# CLIM-FO Climate Change & Forestry

*Electronic Journal and Newsletter March 2013*
FAO, Forestry Department, Forest and Climate Change Team
Food and Agriculture Organization of the United Nations

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# I. IN THE PRESS

*1 April 2013 - ScienceDaily*

Soils in Newly Forested Areas Store Substantial Carbon That Could Help Offset Climate Change

Surface appearances can be so misleading: In most forests, the amount of carbon held in soils is substantially greater than the amount contained in the trees themselves.

*29 March 2013 - AlertNet*

Tanzania fund seeks to protect eastern mountain forests

Khadija Mtungakoa, a 38-year-old mother of three, wears a broad smile as she prepares food on her energy-saving stove. She explains joyfully how it has helped reduce her reliance on the firewood she gathers from the nearby Amani Nature Reserve in Tanzania's Muheza District.

*28 March 2013 - The World Agroforestry Center*

The carbon in blue gums

Researchers and landscape managers now have an accurate way to estimate the carbon held in blue gums (Eucalyptus spp.). Using improved allometric biomass equations along withsimple tree measurements as variables, practitioners can figure out landscape-level carbon in eucalyptus-dominated landscapes with around 95% accuracy. This is expected to facilitate the greater participation in carbon markets of smallholder farmers growing gum trees on their farms – whether on boundaries, in woodlots or scattered in homestead fields.

*27 March 2013 - IISD*

Adaptation Fund Deploys Interactive Mapping tool

The Adaptation Fund Secretariat has launched a tool providing users access to data on the Fund's projects and programmes through a mapping portal.

*27 March 2013 - IISD*

FCPF Carbon Fund and Participants Committee Meetings Discuss REDD+ Activities

Two recent meetings of the Forest Carbon Partnership Facility (FCPF), its Sixth Meeting of the Carbon Fund Participants (CF6, 15-16 March) and its 14th Meeting of the Participants Committee (PC14, 19-21 March 2013), have discussed updates on emissions reductions programmes and considered presentations on REDD+ readiness from a number of countries.

*25 March 2013 - AlertNet*

No need to choose between environment, poverty reduction – experts

Prioritising poverty eradication over environmental protection is a "false dichotomy," according to participants in a House of Lords roundtable on the global development agenda beyond 2015.

*February March 2013 - UN-REDD Programme Newsletter*

Understanding REDD+ and FLEGT Linkages Through Country Experiences

The UN-REDD Programme recently released two new studies on the linkages between REDD+ and Forest Law Enforcement, Governance and Trade processes in Cameroon and Central African Republic.

*18 March 2013 - CIFOR*

Indonesia's REDD+ pilot province: how is it faring two years on?

When Indonesian President Susilo Bambang Yudhoyono selected Central Kalimantan as the pilot province for his country's Reducing Emissions from Deforestation and forest Degradation (REDD+) program, it was widely hoped some of the region's grave environmental issues — such as large expanses of threatened peatlands and high forest conversion rates — would be addressed.

*25 February 2013 - IISD*

Public Backing is the Key to Political Action on Climate Change

The world is already in the grip of environmental and social megaforces including climate change, water scarcity, population growth and ecosystem decline. These megaforces portend economic, social and ecological disaster unless a dramatic change of course can be engineered.

# II. MULTILATERAL PROCESSES IN CLIMATE CHANGE

The next scheduled UNFCCC negotiations will take place from 3-14 June, Bonn, Germany.

# III. EVENTS & MEETINGS

## Upcoming events

### International Conference on Forests for Food Security and Nutrition

*13-15 May, Rome, Italy*

The International Conference on Forests for Food Security and Nutrition will increase understanding of the crucial role that forests, trees on farms and agroforestry systems can play in improving the food security and nutrition of rural people, especially in developing countries. It will propose ways to integrate this knowledge in policy decisions at the national and international levels. The conference objectives are to:

i) highlight the ways in which forests, trees on farms and agroforestry systems contribute to food security and nutrition

ii) explore policy options and innovative approaches for increasing the role of forests, trees on farms and agroforestry systems in food security and nutrition

iii) identify key challenges and bottlenecks hindering that contribution

For more **details**

### 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 Center 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 Center 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), ciil 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 their face. On 25 September, a high-level conference **"Our forests in the 21st 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**

