “[our] daily living condition depends on the sea, and when the sea becomes polluted we will die” (Strangio & Sokheng, 2010).

Others talked about the livelihood security of fishers in Koh Kong threatened by sand mining and the employability prospects of fishers in villages that no longer have any fish. One fisher, Mat Sok, stated “[my] children need to do something else, but I do not know what else

they can do here" (Excerpts from interviews as cited in Marschke, 2012, p. 57). While others discussed the ways in which sand mining indirectly affects student's school participation and thereby their ability to learn new skills. According to Lim Sophorn, a grade 9 teacher in Koh Kong, "[when] the fishing drops off, some students drop out to help their parents" and are unable to complete their secondary education (Turton & Seangly, 2016).

5.6 Social Capital

Finally, my analysis also looked at the implications of sand mining operations in the Koh Kong province on social capital. Social capital refers to the social resources and bonds that connect individuals including networks and connections within communities, access to wider institutions, relationships of trust and common rules and sanctions (DFID, 1999b). It is important to consider the role social capital plays in achieving other capitals in many cases. In the fishing communities in Koh Kong, social capital facilitates co-operation among fishers and community members. It encourages people to invest in collective activities, meaning they will be less likely to engage in unfettered private actions that result in negative impacts such as resource degradation (DFID, 1999b). It can be argued that sand mining activities in Koh Kong indirectly impacted the social bonds and norms that once supported livelihoods of fishers in a number of ways.

First, sand mining led to the formation of certain associations or groups between powerful individuals and corporations who controlled mining operations in the province. This resulted in the active exclusion of many small-fishers from these groups who no longer had access to the resources they needed to sustain their livelihoods and did not benefit from sand mining profits. For example, according to Sun Mala, an environmental activist working in Koh

Kong, villagers no longer had access to the fish and crab populations while the profits of sand mining did not reach impacted communities (Transborder News, 2016). Mala stated that “[villagers’ lose] their natural resources and livelihoods while the government and company get all profits- the impacted fishing families did not get royalties. This is a lack of justice and accountability” (Transborder News, 2016). This exemplifies how sand mining led to the formation of groups trying to monopolize specific opportunities to their own advantage at the expense of others.

Local villagers also spoke of the lack of trust in authority figures as a result of corrupt activities. It could be argued that the associations between sand mining companies and the ruling elite meant greater influence over legislation and policy in favour of these companies and at the expense of local fishers. For example, several sand mining companies were accused of granting dredging licences without following legal requirements to carry out the necessary environmental impact assessments (EIAs) and social assessments (Titthara & Pye, 2015). Activists from the NGO Mother Nature Cambodia claimed that companies such as International Rainbow Company Ltd and Direct Access Ltd began work without studying the impact on habitats and fishing communities (Titthara & Pye, 2015; Sengkong & Kossov, 2016; Penna, 2016). As mentioned, communities living on Koh Kong’s estuaries denied that they had been adequately interviewed by the companies regarding environmental impacts despite the companies saying they had (Sengkong & Kossov, 2016).

Additionally, in July 2009, just months after the government had issued a nationwide ban on sand dredging in rivers, L.Y.P. Group Co. Ltd. received special permission from the Committee for Sand Resources Management to resume sand operations for export, leading to accusations of corruption (Radio Free Asia, 2010). The connections between sand mining

companies and the ruling elite favoured companies and facilitated the over-extraction of sand to the detriment of local fishers and the resource itself.

Similarly, others spoke of the ways in which they no longer had faith in the justice system. You Samon, a fisher from Koh Sralov, told reporters “[we] don’t know what else to do; we protest and the problem gets worse, they put people in jail... I’m afraid for when the sand dredgers come back; no one will help us dismiss them, because they put the activists in jail” (Turton & Seangly, 2016). Another local resident, Pha Sophea, also spoke of the ways in which authorities were abusing their power and preventing residents from protesting sand mining (Sotheary, 2015). Sophea stated that the police had blocked a bridge leading to the provincial capital making it impossible for the residents to speak to Koh Kong Governor Bun Leut in regards to illegal and damaging sand mining operations in the province (Sotheary, 2015). These sorts of associations between organizations controlling sand mining and local authorities exemplify how sand mining resulted in connections that were the foundation of exclusion and coercion of locals.

Finally, it could also be argued that sand mining companies adversely impacted connections and networks between villagers by hiring local fishers as security guards (Pheap, 2015) According to local residents, Direct Access hired 10 fishers for \$10 per day to work as security guards for the barges, which many believed was the company's strategy to divide the community members (Pheap, 2015). In doing so, companies were able to break connections between villagers through the inclusion of some but not others, coercing some villagers into harmful social arrangements that will likely impact their livelihoods should companies leave the area.

5.7 Discussions

The asset or capital-based aspect of the sustainable livelihood framework is useful for understanding the implications of sand mining on livelihood resources, even without conducting a full sustainable livelihood analysis. In order to understand the impacts of sand mining on the livelihoods of local fishers as a whole, we first have to understand what makes their livelihood sustainable. In its simplest form, the framework views people operating in a context of vulnerability, and within this context, people have access to different livelihood resources (or combinations of ‘capitals’) (Majale, 2002). According to the framework, combinations of capitals are required for pursuing different livelihood strategies and identifying these combinations of capitals is a key for analysis (Scoones, 1998). Based on the analysis above, being a successful fisher requires, in most circumstances, access to natural capital (e.g. fish and water, etc.) combined with financial capital (e.g. earning a regular income), social capital (e.g. social networks within fishing communities; trust in authority figures to ensure continued access to resources), physical capital (e.g. tools and fishing equipment such as nets etc.) and human capital (e.g. ability and skills in order to successfully fish).

The availability and access to these capitals would therefore impact one’s livelihood strategies, i.e. the ways in which people combine and use these capitals in pursuit of livelihood outcomes that meet their own livelihood objectives (Majale, 2002). Furthermore, the availability of these resources may also be enhanced or adversely undermined by additional institutional policies and processes, which is captured within the wider framework (Majale, 2002), but not in my analysis. Implications on the accessibility and availability of these capitals would therefore undermine the sustainability of one’s livelihood as seen among fishers in Koh Kong.

This paper is limited to understanding how sand mining activities impact the accessibility and availability livelihood resources that support local fishers. While it is clear that sand mining does impact livelihoods, there is a limited data set available for analysis and restrictions in the scope of this paper. It is for this reason that I have explicitly chosen to only draw upon the asset pentagon to inform my analysis in order to understand how the impacts of sand mining on livelihoods resources, while cognizant that a thorough livelihood analysis using the complete framework is not possible at this point given the limited data set available.

It is clear from my analysis, in limiting my parameters of focus on the pentagon of capitals, other areas, for example the role of transforming structures and processes, are not captured. While the government clearly played a role in facilitating sand mining, the actual ways in which laws and politics are understood, from a local perspective, to have impacted access to livelihood resources are not captured within the media analysis. Furthermore, in using the pentagon of capitals focused through a sand mining lens, I did not examine other aspects that may have impacted livelihood decline. For example, other factors that may impact fish stocks and therefore the livelihoods of small-scale fishers or factors impacting income decline such as a lack of employment opportunities.

