Developing a National M&E framework for climate change

Tracking Adaptation and Measuring Development (TAMD) in Cambodia

Neha Rai, Nick Brooks, Tin Ponlok, Neth Baroda and Erin Nash

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MINISTRY OF THE ENVIRONMENT / GENERAL SECRETARIAT OF THE NATIONAL COUNCIL FOR SUSTAINABLE DEVELOPMENT

BMZ Federal Ministry for Economic Cooperation and Development

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Produced by IIED's Climate Change Group

Working in collaboration with partner organisations and individuals in developing countries, the Climate Change Group has been leading the field on adaptation to climate change issues.

Acknowledgements

The authors would like to greatly appreciate the collaboration from the Department of Climate Change, General Secretariat of the National Council for Sustainable Development, Ministry of Public Works and Transport, Cambodia Climate Change Alliance, UNDP Cambodia, and Consultants of SPCR in Cambodia. The financial support from Department for International Development (DFID) and the Federal Ministry for Economic Cooperation and Development (BMZ) is also greatly appreciated. The authors would also like to thank Clara Landeiro from CCCA for her thorough review and inputs. Disclaimer: The views expressed in this publication are the author's own and do not reflect the view of their institutions.

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Garama 3C Ltd is a UK-based consultancy firm specialising in climate change and international development.

Published by IIED, July 2015

Neha Rai, Nick Brooks, Tin Ponlok, Neth Baroda and Erin Nash (2015). Developing a national M&E framework for climate change: Tracking Adaptation and Measuring Development (TAMD) in Cambodia. Research Report, IIED, London.

http://pubs.iied.org/10118IIED

ISBN: 978-1-78431-145-2

Printed on recycled paper with vegetable-based inks.

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Acronyms

CCAP	Climate Change Action Plan
CCCSP	Cambodia Climate Change Strategic Plan
DCC	Department of Climate Change
CCSP	Climate Change Strategic Plan
CDB	commune database
CRM	climate risk management
CVI	Climate Vulnerability Index
DoP	Department of Planning
DRI	Disaster Risk Index
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GSSD	General Secretariat of the National Council for Sustainable Development
HDI	Human Development Index
IPCC	Intergovernmental Panel for Climate Change
M&E	monitoring and evaluation
MoE	Ministry of Environment
MoP	Ministry of Planning
MPWT	Ministry of Public Works and Transport
NAPA	National Adaptation Programme of Action
NCSD	National Council for Sustainable Development
NSDP	National Strategic Development Plan
PIP	Public Investment Programme
PPCR	Pilot Programme for Climate Resilience
RGC	Royal Government of Cambodia
SCCSP	Sectoral Climate Change Strategic Plan
TAMD	Tracking Adaptation and Measuring Development
VI	Vulnerability index

Executive summary

This report records how Cambodia is implementing its national monitoring and evaluation (M&E) framework to measure the performance of its national and sectoral responses to climate change, using IIED's Tracking Adaptation and Measuring Development (TAMD) approach.

Cambodia's recently released Climate Change Strategic Plan (CCCSP) 2014–2023 recognises the importance of building a national M&E framework that measures and tracks how well the country is managing climate risks and meeting development targets. TAMD, a conceptual framework developed and tested by IIED in nine Least Developed Countries, provides an effective foundation for developing a national M&E system.

TAMD is a twin-track framework that evaluates adaptation success as a combination of how widely and how well countries or institutions manage climate risks (through 'track 1', or 'upstream' indicators) and how successful adaptation interventions are in reducing climate vulnerability and in keeping development on course (through 'track 2', or 'downstream' indicators). With its twin-track approach, TAMD can be used to assess whether climate change adaptation leads to effective development, and also how development interventions can boost communities' capacity to adapt to climate change.

The M&E of climate change responses in Cambodia at this stage sought to assess resilience benefits at national and sectoral levels. For the latter, it measures the climate change responses of the Ministry of Public Works and Transport (MPWT).

At the time of engagement, the emphasis was on creating an M&E framework for climate responses and collecting baseline data. The main activities focused on:

- collecting baseline data from which to measure the effectiveness of interventions in the future,
- mainstreaming the TAMD approach with Cambodia's pre-existing M&E framework for development, and
- Training staff to complete the latter stages of the M&E process when IIEDs engagement is complete.

National-level indicators

The CCCSP suggests two indicator categories to measure institutional response for managing climate change and development performance in a changing climate. The TAMD approach was used by the Department of Climate Change and IIED to understand

how Cambodian institutions are managing climate risks and how well investment in climate change have contributed to reducing vulnerability and losses to families from climate hazards.

At the time of operationalising the framework, the emphasis was on creating the baseline rather than analysing impacts as the M&E framework was recent. DCC, IIED and Cambodia Climate Change Alliance jointly developed baselines for 2014 for the following indicators:

- Institutional readiness for climate change (Track 1 upstream indicators)
- Percentage of communes vulnerable to climate change based on a vulnerability index (Track 2 downstream indicators)
- Families affected by floods, storms and drought (Track 2 downstream indicators).

Sectoral level indicators (MPWT)

After establishing the baseline for Tracks 1 and 2 indicators at the national level, IIED, with support from GIZ, piloted TAMD in the Ministry of Public Works and Transport (MPWT), one of fourteen of Cambodia's sectoral ministries that have developed their own Climate Change Action Plan (CCAP) so far. IIED supports MPWT to monitor and evaluate its CCAP using same principles and approach as applied when measuring national performance.

The CCAP indicator framework comprises four main categories:

- CCAP delivery and mainstreaming
- Institutional readiness to climate change
- Results or outputs indicators
- Impact indicators.

TAMD approach was used to develop baselines for MPWTs institutional readiness for climate change and the percentage of roads and bridges affected by floods (impact indicators).

Track 1: Institutional readiness indicators

In Cambodia, the upstream Track 1 indicators comprise a core set of crosscutting indicators to help understand the extent of institutional readiness and Climate Risk Management (CRM) at national and sectoral levels. Score cards were developed for each indicator to establish a baseline for the current status of national and sectoral institutional readiness in Cambodia. These scorecards use an innovative readiness ladder approach to understand Cambodia's current position within an overall process of climate change policy and institutional development, and to illustrate progress towards milestones. These indicators will be scored on a regular basis to track progress.

Table 1: National and sectoral institutional readiness baseline results, 2014

	National score	MPWT score
Status of climate policy and strategies	30%	Only collected at national level
Status of climate integration into development planning	25%	31%
Status of coordination	45%	45%
Status of climate information	17%	28%
Status of climate integration into financing	25%	23%
TOTAL SCORE	28.4	26.5

The national scorecard results show that Cambodia has strongly invested in better coordination mechanisms to respond to climate change. This includes a dedicated Department of Climate Change set up under the General Secretariat of the National Council for Sustainable Development. However, the production of, access to and use of climate information systems remain weak. Climate information and data is scattered across various ministries and agencies making it difficult to access reliable climate-related information. Even if information exists, there is insufficient capacity to meaningfully assimilate and use the data.

The MPWT scorecard results show that, as at national level, coordination mechanisms for responding to climate change are deemed stronger than the integration of climate change in sectoral financing arrangements. The MPWT's Department of Planning has a climate change technical team mandated with climate change coordination responsibilities. But in terms of sectoral financing arrangements, although there is a costed Climate Change Action Plan in place and the Public Investment Programme reflects climate change action priorities, these are not included in the ministry's budget strategic plan and climate change-relevant project pipelines in line with CCAP are yet to be identified.

Track 2: Impact indicators

Track 2 downstream indicators measure development performance in a changing climate. They help evaluate how successful adaptation actions are in reducing climate vulnerability and encouraging development impacts.

At the national level, two core indicators were measured to assess impacts:

- Percentage of communes vulnerable to climate change (resilience indicator)
- Families affected due to floods, storms and droughts (impact indicator).

At the sector level (MPWT), the percentage of roads and bridges affected by floods were measured as impact indicators.

A hazard-specific vulnerability index was used to measure the percentage of communes that are vulnerable to climate change. Cambodia has three existing vulnerability indices: the Climate Vulnerability Index, the Vulnerability Index and the Disaster Risk Index (DRI). All three comprise sub indicators that were selected on the basis of subjective rationales rather than robust statistical relationships. All these indices also tend to combine indicators of impact and vulnerability, which is problematic.

IIED refined the most recent index, the DRI, using a more robust method for indicator selection. The sub indicators were identified by examining the strength of correlations between socioeconomic variables and the effects of climate hazards. Variables that were strongly correlated with hazard effects were then used as proxies for vulnerability.

The impact variables were also separated from the vulnerability indicators. National and sectoral impact indicators were selected because they were easily accessible and collected regularly within the commune database and because the data for these impacts was available broken down by different hazard type.

Table 2: National and sectoral impact baseline results

Track 2 Impact Indicators (National) (2014)		
% of communes vulnerable to climate change (2014 data)*	17% of the communes are highly vulnerable to floods, droughts and storms 31% are quite vulnerable	
Average number of families affected by all hazards (2011 and 2012 data)	**2014** 18/1000 families	
Families affected by floods	16/1000 families	
Families by droughts	36/1000 families	
Families affected by storms	2.5/1000 families	
Track 2 Impact Indicators (MPWT)	**2011**	**2012**
Average % of roads damaged by floods	4% roads damaged in each province per 1000 sq. km	1%
Bridges affected by floods	1.8 bridges were damaged in each province per 1000 families.	0.5 bridges/1000 families

* Vulnerability defined on the basis of vulnerability index (VI) scores , where highly vulnerable communes = score of >0.199 ; quite vulnerable = 0.199 to −0.487; less vulnerable = −0.487 to −1.174 and any score < −1.174=least vulnerable communes.

Conclusion

The government of Cambodia has integrated M&E methods and tools for measuring climate change responses within the national and sectoral systems. The baseline results established above not only show how progress in sectoral and national institutions can be tracked, but also reflect how policymakers can target specific regions, provinces or communes with support for climate interventions.

Cambodia has used TAMD to discover and define the most important impact indicators by using outcome indicators to test and validate predictive vulnerability or impact indicators. But using a national database to develop vulnerability indices can be challenging, as national-level indicators need further disaggregation to provide an accurate understanding of reality on the ground. The readiness ladder is an innovative approach to show progress towards milestones in policy and institutional development.

As Cambodia progresses towards its strategic vision, its efforts to monitor and evaluate adaptation and development will better inform future investments. It is also pioneering an approach that can serve as an important example to many other developing countries as they develop their national M&E systems for climate change interventions.

1 Introduction

As climate effects increasingly challenge development progress, there is a need for national-level frameworks that monitor and evaluate both adaptation and development. These would allow developing countries to provide evidence for the effective planning and implementation of future investments at a national scale, allowing them to prioritise investments most effectively and bargain harder for climate finance.

But the M&E of adaptation responses is often limited to the project level; portfolio M&E and national-level M&E frameworks remain limited. There has been little investment in national-level M&E frameworks to measure aggregated country level impacts.

The Cambodian government recently released its Climate Change Strategic Plan (CCCSP) 2014–2023. The CCCSP recognises the importance of building a national M&E framework that measures and tracks how well Cambodia is managing its climate risks and meeting development targets (RGC, 2013).

The aims of the national M&E framework for measuring climate change responses is to measure the extent to which adaptation and mitigation efforts have been effective in keeping development on track in a changing climate; generate evidence and lessons as a basis for future policy development; and facilitate the coherent integration of M&E of climate change in national development planning and key sectors. The proposed indicator framework includes:

1. A core indicator set at national level, with five institutional readiness indicators related to policies, institutions and capacities, 3 impact indicators related to reduction in vulnerabilities, damage and loss and GHG emissions, and

2. Two to three indicators from each sector.

In this document the 5 indicators related to institutional readiness and 2 impact indicators related to vulnerabilities and impact were measured in 2014 (See table 3). The baseline for the indicator on GHG emissions (by sector and per capita) will be measured in 2017 and the baseline measurement for sectoral level indicators is ongoing.

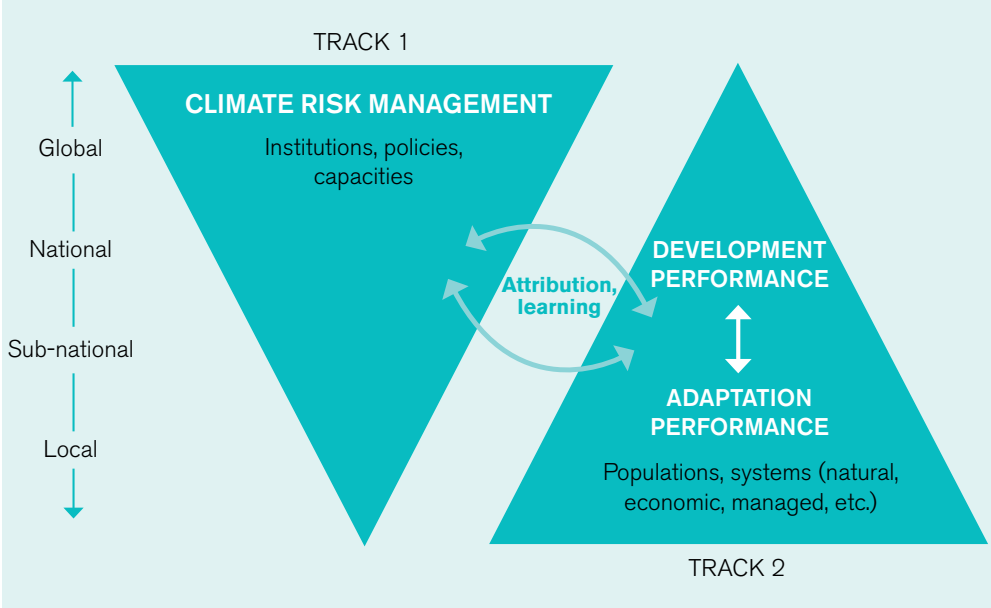
Table 3: Core indicator set in the National M&E Framework for climate change

Institutional readiness indicators	Impact indicators
Indicator 1: Status of climate policy and strategies: Status of development of national policies, strategies and action plans for climate change response	Percentage of communes vulnerable to climate change
Indicator 2: Status of climate Integration into development planning: Status of inclusion of climate change in long, medium (NSDP) and short term (PIP) national and sub-national planning.	Families affected due to floods, storms and droughts
Indicator 3: Status of coordination: Status and functionality of a national coordination mechanism for climate change response and implementation of the CCCSP.	GHG emissions (by sector and per capita)
Indicator 4: Status of climate information: status of production, access and use of climate change information.	+ 2 or 3 indicators per sector
Indicator 5: Status of climate integration into financing: Status, availability and effectiveness of a Financial Framework for Climate Change response.	

Cambodia is using IIED's Tracking Adaptation and Measuring Development (TAMD) approach to facilitate its national M&E framework.

The TAMD approach evaluates the success of climate change responses by combining how widely and how well countries or institutions manage climate risks (Track 1) with how successful adaptation actions are in reducing climate vulnerability and encouraging development (Track 2). This twin-track approach can be used to assess whether climate change adaptation leads to effective development, and how development interventions can boost communities' capacity to adapt to climate change. Importantly, TAMD offers a flexible framework that can be used to generate bespoke frameworks for individual countries; these can be tailored to specific contexts and used at different scales. The upstream dimensions of Track 1 captures the institutions, policies and capacities for

Figure 1: Overview of the TAMD Framework



climate risk management (CRM) that are needed for responding to climate change. The downstream parameters of Track 2 encompass both changes in vulnerability or resilience (adaptation specific results) and improvements in well-being (more general development results). For more information on the TAMD framework, please refer to earlier publications by IIED.[1]

At present the M&E framework in Cambodia is applied at two levels:

- national M&E framework to measure climate change responses within the CCCSP.
- sector level, to measure the impacts of climate change responses within the Ministry of Public Works and Transport's Climate Change Action Plan (CCAP).

This report discusses Cambodia's national and sectoral M&E contexts and the baseline results from applying the TAMD approach at both these levels.

[1] See www.iied.org/tracking-adaptation-measuring-development-tamd

2

Applying M&E at the national level

2.1 National M&E framework for climate change responses

Cambodia's Climate Change Strategic Plan (CCCSP) 2014–2023, released in 2013, commits to developing a national M&E framework for its response to climate change that can track multiple layers of information at national, subnational and sectoral scales. Cambodia already has a national M&E framework for assessing development interventions, which the government aims to integrate with the national M&E system for climate change responses. Doing so will assist in mainstreaming climate change adaptation and mitigation into national development priorities and targets as set out in the National Strategic Development Plan (NSDP).

To assist in developing the national M&E system for climate change responses and to ensure adaptation and development progress in unison, the Government of Cambodia partnered with IIED to use its TAMD approach as a foundation to implementing its framework. The Ministry of Environment's Climate Change Department is leading this process in its capacity as Secretariat of the National Council for Sustainable Development (NCSD)[2], with support from the Cambodian Climate Change Alliance (CCCA).

The aims of the national M&E framework for climate change response, as outlined in CCCSP (RGC, 2013) are to:

- measure how effectively adaptation efforts maintain development on track in a changing climate,

[2] Formerly, Secretariat of the National Climate Change Committee NCCC

- monitor climate change mitigation actions and low-carbon development policies,
- generate evidence and lessons to inform future policy making,
- facilitate the coherent integration of M&E of climate change into national development planning and key sectors, and
- provide the information required to fulfil the reporting obligations of the Government of Cambodia to the UNFCCC and development partners.

These key principles underpin the development of the framework (RGC, 2013).

Using national systems and procedures: The framework is integrated with the national M&E system and is compatible with Ministry of Planning guidelines. Indicators and monitoring procedures rely on data that are currently monitored at commune level.

Mainstreaming M&E of climate change in national, sectoral and subnational development planning: Procedures and indicators for tracking climate change response are integrated in the national M&E system and will be used to track the effectiveness of climate change sectoral strategies and action plans at national and subnational levels.

Strengthening accountability, equity and transparency: The framework provides a means to measure how efficiently and effectively resources are being used to achieve the targets set in policies and action plans. This will improve accountability to civil society and international funding sources.

Promoting participatory learning: The framework focuses on generating knowledge through participatory approaches and supports identification and sharing of lessons learned.

Relevant ministries and agencies will also measure the performance of sectoral climate change strategic plans (SCCSPs). National and sectoral indicators will both be integrated into the NSDP (see Figure 2). To date, fourteen line ministries have developed their climate change action plans. TAMD has piloted its approach in one sector – the Ministry of Public Works and Transport – which is discussed in detail in Section 6.

2.2 How is climate change M&E embedded within Cambodia's development M&E?

Cambodia is making efforts to develop a reliable and consistent framework for monitoring and evaluating development interventions at national, sectoral and subnational levels. Its core development policy, the NSDP, is informed by the priorities of the government's Rectangular Strategy, currently in Phase III. The government has developed an M&E policy framework for the NSDP's 2014–2018 cycle which will help implementers

assess the country's performance at multiple levels: programme, project, sector, national, subnational and entire economy (RGC, 2014).

The Ministry of Planning (MoP) has developed guidelines for line ministries for developing indicators for monitoring and evaluating actions under the NSDP. A number of line ministries are also engaged in attempts to standardise their M&E systems.

Each sectoral line ministry has allocated focal staff members that have the responsibility to report performance in NSDP to the Ministry of Planning's National M&E Working Group. This working group then compiles and totals reported information on key development indicators. Data management rests within two institutions of planning ministry: the General Directorate of Planning and the National Institute of Statistics that has an online platform and a compiled set of data on development indicators. However, quite a lot of sectoral data is scattered across line ministries which is difficult to access.

The government's ultimate aim is to synergise its existing development M&E framework with the national M&E system for climate change, to facilitate the integration of climate change adaptation and mitigation with national development priorities and targets. It used a two-pronged approach to mainstream the national M&E framework for climate change into the NSDP:

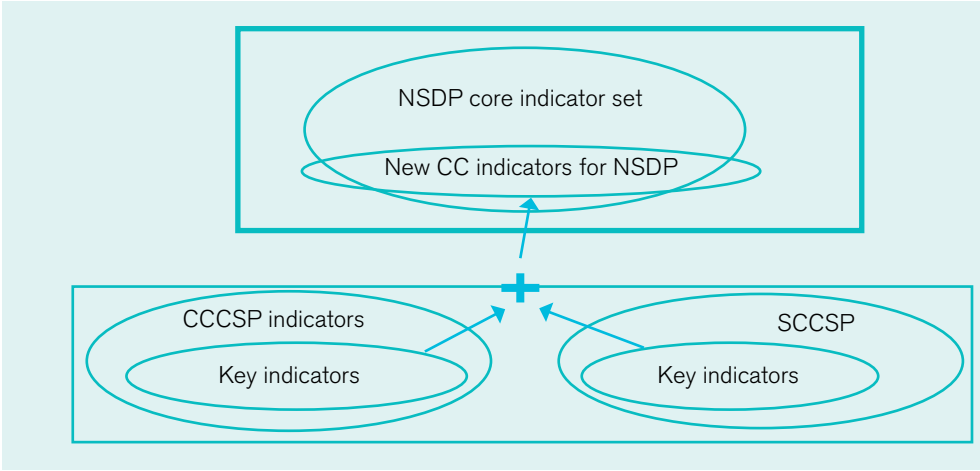
1) **Climate-proofing existing NSDP indicators:** Existing NSDP indicators — such as agriculture productivity, malaria and dengue fatality rates, and indicators related to nutrition, access to safe drinking water sources — were screened and flagged for their likelihood to be affected by climate change. They were then climate-contextualised for the national climate change M&E framework — for example, changes in poverty status were assessed in the context of climatic hazards such as floods, droughts and storms (explained in section 4).

