



## CONTENTS

<b>I. IN THE PRESS .....</b>	<b>3</b>
<b>II. MULTILATERAL PROCESSES IN CLIMATE CHANGE .....</b>	<b>4</b>
<b>III. EVENTS &amp; MEETINGS.....</b>	<b>4</b>
Upcoming events .....	4
Paving the Way to Sustainable Forest and Carbon Management.....	4
International Conference on Climate Change and Tree Responses in Central European Forests .....	4
Forests Africa. Opportunities for a Green Economy .....	4
EFI 20 Years Science and Policy Forum .....	4
Governors' Climate and Forests Task Force.....	5
<b>IV. RESEARCH ARTICLES.....</b>	<b>5</b>
An Operational Framework for Defining and Monitoring Forest Degradation .....	5
Efficient mitigation of founder effects during the establishment of a leading-edge oak population.....	5
Biomass and carbon storage pattern in an age series of teak plantation in dry tropics .....	6
Description of a new procedure to estimate the carbon stocks of all forest pools and impact assessment of methodological choices on the estimates .....	6
Forest management for timber and carbon sequestration in the presence of climate change: the case of <i>Pinus sylvestris</i> .....	6
Transaction costs of carbon offset projects: a comparative study .....	7
Rights to carbon and payments for services rendered under REDD+: options for the case of Mexico .....	7
Public preferences for biodiversity conservation and climate-change mitigation: a choice experiment using ecosystem services indicators .....	7
Adaptive capacity of legal and policy frameworks for biodiversity protection considering climate change .....	8
Implications of ice storm damages on the water and carbon cycle of bamboo forests in southeastern China.....	8
Land use effects on erosion and carbon storage of the Rio Chimbo watershed, Ecuador .....	8
The global climate change mitigation strategy REDD: monitoring costs and uncertainties jeopardize economic benefits .....	9
Sustained carbon uptake and storage following moderate disturbance in a Great Lakes forest .....	9
Forecasting deforestation and carbon emissions in tropical developing countries facing demographic expansion: a case study in Madagascar .....	9
Carbon allocation in a Bornean tropical rainforest without dry seasons .....	10
Experimental warming studies on tree species and forest ecosystems: a literature review .....	10
Human deforestation outweighs future climate change impacts of sedimentation on coral reefs.....	10
Rapid warming accelerates tree growth decline in semi-arid forests of Inner Asia .....	10
Tropospheric ozone reduces carbon assimilation in trees: estimates from analysis of continuous flux measurements .....	11
Long-term changes in forest carbon under temperature and nitrogen amendments in a temperate northern hardwood forest .....	11
Climate isn't everything: competitive interactions and variation by life stage will also affect range shifts in a warming world .....	12
Differences in the potential hydrologic impact of climate change to the Athabasca and Fraser River basins of Canada with and without considering shifts in vegetation patterns induced by climate change.....	12
Feedstock specific environmental risk levels related to biomass extraction for energy from boreal and temperate forests.....	12
Aboveground biomass estimation of small diameter woody species of tropical dry forest.....	13

Towards a European forest policy - conflicting courses .....	13
Carbon allocation, sequestration and carbon dioxide mitigation under plantation forests of north western Himalaya, India .....	13
Carbon stocks and cocoa yields in agroforestry systems of Central America .....	14
The significance of CSR in A/R CDM promotion from the case study of Japan: a focus on corporate forest-related activities and emission trading .....	14
Monthly stem increment in relation to climatic variables during 7 years in an East African rainforest .....	14
Design considerations for tropical forest inventories.....	15
Do shifting forest limits in south-west Norway keep up with climate change? .....	15
Deforestation and landscape structure changes related to socioeconomic dynamics and climate change in Zagros forests .....	15
Forest stands as dynamical systems: an introduction. ....	15
Carbon sequestration and carbon flow in harvested wood products for China .....	16
Carbon sequestration rates in Van Panchayat forests and their benefits under REDD .....	16
Reclaiming degraded rainforest: a spatial evaluation of gains and losses in subtropical eastern Australia to inform future investment in restoration. ....	16
Intensification of coffee systems can increase the effectiveness of REDD mechanisms .....	16
Sustainable development: the journey from Rio (1992) to Rio+20 and beyond. ....	17
Socio-economic, environmental, and governance impacts of illegal logging .....	17
<b>V. PUBLICATIONS, REPORTS AND OTHER MEDIA.....</b>	<b>18</b>
Scoping Dialogue on REDD+ Benefit Sharing. Co-chairs' Summary Report .....	18
IUCN REDD+ Project in Indonesia Supports Customary Land Mapping.....	18
Carbon Stocks and Flows from Harvest to Disposal in Harvested Wood Products from Ontario and Canada .....	19
Policy and Institutions in Adaptation to Climate Change : Case study on tree crop diversity in China, Nepal, and Pakistan .....	19
Forest and Economic Development. A Driver for the Green Economy in the ECE Region.....	19
Quality of governance standards for carbon emissions trading. Developing REDD+ governance through a multi-stage, multi-level and multi-stakeholder approach.....	19
<b>V.I JOBS .....</b>	<b>20</b>
Regional Technical Advisor, multiple positions, UN-REDD Programme UNDP .....	20
Forestry Officer (REDD+) .....	20
Team Leader. FAO-Finland Forestry Programme .....	20
<b>VII. ANNOUNCEMENTS .....</b>	<b>20</b>
Interactive web app lets users map forest carbon emissions activities .....	20
<b>CLIM-FO INFORMATION .....</b>	<b>21</b>

## I. IN THE PRESS

13 August 2013 - Koli Forum

### [IPCC chairman Pachauri in Joensuu: Climate creates crises and new opportunities](#)

Without new efforts made by every country in the world, climate change will continue unabated. As a result, the risk of various crises and the struggle for dwindling natural resources, such as clean water, will increase. Despite the threat they pose, crises are also an opportunity,” reminds one of the most important and influential experts in climate change today, Doctor Rajendra K. Pachauri. Speaking in Joensuu, the Chairman of the UN International Panel on Climate Change and Nobel laureate Rajendra Pachauri remains hopeful. The bioeconomy offers new possibilities. Without renewable natural resources, development trends will not change.

10 August 2013 - USA today

### [Satellite to track climate change](#)

The world's first satellite dedicated solely to tracking atmospheric levels of carbon dioxide is being developed at a Gilbert, Ariz., manufacturing facility, as NASA scientists move to make space the next frontier in the study of global climate change.

9 August 2013 - CIFOR

### [Design benefit-sharing carefully, or risk undermining REDD+, researchers warn](#)

Mechanisms for sharing the benefits from REDD+ must be well designed or they could create problems in the long term, researchers from the Center for International Forestry Research (CIFOR) advise.

6 August 2013 - World Agroforestry Centre

### [Where will trees grow in a new climate?](#)

One of the aspects that scientists look at to evaluate the potential impacts of climate change on natural systems is the likely shift in the geographic distribution and habitats of various species.

2 August 2013 - World Agroforestry Centre

### [World's largest reforestation scheme fails to protect natural forests and threatens more](#)

Since 1999, in an attempt to protect biodiversity and improve environmental conditions, China has invested more than RMB 298 billion (USD 47.82 billion) in reforestation and 'payments

for ecosystem services' programs. The Sloping Land Conversion Program is the largest such program in the world. Initiated primarily as a response to the 1998 floods in the Yangtze River watershed, the Program has restored marginal cultivated lands on sloping land to forests or grasslands, increased forest cover and generally improved ecosystem services.

30 July 2013 - Eco-Business

### [Norway, Japan to fund forestry projects](#)

Viet Nam will receive US\$30 million from the Government of Norway to conduct the second phase of the National UN-REDD Programme to Reduce Emissions from Deforestation and Forest Degradation. The support was marked by an agreement signed yesterday between the Ministry of Agriculture and Rural Development and the Food and Agriculture Organisation (FAO) of the United Nations, the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP).

16 July 2013 - CIFOR

### [Carbon research in Zambia forests to help build REDD+ strategy](#)

Changing rainfall patterns, diminishing water supply, poor soil quality and disappearing tree species are all having a big impact on livelihoods in Zambia's Nyimba District, according to representatives from six local villages, who say that a lengthy 5-km walk to find the once commonplace mopane tree - prized for its edible caterpillars - is now standard. What is behind these dramatic changes? To what extent are they caused by increasing pressure on natural resources, and how much are they affected by customary laws, which differ from village to village?

11 July 2013 - IUCN

### [IUCN's first REDD+ Roundup Newsletter is Now Out](#)

The REDD+ Roundup shares links to the latest news on IUCN's work at the global, regional and national level to help reduce emissions from deforestation and forest degradation (REDD+) in developing countries. In the inaugural July issue of IUCN's monthly REDD+ Roundup newsletter, read the latest news on Uganda and Ghana's REDD+ efforts, as well as a preview of the autumn edition of IUCN's forest conservation magazine "Arborevitae", which focuses on Poverty and REDD+.

