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VULNERABILITY AND ADAPTATION ASSESSMENTS OF NON-ANNEX I PARTIES FROM ASIA: PRELIMINARY SYNTHESIS AND METHODOLOGICAL ISSUES

Working paper

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I. INTRODUCTION

1. In the annex of decision 10/CP.2, non-Annex I Parties were required to provide in their initial national communications their "specific needs and concerns arising from adverse effects of climate change and/or the impact of implementation of response measures, especially on small island countries, countries with low-lying areas, countries with areas liable to drought and desertification, countries with areas with fragile ecosystems, including mountain ecosystems, countries with areas of high atmospheric pollution, countries whose economies are highly dependent on income generated from the production, processing and export and/or on consumption of fossil fuels and associated energy-intensive products, and landlocked and transit countries.

2. The annex to decision 10/CP.2 (paragraph 15) also required non-Annex I Parties to prepare policy options for adequate monitoring systems and response strategies for climate change impacts on terrestrial and marine ecosystems and to develop policy frameworks for implementing adaptation measures and response strategies in the context of coastal zone management, disaster preparedness, agriculture, fisheries, and forestry with a view to integrating these into the national planning process. The non-Annex I parties were also required to develop programmes containing measures the Party believes could contribute to addressing climate change and its adverse impacts.

3. The annex to decision 10/CP.2 did not explicitly require non-Annex I Parties to undertake climate change vulnerability and adaptation assessments despite alluding to the fact that many Parties with characteristics as defined in Article 4.8 of the UNFCCC are vulnerable and that adaptation measures and strategies were required to address the adverse impacts of climate change.

4. A total of 14 countries from the Asia and Pacific region have completed the preparation of and submitted their initial national communications to the UNFCCC. These countries are Cook Islands, Indonesia, Jordan, Kiribati, Lebanon, Malaysia, the Federated States of Micronesia, Nauru, the Philippines, the Republic of Korea, Samoa, Singapore, Tuvalu, and Vanuatu. It is expected that at least six more national communications will be submitted before the end of this year by non-Annex I Parties from the Asia and the Pacific region.

II. OBJECTIVE OF WORKING PAPER

5. The working paper will focus on priority sectors, conclusions, future needs and methodological issues in vulnerability and adaptation assessments. It is anticipated that these information will form the basis for discussions at this workshop and provide insights for further improvement of vulnerability and adaptation assessments in the future.

III. VULNERABILITY AND ADAPTATION ASSESSMENTS

6. Fourteen national communications from non-Annex I Parties that have been prepared and submitted to the UNFCCC have included climate change vulnerability and adaptation assessments on various sectors of their economies. Many of the sectors identified for assessing the impacts have been based on their national goals and development priorities.

IV. METHODS AND TOOLS USED

7. Most Parties used a range of models and approaches to undertake their vulnerability and adaptation assessments and many of them had followed the guidelines provided by the Intergovernmental Panel on Climate Change (IPCC), the UNEP Handbook on vulnerability and adaptation assessment and the methods and tools developed and provided by the United States Country Studies Programme (UCSP) (see table 1).

8. Three Parties (IDN, JOR, SGP) did not use any models and scenarios in analysing the impacts of climate change on various sectors of their economies and many of them have based their analysis on qualitative assessments with the aid of expert judgement and literature review.

9. Seven Parties (COK, FSM, KIR, NRU, TUV, VUT, WSM) made every effort to follow as close as possible the seven-step technical guidelines established by the IPCC in undertaking a vulnerability and adaptation assessment. Some Parties simply used the climate change scenarios generated by equilibrium and transient general circulation models (GCM) for various time horizons and others (COK, FSM, LBN, NRU, TUV, VUT) used a scenario generator SCENGEN linked to MAGICC, a simple global climate model for generating climate change scenarios for impacts analysis.

10. Most Parties used the IPCC sea-level rise scenarios for assessing the impacts on coastal zones and other low-lying areas. The IPCC "best-guess" scenario of a rise of 0.5m and 1.0m in 2100 was often quoted. A few countries (PHL, WSM) also used the statistical techniques to analyse the relationships between the mean climate change and extreme events.

