CLIM-FO Climate Change & Forestry

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I. IN THE PRESS

15 April 2016 - FAO

Google and FAO aim to usher in new era of environmental literacy for all

Geospatial forestry information is a first step in almost real-time natural resources management revolution. For example, easily accessible and rapidly-updated remote sensing data enable a shift in forest management from inventory reports to taking the almost real-time pulse of forests, thus opening a host of new policy prospects and further opening the doors of scientific perception…

22 April 2016 - UNFCC

The Paris Agreement signed by at least 175 Parties

During the 2016 Opening for Signature of the Paris Agreement, held at United Nations Headquarters in New York on 22 April, 175 Parties (174 countries and the European Union) signed the Agreement, and 15 States deposited instruments of ratification...

22 April 2016 - FAO

On Earth Day, FAO Director-General stresses need to protect ecosystems

At a ceremony today marking Earth Day, FAO Director-General José Graziano da Silva stressed the need to protect the world's ecosystems, which form the basis of food security. Earth Day also coincided with the launch of a new Mountain Facility that aims to address the needs of people living in highland areas in the world. Actions are also foreseen to preserve and restore water sources, soils and forests, and protect precious mountain biodiversity…

22 April 2016 - The Nature Conservancy

After Paris - The Original Climate Solution

Just as the world gets to grips with the urgency of limiting global warming to beneath 2°C, the official UN body charged with climate science (the IPCC) has been charged with understanding potential impacts if temperatures rise 1.5°C above pre-industrial levels and how we might limit emissions to stay beneath this threshold... All the science indicates that for us to limit warming to 1.5 degrees, we must...

22 April 2016 - FAO

To fight climate change, invest in agriculture

Rural poor and smallholder farmers among hardest hit, said FAO Deputy Director-General at signing of Paris Agreement... The Agreement recognizes "the fundamental priority of safeguarding food security and ending hunger, and the particular vulnerabilities of food production systems to the impacts of climate change".

28 April 2016 - The Conservation

Why more cities need to add up the economic value of trees

Your parents were wrong: money does grow on trees. Cities routinely rake up tens of millions of dollars from their urban forests annually in ways that are not always obvious…

04 May 2016 - FAO

A green wall of hope for Africa

Imagine a tapestry of green landscapes around the Sahara desert: An extraordinary initiative is taking shape across the Sahel and the Sahara – Africa's Great Green Wall. The week of 2-7 May 2016 sees the first international conference on the Great Green Wall, held in Dakar, Senegal…

04 May 2016 - UN-REDD

UN-REDD study highlights significant economic contribution of forests to Ethiopia's Gross Domestic Product

A year has passed since an inception workshop was held in Addis Ababa to economically value Ethiopia's forests. After all, investments to reduce deforestation and forest degradation or removing carbon through rehabilitation of degraded land are not only in the interest of mitigating climate change, but also makes macro-economic sense…

05 May 2016 - Global News

Climate change: Does a warming climate mean more wildfires?

Boreal forests account for 1.9 billion hectares around the world, which is 33 per cent of Earth's forested land. These forests are a mixture of various trees and home to 150 species of birds and numerous types of wildlife. But all of this is under threat by a warming climate. When it comes to weather conditions propagating wildfires, there are three key ingredients: hot weather, low humidity and wind. A warming climate could produce two of the three ingredients. All you need is a windy day and a forest fire that once seemed manageable – as in this month's case of Fort McMurray - suddenly becomes uncontrollable…

11 May 2016 - The World Bank

A map is worth a thousand words: Supporting forest stewards in addressing climate change

In Nepal, indigenous groups produced a range of training materials, including videos in local languages on forests and climate change, to help more than 100 women and community leaders in the Terai, Hill and Mountain areas better understand what terms like 'mitigation and adaptation strategies for climate resilience' mean for them in their daily lives…

II. MULTILATERAL PROCESSES IN CLIMATE CHANGE

Ongoing session

Bonn Climate Change Conference, 16 - 26 May 2016, Bonn (Germany)
The forty-fourth sessions of the Subsidiary Body for Implementation (SBI 44) and Subsidiary Body for Scientific and Technological Advice (SBSTA 44) as well as the first session of the Ad Hoc Working Group on the Paris Agreement (APA 1) is taking place now, from 16 to 26 May 2016, in Bonn, Germany. **More details here**

Previous session

UNFCCC COP 21/CMP 11, 30 Nov - 11 Dec 2015, Paris (France)
The twenty-first session of the Conference of the Parties (COP) and the eleventh session of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP) took place from 30 November to 11 December 2015, in Paris, France. A key highlight was the adoption of the Paris Agreement. The COP also invited Parties to communicate their first nationally determined contribution (NDC) no later than when the Party submits its respective instrument of ratification, acceptance, approval or accession**.** The COP report can be accessed by **clicking here**.

III. EVENTS & MEETINGS

Recent events

Global Capacity Development Workshop: Integrating Agriculture in National Adaptation Plans

05-07 April 2016 - Rome, Italy
As part of the Integrating Agriculture in National Adaptation Plans programme, FAO and UNDP organized a workshop to develop a common understanding of the NAP process in relation to the agriculture sectors (including forestry and fisheries) and to provide partner countries with training and knowledge exchange opportunities to advance country-level activities and work plans. Topics relevant to the programme such as developing road-maps, skills development on adaptation sensitive planning, budgeting and impact assessment were set on the agenda. **More**

4th International Climate Change Adaptation Conference: Adaptation Futures 2016

10-13 May 2016 - Rotterdam, The Netherlands
Adaptation Futures is the biennial conference of the Global Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA). In 2016, the European Commission and the Government of the Netherlands co-host the fourth edition. Adaptation Futures 2016 is where scholars, practitioners, policymakers and business people from all around the world go to connect, learn and inspire. It highlights adaptation practices and solutions for people, governments and businesses. The programme addresses all sectors and all parts of the world. More than 1600 participants from 102 countries were registered. **More**

Moving forward with implementing NDCs

17 May 2016 - Bonn, Germany
The Paris Agreement sets a goal to keep the global temperature rise since pre-industrial times well below two degrees Celsius, with a preference to limit it to 1.5 degrees. To that end, countries' nationally determined contributions (NDCs) are a major step forward in international climate action. **More**

In-session workshop to identify the types of revegetation activities potentially eligible as project activities under the CDM

17 May 2016 - Bonn, Germany
SBSTA 43 requested the secretariat to organize an in-session workshop at SBSTA 44 to identify the types of revegetation activities potentially eligible as project activities under the CDM under the existing modalities and procedures, and to identify the cases where new modalities and procedures for revegetation would need to be developed, in order to guarantee the environmental integrity of the CDM. **More**

UNEP Science-Policy Forum

19-20 May 2016 - Nairobi, Kenya

The purpose of the Science-Policy Forum was to engage a wide audience of policy-makers, scientists, researchers, and civil society stakeholders in an active discourse on the science and knowledge required to deliver on the environmental dimension of sustainable development. The dialogue was also set to address the challenges and new opportunities emerging at the science-policy interface with the aim of enhancing a collective understanding across both sides of the interface; strengthening the science-policy dialogue and recommending concrete measures for collective action in the context of the 2030 Agenda for Sustainable Development. **More**

Ongoing and Upcoming events

Second United Nations Environment Assembly

23-27 May 2016 - Nairobi, Kenya

The second session of the United Nations Environment Assembly (UNEA-2) is taking place at UNEP headquarters in Nairobi, Kenya, under the overarching theme of Delivering on the environmental dimension of the 2030 Agenda for Sustainable Development. The Assembly, which represents the world's highest-level decision-making body on the environment, will culminate in resolutions and a global call to action to address the critical environmental challenges facing the world today. UNEA provides a groundbreaking platform for leadership on global environmental policy… **More**

2016 AfDB Annual Meeting to focus on energy and climate change

23 - 27 May 2016 - Lusaka, Zambia

The 2016 Annual Meetings of the African Development Bank will take place from Monday, May 23 to Friday, May 27, 2016 at the Mulungushi International Conference Centre in Lusaka, Zambia. The theme of this year's meetings is "Energy and Climate Change", and draws on one of the Bank's "High 5" priority areas, namely to "Light up and Power Africa". It also reflects the Bank's New Deal on Energy and the key resolutions from the recent UN climate talks (COP21) on global warming. The 2016 Annual Meetings theme is aligned with two of the Sustainable Development Goals (SDGs): SDG 7 to "ensure access to affordable, reliable, sustainable and modern energy for all" and SDG 13 to "take urgent action to combat climate change and its impacts". **More**

