Rehabilitation of war veterans with posttraumatic stress disorder in a healing forest garden

Poulsen, Dorthe Varning; Stigsdotter, Ulrika K.

The IUFRO Incubator 2014 Abstract Volume

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IUFRO Incubator 2014

Foreword

The IUFRO Incubator is a new feature in the scientific program of IUFRO's World Congress. The objective of these sessions is to provide students and young scientists an opportunity to present and discuss their thesis or other similar work among an international audience of forest scientists and fellow students.

Each student is allowed only three minutes of presentation, so only key issues and main conclusions can be addressed. This mode of operation was chosen to allow a large number of students an oral presentation of their work, but also to ensure relevance and dynamics in the sessions.

The IUFRO Incubator originated from discussions among the organizers - representatives of the Congress Scientific Committee (CSC) and the International Forestry Students' Association (IFSA) - and was subsequently further developed for the XXIV IUFRO World Congress in Salt Lake City, Utah, USA in 2014. We gratefully acknowledge the support and input provided by our CSC and IFSA colleagues during this process.

We are pleased to offer three IUFRO Incubator sessions encompassing essentially all aspects of forest research. We hope you will enjoy the program and contribute to the discussions, for the benefit of students and young scientists, but hopefully also for the long-term progress of forest science.

John Parrotta   Jens Peter Skovsgaard
Chair, World Congress Scientific Committee   Coordinator, IUFRO Incubator 2014

IUFRO Incubator Session Schedule

SESSION 1   Forest Ecology, Biodiversity and Silviculture
Monday, October 6th
3.30 pm – 6 pm

SESSION 2   Forest Inventory and Modeling, Forest Health, Tree Physiology and
Genetics, Forest Operations, Engineering, Products, Biomass and
Bioenergy
Tuesday, October 7th
8 am – 10.30 am

SESSION 3   Forest Policy, Social Sciences and Forest Economics
Tuesday, October 7th
3.30 pm – 6 pm

SESSION 1

Forest Ecology, Biodiversity and Silviculture

The ecology of Lowe's monkey (*Cercopithecus campbelli lowei*) in Kakum Conservation area, Ghana

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The ecology of Lowe's monkey (*Cercopithecus campbelli lowei*) was investigated at Kakum Conservation Area of Ghana in both dry and wet seasons in 2009 and 2010. Analysis of satellite images and field survey was done to evaluate the dynamics in canopy coverage, species density and composition of the vegetation. Lowe's monkey density and relationship with other living and non-living components were determined. Foraging and feeding behaviors were studied plus proximate analyses of three fruits consumed by the monkeys were determined. The number of tree species enumerated was 97, distributed from 37 to 92 trees per 0.20 ha in eight sampled areas. The mean density of Lowe's monkey was found to be 0.99 and 1.07 per km in the wet and dry seasons respectively. With reference to the implementation of conservation practices in 1993, the average density of the Lowe's monkeys has increased from 0.31 to 1.03 with an average group size of 10.2 in the wet season while in the dry season the mean group size was 11.8. Hunting which could negatively affect the population of monkeys has largely been controlled in the Kakum Conservation Area in recent times. The Lowe's monkey should be promoted as an icon species for it to get conservation, political and public attention and so as to save their populations from collapse.

Relationship between vegetation structure and diversity of dung beetle: a comparison between a fragmented forest, agroforestry system and monoculture

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The Atlantic Forest is considered one of the most important biomes of the world due to its high biodiversity and ecosystem functions. However, this vegetation is fragmented into portions of small dimensions sparse in a agricultural predominantly matrix. Fragmentation causes changes in the environment, reflecting the loss and displacement of biodiversity, being the insects among the most affected groups. Insects are bioindicators of forest fragments degradation. Given their sensitivity to environmental changes, the insects of Scarabaeidae family (dung beetle) are good indicators of disturbance. The objective of the study was to analyze the diversity and abundance of dung beetle in three vegetation systems in Piracicaba-SP, Brazil. The systems were characterized with respect to their structure and micrometeorological condition. The insects were collected monthly from August 2013 to March 2014 using pitfall traps, and quantified and identified to species level where possible. Based on the results, it is possible to have a view of the population dynamic of these insects, and thus, examine the role of the agro-ecosystems in its preservation and as a liaison or rupture in the landscape.

Spatial aspects of biodiversity as a part of harvest scheduling decision process

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Over the last decade, influence of non-wood productive functions, such as environmental, have been increasingly expanding. We can expect that the impact of these functions will continue to grow due to mitigation of climate change impact. As a result, foresters have to seek tools for solving complex ecosystem management problems that include social, environmental and timber-productive functions. The real forest management problems are multi-objective, it means they include more than one objective, and a lot of different restrictions and constraints as well, such as configuration of patches, their size and distribution, shape, adjacency or green-up delay, connectivity, proximity or core area and many others. These problems can be solved by special exact mathematical methods such as multi-objective programming and by tools of geographic information systems (GIS). The use of multi-objective programming in forestry brings many risks. Objective determination of objective weights can be one of the many problems. Other problem is that each objective takes vastly different values in real environmental problems in most cases. This work presents some possible solutions for this on the example of spatial harvest scheduling with regards to the some aspects of biodiversity. Results indicate that harvest balance and sustainability can be achieved also in case of biodiversity conservation.

Multiple species responses to forestry disturbance: a case of epiphytic lichens

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Forestry effects on biodiversity are a pressing but complex topic. Many ecological processes are influenced by management practices and those effects emerge at different scales in space and time. In this study we evaluate the effects of the logging disturbance on epiphytic communities of retention trees, trees left behind at logging, both in the short and longer term. Since forestry practices are similar among regions in Sweden, and different tree species are left in comparable environments, this creates an opportunity to look for generality in epiphyte response across regions and between tree species. In total 2400 tree stems were surveyed for all epiphytic lichen species occurrences up to two meters, on the four most common tree taxa in Sweden, and in four different regions. The survey was conducted on trees in three forest stand categories: old forest not yet logged, and stands logged 3-8 years and 15-20 years previous to the survey containing retention trees. Alpha as well as gamma diversity increased after logging on trees in our study. In order to distinguish whether this diversity consists of certain epiphytic specializations favored by tree retention, or if it marks an increase in habitat generalists, we model and compare the occurrence patterns of ca 150 species.

High resistance to the 2010 drought of the arboreal component of a terra firma forest in the Northwest Amazon

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In the last decade the Amazon forest suffered two severe droughts, in 2005 and 2010. The influence of the latest on those forests has not yet been tested with observational data. In this study the direct effect of the 2010 drought over the mortality rate of trees of 14,519 individuals with DBH ≥ 10 cm was evaluated on a 25 ha permanent plot located in the Amacayacu National Park, Colombian Amazonia. Mortality rates of the individuals (TMI) and of the biomass (TMB) were estimated throughout the plot, for individuals with different wood density in two topographic units (ridges and valleys) and three diameter categories (10≤ DBH<20cm, 20≤DBH<30cm and DBH≥30cm). Confidence limits were estimated by bootstrapping with replacement across 20x20m subquadrats, 1000 times. Significant differences were determined by Analysis of Variance, Student's t test and Tukey HSD. The TMI and TMB whole plot was 1.75 (1.60-1.92) and 1.72 (1.40-2.07) %yr^{-1}, respectively. The main mortality results for the drought period were lower than those reported for other tropical forests under drought conditions. A detailed mortality analysis identified a modest effect of the 2010 drought on this ecosystem. The discussion suggests low sensitivity to the 2010 drought of the Permanent Plot Amacayacu forest.

