Food and Agriculture Organization of the United Nations

CLIM-FO Climate Change & Forestry

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I. IN THE PRESS

02 August 2016 - UNFCCC

Final Compilation and Accounting Report for the first commitment period of the Kyoto Protocol

In accordance with decision 13/CMP.1, the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP) requested the secretariat to publish, after the commitment period and the additional period for fulfilling commitments, the final compilation and accounting reports referred to in paragraph 62 of the annex to that decision, and to forward such reports to the CMP, the Compliance Committee and the Party concerned...

15 August 2016 - KQED

California Wildfires: No Single Season Tells the Story

Judging strictly by recent headlines, you might think this is an epic fire season; a "grim beginning to California fire season," with conflagrations "raining fire from the sky," as recent reports have characterized it. In fact, this year is on par with last year and not too far askew from longer-term averages, says fire scientist Scott Stephens.

15 August 2016 - Forest Trends

The Missing Link in Protecting Forests

What's the biggest missing link in finding the money needed to protect forests? It's not political will or public finance – though more is certainly needed – nor is it formal UN recognition of their importance; forests achieved that last December in Paris. What's missing is the untapped power of the private sector …

16 August 2016 - NamaNews

Turning Plans into Action at Asia Pacific NAMA Market Place

Building on the fresh momentum resulting from the Paris Climate Change Agreement, 2016 is a crucial year to translate global commitments on climate change and development finance into concrete actions and plans. In light of this, the UNFCCC secretariat has organized a NAMA Market Place session to be held during this year's Asia Pacific Carbon Forum from 5-7 September in the Republic of Korea to facilitate implementation of nationally appropriate mitigation actions (NAMAs) from countries in the Asia Pacific region...

18 August 2016 - Business Standard

Climate change is the greatest threat to future business

Global warming has the potential to devastate the global economy and is coming at us much more quickly than the public at large seem to recognise… we cannot rely on reaching this target through carbon emission reductions alone. We must aggressively pursue carbon sequestration as well…

18 August 2016 - Deutsche Welle

An amazing forest in the desert

Forests are springing up in the Egyptian desert. But they're not mirages. Scientists have found a way to grow trees there using sewage….

24 August 2016 - UNFCC

Investors Urge G20 Leaders to Swiftly Ratify Paris Agreement: Letter by 130 Investors Controlling USD 13 Trillion

As leaders of the world's largest economies prepared to attend the upcoming G20 meeting in Hangzhou, China, 130 investors with over USD 13 trillion in assets under management have written to the G20 Heads of State urging them to ratify the Paris Climate Change Agreement this year. The investors, from a coalition of six organizations, have also called on G20 nations to double global investment in clean energy, tighten up climate disclosure mandates, develop carbon pricing and phase out fossil fuel subsidies…

31 August 2016 - ThinkProgress

Reforestation Doesn't Fight Climate Change Unless It's Done Right

Perhaps the most complicating factor in reforestation as a means to combat climate change, however, is climate change itself. Across large parts of western North America, forests are already in serious climate-related trouble. Years of prolonged drought in California have turned the forests of the Sierra Nevada and North Coast into "tinderboxes of highly combustible debris," according to a recent New York Times article. In Canada, forest fires and industrial development have destroyed almost two million acres of boreal forest since 2000…

II. MULTILATERAL PROCESSES IN CLIMATE CHANGE

There are no UNFCCC meetings to report on since the last Clim-FO issue.

III. EVENTS & MEETINGS

Recent events

Workshop on forests and disasters in Southeast Asia

24-25 August 2016, Antipolo City, Philippines

This workshop builds on the collaborative International Seminar on the role of forests in natural disasters and revival of forests and forestry held in Sendai, Japan in February 2012, the pre-session seminar on Forests and Natural Disasters held prior to the 25th session of the Asia-Pacific Forestry Commission in Rotorua, New Zealand in November 2013, and the Workshop of Forests and Natural Disasters in Pacific in Fiji last July 2015. The goal of this workshop was to promote the importance of sustainable forest management to a wide range of stakeholders through supporting them to participate in, update existing and develop new international (including regional) mechanisms and instruments under the auspices of FAO... More

African Ambassadors meet in preparation for COP22

31 August 2016 – Rabat, Morocco

The African Development Bank and the Economic Commission for Africa held today in Rabat, in partnership with the COP22 Steering Committee, an information session for African Ambassadors based in Morocco, in preparation for the upcoming Climate Change Conference. The meeting aimed to present the stakes for Africa at COP22, to prepare countries' participation and to support existing efforts to coordinate the African participation at COP22. COP22 (Marrakech, 7-18 November) is the third Climate Change Conference taking place on African soil, after COP7 (2001) and COP17 (2011). This will be a key moment for Africans to push for global commitments towards the implementation of the Paris Agreement adopted in December 2015 and a shift towards resilient, low carbon development... More

IV. RESEARCH ARTICLES

Integrating Science and Management to Assess Forest Ecosystem Vulnerability to Climate Change

L. A. Brandt, P. R. Butler, S. D. Handler, M. K. Janowiak, P. D. Shannon, C. W. Swanston

Journal of Forestry (2016), DOI: http://dx.doi.org/10.5849/jof.15-147

An ecosystem vulnerability assessment approach (EVAA) was developed to help inform potential adaptation actions in response to a changing climate. EVAA combines multiple quantitative models and expert elicitation from scientists and land managers. In each of eight assessment areas, a panel of local experts determined potential vulnerability of forest ecosystems to climate change over the next century using EVAA. Vulnerability and uncertainty ratings for forest community types in each assessment area were developed. The vulnerability of individual forest types to climate change varied by region due to regional differences in how climate change is expected to affect system drivers, stressors, and dominant species and the capacity of a forest community to adapt. This assessment process is a straightforward and flexible approach to addressing the key components of vulnerability in a collaborative setting and can easily be applied to a range of forest ecosystems at local to regional scales.

