



## CONTENTS

<b>I. IN THE PRESS .....</b>	<b>3</b>
<b>II. MULTILATERAL PROCESSES IN CLIMATE CHANGE .....</b>	<b>4</b>
Bonn Climate Change Conference, 20-25 October 2014, Bonn, Germany .....	4
<b>III. EVENTS &amp; MEETINGS.....</b>	<b>4</b>
Future of Bioeconomy in Europe .....	4
Climate Summit 2014. Catalyzing Action .....	4
2nd International Conference on Evaluating Climate Change and Development.....	4
2014 Global Landscapes Forum .....	4
<b>IV. RESEARCH ARTICLES.....</b>	<b>5</b>
Estimation of carbon emission reductions by managing dry mixed deciduous forest: case study in Popa Mountain Park.....	5
Soil moisture dynamics in a mountainous headwater area in the discontinuous permafrost zone of northern Mongolia .....	5
Modeling forest dynamics along climate gradients in Bolivia .....	5
Linking variability in soil solution dissolved organic carbon to climate, soil type, and vegetation type .....	6
Net carbon uptake has increased through warming-induced changes in temperate forest phenology .....	6
Effects of spatial pattern of greenspace on urban cooling in a large metropolitan area of eastern China .....	7
Allocation of biomass resources for minimising energy system greenhouse gas emissions .....	7
Combined effects of defoliation and water stress on pine growth and non-structural carbohydrates .....	7
Managing temperate forests for carbon storage: impacts of logging versus forest protection on carbon stocks .....	8
Increased topsoil carbon stock across China's forests .....	8
Organic carbon stocks and sequestration rates of forest soils in Germany .....	9
Soil carbon stock change following afforestation in Northern Europe: a meta-analysis .....	9
Effects of alternative forest management on biomass and species diversity in the face of climate change in the northern Great Lakes region (USA) .....	9
Carbon storage of a tropical mangrove forest in Mui Ca Mau National Park, Vietnam .....	10
Temperature sensitivity of soil carbon mineralization and nitrous oxide emission in different ecosystems along a mountain wetland-forest ecotone in the continuous permafrost of Northeast China .....	10
Insect-induced tree mortality of boreal forests in eastern Canada under a changing climate .....	10
Estimating attributes of deciduous forest cover of a sanctuary in India utilizing Hyperion data and PLS analysis ...	11
The projected 21st century forest-fire risk in Finland under different greenhouse gas scenarios .....	11
A comparison of carbon stock estimates and projections for the northeastern United States .....	11
Sample-based estimation of greenhouse gas emissions from forests - a new approach to account for both sampling and model errors .....	12
Opportunity costs of carbon sequestration in a forest concession in central Africa.....	12
Tree species traits but not diversity mitigate stem breakage in a subtropical forest following a rare and extreme ice storm.....	12
A generic method for climate change impact analysis of tree species planting domains .....	13
Predicting impacts of climate change on the aboveground carbon sequestration rate of a temperate forest in northeastern China.....	13
Markedly divergent estimates of Amazon forest carbon density from ground plots and satellites.....	13
Tropical forest wood production: a cross-continental comparison.....	14
Increased water-use efficiency does not lead to enhanced tree growth under xeric and mesic conditions.....	14

Effects of temperature change and tree species composition on N <sub>2</sub> O and NO emissions in acidic forest soils of subtropical China.....	14
Forest summer albedo is sensitive to species and thinning: how should we account for this in Earth system models? .....	15
Impacts of climate change on economics of forestry and adaptation strategies in the southern United States.....	15
REDD+ and forest tenure security: concerns in Nepal's community forestry.....	15
Biophysical suitability, economic pressure and land-cover change: a global probabilistic approach and insights for REDD+.....	16
Is there more soil carbon under nitrogen-fixing trees than under non-nitrogen-fixing trees in mixed-species restoration plantings?.....	16
Ecological role and services of tropical mangrove ecosystems: a reassessment .....	16
Tree mortality in response to climate change induced drought across Beijing, China.....	17
Valuing albedo as an ecosystem service: implications for forest management .....	17
Institutional dimensions of the developing REDD+ process in Cameroon.....	17
REDD+ readiness process in Cameroon: an analysis of multi-stakeholder perspectives.....	18
REDD+ Readiness progress across countries: time for reconsideration .....	18
REDD+ projects and national-level Readiness processes: a case study from Kenya .....	19
<b>V. PUBLICATIONS, REPORTS AND OTHER MEDIA.....</b>	<b>19</b>
Training manual: Improving grassroots equity in the forests and climate change context.....	19
Assessing forest governance: A Practical Guide to Data Collection, Analysis, and Use .....	20
Incentive Contracts for Environmental Services and Their Potential in REDD .....	20
Climate Change and Rural Communities in the Greater Mekong Subregion: A Framework for Assessing Vulnerability and Adaptation Options .....	20
Sharing the Stage. State of the Voluntary Carbon Markets 2014. Executive Summary.....	20
Beyond reforestation: An assessment of Vietnam's REDD+ Readiness .....	21
Fifth Consolidated Annual Progress Report of the UN-REDD Programme Fund. Report of the Administrative Agent of the UN-REDD Programme Fund for the period 1 January - 31 December 2013. ....	21
<b>V.I JOBS.....</b>	<b>21</b>
Team Leader REDD+ Project in Southern Laos.....	21
REDD+ Technical Advisor (NFMS & RELs) (Myanmar).....	22
<b>VII. ANNOUNCEMENTS .....</b>	<b>22</b>
Forests are key to global sustainability .....	22
Tropical managed Forests Observatory .....	22
CIFOR new website.....	22
<b>CLIM-FO INFORMATION.....</b>	<b>23</b>

## I. IN THE PRESS

July 2014 - IISD

### [UNFF Provides Background Note on Proposed SDGs](#)

In a background note, the UN Forum on Forests (UNFF) reports that, "The agreement by the Open Working Group (OWG) on the proposed Sustainable Development Goals (SDGs) is a positive step forward towards an effective and stronger post 2015 development agenda and the post 2015 International Arrangement on Forests." Forests and their multiple functions are directly addressed under Proposed Goals 15 and 6.

July 2014 - REDD-Monitor

### [REDD in the news: 21-27 July 2014](#)

REDD-Monitor's weekly round up of the news on REDD, organised by date with short extracts.

30 June 2014 - IISD

### [June 14 Climate Finance Update](#)

During the months of May and June, the Global Environment Facility (GEF), the Asian Development Bank (ADB), the African Development Bank (AfDB), the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), the Climate Investment Funds (CIF) and the International Fund for Agricultural Development (IFAD) have reported on various climate finance activities and projects, or published reports or newsletters related to climate finance.

June 2014 - FAO

### [COFO 22. World Forest Week](#)

Forests provide many socioeconomic benefits, including food, energy and shelter: basic human needs. To sustain the products and services that help meet these and other needs, forests must be sustainably managed.

27 June 2014 - IISD

### [International Partnership on Mitigation and MRV Discusses INDCs](#)

The 14th informal meeting of the International Partnership for Mitigation and MRV provided a forum for an exchange of views on the goal, purpose and process of a consideration or analysis phase for intended nationally determined contributions (INDCs) to the 2015 agreement, as well as to obtain a common understanding of where things stand on the issue.

23 June 2014 - IISD

### [CPF Chair Supports Two Forest Targets in SDGs](#)

An ideal forests scenario for the Sustainable

Development Goals (SDGs) would include two forest-specific targets, according to Eduardo Rojas-Briales, chair of the 14-member Collaborative Partnership on Forests (CPF) and Assistant Deputy Director-General for Forestry, at the Food and Agriculture Organization of the UN (FAO), in an interview during World Forest Week. Forests are specifically referenced under Proposed Goal 15 in the 'Zero Draft' on the SDGs, which was released by the Co-Chairs of the Open Working Group (OWG) on the SDGs.

June 2014 - FAO

### [Putting people at the centre of forest policies](#)

Countries should put more policy emphasis on maintaining and enhancing the vital contributions of forests to livelihoods, food, health and energy, the UN Food and Agriculture Organization (FAO) said today. FAO's flagship publication The State of the World's Forests (SOFO), presented today at the opening of the 22nd Session of the FAO Committee on Forestry (COFO), shows that a significant proportion of the world population relies on forest products to meet basic needs for energy, shelter and some aspects of primary healthcare - often to a very high degree.

19 June 2014 - World Agroforestry Centre

### [REDD ready or not?](#)

To evaluate the international REDD framework and other processes that were supposed to improve people's livelihoods to encourage them not to deforest, the European Union joined with the World Agroforestry Centre and other partners from 2009 to 2012 in a project called Reducing Emissions from Deforestation and Degradation from Alternative Land Uses in the Rainforests of the Tropics (REDD-ALERT). This complemented work carried out with support from the Norwegian Climate and Forest Initiative and the Norwegian Agency for Development Cooperation for the Reducing Emissions from All Land Uses project with technical facilitation from the CGIAR Research Program on Forests, Trees and Agroforestry, which all in all provided extensive and in-depth data sets and analyses.

28 May 2014 - IISD

### [Forests Trends Releases 'State of the Voluntary Carbon Markets 2014'](#)

Forest Trends' Ecosystem Marketplace has released its 2014 round-up of where voluntary carbon markets stand globally. The report, titled 'Sharing the Stage: State of the Voluntary Carbon Markets 2014,' finds that while US\$379 million were invested in carbon offsets in 2013, this total fell short of 2012 levels by 26.7%, or US\$144 million. However, according to Forest Trends, many of these tons were still transacted, but under compliance regimes, rather than voluntarily.

## II. MULTILATERAL PROCESSES IN CLIMATE CHANGE

### **Bonn Climate Change Conference, 20-25 October 2014, Bonn, Germany**

The Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP) will hold the sixth part of its second session from 20-25 October 2014 in Bonn, Germany. Further information on the session will be made available in due course. [More](#)

## III. EVENTS & MEETINGS

### **Future of Bioeconomy in Europe**

*11 September 2014, Bilbao, Spain*

The European forest-based sector is going through the biggest structural changes in recent history. Many of these changes originate outside the sector itself, such as the need to transform societies towards more resource-efficient bioeconomy, the new economic role of Europe in globalized world, and impact of new technologies. In the seminar 'Future of Bioeconomy in Europe', the topic will be looked at from two perspectives: from outside and within the forest-based sector. The seminar organised in connection with the European Forest Institute's Annual Conference will bring together researchers and policy makers to Bilbao, the European Forest City 2014. Check out the latest. [More](#)

### **Climate Summit 2014. Catalyzing Action**

*23 September 2014, UN Headquarters, New York, United States of America*

The UN Secretary General's Climate Summit will be held in New York on 23 September 2014. The Summit will serve as a public platform for leaders at the highest level to (1) catalyze ambitious action on the ground to reduce emissions and strengthen climate resilience and (2) mobilize political will for an ambitious global agreement under the United Nations Framework Convention on Climate Change (UNFCCC) by 2015. "Action Areas", or bold multi-partner initiatives, are expected to be launched at the Summit. These initiatives were presented and discussed at the Abu Dhabi Ascent meeting held on 4-5 May 2014 (see <https://www.abudhabiascent2014.com/>) Among the initiatives to be launched is a Forest Action Area. This action area has two main thrusts: reducing deforestation and increasing forest restoration. These can make a key contribution to achievement of the goal of limiting global warming to 2o C. The Action Area promotes effective land-use policies implemented by countries, strong financial incentives created to reward emission reductions from tropical forests, sourcing of commodities from deforestation-free areas, and partnerships to achieve the Bonn Challenge of restoring 150 million hectares of degraded forest landscapes by 2020. [More](#)

