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CONTENTS

I. IN THE PRESS 3
II. MULTILATERAL PROCESSES IN CLIMATE CHANGE 4
III. EVENTS & MEETINGS 4
Upcoming events 4
World Forests Summit. Achieving sustainable forest management on a global scale 4
11th International Conference on Dryland Development: "Global Climate Change and its Impact on Food & Energy Security in the Dry lands" 4
International Conference on Forests for Food Security and Nutrition 4
International Conference on Climate Change and Tree Responses in Central European Forests 4
IV. RESEARCH ARTICLES 5
Issues and challenges for the national system for greenhouse gas inventory in the context of REDD+ 5
A global assessment of the effects of climate policy on the impacts of climate change 5
Debunking three myths about Madagascar's deforestation 5
Afforestation opportunities when stand productivity is driven by a high risk of natural disturbance: a review of the open lichen woodland in the eastern boreal forest of Canada 5
Comparative analysis of the influence of climate change and nitrogen deposition on carbon sequestration in forest ecosystems in European Russia: simulation modelling approach 6
Multi-scale drivers of spatial variation in old-growth forest carbon density disentangled with Lidar and an individual-based landscape model 6
Spatial patterns and predictors of forest carbon stocks in western Mediterranean 6
Carbon storage in harvested wood products for Ireland 1961-2009 7
Effects of rapid urban sprawl on urban forest carbon stocks: integrating remotely sensed, GIS and forest inventory data 7
Total carbon accumulation in a tropical forest landscape 7
REDD+ benefit sharing mechanisms: does it make a difference in equity? 8
Incorporating climate change impacts in forest market models 8
Spatial and temporal responses to an emissions trading scheme covering agriculture and forestry: simulation results from New Zealand 8
Can REDD+ save the forest? The role of payments and tenure 9
Modelling the effects of climate change and timber harvest on the forests of central Nova Scotia, Canada 9
Adaptive management for competing forest goods and services under climate change 9
Non-timber forest products, maple syrup and climate change 10
Carbon inventory methods in Indian Forests - a review 10
Can boreal afforestation help offset incompressible GHG emissions from Canadian industries? 10
Vegetation dynamics, and land use and land cover change in the Bale Mountains, Ethiopia 10
Using ecosystem CO_2 measurements to estimate the timing and magnitude of greenhouse gas mitigation potential of forest bioenergy 11
Estimating carbon emissions from forest degradation: implications of uncertainties and area sizes for a REDD+ MRV system 11
Carbon storage in successional and plantation forest soils: a tropical analysis 12
Probing for the influence of atmospheric CO_2 and climate change on forest ecosystems across biomes 12
Sensitivity of soil organic carbon stocks and fractions to different land-use changes across Europe 12

Tree biomass and soil organic carbon densities across the Sudanese woodland savannah: a regional carbon sequestration study 13
The role of the land use, land use change and forestry sector in achieving Annex I reduction pledges 13
Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches 13
Community forest organizations and adaptation to climate change in British Columbia 14
Carbon sequestration by forests in the National Parks of Italy 14
Divergent carbon dynamics under climate change in forests with diverse soils, tree species, and land use histories. 14
Human and climate influences on frequent fire in a high-elevation tropical forest. 15
V. PUBLICATIONS, REPORTS AND OTHER MEDIA 15
Manual for building tree volume and biomass allometric equations 15
Field Report No.16: Guidance and best practices for REDD+ transactions. 16
Forest Transitions across Ages and Continents: Implications for REDD 16
Charting New Waters. State of Watershed Payments 2012 16
Mapping global tropical wetlands from earth observing satellite imagery 16
International climate negotiations at COP 18: the art of the Doha-ble 17
Getting REDD-ready: two models of coordination and engagement from Africa 17
Understanding carbon loss and potential interventions in Manica, Mozambique 17
Adaptation, Forests and REDD+ 17
Advancing on capacity development for national GHG inventory systems 17
V.I JOBS 17
Senior Programme Officer REDD+ 17
VII. ANNOUNCEMENTS 18
Forests for Food Security conference website launched 18
Think Tank Map: new website 18
Now seeking applications for Land for Life Award 2013 18
On-line learning event. “Agroforestry, food security and climate change” 18
CLIM-FO INFORMATION 19

I. IN THE PRESS

22 January 2013 - Reuters

Curbing climate change will cost $700 bln a year - report

The world must spend an extra $700 billion a year to curb its addiction to fossil fuels blamed for worsening floods and heat waves and rising sea levels, a study issued by the World Economic Forum (WEF) showed on Monday.

21 January 2013 - RTCC

Climate change hurting Amazon rainforest warns NASA

Large areas of the Amazon rainforest appear to be deteriorating as a result of drought due to climate change, new research from Nasa reveals.

17 January 2013 - AlertNet

Climate Conversations - A how-to guide for putting REDD+ into practice

Ever wish there was some kind of "REDD+ for underachievers" guide? Something that was not so densely theoretical but told us how this concept actually works in practice? Or whether it actually works in practice?

16 January 2013 - BusinessGreen

Politicians pledge to embrace REDD+ in fight against deforestation

Legislators gathering at a summit in London this week have pledged to boost their efforts to fight deforestation, by advancing the aims of the UN-backed REDD+ finance mechanism in their countries.

16 January 2013 - CIFOR

Trouble ahead if forests and adaptation are not considered in the post Rio+20 era

Forests have occupied a role in the first 20 years of the Rio era (1992-2012) through three main conventions: the Convention on Biological Diversity (CBD), the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Convention to Combat Desertification (UNCCD). In the CBD, forest protection has been regularly highlighted, a trend that is likely to continue in the next decade. The place of forests in the Strategic Plan for Biodiversity 2011-2020, including Aichi Biodiversity Targets ("Living in harmony with nature") is an illustration of its recognition.

15 January 2013 - CIFOR

How much credit can Brazil take for slowing Amazon deforestation - and how low can it go?

Brazilian policymakers can take some of the credit for a dramatic slowdown in the deforestation rate in the Brazilian Amazon, say experts - but that's not the whole story.

15 January 2013 - RISI

The Economist's World Forests Summit to be held in Stockholm, March 5-6

Political attempts failed in Doha, but could better stewardship of the world's forests help stop global warming-or even reverse it? This is one of the key topics to be discussed at The Economist's World Forests Summit, due to be held in Stockholm at the Grand Hôtel on March 5th-6th 2013.

10 January 2013 - World Bank

New Funding for Climate and Forests Protection

In a boost for global efforts to combat climate change and tropical deforestation, Finland, Germany, and Norway have each announced new financial contributions totaling approximately US$180 million to the Forest Carbon Partnership Facility (FCPF), the World Bank administered facility that was set up to compensate developing countries for reductions in carbon dioxide emissions achieved by preserving their forests.

8 January 2013

A 4°C warmer world "will be catastrophic" for forest biodiversity: expert

Global temperatures may be climbing at a rate too fast for our forests and its biodiversity to adapt, a scientist with the Center for International Forestry Research (CIFOR) warned after the World Bank predicted a 4°C warming of the planet if policymakers continue to be apathetic about greenhouse gas emissions.

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

World Forests Summit. Achieving sustainable forest management on a global scale

5-6 March 2013, Stockholm, Sweden

Forests play a crucial role in the world's environment, health and economy - yet they are under threat. Our World Forests Summit will assemble a leading group of experts from around the world to identify common ground and discuss mechanisms for forest stakeholders to work together differently. The summit will openly explore the tensions and compromises that are involved in creating a thriving global green economy, delivering fresh insight into solving critical challenges at both global and national levels. **More**

11th International Conference on Dryland Development: "Global Climate Change and its Impact on Food & Energy Security in the Dry lands"

18-23 March 2013, Beijing, China

It has now been well established that the global climate change is occurring and is having a wide impact on the environment and the livelihood of the people across the world. Dry areas of the world have highly fragile ecosystem, which is highly vulnerable to climate changes. For sustainable development of the drylands and other dry areas in the face of global climate and other changes, it is important to recognize the impacts of climate change and human activities on dryland ecosystem and understand the process and mechanism of dry lands ecosystem changes occurring because of these pressures. In addition, other global changes are also triggering challenges for food and energy security in the drylands. The Conference will provide an opportunity to exchange research results and experiences among colleagues from around the world and to promote international cooperation in developing strategies to meet the challenge of sustainable development of the drylands in the face of these changes. Emphasis will be specially laid on identifying adaptation and mitigation strategies using traditional knowledge as well as modern science and technology for different dryland ecologies. **More**

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**

IV. RESEARCH ARTICLES

Issues and challenges for the national system for greenhouse gas inventory in the context of REDD+

Tulyasuwan, N., Henry, M., Secrieru, M., Jonckheere, I., Federici, S.
Greenshiouse Gas Measurement and Management. Volume 2, Issue 2-3.2012.

