Paris Agreement; research, monitoring and reporting requirements for India

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Implementation of the Paris Agreement would require transformative technologies, policies and measures to stabilize warming in the range 1.5–2°C. Operationalization of the Paris Agreement would necessitate large-scale estimation, monitoring, modelling, reporting and verification of GHG inventories, mitigation actions and their implications and co-benefits, along with reporting on climate change impacts and adaptation. This article highlights the need for research, modelling, monitoring, reporting and data requirements for India, keeping in mind the need for transparency, accuracy, completeness, consistency and comparability. Further, India will have to initiate large-scale research and data generation for operationalization of the Paris Agreement.

Keywords: Climate impacts, forestry sector, mitigation strategies, vulnerability assessment.

IN December 2015, 196 Parties to the United Nations Framework Convention on Climate Change (UNFCCC) adopted the Paris Agreement at the 21st Conference of the Parties in Paris, France. India ratified the Paris Agreement on 2 October 2016. By 5 October 2016, the threshold for entry into force of the Paris Agreement was achieved (the milestone when 55 Parties accounting for 55% of global emissions deposited their instruments of ratification to the Agreement). After thirty days of the achievement of this milestone, the Paris Agreement entered into force on 4 November 2016.

The Paris Agreement has a total of 21 legally binding articles, of which Article 2 sets its long-term climate change mitigation and adaptation ambitions. Article 2 aims at 'holding the *increase* in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C.' It further aims at '*increasing* the ability to adapt to the adverse impacts of climate change and foster climate resilience'. Global temperatures have already risen by 1°C compared to the pre-industrial times[1]. It is unanimously agreed by the climate science and the policy communities that an increase in global temperatures in excess of 1.5°C and 2°C constitutes dangerous climate change, as this may adversely impact food-production systems and ecosystem services across the world, threatening food and livelihood security[2]. Thus, successful implementation of the Paris Agreement is essential for the sustainable development of the global community, and more specifically, instrumental in achieving the Sustainable Development Goals set by the United Nations in 2016.

According to estimates published by different groups[3,4], the current rate of greenhouse gas (GHG) emissions will likely take the world to a temperature increase of 4.8°C or more by the end of the century. The Nationally Determined Contributions (NDCs) submitted by the countries at the Paris Agreement are inadequate to limit warming at or below 2°C and in fact, are likely to take the global mean temperature to about 3°C (2.7°C at >50% probability) towards the end of the 21st century[3,5]. Thus, implementation of the Paris Agreement would not only require strict implementation of the nationally determined committed climate pledges, but it also needs to ensure that the climate pledges are gradually ratcheted up to meet the ambitions of limiting warming in the range 1.5°–2°C as stated in Article 2.

This article highlights the requirements of research, measurements, monitoring, modelling and reporting of various aspects of GHG inventory, mitigation of GHG emissions, impacts and vulnerabilities to climate change and adaptation actions, and their impacts in an accurate and transparent manner, in the context of the Paris Agreement for India.

The Paris Agreement and India's climate pledge

India is a Party to UNFCCC. As part of its Nationally Determined Contribution (NDCs) to UNFCCC in the run up to the Paris Agreement, India promised to reduce the GHG emission intensity of its economy by more than one-third. India's NDC indicates that a unit of GDP will be produced at least 33% more efficiently in terms of GHG emissions, compared to 2005 levels. India has also

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promised to produce 40% of its electricity from non-fossil energy sources. In addition to the goal of emissions reduction, India has also pledged to increase its forest cover so as to generate an additional carbon sink of 2.5–3 billion tonnes of CO_2 (1 billion tonne = 1 giga tonne) by the year 2030. This goal implies that India will be adding up to 200 Mt CO_2 per year in terms of forest carbon sinks[6].

Operationalization of the Paris Agreement

Three critical aspects for operationalization of the Paris Agreement include the following:

a. Estimation of GHG inventory, modelling and projection of GHG emissions and mitigation potentials, development and operationalization of mitigation actions, and assessments of costs and impacts of the mitigation actions.
b. Development of adaptation actions based on assessment of climate change projections, impacts and vulnerabilities, monitoring of impacts of adaptation actions and their co-benefits and trade-offs.
c. Transparent, accurate, complete, consistent and comparable (TACCC) monitoring, reporting and verification (MRV) of GHG inventories, GHG emissions reductions, mitigation and adaptation actions and their impacts.