# *IV. RESEARCH ARTICLES*

### Rate my data: quantifying the value of ecological data for the development of models of the terrestrial carbon cycle

**Keenan, T. F.; Davidson, E. A.; Munger, J. W.; Richardson, A. D.**
*Ecological Applications; 2013. 23: 1, 273-286*

Primarily driven by concern about rising levels of atmospheric $CO_2$, ecologists and earth system scientists are collecting vast amounts of data related to the carbon cycle. These measurements are generally time consuming and expensive to make, and, unfortunately, we live in an era where research funding is increasingly hard to come by. Thus, important questions are: "Which data streams provide the most valuable information?" and "How much data do we need?" These questions are relevant not only for model developers, who need observational data to improve, constrain, and test their models, but also for experimentalists and those designing ecological observation networks. Here we address these questions using a model-data fusion approach. We constrain a process-oriented, forest ecosystem C cycle model with 17 different data streams from the Harvard Forest (Massachusetts, USA). We iteratively rank each data source according to its contribution to reducing model uncertainty. Results show the importance of some measurements commonly unavailable to carbon-cycle modelers, such as estimates of turnover times from different carbon pools. Surprisingly, many data sources are relatively redundant in the presence of others and do not lead to a significant improvement in model performance. A few select data sources lead to the largest reduction in parameter-based model uncertainty. Projections of future carbon cycling were poorly constrained when only hourly net-ecosystem-exchange measurements were used to inform the model. They were well constrained, however, with only 5 of the 17 data streams, even though many individual parameters are not constrained. The approach taken here should stimulate further cooperation between modelers and measurement teams and may be useful in the context of setting research priorities and allocating research funds.

### Potential changes in forest composition could reduce impacts of climate change on boreal wildfires

**Terrier, A.; Girardin, M. P.; Perie, C.; Legendre, P.; Bergeron, Y.;**

*Ecological Applications; 2013. 23: 1, 21-35*

There is general consensus that wildfires in boreal forests will increase throughout this century in response to more severe and frequent drought conditions induced by climate change. However, prediction models generally assume that the vegetation component will remain static over the next few decades. As deciduous species are less flammable than conifer species, it is reasonable to believe that a potential expansion of deciduous species in boreal forests, either occurring naturally or through landscape management, could offset some of the impacts of climate change on the occurrence of boreal wildfires. The objective of this study was to determine the potential of this offsetting effect through a simulation experiment conducted in eastern boreal North America. Predictions of future fire activity were made using multivariate adaptive regression splines (MARS) with fire behavior indices and ecological niche models as predictor variables so as to take into account the effects of changing climate and tree distribution on fire activity. A regional climate model (RCM) was used for predictions of future fire risk conditions. The experiment was conducted under two tree dispersal scenarios: the status quo scenario, in which the distribution of forest types does not differ from the present one, and the unlimited dispersal scenario, which allows forest types to expand their range to fully occupy their climatic niche. Our results show that future warming will create climate conditions that are more prone to fire occurrence. However, unlimited dispersal of southern restricted deciduous species could reduce the impact of climate change on future fire occurrence. Hence, the use of deciduous species could be a good option for an efficient strategic fire mitigation strategy aimed at reducing fire propagation in coniferous landscapes and increasing public safety in remote populated areas of eastern boreal Canada under climate change.

### Soil organic carbon in an old-growth temperate forest: spatial pattern, determinants and bias in its quantification

**Yuan ZuoQiang; Gazol, A.; Lin Fei; Ye Ji; Shi ShuAi; Wang XuGao; Wang Miao; Hao ZhanQing**
*Geoderma; 2013. 195/196: 48-55.*

Although there exists a consensus regarding the spatial variation of Soil Organic Carbon (SOC) are important inputs in the models being used to understand the present and future C cycle and to predict the global climate change, neither the way to quantify the relative contribution of factors such as topography or canopy composition on SOC variation nor how soil sampling intensity affects the estimated fraction is completely clear. In this study, we propose the use of variation partitioning with environmental factors (topographic and soil variables), canopy composition and spatial structure, as a powerful tool for partitioning spatial variation in SOC. Furthermore, we address the importance of sampling density of observations that are required to characterize the spatial variations in SOC. Our results indicated that SOC variation was mainly determined by soil factors like moisture and pH, but the topography and canopy composition also contributed significantly. The spatial pattern of SOC was weaker along trajectories of sparser sampling density when compared with the reference data (n=967). SOC is spatially structured, partially due to the soil conditions that determine decomposition rates of the organic matter, but also due to the sink-source balance of the canopy structure and composition, and to the different conditions created by the topographic heterogeneity. Moreover, these factors are interrelated because topographic conditions can influence soil variations. The estimation of SOC variation is strongly dependent on sampling density, and, thus, to draw strong conclusions about local patterns, an exhaustive and intensive sampling effort is needed.