Wealth Accounting and the Valuation of Ecosystem Services (WAVES) 6th Annual Partnership Meeting

31 May - 01 June 2016 - San Jose, Costa Rica

The sixth annual WAVES partnership meeting will bring together WAVES countries, UN agencies, donors, CSOs and other institutions supporting Natural Capital Accounting (NCA). The WAVES countries will showcase results from their work on constructing water, forest, minerals and ecosystem accounts… **More**

18th European Forum on Urban Forestry

31 May - 04 June, 2016 - Ljubljana, Slovenia

The European Forum on Urban Forestry is a unique venue where urban forestry professionals meet scientists and policy-makers within the field. The forum meets yearly, started 19 years ago, hosted by one of the members. It provides a meeting place for practitioners, scientists and educators involved with the planning, design and management of urban forests – from woodlands to urban parks and street trees. The theme for this year is "Urban forests for resilient cities"... **More**

50th Meeting of the GEF Council

06 May and 09 June 2016 - Washington D.C., USA

The Global Environment Facility (GEF) Council meets twice a year to approve new projects with global environmental benefits in the GEF's focal areas of biodiversity, climate change mitigation, chemicals and waste, international waters, land degradation, and sustainable forest management; and in the GEF's integrated approach programs on sustainable cities, taking deforestation out of commodity chains, and sustainability and resilience for food security in Sub-Saharan Africa. The Council also provides guidance to the GEF Secretariat and Agencies. On 9 June the GEF Council will convene as the 20th meeting of the Least Developed Countries Fund (LDCF) and Special Climate Change Fund (SCCF), also at the same location. **More**

Global Alliance for Climate-Smart Agriculture (GACSA) Annual Forum

14 - 17 June 2016 - Rome, Italy

The theme of this year's Annual Forum is Climate-Smart Agriculture in Action. GACSA's ambitious future is based upon supporting and inspiring action. Farmers, fishers, foresters, and ranchers are at the center of this action, and therefore GACSA is devoting its Annual Forum to showcasing climate-smart agriculture in action... **More**

IV. RESEARCH ARTICLES

Changes in forest production, biomass and carbon: Results from the 2015 UN FAO Global Forest Resource Assessment

M. Köhl, R. Lasco, M. Cifuentes, O. Jonsson, K. T. Korhonen, P. Mundhenk, J. de Jesus Navar, G. Stinson,
Forest Ecology and Management (2015), Volume 352, 7 September 2015, Pages 21-34

Forests are important sources of livelihoods to millions of people and contribute to national economic development of many countries. In addition, they are vital sources and sinks of carbon and contribute to the rate of climate change. The UN Food and Agriculture Organization has been collecting and presenting data on global forest resources and forest cover since 1948. This paper builds on data from FAO's 2015 Global Forest Resource Assessment (FRA) and presents information on growing stock, biomass, carbon stock, wood removals, and changes of forest area primarily designated for production and multiple use of the world's forests. Between 1990 and 2015, the total growing stock volume has increased in East Asia, Caribbean, Western and Central Asia, North America, Europe (including the Russian Federation), and Oceania with the highest relative increase in East Asia and the Caribbean. In all other subregions the total growing stock volume decreased. North and Central America, Europe and Asia report forest C stock increases while South America and Africa report strong decreases and Oceania reports stable forest C stocks. The annual rate of decrease of forest C stock weakened between 1990 and 2015. The total volume of annual wood removals including woodfuel removals increased between 1990 and 2011, but shows a remarkable decline during the 2008–2009 economic crisis. Forest areas designated for production purposes differ considerably between subregions. The percentage of production area out of total forest area ranges between 16 percent in South America and 53 percent in Europe. Globally about one quarter of the forest area is designated to multiple use forestry. The balance between biomass growth and removals shows considerable sub-regional differences and related implications for the sustainable use of forests.

New estimates of CO2 forest emissions and removals: 1990–2015

S. Federici, F. N. Tubiello, M. Salvatore, H. Jacobs, J. Schmidhuber
Forest Ecology and Management (2015), Volume 352, Pages 89-98. doi:10.1016/j.foreco.2015.04.022

Using newly available data from the 2015 Forest Resources Assessment (FRA), we refined the information, currently available through the IPCC AR5 and FAOSTAT, on recent trends in global and regional net CO_2 emissions and removals from forest land, including from net forest conversion (used as a proxy for deforestation) and forest remaining forest. The new analysis is based on the simplified forest carbon stock method of the FAOSTAT Emissions database, equivalent to a Tier 1, Approach 1 IPCC methodology, limited to biomass carbon stocks. Our results indicated that CO_2 emissions from net forest conversion decreased significantly, from an average of 4.0 Gt CO_2 yr^{-1} during 2001–2010 to 2.9 Gt CO_2 yr^{-1} during 2011–2015. More than half of the estimated reductions over the last five years, some 0.6 Gt CO_2 yr^{-1}, took place in Brazil. Detailed analyses further indicated that remaining forests continued to function as a net carbon sink globally, with an average net removal of −2.2 Gt CO_2 yr^{-1} during 2001–2010, and −2.1 Gt CO_2 yr^{-1} during 2011–2015. Annex I Parties represented the bulk of this sink, contributing 60% of the total in 2011–2015, down from 65% in 2001–2010. Compared to previous FAOSTAT assessments for the period 2001–2010, based on the 2010 FRA and published in the IPCC AR5, the use of FRA 2015 data led to estimates of net forest conversion that were consistent with previous ones (4.0 vs. 3.8 Gt CO_2 yr−1), while the estimated forest sinks were 22% larger (−2.2 vs. −1.8 Gt CO_2 yr^{-1}). The net contribution of forests to anthropogenic forcing based on FRA2015 data was thus smaller than previously estimated by the IPCC AR5. Finally, we separated for the first time net emissions and removals from forest land into a sink component and a degradation component. Results indicated that, contrary to CO_2 emissions from deforestation, CO_2 emissions from forest degradation increased significantly, from 0.4 Gt CO_2 yr^{-1} in the 1990s, to 1.1 Gt CO_2 yr^{-1} in 2001–2010 and 1.0 Gt CO_2 yr^{-1} in 2011–2015. Emissions from forest degradation were thus one-fourth of those from deforestation in 2001–2010, increasing to one-third in 2011–2015.

Carbon storage and sequestration of re-growing montane forests in southern Ecuador

D. V. Spracklen, R. Righelato
Forest Ecology and Management (2016) 364, Pages 139-144. doi:10.1016/j.foreco.2016.01.001

The storage and sequestration of carbon by tropical montane forests is poorly understood. We quantified the above-ground biomass (AGB) storage in secondary tropical montane forests in southern Ecuador. The AGB in older secondary (>40 years old) forest was found to be 158 ± 38 Mg ha^{-1} of land surface at 1000 m elevation and 104 ± 25 Mg ha^{-1} of land surface at 2250 m elevation. This is less than the storage reported in a recent synthesis of AGB observations in mature tropical montane forests, potentially due to a legacy of selective logging within our study sites. The slope angle resulted in AGB being 1.5–10% greater when reported on a planimetric compared to land surface area basis. We also quantified AGB in areas of abandoned pasture where grazing and fire had been excluded. Pasture that had been recently abandoned (1–2 years) stored 2–18 Mg ha^{-1} of AGB with the higher values due to the presence of relict trees. Re-growing secondary forests, established through natural

regeneration, accumulated AGB at a rate of 10 Mg ha−1 yr−1 at 1000 m elevation and 4 Mg ha^{-1} yr^{-1} at 2250 m elevation, for the first 5–7 years after pasture abandonment. After 12–15 years, accumulation of AGB slowed to 1–2 Mg ha^{-1} yr^{-1}. Net biomass accumulation rates were similar to those observed in lowland humid tropical forests, suggesting that regenerating tropical montane forests provide an important carbon sequestration. In newly regenerating forests, small trees (DBH < 10 cm) contributed up to 50% of total AGB. In the older secondary forest at high elevation coarse dead wood contributed 34% of total AGB.

