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## I. IN THE PRESS

14 December 2014 - *The Guardian*

### [Lima climate change talks reach global warming agreement](#)

International negotiators at the Lima climate change talks have agreed on a plan to fight global warming that would for the first time commit all countries to cutting their greenhouse gas emissions.

The plan, agreed at United Nations talks on Sunday, was hailed as an important first step towards a climate change deal due to be finalised in Paris next year. The proposals call on countries to reveal how they will cut carbon pollution, ideally by March next year.

14 December 2014 - *UNFCCC*

### [Lima Call for Climate Action Puts World on Track to Paris 2015](#)

A new 2015 agreement on climate change, that will harness action by all nations, took a further important step forward in Lima following two weeks of negotiations by over 190 countries. Nations concluded by elaborating the elements of the new agreement, scheduled to be agreed in Paris in late 2015, while also agreeing the ground rules on how all countries can submit contributions to the new agreement during the first quarter of next year. These Intended Nationally Determined Contributions (INDCs) will form the foundation for climate action post 2020 when the new agreement is set to come into effect. During the two week 20th Conference of the Parties, countries also made significant progress in elevating adaptation onto the same level as action to cut and curb emissions.

11 December 2014 - *IISD*

### [GLF Statement Calls for Greater Participation and Coordination](#)

The Global Landscapes Forum (GLF) organizers and participants released an 'Outcome Statement' that recognizes the link between healthy landscapes and efforts to address climate change. The statement reflects discussions among the 1,700 participants about how landscapes approaches contribute to sustainable solutions around the world.

10 December 2014 - *IISD*

### [The UN System Delivering as One on Climate Action](#)

The UN system of organizations is comprised of more than 40 entities covering issues ranging from

human rights to agriculture and civil aviation. With climate change affecting virtually every aspect of development, it is a matter of concern for all of them. At the same time, the transition to low-carbon, resilient and inclusive development offers huge opportunities to achieve the ultimate objective of the UN system - a life in dignity for all.

8 December 2014 - *IISD*

### [Alliance Aims to Expand Climate-Smart Agriculture in Africa](#)

As part of the New Partnership for Africa's Development (NEPAD) Vision 25 x 25, which aims to reach 25 million African farm households by 2025, the Africa Climate-Smart Agriculture Alliance (ACSAA) initiative will ensure that six million smallholders in Africa are practicing climate-smart agriculture (CSA) within the next seven years. The initiative will address multi-sectoral issues surrounding African smallholder farmers' vulnerability to climate change; and build the capacity of national institutions and community-based organizations to transfer climate-smart farming skills to rural households

8 December 2014 - *IISD*

### [UN-REDD COP 20 Event Examines REDD+ Post-2015](#)

The UN Collaborative Programme on Reducing Emissions from Deforestation (UN-REDD) organized a high-level dialogue to explore a post-2015 vision for REDD+ as a catalyst for sustainable development and the 2016-2020 role of UN-REDD. The side event, 'Looking Forward: REDD+ Post 2015,' convened on the margins of the Lima Climate Change Conference

24 November 2014 - *IISD*

### [Forest Carbon Markets Value Surpasses US\\$1 Billion](#)

A recently released report, titled 'Turning over a New Leaf: State of Forest Carbon Markets 2014' and published by the Ecosystem Marketplace, reveals that the cumulative value of the forest carbon market has now exceeded US\$1 billion thanks to a 17% increase in carbon transactions between 2012 and 2013. Despite the increase in carbon traded, however, the report notes that the total value of forest carbon transactions has decreased due to a drop in average carbon prices. Individual forest carbon prices vary drastically according to the report, ranging from US\$1 per ton of carbon dioxide equivalent (tCO<sub>2</sub>e) on the Chicago Climate Exchange, to US\$100/tCO<sub>2</sub>e on the domestic carbon offset market in Japan.

## II. MULTILATERAL PROCESSES IN CLIMATE CHANGE

### Past events

#### **United Nations Framework Convention on Climate Change**

*1 - 12 December 2014, Lima, Peru*

The Lima Climate Change Conference convened from 1-14 December 2014, in Lima, Peru. It included the 20th session of the Conference of the Parties (COP 20) to the UN Framework Convention on Climate Change (UNFCCC) and the 10th session of the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (CMP 10). Three subsidiary bodies (SBs) also met: the 41st sessions of the Subsidiary Body for Scientific and Technological Advice (SBSTA 41) and the Subsidiary Body for Implementation (SBI 41), and the seventh part of the second session of the Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP 2-7).

Negotiations in Lima focused on outcomes under the ADP necessary to advance towards an agreement in Paris at COP 21 in 2015, including elaboration of the information, and process, required for submission of intended nationally determined contributions (INDCs) as early as possible in 2015 and progress on elements of a draft negotiating text. Following lengthy negotiations on a draft decision for advancing the Durban Platform for Enhanced Action, COP 20 adopted the 'Lima Call for Climate Action,' which sets in motion the negotiations in the coming year towards a 2015 agreement, the process for submitting and reviewing INDCs, and enhancing pre-2020 ambition. For a full summary please refer to ENB's summary [here](#)

## III. EVENTS & MEETINGS

### Upcoming events

#### **XIV World Forestry Congress**

*7-15 September 2015, Durban, South Africa*

Forests are essential to life on our planet, to mitigating and adapting to climate change, ensuring adequate supply of fresh water, enhancing biodiversity and providing sustainable incomes and livelihoods, including food security. But they face unprecedented and unrelenting pressures. The 14th World Forestry Congress, hosted by the Republic of South Africa, will bring together the global forestry community to review and analyse the key issues and to share ways of addressing them. The Congress - the first to be held in Africa - is inclusive of people from all countries, regions and sectors, whether they belong to a government organization, NGO, private company, scientific or professional body, a forestry society, or simply have a personal interest in attending. The broad participation and inclusive discussion on forestry issues will facilitate their mainstreaming in global agendas on sustainable development as well as building new partnerships. [More](#)  
The call for events is open until the 13th of March. More information, click [here](#).

## IV. RESEARCH ARTICLES

### **Mobilization of biomass for energy from boreal forests in Finland & Russia under present sustainable forest management certification and new sustainability requirements for solid biofuels**

Sikkema R, Faaij APC, Ranta T, Heinimo J, Gerasimov YY, Karjalainen T, Nabuurs GJ

*Biomass & Bioenergy* 71 (2014): 23-36

Forest biomass is one of the main contributors to the EU's renewable energy target of 20% gross final energy consumption in 2020 (Renewable Energy Directive). Following the Renewable Energy Directive (EU legislation for biofuels), new sustainability principles are launched by the European energy sector, such as the Sustainable Biomass Partnership (SBP). The aim of our study is the investigation of the quantitative impacts from the SBP principles for forest biomass for energy only. We deploy a bottom up method that quantifies the supplies and the costs from log harvest until forest chip delivery at a domestic consumer. We have a reference situation with existing national (forest) legislation and voluntary certification schemes (scenario 1) and a future situation with additional criteria based on the SBP principles (scenario 2). Two country studies were selected for our (2008) survey: one in Finland with nearly 100% certification and one in Leningrad province with a minor areal share of certification in scenario 1. The sustainable potential of forest resources for energy is about 54 Mm<sup>3</sup> (385 PJ) in Finland and about 13.5 Mm<sup>3</sup> (95 PJ) in Leningrad in scenario 1 without extra criteria. The potential volumes reduce considerably by maximum 43% respectively 39% after new criteria from the SBP, like a minimum use of sawlogs, stumps and slash for energy, and by an increased area of protected forests (scenario 2A Maximum extra restrictions). In case sawlogs can be used, but instead ash recycling is applied after a maximum stump and slash recovery (scenario 2B Minimum extra restrictions), the potential supply is less reduced: 5% in Finland and 22% in Leningrad region. The estimated reference costs for forest chips are between € 18 and € 45 solid m<sup>-3</sup> in Finland and between €7 and €33 solid m<sup>-3</sup> in the Leningrad region. In scenario 2a, the costs will mainly increase by €7 m<sup>-3</sup> for delimiting full trees (Finland), and maximum €0.3 m<sup>-3</sup> for suggested improved forest management (Leningrad region). In scenario 2B, when ash recycling is applied, costs increase by about € 0.3 to € 1.6 m<sup>-3</sup>, depending on the rate of soil contamination. This is an increase of 2%, on top of the costs in scenario 2A.