## Deep instability of deforested tropical peatlands revealed by fluvial organic carbon fluxes

**Moore, S.; Evans, C. D.; Page, S. E.; Garnett, M. H.; Jones, T. G.; Freeman, C.; Hooijer, A.; Wiltshire, A. J.; Limin, S. H.; Gauci, V.;**
*Nature 2013. 493: 7434, 660-663*

Tropical peatlands contain one of the largest pools of terrestrial organic carbon, amounting to about 89,000 teragrams$_1$ (1 Tg is a billion kilograms). Approximately 65 per cent of this carbon store is in Indonesia, where extensive anthropogenic degradation in the form of deforestation, drainage and fire are converting it into a globally significant source of atmospheric carbon dioxide. Here we quantify the annual export of fluvial organic carbon from both intact peat swamp forest and peat swamp forest subject to past anthropogenic disturbance. We find that the total fluvial organic carbon flux from disturbed peat swamp forest is about 50 per cent larger than that from intact peat swamp forest. By carbon-14 dating of dissolved organic carbon (which makes up over 91 per cent of total organic carbon), we find that leaching of dissolved organic carbon from intact peat swamp forest is derived mainly from recent primary production (plant growth). In contrast, dissolved organic carbon from disturbed peat swamp forest consists mostly of much older (centuries to millennia) carbon from deep within the peat column. When we include the fluvial carbon loss term, which is often ignored, in the peatland carbon budget, we find that it increases the estimate of total carbon lost from the disturbed peatlands in our study by 22 per cent. We further estimate that since 1990 peatland disturbance has resulted in a 32 per cent increase in fluvial organic carbon flux from southeast Asia - an increase that is more than half of the entire annual fluvial organic carbon flux from all European peatlands. Our findings emphasize the need to quantify fluvial carbon losses in order to improve estimates of the impact of deforestation and drainage on tropical peatland carbon balances.

## Case study for the assessment of the biogeophysical effects of a potential afforestation in Europe

**Galos, B.; Hagemann, S.; Hansler, A.; Kindermann, G.; Rechid, D.; Sieck, K.; Teichmann, C.; Jacob, D**
*Carbon Balance and Management; 2013. 8: 3*

Background: A regional-scale sensitivity study has been carried out to investigate the climatic effects of forest cover change in Europe. Applying REMO (regional climate model of the Max Planck Institute for Meteorology), the projected temperature and precipitation tendencies have been analysed for summer, based on the results of the A2 IPCC-SRES emission scenario simulation. For the end of the 21st century it has been studied, whether the assumed forest cover increase could reduce the effects of the greenhouse gas concentration change. Results: Based on the simulation results, biogeophysical effects of the hypothetic potential afforestation may lead to cooler and moister conditions during summer in most parts of the temperate zone. The largest relative effects of forest cover increase can be expected in northern Germany, Poland and Ukraine, which is 15- 20% of the climate change signal for temperature and more than 50% for precipitation. In northern Germany and France, potential afforestation may enhance the effects of emission change, resulting in more severe heavy precipitation events. The probability of dry days and warm temperature extremes would decrease. Conclusions: Large contiguous forest blocks can have distinctive biogeophysical effect on the climate on regional and local scale. In certain regions of the temperate zone, climate change signal due to greenhouse gas emission can be reduced by afforestation due to the dominant evaporative cooling effect during summer. Results of this case study with a hypothetical land cover change can contribute to the assessment of the role of forests in adapting to climate change. Thus they can build an important basis of the future forest policy

## Potential stocks and increments of woody biomass in the European Union under different management and climate scenarios

**Kindermann, G. E.; Schorghuber, S.; Linkosalo, T.; Sanchez, A.; Rammer, W.; Seidl, R.; Lexer, M. J**

*Carbon Balance and Management; 2013. 8: 2,*

Background: Forests play an important role in the global carbon flow. They can store carbon and can also provide wood which can substitute other materials. In EU27 the standing biomass is steadily increasing. Increments and harvests seem to have reached a plateau between 2005 and 2010. One reason for reaching this plateau will be the circumstance that the forests are getting older. High ages have the advantage that they typical show high carbon concentration and the disadvantage that the increment rates are decreasing. It should be investigated how biomass stock, harvests and increments will develop under different climate scenarios and two management scenarios where one is forcing to store high biomass amounts in forests and the other tries to have high increment rates and much harvested wood. Results: A management which is maximising standing biomass will raise the stem wood carbon stocks from 30 tC/ha to 50 tC/ha until 2100. A management which is maximising increments will lower the stock to 20 tC/ha until 2100. The estimates for the climate scenarios A1b, B1 and E1 are different but there is much more effect by the management target than by the climate scenario. By maximising increments the harvests are 0.4 tC/ha/year higher than in the management which maximises the standing biomass. The increments until 2040 are close together but around 2100 the increments when maximising standing biomass are approximately 50% lower than those when maximising increments. Cold regions will benefit from the climate changes in the climate scenarios by showing higher increments. Conclusions: The results of this study suggest that forest management should maximise increments, not stocks to be more efficient in sense of climate change mitigation. This is true especially for regions which have already high carbon stocks in forests, what is the case in many regions in Europe. During the time span 2010-2100 the forests of EU27 will absorb additional 1750 million tC if they are managed to maximise increments compared if they are managed to maximise standing biomass. Incentives which will increase the standing biomass beyond the increment optimal biomass should therefore be avoided. Mechanisms which will maximise increments and sustainable harvests need to be developed to have substantial amounts of wood which can be used as substitution of non sustainable materials

