



## *Accounting for Carbon*

The ability to accurately monitor, report and verify greenhouse gas emissions is the cornerstone of any effective policy to mitigate climate change. *Accounting for Carbon* provides the first authoritative overview of the monitoring, reporting and verification (MRV) of emissions from the industrial site, project and company level to the regional and national level. It describes the MRV procedures in place in more than 15 of the most important policy frameworks – such as emissions trading systems in Europe, Australia, California and China, and the United Nations Framework Convention on Climate Change – and compares them along key criteria such as scope, cost, uncertainty and flexibility. This book draws on the work of engineers and economists to provide a practical guide to help government and non-governmental policy makers and key stakeholders in industry to better understand different MRV requirements, the key trade-offs faced by regulators and the choices made by up-and-running carbon pricing initiatives.

VALENTIN BELLASSEN is a researcher at Institut National pour la Recherche Agronomique (INRA) where he focuses on the economics of agro-ecology. He is also an accredited UNFCCC reviewer for national greenhouse gas inventories. For four years, he worked at CDC Climat where he managed the research unit on MRV, agriculture and forestry.

NICOLAS STEPHAN is an investment officer at CDC Climat where he is in charge of voluntary carbon offsetting as well as participations in innovative carbon investment vehicles. He worked for five years in the research department of CDC Climat on various topics related to carbon and energy markets.

# Accounting for Carbon

Monitoring, Reporting and Verifying  
Emissions in the Climate Economy

*Edited by*

VALENTIN BELLASSEN AND  
NICOLAS STEPHAN



CAMBRIDGE  
UNIVERSITY PRESS

Cambridge University Press & Assessment  
 978-1-009-24321-6 — Accounting for Carbon  
 Edited by Valentin Bellassen, Nicolas Stephan  
 Frontmatter  
[More Information](#)

## CAMBRIDGE UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, United Kingdom  
 One Liberty Plaza, 20th Floor, New York, NY 10006, USA  
 477 Williamstown Road, Port Melbourne, VIC 3207, Australia  
 314-321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre, New Delhi - 110025, India  
 103 Penang Road, #05-06/07, Visioncrest Commercial, Singapore 238467

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning and research at the highest international levels of excellence.

[www.cambridge.org](http://www.cambridge.org)

Information on this title: [www.cambridge.org/9781009243216](http://www.cambridge.org/9781009243216)

© Cambridge University Press 2015

This publication is in copyright. Subject to statutory exception and to the provisions of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of Cambridge University Press.

First published 2015

First paperback edition 2022

*A catalogue record for this publication is available from the British Library*

*Library of Congress Cataloging in Publication data*

Accounting for carbon : monitoring, reporting and verifying emissions in the climate economy / edited by Valentin Bellassen and Nicolas Stephan.  
 pages cm

Includes bibliographical references and index.

ISBN 978-1-107-09848-0 (hardback)

1. Greenhouse gases—Measurement. 2. Environmental monitoring.

3. Pollutants—Reporting. 4. Greenhouse gases—Government policy. 5. Emissions trading. 6. Climatic changes—Economic aspects. I. Bellassen, Valentin, 1985— II. Stephan, Nicolas.

TD885.5.G73A28 2015

363.7387463—dc23

2014043078

ISBN 978-1-107-09848-0 Hardback

ISBN 978-1-009-24321-6 Paperback

Cambridge University Press has no responsibility for the persistence or accuracy of URLs for external or third-party internet websites referred to in this publication, and does not guarantee that any content on such websites is, or will remain, accurate or appropriate.

Contents

<i>List of figures and map</i>	<i>page xi</i>
<i>List of tables</i>	xiii
<i>List of boxes</i>	xvii
<i>Notes on contributors</i>	xviii
<i>Acknowledgements</i>	xxii
1 Introduction: key notions and trade-offs involved in MRVing emissions	1
VALENTIN BELLASSEN AND IAN COCHRAN	
1.1 Purpose and audience for this book	1
1.2 Climate economics at work	2
1.3 Scale, scope, uncertainty and related trade-offs: key definitions and stakes of MRV in climate economics	4
1.4 Outline, editorial choices and comparison tools between chapters	8
Appendix	12
Bibliography	16
Part I MRV of territorial/jurisdictional emissions	19
2 Trendsetter for territorial schemes: national GHG inventories under the UNFCCC	21
JEAN-PIERRE CHANG AND VALENTIN BELLASSEN	
2.1 Context	21
2.2 Objectives, national inventory system and challenges	27
2.3 Monitoring	33
2.4 Reporting	45
2.5 Verification	55
2.6 MRV costs	60
2.7 MRV ID table	63
	v