It should also be noted that there are a number of other aspects missing from the media available and, therefore, from my analysis. This is a result of both limited media sources and articles available and of what is captured within the capital aspect of the sustainable livelihood framework based on the parameters I have chosen for my research. One aspect missing from the analysis is a consideration of gender. Through my analysis, it became clear that the majority of the media articles examine sand mining implications on small-scale fishers, given that this is the

main livelihood of many people living along the coast in Koh Kong (Marschke, 2012; FAO, 2013), and that the majority of fishers were men. Women are not usually involved directly in fishing and instead take part in post-harvest activities in part because of gender constraints within societies (Marschke, 2012; FAO, 2013). In a 2013 study conducted by the FAO in Cambodia, results showed that women had less time as a result of domestic household obligations as well as a lack of confidence in holding managerial positions which impacted their participation as fishers (FAO, 2013). As such, my epistemological framework does not significantly capture women nor does the data available for analysis, making it difficult to understand how sand mining may impact the livelihoods of men and women differently.

My analysis is also primarily concentrated on the household level as the sole unit of analysis rather than the individual level. Again this has to do with the lack of data available at this time that examines the local perspective on sand mining in Koh Kong at the individual level. While some of the articles look at the individual level, the majority of them look at the impacts of sand mining on families as a whole, rather than disaggregating between men, women and different age groups. This has some limitations in itself as I have failed to account for intra-household inequalities in the control of finances, interests, opportunities, and decision-making, which often have gendered dimensions/implications (Krantz, 2001). This plays into the gender aspect as the struggles women face as a result of sand mining may not be properly understood if they are considered subordinate members of households (Krantz, 2001).

Finally, it should be noted that there are limitations in using secondary data alone for my analysis. In conducting a content analysis, I am cognizant that this is only a purely descriptive method. I did not conduct fieldwork nor speak directly with villagers from Koh Kong. Secondary

data describe what is happening as a result of sand mining but not necessarily the underlying motives for the observed patterns and behaviours. Furthermore, as mentioned, the analysis is limited by availability of material, which in this case was limited primarily to independent media articles.

Part 6: Conclusions

6.1 Overview

Findings from my analysis suggest that sand mining in the Koh Kong province has greatly affected both the accessibility and availability of resources needed to sustain the livelihoods of fishers in the province. As such, it has impacted their ability to cope with and recover from stresses and shocks and maintain or enhance their capabilities and resources (Chambers & Conway, 1991) thus affecting the sustainability of their livelihoods. Based on the media analysis, most of the fishers interviewed had not diversified their livelihood activities and were primarily dependent on fishing to earn a living. As a result of sand mining activities in the province, fishing is a less feasible employment option for many villagers and a lack of skills in other areas further prevented fishers from diversifying their activities. As such, the effects of sand mining activities were seen by many as detrimental to their livelihoods, forcing villagers who were unable to adapt to leave the province to find work elsewhere.

The purpose of this paper was to demonstrate the dire need for research on sand mining. There is a huge need for such research in a rapidly urbanizing world yet hardly anyone is talking about sand. The need for sand will continue to increase in response to rapid population and urban growth around the world, especially in Asia. Given the sheer size the industry, sand mining has certainly not received the academic attention that it commands. The majority of literature on

sand mining examines its environmental implications while hinting to the cascading socioeconomic impacts for those living near the sites of extraction. Yet, no detailed livelihood analysis exists. The limited research and literature available has undoubtedly contributed to the lack of awareness surrounding sand mining.

Furthermore, limited global monitoring mechanisms and the absence of an overarching body of authority has made it difficult to regulate and enforce the legal extraction of sand. This has led to exploitation and illegal mining in many places, which has helped perpetuate the invisible nature of sand. Further evidence-based research is needed to bridge the knowledge gap and inform new laws, regulations and policies on sand mining.

6.2 Opportunities

Given the limitations identified through the literature review and my analysis, it is clear that further research centered on the implications of sand mining on livelihoods in the Koh Kong province is direly needed. Media articles have provided a starting point that has brought a local perspective on sand mining as an object of study to the forefront of the conversation, after nearly a decade of little consideration from the government in Cambodia. It is clear that sand mining has in fact impacted the livelihoods of local fishers living along the coastline in Koh Kong and there are opportunities for further analysis in this area. However, it should be noted that given the recent shut down of independent media in Cambodia, opportunities for this type of research using secondary data are limited in this aspect moving forward. That being said, academic research has an opportunity to become a stronger channel through which sand mining and its implications on livelihoods are studied.

Furthermore, in drawing upon the pentagon on capitals of the sustainable livelihood framework, my goal was to better understand the ways in which sand mining impacts the availability and accessibility of livelihoods resources that act as the foundation for a sustainable livelihood. From my analysis of the secondary data available, I have concluded that there are a number of ways in which sand mining has impacted the availability and accessibility of these resources, however this is only a starting point. The sustainable livelihood framework could be applied to its full extent, because as Scoones (1998) points out, it is insufficient just to analyze the different aspects of livelihood resources and strategies as separate elements. It is equally important to analyze the institutional processes and organizational structures that link these various elements together (Scoones, 1998).

A thorough analysis at the individual level that disaggregates between men, women and different age groups is also needed in order to understand how sand mining impacts men, women and children differently in Koh Kong. From here, there is the opportunity to determine possible points of intervention, which as Krantz (2001) points out, might include direct support to assets (i.e. access and availability of assets) and support to effective functioning of institutional structures and processes that influence both access to assets as well as the ways in which they are used by people.

There is also an opportunity for researchers to look at the potential positive implications of sand mining in both Cambodia and a global context. While this paper unpacks the adverse impacts of sand mining on livelihoods, it would also be interesting to see if and how sand mining has led to the creation of employment opportunities near extraction sites and if there have been any positive socioeconomic impacts from mining. Some of the media articles mentioned how

sand mining companies had employed fishers in Koh Kong. Further research is needed to understand how the extraction of sand could have positive socioeconomic impacts if managed sustainably.

Finally, Cambodia is only one piece of the puzzle. At the global level, sand mining continues to increase and shows no signs of relenting. There remains a gap in knowledge and general lack of awareness of sand mining in the broader context. As sand mining begins to gain more traction through media exposure, there is an opportunity for academic researchers to capitalize on this exposure and unpack the implications of sand mining in a global context. As mentioned, academic research can help to bridge the knowledge gap and inform policies regarding the sustainable management of sand at the global level. This research is timely and necessary in order to ensure the prosperity and sustainability of sand as a resource for generations to come.

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Appendix A

	Material	Title	Author	Date	Summary	Capitals
	<p>Red = natural capital (environmental resources) Blue = physical capital (infrastructure, tools equipment) Green = human capital (ability) Orange = financial capital (stable source of income) Purple = social capital (relationships of trust)</p>					
	Article / New Internationalist	Meet those fighting sand-dredging in Cambodia	Rod Harbinson	01-Jun-17	<p>Fisher Lim Lon noted that many of the small islands in the Koh Kong province had been lost to sand dredging and that Sweetheart Island was the only remaining Island to fish for crab. Author noted that dead mangroves where the river bank had collapsed as a result of dredging. A farmer complained that his riverside fields had receded 20 metres from erosion since the arrival of the dredgers.</p> <p>Fisher, Phen Sophany, noted that the water level dropped from 2 metres prior to dredging to 5 to 8 metres in some areas resulting in a decrease in crabs (because they need shallow water for breeding). Dredging upstream leads to muddy water flowing downstream, killing the crab populations who are unable to live in muddy water.</p> <p>By 2015, dredging was hitting the community hard. Catches were down, and many families had taken out high-interest loans from loan sharks to stay in business. Others 'collected water snails in the mangroves, but now there are no snail stocks'. Some quit crab fishing altogether to seek work in the new economic zone factories in Koh Kong city, a two-hour boat ride away.</p> <p>In April Mother Nature's activists also discovered that construction of a sand-washing facility was under way deep inside a national protected area. Since then, fishers have noted that some of the fish and dolphins have begun to return to Koh Sralao since the halt on sand dredging. However they have noted that some of dredging boats remain in the area.</p>	Natural capital, Financial capital
2	Article/ The Phnom Penh Post	Dredging boats spotted off Koh Kong	Yon Sineat and Yesenia Amaro	03-Jul-17	<p>Villagers noted that sand dredging boats had been spotted off the coast of Koh Kong, prompting fears that they were set to begin operations, despite a standing ban on sand exports from companies operating in coastal areas. Mut Sopha, a community representative from Koh Salao village in Koh Kong district, went to the site yesterday and saw the sand dredging equipment and the boats stationed there. She noted that "It affects the community nearby . . . When they start washing the sand, [the] water will get dirty and [will] kill life in the water." She also noted that dredging could destroy nearby mangrove forests.</p>	Natural Capital