### **2nd International Conference on Evaluating Climate Change and Development**

*4-6 November, 2014, Washington D.C., United States of America*

Scheduled for November 4-6, 2014 in Washington D.C., this 2nd International Conference will tackle the difficulties linked to the evaluation of climate change and development, described by many as a major 21st century evaluation challenge. Participants for the conference are expected to be drawn equally from the global South and North to take stock of existing tools and methods but also reflect on and share experiences on emerging approaches in order to improve the practice of climate change evaluation. Efforts will also be made towards identify new and innovative ways to create an enabling environment for the demand and use of climate change and development evaluation in order to improve policy making. [More](#)

### **2014 Global Landscapes Forum**

*6-7 December, 2014, Lima Peru*

The second Global Landscapes Forum will be held in Lima on the weekend in the middle of the 20th Conference of the Parties (COP20) to the UNFCCC. With this timing and location, this major event can draw on the presence in the city of world leaders, development experts and leading thinkers to create an influential space to position landscapes at the center of the emerging climate and development agreements. Countries are forging a successor to the Kyoto Protocol under the United Nations Framework Convention on Climate Change (UNFCCC) and, in parallel, designing a set of Sustainable Development Goals to replace the Millennium

Development Goals. Connecting these two processes and multifunctional landscapes is vital if we are to overcome the complex challenges common to everyone on the planet. The two-day event will take place at the Westin Lima Hotel and Convention Center, a 20-minute drive from the COP20 venue and in the only venue in Lima outside the COP with the capacity to support an event of this size and diversity. [More](#)

## IV. RESEARCH ARTICLES

### **Estimation of carbon emission reductions by managing dry mixed deciduous forest: case study in Popa Mountain Park**

Aye, Y. Y.; Pampasit, S.; Umponstira, C.; Thanacharoenchanaphas, K.; Sasaki, N

*Low Carbon Economy*; 2014. 5(2):80-93

Global efforts in mitigating climate change are increasingly important as more evidence of climate change impact is apparent. Reducing carbon emissions under the United Nations' reducing emissions from deforestation and forest degradation, conservation of carbon stocks, sustainable management of forests, and enhancement of forest carbon stocks (REDD+) have multiple implications for climate change mitigation and sustainable development. However, implementing REDD+ project requires understanding of the magnitude of emissions in the absence of project activities (baseline) and vice versa (projectline). This study attempted to estimate carbon emission reductions by reducing deforestation in dry mixed deciduous forests in Popa Mountain Park in Myanmar. Baseline deforestation was determined using the 1989-2005 forest cover data, while carbon stocks were derived from forest inventory data. Our results show that about 25% to 63% of forest area in the study site will be lost between 2013 and 2043 if no REDD+ project is implemented. Our study results suggest that managing 4220 ha of dry mixed deciduous forest in Popa Mountain Park could reduce emissions of about 104023.8-241991.0 t CO<sub>2</sub> over a 30-year project cycle or about 3467-8066 t CO<sub>2</sub> annually depending on deforestation rates. In terms of carbon revenues, the project would generate about US \$349503.3-\$846968.6 per 30 years or US \$11650.1-\$28232.3 annually depending on the assumption of carbon price. It is therefore important that carbon financing be made available to protect the forests in the Popa Mountain Park as well as other parts in Myanmar.

### **Soil moisture dynamics in a mountainous headwater area in the discontinuous permafrost zone of northern Mongolia**

Kopp, B. J.; Minderlein, S.; Menzel, L

*Arctic, Antarctic, and Alpine Research*; 2014. 46(2):459-470

Soil moisture has widely been identified as a key factor for vegetation distribution in semi-arid areas. In the forest-steppe ecotone of the Khentii Mountains in northern Mongolia, soil moisture is directly controlled by exposition, slope, the presence or absence of permafrost, and vegetation cover. This study investigates the distribution of soil moisture and highlights the effects of a recent wildfire on this fragile ecosystem. Steep southerly exposed slopes are permafrost free and covered with steppe vegetation. Here, relatively warm and dry soils prevail, and high drying rates were observed following precipitation events during the summer period. The less inclined northerly exposed slopes are covered with taiga and feature relatively cold and wet soils overlying permafrost. Following a wildfire, the mean thickness of the organic surface layer drastically decreased from 0.15 m in the pristine taiga to 0.03 m in a heavily burned forest. As vegetation removal directly reduced evapotranspiration, soils in the burned forest were significantly the wettest and soil drying was less pronounced. Simultaneously, permafrost degradation was enhanced due to a significant increase in soil temperature. Thus, the conversion of forest areas to steppe after wildfires appears to be a long-term and possibly irreversible process during the ongoing climatic trend.

### **Modeling forest dynamics along climate gradients in Bolivia**

Seiler, C.; Hutjes, R. W. A.; Kruijt, B.; Quispe, J.; Anez, S.; Arora, V. K.; Melton, J. R.; Hickler, T.; Kabat, P

*Journal of Geophysical Research: Biogeosciences*; 2014. 119(5):758-775

Dynamic vegetation models have been used to assess the resilience of tropical forests to climate change, but the global application of these modeling experiments often misrepresents carbon dynamics at a regional level, limiting the validity of future projections. Here a dynamic vegetation model (Lund Potsdam Jena General Ecosystem Simulator) was adapted to simulate present-day potential vegetation as a baseline for climate change impact assessments in the evergreen and deciduous forests of Bolivia. Results were compared to

biomass measurements (819 plots) and remote sensing data. Using regional parameter values for allometric relations, specific leaf area, wood density, and disturbance interval, a realistic transition from the evergreen Amazon to the deciduous dry forest was simulated. This transition coincided with threshold values for precipitation (1400 mm yr<sup>-1</sup>) and water deficit (i.e., potential evapotranspiration minus precipitation) (-830 mm yr<sup>-1</sup>), beyond which leaf abscission became a competitive advantage. Significant correlations were found between modeled and observed values of seasonal leaf abscission ( $R^2 = 0.6$ ,  $p < 0.001$ ) and vegetation carbon ( $R^2 = 0.31$ ,  $p < 0.01$ ). Modeled Gross Primary Productivity (GPP) and remotely sensed normalized difference vegetation index showed that dry forests were more sensitive to rainfall anomalies than wet forests. GPP was positively correlated to the El Niño-Southern Oscillation index in the Amazon and negatively correlated to consecutive dry days. Decreasing rainfall trends were simulated to reduce GPP in the Amazon. The current model setup provides a baseline for assessing the potential impacts of climate change in the transition zone from wet to dry tropical forests in Bolivia.

### **Linking variability in soil solution dissolved organic carbon to climate, soil type, and vegetation type**

Camino-Serrano, M.; Gielen, B.; Luysaert, S.; Ciais, P.; Vicca, S.; Guenet, B.; Vos, B. de; Cools, N.; Ahrens, B.; Arain, M. A.; Borken, W.; Clarke, N.; Clarkson, B.; Cummins, T.; Don, A.; Pannatier, E. G.; Laudon, H.; Moore, T.; Nieminen, T. M.; Nilsson, M. B.; Peichl, M.; Schwendenmann, L.; Siemens, J.; Janssens, I

*Global Biogeochemical Cycles*; 2014. 28(5):497-509

Lateral transport of carbon plays an important role in linking the carbon cycles of terrestrial and aquatic ecosystems. There is, however, a lack of information on the factors controlling one of the main C sources of this lateral flux, i.e., the concentration of dissolved organic carbon (DOC) in soil solution across large spatial scales and under different soil, vegetation, and climate conditions. We compiled a database on DOC in soil solution down to 80 cm and analyzed it with the aim, first, to quantify the differences in DOC concentrations among terrestrial ecosystems, climate zones, soil, and vegetation types at global scale and second, to identify potential determinants of the site-to-site variability of DOC concentration in soil solution across European broadleaved and coniferous forests. We found that DOC concentrations were 75% lower in mineral than in organic soil, and temperate sites showed higher DOC concentrations than boreal and tropical sites. The majority of the variation ( $R^2 = 0.67-0.99$ ) in DOC concentrations in mineral European forest soils correlates with NH<sub>4</sub><sup>+</sup>, C/N, Al, and Fe as the most important predictors. Overall, our results show that the magnitude (23% lower in broadleaved than in coniferous forests) and the controlling factors of DOC in soil solution differ between forest types, with site productivity being more important in broadleaved forests and water balance in coniferous stands.

### **Net carbon uptake has increased through warming-induced changes in temperate forest phenology**

Keenan, T. F.; Gray, J.; Friedl, M. A.; Toomey, M.; Bohrer, G.; Hollinger, D. Y.; Munger, J. W.; O'Keefe, J.; Schmid, H. P.; Wing, I. S.; Yang, B.; Richardson, A. D.;

*Nature Climate Change*; 2014. 4(7):598-604.

The timing of phenological events exerts a strong control over ecosystem function and leads to multiple feedbacks to the climate system. Phenology is inherently sensitive to temperature (although the exact sensitivity is disputed) and recent warming is reported to have led to earlier spring, later autumn and increased vegetation activity. Such greening could be expected to enhance ecosystem carbon uptake, although reports also suggest decreased uptake for boreal forests. Here we assess changes in phenology of temperate forests over the eastern US during the past two decades, and quantify the resulting changes in forest carbon storage. We combine long-term ground observations of phenology, satellite indices, and ecosystem-scale carbon dioxide flux measurements, along with 18 terrestrial biosphere models. We observe a strong trend of earlier spring and later autumn. In contrast to previous suggestions we show that carbon uptake through photosynthesis increased considerably more than carbon release through respiration for both an earlier spring and later autumn. The terrestrial biosphere models tested misrepresent the temperature sensitivity of phenology, and thus the effect on carbon uptake. Our analysis of the temperature-phenology-carbon coupling suggests a current and possible future enhancement of forest carbon uptake due to changes in phenology. This constitutes a negative feedback to climate change, and is serving to slow the rate of warming.

## **Effects of spatial pattern of greenspace on urban cooling in a large metropolitan area of eastern China**

Kong FanHua; Yin HaiWei; James, P.; Hutyra, L. R.; He, H. S

*Landscape and Urban Planning*; 2014. 128:35-47

Urban areas will experience the greatest increases in temperature resulting from climate change due to the urban heat island (UHI) effect. Urban greenspace mitigates the UHI and provides cooler microclimates. Field research has established that temperatures within parks or beneath trees can be cooler than in non-greenspaces, but little is known about the effects of the spatial pattern of greenspace on urban temperatures or the optimal spatial patterns needed to cool an urban environment. Here, urban cool islands (UCIs) and greenspace in Nanjing, China were identified from satellite data and the relationship between them analyzed using correlation analyses. The results indicate the following: (1) Areas with a higher percentage of forest-vegetation experience a greater cooling effect and a 10% increase in forest-vegetation area resulted in a decrease of about 0.83 degrees C in surface temperature; (2) A correlation analysis between mean patch size, patch density, and an aggregation index of forest vegetation with temperature reduction showed that for a fixed amount of forest vegetation, fragmented greenspaces also provide effective cooling; (3) The spatial pattern of UCIs was strongly correlated with greenspace patterns; a mainland-island greenspace spatial configuration provided an efficient means of enhancing the cooling effects; and (4) the intensity of the cooling effect was reflected in cool island characteristics. These findings will support better prediction of the effects of specific amounts and spatial arrangements of greenspace, helping city managers and planners mitigate increasing temperatures associated with climate change.