2) **Including a new set of indicators for adaptation and low-carbon development:** NSDP was advised to include some core climate change indicators selected from within the CCCSP. (Figure 2). The following climate change indicators from the national M&E framework are integrated into the NSDP 2014–2018, Chapter 1V, page 225:

    1) Ratio of climate-related expenditure to total public spending
    2) Mainstreaming climate change issues into national and subnational planning
    3) Percentage of communes vulnerable to climate change
    4) Carbon credit from clean development and other mechanisms.

Indicators 2 and 3 are being tracked using TAMD's Track 1 and 2 approaches.

Figure 2: Integrating climate change indicators in NSDP



Source: National M&E framework for climate change

The Cambodian government reviewed 10 similar M&E frameworks (see Appendix 8 for a full list) but identified TAMD as most directly relevant to its needs. It felt that one of the main advantages of TAMD was its focus on development performance in a changing climate, and therefore it's potential to provide a common framework to standardise M&E practices across sectors and scales within Cambodia. TAMD's ability to make use of existing development indicators was an important consideration, as Cambodia had a national M&E framework for development in place. This provided the potential to reduce the costs, complexities and burdens associated with developing a second national framework, and may increase the chances of success by building on previous progress.

2.3 Applying TAMD at the national level

IIED has applied TAMD at national level and sectoral level to assess how Cambodia is managing its climate risks and improving its development effectiveness as a result. A research team from IIED and Garama 3c applied TAMD in Cambodia, working in partnership with the Ministry of Environment's Climate Change Department, with support from the Cambodia Climate Change Alliance.

TAMD's twin-track approach helps measure institutional response for climate change management and development performance in a changing climate, as follows (see also Figure 1):

Upstream Track 1 indicators track institutional readiness to manage climate climate risks: These include indicators related to status of climate policy and strategies, climate integration into development planning, coordination mechanisms, climate information systems and status of integration into financing.

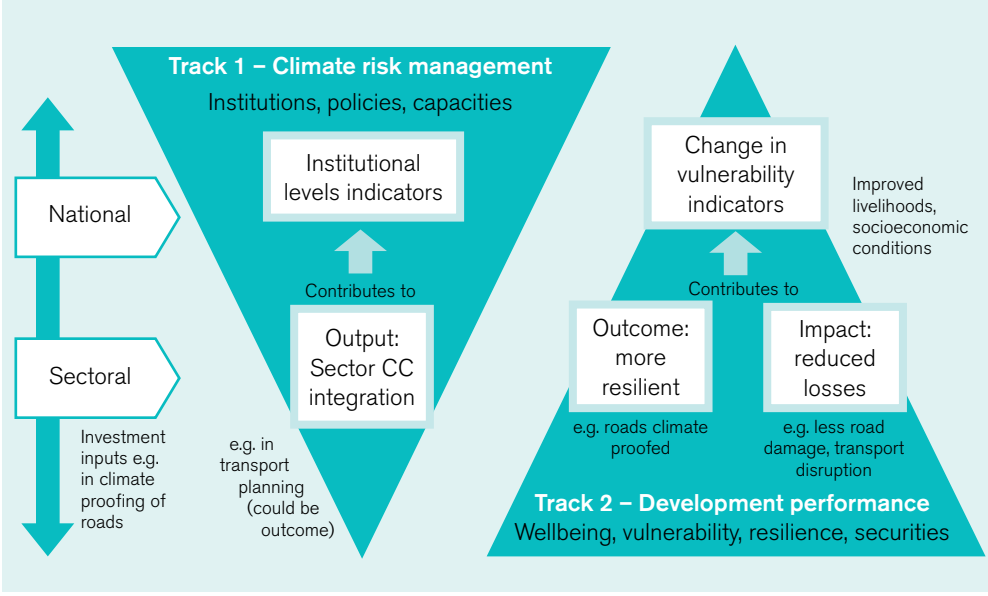
Downstream Track 2 indicators track changes in development impacts and climate vulnerability of communities: Results are assessed alongside climate trends and incidence of climate extremes.

This methodology uses diverse approaches to collect data, develop theories of change and establish baselines that can be used to inform future evaluations of adaptation planning and development progress.

2.4 Theory of change

A theory of change is an explanatory model or narrative that links CRM and institutional readiness processes to adaptation and development results on the ground. Governments can use an existing theory of change or develop a new one with relevant stakeholders. The Cambodian government built on existing theories of change from its NSDP and NCCSP to inform the ToC for the National M&E framework. Figure 3 shows the Cambodian national pathway for M&E.

Figure 3: Cambodian national M&E pathway

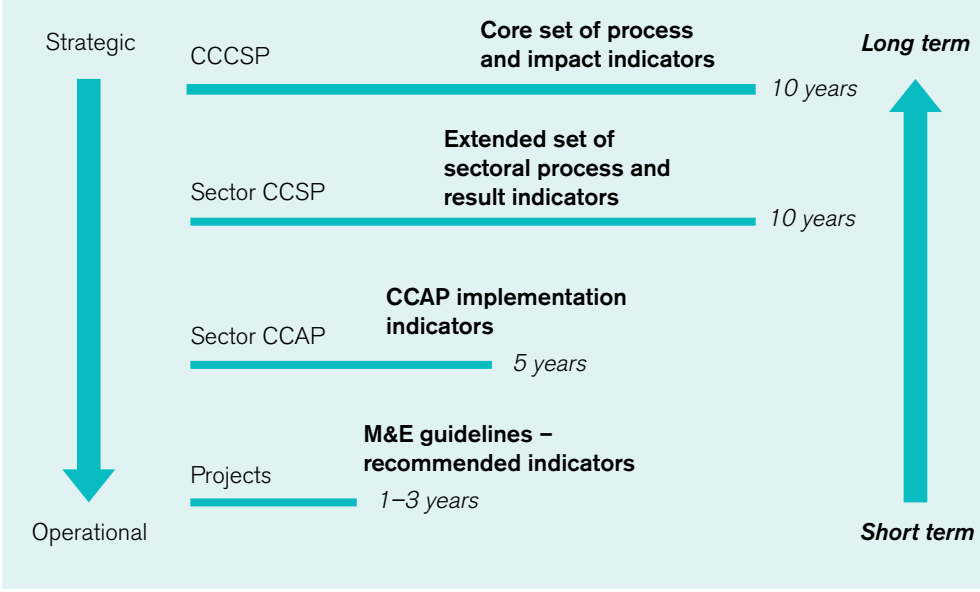


Cambodia's preliminary theory of change (attached in the Appendix 1) was developed by NCSD, formerly NCCC and revised a number of times during the preparation of the CCCSP, to assist in the process of identifying objectives and strategies. The broad theory of change underpinning CCCSP is that better climate change policies, institutions, coordination and awareness about climate change issues improves resilience by reducing vulnerability and losses and damage.

The TAMD approach uses theories of change and narratives to integrate the information generated by the indicators in Tracks 1 and 2 by explaining the trends observed within and across the indicators. The TAMD framework provides a general conceptual approach to dealing with issues of scale and aggregation. When applied to the development of a national framework rather than a specific project or programme, one of the key challenges is to establish a logical structure (or impact path) to link the various scales of response planning and implementation. For this purpose, the national M&E framework for climate change responses distinguishes levels of climate change response planning as illustrated in Figure 4.

The final theory of change assumes that improved national-level CRM leads to better subnational and sectoral-level CRM, enhances resilience and builds the adaptive capacity of people, institutions and systems to respond effectively to climate change and secure and improve wellbeing and development performance. The final framework will therefore be able to track impacts across various levels and scales of climate change response planning and implementation, documenting multiple layers of information, as depicted in Figure 4.

Figure 4: Multilayer indicator framework



3

Developing national-level indicators

Indicators are metrics that measure change. They can be used to describe a situation, monitor the evolution of a situation and/or measure achievements against an objective, comparing quantitative or qualitative units to a baseline.

The Cambodian government identified a core set of long-term impact indicators,[3] including cross-cutting and sectoral indicators at the strategic level – see Appendix 9- for a list of these indicators. Out of this longlist, four categories of indicators were finally shortlisted and proposed for tracking under the national M&E framework.

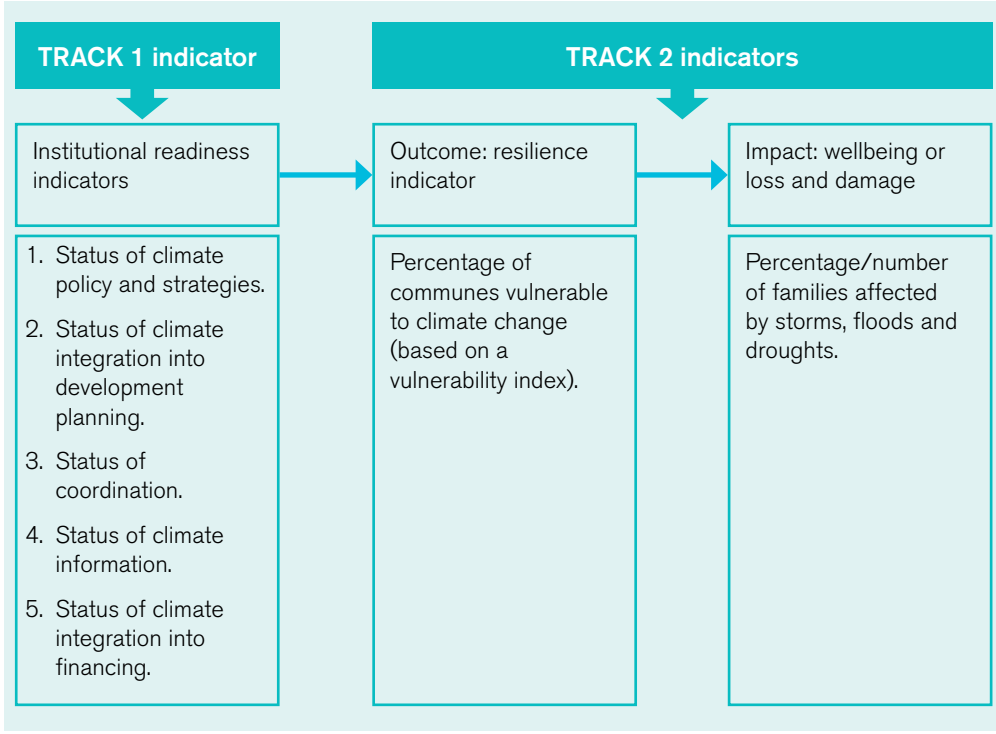
- Institutional readiness for mainstreaming of climate change into planning (Track 1 institutional readiness indicators)
- Percentage of communes vulnerable to climate change (Track 2 Resilience indicators)
- Percentage of families affected by climate hazards (Track 2 loss and damage impact indicators)
- Contextual indicators of hazard (Track 2).

Track 1 and 2 indicators were developed in consultation with stakeholders at different levels. From a technical point of view, indicators were required to be:

- Specific, measurable, achievable, attributable, realistic and time-bound: it should be possible to establish a baseline and a target for each indicator.
- Relevant to inform decision making and the setting of national priorities.
- Easy to populate from the existing commune database (CDB)

[3] See Appendix 9 for a full list of the indicators that Cambodia considered for Tracks 1 and 2.

Figure 5: Core indicators for national M&E for climate change in Cambodia



3.1 Track 1 indicator: institutional readiness

In Cambodia, the Track 1 indicators comprise a core set of five cross-cutting indicators that assist in understanding the extent of institutional readiness and CRM at the national level. These core indicators were developed in iterative stages and validated and refined at a national workshop in December 2013 (Ponlok et al., 2014). A participatory focus group discussion with staff from the General Secretariat of the National Council for Sustainable Development in 2015 further finalised and tested the indicators.

The objective of these process indicators is to measure the extent to which national efforts have integrated CRM into development policy or enhanced institutional capabilities to respond to climate change.

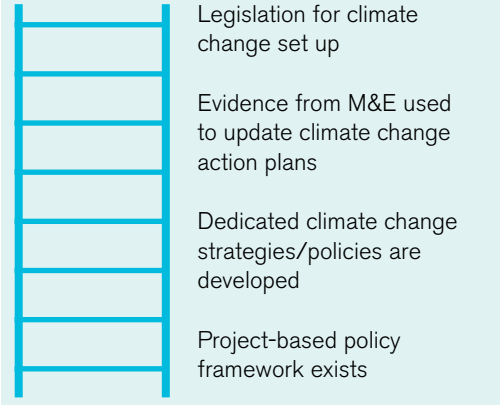
The Policy and Coordination Office within the Department of Climate Change (DCC), General Secretariat of the National Council for Sustainable Development, will use scorecards to assess the following five categorical indicators at regular intervals to understand how Cambodia is integrating climate resilience into national systems and responding to climate change:

Photo 1 Scoring session during the National M&E workshop in Sihanoukville, 2013

1. **Status of climate policy and strategies**: Status of development of national policies, strategies and action plans for climate change response.
2. **Status of climate integration into planning:** Level of inclusion of climate change in long, medium and short term national and subnational planning – this includes the NSDP and the Public Investment Programme (PIP).
3. **Status of coordination:** Status and functionality of a national coordination mechanism for climate change response and implementation of the CCCSP.
4. **Status of climate information**: Status of production, access and use of climate change information.
5. **Status of climate integration into financing:** Status, availability and effectiveness of a financial framework for climate change response.

The indicators are measured using scorecards (see Appendix 2 and 3 for a list of national and sectoral scorecards for each indicator category). These scorecards use a readiness ladder approach to understand Cambodia's current position within an overall process of developing climate change policy and institutions and to illustrate progress towards milestones (see Figure 6) (Rai et al., 2014).

Figure 6: Example of readiness ladder



Source: (Rai et al., 2014)

The ladder starts with the initial steps, even if they have been completed. Progress along each ladder is not necessarily incremental or sequential. Each rung is scored according to whether a milestone has been reached: yes = 2, no = 0 , partially = 1. A total score (percentage) is then calculated for each of the five indicators. The process also uses narratives and other supporting evidence to understand the reasoning behind the score.

3.1.1 Results from the Track 1 scoring process: 2014 baseline

Table 4 summarises the scores against the criteria used to measure the national capacity for climate risk management. These categorical indicators will be measured on a regular basis.

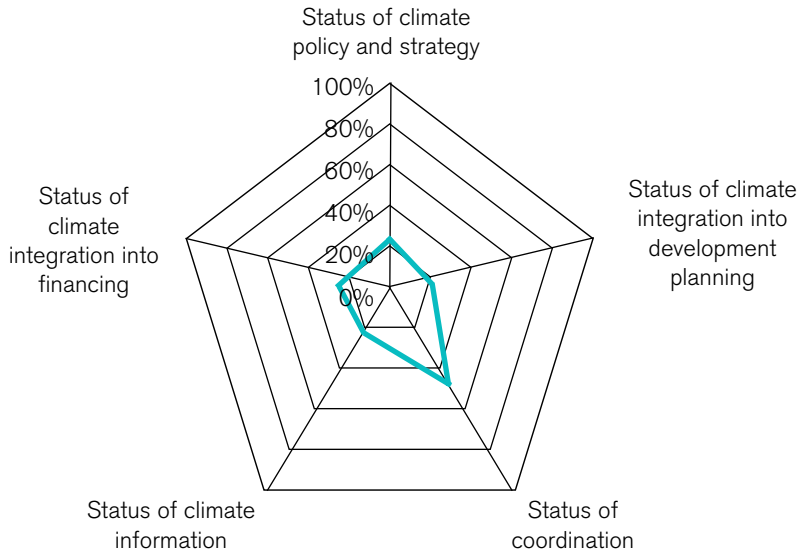
Table 4: National-level institutional readiness indicators , 2014

Indicator	Score %	National level (Department of Climate Change, NCSD): 2014 baseline
1: Status of climate policy and strategies: Status of development of national policies, strategies and action plans for climate change response.	30	Cambodia has evolved from project-based initiatives such as the National Adaptation Programme of Action (NAPA) to a dedicated National Climate Change Strategy. The government is developing national and sectoral M&E frameworks.
2: Status of climate integration into planning: Level of inclusion of climate change in long, medium and short-term national and subnational planning.	25	• NSDP 2009–2013 mentions climate change, but no specific funding allocations are made to climate-relevant actions. • NSDP 2014–2018 includes specific actions and indicators from the CCSAP. • The PIP is developing climate change action plans. • There are no formal procedures in place to screen investments against climate risks and climate change is not integrated into subnational planning.

Indicator	Score %	National level (Department of Climate Change, NCSD): 2014 baseline
3: Status of coordination: Status and functionality of a national coordination mechanism for climate change response and implementation of the CCCSP.	45	• Cambodia has set up a dedicated mechanism to coordinate and implement climate change-related actions. • The Ministry of Environment (now General Secretariat of the National Council for Sustainable Development) set up a climate change office, which was upgraded to a Department of Climate Change (DCC) in 2009. • There are also two inter-ministerial bodies: a policy-level coordination body, NCSD (formerly NCCC) and a technical advisory body, the Climate Change Technical Team. • NCSD brings together representatives from different line ministries. Participation and implementation levels need further strengthening. • CCD plays a key coordination role in international negotiations. The institutional coordination structure links climate change to large programmes, such as REDD+. • The system will gain from enhancing human capacities in coordination, but information exchange mechanisms also need further strengthening.
Indicator 4: Status of climate information: Status of production, access and use of climate change information.	17	Climate-related information is scattered across different levels, including projects, sectors and ministries. The coordination mechanism for sharing information is pretty informal.
Indicator 5: Status of climate Integration into financing: Status, availability and effectiveness of a Financial Framework for Climate Change response.	25	• Cambodia has a national pilot trust fund for climate change. • The environment and finance ministries conduct a joint climate public expenditure review. • There is a reference baseline for climate finance available. • There is also an inter-ministerial sub-working group on climate finance. • A climate change financing framework is under development. A complete draft has been reviewed.

Figure 7 illustrates the status of institutional readiness in Cambodia in 2014. It uses a spider graph to show the scores for each of the five indicators. The same indicators will be used to track progress at subsequent intervals, in 2018 and 2024.

Figure 7: National-level institutional readiness in Cambodia, 2014



	Indicator	2014 baseline
1	Status of climate policy and strategy	30%
2	Status of climate integration into development planning	25%
3	Status of coordination	45%
4	Status of climate information	17%
5	Status of climate integration into financing	25%

The scorecards results show that Cambodia has strongly invested in better coordination mechanisms to respond to climate change. This includes a dedicated climate change department in the General Secretariat of the National Council for Sustainable Development (GSSD). The production of, access to, and use of climate information systems remain weak. With data scattered across various ministries and agencies, it is difficult to access reliable climate-related information. When information does exist, the capacities to meaningfully assimilate and use the data are inadequate. This clearly shows Cambodia's climate change readiness in some matters more than others.

3.2 Track 2 indicators: measuring impacts

At Track 2, Cambodia measures how successfully adaptation actions are reducing climate vulnerability and enhancing development impacts. Cambodia has used the following Track 2 indicators:

T2 (1) Percentage of communes vulnerable to climate change. Cambodia has used a hazard-specific vulnerability index to measure changes in vulnerability at the national level.

T2 (2) Families affected by storms, floods and droughts.

The following methods were used to identify the indicators:

- screening indicators currently monitored in Cambodia and in use in other countries,
- a review of literature and published climate change indicator frameworks, and
- the scoping work carried out by the Pilot Programme for Climate Resilience (PPCR) project.

The selection was based on robustness of the indicator, feasibility and relevance in the context of Cambodia. As a first step, existing vulnerability indices in Cambodia were reviewed and a refined hazard specific vulnerability index was developed.

3.3 Existing vulnerability indicators in Cambodia

The composite vulnerability indices used in Cambodia combine a wide range of socioeconomic, health and economic indicators. The TAMD team has helped DCC develop appropriate methodologies to analyse and process existing information to produce and refine a compound vulnerability index. It was considered necessary after identifying gaps in previous methodology.

Box 1: What are vulnerability indicators?

Vulnerability or resilience-type indicators seek to capture people's and systems' ability to anticipate, avoid, plan for, cope with, recover from and adapt to (evolving) stresses and shocks (Rai *et al*., 2015). These indicators generally seek to describe characteristics or attributes that affect people's or systems' propensity to cope with, or be harmed by, shocks and stresses. They are also predictive: higher vulnerability indicates a higher likelihood of harm in the event of exposure to a hazard.

The vulnerability index is refined by statistically analysing the strength of correlation between 'predictive' vulnerability indicators that describe underlying socio-economic and environmental conditions, and 'impact' indicators that measure losses and damages from climate-related hazards (i.e. climate extremes and variations). If indicators of vulnerability, resilience and adaptive capacity are sound, they should be able to predict impact variations across populations exposed to the same hazards. These analyses help identify the most important indicators so that they can then be streamlined. Contextualising them by landscape type (urban/rural), hazard and geographical zones will be the next step to further defining the vulnerability index, disaggregated by hazard.

Indicators rely on existing data and data collection systems, but most regular monitoring data are expected to come from the National Institute of Statistics and the National Centre for Disaster Management. The section below provides an analysis of the different types of composite indices in use in Cambodia. (a) the Vulnerability Index (b) the Climate Vulnerability Index, and (c) the Disaster Risk Index.

3.3.1 Vulnerability Index

Cambodia developed a Vulnerability Index (VI) in 2010 as part of the analysis for the second national communication. The VI is based on three main indicators – socio-economic, infrastructure and population.

Box 2: Composition of Vulnerability Index

$VI_h = 0.3*SEI_h + 0.3*IFI_h + 0.4*PDI_h$, where vulnerability levels are a function of socio economic, infrastructure and population indicators:

- socioeconomic indicators (SEI) = f(education, occupation, water sources and access)
- infrastructure indicators (IFI) = f(sanitation, piped water, electricity, housing and isolation)
- population indicators (PDI) = f(population density and dependency ratio)

The VI's unit of analysis is the commune. The index combines the following indicators:

- indicators of exposure and other poverty and development-related indicators that are likely to be relevant to vulnerability to climate hazards/ extremes and associated disasters and to the capacity to respond to longer-term changes in climate, and
- indicators of societally-driven exposure – for example, more people or more assets mean more potential for loss and damage in the event of climate extremes.

