* Coastal Climate Change & Adaptation:

PART I – Practices & Lessons from South East Asia

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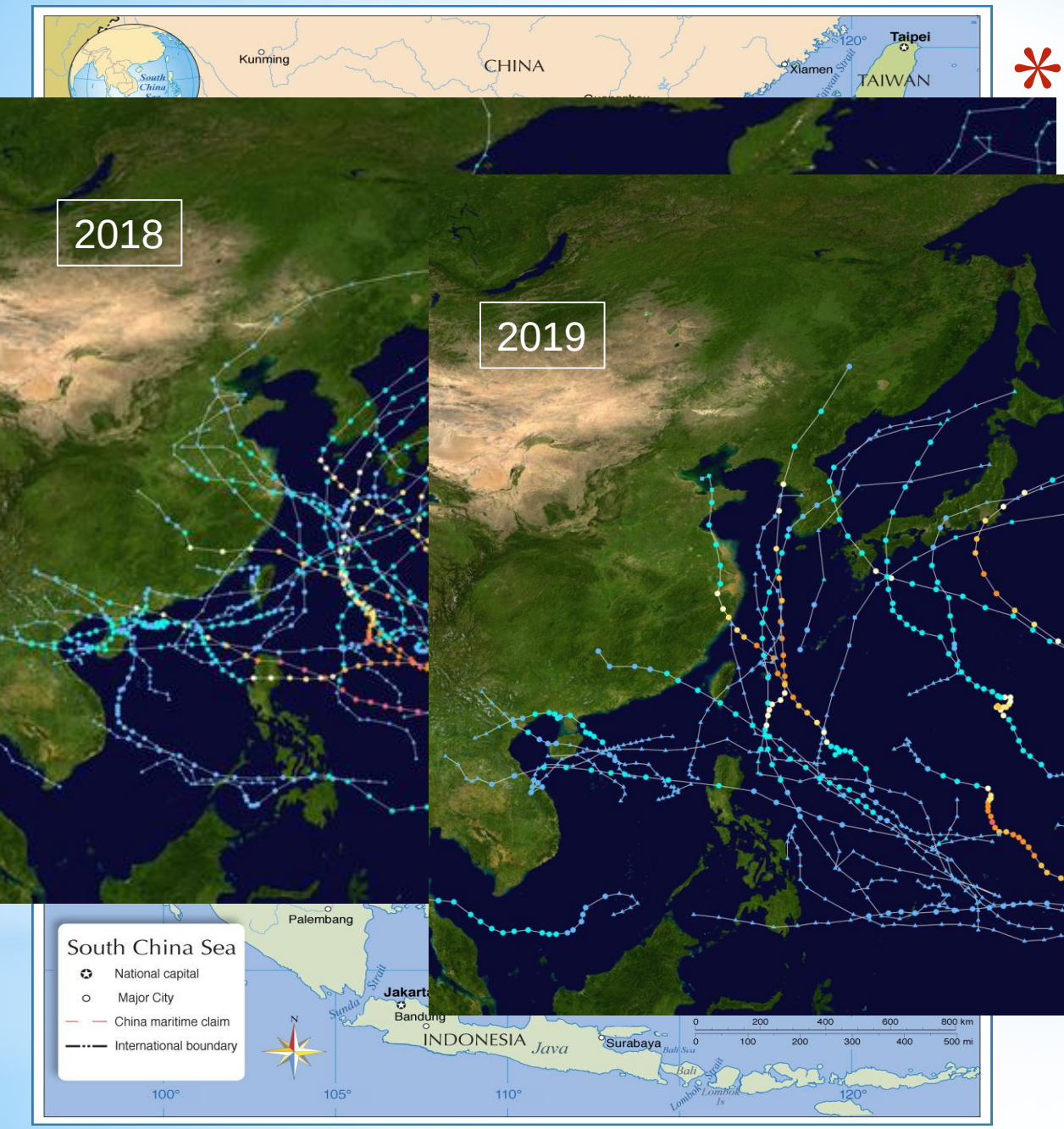
Presentation to the 5th China- ASEAN Academy on Oceans Law & Governance, NISCSS Haikou, Hainan

PART 1 – Morning, November 19, 2019

- 2018 centenary of Elizabeth Mann Borgese
- Peace in The Ocean: *Pacem in maribus*
- The Ocean as a shared heritage for all humankind
- The Ocean as a sustainable resource for all future generations
- The Ocean as respected entity
- *"The Future of Ocean Governance & Capacity Development" (open source)*

IOI-Canada

*South China



PART 1-AM, November 19, 2019

https://www.youtube.com/watch?v=rsfog-x0BNs

https://www3.nhk.or.jp/nhkworld/en/news/special/01/1919/

PART 1-AM, November 19, 2019

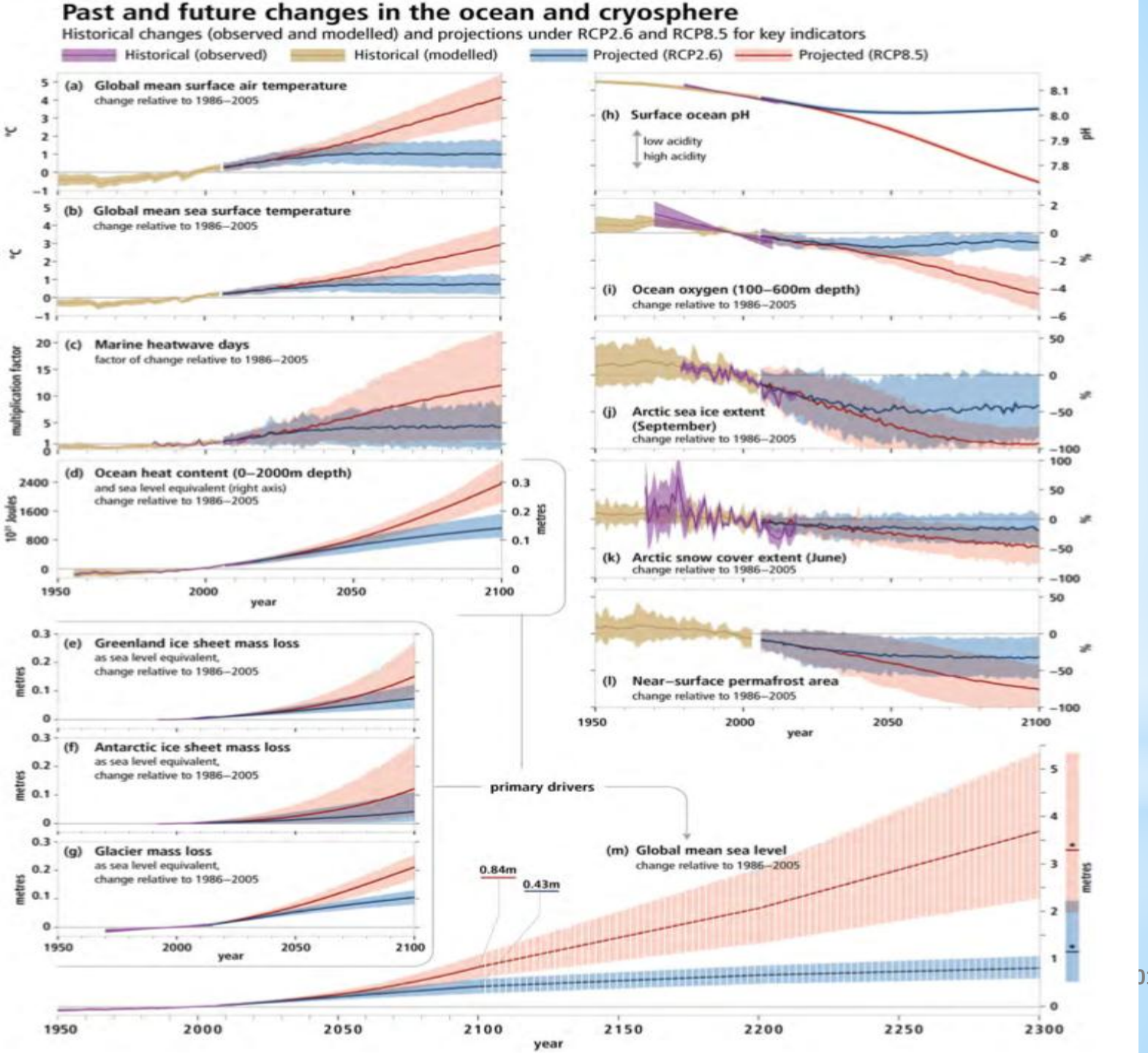
*Coastal Climate Change & Adaptation - Outline

PART I - Morning

1. Introduction - Southeast Asia/China and Climate Change
2. Challenges for the 21st Century - Coastal Zones
3. Understanding Adaptation Needs - Profiling
4. Pillars of Sustainability - Reflecting Importance**

**Class Assignment

*1. Introduction


Past and future changes in the ocean and cryosphere
Historical changes (observed and modelled) and projections under RCP2.6 and RCP8.5 for key indicators
Historical (observed)
Historical (modelled)
Projected (RCP2.6)
Projected (RCP8.5)
(a) Global mean surface air temperature
change relative to 1986–2005
°C
(b) Global mean sea surface temperature
change relative to 1986–2005
°C
(c) Marine heatwave days
factor of change relative to 1986–2005
multiplication factor
(d) Ocean heat content (0–2000m depth)
and sea level equivalent (right axis)
change relative to 1986–2005
10²³ Joules
metres
year
(e) Greenland ice sheet mass loss
as sea level equivalent,
change relative to 1986–2005
(f) Antarctic ice sheet mass loss
as sea level equivalent,
change relative to 1986–2005
(g) Glacier mass loss
as sea level equivalent,
change relative to 1986–2005
metres
year
(h) Surface ocean pH
low acidity
high acidity
pH
(i) Ocean oxygen (100–600m depth)
change relative to 1986–2005
%
(j) Arctic sea ice extent
(September)
change relative to 1986–2005
%
(k) Arctic snow cover extent (June)
change relative to 1986–2005
%
(l) Near–surface permafrost area
change relative to 1986–2005
%
year
primary drivers
(m) Global mean sea level
change relative to 1986–2005
0.84m
0.43m
metres
year

UNFCCC COP21 (2015)- Paris Accord

- To keep global temperatures "well below" 2.0C above pre-industrial times and "endeavour to limit" them even more, to 1.5C
- To achieve ‘zero-net carbon emissions’ at some point between 2050 and 2100
- To review each country's contribution to cutting emissions every 5 years
- For rich countries to help poorer nations by providing "climate finance" to adapt and switch to renewable energy.

