

# National-level progress on adaptation

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**It is increasingly evident that adaptation will figure prominently in the post-2015 United Nations climate change agreement<sup>1,2</sup>. As adaptation obligations under the United Nations Framework Convention on Climate Change evolve, more rigorous approaches to measuring adaptation progress among parties will be critical. In this Letter we elaborate on an emerging area of research referred to as 'adaptation tracking', which has potential to inform development of a global adaptation monitoring framework<sup>3</sup>. We evaluate this potential by presenting evidence on policy change for 41 high-income countries between 2010 and 2014. We examine whether countries that were in early stages of adaptation planning in 2010 are making progress to close adaptation gaps, and how the landscape of adaptation in these countries has evolved. In total we find an 87% increase in reported adaptation policies and measures, and evidence that implementation of concrete adaptation initiatives is growing. Reflecting on the strengths and challenges of this early methodology, we further discuss how adaptation tracking practices could guide development of a robust framework for monitoring global adaptation progress and inform future research on policy change across countries.**

As impacts of climate change begin to manifest, adaptation is rapidly becoming a key priority in climate policymaking and financing. Our understanding of how these efforts are unfolding remains limited to a focus in both the scientific and practitioner communities on case-by-case studies of adaptation policy<sup>4</sup>. Although invaluable in their depth, there is a simultaneous need for comparative analysis and global monitoring which these studies do not fulfil. Similarly, most guidelines for evaluating adaptation policy are focused on project-level monitoring and evaluation (M&E) or single-country evaluation of adaptation policy, not systematic assessment of adaptation progress across countries, sectors and scales<sup>5,6</sup>.

One goal for adaptation tracking is to advance metrics and methodologies for global accounting of adaptation progress that answer critical questions about whether we are adapting enough, fast enough, and across all needed sectors<sup>7</sup>. A growing literature is responding to this gap using systematic reviews of peer review and grey literature or assessments of projects funded through climate financing mechanisms<sup>8–10</sup>. A key challenge to these approaches, however, is ensuring fair representation of adaptation activity across countries, given variable levels of readily available information.

Approaches to measuring global progress in other areas of social and health policy have recently been developed and provide models for adaptation tracking<sup>11,12</sup>. The Convention on the Rights of the Child, for example, uses a qualitative report-based mechanism similar to the UNFCCC National Communications

(NCs) for monitoring implementation of the Convention. To facilitate comparison across countries and over time, Heymann and colleagues developed an indicator-based methodology to document constitutional rights, national laws, and policies across all signatory countries and enable systematic tracking of advances relevant to the Convention<sup>13</sup>. In previous work we developed a similar indicator-based quantitative approach to assessing the state of adaptation using the Fifth National Communication (NC5), thus establishing a benchmark for characterizing the state of adaptation across countries<sup>14,15</sup>.

In this Letter we use this benchmark to assess progress in the implementation of adaptation among 41 Annex I Parties as documented in the recently published Sixth National Communication (NC6). Our goal is to elucidate broad trends in policy change of government-led adaptation during the period between the NC5 and NC6, and critically reflect on the current state of indicator-based assessments for tracking adaptation progress. Here we present findings on key indicators from this first-generation comparative methodology and examine relative changes in reported adaptation levels using a quantitative proxy, the Adaptation Initiative Index (AII). The AII is calculated on a scale of 0 to 19, and provides a basis for comparing the diversity of adaptation instruments reported across countries and over time (see Methods). We conclude this Letter with a discussion about how adaptation metrics could be strengthened by collecting better data in the UNFCCC.

Our results demonstrate that adaptation activity is increasing across the Annex I group. The average AII score for our sample rose from 11 points in the NC5 to 15 in the NC6. Although not all countries with low NC5 AII scores demonstrate progress, several countries that scored at the bottom of the NC5 AII report rapid gains in the NC6 (Table 1). The largest increases are observed with Kazakhstan, Romania and Russia, which report progress in adaptation research and strategic planning, as well as implementation of regulatory measures, public awareness, surveillance and monitoring, and hard (infrastructure) adaptations. In our study of the NC5 only two countries, Australia and Finland, received a maximum score of 19. In the NC6 six additional countries received scores of 19: Portugal, Norway, Sweden, Canada, Spain and United Kingdom.

