

Measurement, Reporting and Verification: A note on the concept with an annotated bibliography

Melissa Mucci

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Overview of the MRV Concept

1. The Concept: MRV. What is it? And Where Did it Come From?

MRV stands for “measuring,” “reporting” and “verifying.” MRV refers to processes whereby factual information is provided, examined and assessed to see whether parties meet their obligations (Wemaere). If states believe in the MRV process and trust in its transparency and accuracy, they are more likely to cooperate with one another and adhere to a strong treaty (MacFaul). “M” refers to actual physical measurement. It is important to ensure that data is reportable so that other actors can assess parties’ activities. This depends on the reliability of measurement and whether the reporting of data is being done in a transparent manner that conforms to a specific reporting format. “V” means that reported data is checked independently for accuracy (Nash, et al.). MRV was initially coined at Bali. The Bali Action Plan initiated new monitoring requirements that forced both developed and developing countries to make commitments concerning mitigation actions that could be measured, reported and verified. This agenda was strengthened at Copenhagen and furthered in Cancun.

2. What Exists Currently and What Works in Practice?

Currently there is no clear definition or framework of MRV. There is no agreement between developed and developing countries regarding MRV (Niederberger & Kimble). There seems to be an agreement among Parties that there is a lack of transparency, but *how* to improve accountability and transparency is unclear (Vine & Sathaye). The language on enforcement is lacking a plan of implementation (The Global Climate Change Regime- GCCR). MRV itself as well as the nature of the related obligations are not clearly defined. An MRV framework is missing (Fransen). The existing climate regime already includes various monitoring, reporting and verification activities, such as reporting in National Communications (NCs), and compiling national GHG inventories and procedures to account for emission reductions (Niederberger & Kimble). It is a thorough system that should be maintained and continuously improved (MacFaul). Without standardized reporting rules, Parties may report using their own standards. This generates confusion and a lack of trust at the international level among Parties (Moncel et al.). Presently, there is a fragmented body of international law that holds major challenges for climate change governance. No single international regime can provide legal and institutional responses to climate change, and no single state can solve climate change. Sovereignty and the need for the consent of states give rise to problems. A challenge for climate change governance is to satisfy the various existing interests that want to influence the interaction between regimes. Multilateral environmental agreements (MEAs) make a great deal of their information available on their websites. MEAs try to encourage and motivate countries to report and to be more transparent, but MEAs cannot make countries do anything (Macauley & Sedjo). MEAs also encourage the participation of various actors, besides states, in the international community. Some MEAs are more encouraging than others in this respect; not all MEAs accord equal importance to non-state actors, like CITES (Graham & Thorpe). States are unlikely to support a treaty if the system appears disproportionately powerful or intrusive. Recent decisions by the COP (Bali & Cancun) confirm the desire by Parties for the UNFCCC to continue to play a central role in climate governance. COP 16 confirmed that UNFCCC reporting framework for developed and developing countries would be more comprehensive and include more frequent reports (Ellis, et al.).

Developed countries need to submit national GHG inventories annually, NCs every four years and updates on their emission reductions biennially. Developing countries need to submit NCs and greenhouse gas inventories every four years. The level of detail required from biennial reports is unclear (Ellis, et al.).

3. What Scholars Think Should Be Done and What Countries Want

An MRV framework should be developed. MRV guidelines should be consistent, transparent, verifiable, objective, relevant and simple. It is currently unclear which actors have the ability to conduct MRV activities. A framework for nationally appropriate mitigation actions (NAMAs) should be established, including types of policies for measurement, reporting and verification of the actions. Such a framework would assist countries in deciding how to agree on what to do, and it could help countries hold other countries to account (Bakker & Huizenga). Developed countries need to provide more funding and assistance to developing countries so that they can properly monitor their emissions and report accurately (GCCR). Common reporting guidelines should apply to all, but flexibility for developing countries should be provided. MRV requirements must reflect the nature of commitments and actions in light of common but differentiated responsibilities. Self-reporting by member states should be supplemented by more frequent institutional reporting (Ghosh & Woods). Capacity building among countries needs to be enhanced (Bernstein & Brunnée). The information compiled from countries' reporting needs to be made more transparent and accessible. A geo-wiki would increase the capacity to collect and share data at an international level; all sources willing to post information would do so on an internet site, information could be shared, and countries could work together to increase transparency and accountability (Macauley & Sedjo). A post-2012 MRV structure should build on the existing NC and inventory systems.