Forest fires and climate change: causes, consequences and management options

C. Aponte, W. J. de Groot and B. M. Wotton

International Journal of Wildland Fire (2016), Volume 25, i-ii. http://dx.doi.org/10.1071/WFv25n8_FO

Fire is, in many cases, an essential ecosystem component that ensures the sustainability of its processes and communities. Since its emergence, fire has played a key role as an environmental filter, selecting for species and their traits, and shaping ecosystems' communities. However, not all fires are the same and ecosystems exposed

to fire regimes out of their historical range of variability might become vulnerable and suffer irreversible changes. During the International Union of Forest Research Organizations (IUFRO) World Congress held in Salt Lake City, Utah, United States (5–11 October 2014), two technical sessions – 'Forests, fire and climate change dynamics' and 'Managing forests for fire in a changing climate' – addressed the interactions between climate change and forest fire regimes, their ecological impacts and consequences, and the role of landscape management to mitigate those impacts.

Thermokarst rates intensify due to climate change and forest fragmentation in an Alaskan boreal forest lowland

M. J. Lara, H. Genet, A. D. McGuire, E. S. Euskirchen, Y. Zhang, D. R. N. Brown, M. T. Jorgenson, V. Romanovsky, A.Breen, and W. R. Bolton

Global Change Biology (2016), Volume 22, Issue 2, pages 816-829. DOI: 10.1111/gcb.13124

Lowland boreal forest ecosystems in Alaska are dominated by wetlands comprised of a complex mosaic of fens, collapse-scar bogs, low shrub/scrub, and forests growing on elevated ice-rich permafrost soils. Thermokarst has affected the lowlands of the Tanana Flats in central Alaska for centuries, as thawing permafrost collapses forests that transition to wetlands. Located within the discontinuous permafrost zone, this region has significantly warmed over the past half-century, and much of these carbon-rich permafrost soils are now within ~0.5 °C of thawing. Increased permafrost thaw in lowland boreal forests in response to warming may have consequences for the climate system. This study evaluates the trajectories and potential drivers of 60 years of forest change in a landscape subjected to permafrost thaw in unburned dominant forest types (paper birch and black spruce) associated with location on elevated permafrost plateau and across multiple time periods (1949, 1978, 1986, 1998, and 2009) using historical and contemporary aerial and satellite images for change detection. We developed (i) a deterministic statistical model to evaluate the potential climatic controls on forest change using gradient boosting and regression tree analysis, and (ii) a 30 × 30 m land cover map of the Tanana Flats to estimate the potential landscape-level losses of forest area due to thermokarst from 1949 to 2009. Over the 60-year period, we observed a nonlinear loss of birch forests and a relatively continuous gain of spruce forest associated with thermokarst and forest succession, while gradient boosting/regression tree models identify precipitation and forest fragmentation as the primary factors controlling birch and spruce forest change, respectively. Between 1950 and 2009, landscape-level analysis estimates a transition of ~15 km^2 or ~7% of birch forests to wetlands, where the greatest change followed warm periods. This work highlights that the vulnerability and resilience of lowland ice-rich permafrost ecosystems to climate changes depend on forest type.

Vulnerability of tropical forest ecosystems and forest dependent communities to droughts

D. J. Vogt, K. A. Vogt, S. J. Gmur, J. J. Scullion, A. S. Suntana, S. Daryanto, R. Sigurðardóttir

Environmental Research (2016), 144, Part B, 27-38. http://doi.org/10.1016/j.envres.2015.10.022

Energy captured by and flowing through a forest ecosystem can be indexed by its total Net Primary Productivity (NPP). This forest NPP can also be a reflection of its sensitivity to, and its ability to adapt to, any climate change while also being harvested by humans. However detecting and identifying the vulnerability of forest and human ecosystems to climate change requires information on whether these coupled social and ecological systems are able to maintain functionality while responding to environmental variability. To better understand what parameters might be representative of environmental variability, we compiled a metadata analysis of 96 tropical forest sites. We found that three soil textural classes (i.e., sand, sandy loam and clay) had significant but different relationships between NPP and precipitation levels. Therefore, assessing the vulnerability of forests and forest dependent communities to drought was carried out using data from those sites that had one of those three soil textural classes.

Effects of climate change on potential habitats of the cold temperate coniferous forest in Yunnan province, southwestern China

W. Li, M. Peng, M. Higa, N. Tanaka, T. Matsui, C. Q. Tang, X. Ou, R. Zhou, C. Wang, H. Yan

Journal of Mountain Science (2016), Volume 13, Issue 8, pp 1411-1422

We built a classification tree (CT) model to estimate climatic factors controlling the cold temperate coniferous forest (CTCF) distributions in Yunnan province and to predict its potential habitats under the current and future climates, using seven climate change scenarios, projected over the years of 2070-2099. The accurate CT model on CTCFs showed that minimum temperature of coldest month (TMW) was the overwhelmingly potent factor

among the six climate variables. The areas of TMW<-4.05 were suitable habitats of CTCF, and the areas of -1.35 < TMW were non-habitats, where temperate conifer and broad-leaved mixed forests (TCBLFs) were distribute in lower elevation, bordering on the CTCF. Dominant species of Abies, Picea, and Larix in the CTCFs, are more tolerant to winter coldness than Tsuga and broad-leaved trees including deciduous broad-leaved Acer and Betula, evergreen broad-leaved Cyclobalanopsis and Lithocarpus in TCBLFs. Winter coldness may actually limit the cool-side distributions of TCBLFs in the areas between -1.35°C and -4.05°C, and the warm-side distributions of CTCFs may be controlled by competition to the species of TCBLFs. Under future climate scenarios, the vulnerable area, where current potential (suitable + marginal) habitats (80,749 km2) shift to non-habitats, was predicted to decrease to 55.91% (45,053 km2) of the current area. Inferring from the current vegetation distribution pattern, TCBLFs will replace declining CTCFs. Vulnerable areas predicted by models are important in determining priority of ecosystem conservation.