We caution that these scores do not signify that countries at the upper end of the AII have taken adequate steps to adapt. Rather this finding suggests that the adaptation landscape in our sample is reaching a state of greater diversity with regards to the range of policy instruments being implemented, represented here with the adaptation initiative typology (Fig. 1). A previous study using the benchmark AII results and a larger sample of

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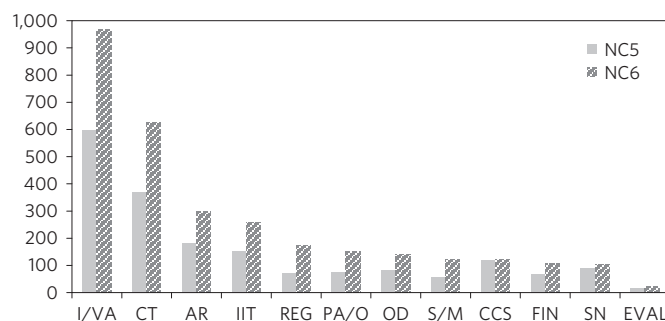
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**Table 1 | Adaptation Initiative Index.**

Country	Change	NC5	NC6
Kazakhstan	14	3	17
Romania	10	4	14
Russia	10	1	11
Bulgaria	9	6	15
Luxembourg	9	5	14
Monaco	8	0	8
Portugal	8	11	19
Lithuania	7	10	17
Croatia	6	5	11
Greece	6	11	17
Austria	4	9	13
Czech Republic	4	14	18
Estonia	4	11	15
Latvia	4	9	13
Liechtenstein	4	5	9
Norway	4	15	19
Poland	4	9	13
Sweden	4	15	19
United Kingdom	4	15	19
Ukraine	3	14	17
Ireland	3	13	16
Malta	3	13	16
Canada	2	17	19
France	2	13	15
Spain	2	17	19
Switzerland	2	15	17
Belarus	1	7	8
Germany	1	16	17
Hungary	1	7	8
Slovenia	1	10	11
Australia	0	19	19
Belgium	0	17	17
Finland	0	19	19
Iceland	0	6	6
Italy	0	17	17
Japan	0	15	15
United States	0	17	17
Denmark	0	16	16
Netherlands	0	15	15
New Zealand	0	17	17
Slovakia	−1	11	10

Scores for the All are calculated from 0 to 19 and capture the diversity of policy instruments reported by each country according to the instrument typology applied in the coding scheme. Higher scores correspond to a wider range of instrument types. The table is ordered by change in All score (greatest to least) from the NC5 to the NC6.

117 high-, medium- and low-income countries suggested that differences in scores may in part be driven by institutional factors, particularly good governance and overall commitment to environmental stewardship<sup>16</sup>. More recent research using survey data from the European Environment Agency suggests that experienced vulnerability, research on projected climate change impacts, and European policy efforts may also be contributing factors explaining differences across adaptation outcomes<sup>17</sup>. The latter two factors are noteworthy in many of the newer European Union countries. Collaborative, EU-funded research projects such as the EU Baltic Sea Region Programme are frequently referred to by new Member States as significant sources of knowledge-sharing and support for adaptation strategy development. Notwithstanding this, it is important to note that so far the EU's role in adaptation is largely limited to expanding the knowledge-base on climate impacts through research funding and decision-making support