Developed countries want the same standards for all, whereas developing countries want different standards for both groups. For several developed countries, such as the US, the MRV of all developing countries' mitigation actions is necessary and the legal character of actions must be the same for all Parties (Macauley & Sedjo). The developed countries want methods of international verification for all Parties. Developing countries stress the need for a gradation approach along developed and developing country lines. According to developing countries, national inventories and NCs are not frequent enough and are not subject to a review process (Wemaere). Developing countries want additional funds, but they are concerned that if they monitor their emissions, it may make them vulnerable to pressure from developed countries to cap those emissions (GCCR). The lack of capacity for measurement and reporting of mitigation actions not only stems from problems with funding but also from the fact that developing countries' NCs are not subject to third party verification. As such, these countries miss out on the important capacity-building function an expert review brings (e.g., feedback and guidance) (GCCR). There is a desire among Parties for the UNFCCC to be a main platform to track countries' performance in implementing policies and meeting their international goals (Moncel, et al.).

4. How Might MRV Work?

A post-2012 MRV structure should build on the existing NC and inventory systems. NCs need to be strengthened and the frequency of reporting needs to be increased. Accurate reporting and verification provide a framework for accountability. It enables the tracking of progress by states and can help determine whether or not they are meeting their international obligations. Such a system is crucial to building trust among Parties and confidence in the objectives of the Convention (Nash, et al.). MRV might work by clearly defining the concept, establishing a framework and initiating standardized reporting rules. The frequency and rigor of reporting and verifying measures also need to be increased. The existence of a geo-wiki could reinforce MRV. Furthermore, Parties should continue to share information via the web platform on the UNFCCC website (UNFCCC).

5. What Problem Is MRV Intended to Solve? And How Much is in Place Now?

MRV is intended to solve the lack of communication and information sharing (UNFCCC), the lack of standardized reporting rules (Moncel, et al.), the lack of transparency and independent verification (Moncel, et al. & Levin, et al.), the lack of appropriate measurement and reporting, and the lack of appropriate data collection (Macauley & Sedjo). There is no existing MRV framework, and there is a need for more effective and sustained international cooperation on climate change (Fransen). NCs need to be strengthened, the frequency of reporting needs to be increased (Buchner), and the UNFCCC reporting framework for developed and developing countries needs to be more comprehensive (Ellis, et al.). Most MEAs do not provide for the verification of reported data. Even the Montreal Protocol, regarded as a successful environmental agreement, does not establish a regular process to verify the accuracy of the information contained in national reports. Instead, like other MEAs, it provides for verification of nationally reported information only if a complaint is made. The expert review process established under the UNFCCC is unusual in international environmental law (Breidenich & Bodansky). Self-reporting is currently in place (Ghosh & Woods). The existing climate regime includes various measurement, reporting and verification activities, including reporting via NCs, compilation of national greenhouse gas inventories and procedures to account for emission reductions (Niederberger & Kimble). Different requirements exist for both developed and developing countries.

6. How to Assess MRV, Improve it & What Difference Could it Make?

In order to assess and improve MRV, it needs to be clearly defined. A set framework needs to be established. MRV needs to be enhanced—all Parties need to improve their measurement and reporting, and international verification should exist at all levels and for all types of reporting. MRV would standardize reporting and verification procedures (Fransen). The UNFCCC needs to continue to play a significant role with respect to MRV. Information-sharing platforms (like a geo-wiki) need to be initiated and supported. Compliance procedures need to be established—it is not enough to just encourage states to act a certain way.

MRV could help create a new benchmark (Stringer & Roberts, 18). Accurate reporting and verification provide a framework for accountability. It could contribute order to create consistency, transparency and trust between developed and developing countries, and to monitor the progress towards the ultimate objective of the UNFCCC—reducing GHG

emissions. MRV can also be important for sharing information (Nash, et al.) and experiences about practices and creating incentives for action. MEAs are encouraging transparency and accountability among all the parties, and they are attempting to facilitate trust among parties. They establish ultimate objectives and try to encourage parties to work toward achieving the stated objectives (Bakker & Huizenga). MRV could measure and promote progress towards treaty goals. MRV can provide an important means of tracking Parties' progress individually and collectively toward the Convention's objective. MRV can facilitate Parties' actions by establishing baselines and helping to identify mitigation potentials; it can allow for their recognition internationally and enhance action through expert advice on opportunities for improvement. MRV could play a particular role in the linkage between developing countries' action and support for those actions. It could create trust between developed and developing countries. MRV could strengthen mutual confidence in countries' actions and in the regime, thereby enabling a stronger collective effort (Breidenich & Bodansky). MRV helps establish trust (and cooperation) among Parties (MacFaul) and in the regime by enabling Parties to be held accountable for their obligations. MRV could introduce consistency and transparency (Vine & Sathaye). MRV could help to ensure the environmental integrity of the regime (MacFaul).