## II. MULTILATERAL PROCESSES IN CLIMATE CHANGE

No events to report on

## III. EVENTS & MEETINGS

### Upcoming events

#### **Paving the Way to Sustainable Forest and Carbon Management**

*19 - 21 August 2013, Faculty of Forestry, Universiti Putra Malaysia, Malaysia*

Arbonaut Ltd. in Finland and the Faculty of Forestry, Universiti Putra Malaysia (UPM) are organizing the workshop Arbonaut Users Days 2013 (AUD'13) from 19 to 21 August, 2013. The 3-days workshop will take place at Faculty of Forestry, Universiti Putra Malaysia, 43400, UPM Serdang, Selangor Darul Ehsan, MALAYSIA. The workshop will focus on basic LiDAR processing and LiDAR Assisted Multi-source Programme (LAMP) for forest inventory and REDD+. [More](#)

#### **International Conference on Climate Change and Tree Responses in Central European Forests**

*1-5 September 2013, Zürich, Switzerland*

The conference aims at exchanging the state of the art regarding direct (physical environment) and indirect effects (interspecific interactions) of climate change on the performance of trees and forest ecosystems. Topics to be discussed stretch from tree physiology and genetics to disturbances and community diversity, with a clear regional focus on Central Europe including the Alps and Carpathians. Keynotes on the response of trees/forest ecosystems to Climate Change (CC) in the focal region and in other regions of the world will frame the sessions, which are open for contributed talks. [More](#)

#### **Forests Africa. Opportunities for a Green Economy**

*17 - 19 September, Nairobi, Kenya.*

The United Nations Environment Programme (UNEP) and the Centre for International Forestry Research (CIFOR) will convene a three-day conference, Forests Africa: Opportunities for a Green Economy. The conference will be supported by the UN-REDD Programme, the World Agroforestry Centre and will be open for partnerships with other organizations. The event will provide a platform for key players from government, the private sector (formal and informal), civil society, media, as well as the research and development sectors, to openly discuss the challenges and opportunities that Africa's forests present for the development and comparative advantage of the continent and its transition to a Green Economy. The conference will aim to take a step toward repositioning forests within Africa's economic and political landscape. In transitioning to a Green Economy, Africa will require economic growth pathways that are diversified, generate greater employment, produce higher outputs with lower inputs, reduce environmental risks and enhance competitiveness for African economies. The conference will increase awareness of the challenges and opportunities for forests to contribute to green economies at the local, national and regional levels through sustainable management, REDD+, trade of forest products and services, and inclusive processes. It will also identify the range of enabling policies required. Delivering on such a goal will require coordinated collaboration among a broad range of policy and non-state stakeholders - especially those from outside the forestry sector. [More](#)

#### **EFI 20 Years Science and Policy Forum**

*23 - 27 September, 2013, Nancy, France*

European Forest Institute (EFI) celebrates its 20th anniversary in 2013. The commemoration is also an opportunity to develop an analysis of the future of our forests, and on how EFI and its partners can contribute to meet the challenges related to the various changes, risks and uncertainties to which the forests will be exposed. The EFI 20 Years Science and Policy Forum will stimulate balanced discussion between policy/decision makers, stakeholders and scientists on concrete issues related to the future of our forests, and the risks and opportunities they face. On 25 September, a high-level conference "Our forests in the 21<sup>st</sup> century - ready for risks and opportunities?" gathers both scientists and decision-makers. The follow-up of the conference on 26 September continues with a session "Risks to European Forests - What added value can a European Forest

Risk Facility provide?” [More](#)

## **Governors’ Climate and Forests Task Force**

1 - 4 October, Puerto Maldonado, Madre de Dios, Peru

The Governors’ Climate and Forests Task Force (GCF) is a unique subnational collaboration between 19 states and provinces from Brazil, Indonesia, Mexico, Nigeria, Peru, Spain, and the United States. The GCF seeks to advance jurisdictional programs for reducing emissions from deforestation and land use and link these activities with emerging greenhouse gas (GHG) compliance regimes and other pay-for-performance opportunities. More than 20% of the world’s tropical forests are in GCF states and provinces, including more than 75% of Brazil’s and more than half of Indonesia’s. The GCF includes states and provinces that are leading the way in building comprehensive, jurisdiction-wide approaches to reducing deforestation and low emissions development as well as the only jurisdiction in the world (California) that is considering provisions that would recognize efforts to reduce emissions from deforestation and forest degradation (REDD+) as part of its GHG compliance system.

[More](#)

## **IV. RESEARCH ARTICLES**

### **An Operational Framework for Defining and Monitoring Forest Degradation**

Thompson, I.D., Guariguata, M.R., Okabe, K., Bahamondez, C., Nasi, R., Heymell, V., Sabogal, C.

*Ecology and Society* 18 (2): 20

Forest degradation is broadly defined as a reduction in the capacity of a forest to produce ecosystem services such as carbon storage and wood products as a result of anthropogenic and environmental changes. The main causes of degradation include unsustainable logging, agriculture, invasive species, fire, fuelwood gathering, and livestock grazing. Forest degradation is widespread and has become an important consideration in global policy processes that deal with biodiversity, climate change, and forest management. There is, however, no generally recognized way to identify a degraded forest because perceptions of forest degradation vary depending on the cause, the particular goods or services of interest, and the temporal and spatial scales considered. Here, we suggest that there are types of forest degradation that produce a continuum of decline in provision of ecosystem services, from those in primary forests through various forms of managed forests to deforestation. Forest degradation must be measured against a desired baseline condition, and the types of degradation can be represented using five criteria that relate to the drivers of degradation, loss of ecosystem services and sustainable management, including: productivity, biodiversity, unusual disturbances, protective functions, and carbon storage. These criteria are not meant to be equivalent and some might be considered more important than others, depending on the local forest management objectives. We propose a minimum subset of seven indicators for the five criteria that should be assessed to determine forest degradation under a sustainable ecosystem management regime. The indicators can be remotely sensed (although improving calibration requires ground work) and aggregated from stand to management unit or landscape levels and ultimately to sub-national and national scales.

### **Efficient mitigation of founder effects during the establishment of a leading-edge oak population**

Hampe, A.; Pemonge, M. H.; Petit, R. J

*Proceedings of the Royal Society of London. Series B, Biological Sciences*; 2013. 280(1764):20131070.

Numerous plant species are shifting their range polewards in response to ongoing climate change. Range shifts typically involve the repeated establishment and growth of leading-edge populations well ahead of the main species range. How these populations recover from founder events and associated diversity loss remains poorly understood. To help fill this gap, we exhaustively investigated a newly established population of holm oak (*Quercus ilex*) growing more than 30 km ahead of the nearest larger stands. Pedigree reconstructions showed that plants belong to two non-overlapping generations and that the whole population originates from only two founder trees. The four first-generation trees that have reached maturity showed disparate mating patterns despite being full-sibs. Long-distance pollen immigration was notable despite the strong isolation of the stand: 6 per cent gene flow events in acorns collected on the trees ( $n=255$ ), and as much as 27 per cent among their established offspring ( $n=33$ ). Our results show that isolated leading-edge populations of wind-pollinated forest trees can rapidly restore their genetic diversity through the interacting effects of efficient long-distance pollen flow and purging of inbred individuals during recruitment. They imply that range expansions of these species are primarily constrained by initial propagule arrival rather than by subsequent gene flow.

## **Biomass and carbon storage pattern in an age series of teak plantation in dry tropics**

Sahu, K. P.; Lalji Singh; Alone, R. A.; Jhariya, M. K.; Pawar, G. V.  
*Vegetos*; 2013. 26(1):205-217

The present study was conducted to investigate the biomass and carbon storage pattern in an age series of teak plantation in tropical environment at Barnawapara Wildlife Sanctuary in Raipur district of Chhattisgarh during the year 2011-2012. The study was conducted in three different age of plantation (19 years, 23 years and 33 years old) in tropical environment. Forest structure was determined using phytosociological observations. Biomass for each plantation site was estimated using allometric equations based on the relationship between girth of tree and dry weight of the components. The carbon storage for the vegetation components was computed as the sum of the products obtained by multiplying dry weights of components with their mean carbon concentrations. A total of 13 species of 9 families were encountered. Tree stand density varied from 1010-1380 stems ha<sup>-1</sup> with basal area ranging from 23.54 to 44.75 m<sup>2</sup> ha<sup>-1</sup>. Species diversity index varied between 0.24 for 19 years old teak plantation to 1.07 for 33 years old teak plantation. The total biomass recorded in age series of teak plantation was between 119.37 t ha<sup>-1</sup> and 235.14 t ha<sup>-1</sup>, and it was highest in 33 years old teak plantation followed by 23 years old teak plantation and lowest in 19 years old teak plantation. The total above ground biomass in different age of plantation ranged from 99.08 to 197.88 t ha<sup>-1</sup>. The below ground biomass in different plantation sites varied from 20.29 to 37.26 t ha<sup>-1</sup>. The total tree biomass increased with age of the plantation. The total carbon (t ha<sup>-1</sup>) recorded among the different age of plantation sites was maximum in 33 years old teak plantation (101.40) followed by 23 years old teak plantation (90.66) and 19 years old teak plantation (51.32). The higher proportion of above ground carbon was allocated in bole followed by branch and root in different age of plantation. The above ground carbon in different age of plantation ranged between 44.07 to 88.09 t ha<sup>-1</sup>. The below ground carbon in different plantation varied from 7.25 to 13.31 t ha<sup>-1</sup>. From these studies, it is evident that the biomass and carbon increased steadily with respect to the increase in the age, dbh and height of the plantation as the biomass is generally associated with the age and size of the trees. Biomass of the individual tree components also increased with the increase in the age of the plantation.

## **Description of a new procedure to estimate the carbon stocks of all forest pools and impact assessment of methodological choices on the estimates**

Latte, N.; Colinet, G.; Fayolle, A.; Lejeune, P.; Hebert, J.; Claessens, H.; Bauwens, S  
*European Journal of Forest Research*; 2013. 132(4):565-577.

Forest ecosystems play a major role in atmospheric carbon sequestration and emission. Comparable organic carbon stock estimates at temporal and spatial scales for all forest pools are needed for scientific investigations and political purposes. Therefore, we developed a new carbon stock (CS) estimation procedure that combines forest inventory and soil and litter geodatabases at a regional scale (southern Belgium). This procedure can be implemented in other regions and countries on condition that available external carbon soil and litter data can be linked to forest inventory plots. The presented procedure includes a specific CS estimation method for each of the following forest pools and subpools (in brackets): living biomass (aboveground and belowground), deadwood (dead trees and snags, coarse woody debris and stumps), litter, and soil. The total CS of the forest was estimated at 86 Tg (185 Mg ha<sup>-1</sup>). Soil up to 0.2 m depth, living biomass, litter, and deadwood CSs account, respectively, for 48, 47, 4, and 1% of the total CS. The analysis of the CS variation within the pools across ecoregions and forest types revealed in particular that: (1) the living biomass CS of broadleaved forests exceeds that of coniferous forests, (2) the soil and litter CSs of coniferous forest exceed those of broadleaved forests, and (3) beech stands come at the top in carbon stocking capacity. Because our estimates differ sometimes significantly from the previous studies, we compared different methods and their impacts on the estimates. We demonstrated that estimates may vary highly, from -16 to +12%, depending on the selected methods. Methodological choices are thus essential especially for estimating CO<sub>2</sub> fluxes by the stock change approach. The sources of error and the accuracy of the estimates were discussed extensively.