Climate-growth analysis for a Brazilian dry forest site

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As a consequence of the running process of climate change, tropical forests may experience dramatic changes in the patterns of temperature, rainfall, and climate extremes manifestations. Current models predict a 3° to 6^OC increase in temperature, and decrease of up to 40% in precipitation volume for Brazil's northeastern region, where this study was conducted. Little is known about how the tree component of this area ecosystem will react to these changes. In the current scenario, trees' growth responses to climate change is of great interest, and through the interpretation of tree-ring time series from *Cedrela odorata* trees (Spanish cedar), this relationship could be elucidated. The constructed tree-ring chronology (23 trees; 40 radii) allowed the correlation with local and global climate drivers spanning the last 110 years. Tree-ring width indicates that annual tree growth was closely related to the local climatic variability, as it was strongly correlated with rainfall and sea surface temperature data. The chronology strong correlation with an index of ENSO severity (El Niño Southern Oscillation) also suggests that large-scale climatic phenomenon have important influence on *Cedrela* growth.

Climate influence on radial growth of *Fagus sylvatica* near to the lower edge of distribution in Hungary

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Future of beech (*Fagus sylvatica* L.) in a changing climate is one of the greatest debates in Europe among the studies dealing with the climate change generated xeric limit shifting. We investigated a submontane beech stand's growth response to climate change during the past 60 years following dendrochronological methods. Tree-ring width data were processed using three alternatives of standardization. To recover the basic climate-growth relationships for beech we analyzed the correlation between the tree-ring width indices and monthly precipitation and temperature data, furthermore two drought indices were employed. Late spring-early summer precipitation was the primary climatic factor governing the beech growth at the study site since the early 1950s, while summer heat played a secondary obstructive role documented by the significant negative correlation. A 30-years running window correlation was used to identify whether the climate-growth connections changed due to the unfavorable climatic trends. The results indicated no evidence of a distinct decline in radial increment, however, a significant increase in climatic impact on growth have been detected including probable changes and shifts in the vegetation period.

Dendroclimatic relationships and possible implications for oak (quercus sp.) in central Poland

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The study investigates the influence of climate conditions on radial increment of oak, with special concern to the situations when analysed trees formed conspicuously wider or narrower tree rings. The research material was collected in central Poland within natural range of pedunculate and sessile oaks. The elaborated residual chronologies were correlated with CRUTS 3.1 climate data. The analyses included thermal and pluvial conditions spanning from April of the year prior to ring formation to September of the current growth year. Special interest was paid to simple water ability index that combined both temperature and precipitation during the vegetation season. Additionally, pointer year analysis was carried out to determine situations when conspicuously smaller or larger increment was formed. The analysed oaks exhibit growth patterns comparable with those known form previous studies concerning that species, where higher and positive influence of precipitation and negative temperature have been observed. Extreme growth reactions expressed by negative and positive pointer years turned to present high dependence of analysed oak' growth on water availability during vegetation season.

How silvicultural treatments and site quality affect carbon storage in a mixed species forest in Maine, USA

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Developing forest management strategies for addressing global climate change is one of the foremost challenges facing resource managers and policy makers today, but little is known about the impacts of alternative management regimes on carbon cycles in many forest types. Long-term studies composed of different silvicultural and harvesting regimes can be used to identify the management practices most likely to increase carbon storage in managed forests. The overall goal of this project is to evaluate the influence of nearly 60 years of different silvicultural regimes and site quality on carbon storage on the Penobscot Experimental Forest in Maine, USA. The primary objective of the study is to evaluate the effects of a control and three silvicultural systems on current total ecosystem carbon and carbon stored in harvested wood products. In 2012, live trees, dead wood, understory plants, and soils were measured on permanent sample plots to estimate total ecosystem carbon. Long-term data collected from the permanent sample plots were used to determine carbon storage in harvested wood products. The results of this research will allow landowners to make informed decisions on which management practices and sites have the potential to maximize carbon storage in various carbon pools.

Test domestication *Halopegia azurea* (K. Schum.) (*Marantaceae)*: Preliminary study on the propagation of rhizome in Community Forest of COPAL (Cameroon)

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In order to domesticate *Halopegia azurea*, tests cuttings from the rhizome and acclimatization of seedlings was carried out. The evaluation of the best substrate for propagation was done with four substrates (0: wetland; 1: sand/wetland, 2: sawdust/wetland; 3: sand/sawdust/wetland), and the growth of the seedlings were also observed *in situ* for 8 weeks. There was a significant difference ($P<0.05$) due to the appearance of seedlings and shootings of new leaves in the nursery. The greatest averages numbers of seedlings and leaves were found in the wetland and sand/wetland, lowest in sawdust/swampy. The mortality also had a significant influence ($P<0.05$), the highest rates were observed in the sawdust/wetland of 68.75% and 53.12% in the sand/sawdust/wetland. The emergence of new leaves and young shoots showed a significant difference in the course of the development of the farm. The highest number of leaves was observed in plants grown in the wetland and sand/wetland, lowest growth of the young plants in sawdust/wetland. The appearance of new shoots was observed only in plants grown in the wetland and sand/wetland.These results suggest that it is possible to domesticate *Halopegia azurea* for leaf production in quantity and quality, and opens up better opportunities for its cultivation.

Ecological impact of harvesting Marantaceae species from swampy ecosystems

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Leaves of two Marantaceae species *Halopegia Azurea* and *Marantochloa purpurea* are harvested from swamps in large quantities every year for commercial purposes. This study seeks to understand the impact of overharvesting Marantaceae species and its contribution to the disappearance of Marantaeae swamps. Interviews and focus group discussions were carried out in 8 villages in Southern Cameroon to determine the harvesting methods, frequency and tenure. Also, 20 x 20 plots were established to document the population structure, trees, lianes, shrubs and food crops present in the swamps. Only mature leaves are harvested all year round with large quantities in the rainy season. Harvesting on a particular land parcel occurs twice a month. Swamps are burned during the dry season to stimulate regeneration of leaves. Another NTFP typical of these swamps is raffia *(Raphia Africana)* used for construction and palm wine. In the 1980s many swamps were cleared and tested for rice cultivation which had a significant contribution to the disappearance of the swamps today. The use of fire, open access and the gradual conversion of Marantaceae swamps into farmland also influenced habitat destruction. Hence, the need to introduce a management plan to prevent further degradation and loss of Marantaceae swamps.