While the indicators seem very reasonable, no rationale is provided for their selection. The indicators are not selected on the basis of empirically based statistical analysis to examine correlations between these development-related indicators and adverse outcomes associated with climate-related extremes and disasters. This may not be feasible, given the available resources and timescales associated with the operationalisation of the index.

As it stands, the VI appears to be an index of development status that is likely to have significant relevance to climate-related risks. The weightings assigned to each indicator category are also subjective.

3.3.2 Climate Vulnerability Index

Climate Vulnerability Index (CVI) = f (capacity to cope, drought and flood indices, forest cover).

Box 3: Composition of Climate Vulnerability Index

The CVI, also representing the commune level, is made up four sub-indices:

- capacity sub-index = f(infant mortality, % temporary residential structures, poverty, population density, % access to potable water, Human Development Index)
- flood index (province) = average over 1982–2002, of area affected, scaled by maximum area affected
- drought index (province) = average over 1982–2002, of area affected, scaled by maximum area affected
- forest cover = % forest cover of province

The CVI combines indicators of development status that might be viewed as 'predictive' indicators of vulnerability, sensitivity and/or adaptive capacity (the Human Development Report (HDR) indicators) with an indicator of ecological health/ sensitivity (forest cover) and indicators of outcomes of climate extremes. Two key observations may be made on this approach.

1. The capacity sub index, HDR indicators and the forest cover indicator should act as predictive indicators of outcomes from climate extremes. In the natural hazards literature, risk is viewed as a function of hazard and vulnerability(Wisner et al., 2003, Brooks, 2003). Here, the hazard component of risk refer to the occurrence of climate extremes, and vulnerability would refer to the societal and environmental factors that mediate the outcomes or impacts of a hazard to which a (social or environmental) system or population is exposed. In this formulation, risks can be measured retrospectively in terms of outcomes, impacts or losses.

More recent approaches, based on the Intergovernmental Panel on Climate Change (IPCC) definition of vulnerability, view vulnerability as a function of exposure, sensitivity and adaptive capacity. This is similar to the natural hazards view of risk, with vulnerability replacing risk, sensitivity replacing vulnerability and the addition of adaptive capacity to address the longer-term nature of climate change(Brooks, 2003). In this formulation, vulnerability is often seen as something that can be quantified in terms of residual impacts.

In both the above approaches, impacts or losses are essentially outcomes (measures of either risk or vulnerability, depending on the formulation used) that are predicted by the social and environmental factors that make populations and systems more or less likely to experience harm when exposed to a given hazard (drought or flood). Combining outcome and predictive indicators into a single index is therefore methodologically problematic.

2. The second issue relates to redundancy and the co-dependence of certain variables.

Forest cover is included in the CVI on the grounds that the presence or absence of forest influences flood risk. However, the importance of forest cover in determining the severity of flooding means that this indicator should co-vary strongly with the area affected by flooding as represented by the flood index. While it is well acknowledged that indicators used to represent vulnerability are unlikely to be truly independent, there is likely to be a strong autocorrelation between these mutually dependent variables. On the one hand this means that one of these indicators might be viewed as redundant. On the other, it means that the CVI is likely to be biased strongly towards flooding, as the inclusion of these mutually dependent variables effectively weights the index in this direction.

It therefore makes sense to separate the CVI into a predictive index and an index that measures outcomes retrospectively. The latter would be the flood and drought index.

Splitting the existing CVI into predictive and retrospective indicators makes sense if it is to be used to map vulnerability to climate hazards that may change as a result of climate change. For example, there may be a change in exposure to climate hazards due to changes in the behaviour and distribution of hazards, such as storm tracks or expansion of drought zones.

Patterns of recent historical impacts — for example, the effects of floods and droughts —provide a reasonable indicator of future patterns of impacts, at least in the near term. However, areas that have experienced low levels of impact or losses in the recent past may experience increased exposure to such hazards in future, and may be highly vulnerable. Relying on indicators of historical loss will not reveal such vulnerabilities, but using predictive indicators based on social and environmental factors will. Combining such indicators with mapping of potential future hazards can indicate where risk is likely to increase or be high in the future.

3.3.3 Disaster Risk Index

The Disaster Risk Index (DRI) is a single composite index constructed by UNDP, based on the definition of vulnerability in the 2001 and 2007 IPCC reports.[4] It has three sub-indices relating to exposure, sensitivity and adaptive capacity, each of which is broken down into further elements. Each element is assigned a score derived from a set of some 20 individual indicators and described by a formula (see box 4). Within each sub-index, each element is assigned equal weight.

These three sub-indices are constructed from the data generated by the sectoral scorecards for the Cambodia millennium development goals as follows. The detailed breakdown of the DRI is given in Appendix 10:

Box 4: Composition of Disaster Risk Index

DRI = exposure*0.2 + sensitivity*0.2 + adaptive capacity*0.6

- exposure = storm impact *0.33 + flood impact*0.33 + drought impact*0.33
- sensitivity = environment score 0.25 + population density*0.25 + poverty score*0.25 + agriculture score*0.25
- adaptive capacity = environment protection*0.25 + business score*0.25 + education score*0.25 + health score*0.25

In many aspects, the indicators used to construct the index provide a good way to capture vulnerability or risk. They capture elements of environmental exposure and represent a wide range of factors that will affect the extent to which people are able to anticipate, plan for, cope with, recover from and adapt to changes in climate hazards, particularly storms, floods and droughts.

Nonetheless, there is no detailed justification for the indicators selected, or for the way the index is constructed. While both seem reasonable, existing data collected for another purpose (the Cambodia millennium development goals) have been assigned to different elements of the index without much rigorous analysis of what the most appropriate and relevant indicators might be. The comments in 3.3.2 about mixing predictive and retrospective indicators also apply to the DRI.

Weighting impact and determining the contribution of different components is problematic. The allocation of equal weights to storm, flood and drought impacts is questionable, on the basis that floods are more frequent and destructive than droughts in Cambodia, and droughts are more frequent than storms. The allocation of equal weights

[4] The most recent IPCC report, released in 2014, moves away from this earlier definition of vulnerability towards one in which vulnerability is viewed in terms of the propensity to suffer harm when exposed to a hazard. This is more in line with earlier definitions in the natural hazards literature (e.g. Wisner et al., 2003).

to the different components of sensitivity and adaptive capacity can also be questioned, as it is unlikely that they all contribute equally.

One way of addressing the question of which indicators are most relevant is to look at statistical relationships between the various components and disaster outcomes or losses, to ascertain how much of the variance in losses is explained by each component.

The high weighting given to the adaptive capacity element of the DRI raises some questions. The index focuses on disasters associated with climate variability, rather than on vulnerability to longer-term changes in climate. On shorter time scales, exposure and sensitivity are likely to be better determinants of disaster outcomes than adaptive capacity, which is more relevant over longer timescales.

3.4 Gaps identified in existing vulnerability indices

The existing vulnerability indices described in 3.3 were proposed by Government of Cambodia as potential indicators for assessing Cambodia's national-level development impacts. The IIED and Garama 3C appraisal of the indices identified a number of issues indicating a need to further refine and reconstruct them. The key issues are summarised here.

1. The existing indices are not specific to the context of climate risk in Cambodia, and their relevance to climate hazards and specific vulnerabilities to those hazards has not been demonstrated. The shortlisted vulnerability indicators should make sense in the context of the hazards faced and the impacts associated with those hazards. In reality, these indicators do not appear to have been selected based on any detailed analysis of the pathways leading from hazards to impacts, or on any consideration of their ability to predict impacts.
2. Indicators that predict vulnerability to climate change may differ by hazard type, and also by impact. For example, communes that are more exposed to environmental pollution may have high vulnerability to flooding due to the high risk of water contamination, but low vulnerability to drought. The existing indices do not select different indicators for different hazards, and implicitly assume that indicators predict the impacts of all hazards equally.
3. All three vulnerability indices tend to mix predictive (exposure and sensitivity) and retrospective (disaster outcome or impact) indicators. It might be desirable to separate out the impact measures — of people affected by climate hazards — from the predictive indicators that measure aspects of socioeconomic and environmental status. In a natural hazards context these could be said to represent risk and underlying vulnerability respectively.

4

Refining disaster risk index: reconstructing a vulnerability index for Cambodia

The government and Cambodian stakeholders have identified two Track 2 indicators for inclusion in the national M&E system: the number of vulnerable provinces, and losses and damages from climate-related extremes and disasters. In the existing vulnerability indices these two indicators are effectively combined into one index. The DRI was further refined and the seperation of these two type of indicators was justified.

After identifying gaps in Cambodia's existing vulnerability indices, the DRI was reviewed, the appropriateness of its constituent indicators and methodology was examined and modifications were proposed. DRI was selected as the base indicator for further refinement as in many aspects the indicators used to construct the index provide as good a way to capture vulnerability or risk as any number of alternative methods.

Mainly using data from the commune database, new sets of indicators were identified and two new indices were created to measure:

- loss/damage – outcomes representing retrospective measurements of risk or vulnerability as quantified in terms of residual impacts, and
- underlying societal vulnerability/ sensitivity as represented by the predictive social and environmental indicators.

The former can be used to test the latter – for example, the communes that experience the greatest losses should be those with the greatest underlying social vulnerability or sensitivity, once variations in frequency and severity of flood and drought hazards are taken into account.

4.1 Methods and iterative steps used in refining the DRI

Steps 1–6: Creating a new VI

Step 1: Separating the DRI into predictive vulnerability indicators and impact indicators. These are currently combined in all the existing indices. The two were separated, where the predictive component is based on the measurement of household, village, district and commune characteristics that can be measured regardless of whether climate extremes and disasters are experienced. These represent socially constructed vulnerability and may include subcomponents relating to sensitivity and adaptive capacity. The retrospective component is based on the measurement of losses and damages from climate extremes after they have occurred, and represents impact.

Step 2: Identifying appropriate vulnerability indicators based on their ability to predict impacts. A long-list of indicators used in the DRI was drawn from existing datasets, and historical data was used to identify those indicators with a significant relationship with (time-lagged) losses and damages from different types of climate hazard. A highly significant relationship suggests that a given indicator is a good 'predictor' of losses and damages and so would make a good vulnerability indicator. The final list of vulnerability indicators is made up of those with a significant correlation at 95 per cent, to develop a composite index.

Photo 2
Vulnerability Index validation workshop with DCC, 2014

Step 3: Assigning weights to indicators. Weightings were based on the strength of the correlation with loss/damage data.

Step 4: Discarding indicators and adding new ones. Any indicators that did not convincingly link vulnerability to impacts in the context of specific climate hazards were discarded, based on expert judgment and/or a statistical analysis of the correlation between those indicators that fall into the predictive and retrospective categories, with the latter lagging the former by one year.

Step 5: Using the predictive and retrospective components of the revised DRI as the basis for constructing the two indicators identified by the government and Cambodian/stakeholders.

Step 6: Constructing the new vulnerability index by hazard type. Initial statistical analysis shows differences in the significance of the relationship between predictive indicators and impacts of climate hazards depending on the hazard type. The final vulnerability index is disaggregated by hazard type into Storm VI, Flood VI and Drought VI. Each VI comprise of sub indicators of vulnerability which strongly predict the impacts of flood, drought and storms.

Steps 7–9: Measuring and interpreting the vulnerability levels

Step 7: Developing thresholds by vulnerability level. Once the VI was constructed, the commune levels were scored for their level of vulnerability based on established thresholds. Highly vulnerable communes = score of >0.199; quite vulnerable = 0.199 to −0.487; less vulnerable = −0.487 to −1.174 and any score < −1.174 = least vulnerable communes. The vulnerability thresholds were defined based on the distribution of the VI results. VI score was categorized as 'highly vulnerable', if more than one standard deviation above the mean; 'quite vulnerable' if between the mean and one standard deviation above; 'less vulnerable' if between the mean and one standard deviation below, and 'least vulnerable' if more than one standard deviation below the mean (table 7, pg 40).

Step 8: Constructing a national baseline for Cambodia. This step involves measuring the percentage of communes that are highly vulnerable to climate change and to different hazard types within provinces.

Step 9: Using the VI results in combination with data on hazard severity and losses. Once vulnerability results are available, the results should be interpreted in parallel with results of losses and damage from specific hazards and the severity and frequency of hazards.

4.2 Composition of the refined vulnerability index

A long list of indicators were drawn from the DRI and those with a significant relationship with time-lagged impacts of different types of climate hazards were short listed. For example, proxies of vulnerability from 2011 were regressed with indicators which depict impact from floods, droughts and storms in 2012 to analyse how dependent variables of impact are influenced by independent proxies of vulnerability.

Independent variables X (time lagged)

Proxies of:

- poverty
- agriculture
- business
- education
- health
- environment

Dependent variables Y=

Families affected by:

- floods (commune database)
- storms (commune database)
- drought (commune database)

Table 6 shows the vulnerability indicators that were identified based on their ability to predict impacts. These proxies are significantly related with families affected by storm, flood and drought hazards (at 95 per cent significance level). They also explain how the factors they measure lead from hazards to effect. The narratives below explain these relationships. The (+) (–) sign indicate the direction of the relationship of each indicator. A negative relationship between families with motors and flood impacts signify that higher the families with motor cars the lesser vulnerable they are to climate stresses. This is something that was lacking for the DRI.

Table 5: Vulnerability indicators that can predict impact

Proxies for flood vulnerability	Proxies for storm vulnerability	Proxies for drought vulnerability
Proxies of poverty		
(–)% families with motors	(–)% families with motors	(–)% houses with electricity
(–)% houses with electricity	(–)% families with water less than 150m from house	(–)% families with water less than 150m from house
(–)% families with water less than 150m from house		
Proxies of agriculture		
(+)% of irrigated rice farms	(+)% of irrigated rice farms	(+)% of irrigated rice farms
(+)% of families with irrigation facilities	(+)% of families with irrigation facilities	(–)Average rice yields per 1,000 families
(+) Number of tractors per 1,000 families		
Proxies of business		
(+)Number of non-agriculture population per 1,000 families		(+)No of non-agriculture population per 1,000 families
(+) Out migration per 1,000 families		(+)Out migration per 1,000 families
(–)Number of commercial vehicles per 1,000 families		(–)Number of commercial vehicles per 1,000 families
Proxies of education		
(–)Pre-School Net Enrolment Ratio: Children 3-5 in Preschool/All Children 3-5	(–)Pre-School Net Enrolment Ratio: Children 3-5 in Preschool/All Children 3-5	(–)Pre-School Net Enrolment Ratio: Children 3-5 in Preschool/All Children 3-5
(–)Number of primary schools with access to clean water per 1,000 families		(–)Number of primary schools with access to clean water per 1,000 families
		(+)Average distance to school
Proxies of health		
(+)Dengue deaths per 100,000		

Proxies for flood vulnerability	Proxies for storm vulnerability	Proxies for drought vulnerability
	Proxies of environment	
(–)% families with access to garbage collection	(–)% families with access to garbage collection	(–)% families with access to garbage collection
(+)% families exposed to pollution	(+)% families exposed to pollution	

These proxies of vulnerability are divided into four categories under the DRI. However, the DRI indicators combine the vulnerability and the impact indicators. The two were separated by hazard type to explain development outcomes at the national level. The section below examines how different predictive indictors explain vulnerability to climate change.

Poverty is a widely known to be a key factor that increases the propensity for communities to be affected by climatic disturbances. Poorer communities are more prone to loss and damage from climate hazards. Families with a higher number of assets — such as motor bikes and cars or access to water and electricity — are more likely to adapt better to climate change as they are in a better economic condition to cope. However, families with a high number of assets may also be more prone to losses as they have more to lose. Our statistical analysis shows that indicators of poverty are negatively related to indicators of impact. This implies that people with more wealth are less vulnerable to climate hazards

Agriculture: Indicators of agriculture are proxies for both exposure and vulnerability. Our analysis shows that people with a higher percentage of irrigated rice farms and access to irrigation are more vulnerable to climate change. Owning large expanses of irrigation-fed rice land in areas which are affected by drought increases the exposure of farmers to drought-related climate hazards.

Health: Dengue mortality is a strong predictor of losses from and impacts of flood-related hazards. Areas that are more prone to dengue disease have less coping capacity to deal with floods and vice versa.

Education: There is a significant correlation between various literacy indicators and mortality from climate-related disasters at a global level. Literacy may mean that people can access information about risks and response options, as well as support for coping with, recovering from and adapting to climate stresses and shocks. Literacy variants may also be covariant with other aspects, such as poverty and affluence that affect vulnerability more directly.

Environment: Indicators of environmental protection are good indicators of vulnerability. A good environmental status may depict a community's better ability to cope with disasters. The percentage of families affected by environmental pollution is a good predictor of how much an area is affected by environmental pollution. A high level will reduce a community's coping capacity, as pollution will be exacerbated during extremes. This is particularly true for flood and storm-related hazards.

Table 6: Composition of hazard-specific vulnerability indices

Flood VI =	Storm VI =	Drought VI =
(–) 0.15*% families with motors	(–) 0.25*% families with motors	(–) 0.15*% houses with electricity
(–) 0.05*% houses with electricity	(–) 0.1*0.05*% families with water less than 150m from house	(–) 0.2*% families with water less than 150m from house
(–) 0.05*% families with water less than 150 m from house	(+) 0.15*% of families with irrigation facilities	(–) 0.05* average rice yields/1,000 families
(+) 0.1*% irrigated rice farms	(–) 0.15* Pre-School Net Enrolment Ratio	(+) 0.05*% irrigated rice farms
(+) 0.05*% families with irrigation facilities	(–) 0.15*% families with access to garbage collection	(+) 0.1* no of non-agriculture population/1000 families
(+) 0.05*no of tractors/1,000 families	(+) 0.2*% families exposed to pollution	(+) 0.05* out migration/1,000 families
(–) 0.05*no of commercial vehicles/ 1,000 families		(–) 0.05* no of commercial vehicles/ 1,000 families
(+) 0.05*no of non-agriculture population/1,000 families		(–) .15* Pre-School Net Enrolment Ratio
(+) 0.05* out migration/1,000 families		(+) 0.05* average distance to school
		(–) 0.1*% families with access to garbage collection

Table 6: Composition of hazard-specific vulnerability indices (cont.)

Flood VI =	Storm VI =	Drought VI =
(+) 0.15* dengue deaths/100,000 (–) 0.05* Pre-School Net Enrolment Ratio (–) 0.05* no of primary schools with access to clean water/1,000 families (–) 0.05*% families with access to garbage collection (+) 0.1*% families exposed to pollution		

5

Baseline results for Track 2 indicators

5.1 Track 2 (1): Indicators of vulnerability

The vulnerability assessment reveals that in 2014, nearly seventeen per cent of communes were 'highly' vulnerable and thirty-one per cent were quite vulnerable to multiple climate change hazards (see table 7). Fifty per cent had a high coping capacity (or lower vulnerability) to climate change hazard impacts. This is based on the hazard specific indices of floods, droughts and storms. Although the total numbers of provinces affected by each hazard were similar across Cambodia, the usefulness of hazard specific indices becomes relevant when comparing differences in province level or commune level hazards. Not each province or communes within these provinces will be equally affected by storms, floods and droughts. For example 4 out of 24 provinces in Cambodia are 'highly' vulnerable to all three hazards; however top 4 provinces differ within each hazard category (See table 8).

Table 7: Vulnerability thresholds

Vulnerable Index scores	VI Category	Number of communes	%
>0.199	Highly vulnerable	279	17.20
0.199 to -0.487	Quite vulnerable	512	31.5
(-)0.487to (-)1.174	Less vulnerable	400	24.6
(-)1.174<	Least vulnerable	430	26.5

The vulnerability thresholds in table 7 were defined based on the distribution of the VI results. VI score was categorized as highly vulnerable, if more than one standard deviation above the mean; quite vulnerable, if between the mean and one standard deviation above; less vulnerable, if between the mean and one standard deviation below and least vulnerable, if more than one standard deviation below the mean. Figure 8 and 9 provide maps of province level and commune level total vulnerability levels in Cambodia.