How climate change adaptation and mitigation strategies can threaten or enhance the biodiversity of production forests: Insights from Sweden

A. Felton, L. Gustafsson, J.-M. Roberge, T. Ranius, J. Hjältén, J. Rudolphi, M. Lindbladh, J. Weslien, L. Rist, J. Brunet, A.M. Felton

Biological Conservation (2016), Volume 194, Pages 11-20

Anthropogenic climate change is altering the management of production forests. These changes are motivated by the need to adapt to the uncertainties and risks of climate change, and by the need to enlist their carbon storage and sequestration capacity as part of global mitigation efforts. These changes do however raise concerns regarding the potential implications for forest biodiversity. Here we evaluate these concerns by assessing the biodiversity implications of climate change adaptation and mitigation strategies (CCAMS) being implemented in the production forests of Sweden. We do so by identifying biodiversity goals aimed specifically at closing the existing gap between the habitat requirements of forest-dependent species, and the conditions provided by production forests, in terms of tree species composition, forest structures, and spatio-temporal forest patterns. We then use the existing literature to determine whether and by which pathway each CCAMS is likely to bridge or extend this gap. Our results indicate that CCAMS will often come into direct or partial conflict with Swedish biodiversity goals in production forests. Furthermore, some CCAMS which are inconsistent with biodiversity goals, such as logging residue removal, are being implemented more extensively than those which were most consistent with biodiversity goals. We nevertheless challenge the necessity of setting the preservation of forest biodiversity against climate change mitigation and adaptation. We clarify how CCAMS with negative biodiversity implications may still be implemented without adverse outcomes, if coupled with conservation interventions, or combined with other CCAMS deemed complementary in habitat provision.

Assessing the economic impact of climate change on forest resource use in Nigeria: A Ricardian approach

N. J. A. Onyekuru and R. Marchant

Agricultural and Forest Meteorology (2016), Volume 220, Pages 10-20

Quantifying the impact of climate change at a regional scale is important in trying to develop adaptation policies. We estimated the economic impact of climate change on forest resource use in Nigeria using the Ricardian model in the STATA statistical software. Using a structured questionnaire, data were collected from 400 rural households in forest communities, sampled from five broad ecological regions across Nigeria to estimate income and potential impact on this as a result of climate change. Estimated average value of annual household income from the forest was $3380. The age of the household head, level of education, mode of transport, hudrology (river flow) significantly and positively affected net revenue from the forest, while noticing of climate change negatively affected net revenue. Also while winter and spring precipitation had positive impacts on net revenue ($1.5 and $0.28 respectively), summer and autumn precipitation had negative impacts; (−$0.073 and −$0.05 respectively). Marginal impact analysis shows that increasing rainfall during winter and spring seasons significantly increases the net revenue per household by $62 and $75 respectively, while increasing precipitation marginally during the summer and autumn seasons reduce the net revenue per household by $42 and $18 respectively. This underscores the place of rainfall as a limiting factor in tropical ecosystem productivity and the growing impact of changing rainfall on household income and efforts to moderate water supply in agriculture and forestry will be an effort in the right direction. Annual marginal increase in rainfall increases net revenue per household by $77. The model shows that a 1 °C increase in temperature will lead to an annual loss of $39 × 10−7 in net income per household, after which further increase in temperature or decreases

in precipitation shows no significant change in net revenue, thus underscoring the resilience of tropical forest to climate change.

Bioclimatic envelope models predict a decrease in tropical forest carbon stocks with climate change in Madagascar

G. Vieilledent, O. Gardi, C. Grinand, C. Burren, M. Andriamanjato, C. Camara, C. J. Gardner, L.Glass, A. Rasolohery, H. R. Ratsimba, V. Gond, J.-R. Rakotoarijaona

Journal of Ecology (2016), Volume 104, Issue 3, Pages 703-715

Recent studies have underlined the importance of climatic variables in determining tree height and biomass in tropical forests. Nonetheless, the effects of climate on tropical forest carbon stocks remain uncertain. In particular, the application of process-based dynamic global vegetation models has led to contrasting conclusions regarding the potential impact of climate change on tropical forest carbon storage. Using a correlative approach based on a bioclimatic envelope model and data from 1771 forest plots inventoried during the period 1996–2013 in Madagascar over a large climatic gradient, we show that temperature seasonality, annual precipitation and mean annual temperature are key variables in determining forest above-ground carbon density. Taking into account the explicative climate variables, we obtained an accurate (R2 = 70% and RMSE = 40 Mg ha−1) forest carbon map for Madagascar at 250 m resolution for the year 2010. This national map was more accurate than previously published global carbon maps (R2 ≤ 26% and RMSE ≥ 63 Mg ha−1). Combining our model with the climatic projections for Madagascar from 7 IPCC CMIP5 global climate models following the RCP 8.5, we forecast an average forest carbon stock loss of 17% (range: 7–24%) by the year 2080. For comparison, a spatially homogeneous deforestation of 0.5% per year on the same period would lead to a loss of 30% of the forest carbon stock. Our study shows that climate change is likely to induce a decrease in tropical forest carbon stocks. This loss could be due to a decrease in the average tree size and to shifts in tree species distribution, with the selection of small-statured species. In Madagascar, climate-induced carbon emissions might be, at least, of the same order of magnitude as emissions associated with anthropogenic deforestation.

Assessing Mechanisms of Climate Change Impact on the Upland Forest Water Balance of the Willamette River Basin, Oregon

D. P. Turner, D. R. Conklin, K. B. Vache, C. Schwartz, A. W. Nolin, H. Chang, E. Watson and J. P. Bolte

Ecohydrology (2016), DOI: 10.1002/eco.1776

Projected changes in air temperature, precipitation, and vapor pressure for the Willamette River Basin (Oregon, USA) over the next century will have significant impacts on the river basin water balance, notably on the amount of evapotranspiration (ET). Mechanisms of impact on ET will be both direct and indirect, but there is limited understanding of their absolute and relative magnitudes. Here we developed a spatially-explicit, daily time-step, modeling infrastructure to simulate the basin-wide water balance that accounts for meteorological influences, as well as effects mediated by changing vegetation cover type, leaf area, and ecophysiology. Three CMIP5 climate scenarios (LowClim, Reference, HighClim) were run for the 2010 to 2100 period. Besides warmer temperatures, the climate scenarios were characterized by wetter winters and increasing vapor pressure deficits. In the mid-range Reference scenario, our landscape simulation model (Envision) projected a continuation of forest cover on the uplands but a 3-fold increase in area burned per year. A decline (12-30%) in basin-wide mean leaf area index (LAI) in forests was projected in all scenarios. The lower LAIs drove a corresponding decline in ET. In a sensitivity test, the effect of increasing CO2 on stomatal conductance induced a further substantial decrease (11-18%) in basin-wide mean ET. The net effect of decreases in ET and increases in winter precipitation was an increase in annual streamflow. These results support the inclusion of changes in land cover, land use, LAI, and ecophysiology in efforts to anticipate impacts of climate change on basin-scale water balances.