Research on mitigation strategies, policies and programmes

In order to achieve the ambitious temperature goals, the Paris Agreement requires that the countries should peak their emissions as early as possible, followed by a rapid reduction in emissions. The Paris Agreement requires all countries, including India to formulate and communicate long-term, low GHG development strategies. The Paris Agreement further aims for a net zero emission of GHGs in the second half of the century by achieving a balance between anthropogenic emissions by sources and removals by sinks of GHGs. It further provides a framework for communicating and maintaining NDCs and establishes a process for progressively increasing mitigation ambition and actions over time, informed by a regular 'global stock-take' to consider the state of implementation of the Agreement. Global stock-take provides an opportunity to the Parties to establish common timeframes, and accounting frameworks for emission reductions for implementation of mitigation actions and to help ensure development of a collective oversight of the implementation of the mitigation actions. Table 1 summarizes the key decisions related to the mitigation actions and their implication for research, monitoring, reporting and verification. The mitigation-related articles of the Paris Agreement point to a few urgent and important action points. India will need to determine when and how it intends to peak its GHG emissions, and what its technological options are for doing so. Once these options have been determined, the manner in which to pursue these options will have to be decided, along with means to monitor their efficacy and impact. Promoting carbon sinks through REDD+, afforestation and reforestation programmes is also an important implication of the Paris Agreement. India will also need to develop and formulate low-carbon strategies and pathways at the national and state levels. Operationalization of the Paris Agreement for the mitigation component involves the following:

1. Mitigation strategies and actions: Development of short-, medium- and long-term mitigation strategies based on modelling, monitoring of mitigation actions, and cost–benefit analysis.
2. Biennial reporting of GHG inventory: estimation of level of activities and emission factors, preparation of database, modelling and use of remote sensing, quality assurance and control, long-term institutional arrangements and establishment of National Inventory Management System (NIMS).
3. Impacts of mitigation actions: modelling and monitoring of environmental, social and economic impacts of the mitigation actions.

Research requirements for adaptation

The Paris Agreement has initiated a process to 'establish a global goal on adaptation' (Article 7.1), a crucial step that encourages Parties to the agreement to go beyond the restrictive and historic funding-focused lens that structured UNFCCC talks on adaptation until now[7]. Suggesting that global adaptation is as important as global mitigation, is an important shift in international climate negotiations that highlights the importance of coupling 21st century mitigation and adaptation actions.

India's economy is tied to crucial sectors such as agriculture, water resources, natural ecosystems and forestry, health, sanitation, infrastructure and energy. To meet the adaptation-related requirements of the Paris Agreement, institutional arrangements to facilitate long-term research will be necessary. Such research will be crucial in developing strategies and plans of action for various sectors. India will also need to determine how to create a national adaptation goal, and more importantly, how to monitor and report on the impacts of its adaptation actions and their impacts. Since adaptation plans will have to be periodically recalibrated and submitted, creating a systematic method to facilitate and improve upon adaptation practices is imperative. Table 2 presents adaptation related articles and their implications for research, monitoring and modelling for India.

Table 1. Mitigation-related research requirements as agreed at the Paris Climate Conference