vi	<i>Contents</i>
2.8 What practitioners say about it	68
Acknowledgements	70
Bibliography	71
3 Variant 1: region/city geographical inventories	72
IAN COCHRAN	
3.1 Introduction	72
3.2 Multiple methodologies and protocols based on actors' needs	73
3.3 Monitoring	79
3.4 Reporting	86
3.5 Conclusions: local needs currently prevail over harmonization	89
Bibliography	102
4 Variant 2: sectoral MRV at the jurisdictional level – forestry (REDD+) in the VCS and the UNFCCC	104
MARIANA DEHEZA AND VALENTIN BELLASSEN	
4.1 Context	104
4.2 Variable scope of requirements: from baseline only to full jurisdictional MRV	106
4.3 Monitoring requirements	106
4.4 Reporting	118
4.5 Verification	118
4.6 Comparison between VCS and UNFCCC requirements for REDD+	120
4.7 MRV costs	123
4.8 Conclusion	127
4.9 MRV ID table	127
Bibliography	135
<b>Part II MRV of industrial sites and entities</b>	<b>137</b>
5 Trendsetter for companies and industrial sites: the EU Emissions Trading Scheme	139
GUILLAUME JACQUIER AND VALENTIN BELLASSEN	
5.1 Context	139
5.2 Monitoring	147
5.3 Reporting and verification	168

<i>Contents</i>	vii
5.4 MRV costs	173
5.5 MRV ID table	177
5.6 What practitioners say about it	183
Bibliography	187
 6 Variant 1: the waste sector in Australia's Carbon Pricing Mechanism, another ETS at site level	 190
MARION AFRIAT AND EMILIE ALBEROLA	
6.1 Context	190
6.2 The waste sector covered by the Carbon Pricing Mechanism	192
6.3 Monitoring the waste sector's GHG emissions	193
6.4 Reporting	204
6.5 Verification	206
6.6 Uncertainty related to waste emissions: is it an issue? Should it be reduced?	211
6.7 Conclusion	213
6.8 MRV ID table	214
Bibliography	219
 7 Variant 2: non-site level emissions in an ETS – the case of electricity importers in the California cap-and-trade	 221
MARION AFRIAT AND EMILIE ALBEROLA	
7.1 Context	221
7.2 Monitoring electricity importers under the GHG Inventory Program	225
7.3 Reporting: a separate report for imported electricity according to sources	239
7.4 Uncertainty in the Californian cap-and-trade program: the carbon leakage issue	248
7.5 Conclusion	254
7.6 MRV ID table	254
Bibliography	261
 8 Variant 3: emissions of a company/institution rather than a site: the case of the Shenzhen ETS	 263
CASPAR CHIQUET	
8.1 China's domestic emissions reduction policy	263
8.2 Shenzhen, China's first operating ETS pilot	268

viii	Contents
8.3	Capping direct and indirect emissions 270
8.4	MRV and compliance at company level 271
8.5	Intensity-based cap and allowances 272
8.6	Reporting, confidentiality and disclosure 276
8.7	Enforcement of compliance 276
8.8	MRV ID table 277
	Bibliography 282
9	Variant 4: coexistence of voluntary and mandatory frameworks at the company level – Carbon Disclosure Project, EU ETS and French legal requirements 283
	ROMAIN MOREL AND IAN COCHRAN
9.1	Introduction 283
9.2	French entities may be subject to up to four major mandatory or voluntary GHG emissions monitoring and reporting frameworks 284
9.3	MRV ID table 295
9.4	Four frameworks may be too many, even though they are flexible enough to be synergetic with one another 295
9.5	Balancing internal management needs and an increasing range of use for external GHG data 306
9.6	Conclusions: the diversity of reporting frameworks leads to higher costs, risks and opportunities 310
	Bibliography 311
10	Direct measurement in the EU ETS 313
	CHRIS DIMOPOULOS
10.1	Context 313
10.2	Direct measurement fundamentals 314
10.3	Direct measurement under the EU ETS 319
10.4	Uncertainty influencing parameters in mass emission measurement 326
10.5	Measurement vs. calculation 330
10.6	Conclusion: what method should be preferred? 334
	Appendix – Relevant international and European standards 335
	Bibliography 336