Growth of *Cedrela odorata* L. and incidence of *Hypsipyla grandella* Zeller as affected by nutrient management

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Cedrela odorata is one of the most important native forest species in México; however, plantation projects with this species have been limited because of the irruption of the meliaceae shoot borer. In some cases, improvement of the internal nutrient balance of plant species has proved effective to increase plant resistance to pest attacks. Accordingly, the objective of this research was to assess *C. odorata* growth as well as the incidence of *H. grandella* as a function of the application of nitrogen, phosphorus, and potassium, in a Spanish-cedar plantation located at Papantla, Veracruz, Mexico. This was achieved by using a factorial experiment with arrangement of experimental units according to a complete randomized design. The fertilizer materials used were, for nitrogen, urea; for phosphorus, calcium simple superphosphate; and, for potassium, potassium sulfate. Diameter and height increments as well as pest incidence-related variables were evaluated periodically. Results indicate that tree diameter was statistically affected by the applied nutrients. The analysis of variance on physiological variables denotes significant effects of the application of potassium. The phosphorus/potassium interaction exerted significant effects on diameter. According to the Kruskal-Wallis test, fertilization with nitrogen showed significant effects on the quantity of new shoots in October 2012. Similarly, a decrease in the shoot borer incidence with the application of potassium was observed, although this effect was not statistically significant.

Cultural practices for producing *Enterolobium cyclocarpum* and *Swietenia humilis* seedlings with appropriate features to reforest low fertility soils

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Based on the context that top pruning and fertilization in the nursery are cultural practices that improve seedling quality as long as the intensity of pruning and fertilization regime are appropriate, the effects of three top pruning intensities (0%, 25% and 50%) and two fertilizer regimes (traditional and exponential) in *Swietenia humilis* seedlings were studied throughout the evaluation of various morphological and physiological indicators of quality, and a quality test trial. There was no synergy between the two practices; yet, each factor influenced independently on the indicators evaluated. The top pruning at 25% and 50 % did not improve the seedling quality of *S. humilis*. In contrast, the exponential supply of nutrients had a favorable effect because it promotes high nutrient reserves. Additionally, the results provided by the quality test trial showed that characteristics acquired by the exponential fertilization effect allow seedlings to perform satisfactorily when low nutrient availability is a limiting factor.

Forest dieback in disturbed wet sclerophyll forests due to tri-trophic interactions: can management of Lantana halt vegetative declines?

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The bell miner, *Manorina melanophrys*, is an aggressive social honeyeater that forms colonies of hundreds of individuals that exclude other insectivorous birds from large tracts of forest. This exclusion, coupled with non-lethal foraging on parasitic Psyllidae is thought to be responsible for wholesale dieback in Australian Eucalypt forests, although the precise mechanisms are currently unknown. We tested the importance of a third factor, lantana, *Lantana camara*, understorey infestation, on insect canopy assemblages, site fidelity of the miners and impacts upon forest health. Data were collected between 2012-2014 across two temperate and two tropical forests, with 24 matched pair quadrats surveyed each season for bell miner density, lantana growth, soil characteristics and vegetative health. Canopy insect assemblage in areas with and without bell miners were also sampled for comparison. Half of these sites were sprayed to remove the introduced lantana understorey in the first year. Lantana health declined with spraying, as confirmed by satellite analysis and ground-truthing, but this had no impact on bell miner occupancy or behaviour, and further did not influence canopy health, which remained similar to control sites. Rather than a lantana understorey facilitating occupancy of sites by miners, it appears that this habitat is preferred but not essential to miner occupation. In terms of amelioration techniques, our data suggest targeting seasonal fluctuations in Psyllidae numbers is a more promising avenue of future research.

Hydrological effects after timber harvesting of Eucalyptus plantation

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We compared pre and post effects of timber harvesting of eucalyptus plantation in water quantity and quality at an experimental watershed. Study area has 75.2 ha covered with Eucalyptus plantation (62.8%) and native vegetation around streams (37.2%), with a shallow soil (< 40cm) and an intermittent streamflow. Daily streamflow and water samples were collected to determine physical and chemical characteristics. In the post harvesting year, total annual rainfall was 17% lower (300mm) than previous one, resulting in a greater number of days with zero streamflow. Moreover, the relationship between annual streamflow and annual precipitation increased by 14% in the post harvesting period, probably by lower rates of evapotranspiration. With exception of nitrate, the following variables have increased annual averages after harvesting: phosphorus (11%), potassium* (25%), calcium* (26%), magnesium* (32%), water conductivity* (25%), suspended sediment (26%), turbidity (48%) and color (16%). Quantitative and qualitative effects after harvesting were expected due to the extension of clearcutting area and could be higher if native vegetation around streams were not maintained. Continuous hydrologic monitoring will reveal how long it will take to return at pre harvesting levels along new forest plantation growing. *statistically significant

Soil nutrient dynamics 22 years after lime application and gap creation in a European beech (*Fagus sylvatica* L.) forest

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Forest management has a considerable influence on the soil nutrient dynamics of forest ecosystems. This study was designed to examine the long-term effects of lime application and canopy removal on soil nutrient dynamics in a European Beech (*Fagus sylvatica* L.) forest. In 1989 trees were felled to create four 30 m wide circular gaps in this beech forest, and 3 t ha^{-1} fine dolomite was applied to two of these gaps and the surrounding area whereas the remaining two gaps and most parts of the stand remained untreated. The soil nutrients of the forest floor (OL, OF, and OH layers) and of the mineral soil in different depths (0-5 cm, 5-10 cm, 10-20 cm, 20-30 cm, and 30-40 cm) were determined in 1997 and 2011. In addition, we examined the influence of liming and gaps on the forest floor organic matter. In 1997 the effects of liming, gaps, and a combination of the two on forest floor dry mass were significant but in 2011, were no longer significant. The effects of gap creation, liming, and the interaction of liming and gaps on C, N, and C/N ratio in the forest floor were more significant in 1997 compared to 2011. However, the effects of gaps and liming on C and N were still significantly twenty-two-years after applying the treatments. Liming and gap creation have positive effects on P, K, and Mg accumulation in the forest floor, especially in the OH layer. K losses do not exist in any plots or layers in the forest floor and gap without liming results in a decrement of forest floor P and K in OL and OF layer. The combination effects of liming and gap increased soil pH and mitigated soil acidity, with the effects decreasing downward in the soil profile. The increase of the Fe contents in untreated stands, unlimed gaps, and limed stand were observable 8-22 years after treatments. Overall, canopy opening combined with liming could positively affect nutrients in soil profiles in the over mature European beech forest twenty three years after applying the treatments.

Changing the shape of trees in regrowth forests of Australia

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Thinking and fertiliser application in regrowth native forests in Australia has been studied to increase forest productivity over more than two decades. However, stem growth responses from these treatments were commonly estimated using equations that relate volume to tree dimension(s): diameter and/or height. It was rarely the equations take into account tree shape and taper. This might offer inaccurate response estimates if the treatments result in uneven distribution of growth along the stem. The long-term effect of thinning and fertiliser of nitrogen (N) and phosphorus (P) application on stem form were assessed in four sites of regrowth forests dominated by *Eucalyptus sieberi* in South-eastern Australia. Relative curves of stem form of individual tree were compared among treatments. Significant differences in shape existed between control and treated trees, but taper was only significantly different at butt swell (the bottom 2.5m of the stem) but not on the upper stem (2.5m up). Further analysis on the necessity of development of treatment-specific stem form equation to the accurate estimation of total stand volume is needed. This is essential due to its high amount of cost and effort versus the availability of improved laser technology in measuring upper stem dimension.