South East Asia/China Experience

Boiling Point

One of the most vulnerable regions to climate change is witnessing the world's biggest jump in greenhouse gas emissions

Amit Prakash

The Blue Dragon, a small riverfront eatery in Hoi An, Vietnam, serves morsels of local trivia to tourists along with $2 plates of crisp spring rolls and succulent noodles. On its damp-stained walls, the Blue Dragon's owner, Nam, marks the level of annual floods that submerge this popular UNESCO World Heritage town renowned for its bright-yellow-painted buildings.

Last November, days before presidents and prime ministers arrived in nearby Da Nang for a meeting of the Asia Pacific Economic Cooperation forum, the water level at the Blue Dragon rose to 1.6 meters (5.25 feet) when typhoon-driven rains lashed the city. Patrons scurried to safety as pots and pans floated by.

"Every time we get big rains or typhoons, it floods and everything shuts down for three to four days," says Nam, 65, who goes by one name. "Last year people had to escape in boats because the water was too high."

Typhoons and floods are becoming more intense and frequent as Vietnam and the rest of Southeast Asia bear the brunt of climate change. Long coastlines and heavily populated low-lying areas make the region of more than 640 million people one of the world's most vulnerable to weather extremes and rising sea levels associated with global warming. Governments are under pressure to act quickly or risk giving up improvements in living standards achieved through decades of export-driven growth.

Southeast Asia faces a dual challenge. It not only must adapt to climate change caused largely by greenhouse gases emitted over decades by advanced economies—and more recently by developing economies such as China and India—it also must alter development strategies that are increasingly contributing to global warming. The region's growing reliance on coal and oil, along with deforestation, are undermining national pledges to curb emissions and embrace cleaner energy sources.

Economic impact

Average temperatures in Southeast Asia have risen every decade since 1960. Vietnam, Myanmar, the Philippines, and Thailand are among 10 countries in the world most affected by climate change in the past 20 years, according to the Global Climate Risk Index compiled by Germanwatch, an environmental group. The World Bank counts Vietnam among five countries most likely to be affected by global warming in the future.

The economic impact could be devastating. The Asian Development Bank (ADB) estimates Southeast Asia could suffer bigger losses than most regions in the world. Unchecked, climate change could shave 11 percent off the region's GDP by the end of the century as it takes a toll on key sectors such as agriculture, tourism, and fishing—along with human health and labor productivity—the ADB estimated in a 2015 report. That's far more than its 2009 estimate of a 6.7 percent reduction.

22 FINANCE & DEVELOPMENT | September 2018

ipcc

INTERGOVERNMENTAL PANEL ON climate change

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special report on the imp

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WG III

SOUTHEAST ASIA AND THE ECONOMICS OF GLOBAL CLIMATE STABILIZATION

ASIAN DEVELOPMENT BANK

ADB

IPCC Special Report Oct 2018

- Special Report in 2018 on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways'.
- This Summary for Policy Makers (SPM) presents key findings of the Special Report of 1.5°C and for the comparison between global warming of 1.5°C and 2°C above preindustrial levels.

IPCC Special Report Highlights

* A1. Human activities are estimated to have caused approximately 1.0°C of global warming. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate. (high confidence)
* B1. Climate models project robust differences in regional climate between global warming of 1.5°C, and between 1.5°C and 2°C. These differences include increases in: mean temperature (high confidence), hot extremes in most inhabited regions (high confidence), heavy precipitation in several regions (medium confidence), and probability of drought and precipitation deficits (medium confidence).
* B4. Limiting global warming to 1.5°C compared to 2ºC is projected to reduce increases in ocean temperature as well as associated increases in ocean acidity and decreases in ocean oxygen levels (high confidence). Consequently, limiting global warming to 1.5°C is projected to reduce risks to marine biodiversity, fisheries, and ecosystems, and their functions and services to humans, as illustrated by recent changes to Arctic sea ice and warm water coral reef ecosystems (high confidence).

* CO2 Emitters (Source: CCPI/Wikipedia)

Country	Fossil fuel CO_2 emissions (kt) in 2015[8]	% Fossil fuel CO_2 emissions by country	Emissions per capita (t) in 2015[9]	Emissions (kg) per $1,000 of GDP (2010 US$) in 2014[10]
World	36,061,710	100%	4.9	490.8
China	10,641,789	29.51%	7.7	1235
United States	5,172,336	14.34%	16.1	324.2
European Union	3,469,671	9.62%	6.9	184.7
India	2,454,968	6.81%	1.9	1051.5
Russia	1,760,895	4.88%	12.3	999.4
Japan	1,252,890	3.47%	9.9	205.2
Germany	777,905	2.16%	9.6	197.4
International Shipping	642,024	1.78%	—	—
Iran	633,750	1.76%	8.0	1344.4
South Korea	617,285	1.71%	12.3	475.7
Canada	555,401	1.54%	15.5	301
Saudi Arabia	505,565	1.40%	16.0	921.9
Indonesia	502,961	1.39%	2.0	492.7

*SEA (Source: ADB 2015)

* From 1990 to 2010, carbon dioxide (CO2) emissions in SEA have grown more rapidly than in any other region of the world. Five countries of Southeast Asia collectively account for 90% of regional greenhouse gas (GHG) emissions—Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam.
* Potential regimes for regulating global GHG emissions through 2050:
  ① business as usual (BAU);
  ② fragmented national climate policies;
  ③ a global climate stabilization agreement that is likely to keep warming below 3°C, by limiting GHG concentrations to 650 parts per million (ppm) CO2 equivalent by the end of the century (650 ppm scenario); and
  ④ ambitious targets likely to avoid warming of more than 2°C, by limiting GHG concentrations to 500 ppm CO2 equivalent (500 ppm scenario).
* SEA likely to sustain larger economic losses from climate change than most other areas in the world. The collective effect of impacts on agriculture, tourism, energy demand, labor productivity, catastrophic risks, health, and ecosystems—may be larger than previously estimated. Gross Domestic Product (GDP) is reduced by 11% in 2100 under the BAU emissions scenario
* SEA has experienced rapid economic growth in recent years, and regional GHG emissions have rapidly increased, at nearly 5% per year over the last 2 decades. Deforestation and land use account for a majority of emissions.
* Energy efficiency in most of Southeast Asia is improving more slowly than in other areas of developing Asia or the world as a whole, while coal and oil have been rapidly rising as sources of primary energy. Southeast Asia's per capita emissions are currently near the world average. Without explicit polices aimed at reducing future emissions, the region's GHG emissions are estimated to be at least 60% higher in 2050 than the actual value in 2010. Energy sector emissions are found to be 300% higher.

ADB report- Key messages

* Climate change is already evident in SEA (mean temperature increases between 0.14 and 0.20 C per decade since 1960). Without climate action, impacts will be much larger in the future.
* Climate change poses substantial physical risks from increased river flooding, coastal inundation and sea level rise, increased water stress, and increased frequency of intense cyclones and storms.
* Effects of unmitigated climate change lead to substantial economy-wide consequences and include:
  - ✓reduced agricultural productivity
  - ✓losses of labor productivity
  - ✓reduced human health
  - ✓ increased energy and other resource demand
  - ✓collapse of coastal ecosystems, and
  - ✓loss of terrestrial forest cover and biodiversity.
* To avoid these long-term risks, countries should help to lead the way in global climate action by transitioning toward low-carbon development.

*SEA (Source: FDB/IMF Sept 2018)

* SEA dual challenge: (1) adapt to climate change caused by greenhouse gases emitted over decades by advanced economies and by developing economies such as China and India; and (2) alter development strategies that contribute to global warming, e.g., growing reliance on coal and oil, deforestation.
* "New climate regime" by the end of the century when the coolest summer months would be warmer than the hottest summer months in the period from 1951 to 1980. Rice yields in Indonesia, the Philippines, Thailand, and Vietnam could drop by as much as 50 percent by 2100 from 1990 levels. Hotter weather is also pushing tropical diseases such as malaria and dengue fever northward to countries like Lao P.D.R.
* Energy demand will grow as much as 66% by 2040. Coal alone will account for almost 40% of the increase as it overtakes cleaner-burning natural gas in the energy mix. Risk to the Paris Climate Agreement's goal of limiting the average global temperature gain to 2C.
* Erosion makes the area more vulnerable to storm surges and rising sea levels. The shoreline along Hoi An's popular Cua Dai Beach receded by 150 meters in the years from 2004 to 2012. Floodwalls and sandbags are eyesores for vacationers.
* 70% of Vietnam's population lives along its 3,200-kilometer coastline and in the low-lying delta. Indonesia has one of the world's longest coastlines at 54,700 kilometers. In the Philippines, which has 36,300 kilometers of coastline, 20 typhoons on average make landfall yearly, with increasing destructiveness. Cambodia, Lao P.D.R., and Thailand are also affected by storms and excessive rain, as well as by heat extremes that take a toll on agriculture and human health.

China (CCPI Scorecard)

* China is key. It is by far the world's biggest source of carbon emissions, producing more than one quarter of the global total and twice as much as the United States (second); India (third) emits half as much as the USA.
* China's Paris Agreement commitment requires its CO2 emissions to peak by 2030. Emissions declined between 2014 and 2016. However, 2017 saw coal use increase although it remained below its 2013 peak. Together with rising demand for oil and gas, CO2 emissions in 2017 were above 2014 levels, the previous record high.
* If the recent overall downward trend in China's coal use continues for the next few years, it is plausible that overall CO2 emissions peaked in 2017. In this case, total Chinese GHG emissions would be likely to only show a very slight increase in the period between 2015–2030 and will essentially plateau at close to 12.0 GtCO2e/year. If, however, coal consumption does not continue to decline, and instead stalls at today's levels, and no additional policies are introduced to limit other, non-CO2gases, China's total GHG emissions could continue to rise until at least 2030.
* With current policies, China is on track to meet or exceed its 2030 Nationally Determined Contribution (NDC) under the Paris Agreement.
* China's NDC "Highly insufficient," as it is not ambitious enough to limit warming to below 2°C, let alone limiting it to 1.5°C as required under the Paris Agreement, unless other countries make much deeper reductions and comparably greater effort.