3	Article/ The Phnom Penh Post	Flooded mangrove forest filled in with sand from illegal dredging	Phak Seangly	21-Dec-17	<p>At least 2 hectares of flooded mangrove forest in Koh Kong’s Peam Krasaop Wildlife Sanctuary were filled in with sand from illegal dredging nearby in December 2017. The activities took place close to a crab-raising field, according to Oul Rann, director of the Peam Krasaop Wildlife Sanctuary.</p> <p>Huot Heng, deputy commune chief of Stung Veng commune, claimed that about 2 hectares of mangrove had been filled in with sand, but he was unable to estimate the total land size. He claimed the area had been sold multiple times, but the current owner does not live in the commune.</p> <p>Hak Bora, head of the Khemarak Phumin town land management office, said officials would not “dare” issue any land titles for that land because it’s in the coastal area. Sok Sokhom, director of the Cambodia National Research Organization, a local NGO monitoring mangroves in coastal areas, said there are still many cases of mangrove land grabs, including seven cases in Koh Kong, alone.</p>	Natural Capital
4	Article/ The Phnom Penh Post	Official shares locals’ concerns of dredging	Sen David and Martin de Bourmont	08-Mar-17	<p>In March 2017, an excavator, machine parts and metal structures appeared on islands in the Tatai River in Koh Kong province arousing suspicions among local conservationists that a company intends to launch a sand-dredging operation in the Tatai Wildlife Sanctuary.</p> <p>MINE Secretary of State Meng Saktheara said that while companies had expressed interest in the area, none were currently licensed to dredge there.</p>	Natural Capital
5	Article/ The Phnom Penh Post	Koh Kong probing filling in of mangrove forest	Phak Seangly	20-Feb-18	<p>Provincial officials are investigating the illegal filling of a mangrove forest in Peam Krasaop Wildlife Sanctuary in the Koh Kong province. Sok Sothy, deputy provincial governor, said the sand dredging and filling in of the area are both illegal, as neither the Ministry of Mines and Energy nor the Ministry of Environment have given out permits for such activity in the area. The 2 hectares filled in are part of a more than 1,000-hectare “community zone” – a protected area where residents can still live and cultivate the land – inside the wildlife sanctuary.</p> <p>Alex Gonzalez-Davidson, the co-founder of NGO Mother Nature, said the practice of filling in mangrove forests to sell them to the highest bidder has been taking place for years. However he noted that this skam is remarkable given that it is taking place inside a legally protected zone.</p>	Natural Capital

6	Article/ The Cambodia Daily	Sand Extraction in Koh Kong Province Halted, Ministry Says	Khuon Narim	17-Nov-16	<p>The Cambodia Ministry of Mines and Energy noted in November 2016 that sand mining activities had been suspended in the Koh Kong province in response to the scrutiny from civil society organizations in response to discrepancies in the country's trade export figures. Numbers from the U.N. Commodity Trade Statistics Database (Comtrade) show that the rest of the world—almost entirely Singapore—reported importing over 60 million metric tons more sand than Cambodia reported to have exported from 2005 to last year.</p> <p>Mr. Saktheara, a ministry spokesperson, suggested that irregularities might mask illicit trade involving countries that had banned sand exports, such as Malaysia and Indonesia. The differing figures might be due to “smuggling from other countries that could include Cambodia to Singapore,” he said. Ships “could do some smuggling using the Cambodian flag if we see statistics showing many ships that used Cambodian flags, but were not from Cambodia.”</p>	Social Capital
7	Article/ Reuters	Cambodia digs into sand mining industry as beaches and crabs vanish	Chris Arsenault	03-Nov-16	<p>Local fishermen have complained that dredgers have been stealing the shore beneath their boats on an industrial scale. According to Louk Pou, a fisherman on Koh Sralau, an island that is a hotspot for sand extraction 300 km west of Cambodia's capital Phnom Penh, "Seven beaches have already disappeared because of the mining".</p> <p>Residents in the village say that sand dredging has plunged their once reasonably prosperous fishing community into poverty. Before dredging operations began, Pou said he earned more than \$50 a day fishing for crab from his small motorboat. Now his daily income is less than \$10, and he can no longer afford to send his children to school - complaints echoed by other villagers." There have been big changes in fish stocks here," said fisherman's wife Neak Sopheap.</p> <p>Local residents say that fish and crab stocks have plummeted since dredging operations began in the early 2000s. Dredging machines and sand barges dump their waste directly into the river leaving a "sticky oil", which covers their nets, and has decimated crab populations.</p> <p>According to one fisherman's wife, Neak Sopheap, "the land has been disappearing and some of the mangrove forests have collapsed". Her neighbour, Ek Sophal, was in agreement, noting that "families are borrowing a lot of money and going into debt because there isn't enough fish".</p>	Natural Capital, Financial Capital, Physical Capital