Miombo woodland under threat: Consequences for tree diversity and carbon storage

E. K. K. Jew, A. J. Dougill, S. M. Sallu, J. O'Connell, T. G. Benton
Forest Ecology and Management (2016), Volume 361, Pages 144-153. doi:10.1016/j.foreco.2015.11.011

Agriculture is expanding rapidly in the miombo woodlands of sub-Saharan Africa. Clear felling results in the loss of species and ecosystem services. The remaining woodland is used as a vital support system for the farming communities, and the impact of this utilisation on biodiversity and ecosystem service provision is not clear. Understanding these effects will aid the development of effective, sustainable land management strategies for multiple outcomes, including biodiversity conservation and resource utilisation. This study provides new data on miombo woodland tree species diversity, structure and carbon storage from a 8766 km^2 landscape in south-western Tanzania, which is undergoing rapid conversion to tobacco cultivation. Human utilisation of the woodland was classified by ground surveys which recorded evidence of use (e.g. cut poles and timber, removal of bark and roots, access routes). Nine sites were surveyed and categorised into three groups: high, medium and low utilisation. To determine the effect of utilisation on the tree community stem density, diameter at breast height, tree species richness and carbon storage were recorded. In the low utilisation sites carbon storage was similar to that found in other miombo woodlands (28 t Ha^{-1}), and the Shannon Wiener diversity score for tree species diversity was 3.44. However, in the high utilisation sites, tree species diversity (2.86) and carbon storage declined (14.6 t Ha^{-1}). In areas of moderate utilisation diversity and carbon storage were maintained, but the structure of the woodland was affected, with a reduction of Class 1 (Diameter at Breast Height (DBH) < 10 cm) stems, demonstrating low recruitment which leads to a reduction in sustainability. Tree species richness and abundance demonstrated an intermediate disturbance effect in relation to utilisation, with highest levels at medium utilisation sites. Key miombo woodland species from the subfamily Caesalpinioideae in the two genera Brachystegia and Julbernardia were present in all sites, but the frequency of Brachystegia species declined by 60% from low to high utilisation. The IUCN near-threatened timber species Pterocarpus angolensis, highly protected in Tanzania, was harvested throughout the study site, and the majority of trees recorded were immature (DBH $\leqslant$ 20 cm), suggesting that it is commercially extinct for the foreseeable future. These findings illustrate that in miombo woodlands with low to medium utilisation levels key miombo species are retained, and tree species diversity and carbon storage remains optimal. Sustainable land management plans need to regulate utilisation within miombo landscapes and retain areas of woodland. This will ensure their long term viability, and continue to support the 100 million people who are reliant on miombo woodlands for their goods and services.

Forest health in a changing world: effects of globalization and climate change on forest insect and pathogen impacts

T.D. Ramsfield, B.J. Bentz, M. Faccoli, H. Jactel and E.G. Brockerhoff
Forestry (2016) 89 (3): 245-252. doi: 10.1093/forestry/cpw018

Forests and trees throughout the world are increasingly affected by factors related to global change. Expanding international trade has facilitated invasions of numerous insects and pathogens into new regions. Many of these invasions have caused substantial forest damage, economic impacts and losses of ecosystem goods and services provided by trees. Climate change is already affecting the geographic distribution of host trees and their associated insects and pathogens, with anticipated increases in pest impacts by both native and invasive pests. Although climate change will benefit many forest insects, changes in thermal conditions may disrupt evolved life history traits and cause phenological mismatches. Individually, the threats posed to forest ecosystems by invasive pests and climate change are serious. Although interactions between these two drivers and their outcomes are poorly understood and hence difficult to predict, it is clear that the cumulative impacts on forest ecosystems will be exacerbated. Here we introduce and synthesize the information in this special issue of Forestry with articles that illustrate the impacts of invasions of insects and pathogens, climate change, forest management and their interactions, as well as methods to predict, assess and mitigate these impacts. Most of these contributions were presented at the XXIV IUFRO World Congress in 2014.

Positive feedback between climate change, forest pests and the carbon cycle

A. I. M. Arnold, A. Reinhardt, I. Korczynski, M. Grüning and C. Thies
Annals of Applied Bio-Sciences (2016) 3 (1). e-ISSN: 2349-6991

Forest trees under climate stress increasingly become more vulnerable to insect pests resulting in vastly defoliated swaths of forest land. Here, we simulated a forest pest mass outbreak using a microcosm incubation

experiment, and show a positive feedback between climate change, forest pests and the carbon cycle. Treatments with insect faeces showed 16-fold higher fluxes of carbon dioxide (CO2) and 8-fold higher fluxes of dissolved organic carbon (DOC) compared to treatments without insect faeces (control) across a four weeks period, presumably due to the input of limited nitrogen (N) and fastly decomposable carbon (C) compounds that accelerate soil decomposition processes.

Eucalyptus forest shows low structural resistance and resilience to climate change-type drought

G. Matusick, K. X. Ruthrof, J. B. Fontaine and G. E. St. J. Hardy

Journal of Vegetation Science (2016), Volume 27, Issue 3, pages 493-503. DOI: 10.1111/jvs.12378

Climate change-type drought (the combination of drought and heatwave) has become a widely documented driver of forest dieback yet, to date, limited measurement of post-event forest dynamics has been reported. Can climate change-type drought trigger structural and/or compositional changes in a forest type which is usually highly resilient to other disturbances? Forest areas that were severely and minimally affected by drought were measured repeatedly at 3, 6, 16, 26 and 49 mo post-event for changes in forest structure and composition of the two dominant tree species (Eucalyptus marginata/ Corymbia calophylla). Means and dispersal from pre-drought conditions were analysed for each structural variable among drought severity classes and between measurement periods. Resprouting, the predominant resilience mechanism in Eucalyptus, was assessed at 6 and 16 mo, while regeneration type and density were determined at 16 mo post-drought. Structural changes were observed after 49 mo on plots severely but not minimally affected by drought, including a 30% increase in stem density ($P < 0.0001$) and reduction in tree diameter (23%; $P < 0.01$), basal area (33%; $P < 0.0001$), canopy height (40%; $P < 0.0001$) and live biomass (36%; $P = 0.01$). On severely affected plots, all structural variables plateaued at levels different from pre-drought conditions. Large, old trees on severely affected plots were replaced by high densities of small stems (1–10 cm DBH). Resprouting among drought affected trees ($P < 0.001$) and tree regeneration ($P = 0.02$) were higher on severely affected plots. No significant shifts in the proportional abundance of the two dominant species, E. marginata and C. calophylla, were observed for structural attributes or regeneration after 49 mo. Climate change-type drought can cause structural shifts in a resprouting mediterranean-type forest, providing evidence for a shift to an alternate state, particularly with repeated disturbance. While the study area showed low structural resistance and resilience, tree species composition was resilient to change, as E. marginata is likely to remain dominant in the future due to its resprouting capacity. Findings support the view that climate change-type drought will drive replacement of large trees with short, multi-stemmed individuals, transforming ecosystem structure.

The impacts of climate change and disturbance on spatio-temporal trajectories of biodiversity in a temperate forest landscape

D. Thom, W. Rammer, T. Dirnbock, J. Muller, J. Kobler, K. Katzensteiner, N. Helm and R. Seidl

Journal of Applied Ecology (2016); doi: 10.1111/1365-2664.12644

The ongoing changes to climate challenge the conservation of forest biodiversity. Yet, in thermally limited systems, such as temperate forests, not all species groups might be affected negatively. Furthermore, simultaneous changes in the disturbance regime have the potential to mitigate climate-related impacts on forest species. Here, we (i) investigated the potential long-term effect of climate change on biodiversity in a mountain forest landscape, (ii) assessed the effects of different disturbance frequencies, severities and sizes and (iii) identified biodiversity hotspots at the landscape scale to facilitate conservation management. We employed the model iLand to dynamically simulate the tree vegetation on 13 865 ha of the Kalkalpen National Park in Austria over 1000 years, and investigated 36 unique combinations of different disturbance and climate scenarios. We used simulated changes in tree cover and composition as well as projected temperature and precipitation to predict changes in the diversity of Araneae, Carabidae, ground vegetation, Hemiptera, Hymenoptera, Mollusca, saproxylic beetles, Symphyta and Syrphidae, using empirical response functions. Our findings revealed widely varying responses of biodiversity indicators to climate change. Five indicators showed overall negative effects, with Carabidae, saproxylic beetles and tree species diversity projected to decrease by more than 33%. Six indicators responded positively to climate change, with Hymenoptera, Mollusca and Syrphidae diversity projected to increase more than twofold. Disturbances were generally beneficial for the studied indicators of biodiversity. Our results indicated that increasing disturbance frequency and severity have a positive effect on biodiversity, while increasing disturbance size has a moderately negative effect. Spatial hotspots of biodiversity were currently found in low- to mid-elevation areas of the mountainous study landscape, but shifted to higher-elevation zones under changing climate conditions. Our results highlight that intensifying disturbance regimes may alleviate some of the impacts of climate change on forest biodiversity. However, the projected shift in biodiversity hotspots is a challenge for static conservation areas. In this regard, overlapping hotspots under current and expected future conditions highlight priority areas for robust conservation management.