### **Multi-Level policy dialogues, processes, and actions: Challenges and opportunities for national REDD+ safeguards Measurement, Reporting, and Verification (MRV)**

Jagger, P., Brockhaus, M., Duchelle, A.E., Gebara, M.F., Lawlor, K., Resosudarmo, I. A. P., Sunderlin, W.D.

*Forests* 5(9): 2136-2162

REDD+ social safeguards have gained increasing attention in numerous forums. This paper reviews the evolution of multi-level policy dialogues, processes, and actions related to REDD+ social safeguards (e.g., Cancun Safeguards 1-5) among policy makers, civil society organizations, and within the media in Brazil, Indonesia and Tanzania, three countries with well advanced REDD+ programs. We find that progress on core aspects of social safeguards is uneven across the three countries. Brazil is by far the most advanced having drafted a REDD+ social safeguards policy. Both Brazil and Indonesia have benefited from progress made by strong sub-national entities in the operationalization of REDD+ safeguards including free prior and informed consent (FPIC), participation, and benefit sharing. Tanzania has weakly articulated how social safeguards will be operationalized and has a more top-down approach. We conclude that in all three countries, measuring, reporting and verifying progress on social safeguards is likely to be a complex issue. Stakeholders with vested interests in REDD+ social safeguards operate in polycentric rather than nested systems, suggesting that aggregation of information from local to national-scale will be a challenge. However, polycentric systems are also likely to support more transparent and comprehensive safeguards systems. Clear direction from the international community and financing for REDD+ safeguard MRV is essential if REDD+ social safeguards are to be meaningfully integrated into forest-based climate mitigation strategies.

### **Effectiveness of the Local Adaptation Plan of Action to support climate change adaptation in Nepal**

Regmi, B.R., Star, C., Filho, W.L.

*Mitigation and Adaptation Strategies for Global Change*. DOI 10.1007/s11027-014-9610-3

A key challenge in climate change adaptation in developing countries as a whole, and to handling global change in particular, is to link local adaptation needs on the one hand, with national adaptation initiatives on the other, so that vulnerable households and communities can directly benefit. This study assesses the impact of

the Nepal government's efforts to promote its Local Adaptation Plan of Action (LAPA) and its applicability to other least developed countries (LDCs). Based on data gathered from two field studies in Nepal, the research shows that the Nepal's LAPA has succeeded in mobilizing local institutions and community groups in adaptation planning and recognizing their role in adaptation. However, the LAPA approach and implementation have been constrained by sociostructural and governance barriers that have failed to successfully integrate local adaptation needs in local planning and increase the adaptive capacity of vulnerable households. This paper describes the mechanisms of suitable governance strategies for climate change adaptation specific to Nepal and other LDCs. It also argues the need to adopt an adaptive comanagement approach, where the government and all stakeholders identify common local- and national-level mainstreaming strategy for knowledge management, resource mobilization, and institutional development, ultimately using adaptation as a tool to handle global change.

### **Changes in Income Structure in Frontier Villages and Implications for REDD+ Benefit Sharing**

Kurashima, T., Matsuura, T., Miyamoto, A., Sano, M., Tith, B., Chann, S.

*Forests* 5(11): doi:10.3390/f5112865

A methodological characteristic of the REDD+ scheme is that it attempts to reduce deforestation by rewarding communities that change problematic land use practices. This has led to discussions on benefit sharing. This article focuses on incentives for alternative land use practices among village members living in frontier areas, especially in relation to support for sustainable land use and people's livelihoods, and clarifies the issues that REDD+ projects are likely to face in this context. Although some documents regarding REDD+ projects have mentioned support to encourage such incentives, insufficient consideration has been given to the realities of the changes in frontier communities. REDD+ projects are unlikely to motivate members to embrace alternative land use practices if support or benefit sharing does not match members' expectations. Here, we examine the changes in household (HH) income and structure, as well as in livelihood activities, experienced by Cambodian frontier villagers living at the site of a planned REDD+ project. During the nine years compared in this study, the frontier villages experienced broad and imbalanced changes in HH income owing to the rapid expansion of the cultivation of cash crops. Our results indicate that benefit sharing or support inevitably becomes more difficult and challenging in frontier areas than in areas where subsistence production systems still predominate, although such frontiers could, in theory, yield maximum returns with regard to forest carbon balance if the REDD+ projects addressed benefit sharing and support and came to fruition.

### **Expansion of Protected Areas under Climate Change: An Example of Mountainous Tree Species in Taiwan**

Lin, W-C., Lin, Y-P., Lien, W-Y., Wang, Y-C., Lin, C-T., Chiou, C-R., Anthony, J., Cross, N.D.

*Forests* 5(11): 2882-2904

Tree species in mountainous areas are expected to shift their distribution upward in elevation in response to climate change, calling for a potential redesign of existing protected areas. This study aims to predict whether or not the distributions of two high-mountain tree species, *Abies* (*Abies kawakamii*) and *Tsuga* (*Tsuga chinensis* var. *formosana*), will significantly shift upward due to temperature change, and whether current protected areas will be suitable for conserving these species. Future temperature change was projected for 15 different future scenarios produced from five global climate models. Shifts in *Abies* and *Tsuga* distributions were then predicted through the use of species distribution models (SDMs) which included occurrence data of *Abies* and *Tsuga*, as well as seasonal temperature, and elevation. The 25 km × 25 km downscaled General Circulation Model (GCMs) data for 2020-2039 produced by the Taiwan Climate Change Projection and Information Platform was adopted in this study. Habitat suitability in the study area was calculated using maximum entropy model under different climatic scenarios. A bootstrap method was applied to assess the parameter uncertainty of the maximum entropy model. In comparison to the baseline projection, we found that there are significant differences in suitable habitat distributions for *Abies* and *Tsuga* under seven of the 15 scenarios. The results suggest that mountainous ecosystems will be substantially impacted by climate change. We also found that the uncertainty originating from GCMs and the parameters of the SDM contribute most to the overall level of variability in species distributions. Finally, based on the uncertainty analysis and the shift in habitat suitability, we applied systematic conservation planning approaches to identify suitable areas to add to Taiwan's protected area network.

### **Forest Carbon Offsets Revisited: Shedding Light on Darkwoods**

van Kooten, G.C., Bogle, T.N., de Vries, F.P

*Forest Science*. DOI: <https://dx.doi.org/10.5849/forsci.13-183>

This paper investigates the viability of carbon offset credits created through forest conservation and preservation. A detailed forest management model based on a case study of a forest estate in southeastern British Columbia, owned by The Nature Conservancy of Canada (NCC) is used to demonstrate the challenging

nature of estimating forest carbon offsets. For example, the NCC management plan creates substantial carbon offset credits because the counterfactual is that of a private forest liquidator, but when sustainable management of the site is assumed, the commercial operator would sequester much more carbon than under the NCC plan. The broader message is that the creation of carbon offsets is highly sensitive to ex ante assumptions and whether physical carbon is discounted. We demonstrate that more carbon gets stored in wood products as the discount rate on carbon rises (addressing climate change is more urgent). A high discount rate on carbon favors greater harvests and processing of biomass into products, while a low rate favors reduced harvest intensity. Further, since carbon credits earned by protecting forests may find their way onto world carbon markets, they lower the costs of emitting CO<sub>2</sub> while contributing little to mitigating climate change.