Preliminary investigation of flood tolerance potentials in three indigenous tree species in Nigeria

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weeks. The plants were subjected to two treatments: flooded and non-flooded. Ten seedlings of each species were subjected to each of the two treatments and were replicated five times in a 2 X 3 factorial experiment in a completely randomised design. A total of (50 plants per species and150 plants per treatment) 300 plants were used for the experiment. Non- flooded plants were irrigated every other day while flooding was imposed by placing the plants in water filled containers, providing a water level of at least 3-5 cm above the soil surface (depending on the height of the species at the time of transfer). The cotyledons of the flooded plants were under water, but all true leaves were above the water line. The variables measured fortnightly on each of the seedlings for sixteen weeks were: the seedling height, Collar diameter (measured above the soil surface) and the total number of leaves on each plant. For biomass estimation, five plants from each of the species were randomly harvested from the replicates per treatment. This makes a total of 30 seedlings every fortnight. Each plant was separated into 3 components; leaf, stem and root and the following variables were measured fortnightly over a period of sixteen weeks: Leaf area, (which was obtained using leaf area meter), for biomass estimation, the wet weight of the samples (leaf, stem and root) were determined. The samples were oven dried at 600c for 72 hours to a constant weight to obtain the dry matter component. Leaf biomass, root biomass and stem biomass. The data generated were subjected to descriptive statistics and Analysis of variance (ANOVA) Where there were significant difference (at 5% probability level),Duncan Multiple Range Test (DMRT) was used to separate the means. *R racemosa* had the highest growth performance; height (49.86cm), collar diameter (20.10mm) and the leaf area(358.80cm2) respectively, compared with *A.congensis* which had the least height (9.83cm), collar diameter (2.9mm) and the leaf area (70.40cm2). However, in terms of biomass accumulation, the highest leaf biomass accumulation was observed in *A.congensis* (79.89g), while the highest stem and root biomass was observed in *C. Patens* (65.85% and 83.83% respectively). There was no significant difference between C. patens (65.85%) and *A.congensis* (64.70%)in stem biomass and between *A.congensis* (69.65%) and *R racemosa* (66.82%) in root biomass. It could be concluded that C. patens in a flooded condition, will maintain a moderately but continuous high growth rate and biomass accumulation. Thus *C paten* which performed best in the flooded regime may be the candidate specie of flood management.

Evaluation of the influence of lianas on growth and hydraulic physiology of host trees in a forest fragment in Brazil

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Lianas are important components of tropical forest ecosystems. However, there is a negative effect when an imbalance of these plants occurs on host trees, restricting the normal progress of forest succession. In this context, the objective of the study is to evaluate the influence of lianas on diameter growth and hydraulic dynamics of 5 native species in a degraded forest fragment in southeastern Brazil, being *Trichilia clausenii*, *Piptadenia gonoacantha*, *Aloysia virgata*, *Bauhinia forficata* e *Ceiba speciosa*. About 15-20 trees/species, located in circular plots (radius 10 m) were selected and subjected to 2 treatments: one counting with lianas management (removal of all lianas) and another without any kind of management (control). In order to follow the continuous diameter growth, 90 dendrometers bands were installed at breast height in September 2012, and 2 years of monthly measurements were taken. For the evaluation of hydraulic physiology, analysis on leaf water potential and stomatal conductance will be performed during the dry season of this year (July-August 2014). Initial results indicate that *P. gonoacantha* and *C. speciosa* had the highest increase in trunk diameter. Other results will be presented in special session of Congress, pointing aspects of strategic importance for forest restoration projects in Brazil.

Sylvigenetic Analysis of the Tropical Wet Forest of La Cangreja National Park, Central Pacific, Costa Rica

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Information of 13 years (1998-2011) from six sites with permanent sample plots at La Cangreja National Park, Costa Rica, was analyzed to determine forest sylvigenetic development. On 2011, annual averages values were: mortality 1.88±0.62%, recruitment 1.5±0.34%, Nha^{-1} 555±52 and Gha^{-1} 39.6±6.0 m2ha-1. Correspondence and cluster analysis determined that exist three kinds of forest on the six sites studied. a.) Logged forest: on Phase III dynamic of Sylvigenesis; G 38.2 m^{2}ha, Nha^{-1} 560, mortality 2.05%, recruitment 1.41%. In the future, it is expected that this forest holds the actual structure and floristic composition. b.) Mature secondary forest: on Phase III homeostatic of Sylvigenesis; G 53.01 m2/ha, N/ha 568, mortality 1.2%, recruitment 1.76%. The future of this forest would depend of *Ficus insipida* trees mortality. If they die and decomposed standing up, saplings would have chance to reach the canopy and close gaps but if they fall, gaps size would be bigger and Sylvigenesis would return to the Phase II or Phase I. c.) Intermediate maturity secondary forest: on Phase III dynamic of Sylvigenesis Gha-1 31,75 m2, Nha-1 522, mortality 1,88%, recruitment 1,64%. In the future is expect that pioneer species keep on dying, and gaps will be closed by established regeneration of partial tolerant shade species into low diameter class.

Analysis of the qualitative and quantitative phenotypic traits of *Quercus petraea* and *Querqus robur* in Forest Căpriana, Republic of Moldova

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Research has aimed at analyzing stationary conditions, the trees and the quantitative and qualitative characteristics of sessile and pedunculate oak trees in Forest Căpriana.

The working method were selected three forest stands of the same age class of main types of stationary 6157 and 6155.

Each forest stand was made for 30 trees phenotypic description of the species based respectively accompanying species.

The analysis of the three areas of study in Forest Căpriana can make the following conclusion: *Quercus petraea* being in suboptimal vegetation behave quite well in the studied forest stands in comparison with *Querqus robur* which is in the most favorable stationary conditions.

Experimental study of the effect of the exotic invasive shrub *Rhamnus frangula* on understory tree seedling and herbaceous plant growth

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To test the hypothesized negative effect of the exotic invasive shrub *R. frangula* on understory tree seedling and herbaceous plant survival and growth, we will use the understory of a 15 year-old experimental hybrid poplar plantation. The plantation (southern Quebec, Canada) contains 9 hybrid poplar clones, planted in 3 replicate blocks. Seedlings of 2 tree species (under 5 clones) and 4 herb species (under 2 clones) will be planted May 2014. In 2013, herbicide was applied to half of the poplar plots (split-plot); all remaining stems of *R. frangula* will be cut to obtain a complete removal treatment. This design, within a regularly spaced plantation of poplars of the same age, reduces confounding factors to the minimum (forest composition, spatial structure, age & size of seedlings & herb plants). Deer browsing will be prevented with a high exclusion fence. Environmental factors (light, soil nutrients and moisture, poplar basal area, understory vegetation biomass, *R. frangula* biomass (using allometric relationship with diameter at base)) will be measured. Growth and survival of seedlings and plants will be measured for 2 growing seasons. ANOVA will determine if *R. frangula* removal had an effect on seedling or herb growth and survival, and if any other factor had a stronger effect.

Understory plant community response to forest management in a second-growth hardwood forest in the eastern United States

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The understory is a vital part of temperate forested systems, providing significant contributions to both diversity and ecosystem function. Historically undervalued, there is an increasing understanding of the importance of this stratum for both forest management and conservation. Although there has been much research on the effect of forest harvesting on understory plant diversity, the mechanisms driving those responses are not well understood. In addition, isolating specific forest harvesting factors (e.g. harvest intensity, environmental conditions) and examining their roles on understory plant communities is rarely done. This study examines understory plant community response to forest harvesting in a second-growth managed forest. First, we describe trends in diversity and demographics in response to environmental conditions, land-use history and forest harvesting from a landscape-scale observational study. Next we isolate specific harvest related variables in an experimental gap experiment to explore the role of site, gap position, and disturbance intensity on successional patterns within understory plant communities. This research advances the understanding of how temperate forest understory plant communities respond to forest harvesting, and the mechanisms driving those responses, which is critical considering the importance of the stratum to forest management and ecosystem function.