Nexus between food, energy, water, and forest ecosystems in the USA

Thomas L. Tidwell

J Environ Stud Sci (2016) 6:214-224 - DOI 10.1007/s13412-016-0367-8.

Efforts to promote appreciation for the multifaceted contributions of forests are particularly timely because of the many threats currently faced by forests. These threats include the world's growing population, which is projected to top 9.1 billion by 2050; global climate change; land degradation; land scarcity; and deforestation. Already, human activities have destroyed 50% of the forests that once existed under modern climatic conditions. The US Forest Service's research and management activities are promoting the health, productivity, and resilience of forests and grasslands by, for example, advancing agroforestry, producing and applying science and technology that integrates energy production into sustainable forest and grassland management practices, and protecting water supplies by increasing the quality of aquatic habitats, reducing erosion, and decreasing peak flows. The US Forest Service must increase public understanding and support for such efforts to restore and create healthy landscapes that will supply vital resources to future generations.

Paradigms of climate change impacts on some major food sources of the world: A review on current knowledge and future prospects

A. Tripathi, D. K. Tripathi, D.K. Chauhan, N. Kumar, G.S. Singh

Agriculture, Ecosystems & Environment (2016), Volume 216, Pages 356-373. doi:10.1016/j.agee.2015.09.034

Due to the adverse impacts of climate change on earth systems, the research in this field has been profoundly taken a part in all scientific arenas since last few decades. The deleterious impacts of climate change on agricultural production are challenging the food security of the world in terms of quantity and quality both. Wheat, rice, maize, vegetables, fruits and fish-food provide food security for more than half of the world and are under immense pressure of changing climate. This review is an overview of the significant impacts associated with climate change on these food sources. In present synthesis, various phenological, physiological, biochemical and reproductive responses in major food crops have been summarized emphasizing the vulnerable growth and development stages. Winter and summer sensitivity responses, and morpho-biochemical acclimation patterns have also been summarized. Sustenance in wheat and rice production is evident but impacts of increasing temperatures are negating this on bio-physiological level impacts. Maize crops are experiencing more impacts on yield as compared to wheat and rice. Fruits and vegetable production is highly vulnerable to climate change at their reproductive stages and also due to more disease prevalence. Fisheries as a critical animal food source; is in extreme danger as apparent changes in their habitat and unmanageable environmental conditions are producing extreme losses. This review also provides an account of stress responses and useful adaptive measures. This synthesis may be helpful in understanding manifold dimensions and interactions of climate change impacts on selected major food sources of the world.

Effects of climate change and habitat loss on a forest-dependent bee species in a tropical fragmented landscape

A. Nemésio, D. P. Silva, J. C. Nabout and S. Varela

Insect Conservation and Diversity (2016), Vol. 9 Issue 2, pages 149-160. DOI: 10.1111/icad.12154

Climate change and deforestation are suggested to be the main drivers of decline in pollinators. Forest-dependent species are expected to be the most affected and Euglossa marianae Nemésio (Hymenoptera: Apidae), an endemic species of the highly fragmented Brazilian Atlantic Forest (AF), is believed to be declining as a consequence of human impact. Over the last 17 years, we carried out field surveys to unveil its distribution, allowing us to investigate the potential effects of global climate change on this species, from the last glacial maximum into the future, using species distribution models. Our main goals were to: (i) identify populations potentially under risk of extinction given future climate change; (ii) quantify the amount of climatically suitable and climatically stable areas for E. marianae within AF; (iii) evaluate the area that are available as natural habitat and under legal protection, in an attempt to indicate priority areas to preserve this species. The most stable areas for maintaining populations of E. marianae were located in southern Bahia and northern Espírito Santo states, a region severely affected by deforestation and with several protected areas. Climate change per se does not seem to be the major problem for E. marianae. It may constitute an indirect problem given the limited dispersal abilities of this species, however. Climatically suitable areas will probably increase southwards in the future, but the extreme fragmentation of AF adds great uncertainty as to whether the species will disperse southwards, to regions such as the 'Serra do Mar' in northeastern São Paulo.

Forest management options for adaptation to climate change: a case study of tall, wet eucalypt forests in Victoria's Central Highlands region

R. J. Keenan and C. Nitschke

Australian Forestry (2016), DOI:10.1080/00049158.2015.1130095.

Australia has a highly diverse and variable climate and its forests are well-adapted to climatic variation. However, human-induced changes in climate could exceed historical ranges of variability and have effects on forests well beyond the experience of forest managers. These conditions will require implementation of management practices appropriate to a changing climate but there has been little analysis of potential management options for Australian native forests. The paper analyses potential management options for the tall, wet eucalypt forests in Victoria's Central Highlands. This region has already experienced a strong drying and warming trend and a high incidence of severe bushfires over the last 15 years. Future changes are likely to include rising CO2, increasing temperatures and an overall decrease and changing seasonal patterns in rainfall. This is likely to result in higher fire danger weather conditions, changes in phenology of flowering, seeding and germination and shifts in forest composition and productivity. A range of different management options were considered and analysed in terms of current practice, costs and implementation feasibility. Many management actions identified to support adaptation to climate change were assessed as currently being implemented as part of sustainable forest management arrangements. Options that are not generally currently implemented include developing gene management programs and off-site gene banks, ex-situ conservation and increasing cooperation in species management, increasing stand and regional species diversity, identification and deployment of more drought- or disturbance-tolerant species or genotypes, planning to reduce disease losses through monitoring and sanitation harvests, managing stand structure to reduce impacts on water availability and implementing silvicultural techniques to promote stand vigour, as practised elsewhere in Australia. The likelihood of more intense rainfall events will require changes to infrastructure, such as forest road design and construction specifications. Implementing adaptation will require new approaches to forest management, potentially involving significant human intervention, new ecological, environmental and social research, new modes of communication with the public, new policies and revised regulations and management prescriptions.

Climate change impacts on the sustainability of the firewood harvest and vegetation and soil carbon stocks in a tropical dry forest in Santa Teresinha Municipality, Northeast Brazil

T. D. Althoff, R. S. C. Menezesa, A. L. Carvalhoa, A. S Pintob, , G. A. C. F. Santiagoa, , J. P. H. B. Omettoc, C. von Randowc, E. V. B. Sampaioa

Forest Ecology and Management (2016), Volume 360, Pages 367-375. doi:10.1016/j.foreco.2015.10.001

The Brazilian semi-arid region is characterized by low and erratic rainfall, high temperatures and high potential evapotranspiration. The removal of firewood from the native tropical dry forest, called "Caatinga", can negatively impact important ecosystem services, such as soil conservation, water resources, biodiversity and atmospheric carbon capture, if performed in an unsustainable manner. Most global climate models indicate that Caatinga will experience temperature increases and rainfall decreases in the next few decades. We used the Century model to simulate the impact of climate changes on woody vegetation growth and on vegetation and soil organic carbon stocks in a Caatinga area managed with a single clear cut or cuts every 10 years, 15 years, and 20 years, followed or not followed by the burning of plant residues (leaves and small branches) left after firewood removal. The effects of future climate projections, (LOW, MIDI and HIGH members of the climate scenario SRES A1B, which corresponded to different CO_2 emission predictions, downscaled by the Eta/CPTEC model), were compared to those of the projection of the historical climate. With the current climate, it would take 50 years to regenerate the Caatinga biomass stock to a level close to that before cutting after a single cut, followed or not followed by fire. Therefore, the recommended cutting cycles (10–20 years) were not long enough to allow for the regeneration of a fully mature Caatinga. However, all of these cycles reached sustainable biomass production levels, with similar total productions until the end of the century. Under these conditions, the lower proportions of biomass recovery of shorter cycles would be compensated by more frequent cutting. The model also indicated that burning or not burning the residues would have little effect. On the contrary, if the climate changes as predicted, the biomass of the native Caatinga vegetation and soil organic carbon stock would decrease throughout this century, even without cutting the vegetation. All of the cutting cycles would not provide sustainable firewood production, with reduced production after each consecutive cut. Therefore, if the climate changes as expected, forest management legislation should require longer periods of forest recovery between cutting cycles for sites with environmental conditions (e.g., climate, soil and vegetation) similar to those of the present study.