## **Allocation of biomass resources for minimising energy system greenhouse gas emissions**

Bentsen, N. S.; Jack, M. W.; Felby, C.; Thorsen, B. J

*Energy (Oxford)*; 2014. 69:506-515

The European Union (EU) energy policy has three targets: supply security, development of a competitive energy sector and environmental sustainability. The EU countries have issued so-called National Renewable Energy Action Plans (NREAP) for increased renewable energy generation. Biomass is stipulated to account for 56% of renewable energy generation by 2020, corresponding to an increase in bioenergy generation from  $2.4 \times 10^9$  GJ in 2005 to  $5.7 \times 10^9$  GJ in 2020. There is uncertainty about the amounts of biomass available in the EU, and import challenges policy targets on supply security and sustainability. We address issues about how, from a technical point of view, the EU may deploy its biomass resources to reduce greenhouse gas (GHG) emissions from energy consumption. We investigate if deployment patterns depend on resource availability and technological development. In situations with adequate biomass availability the analysis suggests that liquid fuel production should be based on agricultural residues. Electricity production should be based on forest residues and other woody biomass and heat production on forest and agricultural residues. Improved conversion technologies implicitly relax the strain on biomass resources and improve supply security.

## **Combined effects of defoliation and water stress on pine growth and non-structural carbohydrates**

Jacquet, J. S.; Bosc, A.; O'Grady, A.; Jactel, H

*Tree Physiology*; 2014. 34(4):367-376

Climate change is expected to increase both pest insect damage and the occurrence of severe drought. There is therefore a need to better understand the combined effects of biotic and abiotic damage on tree growth in order to predict the multi-factorial effect of climate change on forest ecosystem productivity. Indeed, the effect of stress interactions on tree growth is an increasingly important topic that greatly lacks experiments and data, and it is unlikely that the impact of combined stresses can be extrapolated from the outcomes of studies that focused on a single stress. We developed an original manipulative study under real field conditions where we applied artificial defoliation and induced water stress on 10-year-old (~10 m high) maritime pine trees (*Pinus pinaster* Ait.). Tree response to combined stresses was quantitatively assessed following tree secondary growth and carbohydrate pools. Such a design allowed us to address the crucial question of combined stresses on trees under stand conditions, sharing soil supplies with neighboring trees. Our initial hypotheses were that (i) moderate defoliation can limit the impact of water stress on tree growth through reduced transpiration demand by a tree canopy partly defoliated and that (ii) defoliation results in reduced non-structural carbohydrate (NSC) pools, affecting tree tolerance to drought. Our results showed additive effects of defoliation and water stress on tree growth and contradict our initial hypothesis. Indeed, under stand conditions, we found that partial defoliation does not limit the impact of water stress through reduced transpiration. Our study also highlighted that, even if NSC in all organs were affected by defoliation, tree response to water stress was not triggered. We found that stem NSC were maintained or increased during the entire growing season, supporting literature-based hypotheses such as an active maintenance of the hydraulic

system or another limiting resource for tree growth under defoliation. We also observed a significant decrease in root carbohydrates, which suggests a shift in the root carbon balance under defoliation. The decrease in carbohydrate supply under defoliation may not counterbalance the carbon use for mineral and water uptakes or a translocation to other tissues.

### **Managing temperate forests for carbon storage: impacts of logging versus forest protection on carbon stocks**

Keith, H.; Lindenmayer, D.; Mackey, B.; Blair, D.; Carter, L.; McBurney, L.; Okada, S.; Konishi-Nagano, T  
*Ecosphere*; 2014. 5(6):art75

Management of native forests offers opportunities to store more carbon in the land sector through two main activities. Emissions to the atmosphere can be avoided by ceasing logging. Removals of carbon dioxide from the atmosphere can be increased by allowing forests to continue growing. However, the relative benefits for carbon storage of managing native forests for wood production versus protection are contested. Additionally, the potential for carbon storage is impacted upon by disturbance events, such as wildfire, that alter the amount and longevity of carbon stocks. Using a case study of montane ash forests in southeastern Australia, we demonstrated that the total biomass carbon stock in logged forest was 55% of the stock in old growth forest. Total biomass included above- and belowground, living and dead. Biomass carbon stock was calculated spatially as an average across the landscape, accounting for variation in environmental conditions and forest age distribution. Reduction in carbon stock in logged forest was due to 66% of the initial biomass being made into products with short lifetimes (<3 years), and to the lower average age of logged forest (<50 years compared with >100 years in old growth forest). Only 4% of the initial carbon stock in the native forest was converted to sawn timber products with lifetimes of 30-90 years. Carbon stocks are depleted in a harvested forest system compared with an old growth forest, even when storage in wood products and landfill are included. We estimated that continued logging under current plans represented a loss of 5.56 Tg C over 5 years in the area logged (824 km<sup>2</sup>), compared with a potential gain of 5.18-6.05 TgC over 5 years by allowing continued growth across the montane ash forest region (2326 km<sup>2</sup>). Avoiding emissions by not logging native forests and allowing them to continue growing is therefore an important form of carbon sequestration. The mitigation value of forest management options of protection versus logging should be assessed in terms of the amount, longevity and resilience of the carbon stored in the forest, rather than the annual rate of carbon uptake.

### **Increased topsoil carbon stock across China's forests**

Yang YuanHe; Li Pin; Ding JinZhi; Zhao Xia; Ma WenHong; Ji ChengJun; Fang JingYun  
*Global Change Biology*; 2014. 20(8):2687-2696

Biomass carbon accumulation in forest ecosystems is a widespread phenomenon at both regional and global scales. However, as coupled carbon-climate models predicted, a positive feedback could be triggered if accelerated soil carbon decomposition offsets enhanced vegetation growth under a warming climate. It is thus crucial to reveal whether and how soil carbon stock in forest ecosystems has changed over recent decades. However, large-scale changes in soil carbon stock across forest ecosystems have not yet been carefully examined at both regional and global scales, which have been widely perceived as a big bottleneck in untangling carbon-climate feedback. Using newly developed database and sophisticated data mining approach, here we evaluated temporal changes in topsoil carbon stock across major forest ecosystem in China and analysed potential drivers in soil carbon dynamics over broad geographical scale. Our results indicated that topsoil carbon stock increased significantly within all of five major forest types during the period of 1980s-2000s, with an overall rate of 20.0 g C m<sup>-2</sup> yr<sup>-1</sup> (95% confidence interval, 14.1-25.5). The magnitude of soil carbon accumulation across coniferous forests and coniferous/broadleaved mixed forests exhibited meaningful increases with both mean annual temperature and precipitation. Moreover, soil carbon dynamics across these forest ecosystems were positively associated with clay content, with a larger amount of SOC accumulation occurring in fine-textured soils. In contrast, changes in soil carbon stock across broadleaved forests were insensitive to either climatic or edaphic variables. Overall, these results suggest that soil carbon accumulation does not counteract vegetation carbon sequestration across China's forest ecosystems. The combination of soil carbon accumulation and vegetation carbon sequestration triggers a negative feedback to climate warming, rather than a positive feedback predicted by coupled carbon-climate models.

## **Organic carbon stocks and sequestration rates of forest soils in Germany**

Gruneberg, E.; Ziche, D.; Wellbrock, N.  
*Global Change Biology*; 2014. 20(8):2644-2662.

The National Forest Soil Inventory (NFSI) provides the Greenhouse Gas Reporting in Germany with a quantitative assessment of organic carbon (C) stocks and changes in forest soils. Carbon stocks of the organic layer and the mineral topsoil (30 cm) were estimated on the basis of ca. 1.800 plots sampled from 1987 to 1992 and resampled from 2006 to 2008 on a nationwide grid of 8x8 km. Organic layer C stock estimates were attributed to surveyed forest stands and CORINE land cover data. Mineral soil C stock estimates were linked with the distribution of dominant soil types according to the Soil Map of Germany (1:1 000 000) and subsequently related to the forest area. It appears that the C pool of the organic layer was largely depending on tree species and parent material, whereas the C pool of the mineral soil varied among soil groups. We identified the organic layer C pool as stable although C was significantly sequestered under coniferous forest at lowland sites. The mineral soils, however, sequestered  $0.41 \text{ Mg C ha}^{-1} \text{ yr}^{-1}$ . Carbon pool changes were supposed to depend on stand age and forest transformation as well as an enhanced biomass input. Carbon stock changes were clearly attributed to parent material and soil groups as sandy soils sequestered higher amounts of C, whereas clayey and calcareous soils showed small gains and in some cases even losses of soil C. We further showed that the largest part of the overall sample variance was not explained by fine-earth stock variances, rather by the C concentrations variance. The applied uncertainty analyses in this study link the variability of strata with measurement errors. In accordance to other studies for Central Europe, the results showed that the applied method enabled a reliable nationwide quantification of the soil C pool development for a certain period.

## **Soil carbon stock change following afforestation in Northern Europe: a meta-analysis**

Barcena, T. G.; Kiaer, L. P.; Vesterdal, L.; Stefansdottir, H. M.; Gundersen, P.; Sigurdsson, B. D  
*Global Change Biology*; 2014. 20(8):2393-2405

Northern Europe supports large soil organic carbon (SOC) pools and has been subjected to high frequency of land-use changes during the past decades. However, this region has not been well represented in previous large-scale syntheses of land-use change effects on SOC, especially regarding effects of afforestation. Therefore, we conducted a meta-analysis of SOC stock change following afforestation in Northern Europe. Response ratios were calculated for forest floors and mineral soils (0-10 cm and 0-20/30 cm layers) based on paired control (former land use) and afforested plots. We analyzed the influence of forest age, former land-use, forest type, and soil textural class. Three major improvements were incorporated in the meta-analysis: analysis of major interaction groups, evaluation of the influence of nonindependence between samples according to study design, and mass correction. Former land use was a major factor contributing to changes in SOC after afforestation. In former croplands, SOC change differed between soil layers and was significantly positive (20%) in the 0-10 cm layer. Afforestation of former grasslands had a small negative (nonsignificant) effect indicating limited SOC change following this land-use change within the region. Forest floors enhanced the positive effects of afforestation on SOC, especially with conifers. Meta-estimates calculated for the periods <30 years and >30 years since afforestation revealed a shift from initial loss to later gain of SOC. The interaction group analysis indicated that meta-estimates in former land-use, forest type, and soil textural class alone were either offset or enhanced when confounding effects among variable classes were considered. Furthermore, effect sizes were slightly overestimated if sample dependence was not accounted for and if no mass correction was performed. We conclude that significant SOC sequestration in Northern Europe occurs after afforestation of croplands and not grasslands, and changes are small within a 30-year perspective.

## **Effects of alternative forest management on biomass and species diversity in the face of climate change in the northern Great Lakes region (USA)**

Duveneck, M. J.; Scheller, R. M.; White, M. A.  
*Canadian Journal of Forest Research*; 2014. 44(7):700-710

Northern Great Lakes forests represent an ecotone in the boreal-temperate transition zone and are expected to change dramatically with climate change. Managers are increasingly seeking adaptation strategies to manage these forests. We explored the efficacy of two alternative management scenarios compared with business-as-usual (BAU) management: expanding forest reserves meant to preserve forest identity and increase resistance, and modified silviculture meant to preserve forest function and increase adaptive capacity. Our study landscapes encompassed northeastern Minnesota and northern Lower Michigan, which are predicted to experience significant changes in a future climate and represent a gradient of latitude, forest type, and management. We used the LANDIS-II forest simulation model to simulate forest change under current climate, low emissions climate, and high emissions climate futures. Our results suggest that under a low emissions climate scenario, expanded reserves and modified silviculture strategies can be effective at increasing resistance by preserving forest composition, including legacy species (e.g., balsam fir (*Abies balsamea* (L.)

Mill.)), and increasing adaptive capacity by maintaining or increasing aboveground biomass compared with BAU management. Under a high emissions climate scenario, the expanded reserve strategy was not effective at preserving legacy species; however, the modified silviculture strategy was effective at increasing aboveground biomass compared with BAU management. These results highlight alternative management options and limitations in the face of climate change.