On the basis of the current negotiations under the United Nations Framework Convention on Climate Change, REDD+ (reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries) is to become a mechanism that mobilizes financial resources to developing countries to fund climate change mitigation activities. To achieve this goal, it is essential that the appropriate infrastructure be established to support such activities, in the shape of a common approach to measurement, reporting and verification (MRV) for REDD+ activities: an operational national forest greenhouse gas (GHG) inventory. In particular, in the light of more frequent future reporting requirements, a national inventory system (NIS) for GHG inventories is required for non-Annex I Parties in order to ensure permanent MRV. Given the limited literature available on NIS in the context of REDD+, the aim of this article is to identify the current needs facing non-Annex I Parties and to offer some suggestions as to how these needs may be met. An analysis of non-Annex I Parties reveals diversity among regions. In many aspects, parties from Latin America are generally better informed about and more engaged with the development of AFOLU GHG inventories, followed by the Asia-Pacific and Africa regions. Despite regional variations, the main common challenges are as follows: insufficient institutional arrangements, inadequate financing, limited technical capacity and a lack of available data. Our suggestions for meeting these needs and overcoming the challenges posed by the establishment of an NIS for GHG inventories are made based on the current practices of Annex I Parties.

A global assessment of the effects of climate policy on the impacts of climate change

Arnell, N.W., Lowe, J.A., Gosling, S.N., Gottschalk, P., Hinkel, J., Lloyd-Hughes, B., Nicholls, R.J., Osborn, T.J., Osborne, T.M., Rose, G.A., Smith, P., Warren, R.F.
Nature Climate Change (2013) doi:10.1038/nclimate1793

This study presents the first global-scale multi-sectoral regional assessment of the magnitude and uncertainty in the impacts of climate change avoided by emissions policies. The analysis suggests that the most stringent emissions policy considered here—which gives a 50% chance of remaining below a 2 °C temperature rise target—reduces impacts by 20–65% by 2100 relative to a 'business-as-usual' pathway which reaches 4 °C, and can delay impacts by several decades. The effects of mitigation policies vary between sectors and regions, and only a few are noticeable by 2030. The impacts avoided by 2100 are more strongly influenced by the date and level at which emissions peak than the rate of decline of emissions, with an earlier and lower emissions peak avoiding more impacts. The estimated proportion of impacts avoided at the global scale is relatively robust despite uncertainty in the spatial pattern of climate change, but the absolute amount of avoided impacts is considerably more variable and therefore uncertain.

Debunking three myths about Madagascar's deforestation

Horning, N.R
Madagascar Conservation and Development. Volume 7, Issue 3. December 2012.

After more than three decades of describing, explaining, and tackling deforestation in Madagascar, the problem persists. Why do researchers, practitioners, politicians, and farmers remain perplexed about this problem? This essay offers that our collective thinking of the past three decades has inadvertently perpetuated three myths. The first is that farmers are central agents of deforestation. The second is that the Malagasy state has the capacity and willingness to address the problem. And the third is that Madagascar is unique, especially relative to the rest of Africa. This essay examines each of these established 'truths' in an effort to overcome deforestation and all the degradation – environmental, social, and economic – that accompanies it. It argues that the assumptions behind conservation policies and projects are perpetuated by a class of powerful domestic and foreign individuals whose interests are best served by not questioning their validity. It concludes that fighting deforestation from now on must entail a deliberate, collective effort to question these assumptions and a willingness to open up the thinking to farmers and fellow Africans.

Afforestation opportunities when stand productivity is driven by a high risk of natural disturbance: a review of the open lichen woodland in the eastern boreal forest of Canada

Mansuy, N., Gauthier, S., Bergeron, Y.

Mitigation and Adaptation Strategies for Global Change. Volume 18, Issue 2, pp. 245-264

Afforestation has the potential to offset the increased emission of atmospheric carbon dioxide and has therefore been proposed as a strategy to mitigate climate change. Here we review the opportunities for carbon (C) offsets through open lichen woodland afforestation in the boreal forest of eastern Canada as a case study, while considering the reversal risks (low productivity, fires, insect outbreaks, changes in land use and the effects of future climate on growth potential as well as on the disturbances regime). Our results suggest that : (1) relatively low growth rate may act as a limiting factor in afforestation projects in which the time available to increase C is driven by natural disturbances; (2) with ongoing climate change, a global increase in natural disturbance rates, mainly fire and spruce budworm outbreaks, may offset any increases in net primary production at the landscape level; (3) the reduction of the albedo versus increase in biomass may negatively affect the net climate forcing; (4) the impermanence of C stock linked to the reversal risks makes this scenario not necessarily cost attractive. More research, notably on the link between fire risk and site productivity, is needed before afforestation can be incorporated into forest management planning to assist climate change mitigation efforts. Therefore, we suggest that conceivable mitigation strategies in the boreal forest will likely have to be directed activities that can reduce emissions and can increase C sinks while minimizing the reversal impacts. Implementation of policies to reduce Greenhouse Gases (GHG) in the boreal forest should consider the biophysical interactions, the different spatial and temporal scales of their benefits, the costs (investment and benefits) and how all these factors are influenced by the site history.

Comparative analysis of the influence of climate change and nitrogen deposition on carbon sequestration in forest ecosystems in European Russia: simulation modelling approach

Komarov, A. S.; Shanin, V. N.

Biogeosciences; 2012. 9: 11, 4757-4770

An individual-based simulation model, EFIMOD, was used to simulate the response of forest ecosystems to climate change and additional nitrogen deposition. The general scheme of the model includes forest growth depending on nitrogen uptake by plants and mineralization of soil organic matter. The mineralization rate is dependent on nitrogen content in litter and forest floor horizons. Three large forest areas in European Central Russia with a total area of about 17 000 km^2 in distinct environmental conditions were chosen. Simulations were carried out with two climatic scenarios (ambient climate and climate change) and different levels of nitrogen deposition (ambient value and increase by 6 and 12 kg N ha^{-1} yr^{-1}. The simulations showed that increased nitrogen deposition leads to increased productivity of trees, increased organic matter content in organic soil horizons, and an increased portion of deciduous tree species. For the climate change scenario, the same effects on forest productivity and similar shifts in species composition were predicted but the accumulation of organic matter in soil was decreased.

Multi-scale drivers of spatial variation in old-growth forest carbon density disentangled with Lidar and an individual-based landscape model

Seidl, R.; Spies, T. A.; Rammer, W.; Steel, E. A.; Pabst, R. J.; Olsen, K

Ecosystems; 2012. 15: 8, 1321-1335

Forest ecosystems are the most important terrestrial carbon (C) storage globally, and presently mitigate anthropogenic climate change by acting as a large and persistent sink for atmospheric CO2. Yet, forest C density varies greatly in space, both globally and at stand and landscape levels. Understanding the multi-scale drivers of this variation is a prerequisite for robust and effective climate change mitigation in ecosystem management. Here, we used airborne light detection and ranging (Lidar) and a novel high-resolution simulation model of landscape dynamics (iLand) to identify the drivers of variation in C density for an old-growth forest landscape in Oregon, USA. With total ecosystem C in excess of 1 Gt ha^{-1} these ecosystems are among the most C-rich globally. Our findings revealed considerable spatial variability in stand-level C density across the landscape. Notwithstanding the distinct environmental gradients in our mountainous study area only 55.3% of this variation was explained by environmental drivers, with radiation and soil physical properties having a stronger influence than temperature and precipitation. The remaining variation in C stocks was largely attributable to emerging properties of stand dynamics (that is, stand structure and composition). Not only were density- and size-related indicators positively associated with C stocks but also diversity in composition and structure, documenting a close link between biodiversity and ecosystem functioning. We conclude that the complexity of oldgrowth forests contributes to their sustained high C levels, a finding that is relevant to managing forests for climate change mitigation.