Figure 8 : Province level vulnerability, 2014

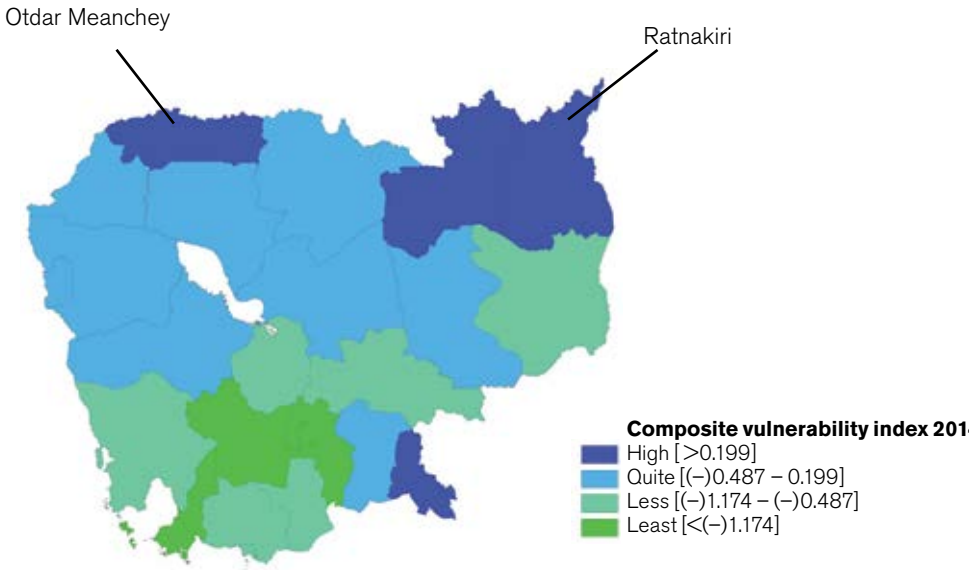


Figure 9: Commune level vulnerability, 2014

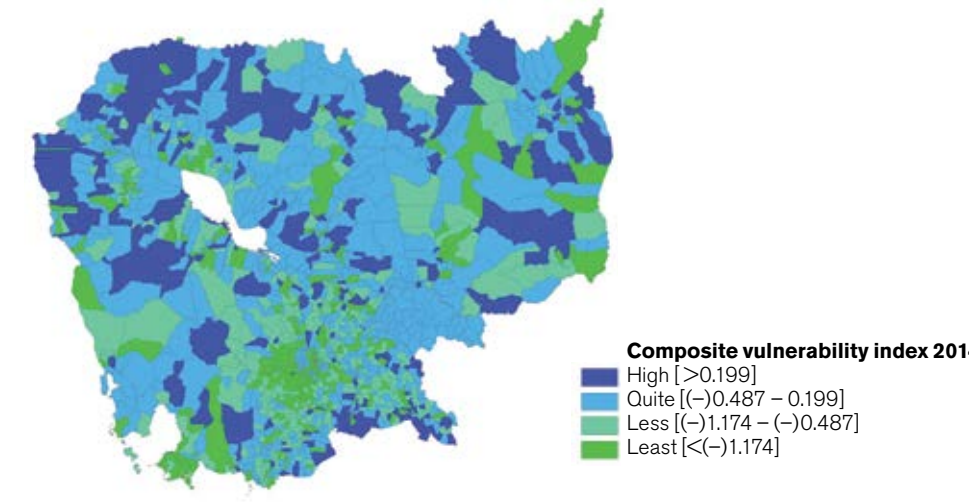


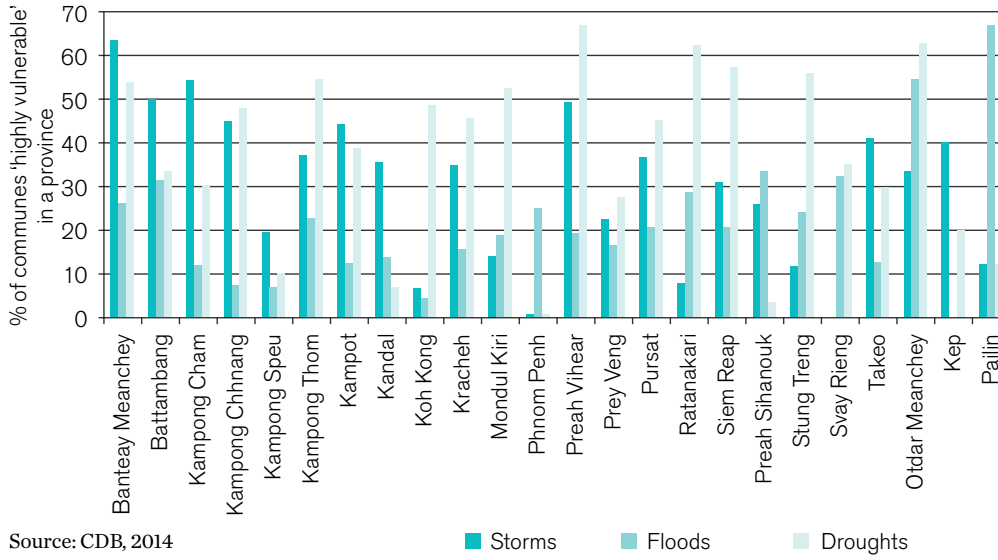
Figure 10, 11 and Table 8 provides a snapshot of 'highly vulnerable' and 'quite vulnerable' provinces by hazard type. The provinces with highest vulnerability to multiple climate hazards are Otdar Meanchey, Ratanakiri, Stung Treng and Svay Rieng.

Hazard specific indices show that although Ratanakiri, Otdar Meanchey, Strung Treng and Svay Rieng are 'highly' vulnerable to flood hazards, the provinces of Battambang, Banteay Meanchey and Preah Vihar are 'quite' vulnerable too. As well as exhibiting high levels of underlying vulnerability, these provinces also experience high exposure to climate hazards, based on the frequency and intensity of floods. For example, Ratanakiri is regularly hit by flash floods. Slower onset flooding is caused by overflow of Tonle Saap and Mekong Rivers that flow through Svay Rieng and other provinces.

Table 8: Top provinces that are ranked 'highly' and 'quite' vulnerable to climate hazards

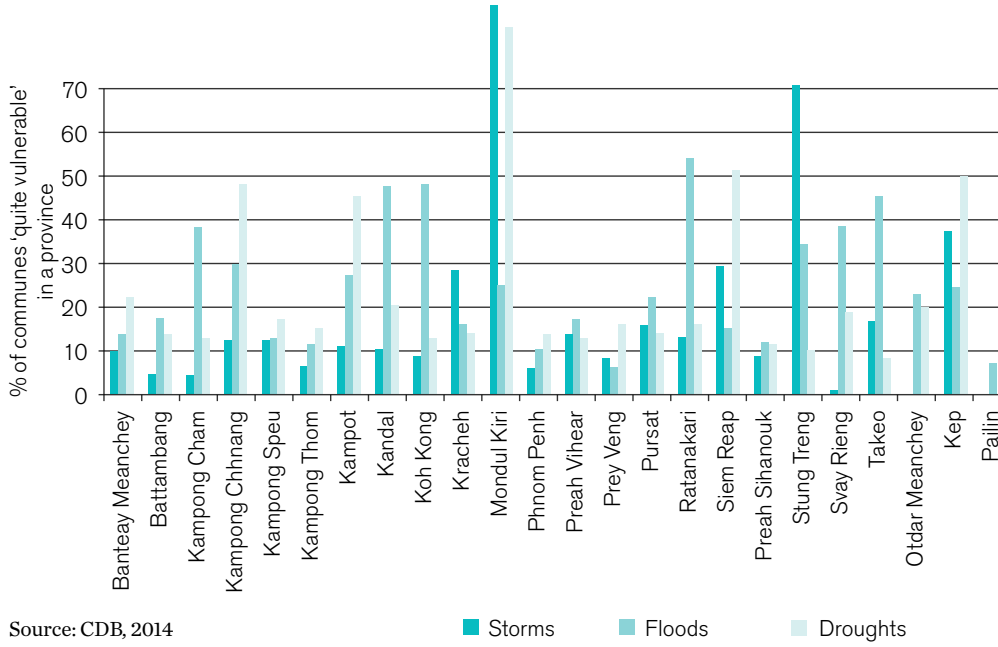
	Total VI	Flood	Storm	Droughts
Highly vulnerable	**Otdar Meanchey (1)** Ratnakiri (2) Stung Treng (3) Svay Rieng (4)	**Ratanakiri (1)** Otdar Meanchey (2) Stung Treng (3) Svay Rieng (4)	**Kampong Chhnang (1)** Banteay Meanchey (2) Takeo (3) Kampong Cham (4)	**Preah Vihar (1)** Kampong Thom (2) Otdar Meanchey (3) Stung Treng (4)
Quite Vulnerable	Battambang (5) Bantaey Meanchey (6) Pailin (7) Preah Vihear (8) Siem Reap (9)	Battambang (5) Preah Vihear (6) Bantaey Meanchey (7) Pailin (8) Pursat (9)	Battambang (5) Preah Vihar (6) Kampot (7) Pursat (8) Kracheh (9)	Mondul kiri (5) Kampong Chhnang (6) Kracheh (7) Siem Reap (8) Takeo (9)

Figure 10: Communes that are 'highly vulnerable' to climate hazards in each province, by hazard type



Source: CDB, 2014

Figure 11: Communes that are 'quite vulnerable' to climate hazards in each province, by hazard type



Source: CDB, 2014

Although the province level rankings provide a holistic overview of vulnerability to climate change at a national level, it is important that decision makers pay specific attention to commune-level vulnerability when planning for climate change responses. Our analysis shows large variations in commune-level vulnerability to different hazard types (See figures 12–15).

For example, although Ratanakiri is the most vulnerable province to droughts and flood in Cambodia, a significant percentage of communes in the province are less vulnerable to storms. Kampong Chhnang and Banteay Meanchey are the most vulnerable provinces to storms; and, although Kampong Chhnang has a higher overall Storm VI score, Banteay Meanchey has a higher percentage of communes vulnerable to storms in Category 1(Highly vulnerable) and 2 (quite vulnerable) (nearly 43%) (Figure 12). Decision makers should consider these variations within provinces while planning support for climate-related interventions.

Figure 12: Province level storm vulnerability, 2014

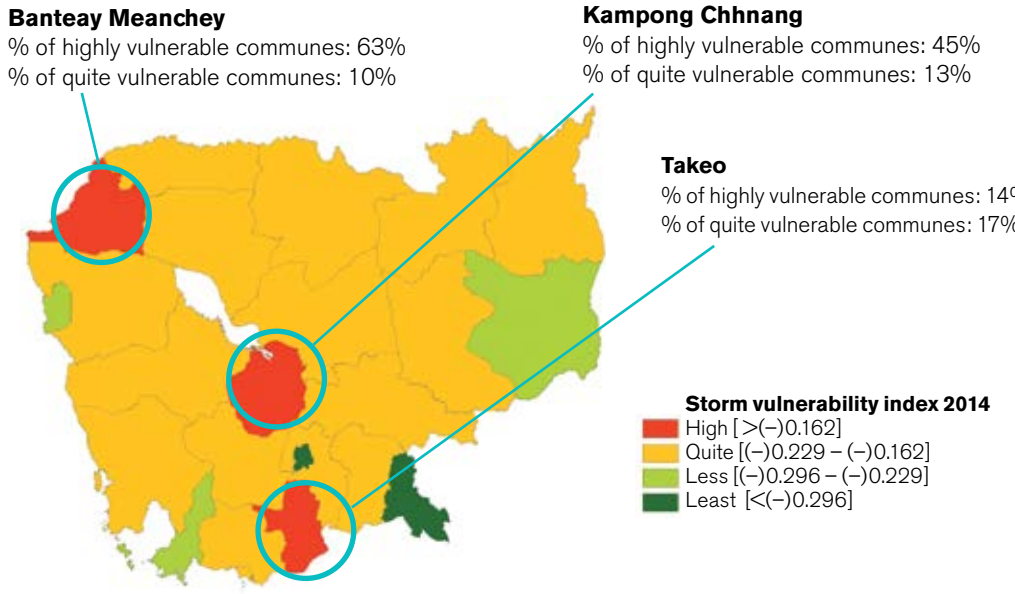


Figure 13: Commune-level storm vulnerability, 2014

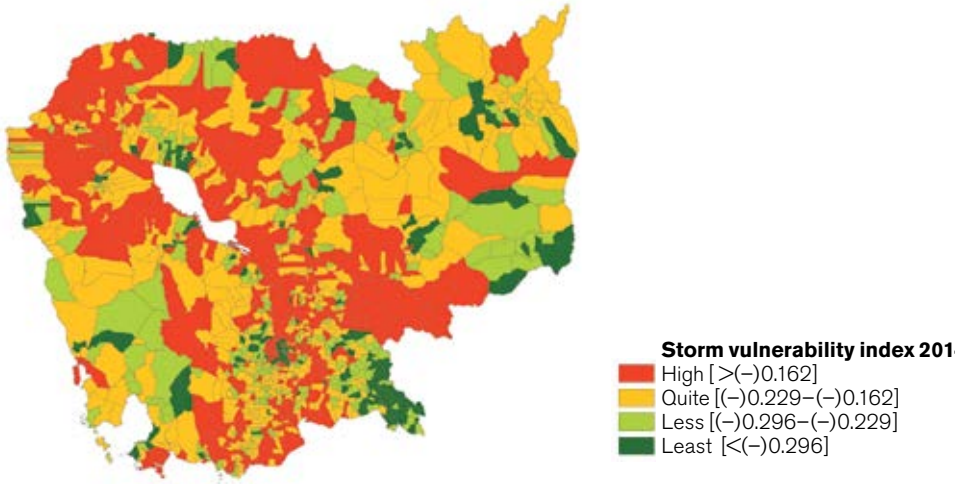


Figure 14: Province level flood vulnerability, 2014

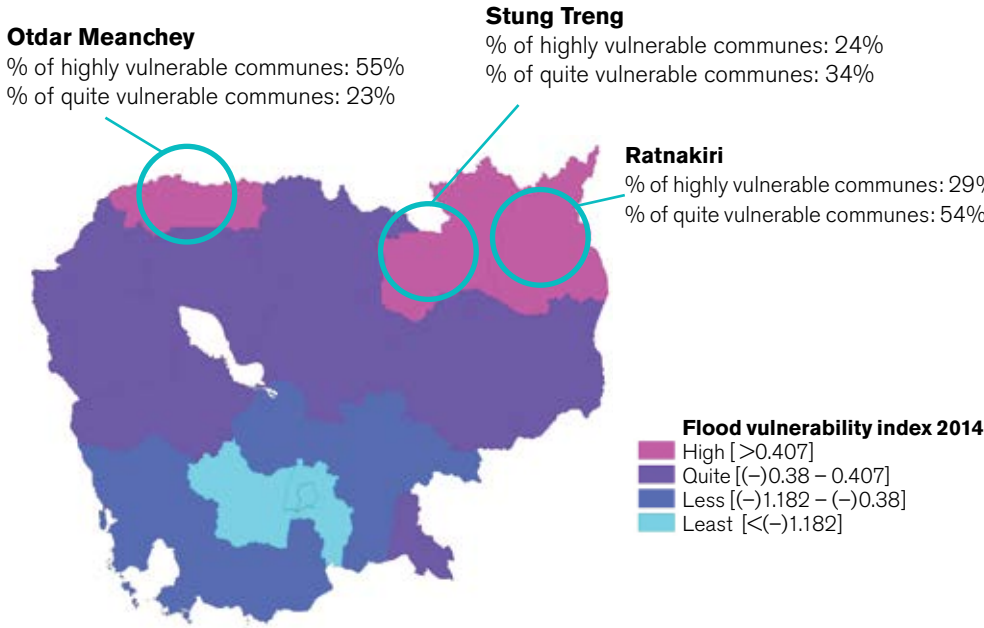
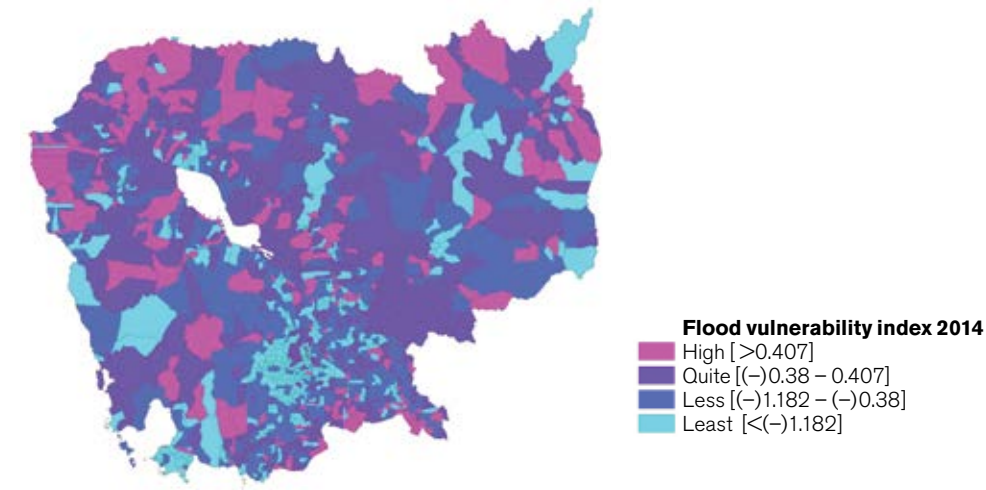


Figure 15: Commune-level flood vulnerability, 2014



Our flood analysis results (see Figures 14–15) further show the need to prioritise commune-level information (see Figures 10 and 12) while targeting provincial support. Although Ratanakiri, Stung Treng, Pailin, Svay Rieng and Banteay Meanchey are ranked as 'highly' vulnerable provinces to flood impacts, nearly 32 per cent of communes in Kampong Thom, which appears lower in the ranks, are 'quite vulnerable' to flood-related hazards.

Figure 16: Province level drought vulnerability, 2014

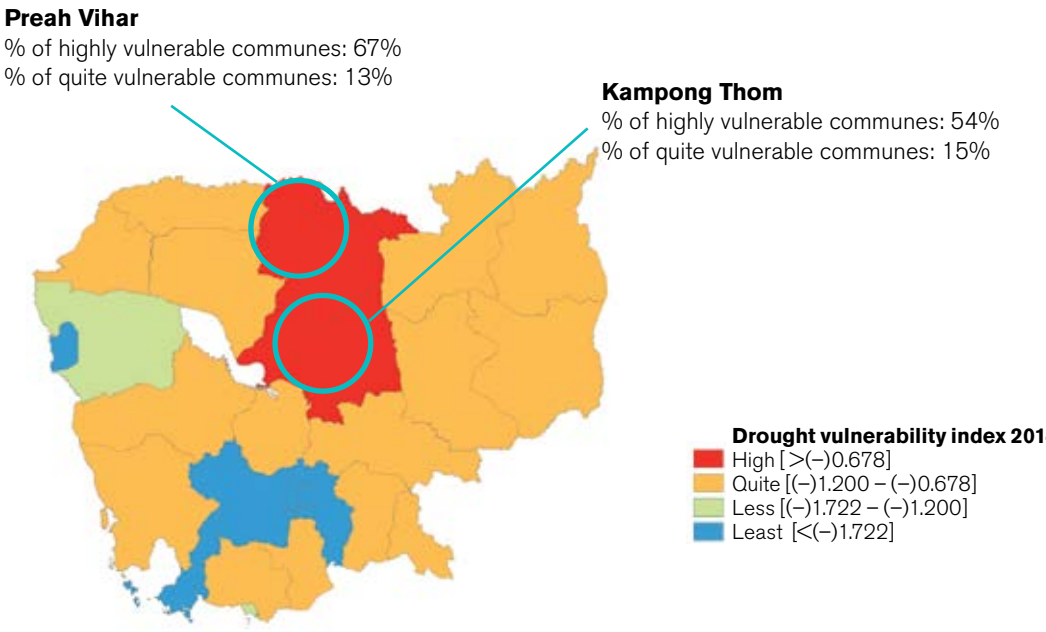
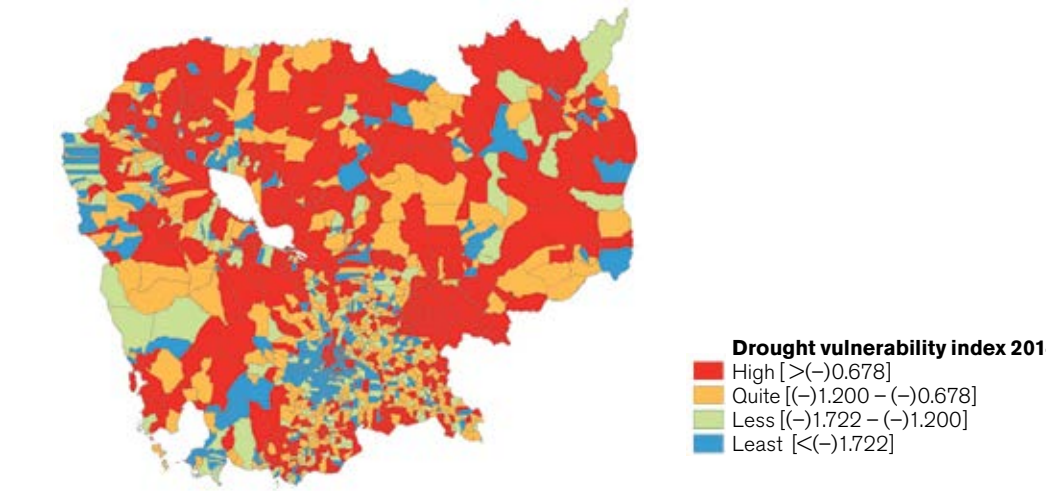


Figure 17: Commune-level drought vulnerability, 2014



5.2 Track 2 (2): Impact indicators of loss and damage

Impact indicators relate to the actual effects of climate hazards (stresses and shocks). To assess the effectiveness of climate change responses in Cambodia, individual impact indicators were tracked by hazard type. The indicators were selected based on their availability in the commune database and their appropriateness for different climate hazards namely flood, drought and storms. These were families affected by floods, storms and drought in the current year (per 1,000 families).

Provincial results show that on average; nearly 34 and 14 in every 1,000 families were affected by multiple hazards in 2011 and 2012. The figures vary considerably for different hazard types. In 2011, floods, storms and drought impacted nearly 79, 1.5 and 20 families per 1,000 households in Cambodia (See Table 9). In 2012, the number of drought affected families have increased to 25 while floods were reduced to 16/1000 families. The high number affected by floods in 2011 is largely because 2011 was a major flood year, while Cambodia was stuck with a drought in 2012.