8	Article/Christian Science Monitor	Cambodia's villagers lose ground – literally – to Singapore's expansion	Michele Penna	21-Oct-16	<p>Singapore, the largest importer of sand worldwide, has been using sand for its land reclamation projects. Cambodia has rushed to meet the demand, exporting millions of tonnes of sand to Singapore, at the expense of local fisherman and one of the Southeast Asia's largest mangrove forests.</p> <p>In the Koh Sralav district, sand dredgers have deepened the shallow estuaries around the village, creating strong currents which have eaten away at the riverbanks, destroying long stretches of mangrove. As a result, the crabs and fish that once lived among the mangrove roots, the mainstay of most family economies around here, have disappeared.</p> <p>Thy Rya, a young woman in the village noted that her husband had to leave Koh Sralav in order to find work elsewhere. “My husband could not find crabs anymore, so he went to work as a construction worker in Koh Kong city”. Before the dredgers arrived, she recalls, her fisherman father could make the equivalent of \$12 a day. By the time her husband left, their family income had decreased to a small fraction of that.</p> <p>The dredgers are more active further east, in Andong Toek, where barges and excavators churn up the river right in front of local peoples’ houses. According to one resident, Thith Kun, the water has become slick with oil and there are hardly any fishing boats remaining in the area. In addition, he noted that catches had been down 90 percent adding that “All the fish and crabs are gone.” “It is really difficult to live. I have four children and I do not know how to feed them.”</p> <p>Those living in the Koh Kong province have similarly been affected by sand mining operations. It is not clear why mining companies were allowed to dredge for sand in mangrove forests that are protected under the Ramsar Convention, nor did it appear that the mining companies followed legal requirements to carry out environmental impact assessments (EIAs) before they began dredging. Villagers noted that they were not consulted before dredging began and once they complained, they were told that whether or not they agreed, they would be mining for sand regardless.</p>	Natural Capital, Financial Capital, Human Capital
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9	Article/ The Phnom Penh Post	Koh Kong sand dredging impact studies due	Bun Sengkong and Igor Kossov	17-Feb-16	<p>The Ministry of Mines and Energy plans to release the environmental impact assessments of two controversial sand-dredging companies in Koh Kong according to Ministry spokesperson. Activists from NGO Mother Nature have long claimed that International Rainbow Company Ltd and Direct Access Ltd began work without studying the impact on habitats and fishing communities.</p> <p>In 2016, the Post obtained an environmental impact assessment for International Rainbow from 2009 as well as a 2013 study conducted directly by International Rainbow. Parts of that report admitted that large-scale dredging operations can negatively impact fishing communities, which comprise a big part of the province's population. Nonetheless, the report concluded that dredging is a net positive for the province.</p> <p>Co-founder of Mother Nature NGO, Alex Gonzalez-Davidson cited the opinion of hydrologists and marine biologists interviewed by his NGO, saying that the notion that estuaries can naturally carry too much sand is an “outright fallacy”. Communities living on Koh Kong’s estuaries have denied that the companies have adequately interviewed them about environmental impacts, according to Mother Nature member Thun Rotha. This contradicts the EIAs’ and Bunsear’s assertion that communities have been consulted.</p>	Natural Capital, Social Capital
10	Article/ The Cambodia Daily	Koh Kong Fishermen Resume Anti-Sand-Dredging Campaign	Aun Pheap	13-Aug-15	<p>Approximately 100 fishermen in the Koh Kong province protested against Direct Access, a company they accuse of illegal sand dredging. The Mother Nature NGO and fishing community accuse Direct Access of dredging too deep, causing pollution, riverbank collapses and a drop in fish and crab stocks. According to the NGO, local villagers used boats to try to chase excavators from the estuary. Direct Access had hired about 10 local fishermen, who told Mother Nature that they were each being paid \$10 per day to work as security guards for the barges in case things turned violent. The NGO believes the company's strategy is to divide the community members.</p> <p>According to the Mines and Energy Ministry, it was determined that Direct Access was not conducting illegal activities and that they were dredging based on their license, not dredging deeper than their contract stipulated. NGO Mother Nature refuted these claims.</p>	Natural Capital, Social Capital

11	Article/ The Cambodia Daily	Fishermen Kept From Sand Dredging Forum	Aun Pheap	05-Aug-15	<p>Since April 2015, activists and villagers have been attempting to stop Rainbow International and Direct Access from dredging the Andoung Toek estuary. They claim the dredging has caused pollution, riverbank collapses and the destruction of fish stocks. District governor Orn Virak said they had collected testimony from about 250 villagers who attended the forum, and would send a report to the Mines and Energy Ministry, which will decide whether to renew Direct Access' license when it expires on August 19 2015.</p> <p>Mr. Sovichea, the activist, said that while no dredging was taking place in Kandorl commune, fishermen there were still losing money because fish and crab populations were disappearing.</p>	Natural capital, financial capital
12	Article/ The Phnom Penh Post	Activists talk dredging woes	Send David	04-Aug-15	<p>Activists and villagers have called on the government to address controversial dredging activities in Koh Kong's Botum Sakor district, as environmental and social impacts continue to take their toll on the surrounding areas and communities. Vey Van Ning, a fisherman who hails from the affected area, said that dredging near his village has completely decimated his fishing prospects and has caused his earnings to go down. He stated that the water has become dirty affecting the fish population. "The water is so dirty now, and there is less fish," he said. "We depend on fishing for a living, but now with [less] fish, our incomes are also less."</p> <p>Seventeen dredging boats and 41 transportation vessels are said to be working the area, creating environmental issues and causing river banks to collapse. Cambodia National Rescue Party lawmaker Son Chhay has sent a letter to Prime Minister Hun Sen stating that two companies were found dredging with the wrong techniques in prohibited locations.</p>	Natural Capital, Financial Capital, Social Capital

13	Article/ The Phnom Penh Post	Villagers protest sand dredging	May Titthara and Daniel Pye	24-Apr-15	<p>Villagers from Koh Kong province’s Koh Kapi commune petitioned the National Assembly’s Environment Commission to raise in parliament an ongoing dispute over sand dredging, two weeks after local NGO Mother Nature began protests against a company they accuse of destroying the environment. You Sophal, one of seven community representatives who came to the capital yesterday, called on Commission Chairman Pol Ham to intervene against the Vietnamese-owned International Rainbow Company arguing that their sand dredging activities was affecting the environment, biodiversity and fisheries in the area.</p> <p>Alex Gonzalez-Davidson, co-founder of Mother Nature argued that the dredgers were operating without a licence and even in the case where companies had one, they had not conducted the necessary assessments of the environmental and social impacts.</p>	Natural Capital, Social Capital
14	Article/ The Cambodia Daily	Fishermen Claim Victory Against Sand Dredgers	Hul Reaksmeay	13-Apr-15	<p>70 residents of Koh Kong province worked together to chase away sand-dredging barges they accused of operating illegally around Koh Kapi island and damaging vital fishing grounds. Villagers tied their motorboats to 12 barges and 8 sand transport boats working near the island until the crews agreed to leave. The villagers continued tying their boats to offending vessels until all the dredgers left the area.</p> <p>According to Sun Mala, co-founder of NGO Mother Nature, the ships all belonged to the International Rainbow company and one of the crewmen showed him a copy of its dredging license on a mobile phone. According to the electronic copy the license had expired in February 2015 and was not valid for Koh Kong district’s Koh Kapi commune.</p> <p>One of the fishermen, Hum Saroeun, said that International Rainbow was just one among many dredging companies that had been working around Koh Kapi for the past 10 years. He argued that "The big ships pump out sand and cause the mangrove trees to fall down," and that they were killing off the vital fish and crab habitat that the community depends on. He said “We use nets to catch crabs, and we have relied on the coast for the past 30 years to feed ourselves.”</p>	Natural Capital, Social Capital, Human Capital

15	Article/ The Phnom Penh Post	Premier orders review of marine dredging	Cheang Sokha and David Boyle	12-Jul-11	Prime Minister Hun Sen yesterday ordered a review of marine dredging operations, warning the practice must be strictly monitored or it could devastate Cambodia's islands and beaches. The premier also said seawater dredging could affect the livelihoods of people in the area. Tourism operators and representatives of communities affected by the dredging have claimed the operation had decimated fish stocks, caused river banks to collapse, scared away tourists and released foul smelling gasses that threatened mangrove ecosystems.	Natural Capital
16	Article/ Khmer Times	Sand mining stopped in Koh Kong	Ven Rathavong	13-Jul-17	Sand mining and exports from Koh Kong province have been banned permanently according to a directive issued by the Ministry of Mines and Energy in July 2017. Ministry spokesman Meng Saktheara said the government had suspended all sand export licences in the province after re-evaluating the environmental and social impact on river systems. Working with CSO to assess sand mining in the Koh Kong province, results showed that the province was unable to support large-scale dredging. According to Mr Saktheara, sand mining in Koh Kong posed a risk to the habitats of critically endangered wildlife, including royal turtles. It also caused riverbanks to collapse and harmed mangrove forests, as well as damaging the livelihoods of local communities.	Natural Capital
17	Article/ The Phnom Penh Post	Fishermen fresh air dredge fears	Sebastian Strangio and Vong Sokheng	06-Jan-10	Villagers in Koh Kong province continue to suffer from large-scale sand-dredging operations in coastal estuaries, which they say have reduced fish catches and threatened the livelihoods of thousands of local fishermen. Un Thanann, provincial coordinator for local rights group Adhoc, said that 1,200 families from Village 4 in Koh Kong's Dong Tung commune had filed two complaints with local authorities since October 2009 in regards to mining operations. Fishermen in the village say that there are no more fish, and villagers need more petrol to travel farther to fish so they have to spend more money. Set Vannak, a coordinator for the rights group Licadho, said that in numerous interviews with fisherman in different villages, he heard complaints that dredging had churned up the riverbeds and polluted the water. Oil from the ships polluted the water causing the fish to disappear. Fisherman Matt Sen, 46, from Village 4, said that two years ago he could net 100 kilograms of fish in just two hours, but that now he regularly spends up to seven hours on the water for catches of 2 kilograms or less. "Our villagers here have been seriously impacted by the sand dredging," he said. "Our daily living condition depends on the sea, and when the sea becomes polluted we will die."	Natural Capital, Human Capital