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Niederberger, Anne Arquit and Melinda Kimble. 'MRV under the UN climate regime: paper tiger or catalyst for continual improvement?' *Greenhouse Gas Measurement & Management* 1 (2011): 47-54.

Stringer, Judy, and Michael Roberts. 'Environmental reporting.' *Chemical Week* 158, 32 (1996): 18.

The Global Climate Change Regime website, <http://www.cfr.org/climate-change/global-climate-change-regime/p21831>

UNFCCC website, www.unfccc.int

Vine, Edward, and Jayant Sathaye. 'The Monitoring, Evaluation, Reporting and Verification of Climate Change Projects.' *Mitigation and Adaptation Strategies for Global Change* 4, 1 (1999): 43-60.

Wemaere, Matthieu. 'Post-2012 Climate Change Agreement. Why MRV is important.' *Institut Du Développement Durable Des Relations Internationales* (December 7, 2009), http://www.iddri.org/Publications/Collections/Idées-pour-le-debat/ID_0709_wemaere_mrv.pdf.

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Bakker, Stefan, and Cornie Huizenga. 'Making climate instruments work for sustainable transport in developing countries.' *Natural Resources Forum* 34 (2010): 314.

In the post-2012 climate regime, there may be substantial international funding available, in addition to existing credit schemes and international funds, which could be channeled through nationally appropriate mitigation actions (NAMAs). This can provide new and better opportunities for sustainable transport in developing countries. The authors propose a framework for NAMAs, including types of policies and measures, measurement, reporting and verification of the actions, and an institutional and financial structure. Climate funding needs to be aligned closely with domestic and multilateral development finance flows in order to make a difference for sustainable transport.

Bernard, Florence, and Peter A. Minang. 'Strengthening Measurement, Reporting and Verification (MRV) for REDD+.' *International Institute for Sustainable Development* (June 2011), http://www.iisd.org/pdf/2011/redd_strengthening_mrv_kenya.pdf.

Over the last few years, the stature of REDD+—reducing emissions from deforestation and forest degradation, plus the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries—has grown remarkably. The climate change agreements reached in Cancun, Mexico, in 2010 marked a critical turning point in the development of REDD+. Measurement, reporting and verification (MRV) is included in the Cancun Agreements as one of the most critical elements necessary for the successful implementation of any REDD+ mechanism.

Establishing an MRV regime should include designating the regulatory entities to be responsible for overseeing, approving and coordinating MRV at local, subnational and national scales. Existing MRV regimes provide opportunities for learning, and lessons learned from early implementation can inform other countries and should be communicated at the international level. Countries need support and assistance to determine available domestic skills, capacities, information and data, which will be the building blocks for developing effective MRV systems. Local community and indigenous peoples' involvement, including through participatory processes, must be an important element of MRV programs to ground truth "top-down" measurements and improve accuracy. Developing countries should consider appointing MRV experts to UNFCCC technical and expert groups. The capacity to implement MRV systems is low in many countries. Less than 20 per cent of developing countries have submitted a complete greenhouse gas (GHG) inventory. MRV is very critical at the results-based stage; there can be no REDD credits without credible and accurate MRV. The MRV system will be shaped by dialogue and debate in the UNFCCC, as well as between national and subnational governments, technical and financial institutions, and other stakeholders in REDD+.

Breidenich, Clare, and Daniel Bodansky. 'Measurement, reporting and verification in a post-2012 climate agreement.' Pew Center on Global Climate Change (April 2009), <http://www.pewclimate.org/docUploads/mrv-report.pdf>.

This report considers options for MRV in a new climate agreement. It begins by looking at basic issues in measurement, reporting and verification, and how they are addressed in different international regimes. It then evaluates existing requirements and mechanisms under the UNFCCC and the Kyoto Protocol that are relevant to MRV. Finally, it outlines a range of options for adapting these mechanisms and establishing new ones for purposes of MRV in a new agreement.

Breitmeier, Helmut, et al. 'The Effectiveness of International Environmental Regimes: Comparing and Contrasting Findings from Quantitative Research.' *International Studies Review* 13 (2011): 579-605.