## Forest carbon balances at the landscape scale investigated with the Q model and the CoupModel - responses to intensified harvests

**Eliasson, P.; Svensson, M.; Olsson, M.; Agren, G. I**

*Forest Ecology and Management; 2013. 290: 67-78*

The increasing demand for solid biofuels, such as logging residue fuels, has highlighted the importance of considering that, in contrast to fossil fuels, biofuels are produced in dynamic ecosystems. The environmental effects of changes in management policy, whether positive and negative, are not obvious. For example, calculations of the carbon budget in single forest stands show that the carbon balance switches dramatically from uptake to loss at final felling. The time taken to recover the carbon losses after disturbance can span decades to centuries. However, forests are not managed on the single stand level but on the landscape scale. Thus, for example, final felling occurs by definition only once for each rotation period on the whole area considered in a single stand, but within the same time span, it occurs frequently on a fraction of the area in a landscape. The actual frequency and ratio of land area affected each year by final felling depend on the age distribution and rotation age of all stands present in the landscape. In order to reliably evaluate the consequences of new management policies, the aggregated effects of a number of individual stands need to be considered. Here we used two different ecosystem models (the Q model and the CoupModel) to compare the carbon budgets of conventional harvesting of stems on a single-stand level and on the landscape scale under different harvesting intensities. In the calculations, the landscape was assumed to consist of many stands, all of different ages and each representing one year of a given rotation period. The results showed that the aggregated carbon balance in the forest landscape was less dramatic than that of a single stand. Provided that environmental factors and management policy remain unchanged, the aggregated carbon balance remains stable over time in any landscape. However, the carbon gains from harvesting and its effects on soil carbon stock occur on different time scales. While any change in harvesting system takes a long time to be fully implemented, changes in the proportion of increased removals take effect without delay, while components of soil organic carbon have response times longer than centuries. The carbon gain after introducing removal of logging residues starts to increase immediately at the first harvest in a landscape. The quantities of soil carbon lost with the increased removals are always less than the removals in biomass. Soil carbon losses show a declining response over time.

## Spatial and temporal variation of carbon stocks in a lowland tropical forest in West Africa

**Lindsell, J. A.; Klop, E**

*Forest Ecology and Management; 2013. 289: 10-17.*

Understanding the nature and cause of spatial and temporal variation in forest carbon is critical for implementation of climate mitigation strategies such as REDD. Such knowledge is lacking and hard to acquire in resource poor regions such as West Africa's Upper Guinea where benefits of such schemes for forest conservation could have great impact. We undertook a systematic and representative survey of an entire Upper Guinea forest - Gola Forest in southeast Sierra Leone – by measuring over 600 plots (0.125 ha) in order to quantify the level of spatial variation in C that might exist within a discrete forest type and relate this to historic and contemporary impacts on the forest. We modelled current C stocks and compared these with values calculated from historic surveys. Mean C content in above ground biomass was c. 160 Mg ha<sup>-1</sup>. The southern part of the forest which was subject to heavier logging in the 1980s had a lower C content (121- 144 Mg ha<sup>-1</sup>) compared to the less disturbed central areas (186 Mg ha<sup>-1</sup>). Volumes of extracted timber and distance to settlements around the forest explained 42% of the variation in C content. Elevation, slope and other metrics of human impact such as distance to roads did not explain significant additional variation. A survey from the 1950s recorded much higher carbon content than currently found in the south of the forest. This accords with evidence that commercial logging in this area was destructively high. However, old surveys from the late 1960s/early 1970s in less disturbed areas recorded lower carbon content than present. Most of the past surveys were in areas that had not yet been commercially logged so the accumulation in biomass in the last 40 years implies recovery from a much older disturbance event, or a change in environmental conditions promoting growth. As a typical Upper Guinean forest, our results from Gola Demonstrate the long term impacts of disturbance events on carbon stocks and how these can vary greatly at small scales, highlighting the need for representative and regionally relevant empirical data to inform REDD type initiatives. Nonetheless these forests remain important for carbon sequestration and storage in the region despite this history and the parts of the forest with no recorded logging activity that increased in carbon in recent decades with levels now akin to undisturbed plots reported from elsewhere in the region demonstrate the sequestration potential these forests provide once adequately protected.