Paris Agreement	Text of Article/Paragraph	Implications for research (including modelling and monitoring)
Article 4 (1)	'In order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty.'	1. To determine 'when and how' to achieve peaking of emissions, India needs to develop low carbon pathways, by modelling greenhouse gas (GHG) reduction possiblities in all the sectors of the economy as well as the associated costs, benefits, trade-offs and synergies. 2. Evaluation of the technology options for radically reducing GHG emissions in the long term.
Article 4 (3)	'Each Party's successive nationally determined contribution will represent a progression beyond the Party's then current nationally determined contribution and reflect its highest possible ambition, reflecting its common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.'	1. Continuous monitoring, reporting and verification of GHG mitigation measures and implementation. 2. Establishment of National GHG Inventory Management System (NIMS). 3. Periodic assessment of the potential for enhancing the GHG emission reduction commitments for India. 4. Periodic estimation of requirement of finance and investment for implementing NDCs.
Article 4 (7)	Mitigation co-benefits resulting from Parties' adaptation actions and/or economic diversification plans and its contribution to mitigation outcomes.	1. Methods and models for assessing the mitigation impact of various technologies and measures. 2. Methods and models for assessment of the co-benefits or trade-offs between mitigation and adaptation actions. 3. Strategy for technology development and transfer for mitigation and adaptation.
Article 4 (19)	'All parties should strive to formulate and communicate long-term low greenhouse gas emission development strategies, mindful of Article 2 taking into account their common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.'	1. Modelling, development and formulation of low-carbon pathways at the national and decentralized levels. 2. Development and reporting of mitigation pathways consistent with limiting warming to 1.5–2°C. 3. Assessment of the impact of mitigation actions from NDC. 4. Methods and models for selection/evaluation of mitigation technologies, policies and measures. 5. Strategy for enhanced public and private sector participation in implementing mitigation measures.
Article 5 (1)	Parties should take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases as referred to in Article 4, paragraph 1(d), of the Convention, including forests.	1. Development of REDD+, afforestation and reforestation strategies. 2. Options and pathways to enhance forest carbon stock by 2.5–3 $GtCO_2e$ by 2030, based on modelling. 3. Pathways to bring 33% of the geographic area under forest cover. 4. Estimation of area under forests, carbon stock changes, deforestation, forest degradation and afforestation.
Article 5 (2)	Parties are encouraged to take action to implement and support, including through results-based payments, for activities relating to reducing emissions from deforestation and forest degradation, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries. Development of alternative policy approaches, such as joint mitigation and adaptation for the integral and sustainable management of forests, while incentivizing, as appropriate, non-carbon benefits associated with such approaches.	1. Forest policy and incentives for development of carbon and non-carbon benefits. 2. Periodic monitoring of forest area and carbon stock changes, area burnt and biomass burnt. 3. Estimation and reporting of non-carbon (biodiversity, social and economic) impacts or benfits. 4. Modelling of forest GHG inventories and modelling of mitigation potentials for different mitigation options.