Stand structure and dynamics of a *Populus euphratica* riparian forest located in the vicinity of Ejina Oasis, Inner Mongolia, China

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To explore ecological mechanisms sustaining a riparian forest growing under unstable environmental conditions, we performed replicate censuses to determine the structure and dynamics of a *Populus euphratica* population in the vicinity of Ejina Oasis (Inner Mongolia). Even when the stands were established on riverside flatland, we detected slight undulations in ground level and salt concentration affected forest structure. *P. euphratica* was preferentially distributed on high ground with high salinity soil. The frequency distribution of tree heights was bimodal, with the population members falling into two groups: those <2 m tall (saplings) and those >2 m tall (canopy trees). Small individuals comprised a sapling bank on the forest floor. The forest canopy was stable over time, but the seedling bank beneath it was highly dynamic. Since total plant water consumption remained constant under different weather conditions, we suggest that strong intraspecific competition for water occurs among canopy trees. Individual saplings persisted for about 5 years, and the sapling bank formed guaranteed regeneration of the forest. We view sapling dieback through partial defoliation as a mechanism for escaping water-deficiency stress.

SESSION 2

Part 1 – Inventory and Modeling

Scaling local tree mortality models to a regional scale using combined estimators in a meta-regression approach

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In Canada, higher spatial scale tree mortality pattern of common Boreal Forest species become more important for forecasting changes in ecological processes at larger scales. Meta-regression analysis were used to develop mortality models for the common Boreal species: aspen (*Populus tremuloides* Michx.), jack pine (*Pinus banksian* Lamb.), white spruce (*Picea glauca* (Moench) Voss) and black spruce (*Picea mariana* (Mill.) B.S.P.). For building regional scale mortality models, tree level long time repeated measures observational data were used form Boreal forest of Alberta, Ontario and Quebec. A modified logistic regression was used to model the annual probability of survival where time periods were irregular. Several combing techniques were compared to select the best approach where Monte Carlo simulation was performed only on Alberta data. The biases, variances, and mean squared errors (MSE) relative to the true model were compared across estimators. Among various combing techniques, the combined estimator using weights provided by inverse variances of local scale model, resulted the lowest biased MSEs and was used to develop the higher spatial scale mortality models.

Site index models for young trees in multilayer silver fir stands in southern Poland

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Silver fir is an important species despite its relatively small share in structure of Polish forests. This species has its northernmost range border in Poland, constituting mostly mountainous forest complexes in southern and central part of the country. Height growth is one of the most important processes characterizing the development of silver fir. One of the results of my PhD thesis are height growth models based on 360 young trees cut and measured in 30 silver fir stands growing in the same site conditions. Calculations were carried out based algorithms giving the ability to optimize very large data sets and fitting parameters such as residual mean square error, mean error and coefficient of determination and three types of height growth models: logarithmic, anamorphic and polymorphic (characterized by the best fit). Developed functions makes possible to understand the growth processes in complex ecosystems such as multilayer silver fir stands. Also applied the developed equations into stand growth models and consequently translated into the share and condition of this tree species in the Polish forests is possible.

Analysis of aboveground carbon sequestration potential of the REDD+ demonstration site in Southern, Leyte, Philippines

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The study was a novel initiative for it was the first demonstration site to account for a reference emission level (REL) that can be used as an interim one for national use. It aims to assess the baseline carbon stocks and potential carbon sequestration of the different REDD+ options in the Southern Leyte REDD+ site. In coming up with the REL, emission factors were derived from 156 plots and activity data from the national land cover change analysis. The results suggest that the project area is a carbon sink with a baseline net emission removal of 0.33-1.06 M tCO_{2eq}/yr. However, emissions from degradation (0.17-0.66 M tCO_{2eq}/yr) accounted for almost half of the total emissions; hence efforts to address this must be considered. A suite of REDD+ mitigation options were also analysed and revealed it can have net emission removals from 0.46-1.54 M tCO_{2eq}/yr. The study also considered the different socio-economic issues related to safeguarding this aspect under the REDD+ mechanism. Bearing these results in mind, the current national deforestation rates and the identified drivers for deforestation and degradation, it would be an opportune time to re-assess where efforts should be concentrated to give realistic results through this mechanism.

Geospatial methods of forest carbon monitoring in relation to land use change for REDD+ in Nepal

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Reducing Emission from Deforestation and forest degradation (REDD) mechanism is thought as the solution by payment for the reduction of GHG emission to the atmosphere due to deforestation and forest degradation. The accepted REL and MRV components are the components of REDD mechanism. Thus the quantification of land use change over the time mainly attributing the forest cover change, aboveground and below ground forest carbon, soil organic carbon (SOC) and the carbon flux over the time are the basis for the carbon benefit measurement. The current study tried to quantify using the geospatial tools from the three different micro watershed of Nepal located in different altitudinal zones i.e. <500m, 1000m and 1500m. The object based image analysis (OBIA) techniques were used to classify the Remote sensing data i.e. Landsat to support as a forest cover changes and Land change modeller were used to model for the future scenario those land use changes. The field measurement coupled with indices from the remote sensing such as NDVI were used for the quantification of AGB and BGB. The SOC was quantified mainly with the field measurements. The result shows that the land use change has considerable contribution to the forest and soil carbon stocks. It is concluded that the geospatial tool has immense scope to quantify the land use change and carbon benefits and made comparison on the relation of such phenomenon with the carbon stocks.

SESSION 2
Part 2 – Forest Health, Tree Physiology and Genetics

Inter-annual difference in the water use of mature sugar maple in response to experimental warming and irrigation

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Sugar maple (*Acer saccharum*) crown dieback, likely related to decreased water availability, is increasing in the Upper Midwestern USA and could be exacerbated further by the expected 3-5° C increase in mean annual temperature. The objective of our study was to investigate the effects of experimental soil warming and irrigation on transpiration rates of sugar maple over three growing seasons. We installed heat dissipation sap flow sensors in 33 trees in eight 100 m^2 plots (two replicates each of four treatments): 1) heat-only, 2) water-only, 3) heat+water, and 4) control. We expected transpiration rates to increase in the water-only treatment, decrease in the heat-only treatment, yet we expected no change in the heat+water treatment as we expected supplementary irrigation to counteract the negative effects of warming-induced soil evaporation. Our results showed that the heat+water treatment was no different than control when precipitation was normal, indicating increased temperature only, when not coupled with low soil water availability, had little effect on transpiration. However, during a drier than average year, transpiration decreased the heat+water treatment compared to control, indicating that the additional water did not compensate for increased soil evaporation. Overall, drought effects due to climate change could potentially increase the prevalence of crown dieback, which may decrease sugar maple productivity on drier sites within its current range.