The authors want to determine the effectiveness of regimes. They claim regimes do make a difference; many regimes have a strong or at least a moderate causal effect in producing observed outcomes and impacts. Regimes achieve lower performance scores when faced with problems that are poorly understood or characterized by severe political malignancy. The significance of power construed either as the ability to get others to do things they would not otherwise have done or as control over outcomes has led regime analysts to pay attention to asymmetries in capabilities and resources that actors can bring to bear in pursuing their interests. Power is a force to be reckoned with in efforts to understand the roles that regimes play in international affairs. The question is how exactly does this force work? The effects of power are contingent on the presence or absence of certain other factors, such as the political malignancy of the problem, the decision rules in use and the depth of knowledge of the problem.

Brunnée, Jutta, and Stephen J. Toope. *Legitimacy and Legality in International Law. An International Account*. Cambridge: Cambridge University Press, 2010.

The Copenhagen Accord contains at least three genuine breakthroughs:

1. In addition to “quantified economy-wide emission targets for 2020” by industrialized countries, it envisages for the first time an international commitment to “mitigation actions” by developing countries. The former are to be “measured, reported and verified...in accordance with...guidelines adopted by the Conference of the Parties” to the UNFCCC. The latter are to be reported through national communications under the convention and, if supported through international financing, will be “subject to international measurement, reporting and verification,” also in accordance with guidelines adopted by the Conference of Parties (COP). The Accord caters to the developing country demand for clear differentiation between the two groups.

2. The Accord commits industrialized countries to providing “new and additional resources...approaching USD 30 billion for the period 2010–2012,” and to mobilizing “USD 100 billion a year by 2020 to address the needs of developing countries.” It appears as if these financing commitments are to be “measured, reported and verified” along with Annex I Parties’ emission reductions.

3. The Accord suggests that the idea of differentiation among developed countries is taking hold and is gaining the acceptance of China and India, notwithstanding their public statements to the contrary.

The COP is to adopt guidelines for the measuring, reporting and verification of Annex I emission reductions and financing, as well as for national communications by non-Annex I countries on their actions. But the language in the Accord suggests that the measuring, reporting and verification as such can be domestic action.

Buchner, Barbara, et al. 'Monitoring and Tracking Long-Term Finance to Support Climate Action.' Organisation for Economic Co-Operation and Development (May 2011).

The existing effort to track climate finance lacks transparency, comparability and comprehensive.

The Cancun Agreements recognize the shortcomings of current reporting of climate finance under the UNFCCC and have called for significant improvements on this issue, both regarding the frequency and coverage of reporting. They call for strengthening national communications, increasing the frequency of reporting via biennial reports to be reported by developed and developing countries, and the creation of a registry to record developing countries' mitigation action seeking international support and associated funding needs. All these items include some elements of climate finance reporting. Importantly, the Agreements call for strengthened reporting on climate support both from developing countries as recipients and from developed country donors. Any framework for MRV of climate finance should help countries to assess—individually and collectively—whether they are meeting their financial and other support objectives, and to facilitate the implementation of these objectives by identifying where progress could be made. It should ensure transparency and accountability, which in turn require comprehensive, accurate and comparable information. The framework proposed here, and implementation of either of the straw man options, could go some ways towards achieving these goals and can therefore pave the way for a better understanding and assessment of the effectiveness of climate finance, helping steer future efforts to address climate change most efficiently.

Climate Action Network International. (March 28, 2011). *CAN-International submission on measurement, reporting and verification*. Retrieved from <http://unfccc.int/resource/docs/2011/smsn/ngo/258.pdf>.

A robust MRV process facilitating increased transparency with respect to the commitments and actions countries are taking to respond to climate change is essential for generating national emissions data; assessing the effectiveness of country actions against international and domestic commitments and actions; evaluating the collective ability of country actions to prevent “dangerous human interference with the climate system” as stated in the Convention; achieving environmental integrity and good climate governance; and building trust between countries. An MRV system is also indispensable to building a compliance regime but is not a substitute for it. The MRV provisions in the Cancun Agreements represent progress toward greater accountability; however, the effectiveness of these provisions will depend on the design and operationalization of the components of an MRV system in the coming months. The process should be guided by principles that will ensure the integrity of the MRV system, including the promotion of comparability, consistency, accuracy, transparency, and completeness of information, and respect for the principle of Common but Differentiated Responsibilities and Respective Capabilities. The system should remain practical and effective by building on the strengths of international systems, beginning with the Kyoto Protocol. Transparency must

apply to the MRV process itself: public access and participation must be guaranteed throughout the process. Civil society organizations play a valuable role in providing data on country actions and support, and cross-checking the information.