Spatial patterns and predictors of forest carbon stocks in western Mediterranean

Vayreda, J.; Gracia, M.; Canadell, J. G.; Retana, J.

Ecosystems; 2012. 15: 8, 1258-1270

Mediterranean semi-arid forest ecosystems are especially sensitive to external forcing. An understanding of the relationship between forest carbon (C) stock, and environmental conditions and forest structure enable

prediction of the impacts of climate change on C stocks and help to define management strategies that maximize the value of forests for C mitigation. Based on the national forest inventory of Spain (1997-2008 with 70,912 plots), we estimated the forest C stock and spatial variability in Peninsular Spain and, we determined the extent to which the observed patterns of stand C stock can be explained by structural and species richness, climate and disturbances. Spain has an average stand C stock of 45.1 Mg C/ha. Total C stock in living biomass is 621 Tg C (7.8% of the C stock of European forests). The statistical models show that structural richness, which is driven by past land use and life forest history including age, development stage, management activities, and disturbance regime, is the main predictor of stand tree C stock with larger C stocks in structurally richer stands. Richness of broadleaf species has a positive effect on both conifer and broadleaf forests, whereas richness of conifer species shows no significant or even a negative effect on C stock. Climate variables have mainly an indirect effect through structural richness but a smaller direct predictive ability when all predictors are considered. To achieve a greater standing C stock, our results suggest promoting high structural richness by managing for uneven-aged stands and favoring broadleaf over conifer species.

Carbon storage in harvested wood products for Ireland 1961-2009

Donlan, J.; Skog, K.; Byrne, K. A
Biomass and Bioenergy; 2012. 46: 731-738

Forests are significant stores of carbon (C). This has been recognised by the United Nations Framework Convention on Climate Change and forests are one of the sectors which are included in national greenhouse gas (GHG) inventories. Some of this C pool remains in wood after harvest and can remain in use for long periods of time. Accounting for the C stored in harvested wood products (HWP) can potentially contribute to GHG mitigation. A model was developed for this research to estimate C stocks and flows in HWP in Ireland for the years 1961-2009. The change in carbon stocks in HWP were estimated on an annual basis and shown to increase between 1961 and 2009. This increase in annual net additions to C stocks is the result of an increase in domestic harvest (and the resulting inflow into HWP pool) and an increase in HWP going to end uses with longer half-lives. This model (using a Tier II method) is an improvement to previous national estimates (using the Tier I method). Uncertainty was reduced by utilizing national data. This work shows that HWP has considerable potential to support GHG mitigation in Ireland. Inclusion of HWP in Ireland's National Inventory Report (NIR) would give a more comprehensive picture of how the Irish forest sector is mitigating GHG emissions. This model will be incorporated into CARBWARE (Black 2008), the model used to estimate C stored in each of the 5 forest pools, of current and future Irish forests.

Effects of rapid urban sprawl on urban forest carbon stocks: integrating remotely sensed, GIS and forest inventory data

Ren Yin; Yan Jing; Wei XiaoHua; Wang YaJun; Yang YuSheng; Hua LiZhong; Xiong YongZhu; Niu Xiang; Song XiaoDong
Journal of Environmental Management; 2012. 113: 447-455

Research on the effects of urban sprawl on carbon stocks within urban forests can help support policy for sustainable urban design. This is particularly important given climate change and environmental deterioration as a result of rapid urbanization. The purpose of this study was to quantify the effects of urban sprawl on dynamics of forest carbon stock and density in Xiamen, a typical city experiencing rapid urbanization in China. Forest resource inventory data collected from 32,898 patches in 4 years (1972, 1988, 1996 and 2006), together with remotely sensed data (from 1988, 1996 and 2006), were used to investigate vegetation carbon densities and stocks in Xiamen, China. We classified the forests into four groups: (1) forest patches connected to construction land; (2) forest patches connected to farmland; (3) forest patches connected to both construction land and farmland and (4) close forest patches. Carbon stocks and densities of four different types of forest patches during different urbanization periods in three zones (urban core, suburb and exurb) were compared to assess the impact of human disturbance on forest carbon. In the urban core, the carbon stock and carbon density in all four forest patch types declined over the study period. In the suburbs, different urbanization processes influenced forest carbon density and carbon stock in all four forest patch types. Urban sprawl negatively affected the surrounding forests. In the exurbs, the carbon stock and carbon density in all four forest patch types tended to increase over the study period. The results revealed that human disturbance played the dominant role in influencing the carbon stock and density of forest patches close to the locations of human activities. In forest patches far away from the locations of human activities, natural forest regrowth was the dominant factor affecting carbon stock and density.

Total carbon accumulation in a tropical forest landscape

Sierra, C. A.; Valle, J. I. del; Restrepo, H. I
Carbon Balance and Management; 2012. 7: 12

Regrowing tropical forests worldwide sequester important amounts of carbon and restore part of the C

emissions emitted by deforestation. However, there are large uncertainties concerning the rates of carbon accumulation after the abandonment of agricultural and pasture land. We report here accumulation of total carbon stocks (TCS) in a chronosequence of secondary forests at a mid-elevation landscape (900-1200 m asl) in the Andean mountains of Colombia. Results: We found positive accumulation rates for all ecosystem pools except soil carbon, which showed no significant trend of recovery after 36 years of secondary succession. We used these data to develop a simple model to predict accumulation of TCS over time. This model performed remarkably well predicting TCS at other chronosequences in the Americas (Root Mean Square Error <40 Mg C ha^{-1}), which provided an opportunity to explore different assumptions in the calculation of large-scale carbon budgets. Simulations of TCS with our empirical model were used to test three assumptions often made in carbon budgets: (1) the use of carbon accumulation in tree aboveground biomass as a surrogate for accumulation of TCS, (2) the implicit consideration of carbon legacies from previous land-use, and (3) the omission of landscape age in calculating accumulation rates of TCS. Conclusions: Our simulations showed that in many situations carbon can be released from regrowing secondary forests depending on the amount of carbon legacies and the average age of the landscape. In most cases, the rates used to predict carbon accumulation in the Americas were above the rates predicted in our simulations. These biome level rates seemed to be realistic only in landscapes not affected by carbon legacies from previous land-use and mean ages of around 10 years.

REDD+ benefit sharing mechanisms: does it make a difference in equity?

Mustalahti, I.; Rakotonarivo, S

Scandinavian Forest Economics; 2012. 44, 115-123.

The concept of Reducing Emissions from Deforestation and Forest Degradation (REDD+) has become a key debate of international cooperation on climate change. While most countries acknowledge the importance of so called community carbon benefits under REDD+ interventions, they are only just beginning the process of defining institutional arrangements for the sharing of economic benefits in REDD+. The Tanzanian Community Carbon Enterprise and UN-REDD+ models offer two examples of benefit sharing mechanisms which remains to be analyzed. The various actors and groups involved in designing these models have varying degrees of negotiation powers and diverse interests regarding the objectives, design and implementation of REDD+. This raises questions of institutional choices: how REDD+ benefit sharing mechanisms influences equity in forms of recognition of local representation and accountability of the non-governmental organizations to agrarian communities and in various levels of governance.

Incorporating climate change impacts in forest market models

Latta, G. S.; Sjolie, H. K.; Solberg, B

Scandinavian Forest Economics; 2012. 44, 79-87

Climate change induced by anthropogenic greenhouse gas (GHG) emissions such as fossil fuel combustion, conversion of forest land, agriculture, and industry has emerged as one of the most compelling issues of our time. Forests can play a central role in emissions abatement efforts through afforestation, improved forest management, and utilization of biomass for energy production. Identifying effective mitigation opportunities is difficult in that it involves a complex interaction between shifts in forest investment, harvest rates, and utilization as well as the associated market responses via prices and trade levels. Forest sector models are being increasingly utilized to identify efficient policy signals that reduce GHG emissions levels to meet both domestic and international climate change goals. Their ability to simulate climate change policies vary as they differ in geographic scope, intertemporal dynamics, product incorporation, and forest growth representation. First, we summarize an array of studies linking commonly applied forest sector models with vegetation models projections of climate change impacts. We then discuss issues that may influence a model's ability to simulate a policy or impact of a changing climate on forests. We conclude with suggestions for future modeling research challenges and opportunities.