### **Effects of variation in precipitation on the distribution of soil bacterial diversity in the primitive Korean pine and broadleaved forests**

Wang NanNan; Wang MeiJu; Li ShiLan; Sui Xin; Han ShiJie; Feng FuJuan

*World Journal of Microbiology & Biotechnology*; 2014. 30(11):2975-2984

Patterns of precipitation have changed as a result of climate change and will potentially keep changing in the future. Therefore, it is critical to understand how ecosystem processes will respond to the variation of precipitation. However, compared to aboveground processes, the effects of precipitation change on soil microorganisms remain poorly understood. Changbai Mountain is an ideal area to study the responses of temperate forests to the variations in precipitation. In this study, we conducted a manipulation experiment to simulate variation of precipitation in the virgin, broad-leaved Korean pine mixed forest in Changbai Mountain. Plots were designed to increase precipitation by 30% [increased (+)] or decrease precipitation by 30% [decreased (-)]. We analyzed differences in the diversity of the bacterial community in surface bulk soils (0-5 and 5-10 cm) and rhizosphere soils between precipitation treatments, including control. Bacteria were identified using the high-throughput 454 sequencing method. We obtained a total 271,496 optimized sequences, with a mean value of 33,242 ( $\pm 1,412.39$ ) sequences for each soil sample. Being the same among the sample plots with different precipitation levels, the dominant bacterial communities were *Proteobacteria*, *Acidobacteria*, *Actinobacteria*, *Planctomycetes*, and *Chloroflexi*. Bacterial diversity and abundance declined with increasing soil depth. In the bulk soil of 0-5 cm, the bacterial diversity and abundance was the highest in the control plots and the lowest in plots with reduced precipitation. However, in the soil of 5-10 cm, the diversity and abundance of bacteria was the highest in the plots of increased precipitation and the lowest in the control plots. Bacterial diversity and abundance in rhizosphere soils decreased with increased precipitation. This result implies that variation in precipitation did not change the composition of the dominant bacterial communities but affected bacterial abundance and the response patterns of the dominant communities to variation in precipitation.

### **Himalayan alpine vegetation, climate change and mitigation**

Salick, J.; Ghimire, S. K.; Fang ZhenDong; Dema, S.; Konchar, K. M

*Journal of Ethnobiology*; 2014. 34(3):276-293.

The Himalaya are experiencing the most drastic global climate change outside of the poles, with predicted temperature increases of 5-6 degrees C, rainfall increases of 20-30%, and rapid melting of permanent snows and glaciers. We have established a 1500 km trans-Himalayan transect across Nepal, Bhutan, and the Tibetan Autonomous Prefecture (TAP), China to document the effects of climate change on alpine plants and peoples. Data show that Himalayan alpine plants respond to environmental and climate change variables including elevation, precipitation, and biogeography. People use alpine plants mostly for medicines and grazing. Climate change threatens rare, endemic, and useful Himalayan plant species and is being monitored into the future. Mitigation of climate change in the Himalaya takes place, without conscious reference to climate change, through carbon negative livelihoods informed by traditional ecological knowledge (TEK) including conservation of sacred sites, afforestation, tree crops, and soil carbon sequestration through incorporation of mulch and manure.

### **Sensitivity of colour indices for discriminating leaf colours from digital photographs**

Mizunuma, T.; Mencuccini, M.; Wingate, L.; Ogee, J.; Nichol, C.; Grace, J

*Methods in Ecology & Evolution*; 2014. 5(10):1078-1085

Digital images of tree canopies have been analysed to understand how forest phenology responds to climate change. Researchers have used different colour indices to carry out quantitative analyses, but uncertainties over the performance of the various indices are hampering progress in their use. To compare the various indices under controlled conditions, we carried out experiments using a low-cost off-the-shelf digital camera with a set of standard colour charts as model leaves for different stages: emerging leaves, yellowish green; newly expanded leaves, green; fully mature leaves, dark green; senescent leaves, yellow. Two models of cameras, a compact digital camera and a surveillance 'live image' camera were used, and photographs were

taken by two cameras for each model under clear or overcast sky conditions with two colour balance settings. The indices were also compared with those derived from spectral reflectance. Colour indices based on hue distinguished leaf colour samples with only a small influence of camera models, balance setting and sky conditions, while indices based on green were strongly influenced by camera models and were relatively insensitive to leaf colours. The strength of the green channel relative to the total of digital numbers took similar values for the mature and senescent replica leaves, highlighting its poor ability to identify the change of colour in autumn. Spectral-based hue was also sensitive to the gradation of leaf colours and showed a good correlation with the digital representation of hue regardless of camera models and balance setting. Remarkably, the primitive digital number of red,  $N_{red}$ , also discriminated leaf colours well, with a small influence of the factors investigated here, showing a good correlation with the reflectance of the red band, except from images taken by the surveillance cameras with auto balance. Hue was a robust index across the image set, while the green-based indices often used to quantify canopy phenology in previous studies performed poorly. Hue was well correlated with spectral reflectance indices and worked better than all other indices to discriminate leaf colours. We recommend using hue as a colour index for tracking different stages of leaf development.

### **Temperate forest fragments maintain aboveground carbon stocks out to the forest edge despite changes in community composition**

Ziter, C.; Bennett, E. M.; Gonzalez, A.;  
*Oecologia*; 2014. 176(3):893-902.

Edge effects are among the primary mechanisms by which forest fragmentation can influence the link between biodiversity and ecosystem processes, but relatively few studies have quantified these mechanisms in temperate regions. Carbon storage is an important ecosystem function altered by edge effects, with implications for climate change mitigation. Two opposing hypotheses suggest that aboveground carbon (AGC) stocks at the forest edge will (a) decrease due to increased tree mortality and compositional shifts towards smaller, lower wood density species (e.g., as seen in tropical systems) or, less often, (b) increase due to light/temperature-induced increases in diversity and productivity. We used field-based measurements, allometry, and mixed models to investigate the effects of proximity to the forest edge on AGC stocks, species richness, and community composition in 24 forest fragments in southern Quebec. We also asked whether fragment size or connectivity with surrounding forests altered these edge effects. AGC stocks remained constant across a 100 m edge-to-interior gradient in all fragment types, despite changes in tree community composition and stem density consistent with expectations of forest edge effects. We attribute this constancy primarily to compensatory effects of small trees at the forest edge; however, it is due in some cases to the retention of large trees at forest edges, likely a result of forest management. Our results suggest important differences between temperate and tropical fragments with respect to mechanisms linking biodiversity and AGC dynamics. Small temperate forest fragments may be valuable in conservation efforts based on maintaining biodiversity and multiple ecosystem services.

### **Linking belowground and aboveground phenology in two boreal forests in Northeast China**

Du EnZai; Fang JingYun  
*Oecologia*; 2014. 176(3):883-892

The functional equilibrium between roots and shoots suggests an intrinsic linkage between belowground and aboveground phenology. However, much less understanding of belowground phenology hinders integrating belowground and aboveground phenology. We measured root respiration ( $R_a$ ) as a surrogate for root phenology and integrated it with observed leaf phenology and radial growth in a birch (*Betula platyphylla*)-aspen (*Populus davidiana*) forest and an adjacent larch (*Larix gmelinii*) forest in Northeast China. A log-normal model successfully described the seasonal variations of  $R_a$  and indicated the initiation, termination and peak date of root phenology. Both root phenology and leaf phenology were highly specific, with a later onset, earlier termination, and shorter period of growing season for the pioneer tree species (birch and aspen) than the dominant tree species (larch). Root phenology showed later initiation, later peak and later termination dates than leaf phenology. An asynchronous correlation of  $R_a$  and radial growth was identified with a time lag of approximately 1 month, indicating aprioritization of shoot growth. Furthermore, we found that  $R_a$  was strongly correlated with soil temperature and air temperature, while radial growth was only significantly correlated with air temperature, implying a down-regulating effect of temperature. Our results indicate different phenologies between pioneer and dominant species and support a down-regulation hypothesis of plant phenology which can be helpful in understanding forest dynamics in the context of climate change

### **On the economics of tropical deforestation: carbon credit markets and national policies**

Barua, S. K.; Lintunen, J.; Uusivuori, J.; Kuuluvainen, J  
*Forest Policy and Economics*; 2014. 47:36-45

This paper contributes to the economics of deforestation by presenting a formal, infinite horizon dynamic

model describing the use of tropical forest resources. As an alternative to clearing the forest, a landowner has the option to sell it to an international carbon crediting program. The model is used to investigate corrective incentive programs needed to ensure a socially optimal level of forest resources. Optimal conditions for a land income tax and carbon compensation rate are derived. The paper shows that the optimality of national carbon compensation policies crucially depends on the land income taxation. In the presence of an optimal land income tax-subsidy program, the government may need to pass on to the landowners the very carbon compensation that it receives from the international community to ensure a socially optimal tropical forest stock. However, the government may need to over-transfer or under-transfer the carbon compensation depending on whether the pre-existing land income tax is below or above the optimal level, respectively. This suggests that the pre-existing sub-optimality in land income taxation in a given country can be corrected by adjusting the carbon compensation. Therefore, a carbon compensation scheme should take into account existing national policies that affect forest clearing.