## **Forest management for timber and carbon sequestration in the presence of climate change: the case of *Pinus sylvestris***

Goetz, R. U.; Hritonenko, N.; Mur, R.; Xabadia, A.; Yatsenko, Y  
*Ecological Economics*; 2013. 88:86-96

Climatic changes will affect the dynamics of a forest ecosystem. Consequently, carbon sequestration costs can only be estimated correctly if changes in climatic conditions are considered. This article determines the changes in mitigation costs of an optimal forest management regime in the presence of climatic changes and varying prices, and takes account of substitution processes between timber production and carbon sequestration at the stand level. The study demonstrates that in the presence of climate change the sequestration costs per ton of carbon increase with higher amounts of carbon sequestered per hectare. This finding can be used to identify a threshold for the amount of sequestered carbon per hectare below which the costs of carbon sequestration are hardly influenced by climate change.



### **Transaction costs of carbon offset projects: a comparative study**

Cacho, O. J.; Lipper, L.; Moss, J

*Ecological Economics*; 2013. 88:232-243

The land-use change and forestry sector can be a cost-effective contributor to climate mitigation in at least three ways: providing carbon offsets through carbon sequestration in biomass and soils, reducing emissions of methane and other greenhouse gases, and producing biofuels that replace fossil fuels. The presence of carbon markets should help encourage these activities; however, most carbon trades to date have occurred in the energy sector. A major obstacle to carbon trades from land-use systems is the presence of high transaction costs of converting a carbon offset into a tradable commodity, so the prevailing market carbon prices may not provide enough incentive for adoption. This paper presents a model of the exchange of carbon offsets between a project developer and a group of landholders. The model is solved to derive project feasibility frontiers that show the minimum number of contracts necessary to make a project feasible at any given carbon price. The model is applied to two case studies (smallholder agroforestry in Indonesia and partial reforestation of family farms in Australia) under two types of contract (purchase of carbon flows and rental of carbon stocks). The paper concludes by identifying possible strategies to reduce transaction costs while maintaining project integrity.

### **Rights to carbon and payments for services rendered under REDD+: options for the case of Mexico**

Skutsch, M.; Simon, C.; Velazquez, A.; Fernandez, J. C.

*Global Environmental Change*; 2013. 23(4):813-825.

Mexico is relatively advanced in its preparation for international policy on Reduced Emissions from Deforestation and forest Degradation (REDD+) and has many of the pre-conditions needed to support a community approach in the implementation of a national REDD+ programme, particularly as regards tenure of forests and experience with community forest management and PES schemes, although these conditions do not pertain everywhere. One critical issue that is yet to be resolved concerns rights to carbon credits and distribution of the financial benefits flowing from REDD+. We demonstrate that attribution of carbon credits from reduced deforestation and degradation at the community level is virtually impossible from a technical viewpoint, since these credits are counterfactual. Payments based on assessment of performance of each community in terms of such reductions would moreover be inequitable and inefficient. Flat rate payments in return for agreed improvements in management are likely to be more motivating and much easier to administer. However, increases in carbon stock (forest enhancement) can be physically measured on site, and could be more easily attributed to each individual community. We therefore propose a system in which reduced deforestation and degradation are considered environmental services, with credits accruing to national government. The financial value of the credits may be used to finance flat rate payments to communities who agree to implement improved management. On the other hand, credits for forest enhancement, which reflect measurable increases in carbon in the communities' trees, would be considered environmental goods. These should be considered the direct property of the owners of the forest (in the same sense as wood or poles) and it would be possible for communities to sell these credits themselves. We acknowledge however that many other problems face implementation of REDD+ in Mexico, and provide a number of important examples.

### **Public preferences for biodiversity conservation and climate-change mitigation: a choice experiment using ecosystem services indicators**

Shoyama, K.; Managi, S.; Yamagata, Y

*Land Use Policy*; 2013. 34:282-293

Potential conflicts exist between biodiversity conservation and climate-change mitigation as trade-offs in multiple-use land management. This study aims to evaluate public preferences for biodiversity conservation and climate-change mitigation policy considering respondents' uncertainty on their choice. We conducted a choice experiment using land-use scenarios in the rural Kushiro watershed in northern Japan. The results showed that the public strongly wish to avoid the extinction of endangered species in preference to climate-change mitigation in the form of carbon sequestration by increasing the area of managed forest. Knowledge of the site and the respondents' awareness of the personal benefits associated with supporting and regulating services had a positive effect on their preference for conservation plans. Thus, decision-makers should be careful about how they provide ecological information for informed choices concerning ecosystem services tradeoffs. Suggesting targets with explicit indicators will affect public preferences, as well as the willingness of the public to pay for such measures. Furthermore, the elicited-choice probabilities approach is useful for revealing the distribution of relative preferences for incomplete scenarios, thus verifying the effectiveness of

indicators introduced in the experiment.

### **Adaptive capacity of legal and policy frameworks for biodiversity protection considering climate change**

Pettersson, M.; Keskitalo, E. C. H

*Land Use Policy*; 2013. 34:213-222

Protection of biodiversity under conditions of climate change is likely to place large requirements on existing frameworks for biodiversity protection at both EU and national level. While these systems are not perfectly adapted today, the inclusion of climate change concerns will require revision and addition of new issues, such as species migration corridors and buffers, as well as proactive strategies in areas that may not be protected today. Biodiversity in forest is particularly important as forest range over large areas that include also other land uses; this holds particularly true for the large forested areas in northern Europe. Illustrating complexities regarding biodiversity protection, this study reviews the applicable legal framework related to biodiversity in forests on EU and national level in Sweden, one of the countries with the largest forest areas in the EU. Mainly drawing on a policy and legal study, the paper concludes that adapting the legislative and policy system to a future with large uncertainties in terms of extent of change poses a problem for what are largely reactive systems in particular in terms of legislation.

### **Implications of ice storm damages on the water and carbon cycle of bamboo forests in southeastern China**

Xu XiaoJun; Zhou GuoMo; Liu ShuGuang; Du HuaQiang; Mo LuFeng; Shi YongJun; Jiang Hong; Zhou YuFeng; Liu EnBin

*Agricultural and Forest Meteorology*; 2013. 177:35-45.

Extreme climate events have significant impacts on carbon and water exchanges between forest ecosystems and the atmosphere. Quantification of extreme climate event effects on carbon and water exchanges of forests can improve our understanding of the feedbacks between the terrestrial ecosystem and the atmosphere in the context of global change. This study analyzes the impacts of the early 2008 ice storm that occurred in southeastern China. The impacts on the Gross Primary Production (GPP) and Evapotranspiration (ET) of Moso bamboo forests were analyzed using ecosystem models, MODerate resolution Imaging Spectroradiometer (MODIS) data, and Eddy Covariance flux tower measurements. Interannual differences in GPP and ET were divided into three parts: (1) environmental-dependent, (2) biophysical-dependent, and (3) ice storm damage-dependent. Our results showed that the GPP and ET of Moso bamboo forests were accurately predicted using the remote sensing-driven Penman-Monteith (RS-PM) and Eddy Covariance Light Use Efficiency (EC-LUE) models, respectively. The early 2008 ice storm caused a slight decrease in annual ET and GPP, mainly during the ice storm. Plant transpiration had a slight decrease, but soil (background) evaporation increased because of the reduction in Leaf Area Index (LAI) caused by ice storm effects. This ice storm decreased annual mean GPP by  $0.17 \text{ g C m}^{-2} \text{ d}^{-1}$  (roughly 3% of average GPP in 2008) since the fraction of photosynthetically active radiation (FPAR) approached to zero because of ice and snow cover effects. Ice storm damage effects on ET and GPP for the off-year (the year with few new shoot production) were slightly greater than those for the on-year (the year with many new shoot production) due to their different growth characteristics. The time for bamboo forest recovery (1-2 years) from ice storm damage was quite short.

### **Land use effects on erosion and carbon storage of the Rio Chimbo watershed, Ecuador**

Henry, A.; Mabit, L.; Jaramillo, R. E.; Cartagena, Y.; Lynch, J. P

*Plant and Soil*; 2013. 367(1/2):477-491

Background and aims: Soil carbon storage is an important component of global carbon cycling. Andean Andisols have high carbon content and are vulnerable to erosion because of agricultural intensification and deforestation. This study examines the effects of land use on erosion and soil carbon storage in the Rio Chimbo watershed of Ecuador. Methods: Soil carbon content, age, and erosion estimated from  $^{137}\text{Cs}$  inventories was measured along an elevational transect under annual cropping, natural forest, paramo, pasture, and tree plantations. Results: Land use, particularly annual cropping, affected  $^{137}\text{Cs}$  levels in the upper soil layers, but did not have an impact on total carbon storage to a depth of 1 m. Relative erosion rates estimated from  $^{137}\text{Cs}$  inventories at sites under annual cropping averaged  $27 \text{ t ha}^{-1} \text{ y}^{-1}$  over the erosion rate of non-cultivated sites. A linear relationship was observed between soil carbon age (determined by  $^{14}\text{C}$  levels) and  $^{137}\text{Cs}$  levels, where pasture sites had lower  $^{137}\text{Cs}$  and older carbon compared to natural forest sites. Conclusions: The effects of land use on soil loss in the Rio Chimbo watershed suggest a loss and/or removal of soil carbon, particularly under annual cropping.



## **The global climate change mitigation strategy REDD: monitoring costs and uncertainties jeopardize economic benefits**

Plugge, D.; Baldauf, T.; Kohl, M.;

*Climatic Change*; 2013. 119(2):247-259.