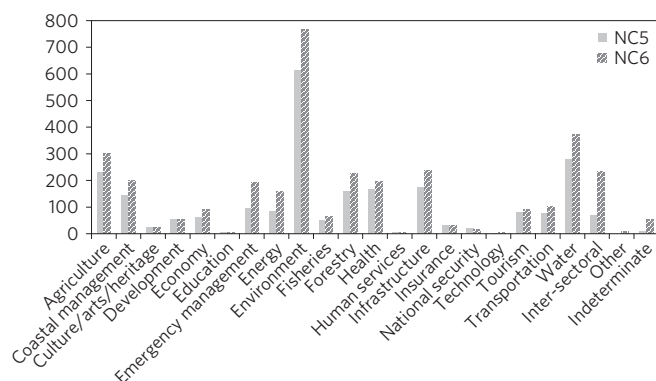
**Figure 1 | Number of initiatives reported by type.** Each reported initiative was categorized according to a policy-instrument typology with 12 categories. These categories are grouped on two levels: groundwork initiatives and adaptation initiatives. Groundwork-level initiatives include: impact and vulnerability assessment (I/VA), conceptual tools (CT), adaptation research (AR), climate change scenarios (CCS) and stakeholder networking (SN). Adaptation-level initiatives include: infrastructure/innovation/technology (IIT), regulation (REG), public awareness and outreach (PA/O), organizational development (OD), surveillance and monitoring (S/M), financial support (FIN) and evaluation (EVAL).

tools; the EU's direct role in policymaking is limited to integration of climate change considerations into EU policies. This suggests that implementation processes in Member States, including national adaptation priorities and policy-instrument selection, are more likely shaped by domestic structures and cultures. Further research suggests this may in part explain why countries such as Hungary adopted climate adaptation strategies before the adoption of the EU White Paper on adapting to climate change<sup>18–21</sup>.

In analysing the aggregated data we found a significant increase in the total reported number of adaptation policies, programmes and initiatives being implemented across Annex I Parties. The number of reported actions increased by 87%, from 1,457 actions in the NC5 to 2,722 actions in the NC6 (Fig. 1). We continue to see the environment, water and agriculture sectors reporting the highest number of initiatives, although large increases in reporting are observed in other sectors, including emergency management and energy (Fig. 2). Notably, the greater share of reporting continues to be on initiatives that inform or prepare for adaptation (for example, vulnerability assessments, adaptation research, strategic planning tools). The largest percentage increases in reporting, however, are for regulatory actions (139%), surveillance and monitoring (114%), and public awareness and outreach (101%).

On closer examination of regulatory actions we find an increase in climate change-specific regulations (NC5<sub>n-actions</sub> = 6) in the NC6 (NC6<sub>n-actions</sub> = 19), including national-level legislation introducing legal requirements on adaptation. The increase in national climate change legislation is a key development and indicates a seriousness towards making adaptation more meaningful at a national level<sup>22,23</sup>. Nonetheless, regulatory adaptations reported in the NC6 still broadly constitute incremental adjustments and were largely mainstreamed into existing regulations (about 75% of regulations). For example, the most frequently reported regulations in both the NC5 and NC6 concern land use and buildings (NC5<sub>n-actions</sub> = 16; NC6<sub>n-actions</sub> = 45). Nineteen countries have amended building codes or zoning regulations to take into account projected changes in flooding frequency and intensity, increases in thermal load, and sea level rise. Inclusion of adaptation needs in regulations related to long-term ecosystem protection was also commonly reported (NC5<sub>n-actions</sub> = 13; NC6<sub>n-actions</sub> = 45).

Notwithstanding this progress, we also see evidence of policy dismantling in the NC6, where the overall policy density in a given policy area decreased. This raises questions about the durability of



**Figure 2 | Number of initiatives reported by sector.** Documentation on each reported initiative includes sectors reported to be involved in the planning and/or implementation of the initiative.

new adaptation policies. Slovenia, for example, reports the closure of the Government Office of Climate Change and subsequent suspension of the draft national climate change strategy. In Australia, changes in political leadership during 2013 resulted in the disbanding and reorganization of the Department of Climate Change and Energy Efficiency into the Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (for further information see Supplementary Information 1: Australia). These cases prompt questions about the stability of adaptation organizations in the context of political transitions<sup>24</sup>. In particular, the Australian example indicates that even early adaptors with a strong record of government-supported research and collaboration can show significant patterns of policy dismantling following changes in government or political decision-making<sup>25</sup>.