### **Whole-tree harvesting with stump removal versus stem-only harvesting in peatlands when water quality, biodiversity conservation and climate change mitigation matter**

Miettinen, J.; Ollikainen, M.; Nieminen, T. M.; Ukonmaanaho, L.; Lauren, A.; Hynynen, J.; Lehtonen, M.; Valsta, L

*Forest Policy and Economics*; 2014. 47:25-35

This article examines alternative forest harvesting regimes when ecosystem services in terms of water quality, biodiversity conservation and climate change mitigation are included in the analysis. The harvesting regimes are whole-tree harvesting with stump removal and conventional stem-only harvesting. The harvesting regimes are evaluated under two alternative climate policy contexts. The first alternative is a carbon neutral bioenergy policy, which assumes the carbon dioxide (CO<sub>2</sub>) neutrality of bioenergy and produces substitution benefits, as bioenergy replaces fossil fuels. The second alternative climate policy, a carbon non-neutral bioenergy policy, takes into account the fact that bioenergy causes carbon dioxide emissions, producing substitution costs, and that harvested woody biomass affects the ability of a forest to act as a carbon sink. We extend the traditional Faustmann (1849) rotation model to include nutrient load damage, biodiversity benefits, and climate impacts. The empirical analysis is based on Finnish data from a catchment experiment carried out on drained peatland forests. The empirical results show that under a carbon neutral bioenergy policy, whole-tree harvesting with stump removal produces the highest net social benefits. However, if a carbon non-neutral bioenergy policy is assumed, the net social benefits are greater under stem-only harvesting.

### **Forest biomass for bioenergy: opportunities and constraints for good governance. A case study from Italy**

Maesano, M.; Drigo, R.; Lasserre, B.; Chirici, G.; Marchetti, M

*Drewno*; 2014. 57(192):63-76

Interest in the use of biomass for energy has increased significantly in the last few years. The latest report by the Intergovernmental Panel on Climate Change highlights the influence mankind has had on the climate: an unprecedented increase in GHG levels in the last 800,000 years and a rise of 40% in CO<sub>2</sub> concentrations since pre-industrial times. The challenge now is to find energy alternatives, and in this context, one important option is bioenergy, one of the most important energy sources of the future. In light of this, the goal of this paper was to assess the sustainable potential of wood fuel resources in Italy using WISDOM methodology. WISDOM, developed by the FAO, has been applied in many countries around the world. From this study, at national level, household consumption was at 19.3 Mt in 2003 (average value), while the potential supply of woody biomass (productivity) was 24.9 Mt (average value), with a surplus of almost 6 million tons between household consumption and productivity. This study represents an advance in knowledge of the biomass potential for energy use in Italy, and, as such, is subject to possible future improvement. Forest bioenergy development creates good opportunities to mobilize the production potential of European forests, and to contribute to a more climate-friendly, bio-based economy

### **Estimates and forecasts of forest biomass and carbon sequestration in North America and Australia: a forty-five year quest**

Botkin, D. B.; Ngugi, M. R.; Doley, D.

*Drewno*; 2014. 57(192):7-28

A half-century of forest inventory research involving statistically-valid field measurements (using statistically representative sample size and showing confidence limits) and well-validated forecasting methods are reviewed in this paper. Some current procedures overestimate global and large-scale forest biomass, carbon storage, and carbon sequestering rates because they are based on statistically-invalid methods (errors in estimates are unavailable and unreported), or they fail to consider key dynamic characteristics of forests. It is sometimes assumed that old-growth forests can serve as fixed, steady-state storage of biomass and carbon for

indefinitely long periods, but it is shown by both modelling and remote sensing that forests are dynamic systems, the state of which can change considerably over as short a time as a decade. Forecasting methods show that maximum biomass and carbon storage in some important forest types occurs in mid-succession, not in old-growth. It is proposed, therefore, that realistic biomass and carbon storage estimates used for carbon credits and offsets be determined as the statistical mean minus the confidence interval and that practical carbon sequestering programs include specific time frames, not indefinitely long periods of time.

### **The legacy of episodic climatic events in shaping temperate, broadleaf forests**

Pederson, N.; Dyer, J. M.; McEwan, R. W.; Hessler, A. E.; Mock, C. J.; Orwig, D. A.; Rieder, H. E.; Cook, B. I  
*Ecological Monographs*; 2014. 84(4):599-620

In humid, broadleaf-dominated forests where gap dynamics and partial canopy mortality appears to dominate the disturbance regime at local scales, paleoecological evidence shows alteration at regional-scales associated with climatic change. Yet, little evidence of these broad-scale events exists in extant forests. To evaluate the potential for the occurrence of large-scale disturbance, we used 76 tree-ring collections spanning 840000 km<sup>2</sup> and 5327 tree recruitment dates spanning 1.4 million km<sup>2</sup> across the humid eastern United States. Rotated principal component analysis indicated a common growth pattern of a simultaneous reduction in competition in 22 populations across 61000 km<sup>2</sup>. Growth-release analysis of these populations reveals an intense and coherent canopy disturbance from 1775 to 1780, peaking in 1776. The resulting time series of canopy disturbance is so poorly described by a Gaussian distribution that it can be described as "heavy tailed," with most of the years from 1775 to 1780 comprising the heavy-tail portion of the distribution. Historical documents provide no evidence that hurricanes or ice storms triggered the 1775-1780 event. Instead, we identify a significant relationship between prior drought and years with elevated rates of disturbance with an intense drought occurring from 1772 to 1775. We further find that years with high rates of canopy disturbance have a propensity to create larger canopy gaps indicating repeated opportunities for rapid change in species composition beyond the landscape scale. Evidence of elevated, regional-scale disturbance reveals how rare events can potentially alter system trajectory: a substantial portion of old-growth forests examined here originated or were substantially altered more than two centuries ago following events lasting just a few years. Our recruitment data, comprised of at least 21 species and several shade-intolerant species, document a pulse of tree recruitment at the subcontinental scale during the late-1600s suggesting that this event was severe enough to open large canopy gaps. These disturbances and their climatic drivers support the hypothesis that punctuated, episodic, climatic events impart a legacy in broadleaf-dominated forests centuries after their occurrence. Given projections of future drought, these results also reveal the potential for abrupt, meso- to large-scale forest change in broadleaf-dominated forests over future decades.

### **Rapid losses of surface elevation following tree girdling and cutting in tropical mangroves**

Lang'at, J. K. S.; Kairo, J. G.; Mencuccini, M.; Bouillon, S.; Skov, M. W.; Waldron, S.; Huxham, M.;  
*PLoS ONE*; 2014. 9(9):e107868.

The importance of mangrove forests in carbon sequestration and coastal protection has been widely acknowledged. Large-scale damage of these forests, caused by hurricanes or clear felling, can enhance vulnerability to erosion, subsidence and rapid carbon losses. However, it is unclear how small-scale logging might impact on mangrove functions and services. We experimentally investigated the impact of small-scale tree removal on surface elevation and carbon dynamics in a mangrove forest at Gazi bay, Kenya. The trees in five plots of a *Rhizophora mucronata* (Lam.) forest were first girdled and then cut. Another set of five plots at the same site served as controls. Treatment induced significant, rapid subsidence (-32.1±8.4 mm yr<sup>-1</sup> compared with surface elevation changes of +4.2±1.4 mm yr<sup>-1</sup> in controls). Subsidence in treated plots was likely due to collapse and decomposition of dying roots and sediment compaction as evidenced from increased sediment bulk density. Sediment effluxes of CO<sub>2</sub> and CH<sub>4</sub> increased significantly, especially their heterotrophic component, suggesting enhanced organic matter decomposition. Estimates of total excess fluxes from treated compared with control plots were 25.3±7.4 tCO<sub>2</sub> ha<sup>-1</sup> yr<sup>-1</sup> (using surface carbon efflux) and 35.6±76.9 tCO<sub>2</sub> ha<sup>-1</sup> yr<sup>-1</sup> (using surface elevation losses and sediment properties). Whilst such losses might not be permanent (provided cut areas recover), observed rapid subsidence and enhanced decomposition of soil sediment organic matter caused by small-scale harvesting offers important lessons for mangrove management. In particular mangrove managers need to carefully consider the trade-offs between extracting mangrove wood and losing other mangrove services, particularly shoreline stabilization, coastal protection and carbon storage.