11. Some impact models were also used to assess the impacts of climate change on various sectors. These impact models were usually sector-specific and included DSSAT3/IBSNAT, CERES in agriculture and CLIRUN in water resources (PHL).

V. SECTORAL ASSESSMENTS

12. Most reporting Parties focussed their vulnerability and adaptation assessments on agriculture, water resources, coastal zones and marine ecosystems, terrestrial ecosystems (forest and biodiversity), and human health. The others included agroforestry, fisheries, energy and housing (table 2).

13. Some Parties used their own national impact models to assess impacts in various sectors. For example, in agriculture the Republic of Korea used its own impact model on agriculture; the Philippines in water resources and terrestrial ecosystems.

14. The emphasis on vulnerability and adaptation assessment on various sectors varied markedly between countries and subregions. For example in the Pacific region coastal zones and marine ecosystems were given more emphasis while in Southeast Asia and West Asia, agriculture and water resources were the main features of the biophysical impacts. The selection of sectors for impact analysis were mainly linked to the national circumstances and the importance of such sectors to the national economies.

15. Most Parties tended to focus their assessments on each sector in isolation although some Parties (KIR, PHL, WSM) considered impacts across several sectors. Samoa produced a flow

chart depicting the effects of storm surge and tropical cyclones on coastal infrastructure, health, soils and water resources.

16. A number of Parties (FSM, KOR, NRU, PHL, TUV, VUT, WSM) anticipate that future climate change will lead to an increase in the frequency of extreme events such as droughts, floods, tropical cyclones, and El Niño-like mean state. Analysis based on historical analogues and statistical techniques by some Parties (PHL, WSM) suggest an increased frequency of extreme events under future climate change.

17. The small island States of the Pacific region (COK, FSM, KIR, NRU, TUV, VUT, WSM) and countries with a long coast line (PHL) stated that they already experience extreme events under current mean state. Future climate change and projected rapid growth in population, higher demand for goods and services and pressure on resources would exacerbate the impacts and increase their vulnerabilities.

A. Agriculture and food security

18. All reporting Parties assessed the impacts of climate change on agriculture as most were concerned about its impact on food security. Agricultural sector involved more detailed and extensive assessment of various exposure units such as food crops (COK, LBN, PHL), economic trees , livestock (MYS) and plantation crops.

19. Impact models such as CERES-Wheat, CERES-Rice within the DSSAT3 package were used by a few Parties (LBN, PHL). The Philippines, in particular, stressed that an increase in rainfall would affect its agricultural production as a result of increased frequency of flooding. Many island States (COK, FSM, KIR, NRU, TUV, VUT, WSM) assessed the likelihood of losses in agriculture as a consequence of sea-level rise.

B. Coastal zones and marine ecosystems

20. Most Parties reported that impacts of climate change on their coastal zones will have negative impact on their socio-economic infrastructure and activities. Many countries (COK, FSM, KIR, NRU, PHL, TUV, VUT, WSM) pointed out that they rely heavily on coastal and marine ecosystems for their livelihood and therefore any change in sea-level and the incidence of extreme events will have negative impacts.

21. Many small island States (COK, FSM, KIR, NRU, TUV, VUT, WSM) place greater significance on the impacts of accelerated sea-level rise and most of them were concerned about impacts on their coastal zones and its consequent effect on their water resources, fisheries and coral reef ecosystems. Kiribati, the Federated States of Micronesia and Tuvalu particularly stressed the effects sea-level rise would have on their national economies.

22. Other exposure units that Parties considered to be affected in the coastal zones included soils, mangroves, estuarine wetlands and sea grass communities.

C. Water resources

23. Most of the Parties expect that climate change will have an impact on their water resources. More than 50 per cent of the reporting Parties assessed the impacts by analysing the hydrological parameters such as runoff and the water balance. Small island States (KIR, TUV)

that rely almost entirely on rainwater and from the Ghyben-Herzberg freshwater lens were particularly concerned about the incidence of drought and its effect on human health as a result of climate change and sea-level rise.

24. Several countries (FSM, KOR, PHL) indicated that changes in estimated runoff could be quite large; and the Philippines, in particular, reported that it already experiences severe water supply problems mainly as a consequence of population pressure, agriculture and industry, rapid urbanization and unabated pollution of its water resources, coupled with climate variability and extreme events.