Table 9: Average number of families affected by multiple hazards, 2011, 2012 and 2014

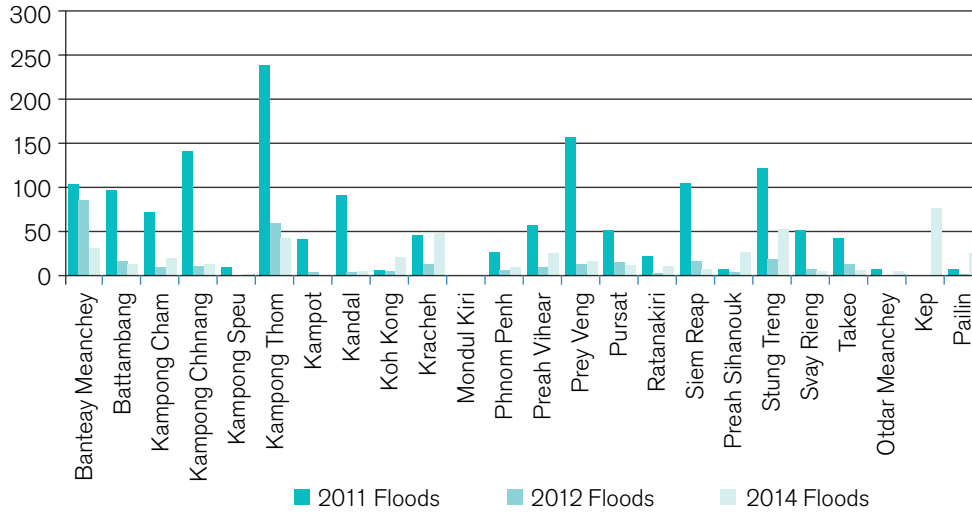
Hazard type	Number of affected families (per 1,000 families)		
	2011	2012	2014
All hazards (average)	34/1000 families	14/1000 families	18/1000 families
Floods (average)	79/1000 families	16/1000 families	16/1000 families
Droughts (average)	20/1000 families	25/1000 families	36/1000 families
Storms (Average)	1.5/1000 families	1/1000 families	2.5/1000 families

Source: commune database, 2011, 2012 and 2014

5.1.1 Families affected by floods

In 2011, on average 79 per 1,000 families were affected by floods in each province. The number reduced by nearly 80% in 2012. Kampong Thom, Kampong Chhnang, Prey Veng and Stung Treng were the worst affected in 2011 which was a major flood year in Cambodia. Conditions improved in 2012 for most provinces; however provinces like Stung Treng continued to experience losses in 2012. This could be because of high levels of vulnerability or exposure to other forms of floods.

Figure 18: Families affected by floods (per 1,000 families)

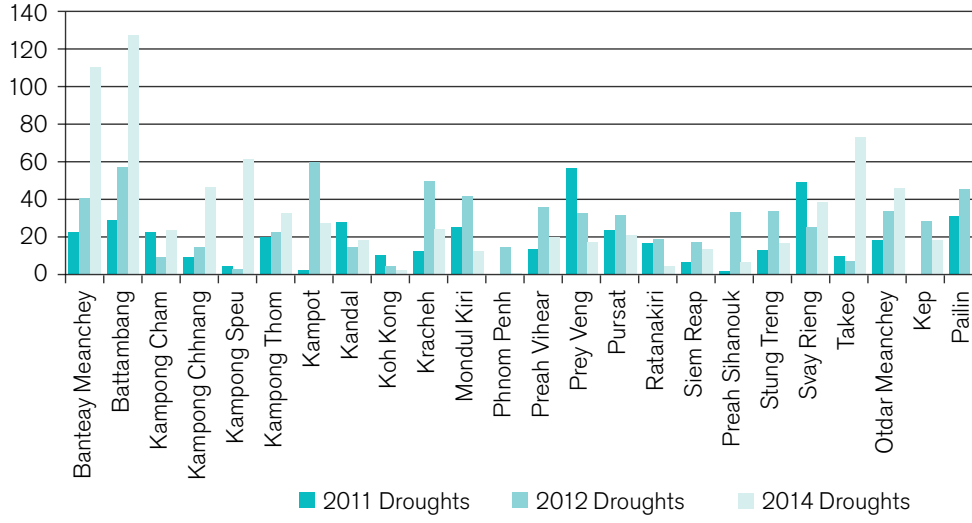


Source: CDB (2011, 2012 and 2014)

5.1.2 Families affected by drought

In 2011, 2012 and 2014, on average nearly 20, 25 and 36 families per 1,000 were affected by drought in Cambodia. In the major drought year of 2014, provinces such as Kampong, Battambang, Banteay Meanchey, Kracheh and Takeo were the most affected by drought.

Figure 19: Families affected by drought (per 1,000 families)

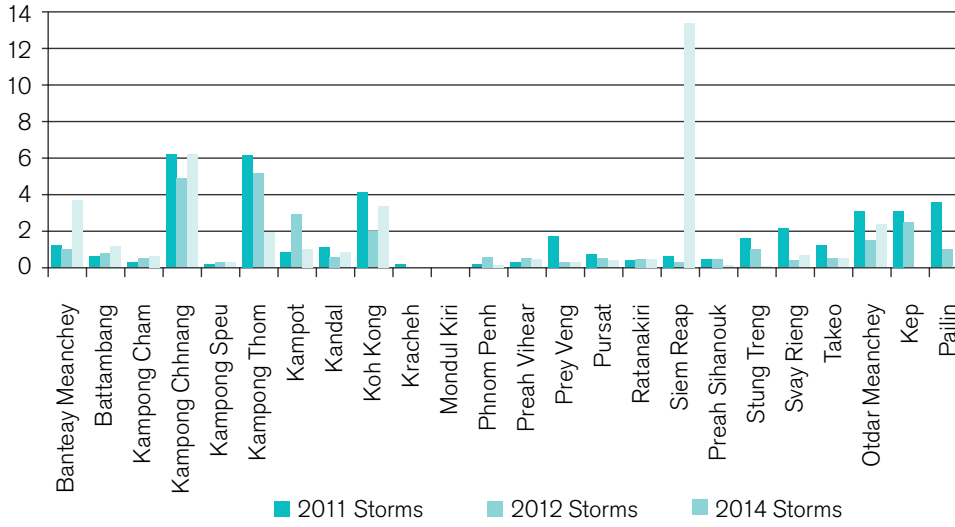


Source: CDB (2011, 2012 and 2014)

5.1.3 Families affected by storms

Storms are not a major disaster risk within Cambodia. In 2011, 2012 and 2014 on average 1 to 3 families were affected by storms. Provinces such as Kampong Chhnang, and Siem Reap were the most affected by storms in 2014.

Figure 20: Families affected by Storms (per 1,000 families)



Source: CDB (2011, 2012 and 2014)

5.3 Contextualising results with climate information

Once the indicators were constructed, the data collected and baseline established, the indicators were processed to understand whether national-level climate change responses have led to improvements in impact and reductions in vulnerability.

Going forward, responsible departments would need to interpret these results to show whether change is happening. One approach is to use qualitative climate information to contextualise or calibrate impact and wellbeing indicators. This means that result from impact indicators should be studied in combination with results from vulnerability assessments and climate information to understand whether vulnerability has reduced or impacts have happened in the context of worsening climate hazards.

For example, vulnerability results and flood impact results were interpreted in combination with information on flood risks. Table 10 and Figures 19–21 show that Stung Treng province experiences high flood intensity, is highly vulnerable to flood impacts and has quite a high number of families affected by floods in both 2011, 2012 and 2014. This suggests that communes with the greatest losses are those with the greatest underlying social vulnerability, when variations in frequency and severity of flood and drought hazards are taken into account. This shows that Stung Treng is highly exposed to flood hazards but also highly vulnerable to climate change which makes it less adapted to climate change.

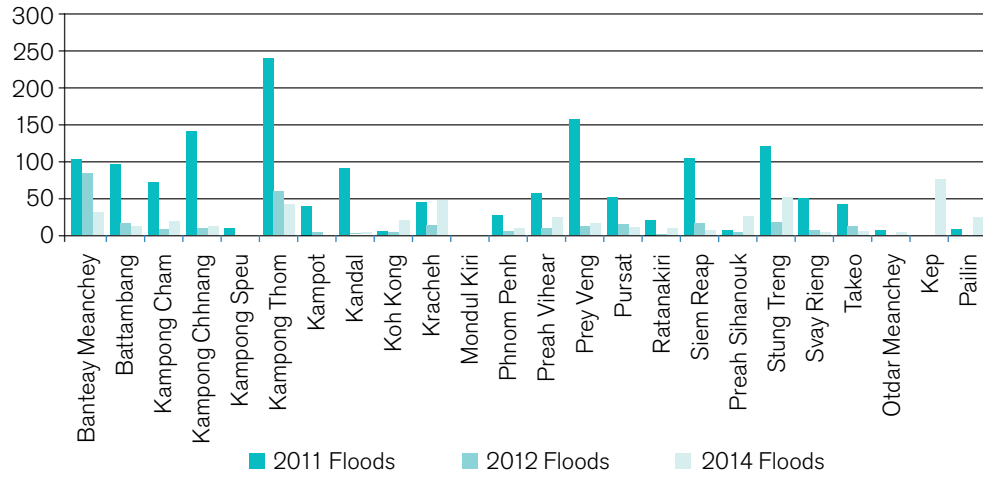
But this is not the case everywhere. Table 10 and Figure 18 also show that, although Ratanakiri experienced the least impacts from floods in 2014 and is not necessarily a flood risk area, it is highly vulnerable to both floods and droughts. This could be because Ratanakiri has less coping capacity to deal with climate shocks, despite not being highly exposed to climate hazards.

Other provinces, such as Kampong Chhnang and Prey Veng, have higher flood impacts and are categorised as a flood risk, but do not show high vulnerability levels. This could be because these regions have developed better coping capacity to deal with flood hazards. This is evident from the fact that although they experience higher losses in extreme flood years (2011) they are able to adapt in years when flooding is not so extreme (2014). Unlike Stung Treng that experienced high losses in both extreme flood (2011) and minor flood (2014) periods.

Table 10: Comparison of results

	High vulnerability	High number of families affected by floods	High flood intensity
Stung Treng	✓	✓	✓
Ratanakiri	✓	×	×
Kampong Chhnang Prey Veng	×	✓	✓

Figure 21: Families affected by Floods (per 1,000 families)



Source: CDB (2011, 2012 and 2014)

Figure 22: Flood exposure map

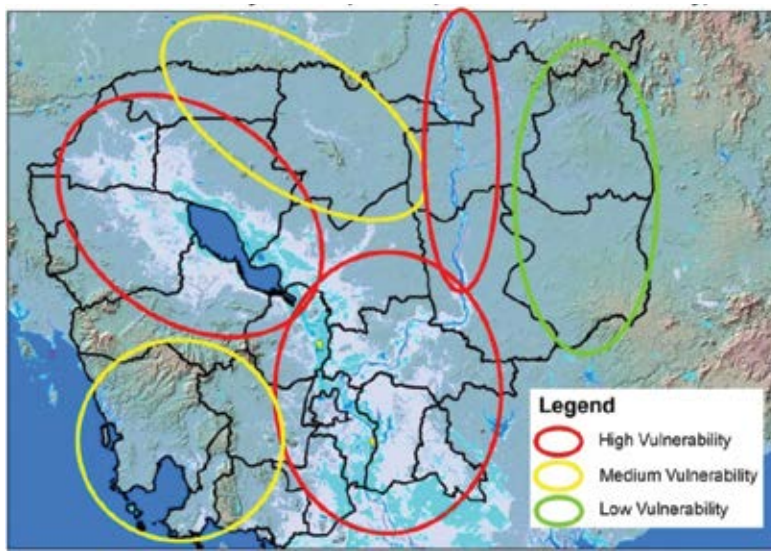
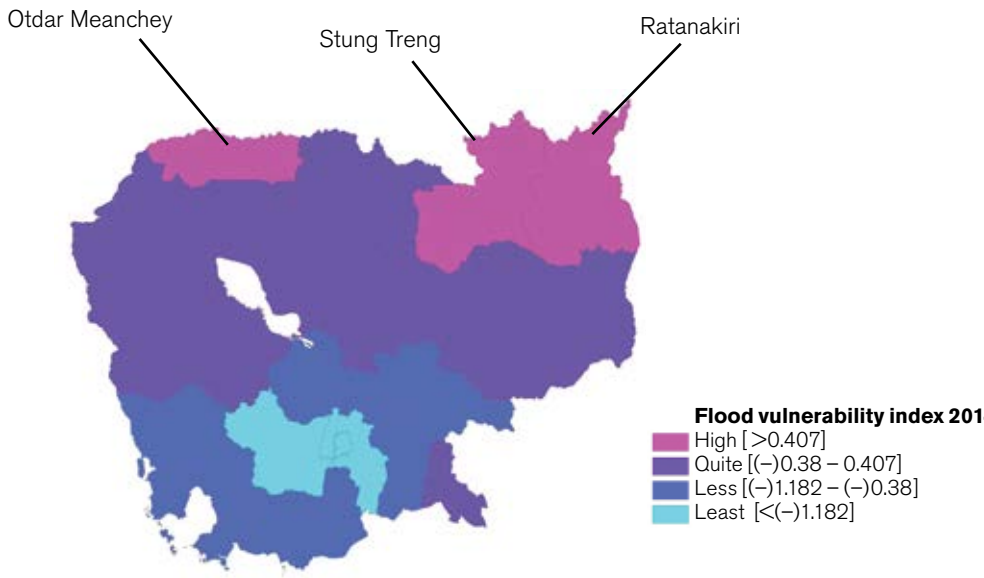


Figure 23: Province level flood vulnerability, 2014



6

Applying M&E at the sectoral level: Ministry of Public Works and Transport

6.1 M&E of sectoral climate change action plans

After establishing the baseline for Track 1 and 2 indicators at the national level, IIED, with support from GIZ, piloted TAMD in one of Cambodia's fourteen sectoral ministries which have developed a CCAP.

Alongside the CCCSP, line ministries have developed their own sectoral CCSPs (SCCSPs) to guide the integration of climate change into their sectoral planning. The CCCSP provides a national perspective and framework for addressing climate change and the SCCSPs focus on sector-specific responses (RGC, 2013). Line ministries have developed their sectoral action plans to operationalise their strategic plans. The fourteen ministries to have developed their CCAPs to date are the Ministry of:

- Environment (MoE)
- Agriculture, Forestry and Fisheries (MAFF)
- Mines and Energy (MME)

- Education, Youth and Sport (MoEYS)
- Health (MoH)
- Women's Affairs (MoWA)
- Water Resources and Meteorology (MoWRAM)
- Public Works and Transport (MPWT)
- Rural Development (MRD)
- Tourism (MoT)
- National Committee for Disaster Management (NCDM)
- Information (MI)
- Land Management Urban Planning and Construction (MLMUPC)
- Industry and Handicrafts (MIH).

IIED with financial support from GIZ supports MPWT to monitor and evaluate its CCAP plan using the same principles and approach as applied by DCC for measuring national performance.

The CCAP will be consistently monitored and evaluated using the national M&E framework for climate change established by the CCCSP. The Department of Planning (DoP) is responsible for managing the monitoring, reporting and evaluation process with technical support from the NCDM Climate Change Working Group (MPWT, 2014) in coordination with NCSD and MoP. The outcomes of the indicators used will be shared by MPWT with NCSD for preparation of the CCCSP progress report. Progress in the implementation of the CCAP will be reviewed on an annual basis.

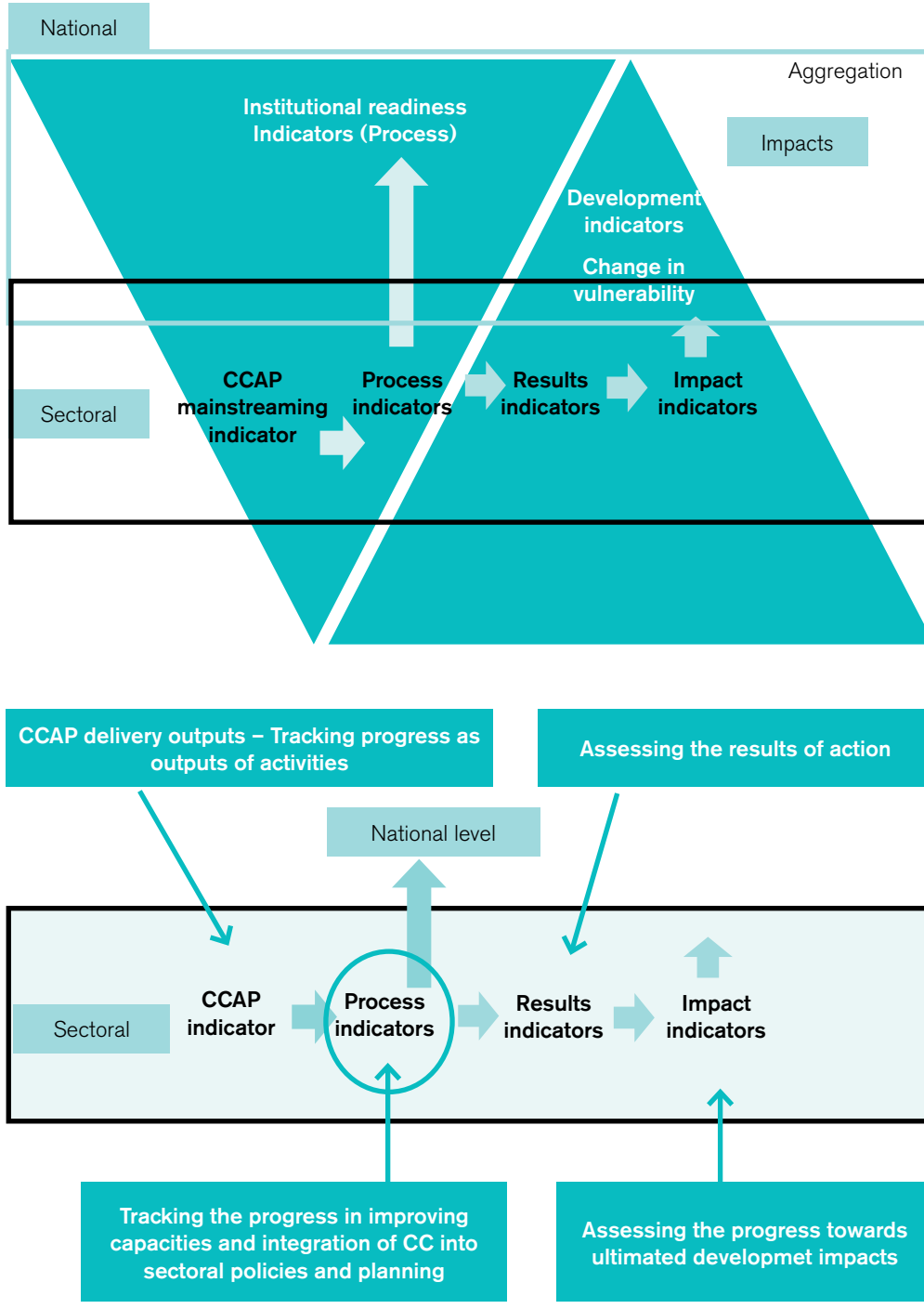
6.2 MPWT CCAP

6.2.1 MPWT sectoral indicator framework

The monitoring and evaluation of CCAP is based on the indicator framework shown in Figure 22. It comprises four main indicator categories:

1. **CCAP delivery and mainstreaming**: These indicators will help track the progress in fundamental aspects of CCAP implementation, such as fund mobilisation. They will be tracked on an annual basis.
2. **Institutional readiness indicators (CRM Track 1 indicators):** These indicators are equivalent to national-level Track 1 indicators. They help track progress in improving capacities and integrating climate change into sectoral policies and planning and will be tracked on an annual basis.

Figure 24: Indicator framework



3. **Results indicators:** These indicators are similar to output indicators, where each indicator assesses the results of specific actions within the action plan. They will be tracked on an annual basis or depending on the nature of action.
4. **Impact (Track 2):** These indicators are similar to national-level Track 2 outcome indicators. Each one will assess progress towards ultimate climate policy and development objectives.

In the following section TAMD's Track 1 and 2 approaches were used to establish MPWT baselines for Indicator 2 (institutional readiness) and Indicator 4 (impact).

6.3 Track 1 indicator: institutional readiness

6.3.1 Measuring institutional progress using a readiness ladder

As at national level, scorecards will be used to regularly assess four categorical indicators to understand how MPWT is integrating climate resilience into its sectoral systems and responding to climate change. These core indicators were developed in iterative stages, after validating and refining them in two workshops: the first in November 2014, followed by a smaller one in March 2015. A participatory focus group discussion with MPWT and the Strategic Programme for Climate Resilience (SPCR) staff further helped us finalise and test the indicators.

The objective of these process indicators is to measure the extent to which sectoral efforts have resulted in building MPWT's institutional readiness to respond to climate change. Four categorical indicators are used to assess institutional readiness:

1. **Status of climate change integration into sectoral planning:** The status of inclusion of climate change in sectoral planning and linkages with national planning.
2. **Status of institutional capacity and coordination:** The status and functionality of institutions and coordination mechanism for climate change response and the implementation of MPWT's CCAP.
3. **Status of climate information:** Status of production, access and use of climate change information at sectoral level.
4. **Status of climate integration into financing:** Status, availability and effectiveness of a financial framework for climate change response.

The scorecards use a readiness ladder approach to understand how MPWT stands in the overall process of climate change policy and institutional development and how the sector is moving towards achieving its milestones. The ladder describes the process that each indicator is measuring from its initial phases, even if these have already been completed.

6.3.2 Results from Track 1 scoring process: 2015 baseline

MPWT's institutional readiness score for 2015 is 31.75%. The ministry will assess its level of institutional readiness at different intervals and use this baseline to measure how far it has moved from its initial score. Table 11 summarises the scores against the criteria used to measure MPWT's capacity for institutional readiness along the four categorical indicators. For detailed scorecards, see Appendix 3.