### **The reduced effectiveness of protected areas under climate change threatens Atlantic Forest tiger moths**

Ferro, V. G.; Lemes, P.; Melo, A. S.; Loyola, R  
*PLoS ONE*; 2014. 9(9):e107792

Climate change leads to species' range shifts, which may end up reducing the effectiveness of protected areas.

These deleterious changes in biodiversity may become amplified if they include functionally important species, such as herbivores or pollinators. We evaluated how effective protected areas in the Brazilian Atlantic Forest are in maintaining the diversity of tiger moths (Arctiinae) under climate change. Specifically, we assessed whether protected areas will gain or lose species under climate change and mapped their locations in the Atlantic Forest, in order to assess potential spatial patterns of protected areas that will gain or lose species richness. Comparisons were completed using modeled species occurrence data based on the current and projected climate in 2080. We also built a null model for random allocation of protected areas to identify where reductions in species richness will be more severe than expected. We employed several modern techniques for modeling species' distributions and summarized results using ensembles of models. Our models indicate areas of high species richness in the central and southern regions of the Atlantic Forest both for now and the future. However, we estimate that in 2080 these regions should become climatically unsuitable, decreasing the species' distribution area. Around 4% of species were predicted to become extinct, some of them being endemic to the biome. Estimates of species turnover from current to future climate tended to be high, but these findings are dependent on modeling methods. Our most important results show that only a few protected areas in the southern region of the biome would gain species. Protected areas in semideciduous forests in the western region of the biome would lose more species than expected by the null model employed. Hence, current protected areas are worse off, than just randomly selected areas, at protecting species in the future.

### **Spatial and temporal patterns of carbon storage in forest ecosystems on Hainan Island, southern China**

Ren Hai; Li LinJun; Liu Qiang; Wang Xu; Li YiDe; Hui DaFeng; Jian ShuGuang; Wang Jun; Yang Hual; Lu HongFang; Zhou GuoYi; Tang XuLi; Zhang QianMei; Wang Dong; Yuan LianLian; Chen XuBing  
*PLoS ONE*; 2014. 9(9):e108163

Spatial and temporal patterns of carbon (C) storage in forest ecosystems significantly affect the terrestrial C budget, but such patterns are unclear in the forests in Hainan Province, the largest tropical island in China. Here, we estimated the spatial and temporal patterns of C storage from 1993-2008 in Hainan's forest ecosystems by combining our measured data with four consecutive national forest inventories data. Forest coverage increased from 20.7% in the 1950s to 56.4% in the 2010s. The average C density of 163.7 Mg C/ha in Hainan's forest ecosystems in this study was slightly higher than that of China's mainland forests, but was remarkably lower than that in the tropical forests worldwide. Total forest ecosystem C storage in Hainan increased from 109.51 Tg in 1993 to 279.17 Tg in 2008. Soil C accounted for more than 70% of total forest ecosystem C. The spatial distribution of forest C storage in Hainan was uneven, reflecting differences in land use change and forest management. The potential carbon sequestration of forest ecosystems was 77.3 Tg C if all forested lands were restored to natural tropical forests. To increase the C sequestration potential on Hainan Island, future forest management should focus on the conservation of natural forests, selection of tree species, planting of understory species, and implementation of sustainable practices.

### **Accounting for biomass carbon stock change due to wildfire in temperate forest landscapes in Australia**

Keith, H.; Lindenmayer, D. B.; MacKey, B. G.; Blair, D.; Carter, L.; McBurney, L.; Okada, S.; Konishi-Nagano, T  
*PLoS ONE*; 2014. 9(9):e107126

Carbon stock change due to forest management and disturbance must be accounted for in UNFCCC national inventory reports and for signatories to the Kyoto Protocol. Impacts of disturbance on greenhouse gas (GHG) inventories are important for many countries with large forest estates prone to wildfires. Our objective was to measure changes in carbon stocks due to short-term combustion and to simulate longer-term carbon stock dynamics resulting from redistribution among biomass components following wildfire. We studied the impacts of a wildfire in 2009 that burnt temperate forest of tall, wet eucalypts in south-eastern Australia. Biomass combusted ranged from 40 to 58 tC ha<sup>-1</sup>, which represented 6-7% and 9-14% in low- and high-severity fire, respectively, of the pre-fire total biomass carbon stock. Pre-fire total stock ranged from 400 to 1040 tC ha<sup>-1</sup> depending on forest age and disturbance history. An estimated 3.9 TgC was emitted from the 2009 fire within the forest region, representing 8.5% of total biomass carbon stock across the landscape. Carbon losses from combustion were large over hours to days during the wildfire, but from an ecosystem dynamics perspective, the proportion of total carbon stock combusted was relatively small. Furthermore, more than half the stock losses from combustion were derived from biomass components with short lifetimes. Most biomass remained on-site, although redistributed from living to dead components. Decomposition of these components and new regeneration constituted the greatest changes in carbon stocks over ensuing decades. A critical issue for carbon accounting policy arises because the timeframes of ecological processes of carbon stock change are longer than the periods for reporting GHG inventories for national emissions reductions targets. Carbon accounts should be comprehensive of all stock changes, but reporting against targets should be based on human-induced changes

in carbon stocks to incentivise mitigation activities.

### **Incorporating climate change and exotic species into forecasts of riparian forest distribution**

Ikeda, D. H.; Grady, K. C.; Shuster, S. M.; Whitham, T. G

*PLoS ONE*; 2014. 9(9):e107037

We examined the impact climate change (CC) will have on the availability of climatically suitable habitat for three native and one exotic riparian species. Due to its increasing prevalence in arid regions throughout the western US, we predicted that an exotic species, Tamarix, would have the greatest increase in suitable habitat relative to native counterparts under CC. We used an ecological niche model to predict range shifts of *Populus fremontii*, *Salix gooddingii*, *Salix exigua* and Tamarix, from present day to 2080s, under five general circulation models and one climate change scenario (A1B). Four major findings emerged. 1) Contrary to our original hypothesis, *P. fremontii* is projected to have the greatest increase in suitable habitat under CC, followed closely by Tamarix. 2) Of the native species, *S. gooddingii* and *S. exigua* showed the greatest loss in predicted suitable habitat due to CC. 3) Nearly 80 percent of future *P. fremontii* and *Salix* habitat is predicted to be affected by either CC or Tamarix by the 2080s. 4) By the 2080s, 20 percent of *S. gooddingii* habitat is projected to be affected by both Tamarix and CC concurrently, followed by *S. exigua* (19 percent) and *P. fremontii* (13 percent). In summary, while climate change alone will negatively impact both native willow species, Tamarix is likely to affect a larger portion of all three native species' distributions. We discuss these and other results in the context of prioritizing restoration and conservation efforts to optimize future productivity and biodiversity. As we are accounting for only direct effects of CC and Tamarix on native habitat, we present a possible hierarchy of effects- from the direct to the indirect- and discuss the potential for the indirect to outweigh the direct effects. Our results highlight the need to account for simultaneous challenges in the face of CC.

### **Production of carbon occluded in phytolith is season-dependent in a bamboo forest in subtropical China.**

Huang ZhangTing; Jiang PeiKun; Chang XiaoChuan [Chang, X. C. S. ]; Zhang Yan; Ying YuQi

*PLoS ONE*; 2014. 9(9):e106843

Carbon (C) occluded in phytolith (PhytOC) is a stable form of C; when PhytOC is returned to the soil through litterfall it is stored in the soil which can be an effective way for long-term C sequestration. However, few estimates on the rate of PhytOC input to the soil are available. To better understand the seasonal dynamics of PhytOC production and the annual rate of stable C sequestration through PhytOC input, we quantified the monthly litterfall, phytolith and PhytOC return to the soil over a year in a typical Lei bamboo (*Phyllostachys praecox*) forest in subtropical China. The monthly litterfall ranged between 14.81 and 131.18 g m<sup>-2</sup>, and the phytolith concentration in the monthly litterfall samples ranged between 47.21 and 101.68 g kg<sup>-1</sup> of litter mass, with the PhytOC concentration in the phytolith ranged between 29.4 and 44.9 g kg<sup>-1</sup> of phytolith, equivalent to 1.8-3.6 g kg<sup>-1</sup> of PhytOC in the litterfall (based on litterfall dry mass). The amount of phytolith input to the soil system was 292.21±69.12 (mean±SD) kg ha<sup>-1</sup> yr<sup>-1</sup>, sequestering 41.45±9.32 kg CO<sub>2</sub>-e ha<sup>-1</sup> yr<sup>-1</sup> of C in the studied Lei bamboo forest. This rate of C sequestration through the formation of PhytOC found in this study falls within the range of rates for other grass-type species reported in the literature. We conclude that return of C occluded in phytolith to the soil can be a substantial source of stable soil C and finding means to increase PhytOC storage in the soil should be able to play a significant role in mitigating the rapidly increasing atmospheric CO<sub>2</sub> concentration.