### **Carbon storage of a tropical mangrove forest in Mui Ca Mau National Park, Vietnam**

Tue, N. T.; Dung, L. V.; Mai Trong Nhuan; Omori, K

*Catena*; 2014. 121:119-126

Mangrove forests constitute the most important sink of carbon (C) in the tropics, the conservation of which is an essential mean in offsetting C emissions and climate change. Mangrove forests are therefore suggested to be an important component of reducing emissions from deforestation and degradation (REDD +) schemes, which require scrupulous quantification of ecosystem C storage in order to monitor temporal C sequestration and emissions. Despite this, proportionally less is known about ecosystem C storage of mangrove forests in Vietnam, where these systems constitute a large proportion of its coastline. In this study, ecosystem C storage of a tropical mangrove forest in Mui Ca Mau National Park, Vietnam (CMNP) was quantified by measuring biomass of trees, roots, and downed woody debris, and sediment organic C and overall depth. Results showed that above- and below-ground C stock ranged from  $90.2 \pm 15.8$  to  $115.2 \pm 19.3$  and from  $629.0 \pm 32.5$  to  $687.0 \pm 29.2$  MgC ha<sup>-1</sup>, respectively. The combination of the above- and below-ground C stocks resulted in a high ecosystem C storage, which ranged from  $719.2 \pm 38.0$  to  $802.1 \pm 12.3$  MgC ha<sup>-1</sup>, and slightly increased from fringe toward interior forest. The 13,400 ha of mangrove forests in the CMNP were estimated to store  $10.3 (\pm 0.8) \times 10^6$  Mg of C, which is equivalent to  $38.0 (\pm 3.0) \times 10^6$  Mg of CO<sub>2</sub>e. The present results suggest that the conservation of mangrove forest is needed to increase ecosystem C storage and to offset C emissions at the regional scale.

### **Temperature sensitivity of soil carbon mineralization and nitrous oxide emission in different ecosystems along a mountain wetland-forest ecotone in the continuous permafrost of Northeast China**

Wang JiaoYue; Song ChangChun; Zhang Jing; Wang LiLi; Zhu XiaoYan; Shi FuXi

*Catena*; 2014. 121:110-118

Soil organic matter decomposition under global warming has a potential to alter soil carbon and nitrogen storages in permafrost. The objectives of this study were to investigate the temperature sensitivity of greenhouse gas emissions from soil samples along a mountain wetland-forest ecotone in the continuous permafrost and determine its influencing mechanisms. The CO<sub>2</sub>, N<sub>2</sub>O and carbon, nitrogen substrates were measured at 5, 15 and 25 °C. The relation between greenhouse gas emission rates and temperature depended on substrate quality in the three ecosystems. Soil DOC, MBC, NH<sub>4</sub><sup>+</sup> and NO<sub>3</sub><sup>-</sup> concentrations determined the higher CO<sub>2</sub> and N<sub>2</sub>O emission rates in the thicket peatland and the surface soil layer. During the incubation period, the degrees of soil carbon and nitrogen losses in the thicket peatland were 0.6–4.7% and 1.0–14.3 (1000 × %), approximately 1.6 and 1.2 times higher than those in the forest and fen, respectively. The highest degrees of soil carbon and nitrogen losses in the thicket peatland indicated that more greenhouse gases would emit from soils when permafrost degradation induced the succession from wetlands or forest to the wetland-forest ecotone. Although the gas emission rates presented significant differences in the three ecosystems, the Q<sub>10</sub> values with 2.0 to 2.2 for CO<sub>2</sub> and 2.4 to 3.0 for N<sub>2</sub>O, did not change significantly, indicating that the temperature sensitivity of gas emissions would not fluctuate much in the ecosystems along the mountain wetland-forest ecotone. However, the higher Q<sub>10</sub> values in the deeper soil layer in our study indicated that the decomposition of soil C and N in the deeper active layer of the permafrost region is more impressionable to global warming. As laboratory results could not actually reflect the situation in the field, more field work about temperature sensitivity of soil organic matter decomposition in different ecosystems should be encouraged in the future.

### **Insect-induced tree mortality of boreal forests in eastern Canada under a changing climate**

Zhang XiongQing; Lei YuanCai; Ma ZhiHai; Kneeshaw, D.; Peng ChangHui

*Ecology and Evolution*; 2014. 4(12):2384-2394

Forest insects are major disturbances that induce tree mortality in eastern coniferous (or fir-spruce) forests in eastern North America. The spruce budworm (SBW) (*Choristoneura fumiferana* [Clemens]) is the most devastating insect causing tree mortality. However, the relative importance of insect-caused mortality versus tree mortality caused by other agents and how this relationship will change with climate change is not known.

Based on permanent sample plots across eastern Canada, we combined a logistic model with a negative model to estimate tree mortality. The results showed that tree mortality increased mainly due to forest insects. The mean difference in annual tree mortality between plots disturbed by insects and those without insect disturbance was 0.0680 per year ( $P < 0.0001$ , T-test), and the carbon sink loss was about 2.87t C ha<sup>-1</sup> year<sup>-1</sup> larger than in natural forests. We also found that annual tree mortality increased significantly with the annual climate moisture index (CMI) and decreased significantly with annual minimum temperature (Tmin), annual mean temperature (Tmean) and the number of degree days below 0°C (DD0), which was inconsistent with previous studies (Adams et al. 2009; van Mantgem et al. 2009; Allen et al. 2010). Furthermore, the results for the trends in the magnitude of forest insect outbreaks were consistent with those of climate factors for annual tree mortality. Our results demonstrate that forest insects are the dominant cause of the tree mortality in eastern Canada but that tree mortality induced by insect outbreaks will decrease in eastern Canada under warming climate.

### **Estimating attributes of deciduous forest cover of a sanctuary in India utilizing Hyperion data and PLS analysis**

Dhaval Vyas; Krishnayya, N. S. R

*International Journal of Remote Sensing; 2014. 35(9):3197-3218*

Continuous and comprehensive evaluation of biochemical and biophysical attributes of forest ecosystems is a key aspect for monitoring their health status in the current global change scenario. Traditional methods of monitoring forest cover such as inventorying are time consuming, cost intensive, and untimely in delivering the output. The present study was carried out to monitor three important deciduous forest covers of India (teak, bamboo, and mixed), utilizing Hyperion (EO1) data of two seasons and partial least squares regression analysis. Attributes measured were canopy chlorophyll, nitrogen, cellulose, lignin, and biomass of tree trunks. Measured attributes showed a wider range, indicating variation in the growth phase of the covers. PLS models developed in this study showed higher  $R^2$  values (0.63-0.90 for chlorophyll and nitrogen, 0.52-0.80 for cellulose and lignin, 0.80-0.86 for bole biomass). From the spectral data analysis we conclude that PLS regression with selected bands is better for the computation of specific biochemical parameters. For parameters such as bole biomass, reflectance spectra of 165 bands worked better. Developed models are advantageous for monitoring two important tropical covers (teak and bamboo) by utilizing space-borne data. A PLS model developed for teak-cover biomass worked well with mixed species cover (tested as an independent data set), indicating the applicability of the model across similar tropical covers.

### **The projected 21st century forest-fire risk in Finland under different greenhouse gas scenarios**

Lehtonen, I.; Ruosteenoja, K.; Venalainen, A.; Gregow, H

*Boreal Environment Research; 2014. 19(2):127-139*

We evaluated forest fire potential at four locations in Finland in the current climate and in projected future climates under the B1, A1B and A2 greenhouse-gas (GHG) emission scenarios. In evaluating the forest fire danger potential, the Canadian fire weather index (FWI) system was used. Using the results of the earlier experimental ignition studies, we further estimated the number of fire danger days in different forest stands typical to the northern boreal zone. By the end of the current century, the annual median number of days with elevated forest fire risk is projected to increase by 10%-40%, depending on the GHG scenario. In different forest stands, approximately 5-10 additional fire risk days were found annually based on the A1B and A2 scenarios. Substantially smaller changes are projected under the low-emission B1 scenario. However, there is great inter-annual variability in the forest fire potential which, in the nearest future, largely overwhelms the projected change.

### **A comparison of carbon stock estimates and projections for the northeastern United States**

MacLean, R. G.; Ducey, M. J.; Hoover, C. M

*Forest Science; 2014. 60(2):206-213*

We conducted a comparison of carbon stock estimates produced by three different methods using regional data from the USDA Forest Service Forest Inventory and Analysis (FIA). Two methods incorporated by the Forest Vegetation Simulator (FVS) were compared to each other and to the current FIA component ratio method. We also examined the uncalibrated performance of FVS growth simulations for predicting net carbon accumulation in live trees. In general, the three carbon stock estimation approaches do not produce estimates that are either equivalent or are simply convertible. A strong spatial pattern of relationships between estimates was associated with regional variation in stand top height. Uncalibrated growth projections gave downwardly biased results that were also poorly correlated with observed carbon accumulation rates, yielding little improvement in root mean square error over the use of a simple regional average. These results reinforce the need for managers and scientists to be careful in choosing methods and reporting carbon stock estimates and to use appropriate model calibration methods in projecting future carbon accumulation.

## **Sample-based estimation of greenhouse gas emissions from forests - a new approach to account for both sampling and model errors**

Stahl, G.; Heikkinen, J.; Petersson, H.; Repola, J.; Holm, S  
*Forest Science*; 2014. 60(1):3-13.

The Good Practice Guidance (GPG) for reporting emissions and removals of greenhouse gases from the land use, land-use change, and forestry (LULUCF) sector of the United Nation's Framework Convention on Climate Change states that uncertainty estimates should always accompany the estimates of net emissions. Two basic procedures are suggested: simple error propagation and Monte-Carlo simulation. In this article, we argue that these methods are not very well-suited for uncertainty assessments in connection with sample-based surveys such as national forest inventories (NFIs), which provide a majority of the data for the LULUCF sector reporting in several countries. We suggest that a more straightforward approach would be to use standard sampling theory for assessing the sampling errors; however, it may be important to also include the error contribution from biomass and other models that are applied and this requires new methods for the variance estimation. In this article, a method for sample-based uncertainty assessment, including both model and sampling errors, is developed and applied using data from the NFIs of Finland and Sweden. The study revealed that the model error contribution to the combined sampling-model mean square error of ratio estimators of mean aboveground biomass on forestland amounted to about 10% in both countries. In estimating 5-year change of the corresponding biomass stocks, using permanent sampling units, the model error contribution was reduced to less than 1%. The smaller impact in the case of change estimation is due to the fact that any tendency of models to either over- or underestimate due to random parameter estimation errors will be the same both at the beginning and the end of a study period. The fairly small model error contributions in our study are due to the large number of sample trees used in the fitting of biomass models in Finland and Sweden; with less sample trees the model error contributions could be expected to be substantial. The proposed framework applies not only to greenhouse gas inventories but also to traditional NFI estimates of, e.g., growing stock in which uncertainties due to model errors typically are neglected in applications.

## **Opportunity costs of carbon sequestration in a forest concession in central Africa**

Ndjondo, M.; Gourlet-Fleury, S.; Manlay, R. J.; Obiang, N. L. E.; Ngomanda, A.; Romero, C.; Claeys, F.; Picard, N

*Carbon Balance and Management*; 2014. 9(4):(3 July 2014)

Background: A large proportion of the tropical rain forests of central Africa undergo periodic selective logging for timber harvesting. The REDD+ mechanism could promote less intensive logging if revenue from the additional carbon stored in the forest compensates financially for the reduced timber yield. Results: Carbon stocks, and timber yields, and their associated values, were predicted at the scale of a forest concession in Gabon over a project scenario of 40 yr with reduced logging intensity. Considering that the timber contribution margin (i.e. the selling price of timber minus its production costs) varies between 10 and US\$40 m<sup>-3</sup>, the minimum price of carbon that enables carbon revenues to compensate forgone timber benefits ranges between US\$4.4 and US\$25.9/tCO<sub>2</sub> depending on the management scenario implemented. Conclusions: Where multiple suppliers of emission reductions compete in a REDD+ carbon market, tropical timber companies are likely to change their management practices only if very favourable conditions are met, namely if the timber contribution margin remains low enough and if alternative management practices and associated incentives are appropriately chosen.