Short-term climate change manipulation effects do not scale up to long-term legacies: effects of an absent snow cover on boreal forest plants

G. Blume-Werry, J. Kreyling, H. Laudon and A. Milbau

Journal of Ecology (2016), DOI: 10.1111/1365-2745.12636

Despite time-lags and nonlinearity in ecological processes, the majority of our knowledge about ecosystem responses to long-term changes in climate originates from relatively short-term experiments. We utilized the longest ongoing snow removal experiment in the world and an additional set of new plots at the same location in

northern Sweden to simultaneously measure the effects of long-term (11 winters) and short-term (1 winter) absence of snow cover on boreal forest understorey plants, including the effects on root growth and phenology. Short-term absence of snow reduced vascular plant cover in the understorey by 42%, reduced fine root biomass by 16%, reduced shoot growth by up to 53% and induced tissue damage on two common dwarf shrubs. In the long-term manipulation, more substantial effects on understorey plant cover (92% reduced) and standing fine root biomass (39% reduced) were observed, whereas other response parameters, such as tissue damage, were observed less. Fine root growth was generally reduced, and its initiation delayed by c. 3 (short-term) to 6 weeks (long-term manipulation). We show that one extreme winter with a reduced snow cover can already induce ecologically significant alterations. We also show that long-term changes were smaller than suggested by an extrapolation of short-term manipulation results (using a constant proportional decline). In addition, some of those negative responses, such as frost damage and shoot growth, were even absolutely stronger in the short-term compared to the long-term manipulation. This suggests adaptation or survival of only those individuals that are able to cope with these extreme winter conditions, and that the short-term manipulation alone would overpredict long-term impacts. These results highlight both the ecological importance of snow cover in this boreal forest, and the value of combining short- and long-term experiments side by side in climate change research.

Dynamics of a temperate deciduous forest under landscape-scale management: Implications for adaptability to climate change

M. G. Olson, B. O. Knapp, J. M. Kabrick

Forest Ecology and Management (2016), http://dx.doi.org/10.1016/j.foreco.2016.07.033

Landscape forest management is an approach to meeting diverse objectives that collectively span multiple spatial scales. It is critical that we understand the long-term effects of landscape management on the structure and composition of forest tree communities to ensure that these practices are sustainable. Furthermore, it is increasingly important to also consider effects of our management within the context of anticipated environmental changes, especially future climate. This study investigated two decades of tree community dynamics within a long-term, landscape-scale management experiment located in a temperate deciduous forest in southeastern Missouri, USA. This experiment tests three alternative landscape management systems: even-aged management (EAM), uneven-aged management (UAM), and no-harvest management (NHM). Specifically, we evaluated effects of landscape management alternatives on: (1) structural and compositional dynamics of the tree communities and (2) adaptability of the tree communities to projected climate change. Changes in the abundance of dominant species under these landscape management systems suggested a prevailing successional trend on these relatively xeric, oak-dominated landscapes. In the overstory layer, there was a decrease in the abundance of red oak species (Section Lobatae), mainly black oak (Quercus velutina Lam.) and scarlet oak (Quercus coccinea Muenchh.), and an increase in white oak (Quercus alba L.) suggesting a shift to white oak dominance is underway. In the midstory and understory layers, flowering dogwood (Cornus florida L.) abundance declined substantially, while maples (Acer spp. L.) and several minor species increased. Declines in shortleaf pine populations indicated that regeneration harvesting is not regenerating this species. Experiment-wide changes in tree community composition suggest that adaptability to projected future climate may have increased over the first two decades of the MOFEP experiment under all management systems and that diverse management objectives can be realized through active management, including adaptation to climate change. However, future research is needed to test this working hypothesis and to more fully evaluate the impacts of silviculture treatments within the context of projected climate.

Freshwater Swamp Forest Trees of Bangladesh Face Extinction Risk from Climate Change

J. C. Deb, H. M. T. Rahman, A. Roy

Wetlands (2016), Volume 36, Issue 2, pp 323-334

Global climate change is impacting the distribution and abundance of species acting as a major cause of species extinction. It is rapid in freshwater swamp forest ecosystems, since they support disproportionate levels of biodiversity compared to their spatial coverage. The natural swamp forests of Bangladesh have been especially susceptible to climate change as they are limited in range to a few scattered patches in the north-eastern region. We sought to understand how climate change may impact the swamp forests of Bangladesh by modelling distributional changes in Pongamia pinnata and Barringtonia acutangula species, which dominate or co-dominate most swamp forest ecosystems across Bangladesh. We used the maximum entropy (MaxEnt) modelling tool, combined presence-only data of species and bioclimatic variables for two climate scenarios (RCP6.0 and RCP8.5). We compared current, 2050 and 2070 distributions. Results suggest that plant extractable water holding capacity

of soil, annual precipitation, precipitation of warmest quarter and mean annual actual evapotranspiration are the key bioclimatic variables for the distribution of both trees. The MaxEnt models indicate that Pongamia pinnata and Barringtonia acutangula trees of Bangladesh face increasing climate stress and may become extinction under both mid-range and extreme climate scenarios.

Incorporating climate change into ecosystem service assessments and decisions: A review

R. K. Runting, B. A. Bryan, L. E. Dee, F. J.F. Maseyk, L. Mandle, P. Hamel, K. A. Wilson, K. Yetka, H. P. Possingham, and J. R. Rhodes

Global Change Biology (2016), DOI: 10.1111/gcb.13457

Climate change is having a significant impact on ecosystem services, and is likely to become increasingly important as this phenomenon intensifies. Future impacts can be difficult to assess as they often involve long time scales, dynamic systems with high uncertainties, and are typically confounded by other drivers of change. Despite a growing literature on climate change impacts on ecosystem services, no quantitative syntheses exist. Hence, we lack an overarching understanding of the impacts of climate change, how they are being assessed, and the extent to which other drivers, uncertainties, and decision making are incorporated. To address this, we systematically reviewed the peer-reviewed literature that assesses climate change impacts on ecosystem services at sub-global scales. We found that the impact of climate change on most types of services was predominantly negative (59% negative, 24% mixed, 4% neutral, 13% positive), but varied across services, drivers, and assessment methods. Although uncertainty was usually incorporated, there were substantial gaps in the sources of uncertainty included, along with the methods used to incorporate them. We found that relatively few studies integrated decision making, and even fewer studies aimed to identify solutions that were robust to uncertainty. For management or policy to ensure the delivery of ecosystem services, an integrated approach that incorporates multiple drivers of change and accounts for multiple sources of uncertainty is needed. This is undoubtedly a challenging task, but ignoring these complexities can result in misleading assessments of the impacts of climate change, sub-optimal management outcomes, and the inefficient allocation of resources for climate adaptation.