Table 2. Adaptation-related research requirements under the Paris Agreement

Location in Agreement	Text of Article/Paragraph	Implications for research, monitoring, modelling and database generation
Preamble		
Paragraph 43 (b)	'Consider methodologies for assessing adaptation needs with a view to assisting developing countries, without placing an undue burden on them.'	1. Development of methods for assessing adaptation needs, plans and assessing their impacts. 2. Guidelines for adaptation planning and mainstreaming adaptation in developmental programmes. 3. Monitoring and assessment of adaptation responses at the national level. 4. Developing effective adaptation practices for different sectors. 5. Methods for assessing the effectiveness and durability of adaptation actions. 6. Research and development of socio-economic and ecological resilience enhancement practices.
Paragraph 95 (c)	'Parties report information on adaptation action and planning including, if appropriate, their national adaptation plans, with a view to collectively exchanging information and sharing lessons learned'.	
Paragraph 95 (f)	'Information on the social and economic impact of response measures.'	
Article 6 (1)	Some parties may choose to pursue voluntary cooperation in the implementation of their nationally determined contributions to allow for higher ambition in their mitigation and adaptation actions and to promote sustainable development and environmental integrity.	1. Development of market and non-market approaches for mitigation and adaptation. 2. Economics and GHG balance studies. 3. Environmental integrity requires transparent and verifiable mitigation and adaptation actions and impacts, and methods.
Article 6 (8)	'Parties recognize the importance of integrated, holistic and balanced non-market approaches being available to Parties to assist in the implementation of their nationally determined contributions…'	
Article 7 (5)	'Parties acknowledge that adaptation action should follow a country-driven, gender-responsive, participatory and fully transparent approach to adaptation actions, taking into consideration vulnerable groups, communities and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional knowledge, with a view to integrating adaptation into relevant socioeconomic and environmental policies and actions.'	1. Assessment of gender implications of adaptation actions. 2. Study of effectiveness of traditional adaptation practices. 3. Evaluation and development of adaptation actions; sectoral and regional. 4. Development of approach and methods for adaptation strategy.
Article 7 (7c)	'Strengthening scientific knowledge on climate, including research, systematic observation of the climate system and early warning systems, in a manner that informs climate services and supports decision-making.'	1. Development of high-density network of climate observation stations. 2. Development of high-resolution observed climatology at the national level, state level and for selected landscapes such as the Himalaya, North East India, the Western Ghats, etc. 3. Development of high-resolution regional climate change projections at national and state levels. 4. Development of early warning systems on weather and climate-related disasters.
Article 7 (7e)	'Improving the effectiveness and durability of adaptation actions.'	1. Development methods for assessing the effectiveness of adaptation actions; short and long term; sectoral and regional assessment.
Article 7 (9)	Each Party shall, as appropriate, engage in adaptation planning processes and the implementation of actions, including the development or enhancement of relevant plans, policies and/or contributions, which may include: (a) The implementation of adaptation actions, undertakings and/or efforts; (b) The process to formulate and implement national adaptation plans; (c) The assessment of climate change impacts and vulnerability, with a view to formulating nationally determined prioritized actions, taking into account vulnerable people, places and ecosystems; (d) Monitoring and evaluating and learning from adaptation plans, policies, programmes and actions; and (e) Building the resilience of socioeconomic and ecological systems, including through economic diversification and sustainable management of natural resources.	1. Long-term research and modelling of climate change projections, impact assessments and development of vulnerability profile. 2. Modelling and field studies on assessment of impact of climate change at sectoral and regional level. 3. Formulation of adaptation plans, policies and programmes. 4. Methods and monitoring of adaptation plans, policies and programmes. 5. National goal on adaptation and reporting of the impacts of adaptation actions. 6. National vulnerability index and measure and reporting of the reduction in vulnerability due to adaptation actions. 7. Methods and monitoring of impact of adaptation policies, programmes and actions. 8. Methods for prioritization of adaptation actions.
Article 9 (4)	'The provision of scaled-up financial resources should aim to achieve a balance between adaptation and mitigation, taking into account country-driven strategies, and the priorities and needs of developing country Parties, especially those that are particularly vulnerable to the adverse effects of climate change and have significant capacity constraints.'	1. Estimation of financial resources needed for adaptation actions. 2. Research to develop a balanced mitigation and adaptation strategy, and prioritization.

India highlighted its vulnerability to climate change in its first and second national communications to UNFCCC. The second national communication was, however, based on the impact assessment carried out using a single climate model (HadRM3), single scenario (A1B), and single impact assessment models for the three sectors: water, forest and agriculture. To meet the needs of the Paris Agreement, the following improvements in impact and vulnerability studies are required.

I Assessment of the observed climate trends and their impact on different sectors in India.
II Application of high-resolution multi-model-based climate change projections for India, at national, state and district levels.
III Improvements in the uncertainty estimates of regional climate change projections.
IV Modelling and assessment of sectoral, and ecosystem or landscape level cross-sectoral integrated climate impact and vulnerability studies.
V Development of methods and assessment of inherent vulnerability or intrinsic vulnerability of the key landscapes and sectors in the country.
VI Development of methods for assessment of the adaptation options and prioritization under uncertainty using the robust decision approach.
VII Research on impact of adaptation actions on vital natural and human ecosystems such as food production, biodiversity, water availability, health, etc.
VIII Estimation of costs and benefits of adaptation actions.

Reporting and transparency requirements

The Paris Agreement establishes a transparency framework for both action (mitigation and adaptation) and support (finances) under common modalities. It includes regular reporting of national GHG inventories, status of implementation of NDCs, status of the financial support provided and received, adaptation efforts and their impacts. The Paris Agreement further establishes a technical expert review for reported information on mitigation and support, but not on adaptation. While details of the transparency framework are still to be determined, Parties are already able to agree on a set of general principles[8]. These include the 'TACCC' principles (transparent, accurate, complete, consistent and comparable), no backsliding from the frequency and quality of UNFCCC reporting, no double counting, environmental integrity, and flexibility in light of capacities. The monitoring, reporting and verification requirements under the Paris Agreement stem from an emphasis on transparency and accountability. India will need to create a robust and accessible archive of data, maps and information pertaining to GHG inventories, mitigation, adaptation actions, etc. India must also strive to ensure that the various sectors maintain systematic records of their GHG emissions, and the nature and impacts of their mitigation activities. The Paris Agreement establishes a common system for transparency for all countries. Through an enhanced transparency framework, all countries will be required to report on their emissions and track progress on achieving their NDCs regularly. The information provided by all parties will be subject to an expert review and facilitative multilateral consideration of progress. Table 3 discusses MRV related reporting requirements and their implications. To achieve the goals of the Paris Agreement and address climate change, a robust and transparent monitoring and verification system is required.