### **Reconciling simulations of seasonal carbon flux and soil water with observations using tap roots and hydraulic redistribution: a multi-biome FLUXNET study**

Alton, P. B

*Agricultural and Forest Meteorology*; 2014. 198\199:309-319

Understanding the response of plants to soil moisture stress is important given a future climate subject to greater extremes, including drought. Nevertheless, major discrepancies still exist between observed and simulated seasonal carbon, water and energy fluxes at the vegetated land-surface. For tropical forest, these discrepancies have been reduced, especially during the dry season, by taking account of tap roots and hydraulic redistribution. The expanding FLUXNET open-access archive allows the current study to extend the investigation of seasonal drought-stress to ten different vegetation types. A state-of-the-art land-surface model

is enhanced to take account of tap roots and hydraulic redistribution in order to compare with traditional simulations. Carbon fluxes and fractional soil water content are simulated and compared against observations. We find that a traditional approach, by neglecting tap roots, simulates a seasonal drought for trees and shrubs which is generally too severe compared to observed net carbon flux. The introduction of a tap root benefits tropical broadleaf forest and other ecosystems with high annual potential evapotranspiration in reducing observation-model discrepancies. Our simulations suggest a minor role for hydraulic redistribution, modifying weekly soil moisture rather than substantially changing seasonal water flux totals.

### **Ecosystem scale methane fluxes in a natural temperate bog-pine forest in southern Germany**

Hommeltenberg, J.; Mauder, M.; Drosler, M.; Heidbach, K.; Werle, P.; Schmid, H. P

*Agricultural and Forest Meteorology*; 2014. 198\199:273-284.

Methane (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>) exchange were investigated over 15 months above a natural bog-pine site in the pre-alpine region of southern Germany. The measurements indicate annual methane emissions of  $+5.3 \pm 0.34 \text{ g C m}^{-2} \text{ a}^{-1}$  and an annual CO<sub>2</sub> uptake of  $-62 \pm 20 \text{ g C m}^{-2} \text{ a}^{-1}$ , resulting in a global warming potential balance of  $-50 \pm 74 \text{ g [CO}_2 \text{ eq.] m}^{-2} \text{ a}^{-1}$ . Air temperature was identified as the environmental parameter showing the highest correlation with methane production, except for periods with low water table ( $< -0.12 \text{ m}$ ). Furthermore, we compared three different methane flux gap-filling methods: the mean daily variation approach (MDV), a look up table (LUT) with various control parameters and an exponential regression function between methane flux and air temperature (NLR). It turns out that the LUT provides the best result for the gap-filling of half-hourly CH<sub>4</sub> fluxes for the present data. By increasing the number of parameters in the LUT, the CH<sub>4</sub> flux prediction could be considerably improved. Except for dry periods, day to day variations could be reproduced very well by the NLR method, but results for sub-daily fluctuations were poor. The choice of gap-filling method affects the annual methane budget estimate by at most  $\pm 0.5 \text{ g C m}^{-2} \text{ a}^{-1}$ , or about 10% of the annual flux. This study presents one of the first eddy covariance based annual methane- and CO<sub>2</sub>-exchange estimates over a natural bog-pine ecosystem outside the boreal zone.

### **Fast and nondestructive method for leaf level chlorophyll estimation using hyperspectral LiDAR**

Nevalainen, O.; Hakala, T.; Suomalainen, J.; Makipaa, R.; Peltoniemi, M.; Krooks, A.; Kaasalainen, S

*Agricultural and Forest Meteorology*; 2014. 198\199:250-258

We propose an empirical method for nondestructive estimation of chlorophyll in tree canopies. The first prototype of a full waveform hyperspectral LiDAR instrument has been developed by the Finnish Geodetic Institute (FGI). The instrument efficiently combines the benefits of passive and active remote sensing sensors. It is able to produce 3D point clouds with spectral information included for every point, which offers great potential in the field of environmental remote sensing. The investigation was conducted by using chlorophyll sensitive vegetation indices applied to hyperspectral LiDAR data and testing their performance in chlorophyll estimation. The amount of chlorophyll in vegetation is an important indicator of photosynthetic capacity and stress, and thus important for monitoring of forest condition and carbon sequestration on Earth. Performance of chlorophyll estimation was evaluated for 27 published vegetation indices applied to waveform LiDAR collected from ten Scots pine shoots. Reference data were collected by laboratory chlorophyll concentration analysis. The performance of the indices in chlorophyll estimation was determined by linear regression and leave-one-out cross-validation. The chlorophyll estimates derived from hyperspectral LiDAR linearly correlate with the laboratory analyzed chlorophyll concentrations, and they are able to represent a range of chlorophyll concentrations in Scots pine shoots ( $R^2 = 0.88$ ,  $RMSE = 0.10 \text{ mg/g}$ ). Furthermore, they are insensitive to measurement scale as nearly the same values of vegetation indices were measured in natural setting while scanning the whole canopy and from clipped shoots re-measured with hyperspectral LiDAR in laboratory. The results indicate that the hyperspectral LiDAR instrument has the potential to estimate vegetation biochemical parameters such as the chlorophyll concentration. The instrument holds much potential in various environmental applications and provides a significant improvement over single wavelength LiDAR or passive optical systems for environmental remote sensing.

### **Contrasting impacts of afforestation on nitrous oxide and methane emissions**

Benanti, G.; Saunders, M.; Tobin, B.; Osborne, B

*Agricultural and Forest Meteorology*; 2014. 198\199:82-93

The impacts of afforestation, with either Sitka spruce [*Picea sitchensis* (Bong.) Carr.] or European ash (*Fraxinus excelsior* L.), on nitrous oxide (N<sub>2</sub>O) and methane (CH<sub>4</sub>) emissions were assessed using a chronosequence (age-related) approach. Conversion of a semi-natural wet grassland on mineral gley soils to a Sitka spruce plantation

drastically increased N<sub>2</sub>O emissions, whereas the opposite trend was seen for CH<sub>4</sub> emissions. Annual cumulative emissions of N<sub>2</sub>O increased from  $0.12 \pm 0.17$  ( $\pm$ values indicate standard error, SE) kg ha<sup>-1</sup> yr<sup>-1</sup> at the grassland site to  $10.12 \pm 2.19$  kg ha<sup>-1</sup> yr<sup>-1</sup> at the 16-year old forest site in this study, which constituted one of the highest recorded losses for unfertilised coniferous forests in Europe. In contrast CH<sub>4</sub> emissions decreased from  $7.61 \pm 3.49$  (grassland site) to  $0.49 \pm 0.65$  (7-year old forest) kg ha<sup>-1</sup> yr<sup>-1</sup>, with the 16-year old forest site acting as a small sink ( $-0.80 \pm 0.12$  kg ha<sup>-1</sup> yr<sup>-1</sup>). The contribution of these gases in terms of carbon dioxide (CO<sub>2</sub>) equivalents to the total greenhouse gas (GHG) budget showed that they can reduce the global warming amelioration capacity for this type of land use change by  $10 \pm 2\%$ , although the magnitude of this reduction is associated with significant uncertainty. In comparison the conversion of a managed grassland into an ash plantation on mineral brown earth soil had no clear effects on either N<sub>2</sub>O or CH<sub>4</sub> emissions, with annual cumulative fluxes for N<sub>2</sub>O of the order of 10 times lower than those from the coniferous stands. A combination of factors could have contributed to these contrasting outcomes, including differences in ecosystem productivity, soil characteristics, management practices, microbial population structure and activity, variations in root activity and vegetation composition, as well as interannual climatic variability, and this is discussed. Overall, the results indicate the difficulty in generalising the impacts of afforestation on GHG budgets in the absence of a better understanding of how tree species, as well as soil and climatic factors, interact to determine trace gas emissions.