2019 Typhoon Season in SEA

- Typhoon season runs throughout 2019, most tropical cyclones typically develop between May and October.
- The season's first named storm, *Pabuk*, reached tropical storm status on January 1, becoming the earliest-forming tropical storm of the western Pacific Ocean on record
- The season's first typhoon, *Wutip (Betty)*, reached typhoon status on February 20. *Wutip* further intensified into a super typhoon on February 23, becoming the strongest February typhoon on record, and the strongest tropical cyclone recorded in February in the Northern Hemisphere.
- Typhoon *Lekima (Hanna)*, became the second costliest typhoon in Chinese history (August 10).
- Hainan affected by Typhoons *Wipha* (Aug 1); *Podul* (Aug 30) - triggered a tornado in Hainan, which killed eight people and left two others injured; damage reached ¥16.22 million (US$2.27 million); *Kabayan* (Sept 1).
- See also: https://en.wikipedia.org/wiki/2019_Pacific_typhoon_season

* 2019 Named Storms

Named Storms	Dates active	Peak classification	Sustained wind speeds	Pressure	Areas affected	Damage (US$)	Deaths
Pabuk	Dec 31, 2018 – Jan 4, 2019	Tropical storm	85 km/h	996 hPa	Natuna Islands, Vietnam, Malaysia, Thailand, Myanmar	$157 million	10
Wutip (Betty)	February 18 – March 2	Typhoon	195 km/h	920 hPa	Caroline Islands, Mariana Islands	$3.3 million	0
Wipha	July 30 – August 4	Tropical storm	85 km/h	985 hPa	South China, Vietnam, Laos	$44.3 million	27
Francisco	August 1 – 8	Typhoon	130 km/h	970 hPa	Japan, Korean Peninsula	Unknown	1
Lekima (Hanna)	August 2 – 13	Typhoon	195 km/h	925 hPa	Caroline Islands, Philippines, Ryukyu Islands, Taiwan, China	$9.28 billion	90
Krosa	August 5 – 16	Typhoon	140 km/h	965 hPa	Mariana Islands, Japan, Korean Peninsula, Russian Far East	$20.5 million	3
Bailu (Ineng)	August 19 – 26	Severe tropical storm	95 km/h	985 hPa	Philippines, Taiwan, South China	$28.2 million	3
Podul (Jenny)	August 24 – 31	Tropical storm	75 km/h	992 hPa	Yap, Philippines, Vietnam, Laos, Thailand, Cambodia	$2.43 million	15
Faxai	August 30 – September 10	Typhoon	155 km/h	955 hPa	Japan	$7 billion	3
Kajiki (Kabayan)	August 30 – September 7	Tropical storm	65 km/h	996 hPa	Philippines, South China, Vietnam, Laos	$12.9 million	6
Lingling (Liwayway)	August 31 – September 7	Typhoon	165 km/h	940 hPa	Philippines, Ryukyu Islands, Korean Peninsula, Northeast China, Russian Far East	$191 million	8
Marilyn	September 10 – 13	Tropical depression	55 km/h	996 hPa	None	None	0
Peipah	September 13 – 16	Tropical storm	65 km/h	1000 hPa	Mariana Islands, Bonin Islands	None	0
Tapah (Nimfa)	September 17 – 22	Typhoon	120 km/h	970 hPa	Taiwan, East China, Japan, South Korea	$7.9 million	3
Mitag (Onyok)	September 25 – October 3	Typhoon	140 km/h	965 hPa	Mariana Islands, Taiwan, Japan, East China, South Korea	Moderate	10
Hagibis	October 4 – 13	Typhoon	195 km/h	915 hPa	Mariana Islands, Japan, South Korea, Russian Far East	TBA	88

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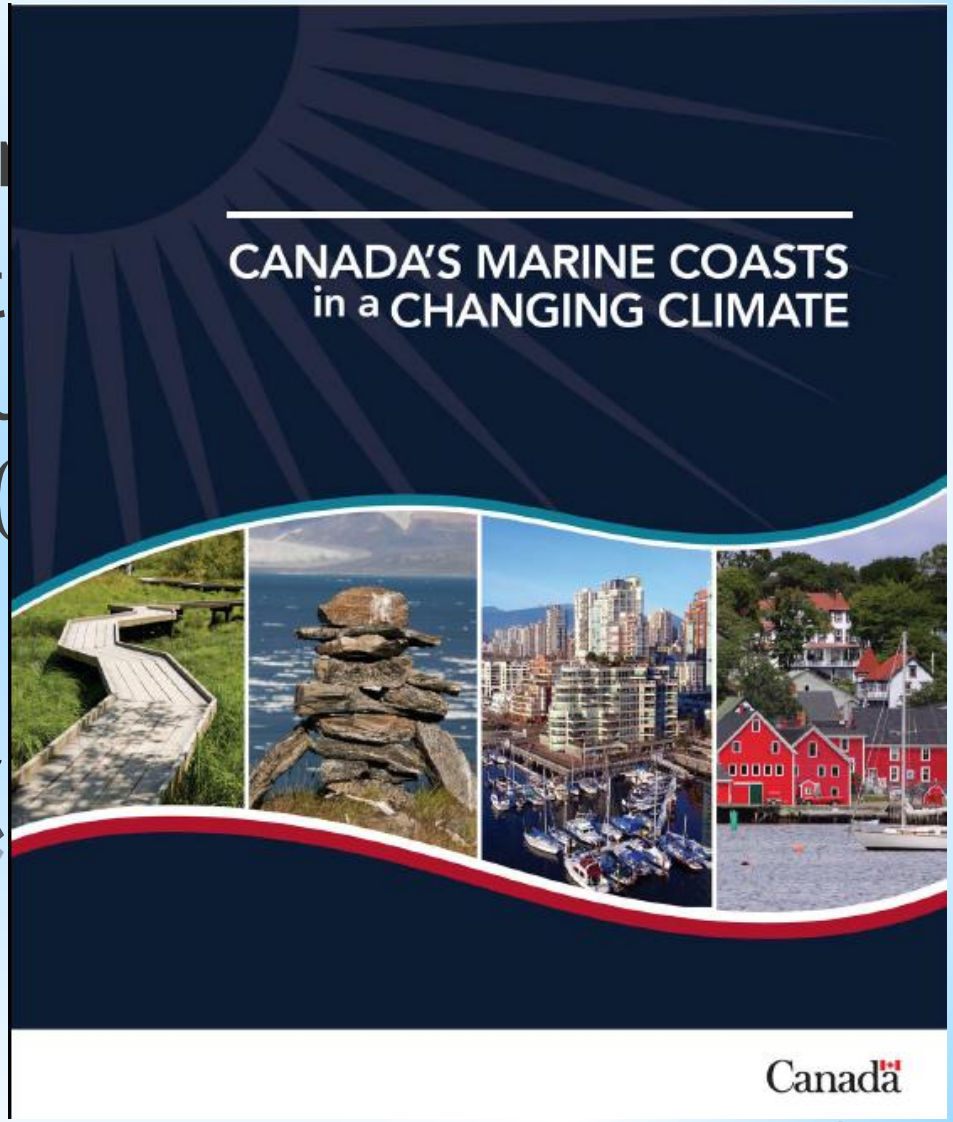


Climate Change Impacts and Adaptation
ASSESSMENT OF CANADA'S MARINE COASTS

-Natural Resources Canada document in development (2016)

1. Warming – air temperatures, land surface, oceans trend attributed to global warming due to increasing GHGs in the atmosphere
2. Increased frequency an severity of coastal storms – events of extreme precipitation, high winds and seasonal storms, storm surge aggravated by sea-level rise, extended periods of drought
3. More human development in coastal areas – higher pollution, GHG emissions, and maladaptation practices along the coastal zones.

*2. Coastal Climate Challenges

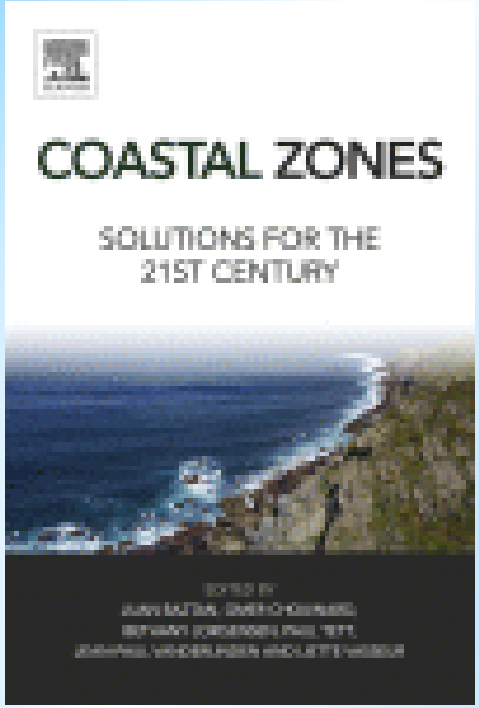
PART 1-AM, November 19, 2019

*Climate Challenges for the 21st Century

United Nations

Report of the United Nations Conference on Sustainable Development

Rio de Janeiro, Brazil
20–22 June 2012



Editors:
Juan Baztan, Omer Chouinard, Bethany Jorgensen, Paul Tett, Jean-Paul Vanderlinden and Liette Vasseur
ISBN: 978-0-12-802748-6

Chapter 10

c0010 Managing Adaptation to Changing Climate in Coastal Zones

Daniel E. Lane[1], Colleen M. Clarke[1], John D. Clarke[1], Michelle Mycoo[2], Judith Gobin[2]
[1]Telfer School of Management, University of Ottawa, Ottawa, ON, Canada; [2]The University of the West Indies, St. Augustine Campus, Trinidad and Tobago

Chapter Outline

s0010 INTRODUCTION

p0015 Coastal zones are the most biologically and economically productive regions in the world. Over 40% of the world's population lives within 150 km of the shore (United Nations Atlas of the Oceans, 2010), and that figure is growing. In Canada, approximately 38% of Canadians live within only 50 km of one of three surrounding oceans—the Atlantic, Pacific, or Arctic Oceans—or one of the Great Lakes. In the Caribbean region, coastal populations in 28 independent territories and island states are generally clustered along thin bands of land in close proximity to the shore. An estimated 60% of the Caribbean's total population of approximately 40 million people lives within less than 100 km from the coast, and approximately 40% of the population resides within a mere 2 km of the coast.

p0020 These coastal zones, where land and water interact, are key landscapes when considering (1) the environmental challenges faced by human societies and (2)

Coastal Zones. http://dx.doi.org/10.1016/B978-0-12-802748-6.00010-3

10010-BAZTAN-9780128027486

*Challenges for the 21st Century

Rio +20

1. Identify community priorities
2. Cede authority to local communities, municipalities
3. Measure, track, and exercise preparedness
4. Implement the precautionary approach and plan strategically
5. Build an education legacy

Laudato Si'

1. ...dialogue that includes everyone
2. We require a new and universal solidarity.
3. drawing on the results of the best scientific research available today (Chapter 1)
4. Article 186 and the Rio Declaration (1992)
5. change is impossible without motivation and a process of education (Article 15)