18	Article/ The Phnom Penh Post	Fresh Sand Controversy	Alex Willemyns and Mech Dara	02-Jan-17	<p>According to Indian customs data, Cambodia exported more than 108,000 tonnes of sand to India in 36 separate shipments between 2013 and 2015. This contradicts Cambodia data which states no sand had been exported to India during that time. The Indian customs data, which were obtained by environmental group Mother Nature, records 36 shipments of sand from Cambodia from 2013 to 2015 with a total of 108,658 tonnes of sand worth \$2.6 million. In comparison, data from Cambodia's Commerce Ministry only recoded sand exports to five countries: Singapore, Thailand, Taiwan, Vietnam and South Korea. A total of 455,000 tonnes – worth \$2.47 million – was exported to those places. This has led to accusations of illegal exportation of sand from environmental organizations.</p> <p>Most of the sand exported from Cambodia comes from along the coast of the Koh Kong province. In April 2013, close to \$1.5 million worth of sand was dredged there and quarantined in India for six months. The Mines Ministry has recorded 14 firms, including International Rainbow Co Ltd and Diamond Sun Co Ltd, exporting coastal sand between 2007 and 2015, and 14 companies as having exported river sand in that period, despite the ban on the export of river sand.</p>	Social Capital
19	Article/ The New York Times	The World's Disappearing Sand	Vince Beiser	23-Jun-16	<p>Sand is the third most used natural resource in the world - behind water and air. It is the foundation making modern life and construction possible. However we are beginning to run out. That's mainly because the number and size of cities are exploding, especially in the developing world. Every year as the global population continues to increase, there are more and more people moving to cities. Since 1950, the world's urban population has ballooned to over 3.9 billion from 746 million. To build cities, people are pulling untold amounts of sand out of the ground. Usable sand is a finite resource. Desert sand generally doesn't work for construction because it is too fine. We have exhausted all surface sand extracts and have moved on to stripping riverbeds, floodplains and beaches to get the sand we need.</p> <p>People have turned to fishing villages in the mangrove-rich estuaries of Cambodia's Koh Kong province for sand. For years, villagers have complained that rampant sand mining is wiping out the crabs and fish that provide their living. Locals have had to send members to work in Phnom Penh garment factories, or have simply moved away because they were unable to make a living in the village once the fish and crab disappeared. The dredging also threatens endangered native dolphins, turtles and otters.</p>	Natural Capital

20	Article / Radio Free Asia	Dredging Threatens Environment	States News Service	12-May- 10	<p>As fish stocks and crab harvests have been substantially reduced since the arrival of dredging vessels, local villagers and fishermen are losing their means for making a living.</p> <p>Senators Ly Yong Phat and Mong Reththy own L.Y.P. Group Co. Ltd. and Mong Reththy Group Co. Ltd., the two companies most responsible for the sand dredging impact in Cambodia according to Global Witness. According to Global Witness both owners maintain a number of business interests in Cambodia that break national laws and have led to the forcible evictions of local residents to make way for land development projects</p> <p>On July 24 2010, just months after prime minister Hun Sen announced the nationwide ban on sand dredging, L.Y.P. Group Co. Ltd. received permission from the Committee for Sand Resources Management to resume sand operations for export. According to Ly Young Phat, the operations were justified because of the constant threat of flooding that local inhabitants face from high coastal waters.</p>	Natural Capital, Social Capital
21	Article/ IRIN	Sand dredging prompts fishermen's protests	IRIN Asia English Service	15-Jul- 10	<p>Fish are the primary source of income for residents in a small southwestern town in Cambodia, however in the area were sand dredging vessels mine for sand, the fish have all disappeared. "When they were dredging a lot, we stopped bothering to even go out since it was not possible to catch anything," Dol Sareem, a 60-year-old fisherman, told IRIN. "In those months, we caught half as much fish."</p> <p>Dredging extracts sand below the sea floor, disturbing marine life and, more significantly, the spawning grounds that replenish it. Dredgers remove 25,000 tons of sand each day from the Cambodian seas to export primarily to Singapore. Global Witness valued a year's worth of Cambodian sand at US\$250 million on the Singapore market.</p> <p>The Global Witness report, Shifting Sands, says the industry lacks transparency and government regulation, and could severely damage marine ecosystems essential to the livelihoods of many fishing communities.</p>	Financial Capital, Natural Capital

22	Article/ The Guardian	Sand mining: the global environmental crisis you've probably never heard of	Vince Beiser	27-Feb-17	<p>Industrial scale sand mining is having negative environmental and ecological impacts worldwide. Its causing local wildlife to die and infrastructure to collapse. Fey Wei Dong is a villager working in a fishing village on Poyang Lake, China's biggest freshwater lake and a haven for millions of migratory birds and several endangered species. Dredging activities in the area are impacting the millions of animals that live there. Poyang Lake hosts millions of cranes, geese and storks during the cold months – as well as several endangered and rare species. It is also one of the few remaining habitats for the endangered freshwater porpoise. Studies have found that the sediment stirred up and the noise generated by sand boats interfere with the porpoise's vision and sonar so drastically they cannot find fish and shrimp to feed on. And there are fewer fish to be found in the first place, say locals.</p> <p>According to local fishermen "The boats are destroying our fishing areas". The dredging destroys fish breeding grounds, muddies the water and tears up her nets. These days, she says, she's lucky to make £1,200 a year. "I've been fishing here for 30 years, and there are fewer and fewer fish," says Tan Jung Hwa, another local fisherman. He's taken to working part-time on the sand boats because he can't earn enough otherwise. Closer to shore, in places such as coastal Cambodia, dredging threatens important mangrove forests, seagrass beds and endangered species like Irrawaddy and spinner dolphins, and the royal turtle.</p>	Natural Capital, Physical Capital
23	Article / The Telegraph	Singapore sand demand damaging Cambodia environment	Neil Chatterje	11-May-10	<p>According to Global Witness report, Cambodia's sand-dredging industry threatened endangered species, fish stocks and local livelihoods, despite the government's May 2009 ban on sand-dredging.</p> <p>The report said Singapore was the world's largest importer of sand in 2008 and has used sand imports to increase its landmass by 22 per cent since the 1960s. It said this development has wreaked havoc on the region's coastlines, with Malaysia, Vietnam and Indonesia having all announced bans on sand dredging for export due to environmental concerns.</p>	Natural Capital
24	Article / Geographical	A line in the sand: mining a scarce resource	Laura Cole	09-Sep-17	<p>Cambodia has stopped selling its sand overseas in response to increasing pressure from environmental organizations. These groups have argued that selling sand, mostly to Singapore to sustain its rapid development, is having negative impacts on local coastal communities and ecosystems. Overall, sand is becoming a scarce resource that has been identified as an emerging issue for the global economy and the environment.</p>	Natural Capital