Investigating drivers of spatial variation in sugar maple leaf morphology with a canopy shading experiment

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The universal pattern of increasing leaf mass per area (LMA) from the bottom to the top of tree canopies has been attributed to natural light gradients or hydraulic limitation due to the negative effects of both gravity and path length on xylem water potential. Our goal was to experimentally tease apart the effects of light and height (a proxy for hydraulic limitation) on leaf morphology. We hypothesized that: 1) light primarily controls LMA while hydraulic limitation effects are negligible; and 2) leaves higher in the canopy have greater morphological acclimation potential (i.e., plasticity). We tested these hypotheses by experimentally shading branches at four height classes (1-3, 7-9, 12-14, and 17-20 m) within a sugar maple (*Acer saccharum*) forest. Branch shading produced similar light conditions across all heights, which enabled the separation of light and hydrostatic effects on LMA. Shading reduced LMA at the highest height classes, but LMA increased with height for shaded leaves despite consistent light conditions. Our results show that leaves acclimated to shading within a single growing season; however, acclimation potential appears to be constrained by hydrostatic gradients in the upper canopy. Our study provided an experimental approach to further understanding interacting factors that affect leaf morphology.

Severity of sugar maple crown dieback in relation to winter climate variables, soil nutrients, and the presence of exotic earthworms

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The contributing factors and temporal severity patterns of crown dieback of sugar maple, Acer saccharum Marsh., was investigated in the Upper Great Lakes Region, USA. A network of 120 evaluation plots was established on private industry and publically owned lands in Michigan, Wisconsin, and Minnesota and evaluated annually from 2009-2012. During that time, mean sugar maple dieback was 12.4% (between 0.8-75.5%) and decreased overall by 5% across the region however, individual plots and trees continued to decline. Relationships were examined between sugar maple dieback and growth, ownership, climate, nutrients, and other biotic and abiotic factors. High levels of forest floor impacts due to exotic earthworm activity was consistently, significantly correlated to high levels of dieback in stepwise regression models. Nutritional status of foliage and soil was also correlated to high levels with dieback and growth suggesting perturbation of nutrient cycling may be predisposing or contributing to dieback. The previous winter's snowfall totals and length of stay on the ground had a significant positive relationship to sugar maple growth rates. An improved understanding of the complex etiology associated with sugar maple dieback is necessary to make appropriate silvicultural decisions.

Variation in photosynthetic temperature responses across vertical tropical forest canopy gradients

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While tropical forests only make up about 15% of global terrestrial surface, they account for over 2/3 of global terrestrial carbon. Tropical trees have been shown to be more susceptible to warming compared to temperate species, and have shown growth declines at elevated temperatures as low as 3^oC above ambient temperatures. However, regional and global vegetation models lack the data needed to accurately represent physiological response to increased temperatures in tropical forests. We compared the instantaneous photosynthetic response to elevated temperatures of mature tropical rainforest trees in two field sites in Puerto Rico. Foliage was accessed with canopy towers, and photosynthetic temperature response curves were generated with a portable infrared gas analyzer. Results supported our hypotheses: 1) optimum photosynthetic temperatures (T_{opt}) were greatest in the upper canopy compared to lower canopy foliage and understory seedlings, and 2) leaf nitrogen, phosphorus, and leaf mass per area all increased with increasing T_{opt}. Our results suggest that this tropical forest is currently operating close to threshold temperatures at which photosynthesis will begin to decline. With continued warming, tropical forests may change from net carbon sinks to sources, with potentially dire implications to global climate feedbacks.

Pines under pressure: How Sierra Nevada forests are impacted by ozone and drought stress

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My research investigates how ponderosa and Jeffrey pines are responding to increasingly prevalent ecosystem stressors, specifically, air pollution and drought. Do our observations of chlorotic mottle, a visible bioindicator of ozone pollution damage to pine needles, translate to growth declines? Are the trees subjected to prolonged pollution reacting to drought in concert with other trees in the region, or might they exhibit different patterns due to the effects of interacting environmental stress? To address these questions, I studied a network of long term monitoring plots in Sierra National Forest and Sequoia/Kings Canyon National Parks, coupled with site-based pollution and climatic records. I have developed tree ring chronologies from each site and combined these with >20 years of climate, ozone, and foliar injury data to develop a model of tree growth. Research thus far shows that in polluted areas, pines continue to sustain injury from ozone pollution, particularly in the summer months. Polluted and unpolluted sites show some differences in growth pattern, and further analysis will determine if these are attributable to divergent stress responses. Understanding how these species respond to stress will improve capacity to describe ecosystem processes and anticipate the many management challenges presented by our dynamic environment.

Effects of tree species biodiversity on fungal pathogen regulation: understanding the spread of the ash dieback pathogen, *Hymenoscyphus pseudoalbidus*

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The fungal pathogen *Hymenoscyphus pseudoalbidus* has been causing widespread decline of European ash (*Fraxinus excelsior*) across Europe. Recent studies that showed lower genetic variability in European *H. pseudoalbidus* populations compared with that found in a Japanese population suggest that the pathogen in Europe likely originated from east Asia. Population genetic investigations of *H. pseudoalbidus* across Europe found that there was no genetic population structure. While these studies focused on fungal isolates throughout Europe, no work has been done to determine the finer scale resolution within one locality across a tree species diversity gradient. In this study, we aim to address whether mixtures of ash with various broadleaved tree species can help regulate the impact of the pathogen by limiting the spread of fungal spores. In a 12 km x 5 km area in the Hainich National Park, Germany, 10 30 m2 plots were chosen that consisted of ash admixtured with broadleaved tree species. Sclerotized ash petioles were collected from selected trees and microsatellite analyses were performed directly from sub-sections of these petioles. We tested the hypothesis that less genetic variation would be found among fungal populations in mixtures than in pure stands of ash.

Effects of White Pine needle damage and climate change on forest health and carbon-water dynamics across the Northeastern US

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White Pine Needle Damage (WPND) is a complex of fungal pathogens currently impacting forests in the northeastern US. Since 2009, chlorosis and defoliations caused by WPND has been observed in Maine, Massachusetts, New Hampshire, and Vermont. This research addresses the impacts of these defoliations on forest health. The goal of this study is to (1) monitor the severity and spread of WPND, (2) access to what extent defoliations are affecting the hydraulic and microclimate dynamics of infected white pine stands, (3) measure annual decline of growth rates, and (4) to develop a climate based model for predicting disease outbreaks. Warmer temperatures and higher than average spring precipitation in the region are thought to be exacerbating WPND. The effects of WPND are being measured through variation in sap flux using heat pulse theory to derive whole tree transpiration rates and dendrochronological analysis between health and diseased individuals to quantify growth changes. Declines in both transpiration and carbon sequestration of this economically important and wide spread species may have significant implication for New England forest management.

Transmission of fungal pathogens in an ebb-and-flow irrigation system at a native plant nursery

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Seedlings from tree and native plant nurseries can be an important component of reforestation projects. When containerized nursery seedlings are irrigated using an ebb-and-flow irrigation, or subirrigation, system, less water is required over the course of the growing season, allowing nursery managers to grow seedlings more sustainably. However, reusing irrigation water creates an avenue for transmission of plant pathogens. My research aims to identify potential fungal pathogens and understand their spread through an ebb-and-flow irrigation system. Working at the Oxbow Native Plant Nursery and Research Facility, I used bait traps to survey for fungal pathogens present in the environment. Then, I cultured a population of carbon-isotope labelled pathogens and introduced the pathogen to containerized seedlings with known susceptibility, including *Cornus sericea*. Throughout the growing season, I sampled the irrigation system at multiple points to re-isolate the labelled pathogens. The resulting densities of the pathogen will determine if the seedlings in production facilities will need to be treated to prevent infection. In future research, I will be testing the effectiveness of different filtration methods on the presence of fungal pathogens in the irrigation water.