REDD (Reducing Emissions from Deforestation and Forest Degradation) has been suggested as a climate change mitigation strategy that is based on the philosophy to reward countries for reducing their deforestation and forest degradation by financial benefits via the generation of carbon credits. While the potential of REDD has been widely discussed, minor attention has been drawn to the implication of uncertainties and costs associated with the estimation of carbon stock changes. To raise awareness of these issues, we conducted a simulation study for a set of countries that show high to low deforestation rates, which demonstrates that the potential to generate benefits from REDD depends highly on the magnitude of the total error while assessment costs and the price of carbon credits play a minor role. For countries with low deforestation rates REDD is obviously not an option for generating benefits as they would need to implement monitoring systems that are able to estimate carbon stock changes with a total error well below 1%. Total errors feasible under operational monitoring systems are only sufficient to gain revenues from REDD-regimes under high deforestation rates.

## **Sustained carbon uptake and storage following moderate disturbance in a Great Lakes forest**

Gough, C. M.; Hardiman, B. S.; Nave, L. E.; Bohrer, G.; Maurer, K. D.; Vogel, C. S.; Nadelhoffer, K. J.; Curtis, P. S

*Ecological Applications*; 2013. 23(5):1202-1215.

Carbon (C) uptake rates in many forests are sustained, or decline only briefly, following disturbances that partially defoliate the canopy. The mechanisms supporting such functional resistance to moderate forest disturbance are largely unknown. We used a large-scale experiment, in which >6700 *Populus* (aspen) and *Betula* (birch) trees were stem-girdled within a 39-ha area, to identify mechanisms sustaining C uptake through partial canopy defoliation. The Forest Accelerated Succession Experiment in northern Michigan, USA, employs a suite of C-cycling measurements within paired treatment and control meteorological flux tower footprints. We found that enhancement of canopy light-use efficiency and maintenance of light absorption maintained net ecosystem production (NEP) and aboveground wood net primary production (NPP) when leaf-area index (LAI) of the treatment forest temporarily declined by nearly half its maximum value. In the year following peak defoliation, redistribution of nitrogen (N) in the treatment forest from senescent early successional aspen and birch to non-girdled later successional species facilitated the recovery of total LAI to pre-disturbance levels. Sustained canopy physiological competency following disturbance coincided with a downward shift in maximum canopy height, indicating that compensatory photosynthetic C uptake by undisturbed, later successional subdominant and subcanopy vegetation supported C-uptake resistance to disturbance. These findings have implications for ecosystem management and modeling, demonstrating that forests may tolerate considerable leaf-area losses without diminishing rates of C uptake. We conclude that the resistance of C uptake to moderate disturbance depends not only on replacement of lost leaf area, but also on rapid compensatory photosynthetic C uptake during defoliation by emerging later successional species.

## **Forecasting deforestation and carbon emissions in tropical developing countries facing demographic expansion: a case study in Madagascar**

Vieilledent, G.; Grinand, C.; Vaudry, R

*Ecology and Evolution*; 2013. 3(6):1702-1716.

Anthropogenic deforestation in tropical countries is responsible for a significant part of global carbon dioxide emissions in the atmosphere. To plan efficient climate change mitigation programs (such as REDD+, Reducing Emissions from Deforestation and forest Degradation), reliable forecasts of deforestation and carbon dioxide emissions are necessary. Although population density has been recognized as a key factor in tropical deforestation, current methods of prediction do not allow the population explosion that is occurring in many tropical developing countries to be taken into account. Here, we propose an innovative approach using novel computational and statistical tools, including R/GRASS scripts and the new phcFM R package, to model the intensity and location of deforestation including the effect of population density. We used the model to forecast anthropogenic deforestation and carbon dioxide emissions in five large study areas in the humid and spiny-dry forests of Madagascar. Using our approach, we were able to demonstrate that the current rapid population growth in Madagascar (+3.39% per year) will significantly increase the intensity of deforestation by 2030 (up to +1.17% per year in densely populated areas). We estimated the carbon dioxide emissions associated with the loss of aboveground biomass to be of 2.24 and 0.26 tons per hectare and per year in the humid and spiny-dry forest, respectively. Our models showed better predictive ability than previous deforestation models (the figure of merit ranged from 10 to 23). We recommend this approach to reduce the uncertainty associated with deforestation forecasts. We also underline the risk of an increase in the speed of deforestation in the short term in tropical developing countries undergoing rapid population expansion.

## **Carbon allocation in a Bornean tropical rainforest without dry seasons**

Katayama, A.; Kume, T.; Komatsu, H.; Saitoh, T. M.; Ohashi, M.; Nakagawa, M.; Suzuki, M.; Otsuki, K.; Kumagai, T

*Journal of Plant Research*; 2013. 126(4):505-515

To clarify characteristics of carbon (C) allocation in a Bornean tropical rainforest without dry seasons, gross primary production (GPP) and C allocation, i.e., above-ground net primary production (ANPP), aboveground plant respiration (APR), and total below-ground carbon flux (TBCF) for the forest were examined and compared with those from Amazonian tropical rainforests with dry seasons. GPP ( $30.61 \text{ MgC ha}^{-1} \text{ year}^{-1}$ , eddy covariance measurements;  $34.40 \text{ MgC ha}^{-1} \text{ year}^{-1}$ , biometric measurements) was comparable to those for Amazonian rainforests. ANPP ( $6.76 \text{ MgC ha}^{-1} \text{ year}^{-1}$ ) was comparable to, and APR ( $8.01 \text{ MgC ha}^{-1} \text{ year}^{-1}$ ) was slightly lower than, their respective values for Amazonian rainforests, even though aboveground biomass was greater at our site. TBCF ( $19.63 \text{ MgC ha}^{-1} \text{ year}^{-1}$ ) was higher than those for Amazonian forests. The comparable ANPP and higher TBCF were unexpected, since higher water availability would suggest less fine root competition for water, giving higher ANPP and lower TBCF to GPP. Low nutrient availability may explain the comparable ANPP and higher TBCF. These data show that there are variations in C allocation patterns among mature tropical rainforests, and the variations cannot be explained solely by differences in soil water availability.

## **Experimental warming studies on tree species and forest ecosystems: a literature review**

Chung HaeGeun; Muraoka, H.; Nakamura, M.; Han SaeRom; Muller, O.; Son YowHan

*Journal of Plant Research*; 2013. 126(4):447-460

Temperature affects a cascade of ecological processes and functions of forests. With future higher global temperatures being inevitable it is critical to understand and predict how forest ecosystems and tree species will respond. This paper reviews experimental warming studies in boreal and temperate forests or tree species beyond the direct effects of higher temperature on plant ecophysiology by scaling up to forest level responses and considering the indirect effects of higher temperature. In direct response to higher temperature (1) leaves emerged earlier and senesced later, resulting in a longer growing season (2) the abundance of herbivorous insects increased and their performance was enhanced and (3) soil nitrogen mineralization and leaf litter decomposition were accelerated. Besides these generalizations across species, plant ecophysiological traits were highly species-specific. Moreover, we showed that the effect of temperature on photosynthesis is strongly dependent on the position of the leaf or plant within the forest (canopy or understory) and the time of the year. Indirect effects of higher temperature included among others higher carbon storage in trees due to increased soil nitrogen availability and changes in insect performance due to alterations in plant ecophysiological traits. Unfortunately only a few studies extrapolated results to forest ecosystem level and considered the indirect effects of higher temperature. Thus more intensive, long-term studies are needed to further confirm the emerging trends shown in this review. Experimental warming studies provide us with a useful tool to examine the cascade of ecological processes in forest ecosystems that will change with future higher temperature.

## **Human deforestation outweighs future climate change impacts of sedimentation on coral reefs**

Maina, J.; Moel, H. de; Zinke, J.; Madin, J.; McClanahan, T.; Vermaat, J. E

*Nature Communications*; 2013. 4(6):1986

Near-shore coral reef systems are experiencing increased sediment supply due to conversion of forests to other land uses. Counteracting increased sediment loads requires an understanding of the relationship between forest cover and sediment supply, and how this relationship might change in the future. Here we study this relationship by simulating river flow and sediment supply in four watersheds that are adjacent to Madagascar's major coral reef ecosystems for a range of future climate change projections and land-use change scenarios. We show that by 2090, all four watersheds are predicted to experience temperature increases and/or precipitation declines that, when combined, result in decreases in river flow and sediment load. However, these climate change-driven declines are outweighed by the impact of deforestation. Consequently, our analyses suggest that regional land-use management is more important than mediating climate change for influencing sedimentation of Malagasy coral reefs.

## **Rapid warming accelerates tree growth decline in semi-arid forests of Inner Asia**

Liu HongYan; Williams, A. P.; Allen, C. D.; Guo DaLi; Wu XiuChen; Anenkhonov, O. A.; Liang ErYuan; Sandanov, D. V.; Yin Yi; Qi ZhaoHuan; Badmaeva, N. K

*Global Change Biology*; 2013. 19(8):2500-2510

Forests around the world are subject to risk of high rates of tree growth decline and increased tree mortality from combinations of climate warming and drought, notably in semi-arid settings. Here, we assess how climate warming has affected tree growth in one of the world's most extensive zones of semi-arid forests, in Inner Asia, a region where lack of data limits our understanding of how climate change may impact forests. We show that

pervasive tree growth declines since 1994 in Inner Asia have been confined to semi-arid forests, where growing season water stress has been rising due to warming-induced increases in atmospheric moisture demand. A causal link between increasing drought and declining growth at semi-arid sites is corroborated by correlation analyses comparing annual climate data to records of tree-ring widths. These ring-width records tend to be substantially more sensitive to drought variability at semi-arid sites than at semi-humid sites. Fire occurrence and insect/pathogen attacks have increased in tandem with the most recent (2007-2009) documented episode of tree mortality. If warming in Inner Asia continues, further increases in forest stress and tree mortality could be expected, potentially driving the eventual regional loss of current semi-arid forests.