## **Tree species traits but not diversity mitigate stem breakage in a subtropical forest following a rare and extreme ice storm**

Nadrowski, K.; Pietsch, K.; Baruffol, M.; Both, S.; Gutknecht, J.; Bruelheide, H.; Heklau, H.; Kahl, A.; Kahl, T.; Niklaus, P.; Krober, W.; Liu XiaoJuan; Mi XiangCheng; Michalski, S.; Oheimb, G. von; Purschke, O.; Schmid, B.; Fang Teng; Welk, E.; Wirth, C  
*PLoS ONE*; 2014. 9(5):e96022

Future climates are likely to include extreme events, which in turn have great impacts on ecological systems. In this study, we investigated possible effects that could mitigate stem breakage caused by a rare and extreme ice storm in a Chinese subtropical forest across a gradient of forest diversity. We used Bayesian modeling to correct stem breakage for tree size and variance components analysis to quantify the influence of taxon, leaf and wood functional traits, and stand level properties on the probability of stem breakage. We show that the taxon explained four times more variance in individual stem breakage than did stand level properties; trees with higher specific leaf area (SLA) were less susceptible to breakage. However, a large part of the variation at the taxon scale remained unexplained, implying that unmeasured or undefined traits could be used to predict damage caused by ice storms. When aggregated at the plot level, functional diversity and wood density increased after the ice storm. We suggest that for the adaptation of forest management to climate change, much can still be learned from looking at functional traits at the taxon level.

## **A generic method for climate change impact analysis of tree species planting domains**

Booth, T.H., Jovanovic, T., Harwood, C.E  
*New Forests* (2014) 45:507-522

A trial application is described, largely using freely available datasets, for the preliminary assessment of climate change impacts on planting domains of key plantation species. The example study examines how climate change may affect locations in parts of South East Asia and southern China suitable for growing *Acacia mangium*, *A. auriculiformis* and *A. crassicarpa*. Simple descriptions of their climatic requirements are checked and, where necessary, refined. Climate data for current conditions as well as projected conditions in 2030, 2050 and 2080 are then used to map areas at a 10 min (about 18 km) resolution that are likely to have suitable climatic conditions for growing the species. Assuming a “business as usual” climate change scenario, climate change impacts are expected to be low in 2030, but likely to become medium by 2050 and high by 2080 as existing plantation sites increasingly fall outside the range of conditions known to be climatically suitable. Assessing likely impacts can help to identify plantations that are potentially most at risk, where performance should be carefully monitored to pick up early signs of any problems. The vulnerability of *Acacia* plantations of the three target species across the region is considered briefly in terms of the impacts of climate change and the ability of managers to adapt plantations to changing conditions.

## **Predicting impacts of climate change on the aboveground carbon sequestration rate of a temperate forest in northeastern China**

Ma Jun; Hu YuanMan; Bu RenCang; Chang Yu; Deng HuaWei; Qin Qin  
*PLoS ONE*; 2014. 9(4):e96157

The aboveground carbon sequestration rate (ACSR) reflects the influence of climate change on forest dynamics. To reveal the long-term effects of climate change on forest succession and carbon sequestration, a forest landscape succession and disturbance model (LANDIS Pro7.0) was used to simulate the ACSR of a temperate forest at the community and species levels in northeastern China based on both current and predicted climatic data. On the community level, the ACSR of mixed Korean pine hardwood forests and mixed larch hardwood forests, fluctuated during the entire simulation, while a large decline of ACSR emerged in interim of simulation in spruce-fir forest and aspen-white birch forests, respectively. On the species level, the ACSR of all conifers declined greatly around 2070s except for Korean pine. The ACSR of dominant hardwoods in the Lesser Khingan Mountains area, such as Manchurian ash, Amur cork, black elm, and ribbed birch fluctuated with broad ranges, respectively. Pioneer species experienced a sharp decline around 2080s, and they would finally disappear in the simulation. The differences of the ACSR among various climates were mainly identified in mixed Korean pine hardwood forests, in all conifers, and in a few hardwoods in the last quarter of simulation. These results indicate that climate warming can influence the ACSR in the Lesser Khingan Mountains area, and the largest impact commonly emerged in the A2 scenario. The ACSR of coniferous species experienced higher impact by climate change than that of deciduous species.

## **Markedly divergent estimates of Amazon forest carbon density from ground plots and satellites**

Mitchard, E.T.A., Feldpausch, T.R., Lopez-Gonzalez, G., Brienen, R.J.W., Malhi, Y., Lewis, S.L., Baker, T.R., Lloyd, J., Quesada, C.A., Meir, P., Alvarez, E.V., Amaral, I., Arroyo, L., Banki, O., Bonal, D., Brown, S., Cerón, C., Chave, J., Cogollo, A., Comisky, J.M., Cornejo\_Valverde, F., Cruz, A.P., Cuenca, W.P., da\_Costa, L., di\_Fiore, A., Domingues, T., Espejo, J.E., Ferreira, L., Frye, P.N., Higuchi, N., Honorio, E., Jimenez, E.M., Killeen, T., Laurance, B., Marimon, B., Marimon\_Junior, B.H., Martinez, R., Monteagudo, A., Mora, M., Murakami, A.A., Neill, D., Pacheco, M., Pitman, N., Polo, I.C.G., Prieto, A., Ramirez-Angulo, H., Solomon, R.P., Silva, N., Silveira, M., Sussman, D., ter\_Steege, H., Terborgh, J., Thomas, R.P., Toledo, M.C.P., Torre, E., van der Heijden, G.C., Vargas, P., Vieira, I., Wang, O., & Phillips, O.L.

*Global Ecology and Biogeography*, (*Global Ecol. Biogeogr.*) (2014): DOI: 10.1111/geb.12168

**Aim** The accurate mapping of forest carbon stocks is essential for understanding the global carbon cycle, for assessing emissions from deforestation, and for rational land-use planning. Remote sensing (RS) is currently the key tool for this purpose, but RS does not estimate vegetation biomass directly, and thus may miss significant spatial variations in forest structure. We test the stated accuracy of pantropical carbon maps using a large independent field dataset. Location Tropical forests of the Amazon basin. The permanent archive of the field plot data can be accessed at: <http://dx.doi.org/10.5521/FORESTPLOTS.NET/> 2014\_1 **Methods** Two recent pantropical RS maps of vegetation carbon are compared to a unique ground-plot dataset, involving tree measurements in 413 large inventory plots located in nine countries. The RS maps were compared directly to field plots, and kriging of the field data was used to allow area-based comparisons. **Results** The two RS carbon maps fail to capture the main gradient in Amazon forest carbon detected using 413 ground plots, from the densely wooded tall forests of the north-east, to the light-wooded, shorter forests of the south-west. The differences between plots and RS maps far exceed the uncertainties given in these studies, with whole regions over- or under-estimated by > 25%, whereas regional uncertainties for the maps were reported to be < 5%.

**Main conclusions** Pantropical biomass maps are widely used by governments and by projects aiming to reduce deforestation using carbon offsets, but may have significant regional biases. Carbon-mapping techniques must be revised to account for the known ecological variation in tree wood density and allometry to create maps suitable for carbon accounting. The use of single relationships between tree canopy height and above-ground biomass inevitably yields large, spatially correlated errors. This presents a significant challenge to both the forest conservation and remote sensing communities, because neither wood density nor species assemblages can be reliably mapped from space.

### **Tropical forest wood production: a cross-continental comparison**

Banin, L., Lewis, S. L., Lopez-Gonzalez, G., Baker, T. R., Quesada, C. A., Chao, K.-J., Burslem, D. F. R. P., Nilus, R., Abu Salim, K., Keeling, H. C., Tan, S., Davies, S. J., Monteagudo Mendoza, A., Vásquez, R., Lloyd, J., Neill, D. A., Pitman, N., Phillips, O. L.

*Journal of Ecology*; doi: 10.1111/1365-2745.12263

1. Tropical forest above-ground wood production (AGWP) varies substantially along environmental gradients. Some evidence suggests that AGWP may vary between regions and specifically that Asian forests have particularly high AGWP. However, comparisons across biogeographic regions using standardized methods are lacking, limiting our assessment of pan-tropical variation in AGWP and potential causes.
2. We sampled AGWP in NW Amazon (17 long-term forest plots) and N Borneo (11 plots), both with abundant year-round precipitation. Within each region, forests growing on a broad range of edaphic conditions were sampled using standardized soil and forest measurement techniques.
3. Plot-level AGWP was 49% greater in Borneo than in Amazonia ( $9.73 \pm 0.56$  vs.  $6.53 \pm 0.34$  Mg dry mass ha<sup>-1</sup> a<sup>-1</sup>, respectively; regional mean  $\pm 1$  SE). AGWP was positively associated with soil fertility (PCA axes, sum of bases and total P). After controlling for the edaphic environment, AGWP remained significantly higher in Bornean plots. Differences in AGWP were largely attributable to differing height-diameter allometry in the two regions and the abundance of large trees in Borneo. This may be explained, in part, by the greater solar radiation in Borneo compared with NW Amazonia.
4. Trees belonging to the dominant SE Asian family, Dipterocarpaceae, gained woody biomass faster than otherwise equivalent, neighbouring non-dipterocarps, implying that the exceptional production of Bornean forests may be driven by floristic elements. This dominant SE Asian family may partition biomass differently or be more efficient at harvesting resources and in converting them to woody biomass.
5. Synthesis. N Bornean forests have much greater AGWP rates than those in NW Amazon when soil conditions and rainfall are controlled for. Greater resource availability and the highly productive dipterocarps may, in combination, explain why Asian forests produce wood half as fast again as comparable forests in the Amazon. Our results also suggest that taxonomic groups differ in their fundamental ability to capture carbon and that different tropical regions may therefore have different carbon uptake capacities due to biogeographic history.

### **Increased water-use efficiency does not lead to enhanced tree growth under xeric and mesic conditions**

Levesque, M.; Siegwolf, R.; Saurer, M.; Eilmann, B.; Rigling, A

*New Phytologist*; 2014. 203(1):94-109

Higher atmospheric CO<sub>2</sub> concentrations (ca) can under certain conditions increase tree growth by enhancing photosynthesis, resulting in an increase of intrinsic water-use efficiency (iWUE) in trees. However, the magnitude of these effects and their interactions with changing climatic conditions are still poorly understood under xeric and mesic conditions. We combined radial growth analysis with intra- and interannual δ<sup>13</sup>C and δ<sup>18</sup>O measurements to investigate growth and physiological responses of *Larix decidua*, *Picea abies*, *Pinus sylvestris*, *Pinus nigra* and *Pseudotsuga menziesii* in relation to rising ca and changing climate at a xeric site in the dry inner Alps and at a mesic site in the Swiss lowlands. iWUE increased significantly over the last 50 yr by 8-29% and varied depending on species, site water availability, and seasons. Regardless of species and increased iWUE, radial growth has significantly declined under xeric conditions, whereas growth has not increased as expected under mesic conditions. Overall, drought-induced stomatal closure has reduced transpiration at the cost of reduced carbon uptake and growth. Our results indicate that, even under mesic conditions, the temperature-induced drought stress has overridden the potential CO<sub>2</sub> 'fertilization' on tree growth, hence challenging today's predictions of improved forest productivity of temperate forests.