## The economic case for prioritizing governance over financial incentives in REDD+

**Fosci, M**

*Climate Policy; 2013. 13: 2, 170-190*

It is argued that the subordination of policies to results-based payments for emissions reductions causes severe economic inefficiencies, which affect the opportunity cost, transaction cost, and economic rent of the programme. Such problems can be addressed by establishing sound procedural, land, and financial governance at the national level, before Reducing Emissions from Deforestation and Forest Degradation (REDD+) economic incentives are delivered at scale. Consideration is given to each governance dimension, the entry points for policy intervention, and the impact on costs. International support must consider the financial and political cost of governance reforms, and use a pay-for-results ethos based on output and outcome indicators. This can be done in the readiness phase but only if the latter's legal force, scope, magnitude, and time horizon are adequately reconsidered. This article provides ammunition for the institutionalists' argument that United Nations Framework Convention on Climate Change (UNFCCC) Parties must prioritize governance reforms between now and the entry into force of the new climate agreement in 2020. Finally, specific recommendations about how such governance reforms can be achieved, which will create the basis for the programme's financial sustainability, are offered. Policy relevance: UNFCCC Parties could make the most cost-effective use of REDD+ resources if they were to prioritize investments in governance over the interim period 2012-2020. REDD+'s financial, technical and political capital should be used to establish sound procedural, sectoral (land), and financial governance systems in relevant countries. This will generate long-term economic savings, compared to an approach that privileges the implementation of results-based payments for emissions reductions. In particular, it will reduce economic inefficiencies, which affect the opportunity and transaction costs, and the private rents embedded in the current programme design. In order to promote the necessary policy reforms, stakeholders should work together to address technical, financial, and political economy issues at the domestic level. In particular, UNFCCC Parties should re-conceptualize the readiness phase by strengthening its legal force, expanding its scope, increasing its financial firepower, and extending its time horizon.

## Shifts of forest species along an elevational gradient in Southeast France: climate change or stand maturation?

**Bodin, J.; Badeau, V.; Bruno, E.; Cluzeau, C.; Moisselin, J. M.; Walther, G. R.; Dupouey, J. L**

*Journal of Vegetation Science; 2013. 24: 2, 269-283*

Aim: Recent vegetation changes in mountain areas are often explained by climate warming. However, effects of land-use changes, such as recolonization of abandoned pastures by forest, are difficult to separate from those of climate change. Even within forest belts, changes in stand structure due to forest management and stand maturation could confound the climate signal. Here, we evaluate the direction and rate of plant species elevation shifts in mountain forests, considering the role of stand dynamics. Location: Forests in the plains and

mountains of Southeast France. Methods: We compared floristic data from the French National Forest Inventory collected in the 1980s and 1990s. They provided a large-scale (30 985 plots) and representative sample of vegetation between 0 and 2500 m a.s.l. Species response curves along the elevation and exposure gradients were fitted with a logistic regression model. In order to assess the effect of changes in successional stages of the forest stands, we compared plant species shifts in the whole set of stands with those solely in closed stands. Results: A total of 62 species shifted downward, whereas 113 shifted upward, resulting in a significant upward mean shift of 17.9 m. Upward shifting species were preferentially woody and heliophilous, suggesting a role for forest closure and maturation in the observed changes. Excluding all open forest stages from analyses, the upward trend became weaker (-3.0 m) and was not significant. Forests of the study area have undergone closure and maturation, more strongly at lower altitudes than at higher ones, producing an apparent shift of species. Conclusions: In the mountain relief of Southeast France, changes in the successional stages of stands appear as the main cause of the apparent upslope movement of forest species. Since a similar trend of forest maturation exists in large areas throughout Europe, forest dynamics should be better taken into account among the causes of vegetation changes before inferring any climate change effect.

## Biomass and carbon stock in moso bamboo forests in subtropical China: characteristics and implications

**Wang, B.; Wei, W. J.; Liu, C. J.; You, W. Z.; Niu, X.; Man, R. Z.**

*Journal of Tropical Forest Science; 2013. 25: 1, 137-148*

Bamboo forests are special forest resources in China with wide distribution, and important economic and ecological values. Of 500 bamboo species native to China, moso bamboo (*Phyllostachys pubescens*) is the most important in the terms of distribution, timber and other economic values. In this study, we examined the variations in biomass carbon stock of moso bamboo forests across subtropical China using national forest resources inventory data (1977-2008), along with stand biomass data compiled from literature. Our results showed that the biomass carbon of moso bamboo forests ranged from 219.56 to 299.31 Tg $ha^{-1}$, accounting for 4.7-5.9% of the total forest biomass carbon in China from 1977 till 2008. At stand level, mean biomass carbon was 70-85 Mg $ha^{-1}$ in the northern and middle subtropical subregions, and 35-45 Mg $ha^{-1}$ in the sout-west mountain and southern subtropical subregions. With high biomass carbon sequestration, along with the quick and low-cost regeneration, high growth rate, short rotation, high phytolith-occluded carbon content and high economic and ecological values, moso bamboo forest can play an important role in carbon sink forestry in subtropical regions of China.