### **Tropospheric ozone reduces carbon assimilation in trees: estimates from analysis of continuous flux measurements**

Fares, S.; Vargas, R.; Detto, M.; Goldstein, A. H.; Karlik, J.; Paoletti, E.; Vitale, M

*Global Change Biology*; 2013. 19(8):2427-2443

High ground-level ozone concentrations are typical of Mediterranean climates. Plant exposure to this oxidant is known to reduce carbon assimilation. Ozone damage has been traditionally measured through manipulative experiments that do not consider long-term exposure and propagate large uncertainty by up-scaling leaf-level observations to ecosystem-level interpretations. We analyzed long-term continuous measurements (>9 site-years at 30 min resolution) of environmental and eco-physiological parameters at three Mediterranean ecosystems: (i) forest site dominated by *Pinus ponderosa* in the Sierra Mountains in California, USA; (ii) forest site composed of a mixture of *Quercus* spp. and *P. pinea* in the Tyrrhenian sea coast near Rome, Italy; and (iii) orchard site of *Citrus sinensis* cultivated in the California Central Valley, USA. We hypothesized that higher levels of ozone concentration in the atmosphere result in a decrease in carbon assimilation by trees under field conditions. This hypothesis was tested using time series analysis such as wavelet coherence and spectral Granger causality, and complemented with multivariate linear and nonlinear statistical analyses. We found that reduction in carbon assimilation was more related to stomatal ozone deposition than to ozone concentration. The negative effects of ozone occurred within a day of exposure/uptake. Decoupling between carbon assimilation and stomatal aperture increased with the amount of ozone pollution. Up to 12-19% of the carbon assimilation reduction in *P. ponderosa* and in the *Citrus* plantation was explained by higher stomatal ozone deposition. In contrast, the Italian site did not show reductions in gross primary productivity either by ozone concentration or stomatal ozone deposition, mainly due to the lower ozone concentrations in the periurban site over the shorter period of investigation. These results highlight the importance of plant adaptation/sensitivity under field conditions, and the importance of continuous long-term measurements to explain ozone damage to real-world forests and calculate metrics for ozone-risk assessment.

### **Long-term changes in forest carbon under temperature and nitrogen amendments in a temperate northern hardwood forest**

Savage, K. E.; Parton, W. J.; Davidson, E. A.; Trumbore, S. E.; Frey, S. D

*Global Change Biology*; 2013. 19(8):2389-2400

Currently, forests in the northeastern United States are net sinks of atmospheric carbon. Under future climate change scenarios, the combined effects of climate change and nitrogen deposition on soil decomposition, aboveground processes, and the forest carbon balance remain unclear. We applied carbon stock, flux, and isotope data from field studies at the Harvard forest, Massachusetts, to the ForCent model, which integrates above- and belowground processes. The model was able to represent decadal-scale measurements in soil C stocks, mean residence times, fluxes, and responses to a warming and N addition experiment. The calibrated model then simulated the longer term impacts of warming and N deposition on the distribution of forest carbon stocks. For simulation to 2030, soil warming resulted in a loss of soil organic matter (SOM), decreased allocation to belowground biomass, and gain of aboveground carbon, primarily in large wood, with an overall small gain in total system carbon. Simulated nitrogen addition resulted in a small increase in belowground carbon pools, but a large increase in aboveground large wood pools, resulting in a substantial increase in total system carbon. Combined warming and nitrogen addition simulations showed a net gain in total system carbon, predominately in the aboveground carbon pools, but offset somewhat by losses in SOM. Hence, the impact of continuation of anthropogenic N deposition on the hardwood forests of the northeastern United States may exceed the impact of warming in terms of total ecosystem carbon stocks. However, it should be cautioned that these simulations do not include some climate-related processes, different responses from changing tree species composition. Despite uncertainties, this effort is among the first to use decadal-scale observations of soil carbon dynamics and results of multifactor manipulations to calibrate a model that can project integrated aboveground and belowground responses to nitrogen and climate changes for subsequent decades.

## **Climate isn't everything: competitive interactions and variation by life stage will also affect range shifts in a warming world**

Ettinger, A. K.; Lambers, J. H. R

*American Journal of Botany*; 2013. 100(7):1344-1355

Premise of the study: The extent to which climate controls species' range limits is a classic biological question that is particularly relevant given anthropogenic climate change. While climate is known to play a role in species distributions, biotic interactions such as competition also affect range limits. Furthermore, climatic and biotic controls of ranges may vary in strength across life stages, implying complex range shift dynamics with climate change. Methods: We quantified climatic and competitive influences on growth of juvenile and adult trees of three conifer species on Mt. Rainier, Washington, United States. We collected annual growth data of these trees, which we compared to the competitive environment and annual climate (100 years of data) experienced by each individual. Key results: We found that the relationships between growth and climate and between growth and competition differed by life stage and location. Growth was sensitive to heavy snowpack and cold temperatures at high elevation upper limits (treeline), but growth was poorly explained by climate in low elevation closed-canopy forests. Competitive effects on growth were more important for saplings than adults, but did not become more important at either upper or lower range limits. Conclusions: In all, our results suggest that range shifts under climate change will differ at leading vs. trailing edges. At treeline, warmer temperatures will lead to increased growth and likely to range expansion. However, climate change will have less dramatic effects in low elevation closed-canopy forest communities, where growth is less strongly limited by climate, especially at young life stages.

## **Differences in the potential hydrologic impact of climate change to the Athabasca and Fraser River basins of Canada with and without considering shifts in vegetation patterns induced by climate change**

Kerkhoven, E.; Gan, T. Y

*Journal of Hydrometeorology*; 2013. 14(3):963-976

The research objectives are to estimate differences between the potential impact of climatic change to the Athabasca River basin (ARB) and Fraser River basin (FRB) of Canada with and without considering shifts in vegetation patterns induced by climate change and how much the difference will depend on vegetation types and climate. The hydrologic effects of vegetation shifts on ARB and FRB were estimated by applying the Mapped Atmosphere-Plant-Soil System (MAPSS) simulated results based on the Intergovernmental Panel on Climate Change's First and Second Assessment Report general circulation model (GCM) scenarios to the modified Interaction Soil-Biosphere-Atmosphere (MISBA) scheme. According to MAPSS, vegetation shifts in mountainous regions of FRB are expected to be dominated by conifer/broadleaf competition, while in ARB, climate projections of MAPSS predicted a southern expansion of the boreal forest. Because of differences in sublimation, there is a tendency for more snow to accumulate in open grassland than forests. Furthermore, changes to simulated mean annual maximum snowpack, runoff, and basin area covered by grassland are positively correlated to each other. Generally, a 4% increase in snow water equivalent (SWE) results in a 1% increase in mean annual runoff. These relationships hold true in both basins over a wide range of GCM-projected climate conditions and vegetation responses, suggesting that most changes in mean annual flow can be attributed to changes in SWE. Because of the different modeling approaches between MAPSS and MISBA, it seems that the treatment of these processes in vegetation and hydrologic models should be similar before conclusions can be drawn from various stand-alone simulations. Ideally, a land surface scheme should be coupled with a vegetation model in future studies.

## **Feedstock specific environmental risk levels related to biomass extraction for energy from boreal and temperate forests**

Lamers, P.; Thiffault, E.; Pare, D.; Junginger, M.

*Biomass and Bioenergy*; 2013. 55:212-226

Past research on identifying potentially negative impacts of forest management activities has primarily focused on traditional forest operations. The increased use of forest biomass for energy in recent years, spurred predominantly by policy incentives for the reduction of fossil fuel use and greenhouse gas emissions, and by efforts from the forestry sector to diversify products and increase value from the forests, has again brought much attention to this issue. The implications of such practices continue to be controversially debated; predominantly the adverse impacts on soil productivity and biodiversity, and the climate change mitigation potential of forest bioenergy. Current decision making processes require comprehensive, differentiated assessments of the known and unknown factors and risk levels of potentially adverse environmental effects. This paper provides such an analysis and differentiates between the feedstock of harvesting residues, roundwood, and salvage wood. It concludes that the risks related to biomass for energy outtake are feedstock specific and vary in terms of scientific certainty. Short-term soil productivity risks are higher for residue

removal. There is however little field evidence of negative long-term impacts of biomass removal on productivity in the scale predicted by modeling. Risks regarding an alteration of biodiversity are relatively equally distributed across the feedstocks. The risk of limited or absent short-term carbon benefits is highest for roundwood, but negligible for residues and salvage wood. Salvage operation impacts on soil productivity and biodiversity are a key knowledge gap. Future research should also focus on deriving regionally specific, quantitative thresholds for sustainable biomass removal.

### **Aboveground biomass estimation of small diameter woody species of tropical dry forest**

Chaturvedi, R. K.; Raghubanshi, A. S

*New Forests*; 2013. 44(4):509-519.

Estimation of accurate biomass of different forest components is important to estimate their contribution to total carbon stock. There is lack of allometric equations for biomass estimation of woody species at sapling stage in tropical dry forest (TDF), and therefore, the carbon stored in this forest component is ignored. We harvested 46 woody species at sapling stage in a TDF and developed regression models for the biomass estimation of foliage, branch, bole and the total aboveground part. For foliage and branch biomass, the models with only stem diameter as estimator showed greater  $R^2$ . For bole and aboveground biomass, the models including wood specific gravity or wood density exhibited higher  $R^2$  than those without wood density. Also, the model consisting of wood density, stem diameter and height had the lowest standard error of estimate for bole and aboveground biomass. Moreover, the  $R^2$  values are very similar among models for each component. The measurement error of height and the use of a standard value of wood density together may introduce more than 2% error into the models. Therefore, we suggest using diameter-only model, which may be more practical and equally accurate when applied to stands outside our study area.