Valuing climate change impacts on European forest ecosystems

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Ecosystem Services, Volume 18, April 2016, Pages 141-153. doi:10.1016/j.ecoser.2016.02.039

This paper presents one of the first attempts to perform a systematic assessment of the climate change impacts on European forests and its capacity to deliver ecosystem services by developing a hybrid economic valuation model. Different methods are combined to assess climate change impacts on forests by different latitudes, productivity in bio-physical terms and related economic consequences. Our computation shows that countries within the Mediterranean European geo-climatic zone will benefit from the highest welfare gain in moving towards an environmentally oriented scenario. The welfare gain has been estimated around 86% increase in the cultural values, 45% increase in the value of carbon sequestration and 24% increase in the values of wood forest products. The other countries show an intermediate state of affairs with mixed results. On the other hand, high welfare losses are always expected when moving to the more economically oriented scenarios, with the highest impacts among the Northern European countries. Results show that all storylines describe significant impacts on human wellbeing. These economic magnitudes contribute to a better understanding of the potential welfare loss across different regions and therefore will have important policy implications, such as developing the ecosystem-base adaption measures for Europe to cope with climate change.

Long-term decline of southern boreal forest birds: consequence of habitat alteration or climate change?

R. Virkkala

Biodiversity and Conservation (2016), Volume 25, Issue 1, pp 151-167. doi:10.1007/s10531-015-1043-0

Climate change and habitat degradation due to land use are the key factors threatening biodiversity. It is important to study both the separate and joined effects of climate warming and land use on biodiversity. In this work long-term population changes of southern boreal forest birds were studied in relation to climate change and direct habitat alteration due to forestry. The study was based on annually repeated bird censuses in 23 consecutive years (1993–2015) in a managed forest landscape. Results were compared with population changes in protected areas where logging is not allowed. During the study period, total bird density declined by 18 % with a change in the bird community composition. Out of the 12 most abundant species seven showed a significant negative trend and only one species a positive trend. Population declines could be connected with the direct alteration of habitat as a consequence of forestry or with the effect of climate change in the case of those species which declined also in protected areas. The increased species are abundant across Europe in human-modified habitats. Due to habitat alteration and climate warming, specific characteristics of southern boreal forest bird communities are changing with communities representing a pattern towards global homogenization. Thus, habitat alteration strengthens the negative effects of climate change.

Demographic response of a neotropical migrant songbird to forest management and climate change scenarios

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Forest Ecology and Management, Volume 359, 1 January 2016, Pages 309-320. doi:10.1016/j.foreco.2015.10.002

Demographic models for species sensitive to human activities that are still relatively common are of particular interest to compare the relative influence of human land use and climate on population trends. Yet, data limitations often restrict our ability to interpret the numerical response of species to habitat alteration and climatic change adds to this challenge. In this study, we used habitat-specific demographic information from an individually-marked population of Ovenbird (Seiurus aurocapilla) and a forest timber supply model to project population trends over an 80-year horizon. We modelled changes in Ovenbird abundance, productivity, and population growth rate as a function of harvesting scenarios (no harvest, forestry-as-usual, and increased [10% or 20%] harvesting intensity) and projected impacts of climate change (0%, 10%, and 50% reductions in population size over the 80-year period), as well as contrasting assumptions about population dynamics (i.e. open vs. closed population). Among the many effects of climate change, it has been hypothesized that reductions in annual snow cover will occur, causing deeper and more frequent frost penetration into the soil and, in turn, a reduction in invertebrate (food) abundance during the following breeding season. Our models suggest that the study area currently is a demographic sink ($\lambda = 0.920$) for Ovenbirds, although some habitat types still act as demographic sources. Over the first 7 years, a large decline in abundance of territorial males (~25%) is projected, unless population levels are maintained through immigration. Interestingly, when we allowed for immigration from outside the study area, population growth rate remained <1 because a larger proportion of the population occupied habitat types acting as sinks. Over an 80-year period, the climate change scenarios we simulated were more likely to have negative impacts (5–49%) than forestry activities, whether we applied the current management plan or more intensive harvesting scenarios. To our knowledge, this study used some of the most detailed habitat-specific demographic information available for a North American forest songbird to model the relative influence of land use, climate, and population dynamics on population trends. Future studies should

examine the possibility of synergistic effects between harvesting and climate change, to model their influence on Ovenbird or other species foraging on litter invertebrates.

Landscape- and regional-scale shifts in forest composition under climate change in the Central Hardwood Region of the United States

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Landscape Ecology (2016). Volume 31, Issue 1, pp 149-163. DOI:10.1007/s10980-015-0294-1

Tree species distribution and abundance are affected by forces operating at multiple scales. Niche and biophysical process models have been commonly used to predict climate change effects at regional scales, however, these models have limited capability to include site-scale population dynamics and landscape-scale disturbance and dispersal. We applied a landscape modeling approach that incorporated three levels of spatial hierarchy (pixel, landtype, and ecological subsection) to model regional-scale shifts in forest composition under climate change. The objectives were to determine (1) how importance value of individual species will change under the PCM B1 and GFDL A1FI modeling scenarios and (2) how overall forest composition at different spatial scales will change under these climate change scenarios in the short, medium, and long term in the Central Hardwood Forest Region (CHFR). We used LANDIS PRO to predict forest composition changes from 2000 to 2300 accounting for climate change, population dynamics, dispersal, and harvest in the CHFR. We analyzed forest composition shifts under alternative climate scenarios and at multiple spatial scales. Shifts in forest composition were found greater under the GFDL A1FI than the PCM B1 modeling scenarios and were greatest at the scale of ecological sections followed by forest sub-regions and the whole CHFR. Forest composition shifted toward more southern and xeric species and lesser northern and mesic species. We suggest it is essential to include site- and landscape-scale processes in models and to evaluate changes at multiple spatial and temporal scales when evaluating changes in species composition due to climate change and disturbance.

Comparative Analysis of Woody Composition of Farmlands and Forest Reserve Along Afram River in a Tropical Humid Savanna of Ghana: Implications to Climate Change Adaptation

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Innovation in Climate Change Adaptation (2016), pp 195-209. DOI:10.1007/978-3-319-25814-0_14

Riparian forests (RF) composition is important for moderating climate change impacts on agricultural watersheds. However, they are under threat from deforestation of catchment areas. The study used remote sensing techniques and field inventorying to assess woody species composition of RF on farmland (FA) and protected area (PA) along Afram rivercourse in the humid savanna of Ghana. Analysis of Landsat images revealed a reduction in forest cover from 1986 (50 %) to 2014 (31 %) in the river catchment. Ground survey of 60 randomly selected plots (500 m2 per plot) equally divided between FA and PA along the river in a 50 m buffer zone showed a reduction in the number of woody species (diameter ≥5 cm) from PA (58) to FA (39). Shannon-Wiener Index for species diversity also reduced from PA (3.8 ± 0.05) to FA (3.1 ± 0.08). Diameter class distribution of species of both PA and FA showed a reversed J-shaped curve indicating successful regeneration. Reduction in species density per hectare from PA (545 ± 18) to FA (277 ± 13) is likely to increase the surface exposure of the riparian area in FA. This will heighten risks of climate disasters such as fires and flooding. Education of farmers on the importance of riparian forests may ensure their protection.

How is global climate policy interpreted on the ground? Insights from the analysis of local discourses about forest management and REDD+ in Indonesia

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Ecology and Society (2016). Vol. 21, No. 2. doi:10.5751/ES-08363-210206

The implementation of "reducing emissions from deforestation and forest degradation" (REDD+) will inevitably be affected by local social and political dynamics, with the potential for success depending significantly on cooperation from a range of stakeholders at the subnational level. Building on recent critical research on REDD+, we look at how global policy is interpreted locally by actors who are likely to be involved in REDD+ implementation. We do this by examining local stakeholder perceptions of REDD+ and forest management in two contrasting provinces of Indonesia, Riau and Papua, where deforestation rates are high and low, respectively. Using data collected from stakeholder workshops, we conduct a discourse analysis that reveals how subnational actors perceive and position themselves around REDD+ and forest governance. The results reveal six discourses common to both case-study provinces, which variously conflict and converge as they are employed by different actors. Seen together, these discourses provide critical insights into the subnational policy environment, which is largely a product of Indonesia's underlying land and forest politics, and they indicate in turn how REDD+ in practice is likely to be interpreted and reconstituted at the local level. A key finding is that local discourses can be grouped around two divergent positions on REDD+: one that supports forest exploitation and sees limited prospects in forest carbon, and one that embraces sustainable forest management and expresses conditional

support for REDD+ subject to benefit-sharing and property arrangements. REDD+ practitioners will therefore need to craft policies and project processes that account for these discursive dynamics.