Spatial and temporal responses to an emissions trading scheme covering agriculture and forestry: simulation results from New Zealand

Kerr, S.; Anastasiadis, S.; Olssen, A.; Power, W.; Timar, L.; Zhang Wei

Forests; 2012. 3: 4, 1133-1156

We perform simulations using the integrated Land Use in Rural New Zealand (LURNZ) model to analyze the effect of various New Zealand emissions trading scheme (ETS) scenarios on land use, emissions and output in a temporally and spatially explicit manner. We compare the impact of afforestation to the impact of other land-use change on net greenhouse gas emissions and evaluate the importance of the forestry component of the ETS relative to the agricultural component. We find that the effect of including agriculture in the ETS is small relative to the effect of including forestry. We also examine the effect of land-use change on the time profile of net emissions from the forestry sector. Finally, we present projections of future agricultural output under

various policy scenarios.

Can REDD+ save the forest? The role of payments and tenure

Barbier, E. B.; Tesfaw, A. T
Forests; 2012. 3: 4, 881-895

A recent policy response to halting global forest deforestation and degradation, and any resulting greenhouse gas emissions is REDD+, which also includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks. Although still in its infancy, the success of REDD+ will depend significantly on whether it can be economically viable and if any resulting payments are sufficient to cover the opportunity cost plus any transaction cost. Where tenure security over forest is weak, REDD+ can pose a risk for forest communities, who could be dispossessed, excluded and marginalized. This review of existing studies explores how payment for avoided deforestation, and forest tenure impact the success of REDD+ projects in terms of *effectiveness*, *efficiency* and *equity*. Effectiveness refers to the difference between deforestation with and without REDD+, efficiency refers to avoiding deforestation at minimal cost, and equity refers to the implication of REDD+ on benefit sharing. We conclude that the potential success or failure of REDD+ as a means to reduce deforestation and carbon emission on forest commons depends critically on designing projects that work within existing informal tenure institutions to ensure that carbon storage benefits align with livelihood benefits.

Modelling the effects of climate change and timber harvest on the forests of central Nova Scotia, Canada

Steenberg, J. W. N.; Duinker, P. N.; Bush, P. G

Annals of Forest Science; 2013. 70: 1, 61-73

Context: Understanding the range of possible climate change impacts on forests and the interactions between them is vital to sustainable forest management. Aims: We examine whether the combined influence of climate change and timber harvest will affect tree species distribution and productivity beyond predictions based on climate alone. Methods: We used the landscape disturbance model LANDIS-II to simulate two climate and two harvest scenarios in 14,000 ha of managed watersheds. Results: The elevated temperature led to a decline in the abundance of boreal species and a substantial increase in some temperate and pioneer species. Importantly, the interaction of climate change and timber harvest yielded changes in the distribution of some species that would not be expected based on climate alone. Conversely, some late-successional species exhibited resistance to climate-driven changes in their distribution. Climate change caused an increase in forest productivity when harvest was simulated, but a decrease in no-harvest scenarios. A time lag in forest response was likely responsible for this decrease in the absence of widespread mortality. Conclusions: The finding that disturbance may drive the range expansion of early-successional broadleaved species and cause a decline of red spruce has implications for forest community associations, as well as for forest management where conifers are favoured for pulp production.

Adaptive management for competing forest goods and services under climate change

Temperli, C.; Bugmann, H.; Elkin, C
Ecological Applications. 22: 8, 2065-2077

Developing adaptive forest management strategies is essential to maintain the provisioning of forest goods and services (FGS) under future climate change. We assessed how climate change and forest management affect forest development and FGS for a diverse case-study landscape in Central Europe. Using a process-based forest model (LandClim) we simulated forest dynamics and FGS under a range of climate change and management scenarios in the Black Forest, Germany, which is shaped by various management practices. We focused on the interdependencies between timber production and forest diversity, the most valued FGS in this region. We found that the conversion to more drought-adapted forest types is required to prevent climate change-induced forest dieback and that this conversion must be the target of any adaptive management, especially in areas where monocultures of drought-sensitive Norway spruce (*Picea abies*) were promoted in the past. Forest conversion takes up to 120 years, however, with past and future adaptive management being the key drivers of timber and forest diversity provision. The conversion of drought-sensitive conifer monocultures maintains timber production in the short term and enhances a range of forest diversity in dices. Using uneven-aged forest management that targets a drought-adapted, diverse, and resilient species mixture, high species diversity can be combined with timber production in the long term. Yet, the promotion of mature-stand attributes requires management restrictions. Selecting future adaptive management options thus implies the consideration of trade-offs between forest resource use and environmental objectives, but also the exploitation of synergies between FGS that occur during forest conversion. Lastly, the large impact of past management practices on the spatial heterogeneity of forest dynamics underpins the need to assess FGS provisioning at the landscape scale.

Non-timber forest products, maple syrup and climate change

Murphy, B. L.; Chretien, A. R.; Brown, L. J

Journal of Rural and Community Development; 2012. 7: 3, 42-64

Non-timber forest products (NTFP), including maple syrup, are an important source of income in rural and remote spaces. NTFPs also contribute to other aspects of rural wellbeing including the provision of environmental services and opportunities for the development and maintenance of social capital and aesthetic/spiritual values. NFTPs are thought to be threatened by climate change, yet little research has been undertaken to assess the potential impacts and adaptive capacity of affected Canadian rural spaces. Maple syrup is one of Canada's most important NTFPs and an important resource in central Canada and Atlantic rural spaces. However, virtually no research has assessed the value of maple syrup as an NTFP, or the potential impact of climate change. This paper, which is part of a larger on-going study, will report on survey work that assessed perceptions of institutional contexts, climatic variability, climate change risk, and resiliency within the maple syrup industry. The results will be of interest to decision-makers in many areas including the maple syrup Industry, Canadian rural policy and climate change policy. Drawing from the survey work and broader study findings, the paper identifies existing capabilities and challenges for dealing with climate change and outlines potential opportunities to increase the adaptive capacity of the maple syrup industry and rural spaces.

Carbon inventory methods in Indian Forests - a review

Wani, A. A.; Joshi, P. K.; Ombir Singh; Rajiv Pandey

International Journal of Agriculture and Forestry; 2012. 2: 6, 315-323

Under the United Nations Framework Convention on Climate Change (UNFCC), participating countries are required to report national inventory of greenhouse gas (GHG) emissions or uptake. The current challenge is to reduce the uncertainties in producing accurate and reliable activity data of Carbon (C) stock changes and emission factors essential for reporting national inventories. Improvements in above ground biomass estimation can also help account for changes in C stock in forest areas that may potentially participate in the Clean Development Mechanism (CDM), REDD plus and other initiatives. The methods adopted for such estimations vary with respect to geography, objective of the study, available expertise, data and scientific excellence adopted. However the current objectives for such estimates need a unified approach which can be measurable, reportable, and verifiable. This might result to a geographically referenced biomass density database for tropical forests that would reduce uncertainties in estimating annual biomass increment and forest aboveground biomass. In the light of above requirements, this paper intends to present an overview of the methodologies adopted in India from local to country level estimates to assess C sequestration potential in different forest components. The paper also discusses remote sensing and Geographical Information System (GIS) initiatives taken in this field and the possibility of adopting an integrated approach for reliable, accurate and cost effective estimates.

Can boreal afforestation help offset incompressible GHG emissions from Canadian industries?