Tamm Review: Observed and projected climate change impacts on Russia's forests and its carbon balance

S. Schaphoff, C. P.O. Reyer, D. Schepaschenko, D. Gerten, A. Shvidenko

Forest Ecology and Management (2016), Volume 361, Pages 432-444

Russia's boreal forests provide numerous important ecosystem functions and services, but they are being increasingly affected by climate change. This review presents an overview of observed and potential future climate change impacts on those forests with an emphasis on their aggregate carbon balance and processes driving changes therein. We summarize recent findings highlighting that radiation increases, temperature-driven longer growing seasons and increasing atmospheric CO2 concentrations generally enhance vegetation productivity, while heat waves and droughts tend to decrease it. Estimates of major carbon fluxes such as net biome production agree that the Russian forests as a whole currently act as a carbon sink, but these estimates differ in terms of the magnitude of the sink due to different methods and time periods used. Moreover, models project substantial distributional shifts of forest biomes, but they may overestimate the extent to which the boreal forest will shift poleward as past migration rates have been slow. While other impacts of current climate change are already substantial, and projected impacts could be both large-scale and disastrous, the likelihood for a tipping point behavior of Russia's boreal forest is still unquantified. Other substantial research gaps include the large-scale effect of (climate-driven) disturbances such as fires and insect outbreaks, which are expected to increase in the future. We conclude that the impacts of climate change on Russia's boreal forest are often superimposed by other environmental and societal changes in a complex way, and the interaction of these developments could exacerbate both existing and projected future challenges. Hence, development of adaptation and mitigation strategies for Russia's forests is strongly advised.

Perception-based analysis of climate change effect on forest-based livelihood: The case of Vhembe District in South Africa

C. Ofoegbu, P. W. Chirwa, J. Francis, F. D. Babalola

Journal of Disaster Risk Studies; Vol 8, No 1 (2016), 10 pages. doi: 10.4102/jamba.v8i1.271

Forests are vulnerable to climate change and are also major sources of livelihood for many rural households in Africa. This study examines rural people's perceptions of climate change impacts on forest-based livelihoods using rural communities of Vhembe District in South Africa as a case study. The study was based on the principles of perceived impact-based assessment, and sustainable livelihoods framework. Using the stratified proportionate random sampling procedure in combination with weighted Enumeration Area for the selected communities, 366 households were chosen and interviewed. Data analysis involved computing frequencies and conducting the Chi-square, binomial tests and binary logistic regression analysis. The respondents identified erratic rainfall, extreme temperature, extreme drought and flooding as key climatic events in their community. But not all identified key climatic events were perceived to constitute risk to forest products and forest-based livelihood. Only extreme drought was indicated to constitute risk to availability of forest products. In addition, the binary logistic regression showed a significant difference ($p < 0.05$) in the perceived risk of climate change to the availability of essential forest products across the three municipalities. Hence the need for forest development initiatives that target vulnerable forest products per community as a means of enhancing resilience of forest-based livelihood to climate change impacts in rural community development in South Africa.

Habitat associations drive species vulnerability to climate change in boreal forests

A. Mazziotta, M. Triviño, O.-P. Tikkanen, J. Kouki, H. Strandman, M. Mönkkönen

Climatic Change (2016), Volume 135, Issue 3, pp 585-595

Species climate change vulnerability, their predisposition to be adversely affected, has been assessed for a limited portion of biodiversity. Our knowledge of climate change impacts is often based only on exposure, the magnitude of climatic variation in the area occupied by the species, even if species sensitivity, the species ability to tolerate climatic variations determined by traits, plays a key role in determining vulnerability. We analyse the role of species' habitat associations, a proxy for sensitivity, in explaining vulnerability for two poorly-known but species-rich taxa in boreal forest, saproxylic beetles and fungi, using three IPCC emissions scenarios. Towards the end of the 21st century we projected an improvement in habitat quality associated with an increase of deadwood, an important resource for species, as a consequence of increased tree growth under high emissions scenarios. However, climate change will potentially reduce habitat suitability for ~9–43 % of the threatened deadwood-associated species. This loss is likely caused by future increase in timber extraction and decomposition rates causing higher deadwood turnover, which have a strong negative effect on boreal forest biodiversity. Our results are species- and scenario-specific. Diversified forest management and restoration ensuring deadwood resources in the landscape would allow the persistence of species whose capacity of delivering important supporting ecosystem services can be undermined by climate change.

Informing climate models with rapid chamber measurements of forest carbon uptake

D. B. Metcalfe, D. Ricciuto, S. Palmroth, C. Campbell, V. Hurry, J. Mao, S. G. Keel, S. Linder, X. Shi, T. Näsholm, K. E. A. Ohlsson, M. Blackburn, P. E. Thornton, R. Oren

Global Change Biology (2016), DOI: 10.1111/gcb.13451

Models predicting ecosystem carbon dioxide (CO_2) exchange under future climate change rely on relatively few real-world tests of their assumptions and outputs. Here, we demonstrate a rapid and cost-effective method to estimate CO_2 exchange from intact vegetation patches under varying atmospheric CO_2 concentrations. We find that net ecosystem CO_2 uptake (NEE) in a boreal forest rose linearly by 4.7 ± 0.2% of the current ambient rate for every 10 ppm CO_2 increase, with no detectable influence of foliar biomass, season, or nitrogen (N) fertilization. The lack of any clear short-term NEE response to fertilization in such an N-limited system is inconsistent with the instantaneous downregulation of photosynthesis formalized in many global models. Incorporating an alternative mechanism with considerable empirical support – diversion of excess carbon to storage compounds – into an existing earth system model brings the model output into closer agreement with our field measurements. A global simulation incorporating this modified model reduces a long-standing mismatch between the modeled and observed seasonal amplitude of atmospheric CO_2. Wider application of this chamber approach would provide critical data needed to further improve modeled projections of biosphere–atmosphere CO_2 exchange in a changing climate.