### **Towards a European forest policy - conflicting courses**

Edwards, P.; Kleinschmit, D

*Forest Policy and Economics*; 2013. 33:87-93

Over the past several years, at least three different forest policy processes have emerged in the European sphere, two of which are legally binding agreements - one under the auspices of Forest Europe, attempting to negotiate a legally binding agreement; and two, the possibility of a legally binding agreement within the European Union (EU). We aim to identify, reconstruct and classify the major conflicts in both the Commission Green Paper on forest protection and information in the EU: preparing forests for climate change and Forest Europe initiated LBA process. The theoretical framework of this study uses an adapted conflict regulation approach based on the conflict triangle model. Empirically four dimensions are analysed to reconstruct and classify the conflicts: substance, procedure, relationship and discourses around the conflict. Empirical data has been gathered by qualitative document analysis and expert interviews with stakeholders at the national and EU level. The results of the empirical analysis identify three major conflicting interests: (a) the subsidiarity principle, (b) forest management and (c) the responsibility for conducting the negotiations. Classifying these three conflicts into substance and procedural dimensions highlights the major role of the latter within the recent European forest policy processes.

### **Carbon allocation, sequestration and carbon dioxide mitigation under plantation forests of north western Himalaya, India**

Devi, B.; Bhardwaj, D. R.; Panwar, P.; Pal, S.; Gupta, N. K.; Thakur, C. L.

*Annals of Forest Research*; 2013. 56(1):123-135.

The organic carbon and soils of the world comprise bulk of the terrestrial carbon and serve as a major sink and source of atmospheric carbon. Increasing atmospheric concentrations of green house gases may be mitigated by increasing carbon sequestration in vegetation and soil. The study attempted to estimate biomass production and carbon sequestration potential of different plantation ecosystems in north western Himalaya, India. Biomass, carbon density of biomass, soil, detritus, carbon sequestration and CO<sub>2</sub> mitigation potential were studied under different plantation forest ecosystems comprising of eight different tree species viz. *Quercus leucotrichophora*, *Pinus roxburghii*, *Acacia catechu*, *Acacia mollissima*, *Albizia procera*, *Alnus nitida*, *Eucalyptus tereticornis* and *Ulmus villosa*. Above (185.57±or-48.99 t ha<sup>-1</sup>) and below ground (42.47±or-10.38 t ha<sup>-1</sup>) biomass was maximum in *Ulmus villosa*. The vegetation carbon density was maximum in *Albizia procera* (118.37±or-1.49 t ha<sup>-1</sup>) and minimum (36.50±or-9.87 t ha<sup>-1</sup>) in *Acacia catechu*. Soil carbon density was maximum (219.86±or-10.34 t ha<sup>-1</sup>) in *Alnus nitida*, and minimum (170.83±or-20.60 t ha<sup>-1</sup>) in *Pinus roxburghii*. Detritus was higher in *Pinus roxburghii* (6.79±or-2.0 t ha<sup>-1</sup>). Carbon sequestration (7.91±or-3.4 t ha<sup>-1</sup>) and CO<sub>2</sub> mitigation potential (29.09±or-12.78 t ha<sup>-1</sup>) was maximum in *Ulmus villosa*. Pearson correlation matrix revealed significant positive relationship of ecosystem carbon with plantation biomass, soil carbon and CO<sub>2</sub> mitigation potential. With the emerging threat of climate change, such assessment of forest and soil carbon inventory would allow to devise best land management and policy decisions for sustainable management of fragile hilly ecosystem.

## Carbon stocks and cocoa yields in agroforestry systems of Central America

Somarriba, E.; Cerda, R.; Orozco, L.; Cifuentes, M.; Davila, H.; Espin, T.; Mavisoy, H.; Avila, G.; Alvarado, E.; Poveda, V.; Astorga, C.; Say, E.; Deheuvels, O.;  
*Agriculture, Ecosystems & Environment*; 2013. 173:46-57.

The cocoa tree (*Theobroma cacao* L.) is cultivated typically in agroforestry systems in close association with a rich list of tree species and other useful plants on the same plot. Cocoa based agroforestry systems are credited for stocking significant amounts of carbon and hence have the potential to mitigate climate change. Since cocoa yields decrease non-linearly with increasing shade, a need is to design optimal cocoa agroforestry systems with high yields and high carbon stocks. We estimated the carbon stocked in a network of 229 permanent sample plots in cacao-based agroforestry systems and natural forests in five Central American countries. Carbon stocks were fractioned by both system compartments (aboveground, roots, soil, litter, dead wood - fine and coarse, and total) and tree use/form (cocoa, timber, fruit, bananas, shade and ornamentals, and palms). Cocoa plantations were assigned to a five-class typology and tested for independence with growing region using contingency analysis. Most Central American cocoa plantations had mixed or productive shade canopies. Only 4% of cocoa plantations were full sun or rustic (cocoa under thinned natural forest). Cocoa tree density was low (548+or-192 trees ha<sup>-1</sup>). Total carbon (soil+biomass+dead biomass) was 117+or-47 Mg ha<sup>-1</sup>, with 51 Mg ha<sup>-1</sup> in the soil and 49 Mg ha<sup>-1</sup> (42% of total carbon) in aboveground biomass (cocoa and canopy trees). Cocoa trees accumulated 9 Mg C ha<sup>-1</sup> (18% of carbon in aboveground biomass). Timber and fruit trees stored 65% of aboveground carbon. The annual rate of accumulation of carbon in aboveground biomass ranged between 1.3 and 2.6 Mg C ha<sup>-1</sup> y<sup>-1</sup>. Trade-offs between carbon levels and yields were explored qualitatively using functional relationships documented in the scientific and technical literature, and expert knowledge. We argue that it is possible to design cocoa-based AFS with good yields (cocoa and shade canopy) and high carbon stock levels. The botanical composition of the shade canopy provides a large set of morphological and functional traits that can be used to optimize shade canopy design. Our results offer Central American cocoa producers a rigorous estimate of carbon stocks in their cocoa plantations. This knowledge may help them to certify and sell their cocoa, timber, fruits and other goods to niche markets with good prices. Our results will also assist governments and the private sector in (i) designing better legal, institutional and policy frameworks, local and national, promoting an agriculture with trees and (ii) contributing to the development of the national monitoring, reporting and verification systems required by the international community to access funding and payment for ecosystem services.

## The significance of CSR in A/R CDM promotion from the case study of Japan: a focus on corporate forest-related activities and emission trading

Fukushima, T

*Journal of Forest Research*; 2013. 18(4):293-304

Today, all companies, irrespective of their industrial classification, have begun to accept approaches to environmental issues as a requirement of conducting business activities. Under such a condition, the CSR (corporate social responsibility) concept is gaining more attention. The CSR concept varies according to the individual country or region, and the period. This study targets the CSR in Japan. This paper intends to analyze and discuss corporate forest-related activities, emission trading and the relationship between A/R CDM (afforestation/reforestation clean development mechanism) and CSR based on the results obtained from the questionnaire. A/R CDM is the political measure based on the Kyoto Protocol to remove greenhouse gases by afforestation and reforestation projects in developing countries. The survey results are as follows: (1) about 60% of companies responded as "CSR being a business opportunity" and "non-implementation of CSR being a business risk," (2) 60-70% of companies are involved in forest-related activities in some way, irrespective of industry, (3) a certain proportion of companies have purchased emission credits and have a high level of interest in carbon offsets, and (4) concerning A/R CDM, companies have a high recognition, but over 70% of them are at the "information collecting stage" with regard to participation. In conclusion, CSR is insufficient as a driving force for A/R CDM promotion, but can suffice for promoting carbon offset-oriented forest-related activities.

## Monthly stem increment in relation to climatic variables during 7 years in an East African rainforest

Gliniars, R.; Becker, G. S.; Braun, D.; Dalitz, H

*Trees: Structure and Function*; 2013. 27(4):1129-1138.

Monthly stem increment of 766 trees was assessed for 7 years in Kakamega Forest, Kenya and related to monthly climatic variables. Mean stem increment of all tree individuals correlated negatively with maximum temperature but not with mean and minimum temperatures. For the precipitation variables sum of precipitation and number of rainy days we found positive correlations. Stem increment of the trees in the early-, mid-, and late-successional groups correlated positively with the number of rainy days. For late-



successional trees increment correlated negatively with mean and maximum temperature and positively with all other precipitation variables. For mid-successional trees we found a negative correlation with mean temperature. In addition, the stem increment of most species related positively to precipitation variables and negatively to mean and maximum temperature. In view of the expected increasing temperatures and fewer but heavier rain events, our results suggest that climate change will lead to a reduction in stem increment. The results appertaining to the successional groups imply that early and mid-successional species are better equipped to perform well under the expected future climatic conditions than the late-successional species. This could reduce the role of this East African forest as a carbon store. As the responses to climatic variables were highly group- and species-specific it is likely that climate change will result in a species composition shift, presumably in favour of drought-resistant and heat-tolerating species.

### **Design considerations for tropical forest inventories**

McRoberts, R. E.; Tomppo, E. O.; Vibrans, A. C.; Freitas, J. V. de;  
*Pesquisa Florestal Brasileira*; 2013. 33(74):188-201

Forests contribute substantially to maintaining the global greenhouse gas balance, primarily because among the five economic sectors identified by the United Nations Framework Convention on Climate Change, only the forestry sector has the potential to remove greenhouse gas emissions from the atmosphere. In this context, development of national forest carbon accounting systems, particularly in countries with tropical forests, has emerged as an international priority. Because these systems are often developed as components of or in parallel with national forest inventories, a brief review of statistical issues related to the development of forest ground sampling designs is provided. This overview addresses not only the primary issues of plot configurations and sampling designs, but also to a lesser extent the emerging roles of remote sensing and uncertainty assessment. Basic inventory principles are illustrated for two case studies, the national forest inventory of Brazil with special emphasis on the state of Santa Catarina, and an inventory for Tanzania.

### **Do shifting forest limits in south-west Norway keep up with climate change?**

Rannow, S

*Scandinavian Journal of Forest Research*; 2013. 28(6):574-580.