### **Caatinga, the Brazilian dry tropical forest: can it tolerate climate changes?**

Santos, M. G.; Oliveira, M. T.; Figueiredo, K. V.; Falcao, H. M.; Arruda, E. C. P.; Almeida-Cortez, J.; Sampaio, E. V. S. B.; Ometto, J. P. H. B.; Menezes, R. S. C.; Oliveira, A. F. M.; Pompelli, M. F.; Antonino, A. C. D.;

*Theoretical and Experimental Plant Physiology*; 2014. 26(1):83-99.

Our review focuses on the projections of climate change in the Brazilian semiarid region, the Caatinga, based on recent publications about global climate change and biology. We found several vulnerable points in the initial estimates, the main one being that the data were collected and analyzed without a multidisciplinary knowledge. This review discusses several studies that show the current knowledge in many semiarid regions around the world. Some of these studies argue for the increase in vegetation greenness responses even under severe and prolonged drought, based on the high resilience the Caatinga native species show under severe drought conditions over the years. Additionally, we include in this review recent data produced by our group on key ecophysiological variables under drought conditions. We also show successful examples of deforested areas recovery in the semiarid region of the Central America. It is critical that the recovery of semiarid areas is coupled with the implementation of socio-environmental policies, engaging the local population and providing subsidies for life wealth improvement. These are key aspects for a long-term recovery and conservation of the Brazilian dry tropical forest.

### **Cerrado vegetation and global change: the role of functional types, resource availability and disturbance in regulating plant community responses to rising CO<sub>2</sub> levels and climate warming.**

Franco, A. C.; Rossatto, D. R.; Silva, L. de C. R.; Ferreira, C. da S

*Theoretical and Experimental Plant Physiology*; 2014. 26(1):19-38.

The cerrado is the most extensive savanna ecosystem of South America and a biodiversity hotspot, harboring a diverse flora (>7,000 species) with high levels of endemism. More than 50% of the cerrado's approximately 2 million km<sub>2</sub> has been converted into pasture and agricultural lands and it is uncertain how the remaining areas will respond to increasing pressures from land use and climate change. Interactions between disturbance regime and resource (water and nutrient) availability are known to determine the distribution of the various plant communities, of contrasting structure and composition, which coexist in the region. We discuss how fire, nutrients and species traits regulate plant community responses to rising CO<sub>2</sub> and global warming, exploring constraints to forest expansion into savanna environments. We describe how climate change will likely reverse a natural process of forest expansion, observed in the region over the past few millennia, accelerating tree cover loss through feedbacks involving fire and resource limitation, and counteracting expected CO<sub>2</sub> stimulation effects. These involve changes in fundamental processes occurring above and below ground, which will probably also impact species performance, distribution and biodiversity patterns. We propose a conceptual framework for predicting changes on vegetation structure, highlighting the need for mechanistic models to accurately simulate vegetation dynamics under climate change scenarios. We conclude by explaining why an effective research agenda must necessarily include mitigation efforts, aimed at minimizing impacts of land clearing through enforced conservation and restoration policies in natural and managed ecosystems.

## V. PUBLICATIONS, REPORTS AND OTHER MEDIA

### **Forest Tenure Reform in Asia and Africa. Local Control for Improved Livelihoods, Forest Management, and Carbon Sequestration.**

*Environment for Development*

Forest tenure reforms are occurring in many developing countries around the world. These reforms typically include devolution of forest lands to local people and communities, which has attracted a great deal of attention and interest. While the nature and level of devolution vary by country, all have potentially important implications for resource allocation, local ecosystem services, livelihoods and climate change. This book helps students, researchers and professionals to understand the importance and implications of these reforms for local environmental quality, climate change, and the livelihoods of villagers, who are often poor. It is shown that local forest management can often be more successful than top-down management of common pool forest resources. The relationship of local forest tenure reform to the important climate change initiative REDD+ is also considered. The work includes a number of generic chapters and also detailed case studies from China, Ethiopia, Kenya, Nepal, Tanzania and Uganda. Using specific examples and a wide variety of disciplinary perspectives, including quantitative and qualitative analytical methods, the book provides an authoritative and critical picture of local forest reforms in light of the key challenges humanity faces today. [More](#)

### **Shifting Cultivation and Environmental Change. Indigenous People, Agriculture and Forest Conservation**

*Environment for Development*

Shifting cultivation is one of the oldest forms of subsistence agriculture and is still practised by millions of poor people in the tropics. Typically it involves clearing land (often forest) for the growing of crops for a few years, and then moving on to new sites, leaving the earlier ground fallow to regain its soil fertility. This book brings together the best of science and farmer experimentation, vividly illustrating the enormous diversity of shifting cultivation systems as well as the power of human ingenuity. Some critics have tended to disparage shifting cultivation (sometimes called 'swidden cultivation' or 'slash-and-burn agriculture') as unsustainable due to its supposed role in deforestation and land degradation. However, the book shows that such indigenous practices, as they have evolved over time, can be highly adaptive to land and ecology. In contrast, 'scientific' agricultural solutions imposed from outside can be far more damaging to the environment and local communities. The book focuses on successful agricultural strategies of upland farmers, particularly in south and south-east Asia, and presents over 50 contributions by scholars from around the world and from various disciplines, including agricultural economics, ecology and anthropology. It is a sequel to the much praised "Voices from the Forest: Integrating Indigenous Knowledge into Sustainable Upland Farming" (RFF Press, 2007), but all chapters are completely new and there is a greater emphasis on the contemporary challenges of climate change and biodiversity conservation. [More](#)

### **Instituting REDD+: An analysis of the processes and outcomes of two pilot projects in Brazil and Tanzania**

*IIED*

REDD readiness is about developing national strategies for REDD+ including the necessary systems to ensure reduced DD, encompassing systems for monitoring/carbon accounting and distribution of international compensations. Establishing REDD+ is a process of change not least regarding actions on the ground. To facilitate the process, new institutions - e.g. rules - for the use of forests must be created. Clarification of property and use rights to forests may also be necessary as part of this process. Moreover, systems for monitoring and control must be developed. Finally, the creation of new organisations - both at national and local levels - may be necessary. From this perspective, establishing REDD+ is about creating the necessary governance structures. A core question in that respect is the legitimacy of such a process and its outputs. Concerning the former, issues regarding participation in decision-making, accountability and transparency are key. Concerning the latter, the focus is on how acceptable the changes in the governance structure are found to be by the involved groups. Establishing REDD+ is a learning process. Hence, a set of pilot projects have been set up to facilitate this. In this report, we document experiences from two such pilots. The first is a project in the RDS Rio Negro in Amazonas, Brazil. The other is in Kilosa, Tanzania. Our objective was to document and evaluate experiences with the process and outputs of introducing REDD+ in these two pilots. This study forms a key component of the project 'Poverty and sustainable development impacts of REDD architecture: options for equity, growth and the environment', led by the International Institute for Environment and Development (IIED) and the Norwegian University of Life Sciences(UMB). [The publication](#)

## Analysis of REDD+ policy networks in Peru

*CIFOR*

The REDD+ policy arena in Peru involves a wide range of actors, governmental as well as civil society, although the environmental and forest sectors predominate. Peruvian government actors show high levels of reputational power while non-governmental actors, international as well as national, dominate the information exchange network. Within the information network, the national REDD+ Group (Grupo REDD+ Perú), a multi-stakeholder forum created for dialogue concerning REDD+, stands out as an important intermediary between different actor groups. Although different groups of actors highlighted different challenges for REDD+ implementation, the interviewed actors declared very few disagreements with other actors. The exception is the position of the Interethnic Association for the Development of the Peruvian Rainforest (AIDESEP) that has been at the center of the few protests concerning REDD+ at a national level. AIDESEP expresses the need to create an indigenous REDD+ mechanism focused on defending the territorial rights of indigenous peoples and supporting communal forest management, instead of searching for solutions by means of the carbon market. A group of principal actors stands out as having more interaction in the study networks, showing high rates of communication and collaboration with other principal actors. They include representatives of the Government, diverse NGOs, private sector and donors. However, the governmental actors that most influence development policies, and thus the drivers of deforestation, are not part of the group of principal actors identified through the network. [The publication](#)