Boucher, J. F.; Tremblay, P.; Gaboury, S.; Villeneuve, C.;

Process Safety and Environmental Protection; 2012. 90: 6, 459-466

To mitigate greenhouse gas and comply with cap-and-trade systems, the carbon capture and storage (CCS) is presently unviable for industrials dealing with low concentration of CO_2 emissions. Alternatively, a new offset opportunity is being analysed in Canada: the afforestation of open woodlands (OWs) in the boreal territory. The results obtained from model simulations (with CBM-CFS3) showed that afforestation of boreal OWs can be a low C-intensive mitigation activity, in particular when understory planting is the chosen silvicultural approach, so that only 8-12 years are needed to reach a net positive C balance with the afforestation of OWs. A largescale afforestation of boreal OWs - scheduled at 20 kha per year during 20 years for a maximum of 400 kha - could provide capped industrials with a significant offset potential, for instance up to nearly 8% offset of all Quebec industrial process emissions (2009 data) after 45 years. In spite of a certain number of issues that can contribute to the uncertainty of the real environmental and economical benefits from the afforestation of OWs as a mitigation activity - most of which issues are discussed in this paper - this study presented a first glimpse at the extent to which the afforestation of boreal OWs in Quebec can provide large emitters with eventually substantial and efficient GHG offset potential, especially those emitters tied up with incompressible GHG emissions.

Vegetation dynamics, and land use and land cover change in the Bale Mountains, Ethiopia

Kidane, Y.; Stahlmann, R.; Beierkuhnlein, C

Environmental Monitoring and Assessment; 2012. 184: 12, 7473-7489

Shifts in biological communities are occurring at rapid rates as human activities induced global climate change increases. Understanding the effects of the change on biodiversity is important to reduce loss of biodiversity

and mass extinction, and to insure the long-term persistence of natural resources and natures' services. Especially in remote landscapes of developing countries, precise knowledge about on-going processes is scarce. Here we apply satellite imagery to assess spatiotemporal land use and land cover change (LULCC) in the Bale Mountains for a period of four decades. This study aims to identify the main drivers of change in vegetation patterns and to discuss the implications of LULCC on spatial arrangements and trajectories of floral communities. Remote sensing data acquired from Landsat MSS, Landsat ETM+ and SPOT for four time steps (1973, 1987, 2000, and 2008) were analyzed using 11 LULC units defined based on the dominant plant taxa and cover types of the habitat. Change detection matrices revealed that over the last 40 years, the area has changed from a quite natural to a more cultural landscape. Within a representative subset of the study area (7,957.5 km^{-2}, agricultural fields have increased from 1.71% to 9.34% of the total study area since 1973. Natural habitats such as upper montane forest, afroalpine grasslands, afromontane dwarf shrubs and herbaceous formations, and water bodies also increased. Conversely, afromontane grasslands have decreased in size by more than half (going from 19.3% to 8.77%). Closed *Erica* forest also shrank from 15.0% to 12.37%, and isolated *Erica* shrubs have decreased from 6.86% to 5.55%, and afroalpine dwarf shrubs and herbaceous formations reduced from 5.2% to 1.56%. Despite fluctuations the afromontane rainforest (Harenna forest), located south of the Bale Mountains, has remained relatively stable. In conclusion this study documents a rapid and ecosystem-specific change of this biodiversity hotspot due to intensified human activities (e.g., deforestation, agriculture, infrastructure expansion). Specifically, the ecotone between the afromontane and the afroalpine area represent a "hotspot of biodiversity loss" today. Taking into consideration the projections of regional climate warming and modified precipitation regimes, LULCC can be expected to become even more intensive in the near future. This is likely to impose unprecedented pressures on the largely endemic biota of the area.

Using ecosystem CO_2 measurements to estimate the timing and magnitude of greenhouse gas mitigation potential of forest bioenergy

Bernier, P.; Pare, D

GCB Bioenergy; 2013. 5: 1, 67-72.

Forest bioenergy opportunities may be hindered by a long greenhouse gas (GHG) payback time. Estimating this payback time requires the quantification of forest-atmosphere carbon exchanges, usually through process-based simulation models. Such models are prone to large uncertainties, especially over long-term carbon fluxes from dead organic matter pools. We propose the use of whole ecosystem field-measured CO_2 exchanges obtained from eddy covariance flux towers to assess the GHG mitigation potential of forest biomass projects as a way to implicitly integrate all field-level CO_2 fluxes and the inter-annual variability in these fluxes. As an example, we perform the evaluation of a theoretical bioenergy project that uses tree stems as bioenergy feedstock and include multi-year measurements of net ecosystem exchange (NEE) from forest harvest chronosequences in the boreal forest of Canada to estimate the time dynamics of ecosystem CO_2 exchanges following harvesting. Results from this approach are consistent with previous results using process-based models and suggest a multi-decadal payback time for our project. The time for atmospheric carbon debt repayment of bioenergy projects is highly dependent on ecosystem-level CO_2 exchanges. The use of empirical NEE measurements may provide a direct evaluation of, or at least constraints on, the GHG mitigation potential of forest bioenergy projects.

Estimating carbon emissions from forest degradation: implications of uncertainties and area sizes for a REDD+ MRV system

Plugge, D.; Kohl, M

Canadian Journal of Forest Research; 2012. 42: 11, 1996-2010.

Under the United Nations Framework Convention on Climate Change (UNFCCC), the mechanism Reducing Emissions from Deforestation and Forest Degradation (REDD) has become an important option to create a financial value for the carbon stored in forests by reducing the emissions from forested lands. Thus far, many studies deal with the detectability of emissions resulting from deforestation. This study concentrates on the emissions and emission reductions from forest degradation. We show, based on data from the United Nations Food and Agricultural Organization's (FAO) Global Forest Resources Assessment 2010, the influence of uncertainties aligned to the estimation of emission reductions from forest degradation. On the example of three countries representing small to large forest areas and low to high carbon stocks, three different approaches for the inclusion of the uncertainties of estimates for two periods are analyzed. Furthermore, by simulating different sizes of areas where forest degradation takes place, the sensitivity of the estimated emission reductions with respect to the size of these areas is shown. The results of the study highlight the importance of identifying sound options of including uncertainties for different periods into a Measuring, Reporting, and Verification (MRV) system to avoid windfall profits from REDD. Moreover, it is demonstrated that an as accurate as possible identification of the areas where forest degradation takes place is decisive for the amount of REDD benefits achievable for a country.

Carbon storage in successional and plantation forest soils: a tropical analysis

Marin-Spiotta, E.; Sapna Sharma

Global Ecology and Biogeography; 2013. 22: 1, 105-117

Aim: To analyse global patterns in soil carbon (C) in tropical successional and plantation forests based on climate, forest age, former land use and soil type to determine factors driving belowground C storage. Location: Pantropical. Methods: We conducted a synthesis of 81 studies reporting soil C stocks in more than 400 reforested and tree plantation sites. We used regression models and regression tree analyses to determine the importance of multiple predictor variables on soil C stocks standardized to three common depth ranges: 0-10, 0-30 and 0-100 cm. Results: Mean annual temperature (MAT) was the most important predictor of soil C. Forest age explained little to no variability in soil C, in contrast with above-ground studies. Data on long-term trends in soil C are limited, as median time since forest growth was 15 years. Soil C stocks were similar between tropical secondary forests, tree plantations and reference forests. Differences between plantation and successional forests only appeared below 10 cm on sites with MAT<21.3 degrees C. Former pastures and cultivated sites differed from each other only to depths of 30 or 100 cm. Climatic variables appeared multiple times across all layers of the regression trees, consistent with strong interactions between MAT and precipitation on soil C stocks. Main conclusions: Climate explained greater variability in soil C in successional and plantation forests than former land use or forest age, despite the tropical location of all sites. Human management factors were more important for predicting soil C stocks in cooler and drier sites, while environmental variables were more important in hotter and wetter sites. The relative importance and interactions between soil type, previous land use and forest cover type differed with soil depth, highlighting the importance of comparing C across consistent depths. Climatic controls suggest sensitivity of soil C stocks in successional and plantation forests to future climate change.

Probing for the influence of atmospheric CO_2 and climate change on forest ecosystems across biomes

Silva, L. C. R.; Madhur Anand

Global Ecology and Biogeography; 2013. 22: 1, 83-92.