In this paper, high-resolution remote sensing data were used to investigate whether a change in the alpine forest limit is observable on the Hardangervidda plateau in south-west Norway. A comparison of declassified CORONA images from 1965 with modern digital aerial surveys from 2004 provided evidence for a change of forest limits towards higher elevations. However, the observed upslope movement is lower than should be expected considering local climate warming and changes in land use. Projections of climate-induced impacts on the forest limits on Hardangervidda based on equilibrium assumptions do not hold true. There are considerable differences between the reaction of forest cover and changes in tree line. Forest cover in alpine areas might show an extensive time lag in the reaction to climatic change, even though conditions for growth of individual trees may have improved considerably. Consequentially, it should be expected that warming temperatures will not cause an immediate and homogenous advancement of forest cover towards higher elevations.

### **Deforestation and landscape structure changes related to socioeconomic dynamics and climate change in Zagros forests**

Khalyani, A. H.; Mayer, A. L.; Falkowski, M. J.; Muralidharan, D

*Journal of Land Use Science*; 2013. 8(3):321-340

The Zagros region of western Iran has been affected by the recent changes both in amount and in structure of forest cover. We evaluated the influence of several driving forces on forest cover and structure, including socioeconomic (urban and rural population and rural income) and climatic (mean annual rainfall and mean annual temperature) variables. We acquired all time series Landsat images of a study site from 1972 to 2009. The images were classified to produce a land cover map of each year. We calculated landscape and patch metrics and identified independent sets of metrics to describe forest change. The most influential driving force for forest loss was urban population and climatic variables to some extent. These challenges should be addressed at broader scales than those associated with the livelihoods and traditional management of local communities. Rural population had a significant association with landscape structure which should be considered in designing restoration projects.

### **Forest stands as dynamical systems: an introduction.**

Garcia, O

*Modern Applied Science*; 2013. 7(5):32-38.

Forest management planning relies heavily on mathematical models that involve time. Concerns about climate

change and ecosystem services have highlighted the limitations of traditional growth and yield prediction tools. Modern dynamical system theory provides a framework for a flexible representation of varying environments, as well as of responses to intensive silviculture and natural disturbances. Emphasis changes from trying to directly model functions of time to modelling rates of change. The fundamental concepts are introduced here in a non-technical manner. The theory is illustrated with a recent whole-stand growth model for even-aged stands, but it is noted that it applies to any system that evolves over time. It is shown also how a modular approach can improve balance and efficiency in the development of such models.

### **Carbon sequestration and carbon flow in harvested wood products for China**

Ji ChunYi; Yang HongQiang; Nie Ying; Hong YinXing

*International Forestry Review*; 2013. 15(2):160-168

The storage of carbon in harvested wood products (HWP) is an important forestry issue in the United Nations Framework on Climate Change Convention. Given that China is a large HWP-trading country, studies on carbon storage and flow of HWP trade are important to help mitigate carbon concentrations in this country. Total carbon storage has continuously increased, and the accumulated carbon storage of HWP in use is greater than that from wood harvested in China. The average annual changes in carbon stock from 1961 to 2011 based on stock-change, production, and atmospheric-flow approaches were 10.6, 7.6, and 2.6 Mt C per year, respectively. Carbon flow in wood product imports has increased constantly, thereby increasing carbon stocks via a stock-change approach. Based on atmospheric-flow approach, large imports of primary wood materials increased the carbon emissions. As a result, the trade of HWP has made HWP in China become a "carbon source."

### **Carbon sequestration rates in Van Panchayat forests and their benefits under REDD**

Rawat, V. S

*Journal of Asian Scientific Research*; 2013. 3(4):396-402.

This study assessed the potential of carbon stock and carbon sequestration rates in Van Panchayat forests at an altitude of 1500-1800 m. The total forest biomass was 308.3 t ha<sup>-1</sup>, of the total biomass tree layer contributed the most, followed by herbs and shrubs. The forest litter biomass varied between 5.4 t ha<sup>-1</sup> (in rainy season) and 6.6 t ha<sup>-1</sup> (in winter season). Maximum Carbon sequestration rate was 5.68 t ha<sup>-1</sup> year<sup>-1</sup> while, minimum carbon sequestration rate was 2.03 t ha<sup>-1</sup> year<sup>-1</sup>. In the present study the girth class of major species was in the younger size of 30-80 cm. The Van Panchayats will have greater potential for future sequestration. If we want to maximize carbon sequestration rates, we need forest management practices that results in healthy forests of all ages. We should give careful consideration to encouraging the conversion of marginal agricultural and range lands to Van Panchayat forest land.

### **Reclaiming degraded rainforest: a spatial evaluation of gains and losses in subtropical eastern Australia to inform future investment in restoration.**

Shoo, L. P.; Scarth, P.; Schmidt, S.; Wilson, K. A.;

*Restoration Ecology*; 2013. 21(4):481-489

Forest restoration is expected to play a pivotal role in reducing extinctions driven by deforestation and climate change over the next century. However, spatial and temporal patterns of restoration (both passive and active) are likely to be highly variable depending on degree of land use change as well as levels of forest and soil degradation and residual vegetation. Uncertainties regarding the spatial and temporal reinstatement of forest on degraded land make it difficult to determine where future investment in active restoration should be targeted. We used satellite data to quantify change in the extent and foliage projection cover (FPC) of woody vegetation returning to land previously cleared of subtropical rainforest in eastern Australia. We show a modest recovery of woody vegetation but document high variability in this trend between local areas, expanding by over 5% in some situations but declining by up to 2% in others over the last decade (1999-2009 period). This was accompanied by minor change in average FPC (-0.2 to 4.2%). Overall, decadal expansion in woody vegetation was most apparent in local areas with intermediate levels of existing forest reestablishment and was most likely to occur on steep terrain near existing vegetation. These results provide a valuable first evaluation of where restoration is occurring and the likely time frame required to meet conservation objectives under a business as usual scenario. This knowledge enables returns from current investment to be quantified and can be used to better allocate funds for restoration in the future.

### **Intensification of coffee systems can increase the effectiveness of REDD mechanisms**

Noponen, M. R. A.; Hagggar, J. P.; Edwards-Jones, G.; Healey, J. R.;

*Agricultural Systems*; 2013. 119:1-9

In agricultural production systems with shade trees, such as coffee, the increase in greenhouse gas (GHG) emissions from production intensification can be compensated for, or even outweighed, by the increase in carbon sequestration into above-ground and below-ground tree biomass. We use data from a long-term coffee

agroforestry experiment in Costa Rica to evaluate the trade-offs between intensification, profitability and net greenhouse gas emissions through two scenarios. First, by assessing the GHG emissions associated with conversion from shaded to more profitable full-sun (un-shaded) systems, we calculate the break-even carbon price which would need to be paid to offset the opportunity cost of not converting. The price per t CO<sub>2</sub>e of emissions reduction required to compensate for the coffee production revenue foregone varies widely from 9.3 to 196.3 US\$ amongst different shaded systems. Second, as an alternative to intensification, production area can be extended onto currently forested land. We estimate this land-use change required to compensate for the shortfall in profitability from retaining lower intensity coffee production systems. For four of the five shade types tested, this land-use change causes additional GHG emissions >5 t CO<sub>2</sub>e ha<sup>-1</sup> yr<sup>-1</sup> resulting in net emissions >8 t CO<sub>2</sub>e ha<sup>-1</sup> yr<sup>-1</sup> for the whole system. We conclude that instead, by intensifying production, mechanisms similar to REDD that are based on reducing emissions through avoided land-use change (REAL) could play a major role in increasing the climate change mitigation success of agroforestry systems at the same time as aiding REDD through reducing pressure for further forest conversion to agriculture.

## **Sustainable development: the journey from Rio (1992) to Rio+20 and beyond.**

Dash, M. C

*International Journal of Ecology and Environmental Sciences*; 2013. 39(1):1-21

Rio-1992 conference gave widespread visibility of the concept of sustainable development (SD), developed by Brundtland commission (1983-1987) and defined Sustainable Development as the development which meets the needs of the present generation without compromising with the necessities of the future generations and proclaimed 27 principles for its implementation. Since the Rio-1992 summit, and adoption of Agenda-21 by the global community, most of the countries including India have set sustainability as a key goal for their development. It is generally accepted that the four pillars of sustainable development are the environmental, social, economic, and technological wellbeing, especially green technology. To achieve SD, different management systems are adopted. The defining aspects of SD are: population control, energy use, increasing productivity, water resource conservation, biodiversity conservation, development of science & technology, and technology transfer. The Rio+20 (2012) emphasised Green Economy, which includes all aspects of SD but emphasizes on the adoption of Green Technology. Indicators of green economy are (i) CO<sub>2</sub> productivity-demand & production based, (ii) Non-energy material productivity (manufacturing) by material group, (iii) measures of natural resource stock. The essence is using green technologies in manufacturing and other sectors so that the GHG load to the environment is substantially reduced to lessen the effect of climate change. The world population is rising and predicted to reach 9 billion by 2050. With huge population increase, there will be enormous pressure on the resources. The world will face several challenges in health care, food and energy security, and fresh water availability. India accounts for the largest proportion of malnourished children in the world and exhibits very high variability; on one hand we have high GDP growth rates, a big pool of scientific manpower, a large middle class, malls, global retail chains, expanding multi-millionaires, and on the other hand huge number of people under poverty, unemployment and debt, with limited access to health facility and education, and most of them live rural areas and slum areas of urban centres. The business group and the people having an assured high income must consider contributing to a fund for national welfare of the deprived people. The Corporate Social Responsibility (CSR) is another option, which can be made mandatory. Massive awareness for population control is to be created. There is increased need of energy in the agriculture, industrial and service sectors. Modern way and standard of living demand more energy for unsustainable consumerism, transport, increased construction work and other aspects of human use. Biomass forms important component of energy source for rural India and about 360 million people depend upon biomass as energy source. India produces 300 million Mg of sugarcane annually and bagasse can be used to produce butanol on a large scale. To lessen the effect of climate change, algae can be used as efficient GHG sequesters. Algae require non-agricultural land, fresh water pond and shallow marine areas (brackish water, saline break water, saline shallow coastal areas etc) for their mass cultivation. About 1 million ha of wasteland is available for algal cultivation. Arresting climate change will require transforming the Indian economy from a high carbon to low carbon and no carbon energy base. The GHG sinks such as forest, is shrinking due to fragmentation and by anthropogenic interference. Soil is getting eroded; marine ecosystem getting polluted and they require conservation measures. Soil biodiversity is an important source of C-sink. These aspects have been discussed in this paper and a conceptual model for GHG sink study has been suggested.