Ellis, Jane, et al. 'Frequent and Flexible: Options For Reporting Guidelines for Biennial Update Reports.' Organisation for Economic Co-Operation and Development (May 2011).

COP 16 confirmed that the future UNFCCC reporting framework for both developed and developing countries is to be more comprehensive and result in more frequent reports. The decisions adopted (UNFCCC, 2011a) stipulate that all countries should submit biennial reports to the UNFCCC. This represents a considerable step up in reporting, particularly in terms of frequency of reports for developing countries. To date, no developing country has submitted information to the UNFCCC on a biennial basis, nor do developed countries report at this frequency on the majority of topics covered by national communications.

The Cancun Agreements provide an outline of what is to be included in biennial reports. Reports from all Parties are to include information on the following: GHG emissions inventories including a national inventory report for developing countries but developed countries are to continue submitting annual national inventory reports; information on progress in mitigation; and information on support provided (developed countries), received and/or needed (developing countries). In addition, information on emissions projections will be included in reports from developed countries. This paper suggests that developing countries with national and/or sectoral GHG emissions goals also provide information on projections, in order to demonstrate their progress in implementing these goals. The decisions adopted at COP 16 indicate that the content of reports will be enhanced in the future. In particular, developing countries "should" report information on methods and assumptions used for GHG inventories, and information on mitigation actions, needs and support received. Developed countries "shall improve" their reporting of information on financial, technology and capacity-building support provided. Information on many of these topics is currently reported in national communications, although gaps exist.

Despite the guidance provided by the COP 16 decisions, some ambiguities and open questions remain relating to, *inter alia*, the content of biennial reports, the relationship between biennial reports and other mechanisms to report or record climate-related information, and the incentives to encourage improvements in reporting over time. In particular, the level of detail required from biennial reports compared to other reporting formats under the UNFCCC (such as national communications) is unclear. Further decisions on the level of detail and scope of biennial reports are needed in the near future, as these are likely to have significant implications for the transparency, comprehensiveness and user-friendliness of biennial reports; the resources needed nationally in order to report on a biennial basis; and the time and resources needed internationally for international assessment and review/international consultations and analysis/review of information contained in biennial reports.

This paper also proposes that flexibility be maintained in the reporting guidelines for biennial reports. This could be achieved through the use of "reporting levels" which reflect the different national circumstances and levels of reporting experience between Parties (particularly within the group of developing country Parties). Parties could choose the

most appropriate level for each section of their report according to their goal type or reporting capacity and “move up” levels as and when they can (as is currently the case for GHG inventory calculations). A limited number of levels are suggested for developed countries, as in many cases reporting to the highest level is already mandatory for these countries. For developing countries there could be greater flexibility and a higher number of reporting levels, reflecting the broad range of national circumstances and reporting capacities within this group. The introduction of reporting levels into guidelines would allow countries to provide information at a level that is consistent with their current capabilities and to improve their reporting over time.

Fransen, Taryn. ‘Enhancing Today’s MRV Framework to Meet Tomorrow’s Needs: The Role of National Communications and Inventories.’ *World Resources Institute* (June 2009), www.wri.org.

Although MRV was established in the Bali Action Plan, the nature of the obligations and the nature of MRV are not defined explicitly in the Plan. An MRV framework is needed. The UNFCCC requires all Parties to report on their activities to implement the Convention through national inventories (report quantitative information on countries’ anthropogenic emissions and removals of greenhouse gases) and national communications (report on a wider range of activities related to climate change, including policies and measures, vulnerability and adaptation, and research). National communications and inventories can contribute to MRV under a post-2012 agreement but are not adequate—as they currently stand—to serve the accountability and facilitative functions critical to the success of such an agreement. These functions could be facilitated by revisions to the existing MRV structure, complemented by new frameworks and processes.

A retrofit of the existing MRV structure for a post-2012 environment might include the following: application of the current Annex I inventory process, as well as relevant Kyoto Protocol accounting provisions, to all developed country Parties; standardized reporting structure for NAMAs; more frequent and complete GHG inventories for developing country Parties with significant emissions; improved definition of support requirements, along with standardized reporting and verification procedures for them; low-carbon development plans or strategies as a means to identify and prioritize NAMAs; a registry as a means to recognize supported and, perhaps, unilateral NAMAs, and to verify both NAMAs and support; and more frequent, streamlined and standardized reports as a complement to or replacement for national communications.

Investment in appropriate MRV frameworks and capacity can be expected to pay off in the form of more effective and sustained international cooperation on climate change.