Finally, no progress was observed in reported inclusion of vulnerable populations in policy design. In the NC5 only 4.67% (68 actions) of all reported actions included discussion about vulnerable populations; this figure dropped even further in the NC6 to 2.22% (62 actions) (Table 2). Furthermore, forty-eight of the initiatives in the NC6 that report on vulnerable groups constitute impact and vulnerability assessments, adaptation research, and strategic planning, rather than concrete adaptation initiatives. Effective adaptation requires responsiveness to inequalities underlying vulnerability and an understanding of who gains and who loses from climate change impacts and adaptation policy responses<sup>26</sup>. The continued levels of low reporting on vulnerable groups brings into question the extent to which current adaptation practices in high-income countries will be able to reduce underlying inequalities that increase vulnerability.

Our overall findings suggest that Annex I Parties are making some progress in implementing concrete adaptation initiatives that have potential to tangibly reduce climate change impacts and vulnerability. In particular, we find growing levels of climate change mainstreaming into existing policy instruments (for example, building codes). In total, 57% of adaptation-level initiatives were mainstreamed into existing instruments rather than implemented as stand-alone adaptations. Notwithstanding this, our results point to the possibility of policy dismantling in some countries, raising questions about the durability of adaptation policies and indicating that further attention is needed to understand political dynamics underlying adaptation policy change. Output-oriented data sets such as this provide opportunities to test hypotheses emerging in the literature on adaptation policy change, and to build an empirical understanding of drivers behind policy innovation and dismantling<sup>17,27</sup>.

In developing this methodology a number of challenges to implementing a global-scale adaptation tracking framework emerged. A critical limitation is the absence of a comprehensive

**Table 2 | Number of initiatives reporting on vulnerable groups.**

	NC5: Initiatives	NC5: Share (%)	NC6: Initiatives	NC6: Share (%)
None	1,389	95.33	2,659	97.72
Elderly	28	1.92	29	1.04
Indigenous group	25	1.72	24	0.86
Children	15	1.03	18	0.64
Chronic/pre-existing condition	17	1.17	16	0.57
Social position	17	1.17	11	0.39
Other*	11	0.75	10	0.37
All	68	4.67	62	2.28

Documentation for each initiative includes information on whether consideration for one or more vulnerable groups was provided in the reporting text. \*Language: NC5<sub>n-actions</sub> = 1, NC6<sub>n-actions</sub> = 0; Nationality: NC5<sub>n-actions</sub> = 1, NC6<sub>n-actions</sub> = 0; Race/ethnicity: NC5<sub>n-actions</sub> = 1, NC6<sub>n-actions</sub> = 0; Religion: NC5<sub>n-actions</sub> = 0, NC6<sub>n-actions</sub> = 0; Sex/gender: NC5<sub>n-actions</sub> = 1, NC6<sub>n-actions</sub> = 3; Sexual orientation: NC5<sub>n-actions</sub> = 0, NC6<sub>n-actions</sub> = 0; Social disability: NC5<sub>n-actions</sub> = 1, NC6<sub>n-actions</sub> = 0; Other: NC5<sub>n-actions</sub> = 9, NC6<sub>n-actions</sub> = 7.

and coherent data source on adaptation that covers all countries and levels of government, and is inclusive of the private and non-governmental sectors<sup>28</sup>. The NCs are at present the best available proxy for comparing adaptation across countries and over time, but are nonetheless an imperfect information source that provides only a snapshot of adaptation activity occurring in each country. The absence of clear metrics to guide reporting on adaptation policy results in uneven reporting at sub-national scales and of private and non-governmental sectors. Furthermore, a lack of coherence in the UNFCCC reporting guidelines about what constitutes 'adaptation' also results in inconsistent usage across reports, impeding efforts to evaluate adaptation progress across countries. This ambiguity is observable across the comparative adaptation literature and makes clarification of the term 'adaptation' paramount for enhancing reflexivity in adaptation tracking methods<sup>29,30</sup>. Notwithstanding these limitations, our study demonstrates that adaptation tracking can move discussion forward about how to systematically analyse adaptation progress across countries. Current practices in monitoring and evaluation at the policy or project-level provide insight into the use of indicator-based frameworks for adaptation analysis; here we urge that these efforts be expanded to include systematic tracking across countries.