### **Effects of temperature change and tree species composition on N<sub>2</sub>O and NO emissions in acidic forest soils of subtropical China**

Cheng Yi; Wang Jing; Wang ShenQiang; Cai ZuCong; Wang Lei

*Journal of Environmental Sciences*; 2014. 26(3):617-625

Tree species and temperature change arising from seasonal variation or global warming are two important factors influencing N<sub>2</sub>O and NO emissions from forest soils. However, few studies have examined the effects of temperatures (5-35 °C) on the emissions of forest soil N<sub>2</sub>O and NO in typical subtropical region. A short-term laboratory experiment was carried out to investigate the influence of temperature changes (5-35 °C) on soil N<sub>2</sub>O and NO emissions under aerobic conditions in two contrasting (broad-leaved and coniferous) subtropical acidic forest types in China. The results showed that the temporal pattern of N<sub>2</sub>O and NO emissions between the three lower temperatures (5 °C, 15 °C, and 25 °C) and 35 °C was significantly different for both broad-leaved and coniferous forest soils. The effects of temperature on soil N<sub>2</sub>O and NO emission rates varied between broad-leaved and coniferous forest soils. Both N<sub>2</sub>O and NO emissions increased exponentially with an increase in temperature in the broad-leaved forest soil. However, N<sub>2</sub>O and NO emissions in the coniferous forest soil were not sensitive to temperature change between 5 °C and 25 °C. N<sub>2</sub>O and NO emission rates were significantly higher in the broad-leaved forest soil as compared with the coniferous forest soil at all incubation temperatures except 5 °C. These results suggest that the broad-leaved forest could contribute more N<sub>2</sub>O and NO emissions than the coniferous forest for most of the year in the subtropical region of China.

### **Forest summer albedo is sensitive to species and thinning: how should we account for this in Earth system models?**

Otto, J.; Berveiller, D.; Breon, F. M.; Delpierre, N.; Geppert, G.; Granier, A.; Jans, W.; Knohl, A.; Kuusk, A.; Longdoz, B.; Moors, E.; Mund, M.; Pinty, B.; Schelhaas, M. J.; Luysaert, S  
*Biogeosciences*; 2014. 11(8):2411-2427

Although forest management is one of the instruments proposed to mitigate climate change, the relationship between forest management and canopy albedo has been ignored so far by climate models. Here we develop an approach that could be implemented in Earth system models. A stand-level forest gap model is combined with a canopy radiation transfer model and satellite-derived model parameters to quantify the effects of forest thinning on summertime canopy albedo. This approach reveals which parameter has the largest affect on summer canopy albedo: we examined the effects of three forest species (pine, beech, oak) and four thinning strategies with a constant forest floor albedo (light to intense thinning regimes) and five different solar zenith angles at five different sites (40 degrees N 9 degrees E-60 degrees N 9 degrees E). During stand establishment, summertime canopy albedo is driven by tree species. In the later stages of stand development, the effect of tree species on summertime canopy albedo decreases in favour of an increasing influence of forest thinning. These trends continue until the end of the rotation, where thinning explains up to 50% of the variance in near-infrared albedo and up to 70% of the variance in visible canopy albedo. The absolute summertime canopy albedo of all species ranges from 0.03 to 0.06 (visible) and 0.20 to 0.28 (nearinfrared); thus the albedo needs to be parameterised at species level. In addition, Earth system models need to account for forest management in such a way that structural changes in the canopy are described by changes in leaf area index and crown volume (maximum change of 0.02 visible and 0.05 near-infrared albedo) and that the expression of albedo depends on the solar zenith angle (maximum change of 0.02 visible and 0.05 near-infrared albedo). Earth system models taking into account these parameters would not only be able to examine the spatial effects of forest management but also the total effects of forest management on climate.

### **Impacts of climate change on economics of forestry and adaptation strategies in the southern United States**

Susaeta, A.; Carter, D. R.; Adams, D. C

*Journal of Agricultural and Applied Economics*; 2014. 46(2):257-272

This article analyzes the impacts of different levels of forest productivity scenarios, disturbance risk, and salvageable rates resulting from climate change on the economics of loblolly pine in the southern United States. Potential adaptation strategies examined include reduction in planting density and use of slash pine instead of loblolly pine. Economic returns are most sensitive to changes in disturbance risk and productivity changes as compared with the salvage rate, planting density, or species selection. Loblolly pine with low planting density economically outperforms high-density loblolly pine. Slash pine is generally a less viable option compared with loblolly pine in most cases.

### **REDD+ and forest tenure security: concerns in Nepal's community forestry**

Bastakoti, R. R.; Davidsen, C.

*International Journal of Sustainable Development and World Ecology*; 2014. 21(2):168-180.

As one of the dominant large-scale mechanisms proposed to combat climate change, biodiversity loss, and rural poverty, REDD+ (Reducing Emissions from Deforestation and Forest Degradation) has added further complexity to the challenging governance of rights and resources in global forests. As REDD+ is commodifying carbon,

concerns emerge about how carbon ownership and its rights can be accommodated into the existing framework that governs local forest resource rights. The Nepalese government has formally entered into REDD+ policy preparations, but it lacks clear legal provisions regarding key forest tenure rights such as carbon ownership, benefit sharing, and the political participation of community forest user groups from national to local. As a result, Nepal's policy process points toward performance-based carbon forestry in a way that may undermine and weaken existing community tenure rights and forest tenure security. This paper discusses Nepal's potential impacts of new REDD+ and carbon ownership arrangements on forest tenure security and community-based forest governance. In a threefold methodological approach, the paper presents three scenarios for a REDD+-oriented tenure reform within the existing framework and assesses their concerns through in-depth qualitative interviews with key stakeholders, representatives, and advocates of Nepal's community forestry system, complemented by a review of government documents and academic literature of REDD+ lessons so far. The analysis identifies critical concerns for forest tenure security, state-community power relationships, and effective local institutions of the commons, and suggests that Nepal's REDD+ process is taking place at a particularly consequential time for structural changes of the forest governance framework.

### **Biophysical suitability, economic pressure and land-cover change: a global probabilistic approach and insights for REDD+.**

Strassburg, B. B. N.; Latawiec, A. E.; Creed, A.; Nga Nguyen; Sunnenberg, G.; Miles, L.; Lovett, A.; Joppa, L.; Ashton, R.; Scharlemann, J. P. W.; Cronenberger, F.; Iribarrem, A  
*Sustainability Science*; 2014. 9(2):129-141.

There has been a concerted effort by the international scientific community to understand the multiple causes and patterns of land-cover change to support sustainable land management. Here, we examined biophysical suitability, and a novel integrated index of "Economic Pressure on Land" (EPL) to explain land cover in the year 2000, and estimated the likelihood of future land-cover change through 2050, including protected area effectiveness. Biophysical suitability and EPL explained almost half of the global pattern of land cover ( $R^2=0.45$ ), increasing to almost two-thirds in areas where a long-term equilibrium is likely to have been reached (e.g.  $R^2=0.64$  in Europe). We identify a high likelihood of future land-cover change in vast areas with relatively lower current and past deforestation (e.g. the Congo Basin). Further, we simulated emissions arising from a "business as usual" and two reducing emissions from deforestation and forest degradation (REDD) scenarios by incorporating data on biomass carbon. As our model incorporates all biome types, it highlights a crucial aspect of the ongoing REDD+ debate: if restricted to forests, "cross-biome leakage" would severely reduce REDD+ effectiveness for climate change mitigation. If forests were protected from deforestation yet without measures to tackle the drivers of land-cover change, REDD+ would only reduce 30% of total emissions from land-cover change. Fifty-five percent of emissions reductions from forests would be compensated by increased emissions in other biomes. These results suggest that, although REDD+ remains a very promising mitigation tool, implementation of complementary measures to reduce land demand is necessary to prevent this leakage.

### **Is there more soil carbon under nitrogen-fixing trees than under non-nitrogen-fixing trees in mixed-species restoration plantings?**

Hoogmoed, M.; Cunningham, S. C.; Baker, P. J.; Beringer, J.; Cavagnaro, T. R.  
*Agriculture, Ecosystems & Environment*; 2014. 188:80-84.

Afforestation of agricultural land provides an important opportunity to mitigate climate change by storing carbon (C) in both plant biomass and the soil. Here we present results of a study in which we sought to determine whether soil under nitrogen(N)-fixing trees contained more C than soil under non-N-fixing trees in mixed-species plantings, and thus if inclusion of N-fixers is beneficial in terms of increasing soil C sequestration. Soils were sampled directly beneath N-fixing and non-N-fixing tree species in riparian and upland mixed-species plantings in southeastern Australia. Soil C and N contents were assessed at both the landscape and individual planting scales. At the landscape scale, there were higher levels of soil C and N under N-fixing trees compared with non-N-fixing trees. At the individual planting scale, the patterns were less clear with both large increases and decreases occurring across the range of sites. The results presented here indicate that the inclusion of N-fixers may help to increase soil C, and N, but that the response may be site- and species-specific.

### **Ecological role and services of tropical mangrove ecosystems: a reassessment**

Lee ShingYip; Primavera, J. H.; Dahdouh-Guebas, F.; McKee, K.; Bosire, J. O.; Cannicci, S.; Diele, K.; Fromard, F.; Koedam, N.; Marchand, C.; Mendelssohn, I.; Nibedita Mukherjee; Record, S  
*Global Ecology and Biogeography*; 2014. 23(7):726-743

Aim: To reassess the capacity of mangroves for ecosystem services in the light of recent data. Location: Global mangrove ecosystems. Methods: We review four long-standing roles of mangroves: (1) carbon dynamics - export or sink; (2) nursery role; (3) shoreline protection; (4) land-building capacity. The origins of pertinent

hypotheses, current understanding and gaps in our knowledge are highlighted with reference to biogeographic, geographic and socio-economic influences. Results: The role of mangroves as C sinks needs to be evaluated for a wide range of biogeographic regions and forest conditions. Mangrove C assimilation may be under-estimated because of flawed methodology and scanty data on key components of C dynamics. Peri-urban mangroves may be manipulated to provide local offsets for C emission. The nursery function of mangroves is not ubiquitous but varies with spatio-temporal accessibility. Connectivity and complementarity of mangroves and adjacent habitats enhance their nursery function through trophic relay and ontogenetic migrations. The effectiveness of mangroves for coastal protection depends on factors at landscape/geomorphic to community scales and local/species scales. Shifts in species due to climate change, forest degradation and loss of habitat connectivity may reduce the protective capacity of mangroves. Early views of mangroves as land builders (especially lateral expansion) were questionable. Evidence now indicates that mangroves, once established, directly influence vertical land development by enhancing sedimentation and/or by direct organic contributions to soil volume (peat formation) in some settings. Main conclusions: Knowledge of thresholds, spatio-temporal scaling and variability due to geographic, biogeographic and socio-economic settings will improve the management of mangrove ecosystem services. Many drivers respond to global trends in climate change and local changes such as urbanization. While mangroves have traditionally been managed for subsistence, future governance models must involve partnerships between local custodians of mangroves and offsite beneficiaries of the services.