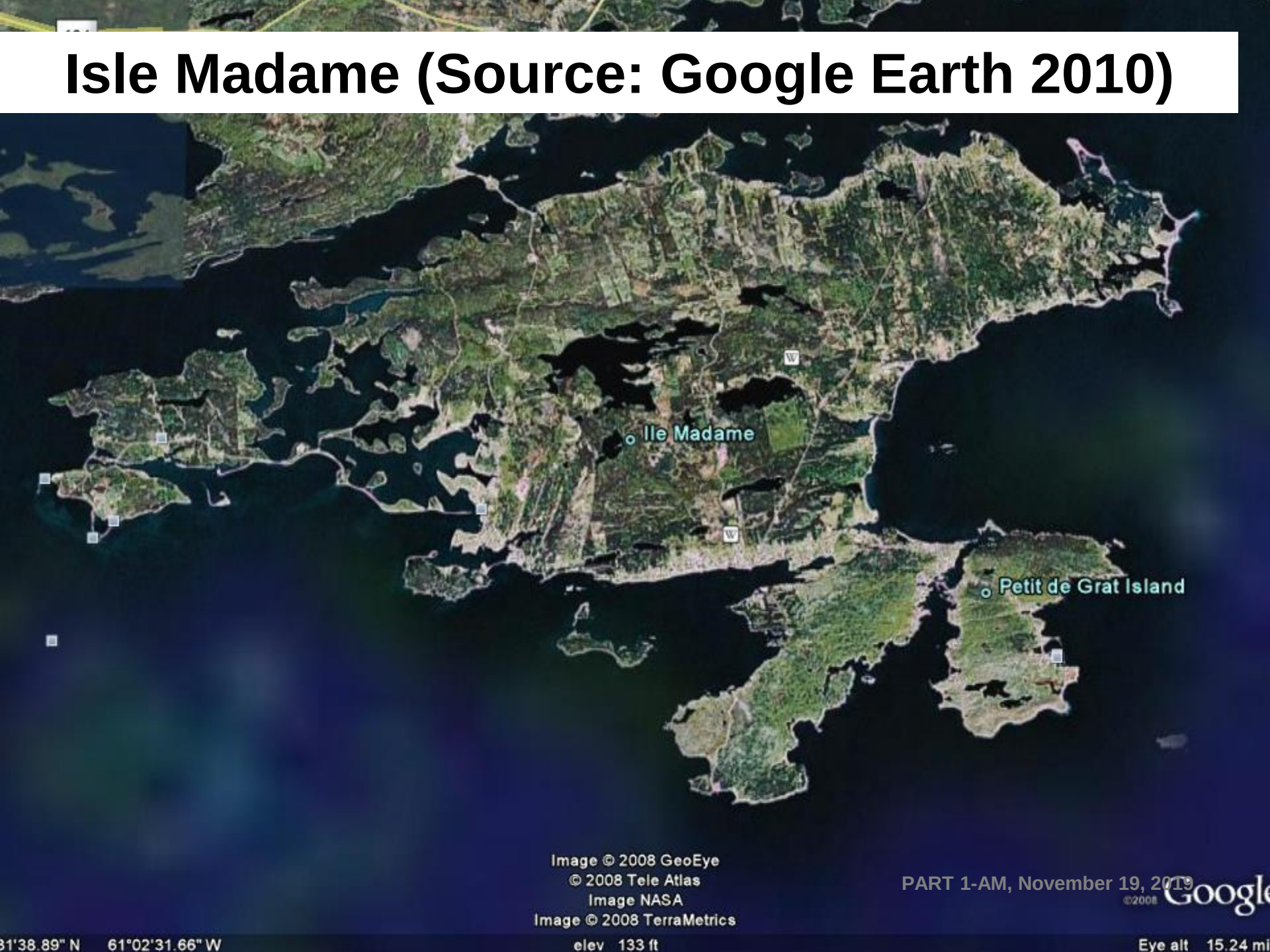
3. Understanding Adaptation Needs - Profiling Coastal Communities

PART 1-AM, November 19, 2019

*Understanding Adaptation Needs

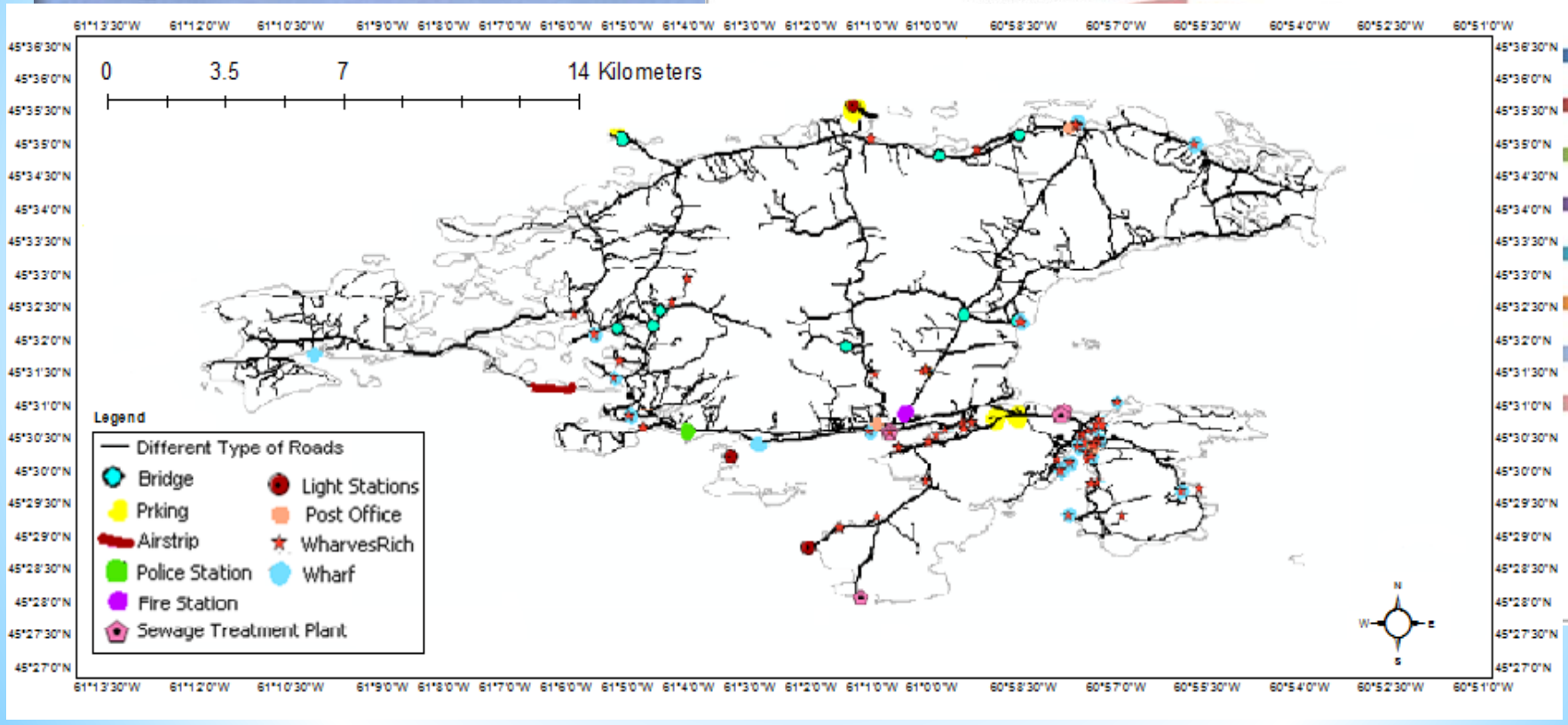
1. Profiling Coastal Communities
2. Assessing Coastal Vulnerabilities
3. Determining Relative Importance of Sustainability Pillars

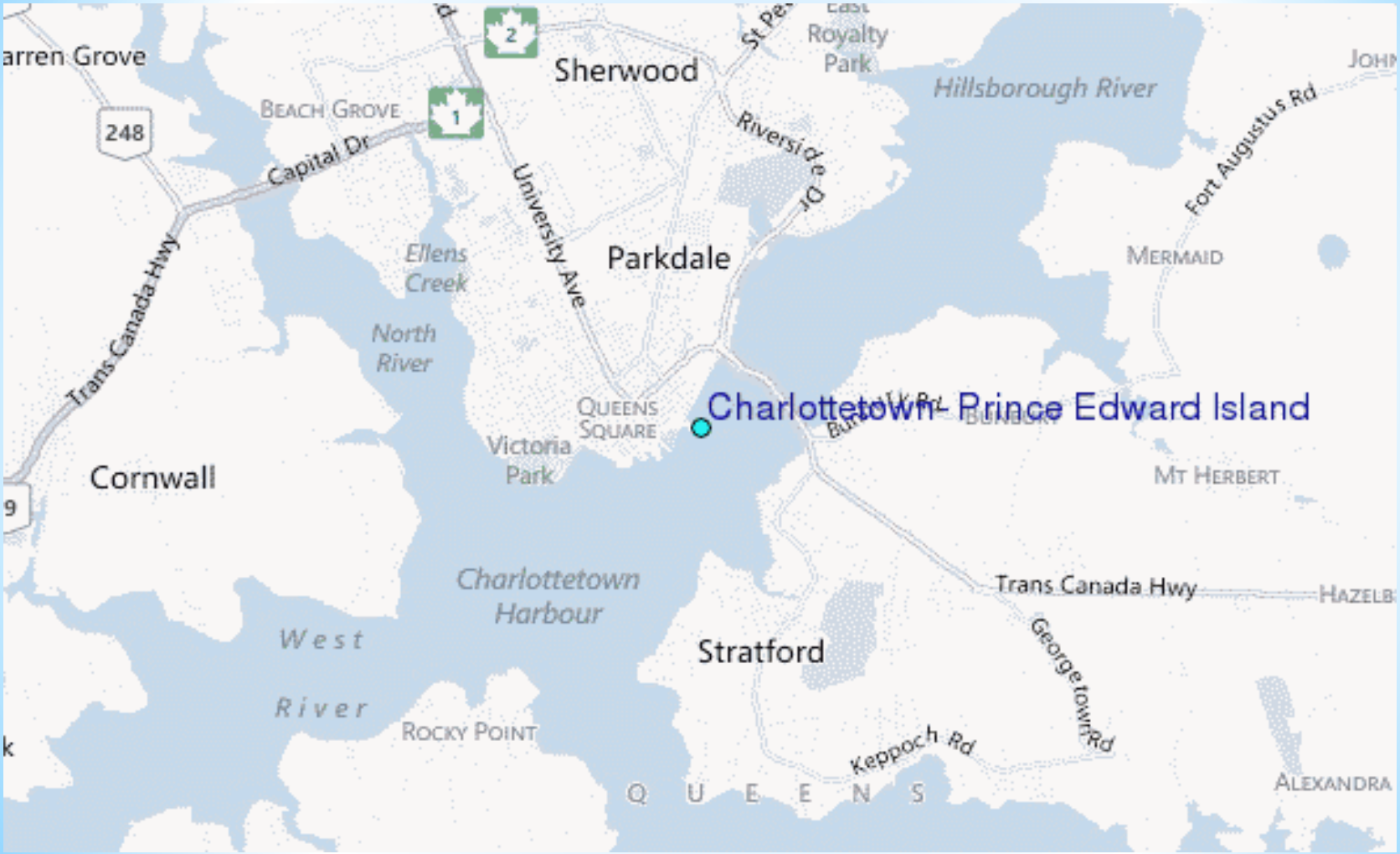
Isle Madame (Source: Google Earth 2010)