The following considerations should inform the development of robust adaptation tracking frameworks. First, further effort is needed to integrate process and output indicators into tracking frameworks. Owing to the constraints of the NCs this methodology focuses largely on output measurements. Evidence of policy dismantling in countries such as Australia and Slovenia, however, demonstrates that process-oriented indicators should be developed to account for potential backtracking on adaptation commitments, an area of policy change for which we have limited empirical research<sup>25</sup>. Second, the next generation of adaptation metrics should respond to calls here and elsewhere to refine our definition of adaptation based on the coherence and intentionality of policies and measures<sup>28,29,31</sup>. This would improve the reliability of self-reported information about adaptation progress and enhance our ability to assess and compare outcomes from mainstreamed and non-mainstreamed adaptation.

Finally, comprehensive and dynamic data sets on adaptation are necessary for more robust tracking methods to be implemented. The post-2015 climate talks in Paris are a major opportunity to discuss how a new generation of reporting mechanisms such as the Intended Nationally Determined Contributions could support tracking of adaptation-relevant laws, policies, programmes and initiatives across countries. Integral to this discussion should be reflection on how verification of adaptation reporting can be strengthened with

the goal of improving reliability and consistency in the UNFCCC reporting process. Advances in these areas would significantly improve capacity to compare adaptation progress across countries and assess the likelihood that current adaptation efforts will concretely reduce vulnerability to climate change impacts.

## Methods

Methods and any associated references are available in the [online version of the paper](#).

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## Author contributions

A.L. contributed to conceptual development, conducted data collection and data analysis, and contributed to manuscript composition; J.F. contributed to conceptual development, data analysis, and manuscript composition; R.B. contributed to data analysis and manuscript composition; L.B.-F. contributed to conceptual development, data analysis, and manuscript composition; S.J.H. contributed to conceptual development, data analysis, and manuscript composition.

## Additional information

Supplementary information is available in the [online version of the paper](#). Reprints and permissions information is available online at [www.nature.com/reprints](http://www.nature.com/reprints). Correspondence and requests for materials should be addressed to A.L.

## Competing financial interests

The authors declare no competing financial interests.



## Methods

Our approach is derived from Lesnikowski *et al.* (2015), who developed a systematic tracking methodology to extract and code adaptation initiatives from 117 countries<sup>15</sup>. The methodology is systematic in its application of an initiative-level protocol for identifying and characterizing distinct actions, thereby enabling comparative analysis across our sample. Using this coding protocol we collect data about adaptation policies, programmes and initiatives from 41 Annex I countries.

This sub-set of countries was selected for study based on the recent submissions of the Sixth National Communications to the UNFCCC, which provide the latest information on planned, public sector adaptation policies and priorities from the Annex I Parties. Three Annex I Parties (Cyprus, Turkey, the European Union) were excluded from analysis owing to lack of baseline data. Kazakhstan joined the Annex I group in September 2009 and began using the reporting guidelines for Annex I Parties to the Convention in December 2009. Baseline data for Kazakhstan were gathered from the second national communication, submitted in June 2009. These reports at present offer the most robust primary source of information on government-led adaptation: they follow a standardized format, reflect key government policies and positions, and are submitted on a regular basis to the UNFCCC Secretariat<sup>18,32</sup>. The NCs, however, are reflective of the relatively recent focus on adaptation (as compared to mitigation), and so have limited reporting guidelines and undeveloped metrics for capturing the status of adaptation. Although future reporting systems will hopefully provide more comprehensive information, they are at present the only consistent, comparable, coherent and comprehensive primary data source available for adaptation tracking purposes<sup>28</sup>.

The coding scheme developed here analyses these reports at the policy, programme and initiative level using a series of indicators to capture a range of information for each discrete measure (for further information see Supplementary Information 2: Coding Manual). The scheme characterizes the current state of adaptation based on the instrument type being reported, vulnerabilities being responded to, sectoral participation in initiatives, and stakeholder participation in initiative design and implementation. Our typology of instruments responds to conceptual ambiguity in the term 'adaptation'<sup>29</sup> by distinguishing between 'groundwork' instruments (GW), which generate information and establish strategic directions to guide adaptation, and 'adaptation' instruments (ADAPT), which aim to tangibly reduce vulnerability to climate change impacts. Groundwork instruments include climate change scenarios, impact and vulnerability assessments, adaptation research, conceptual tools/strategic plans, and stakeholder networking. Adaptation instruments include organizational development, regulations, public awareness/outreach, surveillance and monitoring, infrastructure/technology, resource transfers/financing, and evaluation.