Ghosh, Arunabha and Ngaire Woods. ‘Developing Country Concerns about Climate Finance Proposals: Priorities, Trust, and the Credible Donor Problem.’ In *Climate Finance. Regulatory and Funding Strategies for Climate Change and Global Development*. Edited by Richard B. Stewart, et al. New York: New York University Press, 2009.

Effective monitoring, verification and compliance mechanisms are needed not only for emissions reductions but also for commitments on financing and technology transfers. Industrialized countries have emphasized the importance of effectively monitoring emissions. However, developing countries are concerned about the costs of complying

with verification systems as well as potential asymmetries in the application of such systems. A credible financing mechanism in the climate regime would need new institutional features for monitoring and evaluating the effectiveness of financial flows. First, self-reporting by member states should be supplemented by more frequent institutional reporting to measure the origin and destination of financial flows. One option is to use the Organisation for Economic Co-operation and Development's Creditor Reporting System. Second, the data must also be analyzed to evaluate the impact of financial flows. Here the experience of the World Bank and regional development banks in project evaluation could strengthen reviews held within the UNFCCC. Third, knowledge networks could be established at a regional level to facilitate the sharing of information and experience across countries and build capacity for monitoring and evaluation. Finally, compliance-oriented peer review procedures would be needed within the UNFCCC to apply pressure on developed countries to comply with commitments. Discussions about the timelines, adequacy and impact of financial transfers should be included in extensive reviews similar to those conducted for emissions and implementation of commitments under Article 8 of the Kyoto Protocol.

Hammer, S., et al. 'Verification of greenhouse gas emission reductions: the prospect of atmospheric monitoring in polluted areas.' *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 369, 1943 (2011): 1906-1924.

Independent verification of greenhouse gas emissions reporting is a legal requirement of the Kyoto Protocol, which has not yet been fully accomplished. Dedicated long-term atmospheric measurements of greenhouse gases, such as carbon dioxide and methane, continuously conducted at polluted sites can provide the necessary tools for this undertaking.

Kurz, W.A., and M.J. Apps. 'Developing Canada's National Forest Carbon Monitoring, Accounting and Reporting System to Meet the Reporting Requirements of the Kyoto Protocol.' *Mitigation and Adaptation Strategies for Global Change* 11, 1 (2006): 33-43.

The rate of carbon accumulation in the atmosphere can be reduced by decreasing emissions from the burning of fossil fuels and by increasing the net uptake (or reducing the net loss) of carbon in terrestrial (and aquatic) ecosystems. The Kyoto Protocol addresses both the release and uptake of carbon. Canada is developing a National Forest Carbon Monitoring, Accounting and Reporting System in support of its international obligations to report greenhouse gas sources and sinks. This system employs forest inventory data, growth and yield information, and statistics on natural disturbances, management actions and land use change to estimate forest carbon stocks, changes in carbon stocks, and emissions of non-carbon dioxide greenhouse gases. A key component of the system is the Carbon Budget Model of the Canadian Forest Sector. The model is undergoing extensive revisions to enable analyses at four spatial scales (national, provincial, forest management unit and stand) and in annual time steps. The model and the supporting databases can be used to assess carbon stock changes between 1990 and the present, and to predict future carbon stock changes based on scenarios of future disturbance rates and management actions.

Nash, David, et al. 'Building Trust and Cooperation in a North-South Climate Change Compact. What role for environmental regulators?' *Global Climate Network* (October 2009), <http://www.globalclimatenetwork.info/ecomm/files/buildingtrust.pdf>.

Implementing a comprehensive MRV framework under the Convention will enable Parties and the UNFCCC to fulfill a number of important objectives. Firstly and perhaps most obviously, accurate reporting and verification provides a framework for accountability. Secondly, an integrated MRV system provides international recognition of the different actions—unilateral and supported—that individual states are pursuing. This is particularly important for the developing countries, which are not expected to commit to binding economy-wide emissions reduction targets in the near future. By calling for MRV of nationally appropriate mitigation actions (NAMAs) undertaken by developing countries- which include, for example improving standards for energy efficiency in residential, commercial and transport sectors, increasing renewable energy use and regulating energy intensity in industry. Thirdly, MRV can also help facilitate implementation of low-carbon policies and actions at the national and local level by establishing baselines and helping to identify mitigation potentials and opportunities for improvement. Generating a more timely and comprehensive picture of global, national or sectoral greenhouse gas emissions trends is also useful in enabling the UNFCCC to assess whether global action on greenhouse gas mitigation needs to be enhanced. Finally, MRV can play a role in linking developing countries' actions with support by drawing attention to policies and programs in need of improvement and which incur costs, thereby helping donor countries to better target, plan and execute financial and technical assistance. A transparent MRV framework may also promote best practice and "facilitate information-sharing on mitigation options and their cost with and between countries." Support itself should be subject to MRV as a means to ensure that it is truly additional to other developed countries pre-existing commitments.