25	Article/ The Phnom Penh Post	Koh Kong sand exports permanently banned after volume discrepancies	Yesenia Amaro and Phak Seangly	12-Jul-17	<p>The Ministry of Mines and Energy has permanently banned sand exports from Koh Kong province – eight months after it imposed a temporary ban following controversy over large discrepancies found in sand export figures to Singapore. Documents stated that the Ministry had completely halted all exports of sand from the Koh Kong province to other countries.</p> <p>According to Meng Saktheara, secretary of state and spokesman for the Ministry of Mines and Energy, the previous temporary measure contained a loophole that allowed exporters to continue dredging as long as they maintained they were not exporting. The new permanent measure, he said, closes the loophole by invalidating all current licences for dredging for export in Koh Kong.</p> <p>The permanent ban only applies to Koh Kong, as officials had conducted a reassessment there of environmental and social impacts after concerns were raised by civil society. “Results of the assessment indicate significant impact on the ecology and local communities if large-scale sand dredging continues operating,” according to Saktheara.</p>	Natural Capital, Social Capital
26	Article / National Geographic	Dramatic Photos Show How Sand Mining Threatens a Way of Life in Southeast Asia	Vince Beiser	15-Mar-18	<p>River banks have been collapsing in areas where sand dredging is taking place in Southeast Asia. The main causes of the collapse are the dredging boats, using pumps to raise from the river bed enormous quantities of sand. In towns and villages all along the Mekong River and many other rivers around Vietnam, banks undermined by dredging are collapsing into the water, taking with them farm fields, fish ponds, shops, and homes. In recent years, thousands of acres of rice farms have been lost, and at least 1,200 families have had to be relocated. Hundreds more have evacuated in-stream islands that were literally disappearing beneath their feet. Government officials estimate some 500,000 people in the Mekong Delta area alone need to be moved out of such landslide zones.</p> <p>Sand mining also puts more mud into the waters and scours riverbeds, killing the fish, plants, and other organisms that live there. According to one villager, there is no longer any fish or snails in the area. Meanwhile, five major dams have been built in recent years on the Mekong and another 12 are slated for construction on the Mekong in China, Laos, and Cambodia. The dams further diminish the flow of sediment to the delta. As it continues, the rate of extraction exceeds the natural rate of replenishment, threatening the delta. At this rate, he says, nearly half the delta will be wiped out by the end of this century.</p>	Natural Capital

27	Article/ Radio Free Asia	Cambodian Sand Could Build a Foundation for Legal Action in Singapore		05-Jan- 17	<p>An environmental NGO, Mother Nature Cambodia, is searching for legal grounds for a lawsuit that could uncover the truth about what happened to millions of dollars in sand that disappeared from Cambodia over the past decade. Founder Alejandro Gonzalez-Davidson said that a Singaporean law firm, Eugene Thuraisingam, had agreed to collect information on Singaporean sand purchases for a possible lawsuit against the city-state. U.N. data shows that Cambodia exported \$752 million in sand to Singapore over the past eight years, but Phnom Penh only reported that about \$5 million worth of sand was exported to the island nation that is the world’s top destination for the building material.</p> <p>In 2016, licenses were granted for designated “green zone” areas, where “there is no risk of riverbank collapse” while nearly 70 new sand dredging licenses were issued without holding public auctions or requiring the companies to make publicly available environmental impact assessment results. In all, CCHR found there were 84 companies holding licenses to dredge sand as of May 2016, despite the government’s ban. As Singapore is getting larger, mining operations are wreaking havoc on rivers, deltas, and marine ecosystems in Cambodia and elsewhere.</p>	Natural Capital, Social Capital
28	Article/ The Phnom Penh Post	Koh Kong sand dredging impact studies due	Bun Sengkong and Igor Kossov	17-Feb- 16	<p>The Ministry of Mines and Energy plans to release the environmental impact assessments of two controversial sand-dredging companies in Koh Kong in early 2016. Activists from NGO Mother Nature have claimed that International Rainbow Company Ltd and Direct Access Ltd began work without studying the impact on habitats and fishing communities. Soun Bunsear, head of the ministry’s licensing bureau, yesterday showed the Post an environmental impact assessment for International Rainbow from 2009, as well as a short annual update assessment for Direct Access from 2014. The ministry’s research found that dredging impact would be minimal.</p> <p>Another study from 2013 conducted directly by International Rainbow admitted that large-scale dredging operations can negatively impact fishing communities, which comprise a big part of the province’s population. Nonetheless, the report concluded that dredging is a net positive for the province.</p>	Natural Capital, Social Capital

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29	Article/BBC News	Cambodia bans sand exports permanently		13-Jul-17	<p>Cambodia has permanently banned sand exports, officially ending sales to Singapore which has used it for years as part of its land reclamation. Environmental organizations have argued for years that the dredging has had a serious impact on coastal ecosystems. While a temporary ban was imposed late last year, campaigners alleged dredging had continued. Since 2007, Singapore has imported more than 72 million tonnes of sand from Cambodia according to UN figures .This figure conflicts with the Cambodian government's numbers, which say Singapore imported just 16 million tonnes in the period.</p> <p>Environment groups are hopeful that the ban will put a stop to the trade, which they say has been causing environmental damage for years.</p>	Natural Capital, Social Capital

30	Article/The Associated Press	Sand for Singapore's growth comes at environmental cost to poorer neighbors	Denis Gray	22-Aug-11	<p>Villagers in Cambodia complain that sand dredgers operating 24 hours a day, scooping up sand and piling it onto ocean-bound barges, have decimated the fish so vital to their livelihoods. Riverbanks are beginning to collapse, and the din and pollution are killing a promising ecotourism industry. What is bad news for the poor, remote Tatai community is great tidings for Singapore, the wealthy city-state that is expanding its territory by reclaiming land from the sea. Sand from nearby countries is the prime landfill and also essential building material for Singapore's spectacular skyline.</p> <p>As more and more countries ban the exports of sand, Cambodia continues and has now become Singapore's largest supplier of sand. Sand mining began anew in May on southwestern Tatai River, which empties into the ocean almost directly north of Singapore, across 1,300 kilometers (800 miles) of open water. Despite denials by the main owner of sand mining rights in Koh Kong province, two Cambodian officials told The Associated Press that the sand is destined for the island nation. The mining visible on the Tatai River clearly violates some of Cambodia's own legal restrictions, not to mention a recent government order to suspend it temporarily.</p> <p>Known as the "King of Koh Kong," Ly Yong Phat is one of Cambodia's biggest tycoons and a senator with close ties to Prime Minister Hun Sen. His holdings includes hotels, a casino and agricultural plantations</p>	Natural Capital, Social Capital
31	Article/ The Phnom Penh Post	Sand dredging hits eco-resort	David Boyle and Vong Sokheng	01-Jul-11	<p>According to a private resort owner, sand dredging operations in Koh Kong province escalated, with boat crews allegedly trespassing onto private land and digging sand within hundreds of metres of the complex. Janet Newman, the owner of the Rainbow Lodge eco-tourism resort, said that seven boats had begun dredging "enormous" amounts of sand just 200 metres from her property. "It was chaos on the river. You just wouldn't believe how many boats there were in total. It was so bad that they couldn't even get past each other."</p> <p>Ruling party senator Ly Yong Phat's LYP Group was awarded a concession totaling more than 32 square kilometres to dredge sand for export on the Tatai river in September 2010. A total of nine cranes had moved into nearby areas on the Tatai river, Newman said, claiming they were staffed by Vietnamese and Chinese crews.</p>	Natural Capital