Role of fungi of the gen. *Geosmithia* in relation to the pathosystem elm - elm disease (DED)

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The aim of this study was to investigate whether *Geosmithia* plays a role in *Ophiostoma novo-ulmi*- Elm pathosystem and which kind of relationships exist between these organisms.

The morphological and molecular markers analysis of wild strains of *Geosmithia* spp. collected from dying elm trees in Europe, showed the presence of the species *G. pallida* and *G. langdonii*, and some phylogenetically related undescribed taxonomic entities. Data on the interaction between isolates of the gen. *Ophiostoma novo-ulmi* and of *Geosmithia*, grown in dual culture, showed that *Geosmithia* spp. induces a higher growth rate, a higher production of proto-perithecia in *O. novo-ulmi* ssp. *novo-ulmi* mt A than the control and, as mt A is fertilized, even more mature perithecia were produced, thus significantly increasing its fitness. Pathogenicity tests of *Geosmithia* spp. as well as observations on elms in field shave excluded that the fungus could show a pathogen, endophyte or saprophyte behavior, at least on elm. This study showed different *Geosmithia* communities related to vector species and environmental conditions, and clear evidences of an association between fungi of the gen. *Ophiostoma novo-ulmi* and *Geosmithia*, who share the same habitat, and spread through the same insect vector (*Scolytus* spp.) on elms in Europe. The data suggest that it exists a non-occasional association between *Geosmithia* spp. and *O. novo-ulmi* on elm, which can play an important role in the elm-DED pathosystem, and it could explain the ecological role of this fungus in nature.

Influence of host plant on the physiological attributes of field grown sandal tree (*Santalum album* L.)

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Effects of host plant, casuarina on carbon assimilation, water and nutrient absorption in six year old field grown sandal tree was studied. Radioisotopic study to understand the haustorial translocation from host to field grown sandal tree and anatomical studies of sandal haustoria were also taken up during the investigation. The experiment carried out with three treatments viz, H_0 - Sandal tree without host, H_1 - Sandal tree with host, H_2 - Sandal tree with host plant felled at sixth year of growth. Sandal trees growing with host showed higher rate of photosynthesis, plant water potential and higher leaf NPK content than sandal trees growing without host. Plant water potential and NPK content of sandal tree leaf has decreased significantly after the removal of host from sandal pit. Vascular connection between sandal tree root and host root was observed from the anatomical study of sandal haustoria. Radioactive phosphorus (^{32}P) labelling on host and tracing in sandal tree revealed the translocation of nutrients between sandal and host. This study also noticed translocation from sandal to host, sandal to sandal, host to host mediated through sandal haustoria.

Genetical differences among Central European Cockchafer species

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Cockchafers are widespread pest species throughout Central Europe. In Melolontha genus are six species but economically important species comprise just the European cockchafer (*Melolontha melolontha*), the large cockchafer (*Melolontha pectoralis*) and the forest cockchafer (*Melolontha hippocastani*). The other three cockchafer species are *Melolontha albida*, *Melolontha papposa* and *Melolontha taygetana*, but we have no records for those species in Central Europe.

Hundred-eleven individuals of *M. melolontha*, 15 of *M. hippocastani* and 16 of *M. pectoralis* from Central Europe (Hungary, Austria, Slovenia, Romania and Poland) were investigated.

A 1188 bp fragment of the cytochrome oxidase (COI) gene of the mitochondrial DNA (mtDNA) was amplified by polymerase chain reaction (PCR), sequenced and aligned using ClustalX and MEGA 4.1 to construct phylogeny trees.

The three *Melolontha* species are different in both DNA and amino acid sequence. On the 1188 bp DNA fragment difference was 12.3% between *M. melolontha* and *M. hippocastani*; 13.0% between *M. hippocastani* and *M. pectoralis*; and 5.1% between *M. melolontha* and *M. pectoralis*.

In vitro propagation of A*allanblackia floribunda* (oliv) through nodal culture

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In-vitro propagation of *Allanblackia floribunda* in Murashige and Skoog Medium (MSM) and McCown's Woody Plant Medium (MWPM) was investigated. Two nodal cuttings of 0.8 - 1.0cm long were excised from succulent branches, disinfected and cultured in treatments A(0.1 NAA + 0.2 BAP), B(0.1 NAA + 0.4 BAP), C(0.1 NAA + 0.6 BAP), D(0.1 NAA + 0.8 BAP), E(0.1 NAA + 1.0 BAP), F(0.1 NAA + 1.2 BAP), G(0.1 NAA + 1.4 BAP), H(0.1 NAA + 1.6 BAP), I(0.1 NAA + 1.8 BAP), J(0.1 NAA + 2.0 BAP) and in a Control (without hormone), laid in Randomized Complete Block Design (RCBD) with 10 replicates. Sprouting was achieved on the apical buds, but not on the lateral buds. Growth was first observed on the 13th day of culturing in MSM and 28 days in MWPM. The mean shoot lengths for Treatments were ±1.4cm at the 4th week and ±1.8cm at 11th week in MSM, whereas MWPM gave ±1.2cm at 8th week but stopped at the 10th week. Two leaves were observed on the emerged explants on both media, except for Treatment E of MSM which had 4 leaves and also showed the best performance. Rooting was not supported throughout the experiment.

Landscape-scale assessment of Mexican spotted owl nesting habitat using MODIS imagery

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Forest management practices by Native American tribes rely on active management to sustain the health and vigor of tribal lands into perpetuity. Despite numerous studies on nesting habitat of Mexican spotted owls (*Strix occidentalis lucida*), to our knowledge no one has assessed owl habitat on tribal lands. Anecdotal evidence suggests that owl habitat on tribal lands is different due to the use of regulated sustained yield timber management. We conducted a landscape-scale habitat assessment using remotely-sensed MODIS imagery to compare tribal and non-tribal owl nesting locations within south-central New Mexico. We discovered that the compositional proportion of phenoregions within a 1-km radius of known owl nest sites differed significantly from phenoregion composition within similar neighborhoods surrounding random points placed in suitable habitat. Furthermore, owl sites on the reservation differed significantly from adjacent owl sites on the National Forest. Our findings may help inform forest practitioners about the range of forest conditions that owls will occupy and improve our current understanding about the effects of forest treatments on owls. This new rapid habitat assessment technique using satellite imagery may be a new approach to monitor owl nesting habitat.