Most commentators are in agreement that a post-2012 MRV structure should logically build on the existing national communication and inventory systems.

Developed and developing countries disagree on what should be done; for the most part, developed countries want the same standards for all, and developing countries want different standards for the two groups.

Some developing states, including South Korea and Indonesia, acknowledge the importance of MRV for the implementation of developing country NAMAs, while Mexico has called for quantified "MRVing" of national emissions "as a way to show real reductions." For several developed countries, such as the USA, the MRV of all developing countries mitigation actions is necessary if they are to be "recognized." Developing countries, such as South Africa, have suggested that "support for developing country NAMAs should be commensurate with the level of ambition and accountability for the implementation of the proposed actions."

The latest revised negotiating text includes a reference to an "MRV Panel" to be created under the COP which "shall be in charge of establishing methodologies for MRV, measuring, reporting, and verifying mitigation actions and the support received, as required by paragraph...and keeping records of mitigation...activities implemented by developing countries with their own resources." The developed countries have all called for methods of international verification for all Parties, building on the Convention's "in-depth review" process. Developing countries stress the need for a

gradation approach along developed and developing country lines. The US's submission states that the legal character of actions must be the same for all Parties. As the divergences of views outlines in Parties' submissions to the UNFCCC suggest, how a future MRV regime will play out in practice is still open to debate.

Many developing countries have experienced significant problems in terms of measuring greenhouse gas emissions. The lack of capacity for measuring and reporting mitigation actions in non-Annex 1 countries not only stems from problems with funding but also from the nature of current international verification processes under the UNFCCC. Because developing countries' national communications are not subject to third party verification, these countries essentially miss out on the important capacity-building function an expert review brings, namely providing feedback, guidance and ways to improve inventories according to best practice. There remain significant challenges to overcome if developing countries are to meet existing and any additional reporting requirements under a post-2012 MRV regime. Without the capacity and technical resources to measure and report emissions reductions, developing countries will fail to gain recognition for existing unilateral mitigation measures or attract financial assistance for new policy initiatives. By working together, regulatory authorities can help overcome capacity problems for reporting in developing countries, enable increased recognition of unilateral mitigation actions at the international level and, ultimately, contribute to developing a bottom-up system of equitable global climate regulation. Through their involvement in the supervision, evaluation and review of domestic mitigation policies and measures, environmental regulators can add significant value to the MRV process. With that in mind, they are likely to be key institutions at the front and centre in helping to build trust and confidence among actors in a post-2012 international climate regime.

Niederberger, Anne Arquit and Melinda Kimble. 'MRV under the UN climate regime: paper tiger or catalyst for continual improvement? *Greenhouse Gas Measurement & Management* 1 (2011): 47-54.

Agreement on MRV provisions for developing countries, as called for in the 2008 Bali Action Plan, has proven to be one of the most intractable issues in reaching a global climate deal. The existing climate regime already includes various monitoring, reporting, validation and verification activities, including reporting via National Communications, compilation of national greenhouse gas inventories and procedures to quantify and account for emission reductions under carbon offset schemes. Agreement on provisions for both MRV support and MRV provisions for developing country mitigation actions have proven elusive—both in Copenhagen and in subsequent negotiations. This should come as no surprise, given that a common understanding of the purpose and functions of the MRV regime remains to be articulated, and there is no precedent under the Climate Convention of Kyoto Protocol for “verification” and only limited guidance on reporting on developing country mitigation actions.

Unless the Parties to the UNFCCC take the time to clearly define MRV concepts, consider the policy logic behind the MRV regime (e.g. Compliance? Facilitation? Analysis?) and acknowledge that there is no one-size-fits-all indicator for climate performance across national mitigation actions, the UNFCCC MRV regime risks becoming a paper tiger that is more of a hindrance than a tool to stimulate continual improvement in the climate performance of developing countries. Establishing additional MRV requirements for mitigation actions is an opportunity to support, rather than burden, developing countries in their efforts to improve their climate performance over time, consistent with sustainable development. To do so, however, requires that thought be given to principles, definitions and objectives of the NAMA MRV regime.

Operationalising MRV of Support. Analysis of Finance, Technology and Capacity Building Support. Institute of Global Environmental Strategies (November 2011).