25. The Republic of Korea reported that climate change would have a positive impact on the supply-demand ratio for water under some scenarios of climate change, but other Parties (COK, FSM, KIR, NRU, TUV, VUT) indicated a negative impact due to the intrusion of sea water as a result of sea-level rise.

D. Human health

26. Eight Parties (COK, KIR, LBN, PHL, SGP, TUV, VUT, WSM) assessed the impacts of climate change on human health. All of these Parties indicated negative impacts such as higher incidences of vector and water-borne diseases (KIR, LBN, PHL, SGP, TUV, VUT, WSM). The Philippines analysed the relationships between various climatic factors and population and incidence of diseases, while the Federated States of Micronesia and Nauru noted that there will be direct and indirect impacts on human health.

27. A number of diseases were found to increase in incidences and these included vector-borne diseases such as malaria and dengue (COK, FSM, KIR, LBN, NRU, PHL, TUV, VUT). Increased incidence of water-borne diseases such as cholera, typhoid and intestinal problems were found to be highly likely under future climate change. Other Parties (COK, FSM, VUT) indicated an increase in cardiovascular problems associated with heat stress leading to an increase in mortality and morbidity.

28. Two Parties (PHL, WSM) emphasized the poor living conditions and poor water supply systems and lack of resources in the health sector will be exacerbated by impacts of climate change on the population.

E. Terrestrial ecosystems and forests

29. Four Parties (LBN, MYS, PHL, WSM) reported impacts of climate change on terrestrial ecosystems and forest resources. The impacts included the likelihood of increased incidences of forest fires, low productivity due to drought and flooding, degradation of biologically important marshlands, and altitudinal shifts of forest ecosystems.

30. The Republic of Korea reported that its forest cover is likely to decline with climate change after 100 years but the process of decline is likely to begin after only 30 years. This result was derived from an analysis of impacts under various climate change scenarios.

F. Fisheries

31. Five countries (FSM, KIR, KOR, LBN, VUT) examined the impacts on fisheries. The main focus of the assessment was on the tuna fishery in the Pacific (FSM, KIR, VUT), and the

cold-water fish in the Yellow Sea (KOR). The effect of sea water temperature coupled with a projected El Niño-like mean state in the future as a result of climate change is likely to affect the spawning and migratory patterns of the tuna fishery thereby affecting the catch and incomes of the small island countries (FSM, KIR, VUT) that depend on it for their livelihood.

VI. ADAPTATION MEASURES AND RESPONSE STRATEGIES

32. A number of Parties (FSM, JOR, LBN) listed a number of adaptation projects as part of their adaptation assessments and others (JOR, PHL) have indicated that existing legislation and development plans could facilitate future adaptation to climate change.

33. Most Parties identified a variety of options in various sectors for adaptation based on stakeholder consultations and reviews of existing policies and programmes. Two Parties (PHL, WSM) conducted adaptation analysis in agriculture, water resources, and coastal zones based on a cost and/or measure of effectiveness and benefits as well as by using Adaptation Strategy Evaluator Analysis (ASE) to evaluate and rank adaptation options in these sectors (table 4).

34. Adaptation analysis was mainly undertaken by qualitative assessments of measures, their costs and benefits across various sectors to enhance and define their adaptive capacities and future adaptations. Some Parties (LBN, NRU, PHL, TUV, WSM) indicated that future adaptation to climate change should be integrated into improved resource management.

A. Agriculture

35. A number of adaptation options in agriculture have been identified by the reporting Parties. These include development of new drought-resistant crops, improved system of water management in irrigation, diversification, integrated pest management, improved land management and use, soil fertility maintenance (PHL) and economic options such as liberalization of trade barriers, and the introduction of subsidies and/or incentives schemes (MYS).

36. In the small islands States of the region (COK, FSM, KIR, NRU, TUV, VUT, WSM) breeding and introduction of salt-tolerant root crops is seen as an effective measure, where agriculture is practised in vulnerable low-lying areas. Other measures include improved soil and water conservation practices both in flood and drought prone areas, diversification and intensification of food and plantation crops so that the risk of losses due to extreme events is lessened.