Hydrology, Land Use & Land Cover Distribution

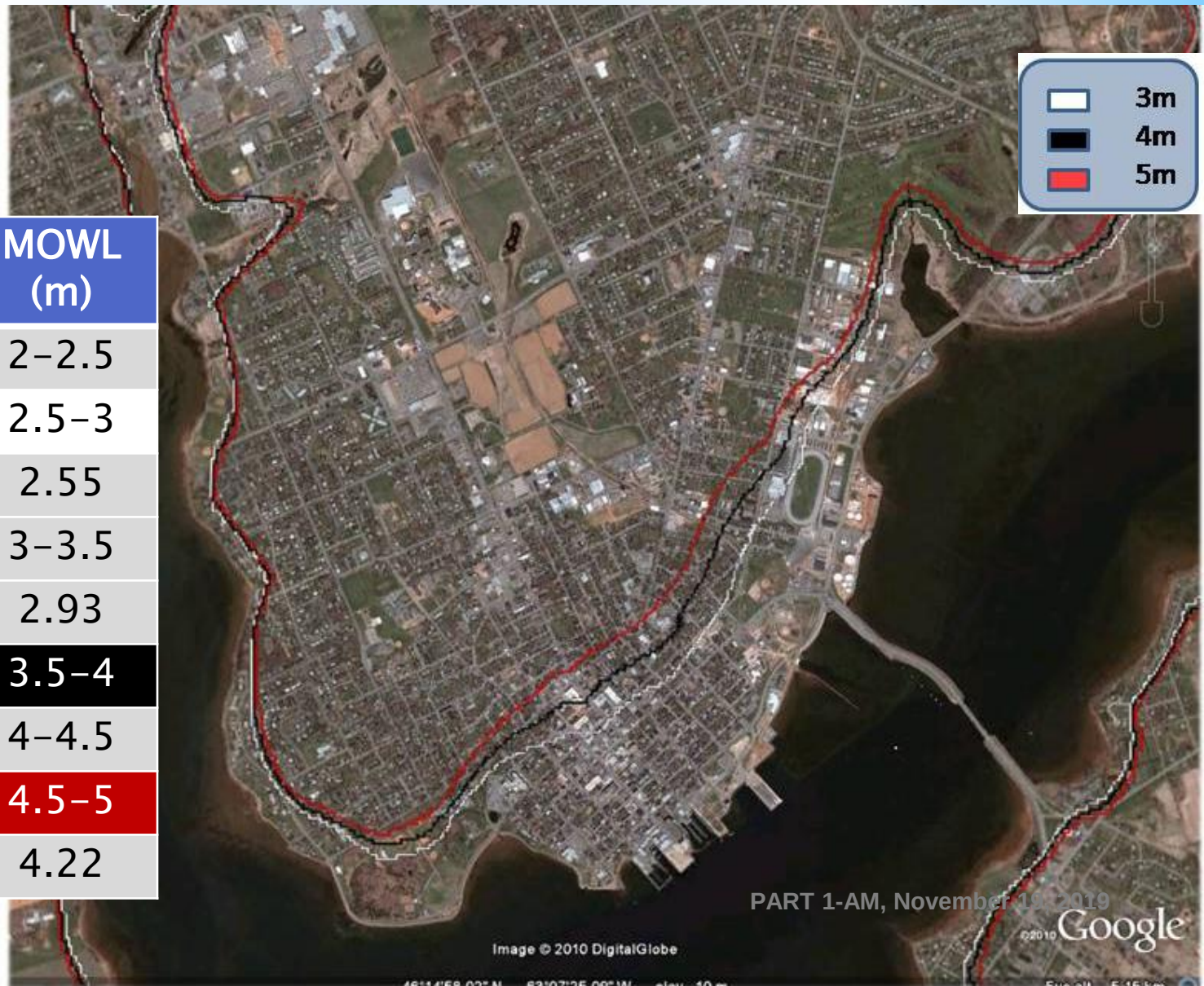
Fields/Beaches




Sherwood
Royalty Park
Hillsborough River
Beach Grove
Capital Dr
University Ave
Riverside Dr
Fort Augustus Rd
Parkdale
Ellens Creek
North River
Mermaid
Trans Canada Hwy
Queens Square
Charlottetown - Prince Edward Island
Victoria Park
Cornwall
Mt Herbert
Charlottetown Harbour
Trans Canada Hwy
West River
Stratford
Rocky Point
Keppoch Rd
Georgetown Rd
Alexandra
Queens

*Charlottetown Spatial/GIS Model

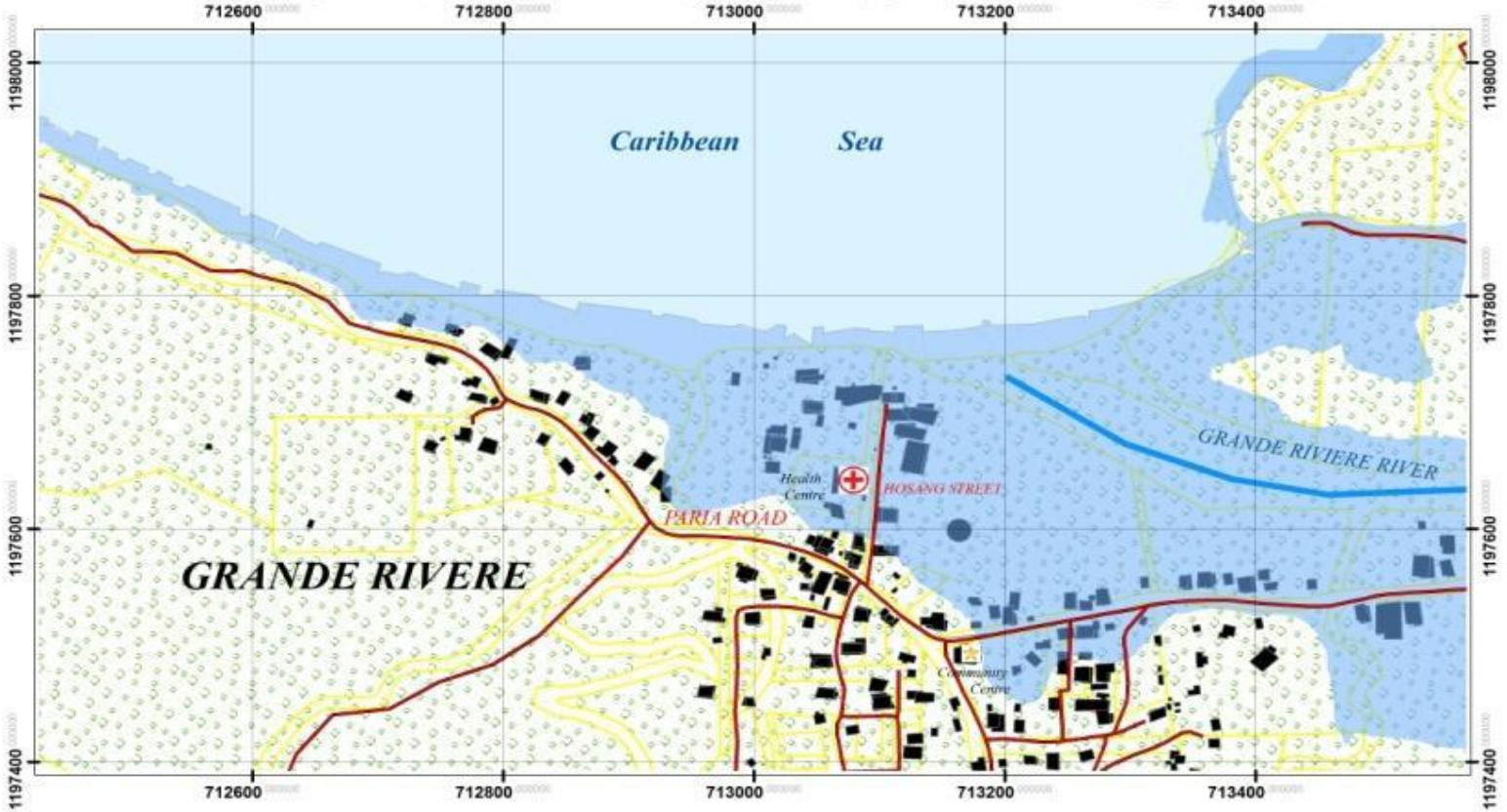
Scenario	MOWL (m)
I	2-2.5
II	2.5-3
NN1962	2.55
III	3-3.5
Juan	2.93
IV	3.5-4
V	4-4.5
VI	4.5-5
NN2000	4.22




Gulf of Mexico
Atlantic Ocean
Caribbean Sea
Pacific Ocean
Greater Antilles
Lesser Antilles
0
500 Miles
0
500 KM
Parallel scale
at 20 degrees N 0 degrees E
20 degrees N
U.S.A.
Sarasota
Fort Myers
Fort Lauderdale
West Palm Beach
Miami
Key West
Grand Bahama
Abaco
THE BAHAMAS
Nassau
Eleuthera
Cat Island
New Providence
Andros
San Salvador
Rum Cay
Great Exuma
Long Island
Samana Cay
Crooked Island
Long Cay
Mayaguana
Acklins
Little Inagua
Great Inagua
Caicos Islands
TURKS AND CAICOS ISLANDS
Turk Islands
Havana
Colon
Guane
CUBA
Cabaiguan
Camaguey
Isla De La Juventud
Merida
Cancun
Campeche
MEXICO
Chetumal
Little Cayman
Cayman Brac
Grand Cayman
CAYMAN ISLANDS
George Town
Guantanamo
Baracoa
Gonaives
Esperanza
HAITI
DOMINICAN REPUBLIC
Port-au-Prince
San Juan
PUERTO RICO
Santo Domingo
JAMAICA
Kingston
VIRGIN ISLANDS (U.S. & UK.)
St. Thomas
Tortola
Anegada
Virgin Gorda
ANGUILLA
St. John
St. Croix
St. Martin
St. Eustatius
Nevis
St. Barthelemy
St. Kitts
Barbuda
Antigua
ANTIGUA AND BARBUDA
SAINT KITTS AND NEVIS
Plymouth
MONTSERRAT
Basse-Terre
GUADELOUPE
Grande-Terre
Maria-Galante
Roseau
DOMINICA
MARTINIQUE
Castries
SAINT LUCIA
Kingstown
BARBADOS
Bridgetown
SAINT VINCENT AND THE GRENADINES
Grenadines
Bequia
St. George's
GRENADA
Port of Spain
TRINIDAD AND TOBAGO
Grand'Rivière
BELIZE
Belmopan
Puerto Barrios
GUATEMALA
San Pedro Sula
Puerto Lempira
HONDURAS
Guatemala
Tegucigalpa
Puerto Cabezas
San Salvador
EL SALVADOR
NICARAGUA
Managua
Granada
Bluefields
Lake Nicaragua
Rivas
Liberia
San Jose
Puntarenas
COSTA RICA
Colon
Panama
PANAMA
David
Oranjestad
ARUBA
Curacao
Bonaire
NETHERLANDS ANTILLES
Barranquilla
Maracaibo
Willemstad
Valencia
Caracas
Barquisimeto
Maturin
Ciudad Guayana
Ciudad Bolivar
VENEZUELA
Monteria
Cucuta
San Cristobal
Rio Magdalena
Rio Orinoco
Medellin
COLOMBIA
GUYANA
Georgetown