## **Socio-economic, environmental, and governance impacts of illegal logging**

Reboredo, F.

*Environment Systems and Decisions*; 2013. 33(2):295-304.

This article examines the main impacts of the illegal logging activities with emphasis on the most important timber production regions. Although the discussion is focused on the environmental, socio-economic and governance impacts, it must be stressed that the term forest governance is the umbrella where the economy, the environmental values, and welfare of forest-dependent communities are sheltered. Considering the

effects/impacts of the illegal logging as a whole, we can summarize the following negative key points: (1) Degradation of the most valuable forest stands threatening biodiversity, including rare and endangered species. (2) Increase in soil erosion and landslides. Increase in CO<sub>2</sub> release and climatic changes. (3) Human rights abuses and disrespect of the basic needs of local communities and their culture. (4) Corruption, crime, coercion, and money laundering. (5) Reduction of royalties, taxes, and other charges paid by logging companies to the producer States. (6) Depreciation of legal activities due to the unfair concurrence. Despite multiple efforts, the results in the combat of illegal logging are far from satisfactory. Increase the certification area in parallel with an accurate control, devolve the state land to the ancient local owners, increase the cooperation between civil society and forest authorities, and finally strongly improve forest governance, particularly anti-money laundering laws, are crucial aspects in the combat of illegal logging. Furthermore, governments and businesses must implement the triple bottom line concept in order to reach sustainability.

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

### **Scoping Dialogue on REDD+ Benefit Sharing. Co-chairs' Summary Report**

#### *The Forests Dialogue*

The Forests Dialogue (TFD) convened a scoping dialogue on REDD+ Benefit Sharing hosted by the World Bank on 23-24 March 2013. The dialogue engaged 40 experts (Annex 1) representing a wide spectrum of stakeholder groups including government, non-governmental organizations, Indigenous Peoples, community members, inter-governmental organizations and research institutes. These participants brought to the dialogue a diverse set of expertise and perspectives in REDD+ policy design and implementation at sub-national, national and international levels. TFD's Benefit Sharing initiative is conducted in partnership with International Union for Conservation of Nature's (IUCN) through the project titled REDD+ Benefits: Facilitating countries and communities in the design of pro-poor REDD+ benefit sharing schemes funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) - International Climate Initiative (ICI) and the Danish International Development Agency (DANIDA). [The publication](#)

### **IUCN REDD+ Project in Indonesia Supports Customary Land Mapping**

#### *IUCN*

With support from IUCN's "Toward Pro-Poor" REDD+ project, two provinces in Indonesia have produced customary land rights maps that are helping to facilitate REDD+ and broader community-based forest management efforts in the region. In order to benefit from REDD+, Papua and West Papua Provinces in Indonesia have identified land rights and active participation of the community as key issues that need to be clarified and facilitated. Given this, IUCN's "Toward Pro-Poor" REDD+ project, with funding from Denmark's Development Cooperation (Danida), has been working closely with the Samdhana Institute, the governments of Papua and West Papua Province, civil society and other NGOs to develop customary land rights maps. Approximately 21 customary areas have been mapped at the local level to identify who owns the land and rights on the land. In addition to supporting REDD+ efforts, these maps have proven to be useful tools for broader land and resources planning, dispute resolution, as well as explaining community rights to the younger generation. Capacity building, facilitated by the development of guidebooks and training workshops, has been an essential part of this mapping work. The maps were developed at the local level through a participatory process that engaged a wide range of stakeholders. Nineteen customary boundary maps have been produced in Baliem Valley in the highland area, and two for the Kaimana District, located in the lowlands. To ensure the maps are not used to encourage investment from big plantations or forest industry activities that might seek to further deplete or degrade the forests, the Samdhana Institute and local government have identified the need to support broader, local-level economic development. To this end, they have piloted a community-based forest management scheme in one village in Kaimana District, West Papua Province. Using the map of their customary territory as a basis, the community has engaged in monitoring and managing their forest and land resources, and they are now seeking legal recognition of their area from the national government. Download a [customary boundary map of Esania village](#) in Indonesia

#### **Next Steps**

Building on the momentum and results of the "Toward Pro-poor REDD+" project, the Samdhana Institute, IUCN and other partners in Papua and West Papua Provinces will continue to develop maps for new customary areas to secure intergenerational tenure rights. The two provinces will also work to get land-use maps formally recognized and used by national and sub-national governments as central tools in REDD+ implementation. In the Baliem Valley, Papua Province, the maps will be legalized and used to develop customary boundary management plans based on cultural zones, as well as in the design of agro-forestry and reforestation activities in degraded areas. In Kaimana, West Papua Province, the maps have been used to propose village forest

licenses, which will allow community groups to continue to legally and sustainably manage their own forests. The districts and partners will develop forest measurement databases which will support the development of detailed forest management business plans and small-scale forest products trading. The province will also continue to invest in training more facilitators needed to ensure the maps can be effectively leveraged by as many stakeholder groups and communities as possible.

For more on IUCN's REDD+ work: Website: [www.iucn.org/redd](http://www.iucn.org/redd)

Twitter: @IUCN\_redd

IUCN [REDD+ Roundup](#) newsletter: Subscribe [here](#)

## **Carbon Stocks and Flows from Harvest to Disposal in Harvested Wood Products from Ontario and Canada**

*Ministry of Natural Resources, Ontario.*

In this report, we systematically analyze the biomass carbon (C) conversion of harvested wood products (HWPs) produced from forests in Ontario and, more broadly, in Canada. The major categories of HWPs referred to are lumber, structural panel, non-structural panel, market pulp, newsprint, fine paper, and "other" paper products. Our analysis tracks C flow for each product type from forest to harvested biomass, re-allocation of biomass C among HWPs, use of wood residue to produce energy, exports of HWPs from Ontario and Canada, and distribution of HWPs among major end uses. As well, service lives of HWPs, end-of-life disposal, and landfill HWP C stock and landfill methane (CH<sub>4</sub>) emissions for HWPs produced and used in Ontario/Canada and in countries that import HWPs from Ontario/Canada are assessed. [The publication](#)

## **Policy and Institutions in Adaptation to Climate Change : Case study on tree crop diversity in China, Nepal, and Pakistan**

*ICIMOD*

The diversification of agriculture has been shown to provide a range of benefits in terms of household adaptive capacity. The integration of trees on cultivated land is a particularly promising form of agricultural diversification. This publication presents the results of a case study carried out in China, Nepal, and Pakistan which reviews the use of trees for agricultural diversification by communities in response to climate-related stresses as part of a larger project documenting local adaptation strategies to climate-induced water stress and hazards in the HKH region. [The working paper](#)

## **Forest and Economic Development. A Driver for the Green Economy in the ECE Region.**

*UNECE and FAO*

The study reviews the many ways in which forests contribute to economic development in the ECE region, and analyses, on the basis of recent ECE/FAO studies, the outlook and main challenges for the forest sector in the region: wood energy, sustainability of wood supply, the forest sector workforce, payment for forest ecosystem services, innovation, demonstrating and communicating the sustainability of forest management. It concludes that the way forward is to establish forests and the goods and services they provide as an integrated part of the green economy. This is a major opportunity for the ECE region forest sector, which must not be missed. The Action Plan for the ECE region forest sector in a green economy maps out how the sector could rise to the challenge. [The publication](#)

## **Quality of governance standards for carbon emissions trading. Developing REDD+ governance through a multi-stage, multi-level and multi-stakeholder approach**

*IGES*

This discussion paper presents the Action Research Project to Develop a National Quality-of-governance Standard for REDD+ and the Forest Sector in Nepal, which was launched by IGES, Griffith University and the University of Southern Queensland. The process of developing a voluntary national standard in Nepal through online surveys, key informant interviews, a multi-stakeholder forum and field consultation, has provided an innovative and field-tested approach to standards development. [The paper](#)

## V.I JOBS

### **Regional Technical Advisor, multiple positions, UN-REDD Programme UNDP**

*UNDP - the deadline for applications is the 15<sup>th</sup> of August 2013*

The UNDP Environment and Energy Group (EEG) is based in UNDP's Bureau of Development Policy. EEG is responsible for providing leadership and technical support for the delivery of the Environment and Sustainable Development pillar of UNDP's Strategic Plan. In particular, EEG assists UNDP Programme countries to develop the capacity to fully incorporate environmental management objectives into development at national and local levels, but also at global and regional scales, and thus ensure that development is sustainable. The principal areas of work are: environmental mainstreaming, environmental finance, adaptation to climate change, and local governance of natural resources. [More](#)

### **Forestry Officer (REDD+)**

*FAO - deadline for application is 20th of August 2013*

Under the overall guidance of the Director, FOM and the supervision of the UN-REDD Programme Coordinator, the incumbent will support REDD+ country programmes implementation related to forest monitoring in countries in Latin America. The duty station will be one of the LAC countries. [More](#)

### **Team Leader. FAO-Finland Forestry Programme**

*FAO - deadline for application is 6th of September 2013*

Under the overall supervision of the Assistant Director-General, Forestry Department and the direct supervision of the Deputy Director, Forest Assessment, Management and Conservation Division, the incumbent will provide leadership, technical support and coordinate outputs, activities and inputs for the FAO - Finland Forestry Programme, "Strengthening Forest Management in a Changing Climate". [More](#)

## VII. ANNOUNCEMENTS

### **Interactive web app lets users map forest carbon emissions activities**

*CIFOR*

A new online portal for monitoring, reporting and verifying (MRV) carbon emissions allows researchers and practitioners to better manage forest inventories, its creators say. The Forest Carbon Database (FCDB) can be used to share measurements of carbon pools – reservoirs with the capacity to store and release carbon, the chemical basis of all known life and climate warming gases. [More](#)



## **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.**

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