India's readiness

The Paris Agreement has already come into force on 4 November 2016, and submission of various reports to UNFCCC may begin post 2020. Some of the reports that India will have to submit to UNFCCC include the following:

1. Mitigation strategies, actions, achievement and impacts.
2. Climate change impacts, vulnerability, adaptation actions, prioritization and impacts.
3. National communications: estimation of GHG inventory, climate change impacts, vulnerability and adaptation, etc.
4. Biennial Update Report (BUR): GHG emissions, mitigation actions and achievements, policies and programmes.
5. NDCs: periodic reports and updates.
6. Adaptation communication.
7. Many other reports related to mitigation, adaptation, financing, REDD+, etc.

Thus, there is a need for large-scale research involving modelling, measurement, monitoring, field studies, and data collection and data quality assurance at the national, state, industry and municipal levels. According to India's recent BUR[9], the country does not yet have a long-term national GHG inventory management system and institutional arrangements. India is also yet to have a well-established data collection and quality assurance (reliability) and control (review and verification) protocol and system. The second national communication (SNC)[10] and BUR[9] list a number of limitations with respect to data requirement and technical capacity for reliable GHG inventory and mitigation assessment. In future, all submissions on GHG inventory and mitigation estimates will be subjected to review and verification. India has not developed vulnerability framework or profile for different sectors and regions. Similarly, in its SNC[10], India has not