## Estimates of soil carbon concentration in tropical and temperate forest and woodland from available GIS data on three continents

**Ladd, B.; Laffan, S. W.; Amelung, W.; Peri, P. L.; Silva, L. C. R.; Gervassi, P.; Bonser, S. P.; Navall, M.; Sheil, D**

*Global Ecology and Biogeography; 2013. 22: 4, 461-469.*

Aim: Concern about climate change, with the subsequent emergence of carbon markets and policy initiatives such as REDD (reducing carbon emissions by decreasing deforestation and forest degradation), have focused attention on assessing and monitoring terrestrial carbon reserves. Most effort has focused on above-ground forest biomass. Soil has received less attention despite containing more carbon than above-ground terrestrial biomass and the atmosphere combined. Our aim was to explore how well soil carbon concentration could be estimated on three continents from existing climate, topography and vegetation-cover data. Location: Peru, Brazil, Argentina, Australia, China. Methods: Soil carbon concentration and leaf area index (LAI) as well as GIS-derived climate and topography variables for 65 temperate and 43 tropical, forest and woodland ecosystems, were either directly measured or estimated from freely available global datasets. We then used multiple regressions to determine how well soil carbon concentration could be predicted from LAI, climate and topography at a given site. We compared our measurements with top soil carbon estimates from the Food and Agriculture Organization of the United Nations (FAO) harmonized world soil map. Results: Our empirical model based on estimates of temperature, water availability and plant productivity provided a good estimate of soil carbon concentrations ($R^2$=0.79). In contrast, the values of topsoil carbon concentrations from the FAO harmonized world soil map correlated poorly with the measured values of soil carbon concentration ($R^2$=0.0011). Main conclusions: The lack of correlation between the measured values of soil carbon and the values from the FAO harmonized world soil map indicate that substantial improvements in the production of soil carbon maps are needed and possible. Our results demonstrate that the inclusion of freely available GIS data offers improved estimates of soil carbon and will allow the creation of more accurate soil carbon maps.

## Sensitivity of tropical carbon to climate change constrained by carbon dioxide variability

**Cox, P. M.; Pearson, D.; Booth, B. B.; Friedlingstein, P.; Huntingford, C.; Jones, C. D.; Luke, C. M**

*Nature 2013. 494: 7437, 341-344*

The release of carbon from tropical forests may exacerbate future climate change, but the magnitude of the effect in climate models remains uncertain. Coupled climate-carbon-cycle models generally agree that carbon storage on land will increase as a result of the simultaneous enhancement of plant photosynthesis and water use efficiency under higher atmospheric $CO_2$ concentrations, but will decrease owing to higher soil and plant respiration rates associated with warming temperatures. At present, the balance between these effects varies markedly among coupled climate-carbon-cycle models, leading to a range of 330 gigatonnes in the projected change in the amount of carbon stored on tropical land by 2100. Explanations for this large uncertainty include differences in the predicted change in rainfall in Amazonia and variations in the responses of alternative vegetation models to warming. Here we identify an emergent linear relationship, across an ensemble of models, between the sensitivity of tropical land carbon storage to warming and the sensitivity of the annual growth rate of atmospheric $CO_2$ to tropical temperature anomalies. Combined with contemporary observations of atmospheric $CO_2$ concentration and tropical temperature, this relationship provides a tight constraint on the sensitivity of tropical land carbon to climate change. We estimate that over tropical land from latitude 30 degrees north to 30 degrees south, warming alone will release 53+or-17 gigatonnes of carbon per kelvin. Compared with the unconstrained ensemble of climate-carbon-cycle projections, this indicates a much lower risk of Amazon forest dieback under $CO_2$ - induced climate change if $CO_2$ fertilization effects are as large as suggested by current models. Our study, however, also implies greater certainty that carbon will be lost from tropical land if warming arises from reductions in aerosols or increases in other greenhouse gases.