<i>Contents</i>	ix
<b>Part III MRV at offset project scale</b>	<b>339</b>
11 Trendsetter for projects: the Clean Development Mechanism	341
IGOR SHISHLOV	
11.1 Context	341
11.2 Monitoring	351
11.3 Reporting	361
11.4 Verification	364
11.5 What practitioners say about it	374
11.6 MRV ID table	376
Appendix – Transaction costs for CDM projects	385
Bibliography	387
12 Case study 1: monitoring requirements for projects reducing N <sub>2</sub> O emissions from fertilizer use across standards	390
CLAUDINE FOUCHEROT	
12.1 Context	390
12.2 Monitoring	392
12.3 Reporting	405
12.4 Verification	406
12.5 Conclusion	408
12.6 MRV ID table	408
Bibliography	421
13 Case study 2: monitoring requirements for reforestation and improved forest management projects across standards	423
MARIANA DEHEZA	
13.1 Context	423
13.2 Monitoring in the CDM for reforestation projects and VCS IFM projects	424
13.3 Reporting	447
13.4 Verification: what are auditors looking for?	447
13.5 Conclusion	451
13.6 MRV ID table	451
Appendix – Determination of monitoring uncertainty	451
Bibliography	465



x		<i>Contents</i>
14	Case study 3: monitoring requirements for fugitive emissions from fuels in the CDM	467
	ALEXANDRA BARKER AND RODERICK ROBINSON	
14.1	Fugitive emissions scale and scope	467
14.2	General principles of fugitive emission methodologies	469
14.3	CDM methodology AM0023	482
14.4	Cost of monitoring	486
14.5	Discussion	489
	Appendix	491
	Bibliography	505
15	Synthesis	510
	VALENTIN BELLASSEN, NICOLAS STEPHAN, MARION AFRIAT, EMILIE ALBEROLA, ALEXANDRA BARKER, JEAN-PIERRE CHANG, CASPAR CHIQUET, IAN COCHRAN, MARIANA DEHEZA, CHRIS DIMOPOULOS, CLAUDINE FOUCHEROT, GUILLAUME JACQUIER, ROMAIN MOREL, RODERICK ROBINSON AND IGOR SHISHLOV	
15.1	MRV requirements across schemes	510
15.2	Incentives to reduce monitoring uncertainty tend to be partial and indirect	515
15.3	MRV costs: large economies of scale	520
15.4	“Materiality” is commonly practiced but it does not outweigh economies of scale	528
15.5	Comparability often trumps information relevance	533
15.6	Staggering MRV vs. carbon pricing implementation	534
15.7	Conclusion	534
	Bibliography	536
	<i>Index</i>	538

## *Figures and map*

1.1 Uncertainty: accuracy and precision	<i>page 7</i>
2.1 Main and latest steps under the UNFCCC regarding MRV and reduction target	24
4.1 VCS JNR simplified crediting scenarios	105
5.1 The cap-and-trade principle	141
5.2 Authorized monitoring methodologies	151
5.3 Number of category A, B and C installations in 2012 (all countries)	158
5.4 Classification of source streams	159
5.5 Tier system for calculation-based approaches (combustion emissions)	159
5.6 Illustration of the principle of unreasonable costs	165
5.7 Risk assessment procedure	166
5.8 The different scenarios leading to update of the monitoring plan	167
5.9 The compliance cycle	169
5.10 Improvement based on verifier's recommendations	173
7.1 Electricity imports and exports from specified and unspecified sources among the e-tag market path	228
7.2 Direct delivered, specified, unspecified, imported and exported electricity under California's cap-and-trade	230
8.1 Energy intensity targets in recent 5-Year Plans. Base years are 2000, 2005 and 2010 respectively	264
8.2 Energy intensity 2001–2011 in tons Standard Coal Equivalent (SCE)	265
8.3 Organizational setup of the Shenzhen ETS	269
8.4 Allowance allocation versus carbon intensity	274
9.1 Ten most common Scope 3 categories (with emissions data) reported to CDP	292
10.1 Extractive CEMS typical configuration	315
10.2 Simple non-dispersive infra-red detector	317