This Letter summarizes findings from four of the indicators used in the coding scheme. The primary indicator categorizes reported measures based on a typology of adaptation policy instruments that distinguishes between policy recommendations, research and planning efforts, and concrete adaptation. We separately record whether the measure was implemented through mainstreaming into an existing policy or programme, or was established as a stand-alone initiative. Another indicator captures the sector(s) participating in the measure, including: agriculture, coastal management, culture/arts/heritage, development, economy, education, emergency management, energy, environment, fisheries, forestry, health, human services, infrastructure, insurance, national security, technology, tourism, transportation and water. Studies about climate change impacts in high-income countries emphasize the effect that relative socio-economic status within affluent societies has in exacerbating disparities in adaptive capacity<sup>33</sup>. Vulnerable communities are thus experiencing heightened risks from climate change within Annex I countries, observable for example in disproportionately high mortality rates among the elderly, sick and socially isolated during extreme heat events<sup>34–36</sup>. We therefore use an indicator to record whether reporting on vulnerable groups is included in descriptions about adaptation measures.

Using descriptive statistics we compare adaptation reporting in the NC5 to NC6 and assess whether particular types of instruments are increasing in use. We are also able to qualitatively examine changes in institutional landscapes based on reported changes in ministerial or departmental organization, and working group or committees. To examine relative changes in reported adaptation levels we use a quantitative proxy, the Adaptation Initiative Index (AII). The AII is calculated on a scale from zero to 19 based on the diversity of adaptation instruments reported by each country, with concrete adaptation measures weighted by two to reflect their greater potential impact on vulnerability reduction:  $\text{Adaptation Score} = (\text{ToA}_{\text{GW}} \times 1) + (\text{ToA}_{\text{ADAPT}} \times 2)$ . The weight is not intended as a statement that adaptation-level initiatives have twice the impact that groundwork-level initiatives have, but is rather a rudimentary effort to capture the distinction between symbolic adaptation and concrete adaptation<sup>29</sup>.

For example, a country that reported a national vulnerability assessment, national legislation guiding adaptation policy, a heat alert and response programme, and construction of new flood defence infrastructure would receive points for: impact and vulnerability assessment (1 point), regulation (2 points), public awareness and outreach (2 points), surveillance and monitoring (2 points), and infrastructure adaptation (2 points). Countries that receive the maximum AII score of 19 report implementation of each policy instrument defined in our adaptation typology indicator. This measurement is thus able to use the density of reported policy instruments as one proxy measure for a developed adaptation portfolio.

By comparing the scores from the NC5 and NC6 we identify countries that are demonstrating the highest growth in adaptation activity. The AII captures the breadth of instrument types reported in the NC for each country and reflects our assumption that countries at more advanced stages of adaptation will demonstrate more diverse policy portfolios. It does not reflect the number of initiatives reported by each country, only the range of instrument type. A maximum score (19) indicates that a country has reported implementing at least one initiative in every instrument type defined in our typology.

A key challenge in calculating adaptation scores for the NC6 was the tendency for some countries to not report ongoing initiatives in the NC6 that were already reported in the NC5. We examined any gaps between policy instruments reported in the NC5 and the NC6 via web searches and determined whether initiatives could be confirmed as still active or were likely to be 'sticky' in nature. In most cases these initiatives were counted towards the AII NC6 score. Most countries therefore demonstrate either an increase in score or no change in score. The AII was developed as an early effort to demonstrate the feasibility of developing quantitative adaptation measurements<sup>37</sup>. We return to it here as a means of comparison between the NC5 and NC6, and urge that future efforts to develop adaptation outcome indices go beyond the AII to consider issues of policy dismantling and capturing of substantiality and intentionality in definitions of adaptation<sup>29</sup>.

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