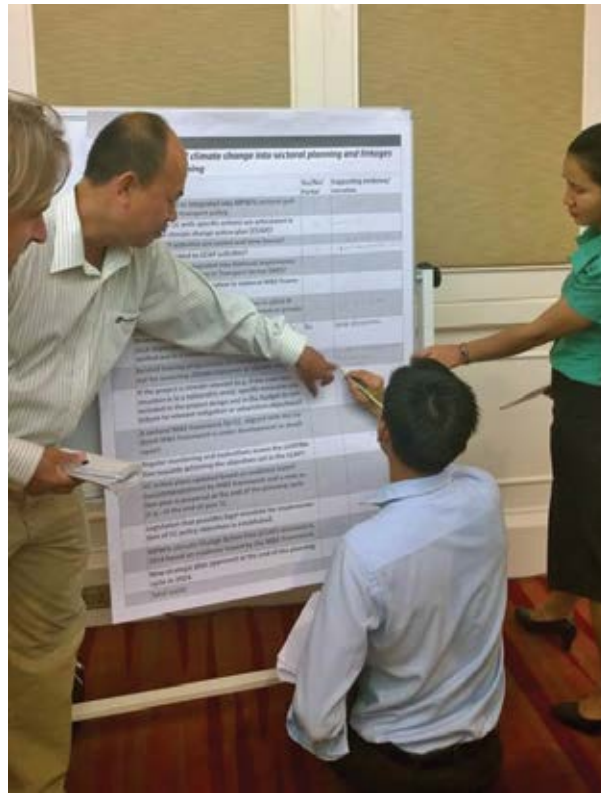


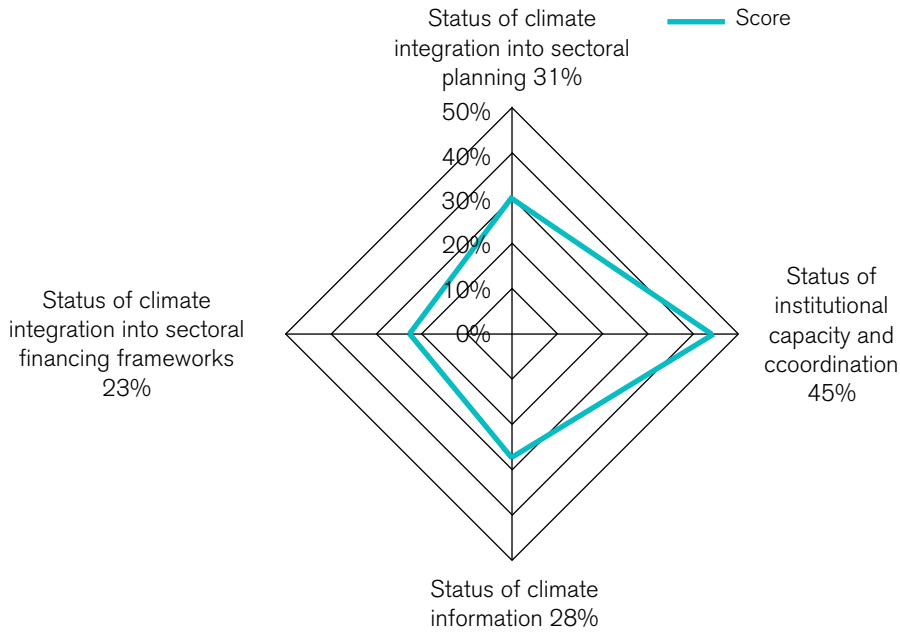
Photo 3 Scoring workshop with MPWT, La Fayette Hotel, 2015

Table 11: Sectoral level institutional readiness indicators: MPWT

	Sector level MPWT 2015 baseline	
Indicator	**Score %**	**Summary narrative behind scoring**
1. Status of climate change integration into sectoral planning: Status of inclusion of climate change into sectoral planning and linkages with national planning.	31	• Responses to climate change with specific actions are articulated in the sectoral CCAP. • CCAP activities are costed and time-bound. • Responsibility for integrating climate change into sectoral M&E systems is assigned within the MPWT's DoP. • The DoP has an office of data evaluation, but capacity is lacking. • There are no formal procedures for screening climate risks within investments. • Climate change is yet to be mentioned or integrated into MPWTs sectoral transport policy.
2. Status of institutional capacity and coordination: Status and functionality of institutions and coordination mechanism for climate change response and implementation of MPWTs CCAP.	45	• Climate change focal points for coordination are established within MPWT – e.g. a climate change technical team is mandated with climate change coordination responsibilities within the MPWT's DoP. • However, working group responsible for coordinating is adhoc and yet to be established within the DoP of MPWT.
3. Status of climate information: Status of production, access and use of climate change information at the sectoral level.	28	• Historical and current records of climate information/data – such as weather patterns, frequency and intensity of disasters) exist at some level (often at project level). • But these are not readily accessible for sectoral use.
4. Status of climate integration into financing: Status, availability and effectiveness of a financial framework for climate change response.	23	• A costed climate change action plan is in place. • CCAP priorities are reflected in the Public Investment Programme. • CCAP priorities are not reflected in the ministry's budget strategic plan • Climate change-relevant project pipelines in line with CCAP are yet to be identified.

The scores for each of the four institutional readiness indicators were then plotted on a spider graph to illustrate the status of climate risk management in MPWT in 2015 (Figure 25). They will use the same categorical indicators to track progress at subsequent intervals, in 2018 and 2024.

Figure 25: The status of institutional readiness in MPWT in 2015



1	Status of climate change integration into sectoral planning	31%
2	Status of institutional capacity and coordination	45%
3	Status of climate information	28%
4	Status of climate integration into financing	23%

Like the national M&E results, the MPWT scorecards show that coordination mechanisms for responding to climate change are stronger than the levels to which climate change is integrated within the sector's financing arrangements.

6.4 Track 2 impact indicators

Impact indicators are helpful to assess progress towards development objectives. They help us understand how successfully adaptation actions in the road sector reduce climate vulnerability and encourage development impacts. To measure these impacts, MPWT has shortlisted two core indicators: the percentage of roads and bridges damaged by floods.

These indicators will help us understand how investments in climate-proofing roads and bridges result in reduced losses and damage of roads. If the percentage of road and bridge loss has increased or decreased, there could be two explanations: either investment in climate proofing of roads is ineffective or effective, or floods patterns (intensity, severity and frequency) have changed.

Section 6.4.1 shares the initial results of impact indicators measured at MPWT level. These were selected due to their availability in the national commune database, which also provides impacts at province, district and commune levels. Although a few other indicators were shortlisted to measure impacts and outcomes, such as costs incurred on rehabilitation of roads, only national-level data was available for these and any provincial and commune-level data was too patchy to be of any use.

6.4.1 Baseline results for MPWT impact indicators

1. Percentage of roads damaged by floods: Our analysis shows that in 2011, a year of extreme flooding, on average four per cent of Cambodia's roads were damaged by floods. This figure reduces to less than one per cent of the country's total road area in 2012. In 2011, nearly eight provinces were categorised as having highly damaged roads (more than six per cent of all roads). In 2012, this was reduced to just one province.

Table 12: Roads damaged by flood in 2011 and 2012

Roads damaged by floods	VI category	Number of provinces	
		2011	2012
More than 6%	Highly damaged	8	1
1–6%	Damaged	8	8
Less than 1%	Less damaged	8	15

While interpreting these results on regular intervals, it would be important to consider flood intensity information. The reduction in roads damaged from 2011–2012 is not due to investment in climate-proofing of roads, but rather is a result of reduced flooding in 2012 compared with 2011.

When assessing the outcomes of climate proofing, it is more useful to compare loss data between years with similar hazard patterns. For example, 2011 and 2013, both flood years or 2012 and 2010, both drought years. It is also useful to compare provinces to assess performance.

Figure 26: Percentage of roads damaged by floods in 2011 and 2012

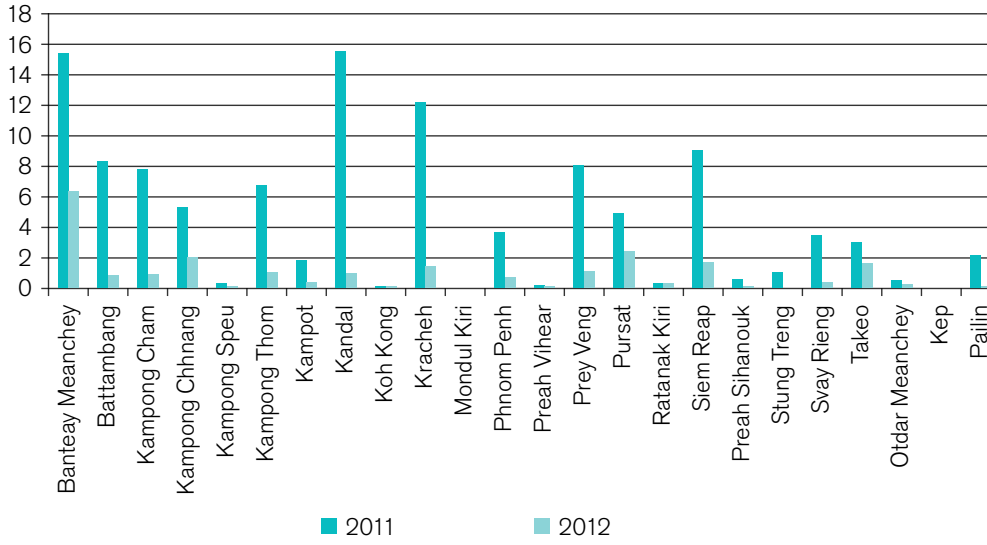
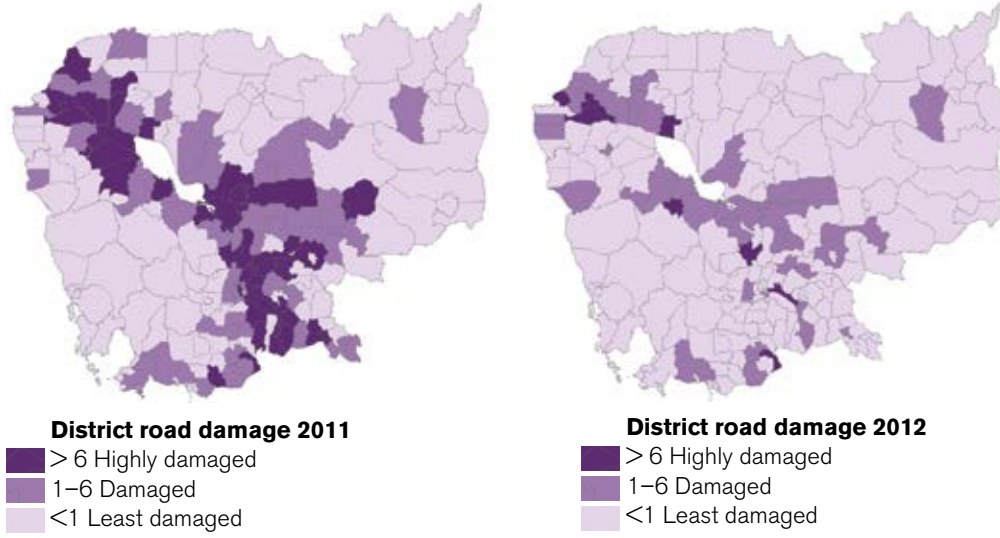


Figure 27: District maps of roads damaged by floods in 2011 and 2012



Source: Commune database (2011 and 2012).

2. Percentage of bridges affected by flood: Our analysis shows that, in 2011, on average 1.8 bridges per 1,000 families were damaged in each province; in 2012, the figure reduces to less than 0.5 bridges. In 2011, nearly three provinces had more than three bridges damaged per 1,000 families, compared to just two provinces in 2012. Phnom Penh and Takeo experienced the biggest bridge losses in 2011; in 2012, Banteay Mench and Kampot were most affected.

Table 13: Number of bridges damaged by floods

Number of bridges damaged per 1,000 families	VI category	Number of provinces	
		2011	2012
More than 3	Highly damaged	3	2
0.3–3	Damaged	6	8
Less than 0.3	Less damaged	15	14

Figure 28: Number of bridges affected by floods per 1,000 families, 2011–2012

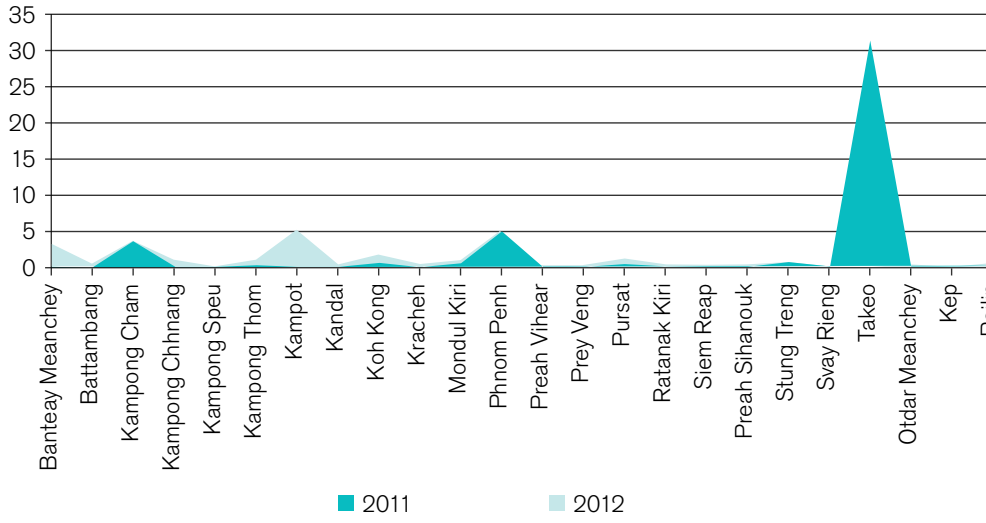
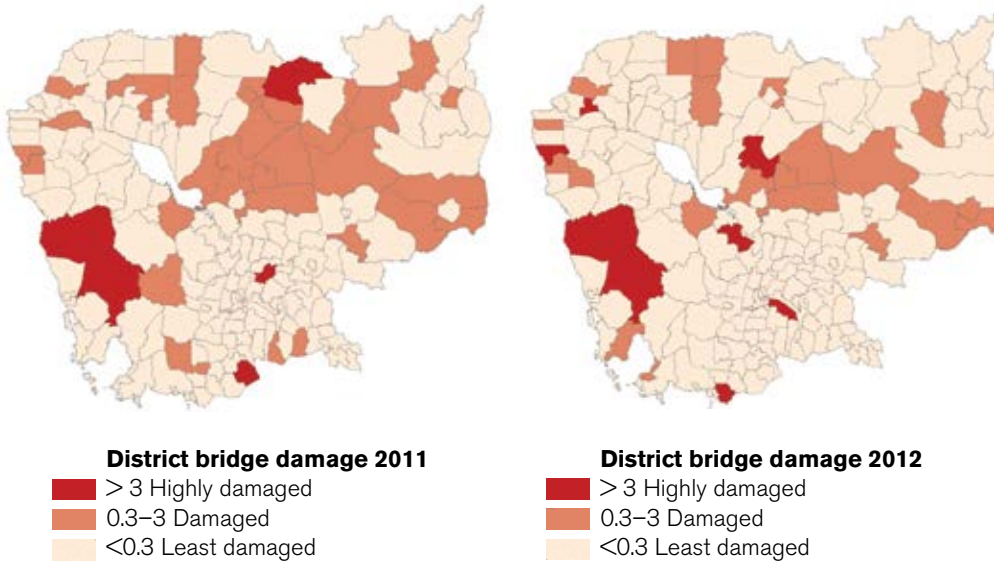


Figure 29: District maps of bridges damaged by floods, 2011–2012



7

Summary of results and lessons

Table 14: National and sectoral institutional readiness baseline results

	National score	MPWT score
Status of climate policy and strategies	30%	Only collected at national level
Status of climate integration into development planning	25%	31%
Status of coordination	45%	45%
Status of climate information	17%	28%
Status of climate integration into financing	25%	23%
TOTAL SCORE	28.4	26.5

Table 15: National and sectoral impact baseline results

Track 2 Impact Indicators (National) (2014)		
% of communes vulnerable to climate change (2014 data)*	17% of the communes are highly vulnerable to floods, droughts and storms 31% are quite vulnerable	
Average number of families affected by all hazards (2011 and 2012 data)	**2014** 18/1000 families	
Families affected by floods	16/1000 families	
Families by droughts	36/1000 families	
Families affected by storms	2.5/1000 families	
Track 2 Impact Indicators (MPWT)	**2011**	**2012**
Average % of roads damaged by floods	4% roads damaged in each province per 1000 sq. km	1%
Bridges affected by floods	1.8 bridges were damaged in each province per 1000 families.	0.5 bridges/1000 families

Lessons from TAMD application at the national and sectoral level

- There is a growing need to look beyond project-level M&E frameworks and to invest in national-level frameworks that can analyse the effectiveness of adaptation responses at national level.
- Applying M&E at the national level would require establishing logical impact pathways that link the various scales of response planning and implementation.
- A readiness ladder can measure progress towards separate milestones. This is an innovative approach to applying scorecards to measure CRM (Track 1).
- If indicators of vulnerability, resilience, and adaptive capacity are sound, they should be able to predict impact variations across populations exposed to the same hazards (Track 2). Statistical correlations between vulnerability and impact indicators can help identify the most important proxies for vulnerability.

8

Addressing the challenges of adaptation M&E

Climate change adaptation poses challenges of unprecedented scale and scope, which cut across normal programming sectors, levels of intervention, and timeframes. Because adaptation interventions are conducted across sectors, scales and long timeframes, evaluating adaptation is an equally challenging process.

TAMD identifies four common challenges in conducting M&E of adaptation:

- long timescales associated with climate change and adaptation
- attributing the outcomes of adaptation to specific actions, interventions or policies
- shifting baseline conditions of climate change over time, which can make it difficult to interpret adaptation results, and
- the contextualisation of adaptation outcomes within wider environmental changes, which may impact adaptation interventions and thereby alter the results.

These challenges all need to be understood and incorporated into evaluation frameworks to ensure that evaluations of adaptation are robust (Brooks et al., 2011). This section discusses some of these challenges and explain how TAMD addresses them within the Cambodian context.

8.1 Long timescales

Measuring the success of adaptation is difficult because it can take many years before an individual, household, community or business is considered resilient. This is particularly true of adaptation initiatives intended to address longer-term changes in climate that will take many years, or even decades, to unfold. The long timescales needed to measure resilience are complicated by the shorter timescales imposed by the cyclical nature of project and programme funding (usually one to five years). These initiatives – whether funded through the national planning process or by external donors – often require measurable results over short timescales that do not complement the incremental nature of building adaptation in the longer term.

In Cambodia, TAMD's inclusion in national and sectoral-level adaptation and development planning is expected to create a regular evaluation process to assess the long-term effectiveness of adaptation interventions. For example, they will measure climate change responses at different intervals in coherence with the NSDP planning cycle.

8.2 Shifting baselines

With climate change already impacting people's lives in Cambodia, adaptation will take place within a shifting climatic and environmental context that will expose vulnerable communities to greater climate-related hazards and risks. This poses a challenge for evaluation, as it has the potential to act as a confounding factor in the assessment of development and adaptation interventions. For example, if an adaptation intervention that aims to improve the productivity of smallholder farmers (thereby improving their asset base and contributing to resilience) yields no overall increases in crop yields, it could appear to show that adaptation efforts are not succeeding. But if the project is implemented during a time of increased drought intensity, the fact that productivity has not declined would actually indicate success in building resilient food systems. So if an adaptation intervention is not contextualised within changes in baseline environmental conditions and events, M&E assessments could misinterpret their effectiveness. Shifting baselines need to be incorporated into the design of forward-looking evaluative tools and the retrospective analysis of data from specific interventions.

In Cambodia, baseline results were interpreted in the context of the shifting climate. For example, 2011 experienced large-scale damage to road infrastructure while this was much lower in 2012. This improvement in road infrastructure was not, however, a sign of better climate proofing of roads; it clearly reflected the fact that 2011 was a year of intense flooding in Cambodia.

8.3 Normalisation and contextualisation

When undertaking adaptation evaluations, "indicators need to be normalised to account for changes and variations in the frequency and severity of extremes, particularly where these extremes are becoming more or less prevalent, and where the extremes in question are infrequent" (Brooks et al., 2011)

In Cambodia, all core vulnerability and impact indicators were adjusted in the context of climate related hazards. For example, impacts were measured in the context of floods, drought and storms. Vulnerability indicators were selected based on their ability to predict the impacts of storm, drought and flood hazards. The availability of hazard-specific impact indicators in Cambodia's commune database made it easier to assess development effects in different climate context. Since 2011, the database has included new indicators such as families affected by floods storms and droughts and road infrastructure damaged by flood. This data was directly used to assess impacts at national and sectoral levels.

The results were also interpreted and contextualised using information on climatic stresses, reading the results of vulnerability in combination with impact and climatic context results. In some cases, results show that those communes that experience the greatest losses are those with the greatest underlying social vulnerability, when variations in frequency and severity of flood and drought hazards are taken into account. For example, Banteay Meanchey province experiences high flood intensity, is highly vulnerable to flood impacts and has quite a high number of families affected by floods.

Tools to address normalisation and contextualisation in relation to climatic variations

The measurement of impacts in isolation of absolute values of loss and damage metrics and climate-sensitive wellbeing-type indicators tells us little about the success of adaptation and resilience-building measures. This is because these variables need to be interpreted in the context of evolving and varying socio-economic and climatic conditions. For example, losses of assets or infrastructure value may increase in absolute terms but decline as a percentage of exposed assets or infrastructure. This ambiguity can be addressed by standardising losses in terms of percentages of exposed assets.

Evolving climatic conditions are more challenging to address. For example, improvements in climate-sensitive wellbeing indicators and loss and damage metrics may result from an amelioration of climate hazards. Alternatively, they may be the results of successful adaptation and resilience interventions in the face of intensifying climate hazards. Without access to data that tell us how climatic conditions and hazards are evolving, the results of adaptation and resilience building activities cannot be interpreted.

There are currently no standard methodologies for 'contextualising' changes in climate-sensitive development indicators with respect to climatic variations. One useful approach is to use simple narratives that explain how these indicators are varying in parallel with key climate variables. If both climate hazards and development/wellbeing indicators can show deterioration, stability or improvement, there are nine possible combinations of climatic and development trajectory. Most of these combinations present us with a ready-made narrative, for example of improving wellbeing against climatic stability or deterioration (i.e. successful adaptation or resilience-building), or of declining wellbeing despite stable or improving climatic conditions (increased vulnerability or maladaptation).