37. Promotion of traditional agricultural systems and agroforestry, developing and encouraging sustainable practices and economic opportunities for the use of trees and other plants is seen by many small islands States as appropriate adaptive responses. Greater emphasis needs to be placed on quarantine surveillance against introduced and invasive species which could destroy local agriculture.

B. Coastal zones and marine ecosystems

38. Eleven Parties (COK, FSM, KIR, LBN, MYS, NRU, PHL, SGP, TUV, VUT, WSM) identified a number of adaptation options which could be implemented in the coastal zones and marine ecosystems. The options included development and construction of seawalls (and beach

protection systems, eg: SGP), beach nourishment and protection of coral reef and marine ecosystems by creating protected areas and encourage the use of appropriate traditional technologies to promote shoreline stabilization (FSM, KIR, LBN, PHL, WSM).

39. Other options identified by Parties included restoration, rehabilitation and reclamation of degraded lands and coastal areas, management of environmental quality, coastal planning and zonation as well as promoting public awareness to enhance protection of coastal and marine ecosystems (MYS, PHL, SGP).

C. Water resources

40. Ten Parties (COK, FSM, KIR, LBN, NRU, PHL, SGP, TUV, VUT, WSM) considered some adaptation options for water resources. These included flood control and/or mitigation measures, improved capacity of water reservoirs and conservation, use of groundwater resources, better watershed management, development of new infrastructure, inclusion of desalination plants and better management of storm water and recycled water.

41. Two Parties (IDN, PHL) considered various ways in which to change cropping schedules in order to lessen the demand for irrigation particularly in the rice fields and others (incl. KOR) considered measures to address risks of floods and drought by improving monitoring and forecasting systems as well as outreach activities such as awareness programmes focused on climate variability and its effects.

42. Three Parties (JOR, LBN, PHL) reported that to enhance adaptation to climate change some measures have to be undertaken to prevent further pollution of their water resources. Improved management and maintenance of existing water supply systems has been identified as a high priority response as well as catchment protection and conservation, drought and flood preparedness strategies and protection of groundwater resources, particularly in small island States (COK, FSM, KIR, NRU, TUV, VUT, WSM).

D. Human health

43. Public awareness programmes related to malaria and dengue, and other water-borne and vector-borne diseases has been identified as a low cost adaptation activity by seven Parties (COK, FSM, KIR, NRU, TUV, VUT, WSM), including monitoring and surveillance of disease vectors is critical (MYS). Improved housing and living conditions, improved emergency response systems have been identified as a viable response strategy (MYS, PHL, VUT).

E. Fisheries

44. To enhance future adaptation to climate change in fisheries, two Parties (FSM, LBN) identified the importance of data collection, research and monitoring of fish stocks particularly in large bodies of water. Improved fisheries management and sustainable use practices of marine resources are also important (MYS, PHL).

F. Terrestrial ecosystems and forests

45. Conservation of biodiversity is considered to be a viable, no-regrets adaptation measure (COK, FSM, KIR, NRU, TUV, VUT, WSM) and forest conservation. Other options identified

included development and enhancement of plantation forestry, development of soil seed banks, efficient use of timber resources, prevention of forest fires, improved land and forest management practices and development and trials of new and faster growing trees, protection and rehabilitation of forests and grasslands (IDN, LBN, MYS, PHL), and integration of existing land and forest management legislation and policies to future adaptation to climate change (IDN, KOR, PHL, WSM).

VII. PROBLEMS ENCOUNTERED IN VULNERABILITY AND ADAPTATION ASSESSMENTS

46. Many Parties (COK, FSM, KIR, LBN, PHL, MYS, NRU, TUV, VUT) have identified major constraints in conforming to the IPCC Guidelines and as a result, no attempt has been made to address all of the steps and procedures identified in the guidelines.

47. Gaps in relevant data required for vulnerability and adaptation assessments has been identified as a major problem in vulnerability and adaptation assessments. Almost all Parties highlighted the need to obtain country- and sector-specific data to underpin their vulnerability and adaptation assessments.