10.3 Overview of EN 14181	325
10.4 Stack gas flow profiles	328
11.1 The CDM scheme	342
11.2 The CDM governance structure	344
11.3 The CDM legislation hierarchy	346
11.4 The CDM project cycle	347
11.5 Geographical and sectoral distribution of CER issuance as of July 2013	350
11.6 Procedure for approval of new methodologies	353
11.7 DOE accreditation procedure	371
12.1 Agricultural emissions and mitigation potential worldwide	391
12.2 Comparison between non-variable and variable EF to calculate N <sub>2</sub> O emissions reductions in the MSU-EPRI methodology	403
13.1 Field monitoring procedure	430
14.1 Progression of methods from Tier 1 to Tier 3 for the detection and quantification of fugitive emissions in the oil and gas industry	471
14.2 Five steps within a Leak Detection and Repair (LDAR) program	473
14.3 Leak measurement scenarios for IPCC Tier 3 bottom-up approach	476
14.4 Measurement of methane plumes using Differential Absorption Lidar (DIAL)	477
14.5 Two approaches to calculate baseline and project emissions in CDM methodology AM0023	484
15.1 Economies of scale in MRV	527
Map 8.1 The seven Chinese emissions trading pilot schemes	267

## Tables

1.1 MRV ID table	<i>page</i> 12
2.1 Example of a CRF table: 2013 summary table 2 for the EU 15	47
2.2 Subcategories for combustion activities in the Energy sector	52
2.3 MRV costs	60
2.4 MRV ID table	63
3.1 Selected tools and methodological frameworks	77
3.2 Principal data sources by inventory “level” categories	82
3.3 Cost of subnational GHG inventories	85
3.4 Example of disaggregated emissions sectors for local governance and decision-making	88
3.5 MRV ID table	91
4.1 Monitoring requirements and accounting approaches	107
4.2 Activities to be accounted for by jurisdictional REDD+ programs	109
4.3 VCS JNR monitoring requirements for activity data and emission factors	114
4.4 Deduction factor for uncertain estimates	116
4.5 Comparison between VCS JNR and UNFCCC requirements for MRVing REDD+	121
4.6 Literature review on monitoring costs for REDD+	124
4.7 MRV ID table	128
5.1 Activities covered by the EU ETS (summary of Annex I of the Directive)	148
5.2 Methodologies to be used for the different ETS activities (summary of Annex IV of the MRR)	152
5.3 Tier requirements for calculation-based approach	160
5.4 Tier requirements for measurement-based approach	160
5.5 Tiers for activity data of major source streams for combustion of fuels	162

5.6 Values allowed for calculation factors according to required tiers	163
5.7 Minimum frequency of analyses	164
5.8 Literature review on MRV costs in the EU ETS	174
5.9 MRV ID table	177
5.10 Relevant period of time taken into account for activity data for the calculation of free allocation for 2013–2020	183
6.1 Summary of methods for monitoring GHG emissions of waste sector in Australia	198
6.2 Default values of composition of solid waste	198
6.3 Default values of waste mix type of each waste stream	199
6.4 Aggregated uncertainty level by waste activities	203
6.5 MRV ID table	214
7.1 Registration calendar for power entities for 2014	231
7.2 The emission factors used for the different imported electricity sources	236
7.3 The calculation of the emission factor for specified facilities depending on their mandatory reporting regulation	240
7.4 Key dates for verification	246
7.5 The impact of meter monitoring error in the verification procedure	247
7.6 MRV costs of the MRR	249
7.7 The leakage according to the implementation or not of an electricity tariff and a ban on resource shuffling	253
7.8 MRV ID table	255
8.1 MRV ID table	278
9.1 MRV ID table	296
9.2 Third-party use of GHG quantification data	309
10.1 N <sub>2</sub> O emitting installations	320
10.2 Maximum permissible uncertainty for measurement-based methods	322
10.3 Direct measurement vs. calculation	331
11.1 Periodic monitoring costs in CDM projects	357
11.2 Comparison of monitoring approaches in the CDM and the EU ETS	361
11.3 Periodic verification costs in CDM projects	370
11.4 MRV ID table	376