The relationship between neighbourhood tree canopy cover and heat-related ambulance calls during extreme heat events in Toronto, Canada

D. A. Grahama, J. K. Vanosb, N. A. Kennyc, R. D. Brown

Urban Forestry & Urban Greening (2016), Volume 20, Pages 180-186

Two thirds of Canadians reside in urban areas and 85% of recent population growth occurs in these areas. The intensity and duration of extreme hot weather events are predicted to increase in Canadian cities and in cities globally. It is well established that human suffering due to extreme heat is exacerbated in urban as compared to rural environments. Understanding the characteristics of urban landscapes that play the greatest roles in exacerbating the human health impact of extreme heat is thus imperative. This study explores the relationship between the amount of canopy cover from trees and the incidence of heat-related morbidity during extreme heat events in 544 neighbourhoods of Toronto, Ontario, Canada. Four extreme heat events from three years were studied. Heat-related ambulance calls were found to be 12.3% higher during the heat events than in the preceding or the following week. The number of heat-related ambulance calls was negatively correlated to canopy cover (Spearman Rank rho = −0.094, $p = 0.029$) and positively correlated to hard surface cover (Spearman Rank rho = 0.150, $p < 0.001$). Toronto neighbourhoods, as defined by Census Tracts, with less than 5% canopy cover had approximately five times as many heat-related calls as those with greater than 5% tree canopy cover, and nearly fifteen times as many heat-related calls as Census Tracts with greater than 70% tree canopy cover. These data suggest that even a marginal increase in the tree canopy cover from <5% to >5% could reduce heat-related ambulance calls by approximately 80%. These results have important implications for human health during heat events, particularly in the context of global climate change and urban heat islands, both of which are trending toward hotter urban environments in future.

Climate, soil and land-use based land suitability evaluation for oil palm production in Ghana

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European Journal of Agronomy (2016), Volume 81, Pages 1-14

In the past decade, oil palm (*Elaeis guineensis Jacq.*) has become the world's most important oil crop. The large demand for palm oil has resulted in a rapid expansion of oil palm cultivation across the globe. Because of the dwindling availability of land in Southeast Asia, most expansion of the industry is expected in Central and South America and sub-Saharan Africa, where land with suitable agro-ecological conditions is available. Using Ghana as a case study, a method for evaluating areas that are both suitable and available for oil palm production is presented. Our assessment used spatial data and GIS techniques, and showed that areas with suitable climatic conditions (annual average water deficit <400 mm) is about 20% greater than was previously identified. The observed differences are the result of using different methods to determine suitability, and climate change. A major climatic factor limiting suitability for oil palm production in Ghana is the annual water deficit, with the most suitable areas located in the rainforest and semi-deciduous forest zones with higher rainfall in southern Ghana. Opportunities for large-scale oil palm plantation development is limited, however, because of the lack of availability of large and contiguous tracts of land that are required for commercial plantation oil palm development. A feasible strategy for oil palm expansion is therefore smallholder production, which can make use of smaller parcels of land. Alternatively, oil palm production in Ghana can be increased by yield intensification on land already planted to oil palm. This can also reduce the requirement for further land clearance for new plantations to meet the growing demand for palm oil. Such assessments will be essential for guiding government policy makers and investors considering investments in oil palm development.

Mangrove vulnerability assessment methodology and adaptation prioritisation

J.C. Ellison

The Malaysian Forester (2016), Volume 79, pp. 95-108, ISSN 0302-2935

Mangroves are vulnerable to climate change impacts such as sealevel rise. Methods for the assessment of vulnerability of mangroves to climate change impacts include initial review of existing information, forest assessment of mangroves, spatial change analysis, grotmd surface elevations in and behind the mangroves, relative sea level trends, sedimentation rates under mangroves, adjacent ecosystem resilience, climate change projections and compilation of local community knowledge. Results showing high vulnerability in any of these can di rectly indicate the adaptation actions that are best prioritised. Actions that reduce existing threats include

improvement of local management, improving legislation that faci litates mangrove protection and sustained use, establ ishment of strategic protected areas and rehabilitation of degraded mangrove areas. Direct adaptation actions include selection of "climate-smart" species in rehabilitation and choice of protected areas, management actions to promote sediment accretion in mangroves, and proactive planning for changed conditions. Ongoing monitoring actions can continue to identitY future trends.

Securing African forests for future drier climates: applying ecophysiology in tree improvement

C. J. Crous, F. S. Malan and M. J. Wingfield

Southern Forests: a Journal of Forest Science (2016), http://dx.doi.org/10.2989/20702620.2016.1207131

Increasing incidences of drought-induced tree mortality are being recorded worldwide, including Africa. African forests cover a significant proportion of the continent, which implies that African forest sustainability is threatened from a climate-change perspective. This is especially problematic in a developing nation context, because forest ecosystems such as plantation forestry provide important goods and services that sustain human well-being and economic growth. Disentangling the likely triggers of tree mortality (including those linked to drought) in landscapes would not only explain the mechanisms underlying local die-offs, but also better predict future mortality events. Methods applied in the field of ecophysiology are particularly useful to study in situ plant responses to an environment. We consider the status quo of global peer-reviewed publication outputs during the past century that have made use of key ecophysiological research approaches, specifically studies concerning 'tree xylem anatomy', 'tree xylem cavitation', 'tree leaf gas-exchange' and 'tree xylem hydraulic conductivity'. We highlight the growth and applicability of this research field in understanding tree ecology. We also assess the role that the forestry sector has had in promoting such research to ensure future-proof forest products. Most importantly, we consider how Africa with its vast forested landscapes fits within this research spectrum. The last decade saw an increase of up to 60% in the total number of articles published, particularly with a focus on tree xylem cavitation and conductivity. Although forest research contributed greatly to the global tally of ecophysiological studies, and such studies in Africa have also increased by up to 88% in the past decade, there remains a general lack of this research topic in the continent. It is clear an optimisation of applied ecophysiological concepts and techniques will promote an improved understanding of tree mortality patterns. We argue that ecophysiological data will be crucial to future-proof tree improvement strategies in African commodity production landscapes, especially given future drier climates.