48. All reporting Parties from Asian region highlighted the limitations in using general circulation models (GCM) for developing regional climate change scenarios and attributed this limitation to a large spatial spatial scale of the GCM outputs and were not useful for analysing impacts at national and local levels.

49. Some Parties found that GCM simulations of current climate, particularly for precipitation was less accurate and therefore projection of changes in rainfall in the future were less certain. Most Parties did not attempt to deal with uncertainties which arose from emission scenarios, climate sensitivity and regional patterns of climate change.

Tables

Table 1. Methods and tools used by Parties from the Asia and the Pacific region in vulnerability assessment

Method	COK	FSM	IDN	JOR	KIR	KOR	LBN	MYS	NRU	PHL	SGP	TUV	VUT	WSM
Scenarios														
GCM equilibrium					✓	✓			✓	✓			✓	
GCM transient	✓						✓	✓				✓		✓
SCENGEN technique	✓	✓			✓			✓	✓				✓	✓
SCM (MAGICC)								✓						
Incremental						✓				✓				
Analog, statistical														✓
Socioeconomic					✓		✓		✓			✓		✓
IPCC ASLR	✓	✓			✓			✓	✓			✓	✓	
Not specified			✓	✓							✓			
***Agricultur*e**														
DSSAT 3/IBSNAT & CERES										✓				
Livestock: SPUR2														
National models						✓								
Qualitative	✓				✓									
Other														
Not specified		✓	✓	✓			✓		✓		✓	✓		✓
Water resources														
CLIRUN														
National models										✓				
Qualitative	✓				✓				✓				✓	
Other														
Not specified		✓	✓	✓		✓	✓				✓	✓		✓
Coastal zones and marine ecosystems														
Common IPCC methodology incl. economic analysis.	✓	✓			✓					✓		✓	✓	✓
Qualitative	✓				✓									
Other (AVVA?)														
Not specified			✓	✓		✓	✓				✓			
Terrestrial ecosystems														
Holdrige or GAP														
National methods							✓	✓						
Qualitative										✓				✓
Other														
Not specified						✓					✓			

Method	COK	FSM	IDN	JOR	KIR	KOR	LBN	MYS	NRU	PHL	SGP	TUV	VUT	WSM
Human health														
Statistical approach								✓		✓				
Qualitative	✓				✓			✓	✓		✓	✓	✓	
Not specified							✓							
Other sectors [1]														
Qualitative	✓	✓			✓	✓	✓		✓	✓		✓	✓	✓
Other					✓	✓						✓		
Not specified			✓	✓			✓				✓			
Integrated analysis														
Qualitative					✓					✓				✓
Not specified														
Quantitative methods														
Consistency with IPCC technical guideline on V&A (as reported by Parties)	✓	✓			✓		✓	✓	✓	✓		✓	✓	✓

Note: "Qualitative" means an approach that includes expert assessments and qualitative about possible impacts of climate change sea level rise.

[1] Includes fisheries, energy, industry, human settlements

Table 2. Summary of the results of impacts and vulnerability assessment by Parties by sector

Country	Sector							*Assistance*
	Agriculture and food security	*Water resources*	*Coastal zones and marine ecosystems*	*Terrestrial ecosystems (forest, rangelands, etc.)*	*Human health*	*Fisheries*	*Other*	
Cook Islands	- q	- q	-		- q		- q biodiversity	PICCAP
Indonesia	-q	-q	-q					
Jordan								
Kiribati	- q	- q	-			- q		USCSP/ PICCAP
Lebanon	± q	- q	- q	- q	- q	- q		
Malaysia	± q	- q	± q	± q	- q		- q livestock	GEF
Micronesia	- q	- q	- q	- q	- q	-q	- q wildlife	USCSP/ PICCAP
Nauru	- slr,q		- q	- q	- q		- biodiversity	PICCAP
Republic of Korea	±	±	-	± forest		-q		
Philippines	- ±	±	- slr ± mangrove	- q	-			USCSP GEF
Samoa			-		-q		- biodiversity	USCSP/ PICCAP
Singapore	- q	- q	± q	- q	-			GEF
Tuvalu	± q	- q	- economic analysis		- q			PICCAP
Vanuatu	- q	- q	-		- q	?		PICCAP

Note:

"-" in the agricultural sector, grasslands and forestry: a decrease in crop yield or biomass,
in the water resource sector: a decrease in runoff,
in the coastal zone and marine ecosystems, health sector and fisheries: general negative impact .