The most problematic combinations of wellbeing and climatic evolution are (i) declining wellbeing against a backdrop of intensifying hazards – here it is possible that adaptation may have prevented an even greater deterioration in wellbeing; and (ii) improving wellbeing against a backdrop of improving climatic conditions – this might be partly the result of improved resilience / reduced vulnerability, but may be entirely due to a reduction in climatic stress. In both of these cases some sort of 'no-intervention' counterfactual involving climate data is required. Methodologies for constructing these counterfactuals are in their infancy, and there are not standard ways of addressing these interpretation challenges.

9

Potential to sustain and scale up: roadmap for M&E

M&E for climate change is a new challenge. In the long run, the government would need capacities and resources to invest in M&E so it can track progress against national objectives and ensure development is kept on track despite the stresses of climate change. The CCCSP foresees three phases for the implementation of the national framework: short-term (2014), medium-term (2018) and long-term (2024). IIED worked with the Cambodian government to establish baselines against its core indicators for the first term. The General Secretariat of the National Council for Sustainable Development (GSSD), through its Department of Climate Change (DCC) will measure progress against these criteria in 2018 and 2024. The DCC's Policy and Coordination Office will also coordinate M&E reporting from various line ministries.

Although Cambodia already has institutional mechanisms to coordinate climate change, its systems need further strengthening to ensure an enabling environment for monitoring and evaluating climate change responses. To further internalise M&E into development sectors, the approach used by MPWT will need to be replicated and scaled up in the other thirteen sectors. There are nine key steps for implementing the M&E framework in the long run.

9.1 Short to medium term

1. **Operationalise the Monitoring, Evaluation and Learning unit:** The DCC's Policy and Coordination Office is responsible for implementing the M&E framework, which includes: collecting data against the core indicators, conducting in-depth studies in some cases and coordinating M&E reporting with line ministries. But this system is yet to fully operationalise. IIED has facilitated DCC's M&E officials to establish baselines for the first term, but in the long run the DCC officials will be fully responsible for this task, and for facilitating sectoral line ministry staff to report against core sectoral indicators.
2. **Capacitate DoPs within sectoral ministries:** Although DCC will play a role in coordinating with line ministries, M&E at sector level is expected to be the responsibility each line ministry's DoP. To ensure effective reporting of progress from line ministries, it will be important that the DCC's Policy and Coordination Office acquaints individual DoPs with data collection procedures and templates for analysis and reporting.
3. **Validating national and sectoral baseline results on the ground:** The current baseline for vulnerability and impact indicators is calculated from data available in Cambodia's commune database. Using a national database is a practical approach for measuring impacts at national level. However, this data often provides a macro-level picture of results. Collecting data from household surveys on the ground provides more a robust assessment of impacts. However, these procedures are complex, resource-hungry and difficult to aggregate when assessing national-level performance. One option to overcome this challenge is to validate national and sectoral results on an ad hoc basis by collecting field-level data. This could involve identifying and testing a sample of vulnerable communes for vulnerability and impact levels. This approach can also be applied to assess extreme differences between communes and to identify anomalies and causality for outlier communes.

9.2 Medium term

4. **Replicating the M&E approach across all fourteen line ministries:** The framework should be mainstreamed in the remaining line ministries in the medium term. This will require establishing sectoral Track 1 and 2 indicators and developing baselines and procedures for data collection.
5. **Mainstreaming M&E for climate change within subnational and local planning**. It is recommended that the approach is piloted at local level.

6. **Refining the commune database:** The vulnerability and impact indicators could be augmented by including new vulnerability-focused questions in the commune database, on the basis of participatory vulnerability assessments in selected communes. Please find below suggestions of some questions to refine the commune-database.

   The approach to identifying indicators of vulnerability has been to undertake statistical analyses of the correlations between the available development or wellbeing indicators (e.g. poverty, infrastructure, health, etc.) and metrics of climate-related loss and damage, with the latter lagged by a year in relation to the former. Development indicators exhibiting strong and statistically significant correlations with loss and damage indicators are identified as potential useful proxies for vulnerability (i.e. vulnerability indicators).

   This analysis needs to be updated frequently, when new data become available. Ideally this should occur each year, with each year's analysis using the latest year of loss and damage data and the preceding year's wellbeing/development indicator values. The aim of this analysis is to identify correlations between wellbeing and loss/damage indicators that are robust over time, or that are especially relevant because they are based on data representing a period during which notable climate extremes occurred.

   Over time, a set of robust vulnerability indicators may be identified through the above analyses. It is likely that, as more years of data become available for analysis, certain proxies for vulnerability will be dropped and others added, from the pool of wellbeing/development indicators. However, it is not possible to identify completely new vulnerability proxies (i.e. indicators that are not present in the existing database) using this analysis.

   The above statistical approach might be complemented with participatory assessments that seek to identify key factors that affect people's resilience, vulnerability and adaptive capacity at the local level. Indicators to capture these factors can be identified/developed, and they can be compared with the indicators identified from the statistical analyses.

   Where participatory assessments identify factors important for vulnerability, resilience or adaptive capacity that are not captured in the existing commune database, it might be recommended that the commune database be updated to include indicators representative of these factors.

Suggested questions for inclusion in the commune database

Commune database contains data on 1083 variables/indicators. 644 of these are collected at the village level, 248 at the commune level, and 191 at the district level.

CDB indicators in its current form are dominated by standard development-type indicators relating to poverty, demographics, gender, infrastructure, services, etc.

To better analyse development impacts of climate change responses, the CDB will gain from including following indicators in its database:

- Measures relating to the frequency and severity of specific hazards.
- Expenditures incurred for coping with specific hazards
- Losses in economic terms (in USD) from extreme climatic events
  - Household assets
  - Farm assets
  - Public infrastructure
  - Natural assets
  - Crop loss
  - Investment loss

However, these are some initial suggestions. To develop a robust list of questions for inclusion in the CDB, a detailed review of commune database will be needed to identify gaps. Participatory vulnerability assessments may also be conducted at a pilot level to understand what factors increase the vulnerability levels of villagers, and using those indicators in the commune data base.

9.3 Long term

7. **Regular monitoring of core indicators:** This can be supported by long-term evaluations.
8. **Analysing M&E results at national and sectoral level** and using this information for better planning and targeting of climate resilient interventions. For example, commune and village-level information on vulnerability levels and impacts can be used to target support towards specific communes, district and villages.
9. **Updating M&E indicators or vulnerability indices if needed**: The framework can be revised based on lessons that emerge during the piloting phase.

10 Conclusion

The government of Cambodia are using TAMD to facilitate a national indicator framework for climate change M&E. It has used TAMD's scorecard system to develop national-level CRM process indicators related to capacity development and institutional reform. It prioritised these indicators into five key national areas, and developed readiness ladders to track progress in national-level institutional processes. It then adapted these ladders as sectoral-level indicators and applied them to sectors that are receiving core funding from the PPCR project in Cambodia, such as the MPWT.

New approaches were used to develop indicators to assess Cambodia's vulnerability levels. For example, the significance of the relationship between socioeconomic parameters and the effects of climate hazards were examined, such as mortality or economic losses, and used this information to identify vulnerability proxies. When there is a strong correlation with hazard effects, they can be used as proxies for resilience or vulnerability, based on their ability to 'predict' these effects. This approach was used to identify indicators of vulnerability to floods, storms and droughts, using local-level data in a commune database. A small subset of vulnerability indicators were isolated from a much larger one and used this to produce preliminary maps of vulnerability to different types of hazards at commune and district levels.

This initial phase of M&E in Cambodia clearly reflects a growing need to look beyond project-level M&E frameworks by investing in national level frameworks that can analyse the effectiveness of adaptation responses at the national level. But applying national-level M&E would require establishing logical impact pathways that link the various scales of response planning and implementation which the national M&E framework has attempted to show in this report.

Overall, both at the national and sectoral, Track 1 and 2 indicators were assessed keeping in mind their feasibility and replicability in the long run and using existing national systems. But there remains the potential to sustain or scale up M&E within systems if national capacities are strengthened to support M&E processes. National, sectoral and subnational systems will need to be strengthened to use the M&E outcomes for better learning. Results from M&E can then be effectively used for planning climate-related support to those areas that need it the most.

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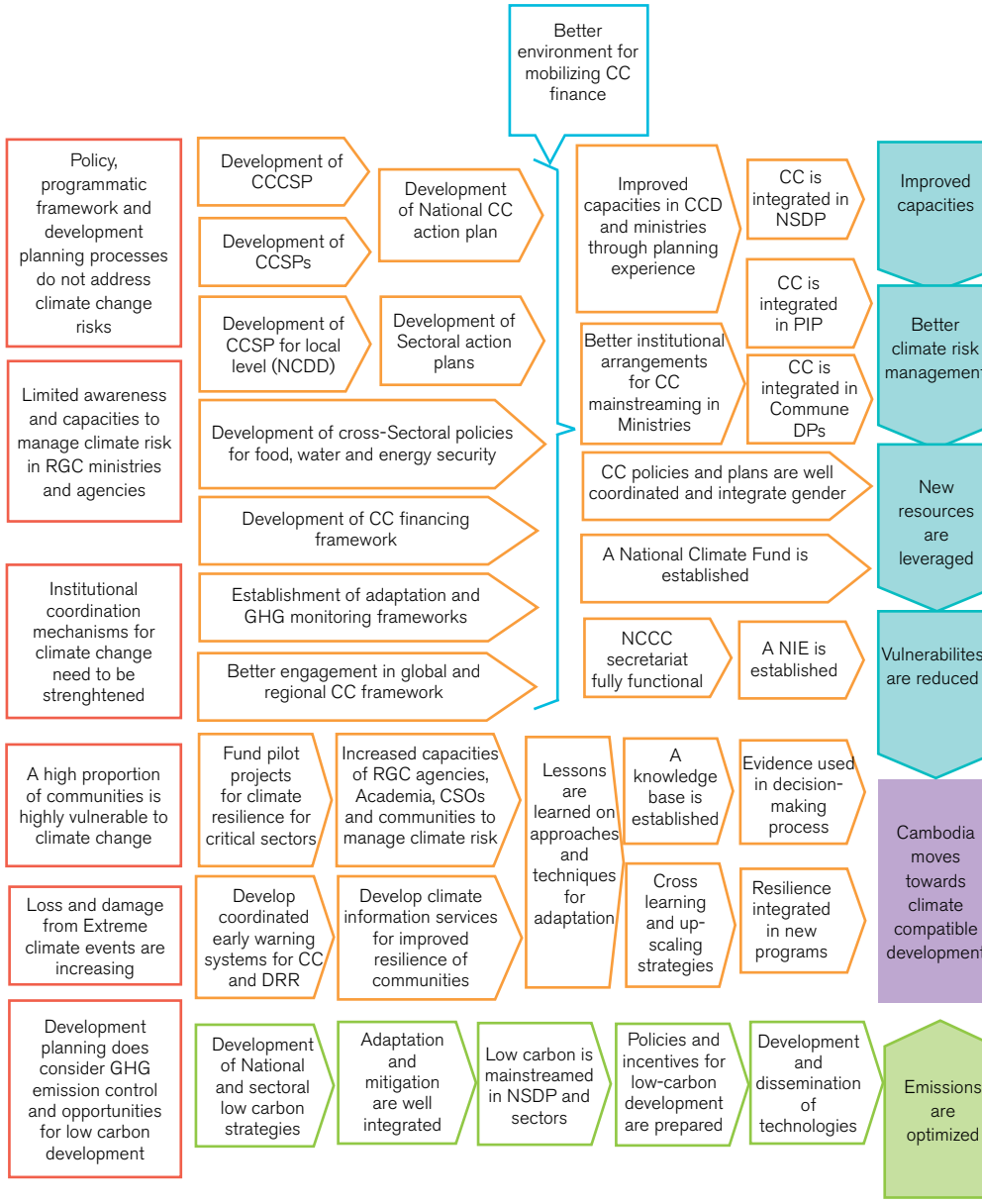
Appendices

Appendix 1. Preliminary CCCSP theory of change



Source: Draft CCCSP document, 2013

Appendix 2. Scorecards used at the national level

Indicator 1: Status of development of national policies, strategies and action plans for climate change response.

Step	Milestone	Yes/No/ Partial	Supporting evidence/ narrative
	NAPA exists but adaptation response is limited to project based approaches.	Yes	Approved in 2006. Two projects implemented
	National CC strategic plan integrating adaptation, disaster risk reduction and mitigation response is approved.	Yes	
	Other national CC Action Plans are under development (including NAPA and NAMA).	Partial	Initial steps Not fully scaled up
	A national M&E framework for CC and disaster risk management is under development.	Partial	In the design phase
	Fourteen sectoral CC action plans approved and more line agencies are developing.	No	Ongoing
	CC action plans updated based on evidence issued by M&E framework and a new action plan is prepared at the end of the planning cycle (e.g. at the end of year 5).	No	CC action plans are not implemented yet
	CCCSP progress monitoring reports are submitted to (yet to be identified) agency, in alignment with NSDP timeline (2.5 years).	No	CCCSP not implemented yet
	Legislation that provides legal mandate for implementation of CC policy objectives is established.	No	In process
	National CC strategic plan reviewed in 2018 based on evidence issued by the M&E framework.	No	Not yet
	New strategic plan approved at the end of the planning cycle in 2024.	No	Not yet
	Total score= (2Yes*2 + 2P*1)/10*2*1= 30%		

Indicator 2: Level of inclusion of climate change in long, medium (NSDP) and short term (PIP) national and subnational planning documents.			
Step	**Milestone**	**Yes/No/ Partial**	**Supporting evidence/ narrative**
	CC is mentioned in NSDP 2009–2013 but no specific measures on fund allocation.	Yes	
	Response to CC is articulated in NSDP 2014–2018 and specific actions and indicators are included from CCCSP with related fund allocations	Partial	It is articulated but NSDP not yet approved but CCCSP indicators are included in NSDP
	Responsibility for CC integration in national M&E Framework is assigned within NIS/ MoP.	No	There are preliminary discussions on it
	Climate change actions plans are integrated into the PIP.	Partial	In the process. In consultation stages
	Formal procedures are in place in CDC for screening major donor and private sector investments against climate risk.	No	Some discussions
	Subnational (commune and district) budgets and planning guidelines integrate climate change.	No	1 pilot project in selected districts
	At least one third of the most vulnerable provinces budget in their Provincial Development Plans the climate change actions identified in the sectoral CCAPs.	No	To be confirmed
	At least half of the most vulnerable provinces budget in their Provincial Development Plans the climate change actions identified in the sectoral CCAPs.	No	
	Almost all of the most vulnerable provinces budget in their Provincial Development Plans the climate change actions identified in the sectoral CCAP.	No	
	Total score: (1*2+2*1)/9*2*1= 22%		

Indicator 3: Establishment and functionality of a national coordination mechanism for climate change response and implementation of the CCCSP.			
Step	**Milestone**	**Yes/No/ partial**	**Supporting evidence/narrative**
	The Climate Change office is established in MoE (2003) and upgraded to climate change department in 2009.	Yes	
	A policy level coordination body is established (NCCC)	Yes	
	A technical advisory inter-ministerial body is established.	Yes	Climate Change Technical Team (CCTT) is established.
	The coordination body for climate change has high convening authority across line ministries.	Partial	NCCC is inter-ministerial and brings together representatives from different line ministries. Participation and level of implementation needs further strengthening.
	The coordinating agencies are fully functional and properly structured to deliver its inter-ministerial coordination mandate.	Partial	Play a key coordination role in international negotiations. Institutional coordination structure is defined to link up climate change and large programmes (e.g. REDD+). Partial because human capacity enhancement needed for coordination and information exchange mechanism needs strengthening.
	A coordinating agency is accredited as an National Implementing Entity (NIE)	No	Discussions are under way. Climate Change Fiscal Framework as one of the potential contributing instruments.
	Specialised inter-ministerial subgroups under the CCTT are established	Partial	Subgroups exist but are limited and still evolving. ToR of CCTT.

	The climate change focal points and working groups are established within sectoral line ministries.	Partial	Working groups were set up within some ministries. They have contributed in developing action plans, but their mandate is short term.
	Regular meetings are organised to review the progress of the CCCSP and the CCAP, aligned with NSDP timeline.	No	
	Stakeholders from civil society, private sector and academia are engaged in the CCCSP regular progress review.	No	
	Regular CCCSP and/or CCAP progress reports are submitted by NCCC secretariat to feed into the NSDP review.	No	
	Total score: (3Y*2+4P*1)/11*2*1= 45%		

Indicator 4: Production, access and use of climate change information

Step	Milestone	Yes/No/ Partial	Supporting evidence/narrative
	Information/data related to climate change exists at a level.	Partial	Exists at some level. Climate-related information is scattered across different levels (e.g. projects, sectors, ministries).
	Coordination mechanism for data sharing through a subgroup is established.	No	It is an informal process.
	A protocol for the management and exchange of data is approved through a legal arrangement.	No	
	A Climate Change knowledge management platform is established (DCC).	No	

	Public meta-database listing climate change info (met and climate data) is available and accessible (e.g. online portal).	No	
	An information base on climate change finance and national and international interventions is available.	Partial	Available at CDC investment project database. The users however need to further screen and analyse the data to make it usable.
	A central clearing house that ensures climate data is analysed (forecasting, modelling), updated, and managed to ensure good quality, accuracy, reliability and validity.	No	
	Climate modelling information is available to public institutions in a format that can be easily used for sector level modelling and climate risk assessments.	No	
	Climate related information and analysis (vulnerability assessments, scenario planning, modeling) is used for decision making.	Partial	It was used in the CCCSP, SNC, SPCR, etc.
	Total score= (3P*1)/9*2*1= 17%		

Indicator 5: Availability and effectiveness of a financial framework for climate change response.

Step	Milestone	Yes/ No/ Partial	Supporting evidence/ narrative
	A national pilot trust fund for climate change is established.	Yes	
	A climate public expenditure review is conducted jointly by the MoE and MoF, and a reference baseline for climate finance is available.	Yes	
	An inter-ministerial subworking group on climate finance is established	Yes	

	A climate change financing framework is approved.	No	Not yet. It is under development. A complete draft has been reviewed.
	A national fund for coordinated management of climate finances is established.	No	
	Coordinated funding arrangement for climate change response exists (e.g. a coordination mechanism for budgetary and extra-budgetary resources).	No	It is project-based at the moment.
	A Climate Change Expenditure Review is regularly conducted and is included in the CCCSP progress report.	No	
	A code to track climate expenditure is established and is consistently applied to produce regular climate expenditure review in CDC/CRDB ODA Database.	No	
	A code to track climate relevant expenditure is established and is consistently applied to produce regular climate expenditure review in NCDD-S / subnational funds.	No	
	A budget code to track climate relevant expenditure is established and is consistently applied to produce regular climate expenditure review in the national budget.	No	
	Formal procedures are in place in MEF for screening major national budget investment against climate risk.	No	
	Budgetary and extra-budgetary resources mobilised are 30%–50% of the annual requirements identified in the CCAP	No	
	Budgetary and extra-budgetary resources mobilised are at least 80% of the annual requirements identified in the CCAP.	No	
	Total score: (3Y*2)/13*2*1=23%		

Appendix 3. Scorecards used at the sector (MPWT) level

Indicator 1: Level of inclusion of climate change into sectoral planning and linkages with national planning			
Step	**Milestone**	**Yes/No/ Partial**	**Supporting evidence/narrative**
	CC is mentioned or integrated into MPWTs sectoral policy (e.g. national transport policy).	No	But it is in NSDP. Recommendations will come from PPCR on proofing of roads.
	Responses to CC with specific actions are articulated in the sectoral CCAP	Yes	In CCAP.
	Specific CCAP activities are costed and time bound?	Yes	Action fiches and activities are well costed and have a time frame. List of potential projects.
	MPWT funds are allocated to CCAP activities.	No	Two projects funded and under implementation. No pre-available funds. CCCA allocates to CCAP. Discussions are underway, but there is no allocation in place yet.
	Climate change is integrated into National Implementation Plan on Environment in Transport Sector.	Yes	Mitigation plans are integrated, including greenhouse gases. There is no resilience component. Need to review the document.
	Responsibility for CC integration into sectoral M&E systems is assigned within the MPWT's DoP.	Partial	There is an office of data evaluation at the DoP, but capacity is lacking. Office of environment and social justice under DoP considers climate change to some extent.

	Formal procedures and clear standards are in place in MPWT for screening major donor, government or private sector investments against climate risk.	No	Environmental and social risks are screened and submitted to PIP, but not for climate risk screening. Donors have their own screening processes. It does not cover CC specifically.
	Responsibilities for applying risk screening criteria by the technical department and the planning departments are spelled out in a ministerial decision.	No	It is project by project. There is no mandate as such.
	Related training programmes for ministry staff are rolled out for screening climate relevance or climate risks.	Partial	Project-based pilot training programmes on hydrology and flood proofing.
	If the project is climate relevant (e.g. if the road construction is in a vulnerable area), specific measures are included in the project design and in the budget to contribute to relevant mitigation or adaptation objectives.	Partial	Some project-based measures are in place, dependent on project ToR. It happens at the design level of projects in some cases.
	A sectoral M&E framework for CC, aligned with the national M&E framework is under development or developed.	Partial	Under development
	Regular monitoring and evaluations assess the contribution towards achieving the CCAP objectives.	No	M&E is under development and therefore not in use yet.
	CC action plans updated based on evidence issued (recommendations) by M&E framework and a new action plan is prepared at the end of the planning cycle (e.g. at the end of Year 5).	No	
	Legislation that provides legal mandate for implementing CC policy objectives at the sectoral level is established.	No	

	MPWTs CCAP is reviewed, based on evidence issued by the M&E framework.	No	
	New CCAP is renewed, based on evidence from M&E.	No	
	Total score: 3Y*2+4P*1/16*2*1= 31%		

Indicator 2: Establishment and functionality of institutions and coordination mecnism for climate change response and implementation of MPWTs CCAP.