Effects of Protected Areas on Forest Cover Change and Local Communities: Evidence from the Peruvian Amazon

J. J. Miranda, L. Corral, A. Blackman, G. Asner, E. Lima

World Development (2016). Volume 78, Pages 288-307. doi:10.1016/j.worlddev.2015.10.026

Protected areas are a cornerstone of forest conservation in developing countries. Yet little is known about their effects on forest cover change or the socioeconomic status of local communities. This paper assesses whether "win–win" scenarios are possible—that is, whether protected areas can both stem forest cover change and alleviate poverty. We examine protected areas in the Peruvian Amazon during the early 2000s. We find that protected areas reduce deforestation. We do not find a robust effect on poverty. Protected areas that allow sustainable extractive activities are more effective in reducing deforestation but less effective in reducing poverty.

The potential for land sparing to offset greenhouse gas emissions from agriculture

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Nature Climate Change 6, 488-492 (2016), doi:10.1038/nclimate2910

Greenhouse gas emissions from global agriculture are increasing at around 1% per annum, yet substantial cuts in emissions are needed across all sectors. The challenge of reducing agricultural emissions is particularly acute, because the reductions achievable by changing farming practices are limited and are hampered by rapidly rising food demand. Here we assess the technical mitigation potential offered by land sparing—increasing agricultural yields, reducing farmland area and actively restoring natural habitats on the land spared6. Restored habitats can sequester carbon and can offset emissions from agriculture. Using the UK as an example, we estimate net emissions in 2050 under a range of future agricultural scenarios. We find that a land-sparing strategy has the technical potential to achieve significant reductions in net emissions from agriculture and land-use change. Coupling land sparing with demand-side strategies to reduce meat consumption and food waste can further increase the technical mitigation potential—however, economic and implementation considerations might limit the degree to which this technical potential could be realized in practice.

Forest management and natural biocontrol of insect pests

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Forestry (2016) Volume 89, Issue 3, Pp. 253-262

Current silvicultural practices are under revision as result of changing demands and pressing environmental issues. We compared the monoculture clear-cut regime commonly used during the recent decades in Europe, especially in Fennoscandia, and in North America, with three alternative forest management methods, short rotation forestry, mixed forest stands and continuous cover forestry. We evaluate how these alternative management methods are likely to affect the natural control of forest insect (regeneration pests, defoliators and bark beetles). Particular emphasis was placed on the effects of forest management on natural enemy pressure. We argue that changing forest management to any of the methods discussed will, in most cases, decrease the relative effects of bottom-up forces (resource quality and quantity) and increase the relative effects of top-down forces (natural enemy pressure) on forest pests. As population growth of the pest species presently causing most damage in European managed forests (i.e. pine weevil and spruce bark beetle) is mainly limited by bottom-up forces (quantity of suitable breeding material), changes in forest management could increase the relative importance of top-down forces by modifying stand characteristics to actively support the natural enemies. However, it remains to be investigated to what extent such alterations will result in decreased damage to trees even though some evidence points in that direction.

Can verifiable information cut through the noise about climate protection? An experimental auction test

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Climatic Change (2016), Volume 134, Issue 1, pp 87-99. doi:10.1007/s10584-015-1502-3

Using an experimental auction, we explore how verifiable information affects the willingness to pay (WTP) for two climate friendly goods given the politicized climate change debate. We test whether the dissemination of (scientific) verifiable information lets subjects cut through the media noise. We define our baseline by first examining how noisy information (pro and con) about climate change affects WTP. We then consider how third

party verifiable information within this noisy information affects WTP. Our results suggest subjects could cut through noisy information to process verifiable information. We find a significant WTP premium for climate protection. The verifiable information treatment increases the premium for both shade-grown coffee (by 51 %) and recycled paper (by 48 %). This suggests the WTP premium for climate change depends on the available information flow and the characteristics of the climate friendly good.

Determining forest degradation, ecosystem state and resilience using a standard stand stocking measurement diagram: theory into practice

C. Bahamondez and I. D. Thompson

Forestry (2016) - doi: 10.1093/forestry/cpv052

Forest degradation is a major issue for policy-makers that is exacerbated by no clear and globally accepted definition of the term. For forest managers, a loss of forest productive capacity is one form of forest degradation. We present a quantitative method to assess forest degradation from a productivity perspective. Our method uses a standard stocking chart and calculation methods based on standard forest inventory data, to derive a clear threshold value for stocking, below which a forest should be considered degraded. The method is illustrated using the example of a self-regenerating Nothofagus production forest type from Chile. For that forest type, we determined that harvesting trees to below a specific basal area relative to site type, resulted in a loss of resilience, an unpredictable shift in ecosystem state, and a degraded condition. Our method illustrates how over-harvesting can degrade the long-term productivity of a stand and forest resilience. Nevertheless, it is important to consider that forests can also be degraded from other perspectives, such as loss of biodiversity, carbon, or protective functions as a result of excessive disturbances. Ecosystem management requires that managers consider degradation from a range of perspectives. We see the quantified approach used here as a way to provide practitioners with, in part, a transition from sustained yield to ecosystem management with an ultimate objective of providing a pathway towards adaptive management of complex systems and avoiding degradation.

Alteration of forest succession and carbon cycling under elevated CO_2

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Global change biology (2016) - DOI: 10.1111/gcb.13077

Regenerating forests influence the global carbon (C) cycle, and understanding how climate change will affect patterns of regeneration and C storage is necessary to predict the rate of atmospheric carbon dioxide (CO_2) increase in future decades. While experimental elevation of CO_2 has revealed that young forests respond with increased productivity, there remains considerable uncertainty as to how the long-term dynamics of forest regrowth are shaped by elevated CO_2 (eCO_2). Here, we use the mechanistic size- and age- structured Ecosystem Demography model to investigate the effects of CO_2 enrichment on forest regeneration, using data from the Duke Forest Free-Air Carbon dioxide Enrichment (FACE) experiment, a forest chronosequence, and an eddy-covariance tower for model parameterization and evaluation. We find that the dynamics of forest regeneration are accelerated, and stands consistently hit a variety of developmental benchmarks earlier under eCO_2. Because responses to eCO_2 varied by plant functional type, successional pathways, and mature forest composition differed under eCO_2, with mid- and late-successional hardwood functional types experiencing greater increases in biomass compared to early-successional functional types and the pine canopy. Over the simulation period, eCO_2 led to an increase in total ecosystem C storage of 9.7 Mg C ha^{-1}. Model predictions of mature forest biomass and ecosystem–atmosphere exchange of CO_2 and H_2O were sensitive to assumptions about nitrogen limitation; both the magnitude and persistence of the ecosystem response to eCO_2 were reduced under N limitation. In summary, our simulations demonstrate that eCO_2 can result in a general acceleration of forest regeneration while altering the course of successional change and having a lasting impact on forest ecosystems.

Urbanization as a land use change driver of forest ecosystem services

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Land Use Policy (2015), Volume 54, Pages 188-199. doi:10.1016/j.landusepol.2016.02.006

Land use change in the form of urbanization is a direct driver affecting the provision of ecosystem services from forests. To better understand this driver, we modeled the effects of urbanization on three regulating and provisioning ecosystem services in two disparate watersheds in Florida, USA. The study integrated available geospatial and plot-level forest inventory data to assess future changes in carbon storage, timber volume and water yield during a period of 57 years. A 2003–2060 urbanization and land use change scenario was developed using land cover data and a population distribution model. The Integrated Valuation and Ecosystem Services Tradeoffs model was then used to quantify changes in ecosystem services. Carbon storage was reduced by 16% and 26% in the urbanized 2060 scenario in both the rural Lower Suwannee and urban Pensacola Bay watersheds, respectively. Timber volume was reduced by 11% in the Lower Suwannee and 21% in the Pensacola Bay

watershed. Water yield, however, increased in both watersheds by 4%. Specific sub-watersheds that were most susceptible to urbanization were identified and mapped and ecosystem service interactions, or trade-offs and synergies, are discussed. Findings reveal how urbanization drives the spatio-temporal dynamics of ecosystem services and their trade-offs. This study provides policy makers and planners an approach to better develop integrated modeling scenarios as well as designing mapping and monitoring protocols for land use change and ecosystem service assessments.