### **Tree mortality in response to climate change induced drought across Beijing, China**

Zhang XiongQing; Lei YuanCai; Pang Yong; Liu XianZhao; Wang JinZeng

*Climatic Change*; 2014. 124(1/2):179-190

Tree mortality in response to climate change induced drought has emerged as a global concern. Small changes of tree mortality rates can profoundly affect forest structure, composition, dynamics and ecosystem services such as carbon sequestration. Our analyses of longitudinal data from natural stands (82 plots) in Beijing showed that tree mortality rates have increased significantly over the two decades from 1986 to 2006. In contrast, recruitment rates decreased significantly over this period. The increase in overall mortality rates resulted from an increase in tree deaths dominantly attributed to changes in temperature and precipitation resulting in drier conditions across latitudes, elevations, tree species, and tree sizes. In addition, the results showed that mortality rates of Chinese pine (*Pinus tabuliformis*) ( $\beta_1 = 0.0874$ ) as a result of climate change induce drought were much smaller than oak (*Quercus*) ( $\beta_1 = 0.1583$ ).

### **Valuing albedo as an ecosystem service: implications for forest management**

Lutz, D. A.; Howarth, R. B

*Climatic Change*; 2014. 124(1/2):53-63

Surface albedo is a property of the Earth's surface that provides an important climate regulating ecosystem service through the reflection of incoming solar radiation. In some regions, the cooling effect of higher albedo associated with snow-covered bare ground and young forests, compared to mature forests, can exceed the cooling effect of carbon sequestration from forest growth. Properly assigning an economic value to the net benefits of albedo-related shortwave radiative flux is therefore important in order to understand how these two ecosystem services may tradeoff under different scenarios and in different forests. Here we place an economic value on albedo-related shortwave radiation through the use of shadow prices derived from an integrated assessment model (DICE). We then examine the potential impact of this value on optimal forest rotation in the White Mountain National Forest (WMNF) in the state of New Hampshire, USA. Our results suggest that valuing albedo can shorten optimal rotation periods significantly compared to scenarios where only timber and carbon are considered. For instance, in spruce-fir stands, very short rotation periods of just 25 years become economically optimal when albedo is considered. We attribute this to the low productivity of the sites within the WMNF as well as the substantial snowfall that occurs in the area. Thus, in high latitude forests where snowfall is common and productivity is low, incorporating the valuation of albedo may lead to relatively short optimal rotation periods if the only ecosystem services considered are timber provisioning and climate regulation.

### **Institutional dimensions of the developing REDD+ process in Cameroon**

Ngendakumana, S., Minang, P.A., Feudjio, M., Speelman, S., Van Damme, P., Tchoundjeu, Z.

*Climate Policy*. DOI:10.1080/14693062.2014.877221

Abstract: The reducing emissions from deforestation and forest degradation (REDD+) initiative has emerged in recent years as a mechanism to simultaneously address climate change, biodiversity, and poverty reduction challenges at the margins of tropical forests. Congo Basin countries, including Cameroon, have embraced the opportunities that REDD+ provides, with great expectations. Yet, it needs to be investigated whether the enabling institutional environment, which is required for implementing REDD+, is present. Understanding is still limited on how to build adequate and strong institutional relations that could shape the reforms towards the

establishment of efficient emissions reductions schemes. Furthermore, uncertainty remains on the operational mechanisms of REDD+, suggesting that, to catalyse effectiveness, there is a need to come up with a governance model nested in relevant policy frameworks. This study builds on a modified '4Is' framework - Institutions, Interests, Ideas and Information - to analyse REDD+ and explore stakeholders' perceptions on the local forest governance potential. A structural implementation model to optimize the effectiveness of REDD+ is developed. Findings suggest that governments need to review existing policies to take into account participation, local people rights, and information access as a way to stimulate actors' willingness to contribute to emissions reductions and carbon stock increases under REDD+ regimes.

Policy relevance: Currently, there is no agreed framework for REDD+ in Cameroon, despite the potential role its humid forests could have to mitigate climate change at national and global levels. Furthermore, there are no initiatives that have fully mapped the boundary institutions to be engaged in REDD+ processes at the landscape level, although there is high commitment of various stakeholders to influence policies towards the implementation of the mechanism itself. For example, forestry companies, local communities, and conservation institutions would like to get involved. Findings indicate that there is potential for a cross-sectoral change and provide guidance as to how the uncertainties and risks, which may undermine the effective participation of stakeholders in the REDD+ processes at local and national levels, might be tackled. The schematic model and analytical frameworks suggested should prove very important to bridge various discourses among diverse actors. The end result is anticipated to be a governance structure for CO2 emissions reductions through changes in land-use practices.

### **REDD+ readiness process in Cameroon: an analysis of multi-stakeholder perspectives**

Alemagi, D., Minang, P.A., Feudjio, M., Duguma, L.

*Climate Policy*, DOI: 10.1080/14693062.2014.905439

Abstract: Cameroon has been a keen participant in Reducing Emissions from Deforestation and Forest Degradation plus conservation, sustainable management of forests and enhancement of carbon stocks (REDD+) negotiations since 2005 and has engaged in activities to enhance the implementation of REDD+. This article reviews progress on REDD+ readiness in Cameroon based on a multiple REDD+ functions framework. Results show that some progress has been made in terms of planning and coordination, institutional development, and the development of some REDD+ projects. Absence of a legal framework, inadequate procedures for stakeholder participation, slow progress in the development of a national strategy, monitoring, reporting, and verification (MRV) challenges, and weak financing remain prominent constraints. Despite having one of the slowest REDD+ Readiness Preparation Proposal (R-PP) processes in the Congo Basin, stakeholders feel strong ownership because the R-PP was done almost entirely by Cameroonian experts. Some opportunities for improving REDD+ can be considered going forward, including the establishment of procedures for a broader participatory process, speeding up the operationalization of the National Observatory on Climate Change, making use of the ongoing forestry law reform, consideration of a carbon concessions concept, tapping from international initiatives to build on MRV, and improving benefit sharing and financing through the development of an appropriate and decentralized mechanism. Enhancing these opportunities is fundamental for successful REDD+ implementation in Cameroon.

Policy relevance: This article offers a new multidimensional approach to assessing the REDD+ readiness process in Cameroon. This critical assessment, which is done using six key functions, provides an opportunity for enhanced understanding of the process by policy makers, decision makers, and professionals with a view to enabling improvements in the readiness process. Furthermore, the article proffers a series of opportunities that the government and other relevant stakeholders can capitalize on to overcome current hurdles affecting the REDD+ readiness process. It is hoped that policy makers driving the REDD+ process in Cameroon will be able to incorporate the findings of this research into their strategic policy, formulated to advance the REDD+ readiness process. More importantly, it is hoped that the multidimensional framework applied in this study could be useful for assessing REDD+ in similar contexts in the Congo Basin.

### **REDD+ Readiness progress across countries: time for reconsideration**

Minang, P., Van Noordwijk, M., Duguma, L.A., Alemagi, D., Do, T.H., Bernard, F., Agung, P., Robiglio, V., Catacutan, D., Suyanto, S., Armas, A., Aguad, C.A., Feudjio, M., Galudra, G., Maryani, R., White, D., Widayati, A., Kahurani, E., Namirembe, S., Leimona, B.

*Climate Policy*, DOI: 10.1080/14693062.2014.905822

Abstract: Efforts towards Reducing Emissions from Deforestation and Forest Degradation plus conservation, sustainable management of forests and enhancement of carbon stocks (REDD+) have grown in importance in developing countries following negotiations within the United Nations Framework Convention on Climate Change (UNFCCC). This has favoured investments in processes to prepare countries for REDD+ at the national level (a process referred to as REDD+ Readiness). Yet, little attention has been given to how Readiness can be assessed and potentially improved. This article presents a framework for Readiness assessment and compares progress in REDD+ Readiness across four countries, namely Cameroon, Indonesia, Peru, and Vietnam. The

Readiness assessment framework comprises six functions, namely planning and coordination; policy, laws, and institutions; measurement, reporting, verification (MRV), and audits; benefit sharing; financing; and demonstrations and pilots. We found the framework credible and consistent in measuring progress and eliciting insight into Readiness processes at the country level. Country performance for various functions was mixed. Progress was evident on planning and coordination, and demonstration and pilots. However, MRV and audits; financing; benefit sharing; and policies, laws and institutions face major challenges. The results suggest that the way national forest governance has been shaped by historical circumstances (showing path dependency) is a critical factor for progress in Readiness processes. There is need for a rethink of the current REDD+ Readiness infrastructure given the serious gaps observed in addressing drivers of deforestation and forest degradation, linking REDD+ to broader national strategies and systematic capacity building.

Policy relevance: Policy makers, researchers and analysts helping to plan and implement REDD+, environmental services and climate change would find this paper potentially helpful. The paper explores progress on REDD+ Readiness across four countries (Cameroon, Indonesia, Peru and Vietnam) and provides broad lessons, recommendations and examples across these countries for further improving REDD+. The paper also suggests an innovative, credible and universally applicable set of criteria and indicators derived through a systematic review that could serve further global comparative analysis of readiness for REDD+ and relevant national environmental services delivery systems, including climate change mitigation.

### **REDD+ projects and national-level Readiness processes: a case study from Kenya**

Bernard, F., Minang, P.A., Adkins, B., Freund, J.T.

Florence Bernard, Peter A. Minang, Bryan Adkins & Jeremy T. Freund

*Climate Policy*, DOI: 10.1080/14693062.2014.905440

**Abstract:** The Bali Action Plan and Cancun agreements on Reducing Emissions from Deforestation and forest Degradation, plus forest conservation, sustainable management of forests and enhancement of forest carbon stocks (REDD+ ) have encouraged demonstration activities as part of Readiness and a step towards national approaches. This has enabled important growth in pilot and demonstration projects. Yet an understanding about how these projects are connected and contribute to national-level technical, policy, and institutional preparedness (Readiness) for REDD+ is lacking. This article examines the linkages between national processes and the private-sector-driven Kasigau Corridor REDD+ project in Kenya. The study reveals interesting cross-scale interactions that have increased over time and have high potential for harnessing national-level processes through lessons from the project level. Key innovations from the Kasigau Corridor Project include the implementation of REDD+ in dry forests, operationalization of conservation easements in the context of REDD+, and demonstration of potential ways of obtaining upfront finance for REDD+. The study also provides a number of key recommendations for Kenya and REDD+ in general, including official endorsement of stand-alone REDD+ projects under national Readiness schemes and exploring jurisdictional and nested REDD+ approaches. Additionally, more accommodating national-level frameworks for attracting private-sector engagement and investments, and for integrating, scaling-out, or scaling-up lessons from such projects, would be needed to enhance national REDD+ Readiness.