## Competition for water and light in closed-canopy forests: a tractable model of carbon allocation with implications for carbon sinks

**Farrior, C. E.; Dybzinski, R.; Levin, S. A.; Pacala, S. W**

*American Naturalist; 2013. 181: 3, 314-330*

The dependence of forest productivity and community composition on rainfall is the result of complex interactions at multiple scales, from the physiology of carbon gain and water loss to competition among individuals and species. In an effort to understand the role of these multiscale interactions in the dependence of forest structure on rainfall, we build a tractable model of individual plant competition for water and light. With game-theoretic analyses, we predict the dominant plant allocation strategy, forest productivity, and carbon storage. We find that the amount and timing of rainfall are critical to forest structure. Comparing two forests that differ only in the total time plants spend in water saturation, the model predicts that the wetter forest has fewer fine roots, more leaves, and more woody biomass than the drier forest. In contrast, if two forests differ only in the amount of water available during water limitation, the model predicts that the wetter forest has more fine roots than the drier forest and equivalent leaves and woody biomass. The difference in these responses to increases in water availability has significant implications for potential carbon sinks with rising atmospheric $CO_2$. We predict that enhanced productivity from increased leaf-level water-use efficiency during water limitation will be allocated to fine roots if plants respond competitively, producing only a small and short-lived carbon sink.

## Evaluating organic carbon storage capacity of forest soil: case study in Kafa Zone Bita District, southwestern Ethiopia

**Abebayehu Aticho**

*American-Eurasian Journal of Agricultural & Environmental Sciences; 2013. 13: 1, 95-100*

Soil, forest and atmosphere are potential carbon sinker in the terrestrial ecosystem, of which the share of soil is more than that of forest and atmosphere. In Ethiopia very few studies have been conducted on forest soil organic carbon storage capacity. The purposes of this study was to determine organic carbon storage capacity of Kafa forest soil and to generate relevant information for stakeholders on forest soil organic carbon storing capacity that helps them for land management decisions and carbon trading. To achieve these goals, a representative forest land was selected in Bita district and five successive soil profiles were excavated at different slope positions of the toposequence. Soil samples were collected from each horizon of the soil profiles to determine soil carbon concentration and bulk density. Organic carbon storage (t $ha^{-1}$) capacity of each horizon was obtained by multiplying the bulk density, organic carbon concentration and horizon thickness of the soil. The amount of organic carbon stored (t $ha^{-1}$) in each profile was obtained by summing up organic carbon stored in the successive horizons of the respective profiles. Multiple linear regression model was employed to describe the effects of independent variables on dependent variables and Pearson's correlations analysis was used to determine the relationship between dependent and independent variables. Regression analysis revealed a unit rise in soil organic carbon concentration, bulk density and sampling depth rises soil organic carbon stock by 5.47, 1.53 and 25.64 t $ha^{-1}$, respectively. Soil organic carbon storage capacity was significantly ($P<0.0001$) affected by organic carbon concentration and sampling depth. Besides, correlation analysis indicated, the amount of organic carbon stored in the soil has a positive relationship with organic carbon concentration and bulk density. The quantity of organic carbon stored in the soil was 639.64+or-286.10 t $ha^{-1}$. The quantity of organic carbon stored in the soil has been governed by soil organic carbon concentration

and bulk density. Thus, soil organic carbon concentration and bulk density improvement are the most important management interventions to increase soil organic carbon storage capacity. Therefore, stakeholders should focus on management activities that improve soil organic carbon concentration and bulk density to boost carbon stock capacity of the soil.

### Consistent shifts in spring vegetation green-up date across temperate biomes in China, 1982-2006

**Wu XiuChen; Liu HongYan**

*Global Change Biology; 2013. 19: 3, 870-880*

Understanding spring phenology changes in response to the rapid climate change at biome-level is crucial for projecting regional ecosystem carbon exchange and climate-biosphere interactions. In this study, we assessed the long-term changes and responses to changing climate of the spring phenology in six temperate biomes of China by analyzing the global inventory monitoring and modeling studies (GIMMS) NOAA/AVHRR Normalized Difference Vegetation Index (NDVI) and concurrent mean temperature and precipitation data for 1982-2006. Results show that the spring phenology trends in the six temperate biomes are not continuous throughout the 25 year period. The spring phenology in most areas of the six biomes showed obvious advancing trends (ranging from -0.09 to -0.65 day/yr) during the 1980s and early 1990s, but has subsequently suffered consistently delaying trends (ranging from 0.22 to 1.22 day/yr). Changes in spring (February-April) temperature are the dominating factor governing the pattern of spring vegetation phenology in the temperate biomes of China. The recently delayed spring phenology in these temperate biomes has been mainly triggered by the stalling or reversal of the warming trend in spring temperatures. Results in this study also reveal that precipitation during November-January can explain 16.1% ($P<0.05$), 20.9% ($P<0.05$) and 14.2% ($P<0.05$) of the variations in temperate deciduous forest (TDF), temperate steppe (TS), temperate desert (TD) respectively, highlighting the important role of winter precipitation in regulating changes in the spring vegetation phenology of water-limited biomes.