32	Article/ The Phnom Penh Post	Activists fear dredging in wildlife sanctuary	Yesenia Amaro and Phak Seangly	11-Jul-17	<p>Activists and a fisherman claimed that a company has started sand dredging within a wildlife sanctuary in Koh Kong, despite a standing ban on sand exports from companies operating in coastal areas. The alleged activities are in the same area where dredging vessels were spotted about a week ago in the vicinity of a sand-processing facility currently under construction in the province, and in an area where two companies were given approval to conduct environmental impact assessments for sand dredging projects. The facility is located inside the Tatai Wildlife Sanctuary.</p> <p>Activists and locals are concerned that the dredging is damaging the ecologically vital mangroves in the sanctuary, under the facade that the sand will be used domestically for construction rather than be exported. Local fisherman In Sophany said he had not seen dredging during the day, but had seen piles of sand at the facility, raising suspicions that dredging might be taking place at night. “Ninety-five percent of our community is fishermen, so if there is sand dredging, it will badly affect our income,” he said. .</p>	Natural Capital, Financial Capital
33	Article/ The Cambodia Daily	Dredging Permitted in Koh Kong Despite Sand Export Ban	Van Roeun	13-Jul-17	<p>The Mines and Energy Ministry issued a directive banning sand exports from Koh Kong province in July 2017, months after it suspended sand exports and new dredging licenses over export record discrepancies. The first-of-its-kind sand export ban still permits companies to dredge sand from specific rivers and parts of the coast, including the Sre Ambel and Tatai rivers, but prevents that material from being sold to other nations.</p> <p>Local authorities and communities should be consulted about all dredging projects, and the operations should not pollute rivers, change the shapes of rivers or block water flow, the statement says. The ministry suspended sand exports and new dredging licenses in November 2016 after months of controversy related to enormous discrepancies in records of sand exports to Singapore. Singapore, which uses sand to reclaim land and expand its territory, reported importing more than 6.5 million tons of Cambodian sand last year in data it provided to the U.N. Commodity Trade Statistics Database—down from more than 10.9 million tons the year before.</p> <p>But Cambodia’s customs department figures show just 14,800 tons of Singapore-bound sand leaving the country last year, continuing a trend over the past three years of the department counting less than 1 percent of the sand recorded by Singapore.</p>	Natural Capital, Social Capital

34	Book	Life, Fish and Mangroves: Resource Governance in Coastal Cambodia	Melissa Marschke	January, 2012	<p>"I have always found a way to earn money, and as my children got older I have been able to help my village, too. I fished with my father, went into the army, became a dynamite fisher and charcoal kiln owner, returned to dive fishing, started selling goods from home, began work with the village resource management committee and recently was elected onto the commune council."</p> <p>"There are fewer fish, everything is expensive since goods are brought in by boat, and it is hard to protect and manage our natural resources as more people become interested in them. Some people are starting to leave the village, which makes us all think about our future." —Excerpts from an interview with Wayne Som Sak, Cambodia, 2010</p>	Natural Capital, Financial Capital
35	Book	Life, Fish and Mangroves: Resource Governance in Coastal Cambodia	Melissa Marschke	January, 2012	<p>"Although my life is better now than it was, since my children can help me earn money for our family, I do worry about the future. There are now more people interested in our fishing grounds . . . bigger fishing boats and barges that carry sand . . . and sections of my nets are destroyed each year. It is harder to catch a consistent amount of fish, even when I fish further from home. My children need to do something else, but I do not know what else they can do here. I like this area, and would prefer to stay if possible." —Excerpts from interviews with Mat Sok, Cambodia, 2002, 2003, 2008, 2010</p>	Natural Capital, Physical Capital, Human Capital
36	Book	Life, Fish and Mangroves: Resource Governance in Coastal Cambodia	Melissa Marschke	January, 2012	<p>"We have done a lot over the years. We have done mangrove replanting, formed internal regulations and shared these with villagers, solved some problems in the village, patrolled to catch and fine illegal fishers, forest cutters and hunters, held monthly meetings, provided environmental education in the primary and junior schools and held village garbage clean-up days."</p> <p>"In the past two years [2008–2010] I have facilitated several meetings between our three local resource management committees, since we have a problem with sand mining near our fishing grounds. Each committee organized for villagers to thumb-print a petition that we sent to the local authorities asking them to investigate this situation." —Excerpts from interviews with Sovanna, head of Koh Sralao's resource management committee, in 2004, 2006 and 2010</p>	Natural Capital, Social Capital

37	Article /Reuters	Cambodia bans sand exports after environmental group pressure	Prak Chan Thul	12-Jul-17	<p>Cambodia has banned all sand exports on environmental grounds, according to the Ministry of Mines and Ennergy, officially ending the sale of sand to Singapore which has for years used it to reclaim land along its coasts. The ministry said most of Cambodia’s sand had gone toward the expansion of the island city-state of Singapore, and it would now have to look for other sources.</p> <p>Environmental groups have been pressing the government to stop the trade, saying the digging and dredging of sand has had a serious impact on coastal ecosystems and surrounding land. Groups have complained that sand in recent months has been exported illegally following a temporary ban in November 2016.</p>	
38	Article/ Transborder News	Activists, villagers vow to stop the sand mining in Kok Kong for export: Profit does not reach the hands of affected communities	Admin	2016	<p>About 50 youths from across the country, 10 monks and 30 local communities gathered for a peaceful protest demanding for the protection of their mangrove forest from sand-dredging in Koh Kong.</p> <p>The no.1 importer of sand from Cambodia is Singapore, second is China, and the largest sand dredging in the country is in Koh Kong province, bordering Thailand. The Mekong River bank near Phnom Penh and Kampot River, Kampot province are also areas that threatened by dredging communities.</p> <p>Koh Sorlaov, a rich mangrove forest in Koh Kong is the most impacted from sand dredging. There are 230 households affected by sand dredging. Villagers are afraid to raise their concerns because they know that the local figures and official are linked to companies. Asked about whether the sand dredging destroy environment, Mala said “mangrove forest is a habitat for aquatic lives, if the dredging barges came and disgorging tonnes of sands, their habitats and spawning ground are destroyed; how would they survive and our fisheries are impacted. Currently, Koh Kong is facing the deterioration: sand mining decimates pristine mangrove forest, destroys fisheries and threatens food security of local communities. “For those who are impacted from sand dredging, some of them migrate to Thailand to sell labor and get income”-he added. For Mala who fights against this illegal sand dredging for years, when asked about profits from sand dredging, he said profit from sand dredging does not reach the impacted communities. “Where the money goes is publicly unknown”-Mala added. Villagers’ loss their natural resources and livelihoods while the government and company get all profits- the impacted fishing families did not get royalties. This is a lack of justice and accountability”.</p>	Natural Capital, Social Capital, Financial Capital, Human Capital