## **V. PUBLICATIONS, REPORTS AND OTHER MEDIA**

### **Training manual: Improving grassroots equity in the forests and climate change context**

*RECOFTC*

Forest-based climate change mitigation approaches aim to reduce human-induced greenhouse gas emissions and to increase the levels of stored and sequestered carbon sinks. Ensuring that the world's forests are intact, managed sustainably and increased in area is now widely accepted as one of the most practical and cost-effective ways to mitigate climate change impacts. Mechanisms for mitigating climate change, including Reducing Emissions from Deforestation and Forest Degradation and the associated conservation, sustainable management of forests and enhancement of forest carbon stocks (REDD+), have the potential to deliver significant economic as well as social and environmental co-benefits. In doing so, however, they also present serious risks and challenges that particularly affect indigenous peoples, local communities, women and other marginalized groups who heavily depend on forests for their livelihoods and whose lives and futures are influenced by decisions that impact those forests. Chief among the challenges to the success of the mitigation efforts are unclear land tenure rights, weak governance and vague benefit-sharing mechanisms for forest resources. Exacerbating those challenges is the widespread marginalization and the non-inclusion of stakeholders within communities and at the local, national and global levels. Stakeholders who are perceived as having little or no power in comparison with other individuals, groups and institutional agencies are particularly excluded from processes that affect them. The exclusion of some community members in decisions on mitigation efforts and other climate change issues needs to be confronted. The necessary shift in practice

would involve the engagement of all stakeholders in the discourse on forests and climate change and a more equitable distribution of benefits from interventions. This training manual provides guidance to train grassroots facilitators to better engage all stakeholders and to promote equity in forest-based climate change and forest management practices and interventions. Its main premise is to extend the practice and process of active participation towards effective engagement, through which equity can be improved. [The publication](#)

### **Assessing forest governance: A Practical Guide to Data Collection, Analysis, and Use**

*PROFOR & FAO*

This is a guide to measuring or assessing forest governance. Forest governance comprises all the social and economic systems that affect how people interact with forests, including bureaucracies, laws, policies, traditional norms and culture, patterns of land tenure, and markets.<sup>1</sup> People assess forest governance for many reasons. Assessments tied to reducing emissions from deforestation and forest degradation, plus fostering conservation, sustainable management of forests, and enhancement of forest carbon stocks (REDD+) have aimed to fulfill international obligations, diagnose problems, and establish a baseline for future monitoring. Assessments under the World Bank Forest Investment Program have helped set the agendas for donor funding. Assessments by nongovernmental organizations (NGOs) have held officials more accountable and have been the basis for advocacy for reform or better implementation of forest laws. [The publication](#)

### **Incentive Contracts for Environmental Services and Their Potential in REDD**

*The World Bank*

Implementation arrangements for Reducing Greenhouse Gas Emissions from Deforestation and Forest Degradation can be seen as contracts that could address some of the inherent problems with forest carbon credits that often lead to high transaction costs—measuring, monitoring, and verification. Self-enforcing contracts, where it is in the best interest of the environmental service providers to comply with the contracts, may be one way to reduce these costs if providers have incentives to uphold their end of the contract. While the literature on Reducing Greenhouse Gas Emissions from Deforestation and Forest Degradation is extensive, there is little information available to guide policy makers or investors on what form such contracts should take. After providing an overview of the current status of Reducing Greenhouse Gas Emissions from Deforestation and Forest Degradation and its role as a tool for reducing carbon emissions on an international scale, the paper describes key issues regarding implementation and reviews the literature on contracts from the related area of Payments for Ecosystem Services programs, which face similar challenges. The remainder of the paper reviews various contractual mechanisms from agricultural and forestry related projects that have been proposed or are being used in practice and discusses the various implications associated with their design and implementation. [The publication](#)

### **Current status of social forestry in climate change adaptation and mitigation in the ASEAN region**

*RECOFTC*

This report covers eight ASEAN countries (Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia (Sabah), Myanmar, Philippines, Thailand and Viet Nam). The information in this report was collected through desk-based research, reviews of national laws and policies, and technical reports. The information on forest cover and social forestry is based on the latest data from national governments, provided by the members of the ASEAN-Swiss Partnership on Social Forestry and Climate Change Learning Group. [The publication](#)

### **Climate Change and Rural Communities in the Greater Mekong Subregion: A Framework for Assessing Vulnerability and Adaptation Options**

*ADB and the GMS Environment Operations Center*

This report presents the methodology and lessons from a climate change adaptation study conducted by the Greater Mekong Subregion (GMS) Core Environment Program. The study yielded a framework and methodology for assessing climate vulnerability and adaptation options for rural communities in the GMS. It was conducted in biodiversity conservation corridors in Lao People's Democratic Republic, Thailand, and Viet Nam during 2011-2012. The report introduces the framework, describes how it was applied, major results, and makes recommendations for future improvement. [The publication](#)

### **Sharing the Stage. State of the Voluntary Carbon Markets 2014. Executive Summary.**

*Ecosystem Marketplace. A forest Trends Initiative*

Across all years of market activity tracked in this report series, voluntary buyers have directly funded 844 Mt

CO<sub>2</sub> e in emissions reductions worth \$4 billion, at an average historical price of \$5.9/t CO<sub>2</sub> e. In 2013, offset suppliers transacted 76 Mt CO<sub>2</sub> e of carbon offsets - down from 102.8 Mt CO<sub>2</sub> e in 2012 - as structural changes in California's carbon market impacted millions of previously "voluntary" tonnes. Market value fell to \$379 million, tracking alongside lower average prices (\$4.9/t CO<sub>2</sub> e market-wide). The volume of offsets transacted directly from projects - and as a result, through brokers - steeply declined (down 40% and 58% from 2012, respectively). Retailer sales were unchanged (22 Mt CO<sub>2</sub> e). Governments played an important market role in 2013, as both offset buyer and supplier, while private sector-led offset demand fell by 46% to 35 Mt CO<sub>2</sub> e. A full 20.3 Mt CO<sub>2</sub> e was attributed to multinational corporate buyers. Energy, transportation, finance, and insurance providers were also key buyer types. "Combating climate change" was cited as buyers' top offsetting motivation - behind 7.2 Mt CO<sub>2</sub> e in transactions. Corporate responsibility and leadership remained prominent motives. Buyers also leveraged offset payments to incentivize supply chain sustainability (a first in this report series). Existing client demand drove 76% of transacted volumes in 2013. First-time buyers made up the remaining 24%, but paid significantly below-average prices (\$3.7/t CO<sub>2</sub> e) and with a focus on forestry. Projects that reduce emissions from deforestation and forest degradation more than doubled their transaction volumes to 22.6 Mt CO<sub>2</sub> e, and their market value also increased by 35% to \$94 million. This growth came at a (lower) offset price of \$4.2/t CO<sub>2</sub> e, down from \$7.4/t CO<sub>2</sub> e in 2012. Around 28.9 Mt CO<sub>2</sub> e of 2013's transactions were associated with the Verified Carbon Standard. Market share for the Gold Standard saw little change from 2012, despite voluntary buyers' increased appetite for Clean Development Mechanism instruments. Survey respondents reported 31.8 Mt CO<sub>2</sub> e in their project portfolios that remained unsold at the end of 2013, including 12.6 Mt CO<sub>2</sub> e reported by 36 suppliers that tried to but simply did not find a buyer by year's end. Survey respondents also projected a potential pipeline of 277 Mt CO<sub>2</sub> e through 2018. [The publication](#)

## **Beyond reforestation: An assessment of Vietnam's REDD+ Readiness**

*World Agroforestry Centre*

As the Government of Vietnam is showing great interest and commitment to REDD+, it is important to examine the country's 'readiness' based on the functions that need to be fulfilled. This paper reports on rapid REDD+ readiness assessment conducted through documents' review, survey-questionnaires, in-depth interviews and round-table discussions with Vietnam's National REDD Network. It was found that Vietnam's reforestation experience does not foretell REDD+ readiness. Its readiness level as perceived by in-situ stakeholders only ranged from low to medium across all functions. For the country to move beyond its current state of REDD+ readiness, activities should focus on indicators where it is weak while strengthening those that are already advancing, and post-reforestation issues should be resolved. Failure to address them will mean an uphill implementation of REDD+. The paper concludes with specific recommendations for Vietnam to advance its REDD+ readiness that might be useful for other countries that share similar issues with Vietnam. [The publication](#)

## **Fifth Consolidated Annual Progress Report of the UN-REDD Programme Fund. Report of the Administrative Agent of the UN-REDD Programme Fund for the period 1 January - 31 December 2013.**

*UN-REDD Programme*

The UN-REDD Programme is pleased to present this 2013 annual report, marked by the Programme's fifth anniversary and by important progress on REDD+ readiness. This annual report has been restructured, in a manner similar to the semi-annual update, to place more emphasis on achieved results and to demonstrate more clearly the links between the Programme's various forms of support and the concrete results delivered at the country level. This report also highlights how the UN-REDD Programme's normative work has supported the development of national REDD+ strategies through tailored frameworks that respect country needs, while facilitating knowledge sharing at global and regional levels. [The report](#)

## **V.I JOBS**

### **Team Leader REDD+ Project in Southern Laos**

*Österreichische Bundesforste AG - deadline for application is 15<sup>th</sup> of August, 2014.*

Österreichische Bundesforste AG (Austrian Federal Forests) is recruiting a Team Leader to support the implementation of a REDD+ project in Xe Pian National Protected Area and its buffer zone in Southern Laos.

[More](#)

## **REDD+ Technical Advisor (NFMS & RELs) (Myanmar)**

*FAO - deadline for application is 18<sup>th</sup> of August 2014*

The REDD+ Technical Advisor (NFMS and RELs) will support the implementation of Roadmap activities for the development of Myanmar's NFMS and RELs/RLs for REDD+. S/he is expected to assist the implementation process by facilitating the work of the government and international/national experts and coordinating, delivering training and capacity building support, communicating and organizing training events with relevant stakeholders, in particular the Forest Department, Ministry of Environmental Conservation and Forestry (MOECAAF), as well as other relevant ministries/departments, NGOs, and local partners. [More](#)

## **VII. ANNOUNCEMENTS**

### **Forests are key to global sustainability**

*World Business Council for Sustainable Development*

[WBCSD's new Infographic](#) on Forests highlights the importance of ALL forests - the Forest Continuum - and sustainable forest management in meeting the increasing demand for wood, fiber, fuel and food. The Forest Continuum includes different types of forests - from natural forests to plantations - and all are critical in meeting different needs. Sustainable Forest Management provides multiple benefits, ranging from social to economic and ecological, for both people and the planet. [Click here](#) to discover the new Infographic.

### **Tropical managed Forests Observatory**

*TmFO*

TmFO is a pan-tropical network aiming at understanding the long term effects of logging on tropical forest ecosystems. TmFO encompasses 490 permanent forest plots spread across the Amazon and Congo basins and South East Asia. The network investigates the response of tropical forests to logging, in terms of biomass dynamic and changes in species composition over time. Thanks to the large number of plots, TmFO represents a unique opportunity to gain understanding and compare forest responses at both regional and continental scales. The ultimate goal of TmFO is to propose new evidence-based logging practices that maintain long-term forest functions, environmental services provision and economic viability. These results will provide strong basis for Politics and forest practitioners to build up new guidance towards sustainable forest management and tropical forests preservation. [More](#)

### **CIFOR new website**

*CIFOR*

The Center for International Forestry Research has launched a new website. Find it [here](#).

## **CLIM-FO INFORMATION**

The objective of CLIM-FO-L is to compile and distribute recent information about climate change and forestry. CLIM-FO-L is issued monthly.

Past issues of CLIM-FO-L are available on the website of *FAO Forest and Climate Change*:

<http://www.fao.org/forestry/climatechange/en/>

For technical help or questions contact [CLIM-FO-Owner@fao.org](mailto:CLIM-FO-Owner@fao.org)

The Newsletter is compiled by Marc Dumas-Johansen and Susan Braatz.

**We appreciate any comments or feedback.**

### **How to subscribe/unsubscribe**

- To join the list, please send an e-mail to [listserv@listserv.fao.org](mailto:listserv@listserv.fao.org) containing the message "Subscribe CLIM-FO-L followed by your name. Leave the subject line blank.
- To unsubscribe, please send an e-mail to [listserv@listserv.fao.org](mailto:listserv@listserv.fao.org), leaving the subject line blank and containing the following message: Unsubscribe CLIM-FO-L followed by your name

Your information is secure - we will never sell, give or distribute your address or subscription information to any third party.

### **How to contribute**

We welcome subscribers' contributions of news, articles, publications and announcements of events. Once on the list, to make a contribution please contact the following address: [CLIM-FO-Owner@fao.org](mailto:CLIM-FO-Owner@fao.org)

**We thank everyone for their contribution.**

### **Disclaimer**

The author does not guarantee the accuracy or quality of the content of the compiled information.

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The mention or omission of specific companies, their products or brand names does not imply any endorsement or judgement by the Food and Agriculture Organization of the United Nations.