<i>List of tables</i>	xv
11.5 Transaction costs for CDM projects	385
12.1 Approved methodologies for reduced N <sub>2</sub> O emissions from fertilizer use across standards	393
12.2 Amount of N from crop residues	396
12.3 Comparison between methodologies	399
12.4 Conservativeness factors and uncertainty deduction for N <sub>2</sub> O emissions reductions based upon uncertainty at 95% confidence level	403
12.5 MRV ID table	409
13.1 Active carbon accounting methodologies for reforestation (AR) and improved forest management (IFM) methodologies in the CDM and the VCS as of January 2014	425
13.2 Compulsory and optional accounting in reforestation and improved forest management projects	427
13.3 Description of three CDM reforestation projects and two VCS improved forest management projects	432
13.4 Trade-off between monitoring uncertainty and carbon revenues for CDM reforestation projects	435
13.5 Monitoring details of three CDM reforestation projects	438
13.6 Monitoring details of two VCS improved forest management projects	442
13.7 Monitoring cost of three CDM reforestation projects	445
13.8 Monitoring cost of three CDM and VCS reforestation projects	446
13.9 Specific validation requirements for CDM reforestation projects	448
13.10 MRV ID table	452
14.1 Advantages and disadvantages of direct vs. indirect methods used within the Tier 3 bottom-up approach	491
14.2 MRV ID table	492
14.3 Effects of CDM projects on fugitive emissions from fuels	499
14.4 Standards which address fugitive emissions	501
14.5 Advantages and disadvantages of equipment used in monitoring fugitive emissions	502
15.1 Verification requirements across carbon pricing mechanisms and management schemes	512

xvi	<i>List of tables</i>
15.2	Type of uncertainty requirements across carbon pricing mechanisms and management schemes 516
15.3	Incentives to reduce monitoring uncertainty across carbon pricing mechanisms and management schemes 521
15.4	MRV costs across carbon pricing mechanisms and management schemes 525
15.5	“Materiality” across carbon pricing mechanisms and management schemes 529

Boxes

3.1 The Covenant of Mayors	<i>page</i> 74
4.1 Uncertainty deduction	117
5.1 MRV for free allocation	182
8.1 Forced shutdowns under the 11th 5-Year Plan	265
8.2 Intensity-based allowances for a laptop manufacturer	275
9.1 Carbon Disclosure Standards Board’s Climate Change Reporting Framework	294



## Contributors

**Valentin Bellassen** has worked as a researcher for the Environmental Defense Fund and as an international negotiator on forests at the UNFCCC, in the delegation of Papua New Guinea. For four years, he worked at CDC Climat where he managed the research unit on carbon offsets, agriculture and forestry. He is currently a researcher at INRA where he focuses on the economics of agro-ecology. He is also an accredited UNFCCC reviewer for national greenhouse gas inventories. Valentin graduated from École Normale Supérieure (Ulm) and holds a PhD in Environmental Sciences.

**Nicolas Stephan** worked for five years in the research department of CDC Climat on various topics related to carbon and energy markets. He was editor in chief of *Tendances Carbone*, a monthly publication which focuses on CO<sub>2</sub> prices. He is currently working in the investment department of CDC Climat, in charge of voluntary carbon offsetting as well as participations in innovative carbon investment vehicles. He holds a Master's in Economics and Business Management from Pantheon-Sorbonne University and a Master's in International Business from Paris-Dauphine University.

**Marion Afriat** works at CDC Climat and she focuses her research on the development of carbon markets in the world and on recent developments made in national carbon and energy efficiency policies among twenty countries. Marion has a Master's degree in International Relations from Paris II Assas University and Paris IV Sorbonne University.

**Emilie Alberola** is a research unit manager – European climate policy at CDC Climat. Her research work deals mostly with an analysis of the development of the European Union Emissions Trading Scheme and its carbon prices. She teaches carbon market economics in the 'Energy, Finance and Carbon' Master's program at Paris-Dauphine University

and the ‘Energy and Finance’ Certificate at the HEC Paris business school. Emilie has a PhD in Economics from Pantheon-Sorbonne University and a Master’s degree in Sustainable Development Management from HEC.

**Alexandra Barker** is a research scientist at NPL and holds an MSc in Environmental Protection and Management from the University of Edinburgh and a BSc in Geography from the University of Southampton. She has extensive experience in remote environmental sensing techniques for carbon measurement and is also involved in research projects investigating metrology improvements in carbon offsetting programs. Alexandra is also working in close collaboration with NPL’s Centre for Carbon Measurement investigating forest carbon accounting.

**Jean-Pierre Chang** focuses on the coordination of national French emission inventories, greenhouse gases (for UNFCCC and Kyoto) and air pollutants (for UNECE). He was one of the architects of the European project “CORINAIR” which set the basis of the national air emission inventory systems for the Member States. He has a Postgraduate Diploma (DEA) in Chemistry–Physics from Paris VI – Pierre et Marie Curie University.