39	Article/ The Phnom Penh Post	Koh Kong fishermen struggle in the shadow of sand dredgers	Shaun Turton and Phak Seangly	27-Jun-16	<p>Phen Sophany cuts the motor as the boat nears the centre of a mangrove-lined estuary in Koh Kong province, near the isolated fishing village of Koh Sralav. “This is where the island used to be,” the 38-year-old member of environmental activist group Mother Nature says, the village visible in the distance. It was about 100 metres by 50 metres, named Koh Kabung – it looked like a crocodile egg, filled with mangroves and crabs. Then they took the sand around it, and when the water came in, it was gone.”</p> <p>Villagers – some of whom plan to protest outside today’s hearing at Koh Kong Provincial Court – say almost eight years of dredging has devastated the stocks of fish, crabs and snails that villages like Koh Sralav rely on for food and trading.</p> <p>As crabbers pull up largely empty traps along a line that stretches for kilometres, skeleton crews on the dredgers keep the machines in working order. “We don’t know what else to do; we protest and the problem gets worse, they put people in jail,” says 32-year-old fisherman You Samon, looking out onto the water from the balcony outside his stilted wooden shack. “I’m afraid for when the sand dredgers come back; no one will help us dismiss them, because they put the activists in jail.”</p> <p>According to a study by the International Union for Conservation of Nature, the destruction of fish habitats by dredging in the Tatai River, which flows into the estuaries surrounding Koh Sralav, has reduced catches by between 70 and 90 per cent. Fisherman Som Chhorn, 45, is usually out on the water at 7am with his wife, while his 16-year-old daughter hunts for snails. Getting older, he returns now in the mid to late afternoon. “I fish until my energy gives out,” Chhorn, clad in an old football jersey, says over lunch in his house along the water in Koh Sralav. Though the demands remain the same, the return is getting much worse. Just four years ago, the family would pull in a 20 kilogram catch after a day of fishing. Now a good day sees Chhorn bring back just 5 kilograms. “Before, I spent less on petrol and caught a lot of fish; now I spend a lot on petrol and catch less fish,” he says.</p> <p>Nearby, in an open-front wooden store, 28-year-old You Samith stands next to sacks of sea snails and buckets of fish and eels, and he shows off some of his</p>	Natural Capital, Social Capital, Human Capital, Financial Capital
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				<p>best stone crabs. Four years ago, the young father traded in his fishing kit for scales and became a broker. It's a line of work he considers far more lucrative, though far from immune to the downturn. "In the past, I used to buy about 10,000 baht [about \$283] of produce a day, now it's about 1,000 baht," he says, adding that he knew at least 30 to 40 people personally who had left for Thailand.</p> <p>One of the Koh Sralav villagers currently mulling a career change is Hie Nary. Her small wooden boat floating in the shadow of the dredging cranes, the 54-year-old widow re-baits the two-kilometre line of crab traps that her son pulls from the water. Though Nary usually re-baits after a catch, the snares are largely empty. "Four years ago, we would get about 20 kilograms [a day]," Nary said. "Today, we have about 3 kilograms." Like many Koh Sralav families, Nary moved to the province seeking a new life, and money, in fishing, arriving in 1994 from Prey Veng province. She now shares another thing in common with many of her fellow villagers: debt. "I am thinking of selling my boat and going to work as a garment worker," says Nary, whose husband, among those who protested with Mother Nature, died in January. "I am in debt about \$3,000; I took out loans to buy the boat and equipment. Sometimes I need new traps because the dredgers break them with their anchors." Fellow villager Khieu Khit, 74, says most of the area's fishermen are in debt. "Everyone except me, because they won't give me a loan," he says.</p> <p>Though the old have memories of better times, the young in Koh Sralav have few options. The village's school stops at grade 9. The nearest high school is a two-hour boat ride away in Koh Kong town, and older students must relocate. Lim Sophorn, who began teaching grade 9 this year, hopes 70 to 80 per cent of his class of 10 will pass the exam and continue with their studies. Though sand dredging is not in the curriculum, it invariably comes up in class, the size of which is sometimes influenced by its consequences. "When the fishing drops off, some students drop out to help their parents," Sophorn says.</p>	
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40	Book	Life, Fish and Mangroves: Resource Governance in Coastal Cambodia	Melissa Marschke	January, 2012	<p>" For the past year we have seen many boats and barges pass in front of our village, and we can hear the equipment being operated all day and all night. It is very noisy. Have you gone out to Koh Kong Island to see the piles of sand and the big ships? These ships have flags from other countries, including Singapore and Malaysia. This is one place where they load the sand to ship somewhere else. At first we tried to stop the sand mining since this activity really affects the crabs but it seems that there is nothing we can do. If we are lucky the companies will soon stop working in this area (May 2010)." Sovanna</p>	Natural Capital
41	Article/ The Phnom Penh Post	Boeung Kak activists join Koh Kong protest	Pech Sotheary	01-Sep-15	<p>Boeung Kak lake evictees yesterday joined about 50 activists who travelled to Koh Kong province to support local demonstrations calling for the release of three detained campaigners from NGO Mother Nature. The group arrived as court documents were released that showed a bail request for the three activists – Sun Mala, Try Sovikea and Sim Somnang – had been denied.</p> <p>Song Srey Leap, a veteran Boeung Kak activist who was arrested in January 2014 for her activism, said that they had travelled to Koh Kong to join locals in their ongoing protests because “we want to show that they are not alone”. “They are sacrificing their life and time to protect the national interest of the country,” she said. “We saw that their situation was unfair and similar to our case.”</p> <p>The Mother Nature activists were arrested on August 17 while campaigning against illegal sand-dredging operations. Last week, demonstrators calling for their release clashed briefly with security forces in Khemarak Phumin town, where protesters continued to rally yesterday. The authorities have blocked a bridge leading to the provincial capital, local resident Pha Sophea said, making it impossible for the activists to speak to Koh Kong Governor Bun Leut.</p>	Social Capital

42	Article/ The Phnom Penh Post	Sand mining spikes in Koh Kong estuaries	Sebastian Strangio & Von Sokheng	10-Mar-09	<p>A CHINESE company is extracting thousands of tons of sand from coastal areas in Koh Kong province each day, raising the spectre of long-term damage to the region's fragile estuarine and marine ecosystems. A recent Post investigation found that a Hong Kong-based firm is openly dredging sand in the province's extensive salt-water estuaries - including areas protected under Cambodian law - for export to Singapore. The Post investigation - based on some dozen interviews and visits to the dredging sites - enlarged upon Global Witness' findings, confirming that that the bulk of Koh Kong's sand is being extracted and shipped to Singapore by Winton Enterprises Limited, a Hong Kong-based mining firm working in close partnership with LYP. It also confirmed that the Peam Krasop Wildlife Sanctuary, a 25,897-hectare protection zone established in 1993 to protect one of the world's last intact coastal mangrove ecosystems, lies at the centre of Winton's extensive sand-mining operations. Sand was observed being extracted by unmarked dredging vessels in Koh Suon, 10 kilometres up the Koh Pao River from Koh Kong town, and in Koh Smach, inside Peam Krasop Wildlife Sanctuary to the south.</p> <p>Stretching its labyrinthine arms over an area of over 25,000 hectares, Peam Krasop's translucent saline waters encompass dense mangrove islands that are among the world's last intact ecosystems of their kind. But the sharp increase in sand-mining activity in Koh Kong has environmentalists worried that virgin coastal estuaries will meet a similar fate to Indonesia's Riau Islands, where intensive sand extraction resulted in serious environmental degradation and forced Jakarta to institute a blanket ban on the practice in January 2007.</p> <p>But as the dredgers close in on Cambodia, local fishermen say they have noticed changes in the age-old patterns that govern life on the water. Chun Doeun, 38, who has been fishing the Koh Pao River for 15 years, noted the strange behaviour of local crab species, which have floated to the water's surface since the arrival of the sand-dredgers last year. "[This] is a strange habit for this kind of species. Crabs always dwell on the riverbed," he said. "The changed habits of the crab species have happened since the start of the sand-dredging operations."</p> <p>Tith Seour, a 48 year-old fisherman angling within sight of the Raffles operation off the coast, said also that recent fish and crab catches had been low, citing the possibility it could be linked to the Winton operations. "For ocean fishermen, I am concerned there will be big waves when the ground surface collapses due to the dredging of the sand," he said.</p>	Natural Capital, Physical Capital
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