* Grande Riviere, NE T&T - Leatherback turtle tracks (March 22, 2010)

MAP OF GRANDE RIVIERE SHOWING 7m RISE IN SEA LEVEL



Data collected by Surveying and Existing Topographic Data
Data process in ArcGIS 9.3 & Map created in ArcGIS 9.3

1:5,000

Projection: UTM Zone 20N
Datum: WGS84
Vertical Datum: Mean Sea Level

Prediction of 50m was derived from the M.E.T office in the U.K Government

Produced on 3rd April 2010 by Amit Seeram

Profiling Communities

1. Community preferences
   * Ecological, economic, social, cultural
2. Recognition of assets
   * Natural, industrial, demographic, cultural
3. History of storm events and impacts
   * Hurricanes, high wind and snow/rain events
4. Sources of community vulnerability

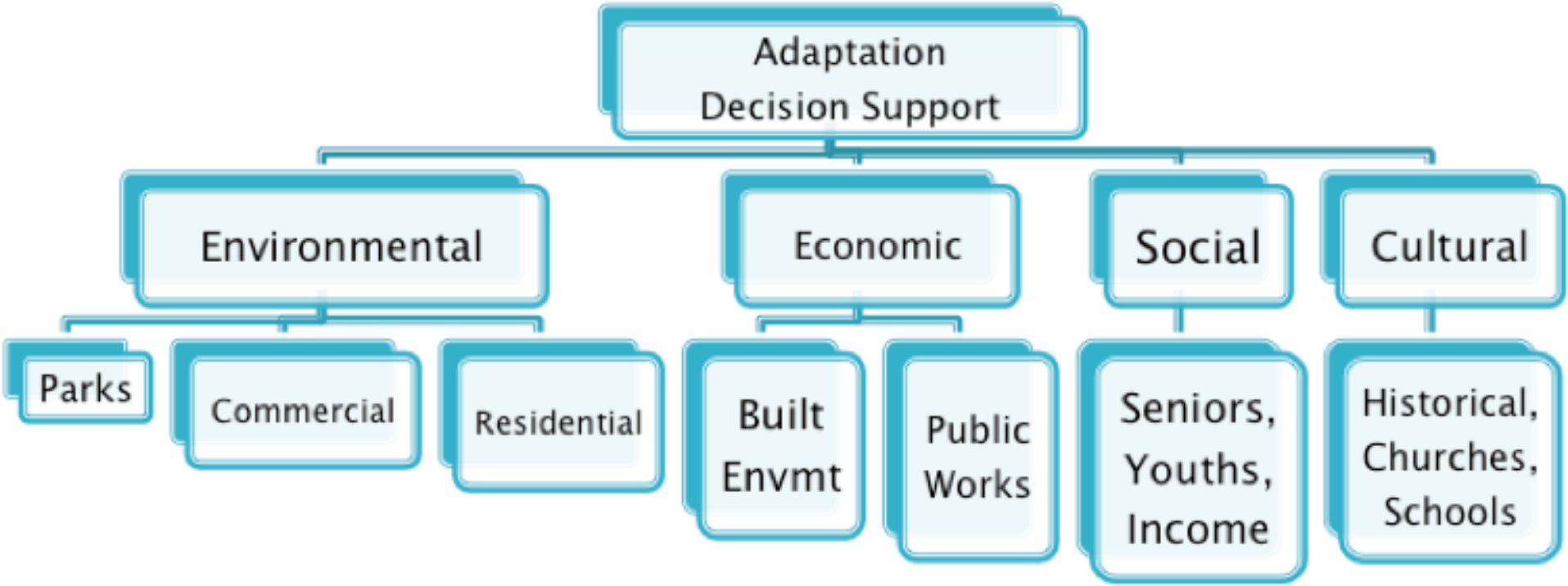
*4. Pillars of Sustainability

PART 1-AM, November 19, 2019

* Community Profile - 4 Pillars of Sustainability (ICSPs)

	Dimension	Sub-categories
1	**Environmental**	Topography, Land and Marine Use, Natural Resources, Climate
2	**Economic**	Employment, Industry, Property, Occupation, Revenues, Earnings, Public Works, Built Environment
3	**Social**	Population, Health, Education, Communications, Community Dynamics, Governance
4	**Cultural**	Places, Groups, Events, Language

*Coastal Community Adaptation Problem Hierarchy



How to compare the relative importance of problem elements?

* Pairwise comparison exercise
* Example: Community Profile Dimensions – Environmental, Economic, Social and Cultural

	Economic	Social	Cultural
Environmental	Value1	Value2	Value3
Economic	-	Value4	Value5
Social	-	-	Value6

*MCDM Worksheets (Handout)

(1) Row	Pairwise Scores 1 2 3 4 5 6 7 8 9		(2) Calculated Cells Ratio
1 Environmental		Economic	
2 Environmental		Social	
3 Environmental		Cultural	
4 Economic		Social	
5 Economic		Cultural	
6 Social		Cultural	

(2) Go back to row 1 and calculate the cells ratio for each row 1-6.

(3) Fill in the table below that summarizes the overall weights for all the pillars.

(3)	Environmental	Economic	Social	Cultural
1 Environmental	1			
2 Economic	-	1		
3 Social	-	-	1	
4 Cultural	-	-	-	1

* MCDM Worksheet Worked Example

(1)

Row		Pairwise Scores 1 2 3 4 5 6 7 8 9	
1	Environmental	■■■■■■■■■□□□□	Economic
2	Environmental	■■■■■□□□□□□□□	Social
3	Environmental	■■■■■■■■□□□□□	Cultural
4	Economic	■■■■■■■■■□□□□	Social
5	Economic	■■■■■■■■■□□□□	Cultural
6	Social	■■■■■□□□□□□□□	Cultural

(2) Calculated Cells Ratio

Row	Col	Ratio
5	4	1.25
4	5	0.8
5	4	1.25
6	3	2
6	3	2
4	5	0.8

(2) Go back to row 1 and calculate the cells ratio for each row 1-6.

(3) Fill in the table below that summarizes the overall weights for all the pillars.

(3) Matrix

	Environmental	Economic	Social	Cultural
1 Environmental	1	1.25	0.80	1.25
2 Economic	0.80	1	2.00	2.00
3 Social	1.25	0.5	1	0.80
4 Cultural	0.80	0.5	1.25	1

Participants' Preferences/Profiling Exercise

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* China-ASEAN 4th Academy (November 2018)

China-ASEAN 4th Academy on Ocean Law and Governance **November 11-21, 2018**

NISCSS, Haikou, Hainan, China

Tuesday, November 13, 2018
Climate Change Adaptation (Lane, IOI-Canada)
Multicriteria Problem Solving Session - Participant Pillar Importance Inputs

Name:	**All 26 China-ASEAN participants (3 empty)**
Country:	**China-ASEAN**

AHP Matrix

	Environmental	Economic	Social	Cultural
1 Environmental	**1.00**	1.40	1.27	1.39
2 Economic	0.71	**1.00**	1.44	1.27
3 Social	0.79	0.70	**1.00**	1.11
4 Cultural	0.72	0.79	0.90	**1.00**

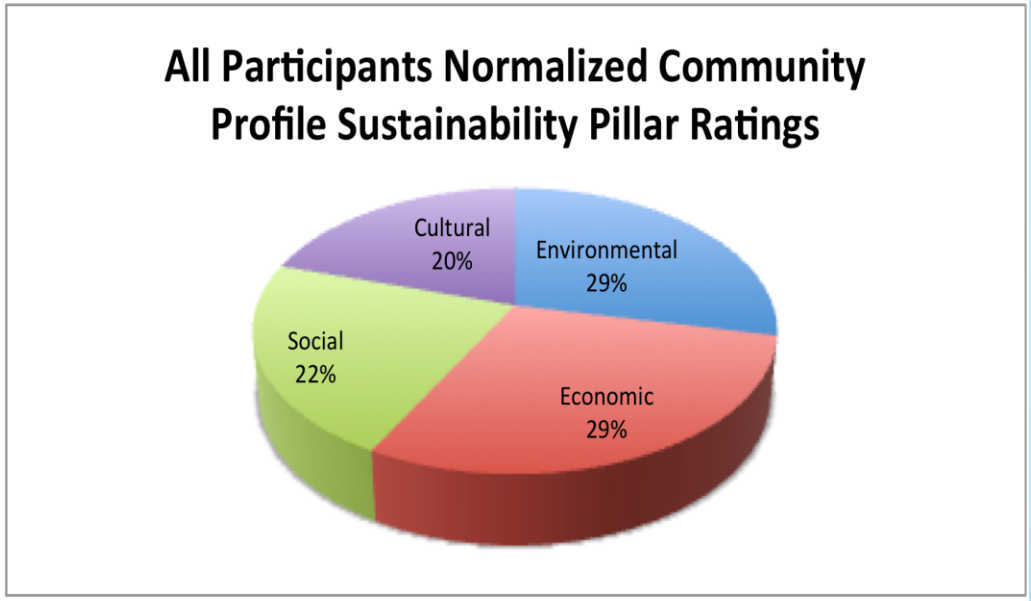
* 1st China-ASEAN Academy Results (January 2016)

AHP Community Profile Dimensions Results

Inconsistency Measure*	0.0011

*This indicator should not exceed 0.10 for reliable rational results.