## Why Forests? Why Now?

*Center for Global Development*

Climate change is a fundamental threat to global prosperity. In particular, climate instability looms increasingly large as an obstacle to achieving development goals. Millions of the world's poorest people perch on hillsides prone to landslides, farm arid lands susceptible to drought, or live in coastal cities vulnerable to storms and rising seas. Low-income households and countries lack the assets that cushion citizens in rich countries from natural disasters, rendering them vulnerable to shocks. [The publication](#)

## Forests under pressure - Local responses to global issues

*IUFRO*

Forests under Pressure - Local Responses to Global Issues is the third major publication produced by the Special Project World Forests, Society and Environment (WFSE) of the International Union of Forest Research Organizations (IUFRO). The two previous volumes are Forests in Global Balance: Changing Paradigms (Mery et al. 2005) and Forests and Society - Responding to Global Drivers of Change (Mery et al. 2010).<sup>\*</sup> IUFRO-WFSE is an open, independent network of scientists and practitioners steered by 10 international research organisations, involving more than 100 researchers from throughout the world. It supports sustainable natural resources management, sustainable development and livelihoods, and related policy processes, focusing principally in two main efforts: 1) collating, critically analysing, and synthesising existing scientific knowledge on topics of international relevance in the forest, society, and environment interface in order to draw out important lessons learned and recommendations and 2) undertaking new research to fill in crucial gaps in existing knowledge. WFSE addresses these topics in a cross-sectoral, holistic, and interdisciplinary fashion, encouraging innovative approaches and anticipating what will influence future forest-related development at different scales, from local to global. [The publication](#)

## Turning over a New Leaf. State of the Forest Carbon Markets 2014.

*Forest Trends' Ecosystem Marketplace*

Protecting the world's forests has gained greater visibility as countries battle the often deadly consequences of a warming climate. While some experts believe it may already be too late to prevent global temperature increases beyond 2 degrees Celsius, the more optimistic believe catastrophic climate shifts are preventable - and halting deforestation is key to these efforts. In service of that goal, last year stakeholders around the world purchased 32.7 million tonnes (MtCO<sub>2</sub>e) of carbon offsets generated by forestry and land-use interventions at a combined value just shy of \$200 million. This level of investment matches 2010's record market activity, resulting in the most-ever annual emissions reductions financed through market-based mechanisms that pay for avoiding deforestation (REDD), planting trees, or adjusting forest management or agricultural practices to enhance carbon sequestration. These activities are beginning to scale up to the state and country level as jurisdictions gradually move from REDD "readiness" to "payment-for-performance". Even at the project level, REDD comprised two-thirds of forest carbon offset transactions last year as private sector buyers injected millions towards halting tropical deforestation. [The publication](#)

## Pushing REDD+ out of its Paralyzing Inertia

*Institute of Green Economy, Noida, India*

By the end of Cancun Climate Conference of 2010, the agreements on REDD+ were already adequate for implementation with clear goals, agreement on methodological guidance and social and environmental safeguards, access to technology for monitoring, and a financial commitment of \$3.5 billion to kick-start the task. But even after 4 years the progress has been confined to a few pilots, and very small part of the committed finances have been utilized. The ongoing SBSTA deliberations on the Safeguard Information System (SIS) suggests that excessive emphasis over a particular way of monitoring implementation of social and environmental safeguards by some developed territories like European Union, and most accredited Observers, is at least partly responsible for the inertia into which REDD+ has fallen. While there is no evidence to link the demand for fool proof implementation of safeguards with reluctance to part with the committed finances by developed countries, this is certainly the undesirable outcome and it is important to devise a way out of this impasse. At the conceptual level it is difficult to disagree with these demand for perfect safeguards except that the REDD+ is not to be implemented in EU where most land related rights are recorded and recognized and the Courts are capable of deciding expeditiously to the satisfaction of all which is not the case in many REDD+ eligible countries. The paper proposes that setting up watertight safeguards is not the most appropriate response to the possibility of flouting of safeguards due to unacceptable trade-offs in terms of costs and lost opportunities. Instead the quest for perfect safeguards as a pre-condition to begin REDD+ activities should be replaced by adequate safeguards, appropriate to national circumstances, that are improved rapidly as REDD+ implementation proceeds. This, combined with swift punishment for wrongdoings, would reduce the possibility for mischief. The recognition of practical limits placed by national circumstances, along with the need for rapid improvement of these circumstances, should be the centrepiece of a dynamic and effective REDD+ strategy and the SIS should be designed accordingly. [The publication](#)

## Equity in climate change and REDD+: A handbook for grassroots facilitators

*RECOFTC*

This handbook is the result of collaboration between two regional RECOFTC projects - Grassroots Capacity Building for REDD+ in Asia (REDD+ Grassroots Project) and Grassroots Equity and Enhanced Networks in the Mekong Region (GREEN Mekong Program). The objective of this question and answer handbook is to support grassroots facilitators who are engaged in delivering training programs on promoting social equity in climate change mitigation, specifically in Reducing Emissions from Deforestation and Forest Degradation (REDD+). It is also a quick reference material for key stakeholders at provincial or district levels, particularly forestry officials, who are engaged in local and regional level learning processes for promoting equity in the development of climate change mitigation measures, and related forest management practices. Although several, more complex, publications on the approach of REDD+ are available and, more recently, material on REDD+ related equity issues have been published, the fact remains that grassroots stakeholders have limited access to concise and easy-to-read material on equity in REDD+. As a consequence, it remains a challenge for grassroots stakeholders to comprehend and use relevant information to promote equity at the local level. Moreover, the concept of social equity is complex, even abstract to some extent; simpler explanations that can be easily understood and articulated at the local level are necessary. Low capacity of grassroots stakeholders, including local civil society and non-government organizations (CSOs and NGOs), impedes them from effectively articulating their aspirations and perspectives to policy-makers, leaving them vulnerable to manipulation by vested interest groups. This question and answer (Q&A) handbook therefore aims to provide simple explanations on some of the key aspects of social equity in the context of forests, climate change and REDD+.

[The publication](#)

## Safeguarding Biodiversity in REDD+

*CIFOR*

Biodiversity safeguards were introduced into the REDD+ mechanism to avoid potential harm to biodiversity. However, for REDD+ to truly contribute to biodiversity conservation, initiatives must go much further. [The brief](#)

## A REDD+ Jurisdictional Approach to achieve Green Development in Indonesia

*SNV*

The Government of Indonesia is committed to an inclusive model of green development, aiming to reduce greenhouse gas emissions, increase forest carbon stocks, and conserve biodiversity while supporting economic growth. In this policy brief, the national REDD+ Agency of Indonesia proposes to adopt a REDD+ Jurisdictional Approach as a means to contribute to achieving green development. The jurisdictional approach is a framework designed to empower all levels of government in Indonesia, and other key stakeholders, to manage, implement and coordinate REDD+ activities. [The publication](#)

## **A sourcebook. Biodiversity monitoring for REDD+**

*Zoological Society of London and GIZ*

This sourcebook highlights the complexities of biodiversity, REDD+ and monitoring biodiversity as part of REDD+. It adopts a simple four-stage monitoring framework: 1) Defining objectives: Why monitor biodiversity for REDD+? 2) Selecting indicators: What to monitor for REDD+? 3) Implementation of monitoring: How to monitor for REDD+? 4) Informing relevant audiences: Sharing and using the information generated. Across this framework, the key considerations for REDD+ can be summarised under three criteria for meaningful monitoring: 1) Purposeful: having clearly stated goals and objectives; 2) Effective: being able to attribute changes in biodiversity to its causes; 3) Realistic: being able to achieve this given real-world resource constraints. [The publication](#)

## **V.I JOBS**

### **General Call for Applications - Science Roster**

*CIFOR*

Read more about the general call [here](#).

## **VII. ANNOUNCEMENTS**

### **Interactive Map of Pre-2020 Emission Reduction Targets and Actions**

*UNFCCC*

In 2009 and 2010, the climate change negotiations continued to address the urgent need to reduce emissions. In line with their leadership role, industrialized countries committed to implementing quantified economy-wide emissions targets for 2020. Developing countries agreed to craft Nationally Appropriate Mitigation Actions (NAMAs) that are in line with their national development objectives. Through NAMAs, developing countries aim to reduce their emissions below business as usual by 2020. [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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