Carbon balance implications of land use change from pasture to managed eucalyptus forest in Hawaii

S. E. Crow, M. Reeves, S. Turn, S. Taniguchi, O. S. Schubert and N. Koch

Carbon Management (2016), http://dx.doi.org/10.1080/17583004.2016.1213140

Mitigation of climate change via increased plant productivity and soil carbon (C) sequestration during land use change can be a powerful driver of the net greenhouse gas emissions of a sustainable production system. Yet the net climate change mitigation of managed forests is affected by both tradeoffs between C sequestration and non-renewable C emissions and assessment methodology. As a case study, we measured ecosystem stocks to determine the potential C implications of converting pasture to managed eucalyptus forest and compared them with the eucalyptus production system's non-renewable C emissions. The forest border was chosen as the system boundary and operations spanned from forest establishment activities to harvested wood placed at the forest perimeter. Eucalyptus biomass C was 57.2 ± 4.2 Mg C ha−1 and soil C stock (to ~1 m depth) was approximately an order of magnitude greater. By the prevalent method for bulk density-based determination of C stock, conversion of pasture to eucalyptus forest significantly increased soil C stock by 17.5 ± 8.0%. However, no significant change was detected by the equivalent soil mass method, a less prevalent but more accurate approach to detecting differences in soil C stock due to land use or management changes. A 7-year eucalyptus production cycle generated 1.0 Mg C ha−1 in non-renewable emissions, which was far exceeded by the tree biomass C. Thus, even without significant soil C sequestration, this system provided a substantial climate change mitigation service by offsetting non-renewable energy use and C emissions associated with wood production, and providing opportunities for biofuel and bioenergy products to displace fossil fuel products.

Mangrove Payments for Ecosystem Services (PES): A Viable Funding Mechanism for Disaster Risk Reduction?

D. A. Friess and B. S. Thompson

Ecosystem-Based Disaster Risk Reduction and Adaptation in Practice (2016), Volume 42 of the series Advances in Natural and Technological Hazards Research, pp 75-98

Mangrove forests provide a multitude of ecosystem services, many of which contribute to Disaster Risk Reduction (DRR) along tropical coastlines. In the face of rapid deforestation, Payments for Ecosystem Services (PES) schemes such as Reducing Emissions from Deforestation and Forest Degradation (REDD+) has been heralded as a potential avenue for financing conservation, although PES schemes remain in an embryonic state for mangroves. Several challenges must be overcome if mangrove PES is to advance. Firstly, challenges exist in quantifying multiple ecosystem services, especially those that contribute to DRR, such as wave attenuation and the control of coastal erosion. Secondly, the permanence of quantified ecosystem services is a central tenet of PES, but is not guaranteed in the dynamic coastal zone. Mangroves are affected by multiple stressors related to natural hazards and climate change, which are often outside of the control of a PES site manager. This will necessitate Financial Risk Management strategies, which are not commonly used in coastal PES, and introduces a number of management challenges. Finally, and most importantly, PES generally requires the clear identification and pairing of separate service providers and service users, who can potentially overlap in the context of DRR. This chapter reviews and discusses these emerging issues, and proposes potential solutions to contribute to the more effective implementation of mangrove PES. Ultimately however, difficulties in pairing separate and discreet service providers and users may render PES for DRR unfeasible in some settings, and we may need to continue traditional modes of DRR finance such as insurance and donor support.

Projecting the distribution and abundance of Mediterranean tree species under climate change: a demographic approach

D. García-Callejas, R. Molowny-Horas and J. Retana

Journal of Plant Ecology (2016), doi: 10.1093/jpe/rtw081

Distribution and abundance patterns of species arise from the spatiotemporal dynamics of demographic processes. Population rates of birth, death, growth, and patterns of dispersal are, in turn, influenced by environmental conditions and biotic interactions. However, current approaches for modelling large-scale geographical patterns often bypass these simple premises. Centered in the mainland territory of Spain and using Pinus halepensis as a case study, our goal was to gain insight into the main drivers affecting local demographic processes, and how large-scale distribution and abundance patterns are shaped by these local variations in vital rates. We applied the integral projection methodology to develop a spatially explicit demographic model of tree species in mainland Spain, using individual-level data from a national forest inventory. In our integral projection model, environmental conditions and competitive interactions influence the survival, growth and reproduction of trees, and we model explicitly the dynamic colonization of new patches. With this framework, the projected distribution and abundance patterns of Pinus halepensis up to 2090 were evaluated under two different climate scenarios. When environmental conditions were kept constant, populations tended to decrease in net number of adults and to increase in net basal area, thus consisting in fewer and bigger individuals. Accounting for climate change in our simulations exacerbated the trend in mortality, causing widespread losses in number of trees, and few locations maintained populations of more than 100 adult individuals per hectare. The expected increase in mortality under climate change, on the other hand, prompted a higher degree of regeneration via the release of niche space, although not enough to maintain current abundance levels. Colonization spatial patterns did not vary significantly with climatic conditions, but the species was able to increase its distribution under climate change more than in a constant climate scenario. Our approach yields relevant information at different spatial scales, from plot-level processes to large-scale abundance patterns. With it, we clearly indicate the strong role that climate change could have in shaping future forest communities through its differential influence on demographic processes.

V. PUBLICATIONS, REPORTS AND OTHER MEDIA

A new role for forests and the forest sector in the EU post-2020 climate targets

European Forest Institute – 2015 / 32 pages

EU forests and the forest sector play a significant role in the EU greenhouse gas balance. This study aims to support EU policy-makers in answering this complex question by: (1) determining whether and how to use forests' sinks and substitution effects as a means to meet the EU's post-2020 targets, without decreasing the overall level of ambition, and (2) identifying new principles and measures to reap the potential of the forest sector to contribute to climate change mitigation in the EU, in synergy with other regional priorities in the land use sector.