Pillar Ratings	**Normalized**	**Idealized**
Environmental	0.28378	0.96665
Economic	0.29357	1
Social	0.22073	0.75189
Cultural	0.20191	0.68776
Total	1	



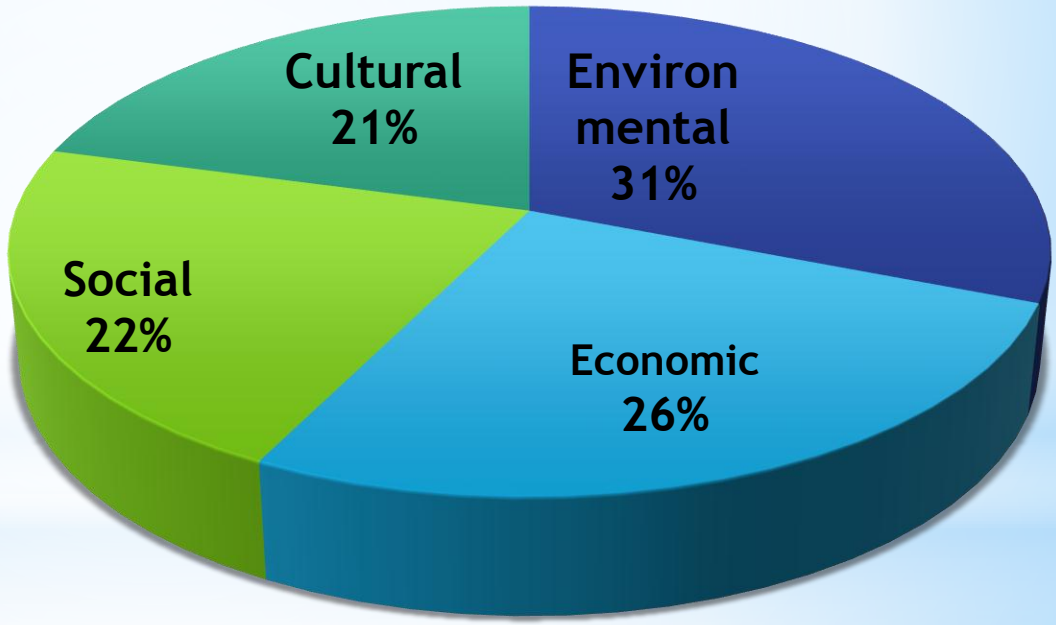
*4th China-ASEAN Academy Results (November 2018)

Inconsistency Measure*	0.0075

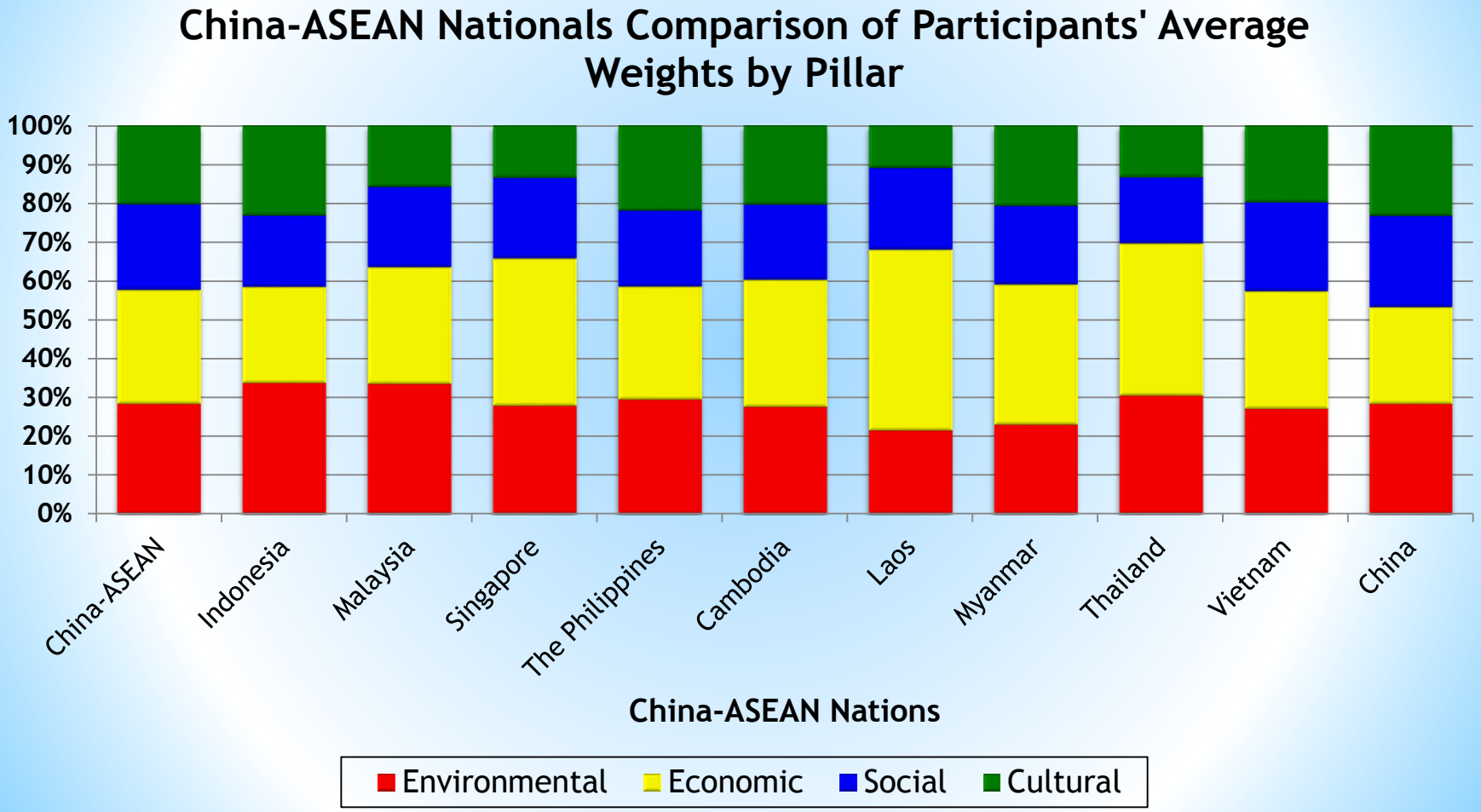
*This indicator should not exceed 0.10 for reliable rational results.

Pillar	Normalized Scores	Idealized Scores
Environmental	0.309	1.000
Economic	0.264	0.854
Social	0.218	0.705
Cultural	0.208	0.672
Total	1.000	
MAX	0.309	

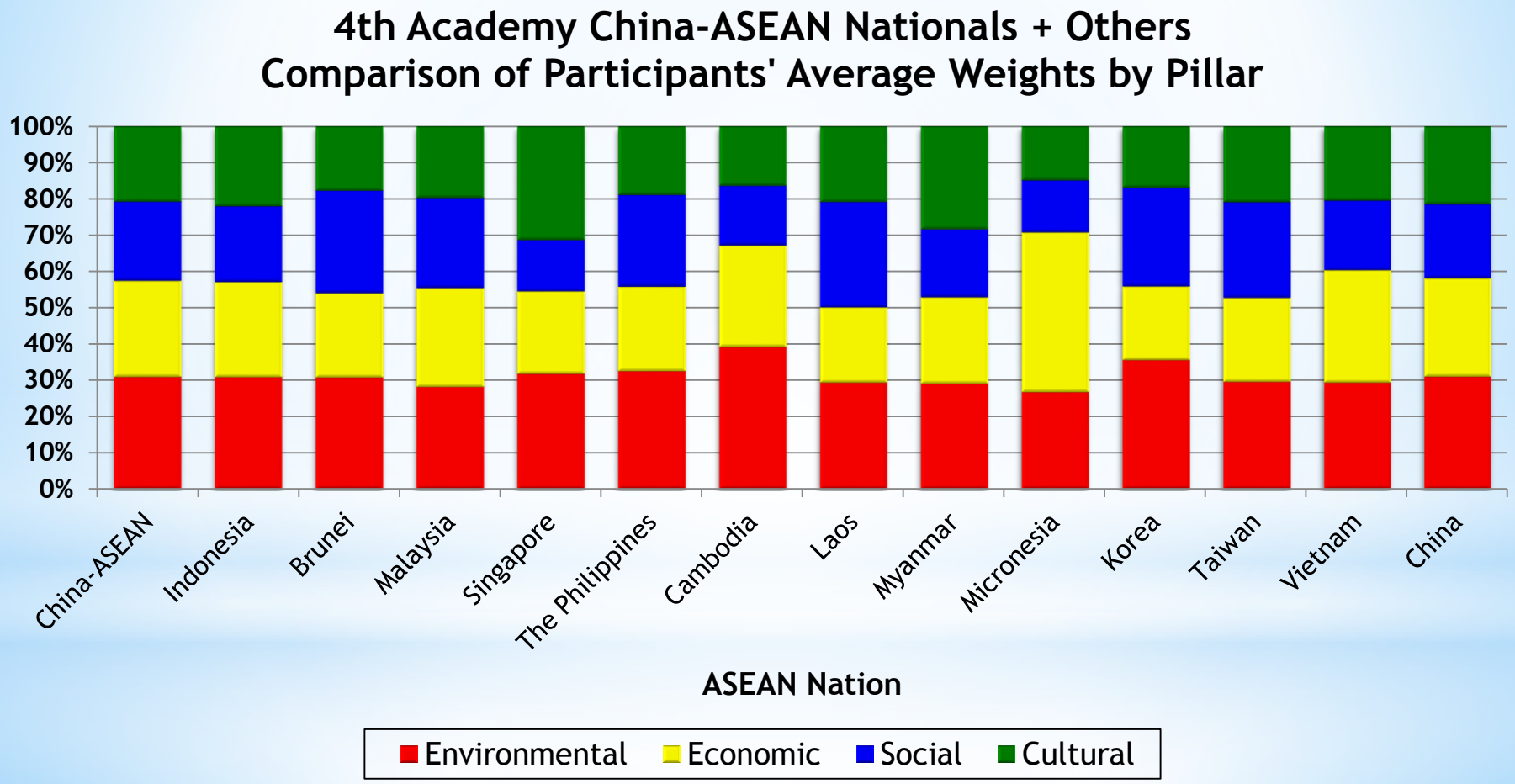
All 26 Participants in 4th Academy Normalized Community Profile Sustainability Pillar Ratings