Aim: Rising atmospheric CO_2 and climate warming have induced changes in tree growth and intrinsic water-use efficiency (iWUE) world-wide, but the long-term impact of such changes on terrestrial productivity remains unknown. Based on a synthesis of the literature, here we investigate the net impact of recent atmospheric changes across forest biomes. Location: A range of sites covering major forest biomes. Methods: We use dendrochronological and isotopic records to provide an integrated analysis of changes in growth and iWUE, evaluating the impacts of atmospheric changes in tree growth. In our analysis, positive relationships between changes in growth and iWUE reflect CO_2 stimulation, while neutral effects yield inflections in growth curves (plotted against iWUE), and negative relationships indicate the prevalence of stressors. To estimate net effects (since 1960) and compare responses across biomes, we use a response contrast (RC) index, based on the ratio between cumulative changes in growth and iWUE. Results: In 37 recently published case studies changes in iWUE were consistently positive, increasing by between 10 and 60%, but shifts in growth varied widely within and among forest biomes. Positive RC values were observed in high latitudes (>40 degrees N), while progressively lower (always negative) responses were observed toward lower latitudes. Growth rates declined between 15 and 55% in tropical forests. In subtropical sites growth declined by between 7 and 10%, while mixed responses occurred in other regions. Main conclusions: Over the past 50 years, tree growth decline has prevailed despite increasing atmospheric CO_2. The impact of atmospheric changes on forest productivity is latitude dependent (R^2=0.9, P<0.05), but our results suggest that, globally, CO_2 stimulation of mature trees will not counteract emissions. In most surveyed case studies warming-induced stress was evoked to explain growth decline, but other factors, such as nutrient limitation, could have overridden the potential benefits of rising CO_2 levels.

Sensitivity of soil organic carbon stocks and fractions to different land-use changes across Europe

Poeplau, C.; Don, A.;

Geoderma; 2012. 192: 189-201

Land-use changes (LUC) influence the balance of soil organic carbon (SOC) and hence may cause CO_2 emissions or sequestration. In Europe there is a side by side of LUC types that lead to SOC loss or SOC accumulation. However, there is a lack of studies covering all major LUC types to investigate qualitative and quantitative LUC effects on SOC. In this study we sampled 24 paired sites in Europe to a depth of 80 cm, covering a wide range of pedo-climatic conditions and comprising the major European LUC types cropland to grassland, grassland to cropland, cropland to forest and grassland to forest. To assess qualitative changes and the sensitivity of different functional SOC pools with distinct turnover times, we conducted a fractionation to isolate five different fractions of SOC. The mean SOC stock changes after LUC were 18+or-11 Mg ha^{-1}(cropland to grassland), 21+or-13 Mg ha^{-1} (cropland to forest), -19+or-7 Mg ha^{-1} (grassland to cropland) and -10+or-7 Mg ha^{-1}

(grassland to forest) with the main changes occurring in the topsoil (0-30 cm depth). However, subsoil carbon stocks (>30 cm depth) were also affected by LUC, at 19 out of 24 sites in the same direction as the topsoil. LUC promoting subsoil SOC accumulation might be a sustainable C sink. Particulate organic matter (POM) was found to be most sensitive to LUC. After cropland afforestation, POM accounted for 50% (9.1+or-2.3 Mg ha^{-1} of the sequestered carbon in 0-30 cm: after grassland afforestation POM increased on average by 5+or-2.3 Mg ha^{-1}, while all other fractions depleted. Thus, afforestations shift SOC from stable to labile pools. The resistant fraction comprising the so-called inert carbon was found to be only slightly less sensitive than the total SOC pool, suggesting that an inert carbon pool was not chemically extracted with NaOCl oxidation, if there is any inert carbon.

Tree biomass and soil organic carbon densities across the Sudanese woodland savannah: a regional carbon sequestration study

Alam, S. A.; Starr, M.; Clark, B. J. F.;
Journal of Arid Environments; 2013. 89: 67-76

Mean tree biomass and soil carbon (C) densities for 39 map sheet grids (1° lat. × 1.5° long.) covering the Acacia woodland savannah region of Sudan (10–16° N; 21–36° E) are presented. Data from the National Forest Inventory of Sudan, Harmonized World Soil Database and FAO Local Climate Estimator were used to calculate C densities, mean annual precipitation (MAP) and mean annual temperature (MAT). Above-ground biomass C and soil organic carbon (SOC, 1 m) densities averaged 112 and 5453 g C m−2, respectively. Below-ground biomass C densities, estimated using root shoot ratios, averaged 33 g C m−2. Biomass C densities and MAP increased southwards across the region while SOC densities were lowest in the centre of the region and increased westwards and eastwards. Both above-ground biomass C and SOC densities were significantly ($p < 0.05$) correlated with MAP ($rs = 0.84$ and $rs = 0.34$, respectively) but showed non-significant correlations with MAT ($rs = -0.22$ and $rs = 0.24$, respectively). SOC densities were significantly correlated with biomass C densities ($rs = 0.34$). The results indicated substantial under stocking of trees and depletion of SOC, and potential for C sequestration. Up-to-date regional and integrated soil and forest inventories are required for planning improved land-use management and restoration.

The role of the land use, land use change and forestry sector in achieving Annex I reduction pledges

Grassi, G.; Elzen, M. G. J. den; Hof, A. F.; Pilli, R.; Federici, S.;

Climatic Change; 2012. 115: 3/4, 873-881

Annex I Parties may receive credits or debits from Land Use, Land Use Change and Forestry (LULUCF) activities, contributing to achieving individual emission reduction targets. In the Durban climate negotiations, Parties agreed new LULUCF accounting rules for the second commitment period of the Kyoto Protocol (CP2). By using these new rules, this paper presents key differences among Parties at the minimum (assuming no additional action) and potential (assuming additional actions) contribution of the forest-related LULUCF activities in achieving the pledges for 2020. Overall, the potential contribution of LULUCF is relatively modest (up to about 2% of 1990 emissions) for the EU, the Annex I Parties likely joining the CP2, and for the Annex I Parties that joined the CP1 as a whole. However, for specific Parties, LULUCF can make a substantial contribution to achieving the pledges. For New Zealand, for instance, the potential contribution of future LULUCF credits may equal 33% of its 1990 emission level. For Australia, the pledges are expressed relative to 2000 emission levels including LULUCF emissions. Given that LULUCF emissions have strongly declined between 1990 and 2000, and a further decline in foreseen by 2020 (based on Australia's projections), the minimum contribution of LULUCF to meet the Australian pledges appears to be about 19% and 7% relative to its 1990 and 2000 emission level, respectively. A further 3% potential contribution is estimated from additional actions.

Assessing temporary carbon sequestration and storage projects through land use, land-use change and forestry: comparison of dynamic life cycle assessment with ton-year approaches

Levasseur, A.; Lesage, P.; Margni, M.; Brandao, M.; Samson, R

Climatic Change; 2012. 115: 3/4, 759-776

In order to properly assess the climate impact of temporary carbon sequestration and storage projects through land-use, land-use change and forestry (LULUCF), it is important to consider their temporal aspect. Dynamic life cycle assessment (dynamic LCA) was developed to account for time while assessing the potential impact of life cycle greenhouse gases (GHG) emissions. In this paper, the dynamic LCA approach is applied to a temporary carbon sequestration project through afforestation, and the results are compared with those of the two principal ton-year approaches: the Moura-Costa and the Lashof methods. The dynamic LCA covers different

scenarios, which are distinguished by the assumptions regarding what happens at the end of the sequestration period. In order to ascertain the degree of compensation of an emission through a LULUCF project, the ratio of the cumulative impact of the project to the cumulative impact of a baseline GHG emission is calculated over time. This ratio tends to 1 when assuming that, after the end of the sequestration project period, the forest is maintained indefinitely. Conversely, the ratio tends to much lower values in scenarios where part of the carbon is released back to the atmosphere due to e.g. fire or forest exploitation. The comparison of dynamic LCA with the ton-year approaches shows that it is a more flexible approach as it allows the consideration of every life cycle stage of the project and it gives decision makers the opportunity to test the sensitivity of the results to the choice of different time horizons.