**Caspar Chiquet** is Head of Implementation for the Advisory Unit and manages the MRV practice of South Pole Carbon. He is responsible for monitoring and certifying emission reductions for 100+ installations throughout Greater China and providing consulting services in the field of monitoring, reporting and verification. He is an expert on IT questions and holds an MA from the University of Zürich in Chinese Studies and International Law and is business-fluent in Chinese.

**Ian Cochran** coordinates CDC Climat’s research on the integration of climate change and the low-carbon energy transition into investment and finance decision-making. Focusing on the financial flows and instruments contributing to reducing greenhouse gas emissions, this work analyzes the methods and metrics to redirect capital towards the development of a low-carbon society. Ian holds a PhD degree in Economics from Université Paris-Dauphine. He also holds a Master of Public Affairs (MPA) from Sciences-Po Paris and a Bachelor’s degree in Policy Studies from the Maxwell School-Syracuse University.

**Mariana Deheza** is a research fellow at CDC Climat. Mariana's fields of expertise include project mechanisms, in particular those linked to voluntary offsets and forestry projects. Before working for CDC Climat, Mariana worked for two years at the Bolivian Ministry of Development Planning on problems linked to the environment and the forestry industry. Mariana has a degree in Industrial Engineering from the Catholic University of La Paz in Bolivia, and an MSc in Environmental Economics from AgroParisTech-Ecole Polytechnique in Paris.

**Chris Dimopoulos** is a Higher Research Scientist at NPL and Team Leader in the Stack Emissions Environmental Measurement team. In addition to his role at NPL, Chris is a member of the CEN Committee for Air Quality TC 264. Chris holds an MSc in Environmental Engineering and Project Management from the University of Leeds and has over seven years of experience in all aspects of stack emission measurements including research and development of monitoring techniques. Chris is also involved in research investigating metrology improvements in GHG measurement.

**Claudine Foucherot** is a research fellow at CDC Climat and focuses her research on economic and political instruments to mitigate climate change in the agricultural sector. She is also in charge of the Climate and Agriculture Club, whose aim is to promote and share knowledge on technical and economic tools which can be used for climate change mitigation and adaptation in the agricultural sector. Trained as an agronomical engineer at AgroParisTech, Claudine has a Master's degree in the economics of sustainable development, energy and environment.

**Guillaume Jacquier** is a technical project manager at CITEPA. He is in charge of projects about the European Union Emissions Trading Scheme and gives training sessions on this subject. He also undertakes studies on air pollution in general, and emission inventories for the Ministry of Environment, subnational authorities or companies. Guillaume has a Master's degree in Energy, Combustion and Environment from the University of Orleans.

**Romain Morel** is a project manager at CDC Climat Research. He is in charge of analyzing policies and tools dedicated to the mobilization of public and private climate finance, including the monitoring of its

impact and its efficiency. His research also focuses on international climate negotiations. He holds an MSc in Engineering from ISAE-SUPAERO and an MSc in Energy Economics from the IFP School.

**Roderick Robinson** is Principal Research Scientist with over 20 years' experience at NPL. He is scientific lead for emissions monitoring at NPL including fugitive emissions measurement using DIAL (Differential Absorption Lidar). In addition to his role at NPL, Rod is Vice Chairman of the CEN Committee for Air Quality TC 264.

**Igor Shishlov** works at CDC Climat and his research focuses on carbon offset projects as well as on monitoring, verification and reporting (MRV) of greenhouse gas emissions. Igor has also been a PhD student at AgroParisTech since September 2012. His thesis focuses on the economics of monitoring ecosystem services on the example of carbon offset projects. Igor holds an MSc in Sustainable Development from HEC Paris and a Diploma in International Business from St. Petersburg State University.

## *Acknowledgements*

First and foremost, we would like to thank the sponsors of the MRV project, without whom this book would never have been written:

- Agence Française de Développement;
- EIT Climate-KIC;
- Ministère français de l'Agriculture, de l'Agroalimentaire et de la Forêt;
- Ministère français de l'Ecologie, du Développement Durable et de l'Energie;
- Union des Industries de la Fertilisation.

We are also grateful to Marco Loprieno (European Commission) and Massamba Thioye (UNFCCC) who accepted the invitation to discuss our findings at our MRV conference in June 2014. We also thank Xueman Wang and Pierre Guigon (Partnership for Market Readiness, The World Bank) for the useful connection provided with new carbon pricing mechanisms being developed in emerging economies.

Many more people contributed to this book through interviews, comments or reviews. Their contribution is acknowledged in the relevant chapters.