Chapter 1, 'An Institutional Analysis of the Measurement, Reporting, and Verification (MRV) System for Support in the Future Climate Regime.' By Koji Fukuda and Makoto Kato.

There is a debate between developing and developed countries regarding how to operationalize MRV. The authors identify a gap in the existing literature: how MRV of support can be operationalized, especially the MRV of financial support, as little progress has been made on MRV of support. There is consensus among Parties that MRV applies to mitigation actions of Parties and support provided to developing countries. The concept of MRV has become a contentious element of the UNFCCC negotiation because of concerns regarding sovereignty. In order to establish flexible, operationable MRV architecture to allow maximum participation of Parties with different national circumstances, it is crucial to focus on how aspects of support provided should be captured through the anticipated MRV architecture. MRV is a relatively new field of research (2007) and its progress is directly linked with the progress of the UNFCCC negotiations.

Stringer, Judy, and Michael Roberts. 'Environmental reporting.' *Chemical Week* 158, 32 (1996): 18.

Little consistency among reporting procedures exists. Followers of environmental reporting trends say that, while lack of standardization is an issue, corporate environment reports are beginning to gain credibility with outside audiences because of their increasing use of quantitative and performance measures.

Vine, Edward, and Jayant Sathaye. 'The Monitoring, Evaluation, Reporting and Verification of Climate Change Projects.' *Mitigation and Adaptation Strategies for Global Change* 4, 1 (1999): 43-60.

Monitoring, evaluating, reporting and verifying (MERV) guidelines are needed for these projects to accurately determine their net GHG, and other, benefits. Implementation of MERV guidelines is also intended to (1) increase the reliability of data for estimating GHG benefits; (2) provide real-time data so that mid-course corrections can be made; (3) introduce consistency and transparency across project types and reporters; and (4) enhance the credibility of the projects with stakeholders. We review the issues involved in MERV activities. The MERV guidelines will be important management tools for all parties involved in carbon mitigation. They will help project participants determine how effective their contributions have been in curbing GHG emissions, and they will help planners and policy makers determine the potential impacts for different types of projects and for improvements in project design and implementation. These guidelines will also be needed for ensuring consistency and transparency across project types and sectors.

In the longer term, MERV-type guidelines will be a necessary element of any international carbon trading system, as proposed in the Kyoto Protocol.

Wemaere, Matthieu. 'Post-2012 Climate Change Agreement. Why MRV is important.' *Institut Du Développement Durable Des Relations Internationales* (December 7, 2009), http://www.iddri.org/Publications/Collections/Idees-pour-le-debat/ID_0709_wemaere_mrv.pdf.

MRV refers to a set of processes and procedures through which factual information is provided, assessed and checked to determine whether, when and how parties effectively meet their respective obligations. As such, MRV can play a key role in building trust among parties and instill confidence in the post-2012 international climate regime. To achieve the ultimate objective of the UNFCCC, all Parties must contribute towards global emissions reductions. To this end, all efforts should be measured and reported in order to demonstrate that, taken collectively, emission pathways are on the right track or, if necessary, show that additional efforts will be necessary. However, MRV requirements must also reflect the nature of commitments and actions in light of common but differentiated responsibilities and respective capabilities. As far as developing country Parties are concerned, national inventories and National Communications are not frequent enough and are not subject to any review process, and further there is no reporting of impacts of policies and measures in terms of their performance of GHG outcome. Common reporting guidelines should apply to all, but flexibility for developing countries should be provided within these guidelines. There is an imperative need for strict measuring and reporting requirements that should apply to all in order to get a thermometer that can guide the governance of the future international climate regime in an environmentally sound manner, including for the review of adequacy of commitments and subsequent adjustments that would be necessary.

Wintergreen, James T., and Lauren M. Sandler. 'Preparing for GHG Inventory Verification.' *Chemical Engineering Progress* 100, 4 (2004): 35.

Planning for verification early will ensure that the organization's baseline and annual inventories are easily verifiable and found to be accurate and complete. This article gives suggestions for setting up a GHG inventory system that is more easily verified. For simplicity, it is limited to the concepts of verification (a third party assessment of collected GHG data) of an inventory (an entity-wide accounting of GHG emissions).

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Head Office

161 Portage Avenue East, 6th Floor, Winnipeg, Manitoba, Canada R3B 0Y4

Tel: +1 (204) 958-7700 | Fax: +1 (204) 958-7710 | Web site: www.iisd.org

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Melissa Mucci is a Doctoral Candidate with the Department of Political Studies at Queen's University.