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

### Trees on-farm: removing the obstacles to enterprise – A review of current climate-smart tree-based experiences in Malawi

*IIED*

Malawi faces a precarious future. Challenges include: rapid growth among rural populations; entrenched rural poverty, lack of food security; biomass use – especially for energy – that now exceeds productive capacity in some areas; widespread resource degradation including deforestation at about 100,000 hectares per year; and an increasingly unpredictable climate. An urgent response is required to this situation in which restoration of tree cover is a central component. Trees are crucial for soil conservation and food security, local energy supply, construction materials and medicines. But they are also critical or diversifying income generation. The Government of Malawi has laid out important policies that should help incentivise the use of tree products in local forest enterprises for income generation through agroforestry, on-farm tree planting and woodlot establishment. But so far these policies have failed to deliver entrepreneurial activity based on trees at any significant scale – either through lack of resources for implementation or through entrenched views that discourage such activities at field level. This report reviews some of the main enterprise developments around on-farm tree crops, assesses their operational challenges, and suggests ways to strengthen their future prospects. **The publication**

### 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 challenges. **The publication**

### Synopsis on Expert Seminar on Gender, Forestry, Climate Change and REDD+

*RECOFTC*

A national expert seminar on Gender, Forestry, Climate Change and REDD+ was held on 19 February 2013 at Vansana Riverside Hotel in Vientiane, Lao PDR. The seminar was a joint initiative of RECOFTC - The Center for People and Forests and Department of Forestry, Lao PDR. The purpose of the seminar was to draw attention to gender concerns in the forestry sector in Lao PDR, with special reference to climate change and REDD+. The specific objectives were: 1) To understand the existing policies and plans aimed at strengthening gender equality in forest management and current initiatives underway to reinforce them through national strategy development on REDD+ and climate change; 2) to identify key issues, challenges, and gaps for inclusion of women as the effective stakeholders in forest based climate change adaptation and mitigation; and 3) to discuss the approaches and methods for addressing identified challenges and opportunities for gender responsive capacity building initiatives at different levels, and communicate them widely in climate change discussions and policy processes in Lao PDR. **The synopsis**

### Measurement, Reporting and Verification (MRV) for low carbon development: Learning from experience in Asia

*IGES*

MRV – Measurement/Monitoring, Reporting and Verification - is commonly understood as a series of processes to quantify GHG emission and their change over time. It is a key instrument to understand the level of emissions and the impact of actions aimed at changing emission levels. For this reason, MRV became a keyword as many developed and developing countries introduce measures to account greenhouse gas emissions and related support. However, little work has been done on clarifying what exactly MRV means and systematically documenting the implemented cases of MRV. In addition, there is a common trade-off between the simplicity and stringency of MRV. This report contributes to the further development of MRV modalities and methodologies by providing conceptual clarification of MRV and outlining 16 case studies of MRV schemes being implemented on the ground. Based on these case studies, the report identified eight key messages. **The publication**

### Biofuels and the sustainability challenge: A global assessment of sustainability issues, trends and policies for biofuels and related feedstocks

*FAO*

This report owes its genesis to the post food crisis of 2007-08, the ensuing debate over the impact of biofuels on global food security, and the rising concern over climate change and its close ties to sustainability. Moreover, the increasing debate over biofuel sustainability and the multiplicity of certification schemes that emerged over the last few years offered an opportunity for a global assessment with particular emphasis on trade, policy and food security. **The publication**

## *V.I JOBS*

### Senior Fellow/Research Fellow – Forests and Climate Change

*Center for Global Development – deadline for application is 30th of May 2013*

The Center for Global Development, an independent, non-partisan research organization in Washington, DC, seeks a dynamic Senior Fellow or Research Fellow to undertake independent research related to climate change, forests, including REDD+, land use and environmental economics. **More**

## *VII. ANNOUNCEMENTS*

### Nurture forests for the future

*FAO*

FAO as part of the UN-REDD Programme believes that Reducing Emissions from Deforestation and forest Degradation (REDD+) can also ensure food security through good agriculture practices, biodiversity conservation, livelihoods diversification, good governance and better land management. That is exactly what we would like you to capture through your lens. Participate in the Nurture forests for the future Photo Contest and send us photos that link forests and REDD+ to food security in your part of the world. Join us to celebrate

the fifth anniversary of the UN-REDD Programme and to raise awareness through photos of how REDD+ can contribute benefits for food security. The competition is being held as a part of the International Conference on Forests for Food Security and Nutrition to be held at FAO headquarters from 13-15 May 2013 where the best 25 photos will be exhibited. The winner of the competition will be awarded a photo mission with FAO. The deadline for submission is 25 April 2013. **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**

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**We appreciate any comments or feedback.**

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