Community forest organizations and adaptation to climate change in British Columbia

Furness, E.; Nelson, H

Forestry Chronicle; 2012. 88: 5, 519-524

The effects of climate change in many regions are expected to be significant, and likely to have a detrimental effect on the health of forests and the communities that often depend on those forests. At the same time climate change presents a challenge as it requires changes in both forest management, and the institutions and policies developed that govern forest management. In this paper, we report on a study assessing how Community Forests Organizations (CFOs) in British Columbia (BC), which were developed to manage forests according to the needs and desires of local communities and First Nations, are approaching climate change and whether or not they are responding to, or preparing for, its impacts. There are practical steps that CFOs can take to improve their ability to cope with future conditions such as planting a wider variety of species, practising different silvicultural techniques and increasing monitoring and observation of the forest. This paper gives an overview of what current capabilities exist in CFOs and suggests potential areas for targeted development.

Carbon sequestration by forests in the National Parks of Italy

Marchetti, M.; Sallustio, L.; Ottaviano, M.; Barbati, A.; Corona, P.; Tognetti, R.; Zavattero, L.; Capotorti, G.;

Plant Biosystems; 2012. 146: 4, 1001-1011

Recent attempts to mitigate global change have brought forestry-based carbon (C) sequestration into sharp focus due to its potential to absorb CO2 from the atmosphere. However, the consequences of actual forest management practices on C storage capacity are still controversial to a certain extent. Under such a perspective, a distinctive relevant issue concerns the management of forest ecosystems within areas specifically designated for nature conservation. From the analysis of biomass data from forests in the National Parks of Italy, we found that the average forest C stock and sink per unit area is relatively higher within National Parks (81.21 and 2.18 tons ha−1, respectively) than on the overall national territory (76.11 and 1.12 tons ha−1 year−1, respectively). The analysis confirms the influence of ecological conditions and management approach on C sequestration capacity. Although the results of the proposed assessment approach have to be considered as rough estimates, the trial proves interesting, given the relative lack of specific information, at least on a large scale, about C stocks and sinks within forest areas designated for nature conservation, and the direct comparison with those forest areas not designated to such an end. The C storage capacity can be enhanced by increasing the productivity of forests, minimizing the disturbance to stand structure and composition. Extending conservation strategies adopted in National Parks to other forest areas of the national territory would allow the restoration of C sequestration potential, where unsustainable management practices have degraded relatively large stocks of biomass.

Divergent carbon dynamics under climate change in forests with diverse soils, tree species, and land use histories.

Scheller, R. M.; Kretchun, A. M.; Tuyl, S. van; Clark, K. L.; Lucash, M. S.; Hom, J.;

Ecosphere; 2012. 3: 11, art110

Accounting for both climate change and natural disturbances - which typically result in greenhouse gas emissions - is necessary to begin managing forest carbon sequestration. Gaining a complete understanding of forest carbon dynamics is, however, challenging in systems characterized by historic over-utilization, diverse soils and tree species, and frequent disturbance. In order to elucidate the cascading effects of potential climate change on such systems, we projected forest carbon dynamics, including soil carbon changes, and shifts in tree species composition as a consequence of wildfires and climate change in the New Jersey pine barrens (NJPB) over the next 100 years. To do so, we used the LANDIS-II succession and disturbance model combined with the CENTURY soil model. The model was calibrated and validated using data from three eddy flux towers and the available empirical or literature data. Our results suggest that climate change will not appreciably increase fire sizes and intensity. The recovery of C stocks following substantial disturbances at the

turn of the 20th century will play a limited but important role in this system. In areas characterized by high soil water holding capacity, reduced soil moisture may lead to lower total C and these forests may switch from being carbon sinks to becoming carbon neutral towards the latter part of the 21st century. In contrast, other areas characterized by lower soil water holding capacity and drought tolerant species are projected to experience relatively little change over the next 100 years. Across all soil types, however, the regeneration of many key tree species may decline leading to longer-term (beyond 2100) risks to forest C. These divergent responses were largely a function of the dominant tree species, and their respective temperature and soil moisture tolerances, and soil water holding capacity. In summary, the system is initially C conservative but by the end of the 21st century, there is increasing risk of de-stabilization due to declining growth and regeneration.

Human and climate influences on frequent fire in a high-elevation tropical forest.

Yocom, L. L.; Fule, P. Z

Journal of Applied Ecology; 2012. 49: 6, 1356-1364

Surface fire has increasingly been regarded as a critical threat to tropical forests, but much of the research documenting degradation of tropical forests by fire comes from the low-elevation humid tropics. Fire in high-elevation tropical forests has received less research attention, but these forests are of high conservation value because they support unique ecosystems, which are often isolated due to their restriction to widely separated peaks. We investigated the frequency and ecological impact of fire on a high-elevation tropical forest of *Pinus hartwegii* in Pico de Orizaba National Park in central Mexico. This forest was previously thought to have been degraded by excessive human-caused fires. We assessed human-caused changes to the fire regime as well as the impact of climate on fire occurrence, both previously undocumented in this region. We found no

increase in fire frequency or evidence of degradation of the forest. We found that the forest was uneven-aged and contained many large and old trees (maximum age 483 years). In the twentieth century, the forest experienced a frequent surface fire regime, with fires scarring trees in 90 of 100 years. However, most fires were small and asynchronous among sites. Inter-annual climatic variability was not an influential driver of fire, and El Nino-Southern Oscillation was not significantly related to the occurrence of widespread fire. *Synthesis and application*. Our results show that this high-elevation tropical forest has not been degraded but has existed with frequent fires for at least a century. A trend in the 21st century towards less-frequent fire could be cause for concern, as a decrease in fire frequency could lead to an increase in tree density and a loss of resilience in the face of climate change and other future disturbance. We recommend that managers take into account historical fire regimes in their local areas: frequent surface fires in the case of Pico de Orizaba. It is important to recognize that although fire can be detrimental in many low-elevation tropical forests, it is an integral part of this high-elevation tropical forest ecosystem, and other high elevation forests may show similar patterns.

V. PUBLICATIONS, REPORTS AND OTHER MEDIA

Manual for building tree volume and biomass allometric equations

FAO

All over the world forests provide many services and some of them, including climate change mitigation actions through forestry sector, require an accurate counting of carbon stocks. Forest volume and biomass is mainly calculated as the result of an equation including easy-to-measure tree characteristics, diameter or height for example, and statistically determined parameters. The quality of theses equations is crucial for ensuring the accuracy of forest carbon estimates and is not only a matter of statistical tools. The errors made all along the process of building these equations should be considered, from the field work to the modelling and the prediction. In this context, the manual for building tree volume and biomass allometric equations aims to provide the knowledge and methodology to establish accurate allometric equations, following seven steps: (1) the knowledge on the complexity of tree growth and biomass allocation, (2) the design of a sampling strategy for field measurement, (3) the campaigns of measurements in the field and in the laboratory, (4) the data entering and shaping, (5) the graphic exploration of the data, (6) the fitting of allometric equations and (7) the validation of the models. The manual has been design for students, researchers and engineers who wish to acquire this knowledge. It requires few pre-requisite as many illustrations, examples and technical advices are provided at every step. The manual is available in French, English and Spanish. Click **here** to download the publication.

Field Report No.16: Guidance and best practices for REDD+ transactions.