Table 3. MRV-related requirements as agreed at Paris Climate Conference

Location in Agreement	Text of Article/Paragraph	Implications for research, monitoring, modelling and database generation
Paragraphs		
Paragraph 20	'*Decides* to convene a facilitative dialogue among Parties in 2018 to take stock of the collective efforts of Parties in relation to progress towards the long-term goal referred to in Article 4, paragraph 1, of the Agreement and to inform the preparation of nationally determined contributions pursuant to Article 4, paragraph 8, of the Agreement.'	1. Need to develop, adopt and report methods and models used for estimation of baseline and projections of GHG emissions, GHG abatement, climate change impacts, vulnerabilities, etc. 2. Systematic archiving of information and creating access during monitoring and evaluation.
Paragraph 31 (b)	'Parties ensure methodological consistency, including on baselines, between the communication and implementation of nationally determined contributions.'	3. Industries, corporations, municipalities, SMEs, educational institutions, utilities, etc. to maintain records of GHG emissions and mitigation activities and their impacts. 4. Developing quality control and quality assurance protocols for all sectors. 5. Development of National Inventory Management System (NIMS).
Paragraph 36	'*Invites* Parties to communicate, by 2020, to the secretariat mid-century, long-term low greenhouse gas emission development strategies in accordance with Article 4, paragraph 19, of the Agreement, and *requests* the secretariat to publish on the UNFCCC website Parties' low greenhouse gas emission development strategies as communicated.'	Modelling of sectoral GHG emissions baseline, cost-effective mitigation actions – scale of mitigation in different sectors in the short-, mid- and long-term.
Paragraph 93 (c)	'The need to promote transparency, accuracy, completeness, consistency, and comparability.'	1. Establishment of NIMS. 2. Methods for development of comparable baseline, data generation, projections and transparent sharing and access to datasets.
Paragraph 125	'Decides to launch, in the period 2016–2020, a technical examination process on adaptation.'	Prepare an inventory of baseline adaptation actions and their impacts in different sectors and regions, especially in the most vulnerable landscapes.
Paragraph 126	'Decides that the technical examination process on adaptation referred to in paragraph 125 above will endeavour to identify concrete opportunities for strengthening resilience, reducing vulnerabilities and increasing the understanding and implementation of adaptation actions.'	Inventory of the proposed adaptation actions. 1. Assessment of vulnerability baseline. 2. Projection of vulnerabilities. 3. Prioritization of adaptation actions, and 4. Assessment of technology and financial needs.
Articles		
Article 13 (1)	'To build mutual trust and confidence and to promote effective implementation, an enhanced transparency framework for action and support, with built-in flexibility which takes into account Parties' different capacities and builds upon collective experience.'	1. Development of a transparent and verifiable database and archiving system. 2. Development of data quality control and quality assurance procedures.
Article 13 (7a)	'A national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases, prepared using good practice methodologies accepted by the Intergovernmental Panel on Climate Change and agreed upon by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement.'	3. India needs to development a robust NIMS. Further India needs to incorporate modelling in the Agriculture, Forestry and other Land Use sector. 4. Evaluate feasibility of application, suitability or applicability of models, assess models for different land categories, test the commonly used models, with existing data, identify data needs for modelling, assess the data availability and data needs, identify the institutions that can supply the data on continuous basis, and suggest a strategy to generate data for long-term modelling.
Article 13 (7b)	'Information necessary to track progress made in implementing and achieving the nationally determined contributions.'	
Article 14 (1)	'The Conference of Parties serving as the meeting of the Parties to the Paris Agreement shall periodically take stock of the implementation of this Agreement to assess the collective progress towards achieving the purpose of this Agreement and its long-term goals (referred to as the 'global stocktake'). It shall do so in a comprehensive and facilitative manner, considering mitigation, adaptation and the means of implementation and support, and in the light of equity and the best available science.'	1. 'Global stock-take' is aimed to consider the state of implementation of GHG reduction commitments and achievement. 2. This provides parties an opportunity to co-operate and establish common timeframes, including end dates for NDCs. 3. Parties could further cooperate and share best practices for developing long-term emissions reduction strategies.
Article 14 (2)	'The Conference of the Parties serving as the meeting of the Parties to the Paris Agreement shall undertake its first global stocktake in 2023 (different from the facilitative dialogue on stock-take in 2018) and every five years thereafter unless otherwise decided by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement.'	1. Estimation and reporting of progress made in the implementation of mitigation and adaptation commitments in the NDC. 2. Database of mitigation and adaptation actions.

developed national or state-level adaptation framework, strategies, policies and programmes. Non-availability and non-accessibility of data, absence of standardized protocols for data collection, quality control, archiving and access could limit reporting in future. Climate change impact assessments reported in SNC are often based on limited modelling (single climate model projections, single future scenario and single impact assessment model)[10]. India needs to establish coordinated model inter-comparison programmes, given the size of the country and its population. Given the size, spread and scale of higher education and research institutions, India can certainly build the required capabilities to effectively implement, monitor and report on various aspects of GHG inventory, mitigation and adaptation to meet the requirements of the Paris Agreement.

Conclusion

Operationalization of the Paris Agreement requires implementation of the mitigation and adaptation actions committed voluntarily by all the countries. The Paris Agreement requires major economies to undertake sustained and long-term modelling of their low-carbon futures and an assessment of the mitigation options, large-scale monitoring, estimation, reporting, and verification of their GHG inventories, mitigation actions, effectiveness of the mitigation actions, and co-benefits for development, poverty alleviation, resilience and adaptation. It also requires climate modelling and projecting impacts of climate change on various ecosystems and communities, developing and implementing adaptation plans, policies and measures. Further, it involves MRV of the impacts of mitigation and adaptation actions. India being the fourth largest economy and the third largest emitter of GHGs will be required periodically to report on the progress made on mitigation and adaptation, GHG emissions reduced and tonnes of carbon sequestered compared to an established baseline scenario. Similarly, reporting of robust climate change projections, impacts and vulnerability assessments, development and implementation of adaptation actions, monitoring and assessment of impacts, costs and benefits will be required. All the information and data provided to UNFCCC will be subjected to review and verification by independent experts under the coordination of the convention. 'The need to promote transparency, accuracy, completeness, consistency, and comparability', will be a challenge requiring research, data quality and transparency.

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