Land degradation, desertification and climate change: anticipating, assessing and adapting to future change

Mark S. Reed and Lindsay C. Stringer – 2016 / 183 pages

Climate change and land degradation have an iterative relationship, driving or exacerbating one another through positive and negative feedback loops. Higher temperatures, changing precipitation patters and more extreme weather fuel the erosion of fertile soils through wind and water. In turn, severe land degradation, especially in the world's drylands, reduces the provision of ecosystem services with devastating consequences for food production, human well-being and the climate.

Do Extreme Weather Events Generate Attention to Climate Change?

M. R. Sisco, V. Bosetti, and E. U. Weber – 2016 / 25 pages

Analyzes were carried out on the effects of 10,748 weather events on attention to climate change between December 2011 and November 2014 in local areas across the United States. Attention was gauged by quantifying the relative increase in Twitter messages about climate change in the local area around the time of each event. Coastal floods, droughts, wildfires, strong wind, hail, excessive heat, extreme cold, and heavy snow events all had detectable effects. Attention was reliably higher directly after events began, compared to directly before. This suggests that actual experiences with extreme weather events are driving the increases in attention to climate change, beyond the purely descriptive information provided by the weather forecasts directly beforehand. Financial damage associated with the weather events had a positive and significant effect on attention, although the effect was small. The abnormality of each weather event's occurrence compared to local historical activity was also a significant predictor. In particular and in line with past research, relative abnormalities in temperature ("local warming") generated attention to climate change. In contrast, wind speed was predictive of attention to climate change in absolute levels. These results can be useful to predict short-term attention to climate change for strategic climate communications, and to better forecast long-term climate policy support.

Model assessment of impacts of climate change, forest management and transfer of forest reproductive material

K. Kramer, M.-J. Schelhaas, B. van der Werf, and G. Hengeveld – 2016 / 169 pages

The model ForGEM was parametrized, validated and initialized throughout the distribution range of Fagus sylvatica, Quercus robur, Picea abies and Pinus sylvestris. The model was used to assess the effect of environmental drivers on the performance of these species, the role of forest management on adaptation of functional traits and the species' genetic diversity throughout the distribution range, and extensive provenance trials were performed in silico.

Bioenergy Harvest, Climate Change, and Forest Carbon in the Oregon Coast Range

M. K. Creutzburg, R. M. Scheller, M.S. Lucash, L. B. Evers, S. D. Leduc, and M. G. Johnson – 2016 / 39 pages

Forests provide important ecological, economic and social services, and recent interest has emerged in the potential for using residue from timber harvest as a source of renewable woody bioenergy. The long-term consequences of such intensive harvest are unclear, particularly as forests face novel climatic conditions over the next century. We used a simulation model to project the long-term effects of management and climate change on above- and below ground carbon storage in a watershed in northwestern Oregon. The multi-ownership watershed has a diverse range of current management practices, including little-to-no harvesting on federal lands, short-rotation clear-cutting on industrial land, and a mix of practices on private non-industrial land. We simulated multiple management scenarios, varying the rate and intensity of harvest, combined with projections of climate change. Our simulations project a wide range of total ecosystem carbon storage with varying harvest rate, ranging from a 45% increase to a 16% decrease compared to current levels. Increasing the intensity of

harvest for bioenergy caused an additional 2-3% decrease in ecosystem carbon relative to conventional harvest practices. Soil carbon was relatively insensitive to harvest rotation and intensity, and accumulated slowly regardless of harvest regime. Climate change reduced carbon accumulation in soil and detrital pools due to increasing heterotrophic respiration, and had variable effects on total ecosystem carbon, ranging from a 5% decrease to a 2% increase depending on management scenario. Overall, we conclude that current levels of ecosystem carbon storage are maintained in part due to substantial portions of the landscape (federal and some private lands) remaining unharvested or lightly managed. Increasing the intensity of harvest for bioenergy on currently harvested land, however, led to a small reduction in the ability of forests to store carbon. Climate change is unlikely to substantially alter carbon storage in these forests, absent shifts in disturbance regimes.

Adaptive management of forests and their genetic resources in the face of climate change

Kramer, K.; Mátyás, C. – 2016 / 04 pages

Decline in health and growth of forests induced by climate change has been reported in different parts of the world. In Europe, low-elevation, drought-prone forests of south and south eastern Europe are particularly exposed to pressures from climate change. In these regions, forests have a significant economic value, and play an important role in the regulation of the hydrological cycle and preservation of biodiversity. A key attribute for tree species to withstand environmental changes is the level of their intraspecific diversity, as that allows adaptation to changes. The conservation and sustainable use of forest genetic diversity have implications with regard to the maintenance of healthy forest ecosystems in the face of environmental changes. Scientists within the EU-funded project FORGER endeavoured to determine the extent to which four widespread forest tree species in Europe may be affected by climatic change, by making use of field trials and modelling tools.

Using Forests to Enhance Resilience to Climate Change: The Case of smallholder agriculture in Savannakhet Province in Lao PDR

Kramer, K.; Mátyás, C. – 2016 / 04 pages

Decline in health and growth of forests induced by climate change has been reported in different parts of the world. In Europe, low-elevation, drought-prone forests of south and south eastern Europe are particularly exposed to pressures from climate change. In these regions, forests have a significant economic value, and play an important role in the regulation of the hydrological cycle and preservation of biodiversity. A key attribute for tree species to withstand environmental changes is the level of their intraspecific diversity, as that allows adaptation to changes. The conservation and sustainable use of forest genetic diversity have implications with regard to the maintenance of healthy forest ecosystems in the face of environmental changes. Scientists within the EU-funded project FORGER endeavoured to determine the extent to which four widespread forest tree species in Europe may be affected by climatic change, by making use of field trials and modelling tools.

V.I JOBS

Senior Forestry Officer (Climate Change and Resilience Team Leader)

FAO – Deadline is 28 September 2016

The Senior Forestry Officer reports to a Deputy Director, FOA, with a high degree of autonomy to provide managerial and technical leadership, guidance and support to the members of the Climate Change and Resilience Team. Key Results: Leadership and technical policy expertise for the planning, development and implementation of Departmental / Division Programmes of work, projects, products, services in accordance with (Departmental &) FAO Strategic Objectives.

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 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 prepared by:

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