Terra Global

This paper, as developed by Terra Global Capital, is meant to serve as a readable guide for projects seeking guidance and best practices for REDD+ transactions, with a focus on private sources of REDD+ project financing. "REDD" refers to the emissions reductions achieved from reducing deforestation or forest degradation in developing countries. Through REDD, emissions reductions through stored carbon are measured and certified as credits that can be sold on global carbon markets. "REDD+" expands that definition to include conservation, sustainable management of forests and enhancement of forest carbon stocks. While markets have successfully tied carbon finance to other sectors, securing private investment remains a key challenge for REDD+ project developers. In many cases, project developers lack familiarity with standards and expectations for commercial documents required by investors. This paper is intended to address that gap. The paper has been funded by the U.S. Agency for International Development through the FIELD-Support Leader with Associates, managed by FHI 360. **The publication**

Forest Transitions across Ages and Continents: Implications for REDD

IGREC

A host of economic, political, social, ecological, religious and aesthetic reasons have anchored forest transitions across the world. Transition results from the relative strengths of causes favoring forest losses and gains and is very context specific. Buddhist emphasis on sacredness of all life forms provided the early emphasis on protection of forests in India. Plague caused the first transition in France wiping out more than one third of its population. The colonization of Americas, and destruction of its forests, provided the second large phase of transition in Europe. Building on earlier works the authors propose that the transitions are led by a combination of one or more of the following factors, namely, acute crisis of availability of forest goods and services, incentives for abandonment of marginal croplands, enhanced agricultural productivity, massive urbanization, globalization, demand displacement, agroforestry intensification, appropriate forest policies, aesthetics, enhanced public awareness and legal imperatives. Popular discourse on REDD places high emphasis on poverty eradication, good governance, low corruption, restoration of land and human rights of indigenous people. These are goals of highest values worthy of being pursued vigorously but there is not much evidence that their successful pursuit would result in reducing emissions from deforestation and forest degradation. **The publication**

Charting New Waters. State of Watershed Payments 2012

Forest Trends

This report is the second installment in the "State of Watershed Payments" series, an effort to globally track the size, scope, and direction of investments in watershed services (IWS) as well as the ecological infrastructure from which they flow. Throughout this report we use the term 'investments in watershed services' to cover the broad diversity of incentive- or market-based mechanisms being used to protect the natural infrastructure of watersheds – including payments for ecosystem services (PES), payments for watershed services (PWS), water quality trading markets, and reciprocal or in-kind agreements. Data comes from surveys, interviews, and desk research on over 200 programs worldwide in more than 30 countries. **The publication**

Mapping global tropical wetlands from earth observing satellite imagery

CIFOR

The extent, volume and carbon content of the world's tropical wetlands are not accurately known. Present estimates are based on disparate sources, of varying quality from different regions. As wetlands are key regulators not only of the global carbon cycle, but also other biogeochemical cycles, better maps of wetlands are urgently needed. This report presents a set of novel approaches for mapping global tropical wetlands from a variety of image data obtained from satellite images of earth. Wetlands only occur under certain topographic positions, and where the climate system provides sufficient water. Combining a global digital elevation model with global climate data, a tropical global map of topographic wetness was created. Using global optical satellite images from a moderate resolution imaging spectroradiometer (MODIS) a second wetness index was developed. In contrast to previous satellite-based wetness indexes, the index attempts to remove the vegetation influence and focus on the soil surface wetness. From an annual time-series of MODIS images, the inundation cycle of the global tropics was captured. As wetlands are characterised by annual variations in inundation, an approach for classifying wetlands from a chrono-sequence of annual MODIS images was developed. In the chrono-sequence, only locations with similar climatic seasonality, and within spatial proximity are classified based on any reference site. The wetness indexes and the chrono-sequence classification scheme are strong candidates for mapping the distribution of global tropical wetlands. **The publication**

International climate negotiations at COP 18: the art of the Doha-ble

CDC Climate research

The Doha climate conference (November 26 - December 8, 2012) allowed the UN process to edge forward. Through the definition of the rules for the second commitment period of the Kyoto Protocol with a foreseeable increase in the ambition of Annex I countries second period commitments by 2014, the conclusion of the negotiation process stemming from the Bali Roadmap and by getting the Durban platform off the ground, the "Doha Climate Gateway" tries to pave the way for a more ambitious international agreement in 2015. However, the need for interim financing by 2020 was not clearly nor decisively addressed in Doha. Thus, the route to a stronger agreement in 2015 remains a long one. **The publication**

Getting REDD-ready: two models of coordination and engagement from Africa

IIED

Deforestation is a complex problem. Almost 50 countries are now working towards REDD+ programmes — new plans to reduce climate change from loss of forests — and they are running into difficult dilemmas. Should REDD+ be led by a forestry agency, or by a cross-sectoral institution that can deal with the many pressures on forested land? How can pilot projects be designed to capture the different sides of the issue in a coherent way? Neighbouring Mozambique and Tanzania have taken approaches that sometimes intersect, but often contrast. Comparing the two offers lessons in how to design the process of getting ready for REDD+. **The publication**

Understanding carbon loss and potential interventions in Manica, Mozambique

IIED

Understanding how land use and its changes affect forest cover and carbon stocks is fundamental to developing sound REDD+ delivery options. A study in Manica Province, a REDD+ pilot area for Mozambique, suggests biomass and forest carbon fell substantially between 2007 and 2010. The study combined radar remote sensing information (to measure changes in biomass and carbon stocks) with field investigations (to establish land use and land cover changes, and their causes). Small-scale agriculture is responsible for nearly half of the loss. Charcoal production and logging account for around a quarter. Large-scale commercial agriculture's small role (around 3 per cent) will increase as allocated land is cleared. The remaining carbon loss comes from diverse smaller causes. Recording and mapping land use rights is crucial for identifying the underlying causes of deforestation and forest degradation, who is involved in those causes, and potential interventions. **The publication**

Adaptation, Forests and REDD+

REDD-Net

Natural disaster management and agriculture tend to dominate discussions on climate change adaptation. But forests matter too. In fact, they matter a lot. Recent research is beginning to uncover just how much forest-based products and services contribute to the livelihoods of rural communities globally – now believed to be approximately one-fifth to one-quarter of household income. We need to begin paying more attention to how forests can increase the resilience of communities to impending climate change impacts. And given the recent rise of our interest in REDD+, how exactly REDD+ can help or hinder this process. **The publication**

Advancing on capacity development for national GHG inventory systems

CD-REDD

The publication contains the first Lessons on Capacity Development for Reducing Emissions from Deforestation and Forest Degradation, it summarizes the work that has been done by presenting an overview of GHG inventory systems and key obstacles related to data availability, institutional arrangements, and availability of resources. **The publication**

V.I JOBS

Senior Programme Officer REDD+

UN-REDD Programme - Deadline for application is 27th of January 2013

The UN-REDD programme is seeking a Senior Programme Officer to be based in Geneva, Switzerland. The core functions of the post will be:

1. Management of inter-agency Quality Assurance of support to countries;

2. Enhance Coordinated Delivery of UN-REDD Results at the National Level;
3. Partnership Development, Dialogue and Advocacy;
4. Knowledge, Lessons and Tools Development; and
5. Programme Development and Resource Mobilization.

More

VII. ANNOUNCEMENTS

Forests for Food Security conference website launched

FAO

FAO recently launched a website for the first ever International Conference on Forests for Food Security and Nutrition, which will take place 13-15 May in Rome. The site includes a provisional conference programme, registration instructions and information for participants, and is available in English, French and Spanish. With the world population projected to exceed nine billion people by 2050, the international conference aims to 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.

For more information visit the website at **http://www.fao.org/forestry/food-security**

Think Tank Map: new website

International Center for Climate Governance

The International Center for Climate Governance (ICCG) has launched the new website of the Think Tank Map, an observatory that provides an overview on the think tanks active in the field of climate change governance. Through an interactive world map, this tool makes it possible to see which organizations are working in the main fields related to climate governance all over the world. The new website presents a novel structure that allows a wide range of searches to be performed, as it is now possible to search not only think tanks, but also their projects. There is a new section presenting a series of statistics about think tanks updated in real-time. **More**

Now seeking applications for Land for Life Award 2013

UNCCD

Are you doing great work to restore land and soils? The UNCCD is now calling for application for the 2013 Land for Life Award. The award will recognize innovation and excellence in sustainable land management, particularly collaborative efforts that promote soil health and benefit people in the drylands. Three winners will be selected by an expert jury which will grant awards from a total prize fund of up to USD 100,000. Nominations are welcome from individuals, businesses, research and academic institutions, local governments, journalists and civil society organizations. The deadline for applications is 15 March 2013.

To apply

On-line learning event. “Agroforestry, food security and climate change”

FAO

Welcome to our online learning event in the Community of practice for climate change mitigation in agriculture. The event is organized jointly by the Mitigation of Climate Change in Agriculture (MICCA) Programme and the Agroforestry Programme of FAO's Forestry Department, in collaboration with CATIE, CIRAD and ICRAF. The event will take place through online forums from Tuesday 5 February until Tuesday 26 February 2013. The event consists of four webinars and the online discussion following the webinars. **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**

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

We appreciate any comments or feedback.

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