Step	Milestone	Yes/No/ Partial	Supporting evidence/narrative
	Climate change focal points for coordination are established within MPWT.	Yes	A CCTT is mandated with CC coordination with DoP of MPWT.
	Working group responsible for coordinating is established within MPWT's DoP.	Partial	Ad hoc Technical Working Group from transport, public works and administration to discuss climate change action planning within DoP.
	Focal points are fully functional and properly structured to deliver its internal coordination mandate.	Partial	
	Working group is fully functional and properly structured to deliver its coordination mandate for CC.	Partial	There is no dedicated working group. Ad hoc working group.
	Capacity building support in coordination is being provided to working groups and focal points.	Partial	Project-based support through CCCA Phase 1 builds capacity of CCTT person in MPWT DoP. JICA-national implementation plan support.
	Capacity building and training support is being provided to build institutional strengths of MPWT staff so that they integrate CC issues in MPWT planning and implementation.	Partial	Project-based training is provided to inter-ministerial staff and MPWT staff by ADB under the PPCR programme. E.g. Vulnerability assessment to identify roads that are highly vulnerable to floods.

	Trained staff considers CC-sensitive risk assessment and monitoring of CC impacts while planning for MPWT investments (roads and transport).	No	Not yet, but envisaged in future (e.g. PPCR may do it at the project level).
	Focal points and working groups coordinate well with DCC and NCSD through regular meetings.	Partial	Ad hoc
	MPWT submits regular CCAP progress reports to NCCC secretariat.	Partial	Coordinating, but through national reporting.
	Regular meetings are organised to review the progress of the sectoral CCAP aligned with CCCSP.	No	
	Total score: 1Y*2+7P*1/10*2*1= 45%		

Indicator 3: Production, access and use of climate change information by MPWT

Step	Milestone	Yes/No/ Partial	Supporting evidence/narrative
	Historical and current records of climate information/data exists and is available for sectoral use. This includes data on weather patterns, frequency and intensity of disasters.	Partial	Available at meteorology department level from the Ministry of Water Resources and Meteorology (MoWRAM), but not readily accessible to the public. Climate data is available before construction of roads for projects on a case–by-case basis. Annual reports after disaster (2000, 2011, 2013) Monthly reports
	Coordination mechanism for data sharing through a subgroup is established.	Partial	Coordination mechanism exists for general data coordination, but not climate.

	A protocol for the management and exchange of data is approved through a legal arrangement.	No	Available at the national level with MoP and NIS, but not at the sectoral level. Some legal backing needed to allow obligatory circulation of data.
	A CC knowledge management platform is established.	No	Project based- JICA (also on climate change). Reports prepared after a disaster on number of roads and bridges affected by disaster. There is no formal platform to share information generated.
	Public meta-database listing CC info (meteorogical and climate data) is available and accessible (e.g. online portal).	No	MPWT does not have access to this data readily.
	An information base on CC finance and national and international interventions is available for use by MPWT.	Partial	Available in a scattered manner with MoE/MEF and CDC.
	A central clearing house that ensures climate data (forecasting, modelling) is analysed, updated and managed to ensure good quality, accuracy, reliability and validity is available for MPWT use.	No	Project-based data analysis is often done by consultants.
	Climate-related information and analysis (vulnerability assessments, scenario planning, modelling) is used for planning and decision making.	Partial	Done at project level.
	Data on CC impacts on the roads sector is used to build better design standards for climate proofing infrastructure.	Partial	Historical data is available from MOWRAM. Gathered through surveys from communities. Done at project level.
	Total score=+5P*1/9*2*1= 28%		

Indicator 4: Availability and effectiveness of a financial framework for climate change response.

Step	Milestone	Y/N/P	Supporting evidence/narrative
	A costed CCAP is in place.	Yes	Year-by-year costing of planned activities.
	Sectoral pilot projects supported by climate finance are in place.	Partial	Two initial Strategic Programme for Climate Resilience (SPCR) projects are active.
	CCAP priorities are reflected in the PIP.	Yes	Starting with 2015–2017 PIP.
	CCAP priorities reflected in the ministry's budget strategic plan and programme budget.	No	
	Identify pipeline of CC-relevant projects in line with CCAP.	No	
	A tool to track % of CC relevance of expenditure is established and used.	No	
	A CC expenditure review is regularly conducted at the sectoral level and reported in the CCAP progress report.	No	
	MPWT has procedures for CC screening and climate-proofing of infrastructure projects.	No	
	MPWT has capacity to assess impact of CC on costs and benefits of proposed projects.	No	
	Budgetary and extra-budgetary resources mobilised are 30%–50% of the annual requirements identified in the CCAP	No	Only two projects funded through SPCR.
	Budgetary and extra-budgetary resources mobilised are at least 80% of the annual requirements identified in the CCAP.	No	
	Total score: (2Y*2+1P*1)/11*2*1= 23%		

Appendix 4. National vulnerability index scores by province

PROV_ CODE	PROV_NAME	Storm VI	Flood VI	Drought VI	Composite VI
1	Banteay Meanchey	−0.154	−0.030	−0.967	−0.034
2	Battambang	−0.172	0.063	−1.238	0.044
3	Kampong Cham	−0.165	−0.619	−1.060	−0.634
4	Kampong Chhnang	−0.153	−0.609	−0.849	−0.581
5	Kampong Speu	−0.215	−1.448	−1.792	−1.435
6	Kampong Thom	−0.195	−0.350	−0.654	−0.428
7	Kampot	−0.185	−0.675	−1.113	−0.691
8	Kandal	−0.197	−1.205	−1.816	−1.198
9	Koh Kong	−0.222	−0.825	−1.144	−0.830
10	Kracheh	−0.191	−0.288	−0.865	−0.395
11	Mondul Kiri	−0.250	−0.379	−0.826	−0.530
12	Phnom Penh	−0.479	−2.481	−2.752	−2.462
13	Preah Vihear	−0.175	0.046	−0.644	−0.151
14	Prey Veng	−0.210	−0.388	−1.103	−0.442
15	Pursat	−0.191	−0.204	−1.086	−0.368
16	Ratanak Kiri	−0.219	1.273	−0.898	0.630
17	Siem Reap	−0.204	−0.239	−0.932	−0.347
18	Preah Sihanouk	−0.241	−1.060	−2.041	−1.261
19	Stung Treng	−0.226	0.585	−0.804	0.270
20	Svay Rieng	−0.321	0.274	−0.968	0.264
21	Takeo	−0.159	−0.725	−0.919	−0.739
22	Otdar Meanchey	−0.217	1.260	−0.724	0.819

23	Kep	−0.202	−1.102	−1.366	−1.022
24	Pailin	−0.268	−0.099	−2.139	−0.121
25	Tboung Khmum	−0.242	−0.466	−1.305	−0.545

Thresholds

Composite VI score		**Flood VI scores**	
>0.199	High	>0.407	High
0.199 to −0.487	Quite	0.407 to −0.38	Quite
(-)0.487to (-)1.174	Less	(-)0.38 to (-)1.182	Less
(-)1.174<	Least	(-)1.183<	Least

Storm VI scores		**Drought VI scores**	
> (-)0.162	High	> (-)0.678	High
(-)0.162 to (-)0.229	Quite	(-)0.678 to −1.200	Quite
(-)0.229 to (-)0.296	Less	(-)1.200 to (-)1.722	Less
(-)0.296<	Least	(-)1.722<	Least

Appendix 5. Number of families affected per 1,000 families, by hazard type in 2011 and 2012

Province	Storms 2011	Floods	Droughts	Storms 2012	Flood	Droughts
Banteay Meanchey	1.196168	**103.9521**	22.49403	0.987096	**85.42559**	40.8472
Battambang	0.595218	98.2417	28.77804	0.76355	17.32078	57.11155
Kampong Cham	0.247646	72.7666	22.65384	0.44987	9.993608	9.107647
Kampong Chhnang	6.189517	141.2098	9.034824	4.849319	11.2952	14.47307
Kampong Speu	0.189759	10.81213	4.579138	0.221182	1.012048	2.87997
Kampong Thom	6.146557	238.7738	20.40645	5.15143	60.42304	22.79516
Kampot	0.862569	41.65423	2.562227	2.882113	5.007779	59.7712
Kandal	1.144946	92.06516	27.73685	0.555609	4.319009	14.45172
Koh Kong	4.1714	6.888668	10.23347	1.969837	6.043345	4.247173
Kracheh	0.209303	46.35058	12.58471	0.064888	14.33733	49.50727
Mondul Kiri	0	0	25.11175	0.036378	0	41.63396
Phnom Penh	0.198118	27.87638	0.465758	0.571766	6.785216	14.46556
Preah Vihear	0.273679	58.23617	13.71999	0.492186	10.81843	36.32744
Prey Veng	1.725941	157.5154	56.63818	0.267296	13.9579	32.6043
Pursat	0.738584	52.41234	23.74084	0.494275	15.7189	31.62587
Ratanak Kiri	0.376359	22.48413	**16.44487**	0.442184	2.876908	**19.07626**
Siem Reap	0.645355	104.9664	6.769776	0.275056	17.32595	17.42824
Preah Sihanouk	0.46665	8.53734	1.745297	0.504472	4.141058	33.36659
Stung Treng	1.588347	121.8505	12.98532	0.976589	19.45481	33.80112
Svay Rieng	2.137964	51.65657	49.27003	0.367518	8.544235	25.28485
Takeo	1.207983	42.82634	9.904636	0.502892	13.98321	7.376196
Otdar Meanchey	3.072036	8.979988	18.37525	1.472198	1.070224	33.74064
Kep	3.1	0	0	2.46	0	28.62
Pailin	3.6	9.08	31	0.97	2.01	45.38
AVERAGE	**1.415356**	**79.03017**	**19.77022**	**1.1**	**15.47**	**25.25**

Appendix 6. Percentage lengths of roads damaged by floods per 1,000km^2 (2011 and 2012)

PROV_CODE		2011	2012
1	Banteay Meanchey	15.40178	6.366398
2	Battambang	8.356033	0.86471
3	Kampong Cham	7.794908	0.931243
4	Kampong Chhnang	5.316506	2.058973
5	Kampong Speu	0.357948	0.15691
6	Kampong Thom	6.790295	1.080381
7	Kampot	1.808445	0.389623
8	Kandal	15.57603	1.005652
9	Koh Kong	0.066498	0.083573
10	Kracheh	12.23574	1.468183
11	Mondul Kiri	0.000492	0.000707
12	Phnom Penh	3.660268	0.709373
13	Preah Vihear	0.218474	0.169015
14	Prey Veng	8.110221	1.092683
15	Pursat	4.897089	2.43826
16	Ratanakiri	0.383068	0.310394
17	Siem Reap	9.113493	1.703567
18	Preah Sihanouk	0.577657	0.148387
19	Stung Treng	1.04409	0
20	Svay Rieng	3.535151	0.420171
21	Takeo	3.083233	1.623233
22	Otdar Meanchey	0.610382	0.287827
23	Kep	0	0
24	Pailin	2.206614	0.109437

	Highly damaged
	Damaged
	Less damaged

Appendix 7. Number of bridges damaged per 1,000 families (2011 and 2012)

PROV_CODE		2011	2012
1	Banteay Meanchey	0.180628	3.039981
2	Battambang	0.062414	0.349513
3	Kampong Cham	3.639761	0.034722
4	Kampong Chhnang	0.147625	0.830099
5	Kampong Speu	0.060487	0.012494
6	Kampong Thom	0.384181	0.645909
7	Kampot	0.247976	4.921023
8	Kandal	0.028241	0.381791
9	Koh Kong	0.713436	1.026008
10	Kracheh	0.211182	0.220087
11	Mondul Kiri	0.603983	0.388881
12	Phnom Penh	5.130191	0
13	Preah Vihear	0.01	0.071021
14	Prey Veng	0.160088	0.033728
15	Pursat	0.591752	0.563087
16	Ratanakiri	0.264146	0.111908
17	Siem Reap	0.13392	0.061284
18	Preah Sihanouk	0.035582	0.192404
19	Stung Treng	0.763703	0.0516
20	Svay Rieng	0.025452	0.012521
21	Takeo	31.4106	0.009662
22	Otdar Meanchey	0.214907	0.211952
23	Kep	0	0
24	Pailin	0.300556	0.313545

	Highly damaged
	Damaged
	Less damaged

Appendix 8. List of frameworks reviewed by the Cambodian government

GEF (2011) Tracking progress for effective action: A framework for monitoring and evaluating adaptation to climate change.

GIZ and WRI (2011) Making adaptation count: concepts and options for monitoring and evaluation of climate change adaptation.

Government of Kenya (2012) National performance and benefit measurement framework. Ministry of Environment and Mineral Resources and Ministry of Finance.

Helio International (2009) Climate-proofing energy systems.

IIED (2011) Tracking Adaptation and Measuring Development.

IIED (2013) An operational framework for Tracking Adaptation and Measuring Development.

ISDR (2008) Indicators of progress: guidance on measuring the reduction of disaster risks and the implementation of the Hyogo Framework for Action.

OECD (2011) Towards green growth: monitoring progress. OECD indicators.

UKCIP (2011) AdaptME Toolkit for monitoring and evaluation of adaptation activities.

UNDP (2007–2008) Proposed Framework for Monitoring Adaptation to Climate Change.

UNFCCC (2010) Synthesis report on efforts undertaken to monitor and evaluate the implementation of adaptation projects, policies and programmes and the costs and effectiveness of completed projects, policies and programmes, and views on lessons learned, good practices, gaps and needs.

Appendix 9. Potential Track 1 and 2 indicators for the National Framework for M&E of Climate Change Response

A9.1 Track 1 indicators

- Value of approved CDM projects
- Integration of CC in national, sectoral and subnational development planning
- Availability of policies for food security, water security and energy security
- Inter-ministerial coordination mechanisms in place
- Effectiveness of coordination mechanisms
- National policies informed by vulnerability and risk assessments
- National investment plans informed by vulnerability and risk assessments
- Laws and regulations related to low carbon development
- Integration of low carbon approaches in urban development planning
- Availability of a greenhouse gas inventory framework
- Availability of climate services (seasonal forecasting, early warning system for floods and drought)
- Availability and accessibility of downscaled climate models for Cambodia
- Extent of the national climate monitoring system (number of stations)
- Evidence of use of lessons from pilot projects in policy development.

A9.2 Track 2 indicators

- Damage and loss by extreme climatic events
- Change in number of vulnerable households
- Sector specific indicators (two to three per sector) to be discussed with line ministries
- Number and surface of CF and FiF
- Ha PA and Marine PA
- Selected indicators from national KAP study for CC awareness
- CC integrated in curriculums, by education level
- Indicators on biodiversity?

- Number of hectares under REDD+, carbon credits generated
- Greenhouse gas emissions, by sector
- Installed solar power
- Indicators for energy efficiency
- Number of beneficiary households of CC interventions, by sector and if possible by type of intervention
- Number of CCA demonstration sites, by sector.

Appendix 10. Breakdown of DRI

POVERTY SCORE		
	Proxies of poverty	**Coefficient (weights)**
	% families with no toilet	10.45
	% families with TV	–5.17
	% families with motorbike	–10.68
	% families with bicycle	–0.79
	% families living in house with cement wall without concrete roof	–6.37
	% families living in house with thatched roof	13.00
	Average family size	1.53
	% women aged 18–45 who are literate	–2.47
	% males aged 18–60 in total population	–15.17
	% houses with electricity	–3.08
	% families using traditional birth attending method	26.57
	% 6–14 year-olds out of school	2.2
	% families with water less than 150m from house	–1.54
	Constant term in the regression equation	24.19
	Calculation of the poverty score	10.45*% families with no toilet +(–) 5.17*% families with TV +(–) 10.68*% families with motorbike +(–) 0.79*% families with bicycle +(–) 6.37*% families living in house with cement wall without concrete roof + 13*% families living in house with thatched roof + 1.53*average family size +(–) 2.47*% women aged 18–45 who are literate +(–) 15.17*% males aged 18–60 in total population +(–) 3.08*% houses with electricity

ENVIRONMENT SCORE		
Category	Proxies of environment indicators	Coefficients (weights)
Storm/ flood/ drought Impact	Families affected by heavy storms in the current year (per 1,000 families)	0.17
	Total deaths due to storms in the current year (per 100,000 people)	0.17
	Families affected by heavy floods in the current year (per 1,000 families)	0.17
	Total deaths due to floods in the current year (per 100,000 people)	0.17
	% of wet rice area flooded	0.17
	Families affected by heavy drought in the current year (per 1,000 families)	0.17
Environment protection indicator	% families using organic pesticide	0.17
	% families using organic fertiliser	0.17
	% families living in a protected area or conservation zone	0.17
	% families that have access to garbage collection	0.17
	% families affected by environmental pollution	0.17
Water Sanitation	% families with improved latrine	0.17
	% families with piped water, private pump well or private ring well, usable year-round, at their house, less than 150m away	0.17
	% families using water from purified system equipment, pump, mixed wells, protected dug wells, or protected rain water storage	0.17

AGRICULTURE SCORE		
	Average rice yield (In Ha)	0.20
	Value of rice production (US$ per capita)	0.15
	Value of short-term crop production (US$ per capita)	0.15
	Value of long-term crop production (US$ per capita)	0.15
	Value of livestock (US$ per capita) (excluding fishery)	0.15
	Total value of other agricultural production (short-term and long-term crops, livestock) (US$ per capita)	0.15
	% total rice land (wet and dry) irrigated	0.10
	% families with irrigated land	0.10
	Number of tractors per 100km^2 of arable land (rice+ short and long-term crops)	0.10
	Number of tractors (per 1,000 families)	0.10
	% families using improved agricultural techniques	0.10
	% of families using fertilisers (organic and chemical)	0.10
	% of families using pesticides (organic and chemical)	0.10
	Families with official land titles (per 1,000 families)	0.10
	Number of land conflict cases in the past year (per 1,000 families)	0.10

BUSINESS SCORE		
	% of primary employment (non-agricultural)	0.15
	Number of businesses (per 1,000 people)	0.15
	Total business employment (per 1,000 people over 18)	0.25
	% people over 18 in national migration	0.10
	% people over 18 in international migration	0.10
	Total road density per populated areas	0.10
	Commercial vehicles (per 1,000 families)	0.10
	Average distance to district HQ	0.10
	Average distance to province HQ	0.10
	Number of loans registered with commune office (per 1,000 families)	0.05
	Vocational enrolment (per 1,000 people aged 18–35)	0.05
	Graduates of vocational programmes (per 1,000 people aged 18–35)	0.05
HEALTH SCORE		
	Maternal deaths per 1,000 births: number of women who died after delivery (0–1 months) (per 1,000 deliveries)	
	Neo-natal deaths per 1,000 births: number of infants who died (0–1month) (per 1,000 live births)	
	Under 5 mortality: number of children who died aged 1 month to 5 years (per 1,000 live births)	
	Families with HIV per 1,000 families: number of families with a member living with HIV (per 1,000 families (proxy for HIV prevalence)	
	AIDS mortality: total number of AIDS-related deaths in the current year (per 100,0000 people)	
	Dengue mortality: total number of deaths from dengue in the current year (per 100,0000 people)	

	Malaria mortality: total deaths number of from malaria in the current year (per 100,0000 people)
	TB mortality: total number of deaths from TB in the current year (per 100,0000 people)
	Proxy for fertility: number of births per 1,000 women aged 15–45 (proxy for use of family planning)
	% deliveries using trained midwives
	Number of trained midwifes per 1,000 people
	% fully immunised children aged 9–12 months
	Average distance from the village to the nearest health centre
	Health centre beds (per 100,000 people)
	Referral hospital beds (per 100,000 people)
	Private hospital beds (per 100,000 people)
	Health centre staff (per 100,000 people)
	Health service (clinics and drug stores) employees (per 100,000 people) (from economic data)
	Referral hospital staff (per 100,000 people)
	District health office officers (per 100,000 people)
	Health NGO staff (per 100,000 people)
EDUCATION SCORE	
	Pre-school net enrolment ratio (children aged 3–5 in preschool : all children aged 3–5)
	Primary net admission ratio (children aged 6 in grade 1 : all children aged 6)
	Primary net enrolment ratio (children aged 6–11 in primary education : all children aged 6–11)
	Lower secondary school net enrolment ratio (children aged 12–14 in lower secondary school (LSS): all children aged 12–14)
	Youth literacy rate (young people aged 15–17 who are literate : all young people aged 15–17)
	Adult literacy rate (people aged 18–45 who are literate : all people aged 18–45)

	Average distance to primary school
	Average distance to LSS
	Average distance to higher secondary school (HSS)
	Government primary student/teacher ratio (number of students per teacher in government primary schools)
	Government lower secondary student/teacher ratio (number of students per teacher in government LSS)
	Government higher secondary student/teacher ratio (number of students per teacher in government HSS)
	% of primary schools with clean water source
	Number of improved toilets per 100 students in primary schools
	% of LSS with clean water source
	Number of improved toilets per 100 students in LSS
	% of HSS with clean water source
	Number of improved toilets per 100 students in HSS
	Literacy class enrolment ratio (Illiterate people aged 15–45 in ongoing literacy classes per 1,000 Illiterate people aged 15–45)
	District education office officers per 100,000 population
	Education NGO staff per 100,000 population

Knowledge Products

Research Report

July 2015

Climate change

Keywords:
Climate resilience, Vulnerability, M&E, Climate Risk Management, Cambodia, TAMD

This report records how Cambodia is implementing its national monitoring and evaluation (M&E) framework to measure the performance of its national and sectoral responses to climate change, using IIED's Tracking Adaptation and Measuring Development (TAMD) approach.

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This research was funded by UKaid from the UK Government, however the views expressed do not necessarily reflect the views of the UK Government.