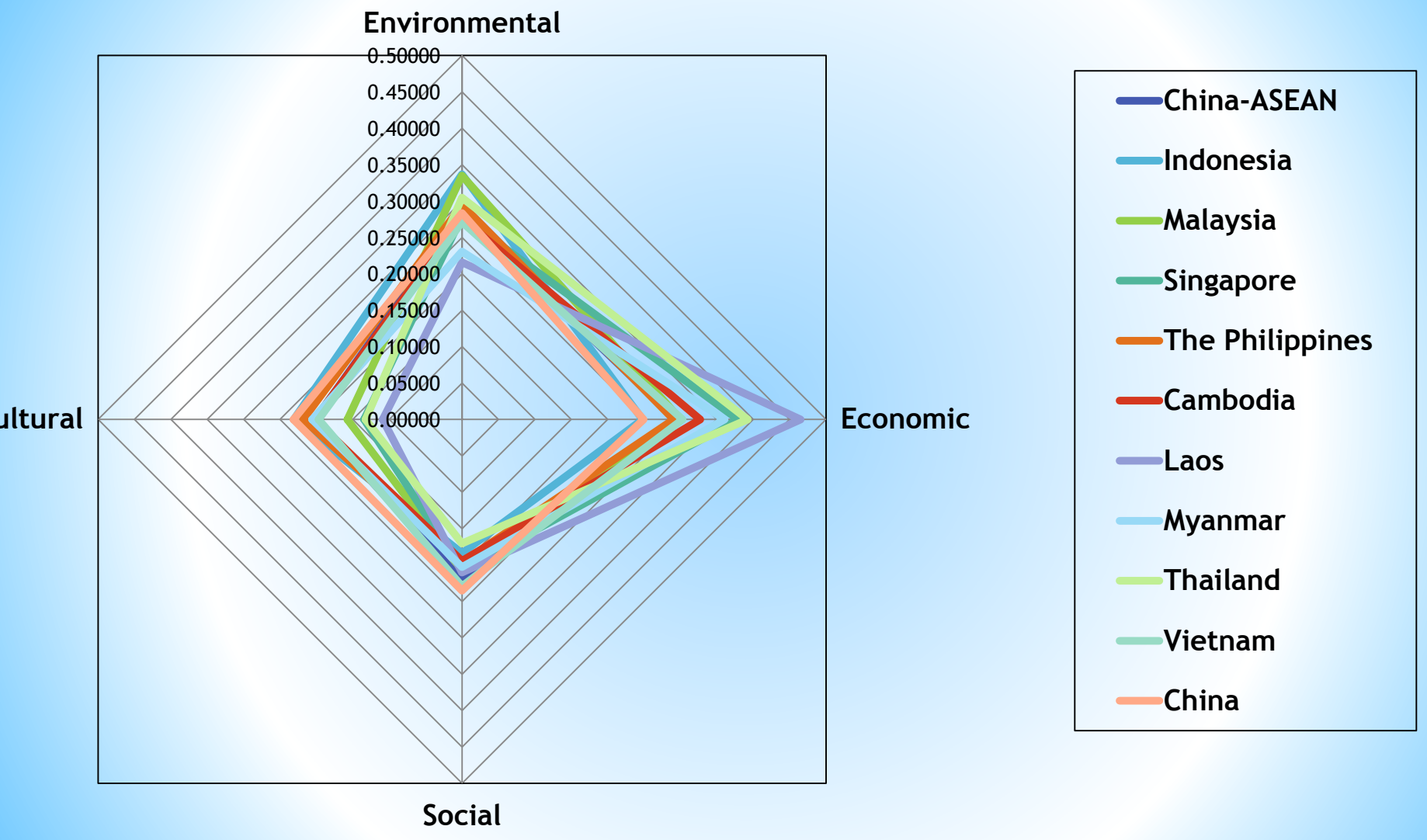
* 1st China-ASEAN Academy (January 2016)



* 4th China-ASEAN Academy (November 2018)



* 1st China-ASEAN Academy (January 2016)



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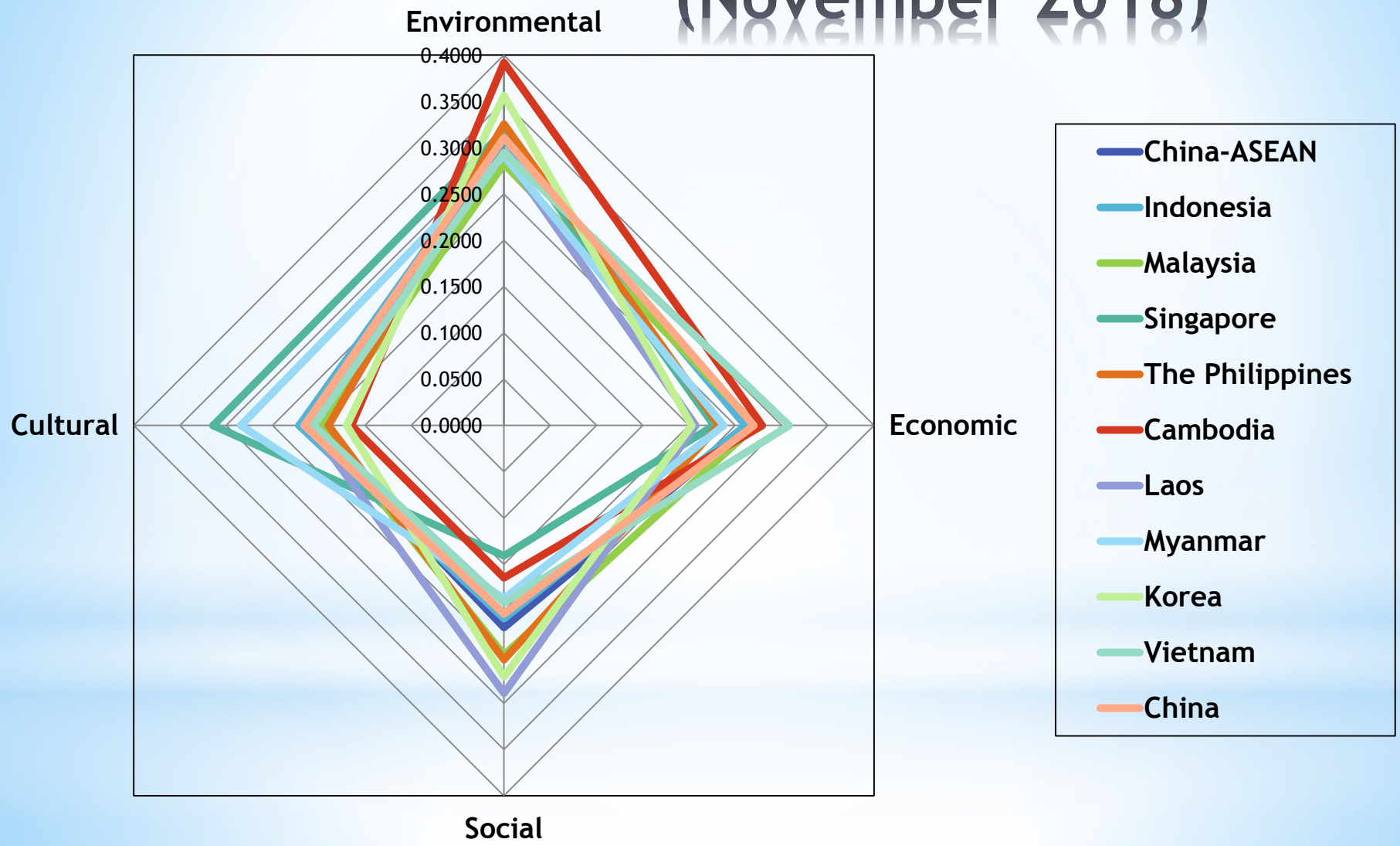
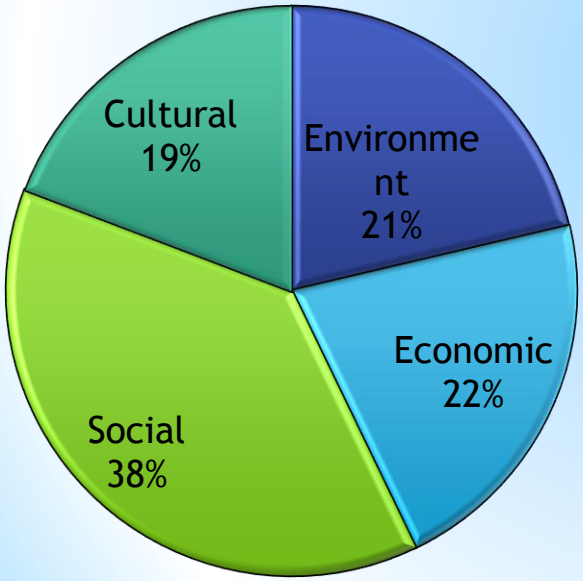


*Priorities & Multi-Participants

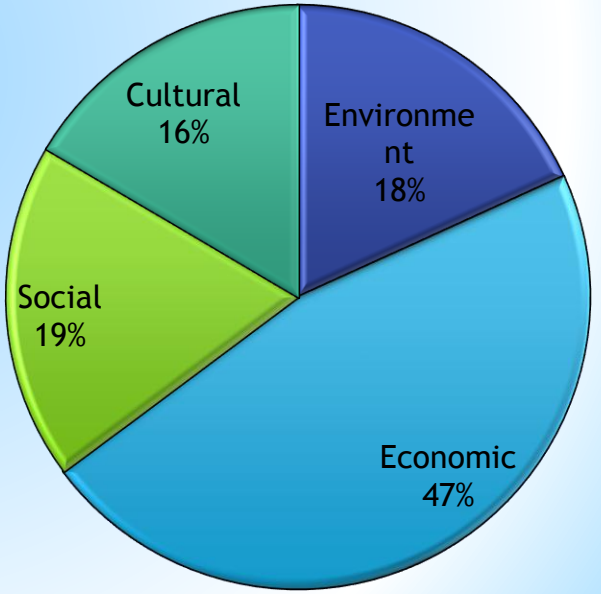
1. **Community**: representatives of the community at large
2. **Local Government**: representatives of local (municipal) government
3. **Business/Industry**: community industries
4. **Professional**: professionals providing service to the community, e.g., lawyers, doctors, nurses, engineers, etc.

*Participants' Categories

Local Government



Business/Industry



*Academy Group Weighting by Participants: Schemes

Participant	Equi-wt	Semi-Dominant	Dominant	Primary-Ignore	Equi-wt-Ignore
#1	1/6	2/6	3/6	4/6	1/3
#2	1/6	1/6	1/6	1/6	1/3
#3	1/6	1/6	1/12	1/6	1/3
#4	1/6	1/6	1/12	0	0
#5	1/6	1/12	1/12	0	0
#6	1/6	1/12	1/12	0	0

What is the Participant weight of members of each Academy Group?

*Tools

1. Geographical Information Systems – (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data.
   * ArcGIS – Esri Mapping Systems
2. System dynamics - a computer-aided approach to policy analysis and design. It applies to dynamic problems arising in complex social, managerial, economic, or ecological systems — literally any dynamic systems characterized by interdependence, mutual interaction, information feedback, and circular causality.
   * STELLA – ISEE Systems
   * Vensim (Open source, free download)
3. MCDM – MultiCriteria Decision Making - Problems characterized by multiple stakeholders, community participants, many and conflicting criteria (environmental, economic, social)
   * AHP – the Analytic Hierarchy Process (Saaty)

*Coffee Break

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