Economic impacts of climate change considering individual, additive, and simultaneous changes in forest and agriculture sectors in Canada: A dynamic, multi-regional CGE model analysis

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Forest Policy and Economics (2016), Volume 63, Pages 43-51. doi:10.1016/j.forpol.2015.12.005

Computable general equilibrium (CGE) model analyses of economic impacts from climate change have often focused on individual impacted sectors such as forest. However, such an approach may not provide accurate economic impact estimates since climate change will affect multiple sectors simultaneously. Furthermore, imprecise aggregate economic impact estimates may result if one were to add together individual sector impact estimates. We used CGE models to compare economic impacts of individual, additive, and simultaneous climate-induced changes in Canadian and other regions' forest and agriculture sectors over the 2006–2051 period. We found negative additive impact biases in a majority of regions for five of our economic variables including GDP, income, imports, terms of trade, capital, and total output. Positive additive impact biases were found in a majority of regions for four economic variables including welfare, consumption, export, and labor. These findings emphasize the importance of considering impacted sectors simultaneously when using CGE models to evaluate the economic impacts of climate change.

Environmental sustainability assessment of using forest wood for heat energy in Ireland

J. J. Fitzpatrick

Renewable and Sustainable Energy Reviews (2016), Volume 57, Pages 1287-1295. doi:10.1016/j.rser.2015.12.197

Wood from Irish forestry has potential for sustainably supplying some of Ireland’s energy needs. This study used an environmental sustainability assessment methodology to assess how much heat energy could be supplied sustainably and the impacts on the environment in comparison to fossil fuels. Around 11% of the Irish land area is forested and around 31% of harvested forest wood is used for energy. Considering this, the steady-state sustainable supply of fuel wood energy from this area was estimated to be around 8.7% of the Irish heat primary energy demand in 2010. Thus, forest wood fuel is a limited resource and can only sustainably supply a small fraction of demand. Life cycle assessment showed that total environmental impact was about 10% of that for heating oil, although this did not include land requirement which is the dominant impact for wood fuel and limits its supply. Even though forest wood is “greener” than heating oil from a climate change perspective, there are a number of other impacts where it performs worse, in particular, emissions of particulate matter during wood combustion which contributed to the highest emissions impact from the life cycle.

V. PUBLICATIONS, REPORTS AND OTHER MEDIA

Synthesis report on the aggregate effect of intended nationally determined contributions

United Nations Framework Convention on Climate change (UNFCCC) - 2016 / 75 pages

This synthesis report on the aggregate effect of the 161 intended nationally determined contributions (INDCs) communicated by 189 Parties by 4 April 2016 provides estimates of the aggregate greenhouse gas emission levels in 2025 and 2030 resulting from the implementation of those INDCs. Those levels are compared with the emission levels in 1990, 2000 and 2010 as well as with emission trajectories consistent with (1) action communicated by Parties for the pre-2020 period and (2) holding the average global temperature rise below 2 ºC and 1.5 ºC above pre-industrial levels. This document identifies and discusses trends that indicate opportunities for enhanced action to address climate change in the longer term. In addition, it synthesizes information relating to adaptation, which was included in the INDCs communicated by 137 Parties.

Climate change and food security: risks and responses

Food and Agriculture Organization of the United Nations (FAO) - 2016 / 110 pages

End hunger, achieve food security and improve nutrition is at the heart of the sustainable development goals. The effects of climate change on our ecosystems are already severe and widespread, and ensuring food security in the face of climate change is among the most daunting challenges facing humankind. While some of the problems associated with climate change are emerging gradually, action is urgently needed now in order to allow enough time to build resilience into agricultural production systems. In spite of considerable progress, almost 800 million people are chronically undernourished, 161 million under-five year olds are estimated to be stunted. At the same time 500 million people are obese and 2 billion lack the essential micronutrients they need to lead healthy lives. This report has three purposes. First, to raise awareness that climate change is already impacting the food security and nutrition of the most vulnerable. Second, the report describes precisely the pathways by which climate change finally impacts the food security of people, and to show the range of actions needed. Third, it also aims to fuel the ongoing discussions on how to operationalize adaptation of agriculture and food systems to climate change, and to show that food security and nutrition, as well as the agriculture sectors that support it, should be a priority area of intervention.

Strengthening resilience to threats and crises

Food and Agriculture Organization of the United Nations (FAO) - 2016 / 04 pages

Half of the global food production is produced by around 2.5 billion smallholders who derive their livelihoods almost exclusively from agriculture. They are amongst the most vulnerable to disasters and crises that can wipe out their crops, supplies, equipment and animals within minutes. Strengthening the resilience of their livelihoods will help reduce human suffering and the financial costs associated with disasters. Moreover, it is a key step to achieving the SDGs and reaching the estimated 60 percent production increase the world needs to feed 9 billion people by 2050.

FAO assessment of forests and carbon stocks, 1990-2015: Reduced overall emissions, but increased degradation

Food and Agriculture Organization of the United Nations (FAO) - 2015 / 04 pages

Global estimates of forest emission trends show that total emissions have decreased by over 25 percent between the period 2001–2010 and the period 2011–2015. FAO data show that the decrease is due to a decline in deforestation rates globally. They also reveal that emissions from forest degradation, estimated for the first time, are increasing over time and represent one-quarter of total emissions.

Land Degradation Neutrality: The Target Setting Programme

The Global Mechanism of the UNCCD - 2016 / 22 pages

On 25 September 2015, world leaders at the United Nations adopted the 2030 Agenda for Sustainable Development, which includes a set of 17 Sustainable Development Goals (SDGs) and 169 associated targets. Of particular relevance for the UNCCD is Goal 15, Target 15.3 “By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world”. This target is our roadmap for the next 15 years.

A natural fix: A joined-up approach to delivering the Global Goals for Sustainable Development

The Global Mechanism of the UNCCD - 2016 / 48 pages

The sustainable management and restoration of our landscapes – achieving land degradation neutrality - will deliver many co-benefits. From biodiversity conservation and combating climate change to ensuring economic

growth and human wellbeing. How we manage the land is closely linked to how many decent jobs we can create; to food and water security; migration and urbanization trends; real climate change mitigation and adaptation action; responsible consumption or resource conflict. We have identified just some of the global goals for sustainable development, where investing in healthy and productive landscapes would be a highly cost-effective intervention with the most immediate and tangible benefits, but delivering land degradation neutrality would be an accelerator of SDG implementation across the board.

The Great Green Wall: Hope for the Sahara and the Sahel

The Global Mechanism of the UNCCD - 2016 / 15 pages

Since the 1970s, Africa has been heavily affected by recurrent periods of drought. These droughts have threatened the livelihoods and future of entire populations across the region. The lack of rain has led to the disappearance of livestock and the destruction of cereal crops. The great famines that rocked the Sub-Saharan region in the 80s each affected millions of people. In addition, the high population growth rate is increasing demand for food and increasing pressure to gain access to other natural resources which are the basis for livelihoods and the survival of the rural population. In Sahelian countries, land degradation causes a decrease of almost 3% of agricultural production per year, further endangering food security in the sub-region. The challenge for this region is to sustainably manage their lands to ensure the future of their people. The Great Green Wall for the Sahara and the Sahel initiative carries a real message of hope: improving the living conditions of local populations in the dry and arid zones, to enable them to find long term solutions to live on their land thanks to sustainable land management (SLM), by increasing their incomes and ensuring their food security. Recognized internationally as a huge African initiative, international institutions working to preserve the environment have mobilized resources and are coordinating development projects in support of the Great Green Wall. Financial resources have been mobilized at the level of the beneficiary countries, the Commission of the African Union (AU), and through several partners of the initiative.

Ethiopia Climate-Smart Agriculture Scoping Study

Food and Agriculture Organization of the United Nations (FAO) - 2016 / 54 pages

This climate-smart agriculture scoping study for Ethiopia was produced by the FAO. The study is aimed at identifying and documenting existing climate-smart agriculture practices in Ethiopia that enable stakeholders to understand the opportunities and constraints to adopting particular climate-smart agriculture technologies or practices.

Eastern Africa Climate-Smart Agriculture Scoping Study: Ethiopia, Kenya and Uganda

Food and Agriculture Organization of the United Nations (FAO) - 2016 / 108 pages

This publication was commissioned under the auspices of the project “FAO technical support to the COMESA-EAC-SADC program on climate change adaptation and mitigation in Eastern and Southern Africa (OSRO/RAF/307/COM)”. The study goal was to consult with stakeholders, including government departments, the private sector, civil society organizations, development partners, research institutions and NGOs involved in current and past climate-smart agriculture initiatives in the Eastern Africa (EA) sub-region, to map, review, analyse and synthesize major past and current CSA initiatives, in order to document the key stakeholders involved, the policies in place and the constraints, challenges, opportunities and enabling factors to adoption of climate-smart agriculture practices and technologies in the subregion.