\+ in the agricultural sector, grasslands and forestry: an increase in crop yield or biomass,
in the water resource sector: an increase in runoff,
in the coastal zone and marine ecosystems, health sector and fisheries: general positive impact

± in the agricultural sector, grasslands and forestry: an increase and decrease in yield or biomass for different crops, scenarios or study areas,
in the water resource sector: an increase and decrease in runoff for different scenarios or study areas,
in the coastal zone and marine ecosystems, health sector and fisheries: mixed impact.

q – qualitative estimations.

Table 3. Adaptation assessment and adaptation evaluation methods by Parties by sectors

Country	*Agriculture and food security*	*Water resources*	*Coastal zones and marine ecosystems*	*Terrestrial Ecosystems (forest, rangelands, etc.)*	*Human health*	*Other*	*Reporting*
Cook Islands			✓		✓		List of needs
Indonesia	✓	✓	✓	✓			List of options
Jordan		✓					NEAP priority actions and preliminary cost estimates
Kiribati	✓	✓	✓				List of options Cross sectoral adaptations
Lebanon	✓	✓	✓	✓	✓	✓ fisheries	Initial adaptation analysis List of options. Cross sectoral adaptations
Malaysia	✓	✓	✓	✓	✓		List of sector-specific adaptation options
Micronesia	✓	✓	✓ CB			✓ fisheries	Initial adaptation analysis List of options
Nauru							General statement on the needs for adaptation
Republic of Korea		✓	✓	✓			List of options
Philippines	✓ ADM	✓ ADM	✓				Adaptation analysis Ranked adaptation options
Samoa	✓ ASE	✓ ASE	✓ ASE	✓	✓		Adaptation analysis Ranked adaptation options
Singapore	✓	✓	✓		✓		Some options identified
Tuvalu							General statement on the needs for adaptation
Vanuatu	✓	✓	✓		✓		List of options

Note: C/CB – cost and cost-benefit analysis;
ASE- Adaptation Strategy Evaluator,
ADM – Adaptation Decision Matrix,
DSSAT – The Decision Support System for Agrotechnology Transfer

Table 4. Summary of adaptation options in the agricultural, water resources, and coastal zone sectors

Option	COK	FSM	IND	JOR	KIR	KOR	LBN	MYS	NRU	PHL	SGP	TUV	VUT	WSM
Agriculture														
Change management practices to those suitable to climate change					✓		✓	✓		✓				✓
Switch to different cultivars, development new crops		✓			✓			✓		✓			✓	✓
Improve and conserve soils		✓						✓		✓			✓	
Enhance irrigation efficiency and expanding irrigation										✓			✓	
Establish seed banks								✓						
Develop new crops								✓						
Develop and introducing policy measures, including taxes, subsidies, facilitation of free market								✓						
Develop early warning system and disaster preparedness										✓	✓			
Improve pest/disease forecast								✓						
Water resources														
Increase water supply, e.g by using groundwater, building water storage reservoirs, improving/ stabilizing watershed management, desalinization etc.			✓	✓			✓			✓	✓		✓	
Decrease water demand, e.g. by increase of efficiency, water recycling.			✓	✓			✓			✓				
Develop and introducing flood and drought monitoring and control system			✓			✓		✓		✓				
Method/approach														
Reduce water pollution			✓	✓			✓			✓	✓			
Improve or develop new water management		✓	✓	✓	✓	✓	✓	✓		✓			✓	
Alter system operating rules, i.e. pricing policies										✓				
Coastal zones and marine ecosystems														
Develop integrated coastal zone management					✓		✓	✓		✓			✓	
Develop planning /new investment requirements							✓						✓	
Protect, including building sea walls, and beach nourishment		✓					✓	✓	✓		✓			
Retreat		✓					✓	✓	✓					
Beach nourishment - see														
Research/monitor the coastal ecosystems		✓						✓	✓	✓			✓	
Accommodation					✓									

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