Climate Action 2016: Catalysing a sustainable future

The GEF - 2016 / 28 pages

Countries agreed in Paris to a new long-term climate change goal: to achieve a balance between anthropogenic emissions and removals of greenhouse gases (GHG) in the second half of this century. This goal cannot be met without a significant contribution from land use. Land use is the source of about a quarter of all GHG emissions, with roughly half the contribution coming from the agriculture (crop and livestock) sector and the other half largely from deforestation and forest degradation. Climate Action 2016 will contribute towards an improved understanding of the opportunities and barriers to scaling up financing for climate-smart land use; including by showcasing innovative financing mechanisms that bridge the gap between local and national actors, project developers, and investors. Looking forward, the work stream will address the potential for mobilizing additional financing for climate-smart land use through market-based mechanisms.

Management of natural tropical forests for the future

IUFRO WFSE - 2015 / 04 pages

The conservation of tropical forests is one of the main challenges of this century; however, areas established for forest conservation will not be able to ensure the conservation of all species. Future conservation of biodiversity and forest ecosystems will have to take place in sustainably managed tropical forests. Sustainable forest management (SFM) aims both to ensure the flow of goods and services and to maintain forest processes intact, safeguarding the array of functional species that provide those goods and services. This issue brief presents the main challenges to sustainable management of tropical forests and specifies changes necessary in order to meet them.

Mitigating Climate Change with Forest Climate Tools

Mathilda Eriksson, *CERE Working Paper, 2016 / 37 pages*

This paper develops the FRICE, a framework that determines optimal levels of forest climate tools in the context of global climate policy. The paper integrates afforestation and avoided deforestation into the well-known global multi-regional integrated assessment model, RICE-2010. The paper finds that climate forest tools can play an essential role in global climate policy and that this role is increasingly important under stringent temperature targets. Under a 2 degree C temperature target, the model reveals that emission reductions from avoided deforestation are quickly exhausted whereas afforestation is capable of substantially reducing emission reductions in both the medium and long run. The model also indicates that the most significant reductions in emissions from avoided deforestation and afforestation can be achieved by focusing policy efforts on tropical forests.

UNEP 2015 Annual Report

United Nations Environment Programme - 2016 / 04 pages

The United Nations Environment Programme's (UNEP) annual report for 2015 illustrates partnerships and global positions required for implementing the Paris Agreement on climate change and the 2030 Agenda for Sustainable Development.

V.I JOBS

Forestry Officer (REDD+)

Food and Agriculture Organization of the United Nations (FAO) - Deadline is 26 May 2016
The post is located in the REDD+ Programme of the Forestry Department, which supports developing countries in their efforts to mitigate climate change through the implementation of REDD+ activities while contributing to national sustainable development. The REDD+ programme supports countries on technical issues related to National Forest Monitoring Systems (NFMS), the development of cost effective and reliable Measurement, Reporting and Verification (MRV) processes and tools for emission reductions, Forest Reference Levels, as well as on REDD+ policy and measures, forest governance, tenure and legal issues in the context of REDD+ activities. The incumbent will lead, provide technical guidance and coordination for FO REDD+ global thematic groups working on National Forest Inventory and Greenhouse Gas Inventory while ensuring technical linkage with other FAO teams for coordinated support.

Expert in Greenhouse Gas Inventory Systems Reporting for results-based REDD+ (RRR+)

Coalition for Rainforest Nations (CfRN) - Deadline is 31 May 2016
CfRN is loking for a motivated expert for the following tasks to be executed under the supervision of the Lead Expert and a Leadership Team: 1. Provide training and capacity building for the development of institutional arrangements for the national GHG inventory, as well as supporting the enhancement of technical capacities of local GHG inventory experts to prepare estimates for AFOLU categories, including REDD+ activities; 2. Prepare and develop tutorial and course materials on the AFOLU sector of the national GHG inventory, to be used for the technical capacity building activities at global, regional and national levels; 3. Support and assist the Lead Expert in developing capacity for measuring, reporting and verification of GHG emissions reductions and carbon stock enhancement in the agriculture, forestry and other land-use sectors in participating countries; 4. Assist building institutions in participating countries to carry out GHG inventories and reporting of information on REDD+ activities and delivery of training through in-country and international workshops; 5. Undertake field missions and deliver training courses in participating countries.

Global Climate Change (GCC) Specialist

Engility - Posted online since 05 May 2016
Engility is seeking a Short Term Technical Assistant (STTA), Global Climate Change Specialist. This specialist will serve in an on-call capacity (part time, varying hours) to support technical aspects of training, knowledge management and communications activities related to clean energy, land use and carbon sequestration, and adaptation to climate change in a development context. There may be tasks around assessing the environmental, economic and developmental impacts of climate change and evaluating appropriate mitigation and/or adaptation measures.

Junior Professional Officer (Environment and Climate change)

Food and Agriculture Organization of the United Nations (FAO) – Deadline is 08 June 2016
Based in Ankara (Turkey), the Junior Professional Officer has a technical focus on Environment and climate change policy and management, climate change mitigation and adaptation, sustainable development, natural resources management – particularly related to land, water, forestry, fisheries and biodiversity. He/She directly reports technically to the Forestry Officer (SEC) and the Climate Change Officer (REU), and under overall supervision of the Sub-regional Coordinator for Central Asia.

Junior Professional Officer (Climate change and Risk Management)

Food and Agriculture Organization of the United Nations (FAO) – Deadline is 08 June 2016
Based in Port-of-Spain, Trinidad & Tobago, the Junior Professional Officer has a technical focus on Climate Change Mitigation and Adaptation, Risk Management, Sustainable Food and Agriculture, Natural Resources Management – in particular, promoting cross-sectoral, integrated and multistakeholder approaches to land, water, fisheries, forestry, agriculture and the conservation of biodiversity. He/She reports to the FAO Representative for Trinidad and Tobago and Suriname and works under the technical guidance and supervision of Forestry Officer at the Subregional Office for the Caribbean.

Junior Professional Officer (Climate change)

Food and Agriculture Organization of the United Nations (FAO) – Deadline is 08 June 2016
Based in Tunis (Tunisia), the Junior Professional Officer has a technical focus on Climate Change. He/She reports to the Land and Water Officer under the overall management of the Sub regional Coordinator of FAO's Subregional Office for North Africa (SNE).

Junior Professional Officer (Forestry)

Food and Agriculture Organization of the United Nations (FAO) – Deadline is 09 June 2016
Based in Manila (Philippines), the Junior Professional Officer has a technical focus on Forest Management and Restoration and Agro-forestry in the framework of FAO's Common Vision for Sustainable Food and Agriculture. He/She directly reports to the Assistant FAO Representative for Programme and is under the overall supervision of the FAO Representative in the Philippines and under the technical guidance of the relevant technical officer(s) of the Regional Office for Asia and the Pacific (RAP) and Headquarters.

VII. ANNOUNCEMENTS

Land Degradation Neutrality Target setting process, May-October 2016

The Global Mechanism of the UNCCD

To launch the Land Degradation Neutrality (LDN) target setting process, regional inception workshops are being organized between May and October 2016. The LDN Pilot countries will be holding a "lessons learned workshop" for all participating countries in October 2016. The workshops will help participants navigate the complexity of defining bold LDN targets, walking them through the steps of the LDN conceptual framework and policy cycle, and providing information on existing data and methodologies to support the mainstreaming of LDN into the national SDG implementation agenda. In particular, the workshops will address the scope, work plan and timeframe, implementation arrangements, working modalities, communication and reporting procedures, and will facilitate the elaboration of draft country work plans, including deliverables, deadlines and budget.

World Environment Day, 05 June 2016

UNEP

Wildlife crime endangers iconic elephants, rhinos, tigers, gorillas and sea turtles. In 2011, a subspecies of Javan rhino went extinct in Vietnam, while the last western black rhinos vanished from Cameroon the same year. Great apes have disappeared from Gambia, Burkina Faso, Benin and Togo, and other countries could quickly follow. Lesser-known victims include helmeted hornbills and pangolins as well as wild orchids and timbers like Rosewood – flowers and timber are also considered wildlife! This year's theme – Go Wild for Life – encourages you to celebrate all those species under threat and take action of your own to help safeguard them for future generations. This can be about animals or plants.

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 on the 15th day of each month.

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 Patrick Bahal'okwibale, Marc Dumas-Johansen, Susan Braatz and Simmone Rose.

We appreciate any comments or feedback.

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