SESSION 2
Part 3 – Forest Operations, Engineering, Biomass and Bioenergy

FVS-OpCost: a New Forest Operations Cost Simulator, developed in R and linked with FVS

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Reduced fiscal budgets has pressured land managers to find innovative and cost efficient ways to reduce the threat from wildfire. Accomplishing this task will require a suite of management tools designed for the variables present in the landscape and are able to give accurate cost estimates on which to base their decisions. The Forest Operations Research Laboratory at the University of Idaho has developed a forest fuels treatment cost analysis program derived from the Fuels Reduction Cost Simulator (FRCS). Programmed into R and linked directly to the Forest Vegetation Simulator (FVS), FVS-OpCost updates the treatment cost formulas with advanced treatment systems, and incorporates refined formulas from recently published literature. This will deliver a finished product capable of interacting with BioSum, covering a greater range of treatment options, and incorporating cost effectiveness into its treatment heuristics. After linking BioSum to FVS-OpCost, several simulations will be tested with various management scenarios to determine optimal fuel treatment costs using the full Forest Inventory Analysis (FIA) plot set. This is presented with a user-friendly interface showing detailed cost analysis for each scenario based on either the model database or user defined criteria.

Optimization of "waterproof" forwarding with LIDAR datasets in Sweden

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There is a great challenge in the forestry to minimize the damage to soil and water!

This study is about how LIDAR datasets from airborne laser scanning can help the forest sector tackle this challenge and at the same time may become more cost-efficient. By analysing the LIDAR dataset in GIS, maps with information about wet areas, topography as well as the wood volume can be extracted and used as parameters for a route optimization for the forwarder.

At each harvest site two LIDAR-based map types, DTM (digital terrain model), and DTW (depth to water) constitute the premises for the optimization. Together with information about nature conservation, cultural heritages and other "no go areas" where terrain driving shall be avoided, a digital surface of the final felling site appears. Results show that these maps become a helpful tool to avoid damage at soils and water.

If combining the digital surfaces with a map concerning the distribution of wood at the site, a dataset possible for optimize on site hauling concerning the forwarding costs appears. In the study a few hauling scenarios at each site were composed for simulation and then the most cost efficient could be chosen. The differences did mainly concern where to cross water and where to put the roadside storage.

Life Cycle Carbon and Economic Assessment of Biochar-based Bioenergy Production in Ontario, Canada

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Bioenergy is considered as carbon neutral solution of current environmental crisis. Biochar is a by-product of bioenergy which can sequester carbon for longer time if applied in soil which is claimed to be carbon negative in the life-cycle. Fossil fuel related emissions are often blamed to be one of the biggest contributors of current environmental greenhouse gas and subsequent global warming. Fossil fuel makes a significant proportion in the current power-supply-mix in Ontario. In order to reduce GHG emissions from coal fired power stations, the province of Ontario is phasing out coal firing plants and replacing with forest biomass plants by 2014. The use of biomass feedstock for power generation not only has the potential to address the environmental problems related to air pollution and climate change, but also ensures energy security for local communities. Production of biochar-based bioenergy by using woody biomass and replacing fossil fuel based power supply will have a very important impact in the environment. We conducted a thorough life cycle assessment using SimaPro®. Here we present a detailed life cycle carbon and economic assessment of biochar-based bioenergy production in Ontario Canada with comparison to conventional bioenergy production along with GHG and other environmental consequences.

**A Long-Term Perspective on Biomass Harvesting: Northern Mixedwood Forest
Productivity 50 Years after Whole-Tree and Stem-Only Harvesting**

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Woody biomass (tree tops and branches) is increasingly harvested to meet demand from
emerging bioenergy markets and as a source of additional income for landowners. However,
there is concern that site productivity may be impaired by whole-tree biomass removal. We are
using a USDA Forest Service experiment within the Penobscot Experimental Forest in Maine to
observe long-term influences of biomass harvesting practices on forest productivity 50 years
after stem-only harvesting (SOH) and whole-tree harvesting (WTH). We are quantifying soil
and foliar nutrient status, biomass, stand structure, and composition in WTH, SOH, and
unharvested (control) units, to determine whether treatments resulted in long-term differences in
productivity. Results will be compared to those from other studies, and to short-term
assessments of treatment outcomes made in our study area. The null hypothesis in this study is
that there are no treatment differences in site productivity and stand attributes 50 years after
harvesting; alternative hypotheses are that total biomass, proportion of shade-tolerant species and
conifers, and soil available and foliar nutrients are lower following WTH than SOH

SESSION 3

Forest Policy, Social Aspects and Economics

The Politics of access, utilization and sharing: lessons from the Ongo Community Forest, Uganda

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This study was carried out in four local communities around Ongo Community Forest, Budongo with the aim of exploring the benefits that are achieved and the governance lessons from the Community Based Forest Management in Uganda. The communities are Ogadra, Kibale, Abangi and Onieni. The objectives of the study were to identify how the local people access forest products: which products, how much and what is the household level importance as well as to explore the structure and functioning of the governance system. The research hypothesizes that there is a significant difference in the accessibility of forest resources between members and non-members of the Ongo Community Forest Association (OCFA); and that the structure and functioning of the forest governance system account for the differences. Combination of qualitative and quantitative research methods were used to ensure research validity. Quantitative data was collected through questionnaire administration, to the members and non-members of the OCFA in the communities. Qualitative data was collected from the four main identified actors; members, non member, executive committee member and Local Councils in the four villages, using semi-structured interviews. Result of the study shows lack of distinguishable socio-economic differences between members and non-members, few existing difference in access to forest products, as well as the conflicts patterns that exist between the different actors and how this influences downward accountability of forest resources management in the study area.

Rethinking forestry, beyond the neoclassical: case study of Québec

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Québec forest value chain is a multidimensional system with multiple processes and multiple stakeholders. Several external factors strongly influence its performance. To deal current and future uncertainties, it is necessary to build a conceptual framework capable of capturing the complex nature of interactions between external factors and multiple actors. Although the forest economy, based on neoclassical economics, is an important tool for decision making in forest industry it becomes insufficient given its static and limiting analysis. The objective is to obtain a dynamic representation of the operation of socio-economic system which develops the forest value chain. External factors and the most important players were identified. Based on conceptual categories (economic performance and production factors), we compared central assumptions of neoclassical economic theory and the reality of the forest sector. Actor's landscape has grown over recent years. The dynamic nature (multidimensionality and inter-temporality) of external factors was proven. We tested eight neoclassical assumptions; five were not able to reflect the reality of Québec forestry sector. To overcome the shortcomings of the neoclassical framework, we propose a larger framework using meta-theoretical approach.

Participatory mapping for a better REDD+ achievement

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Phase 3 of the UN's REDD+ climate change mitigation initiative is underway in Democratic Republic of Congo. This means that concrete and measurable activities are being implemented to assess the reduction of emissions from deforestation and forest degradation. Because REDD+ projects need to include social considerations, the aim of this research was to understand how relationships between communities and their land vary according to geographical location. In summer 2013, we assessed a REDD+ pilot project instigated by the World Wide Fund for Nature in and around the Luki Biosphere Reserve, in Bas-Congo province. We conducted participatory mapping workshops in four communities located both inside and outside the reserve, to understand their respective land-use patterns. Although subsistence activities were similar irrespective of location, communities inside the reserve were more restricted because of their limited access to land. In each community, the maps drawn by the villagers showed that agricultural plots invariably overlapped forested areas, which could limit the success of this REDD+ project. To achieve their targets, REDD+ projects should consider the land-use patterns of local communities.

The Political economy of jurisdictional REDD+ design

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While no binding global commitments currently exist to respond to climate change, sub-national strategies have begun to be implemented to address climate mitigation. In 2006, California passed the first statewide legislation in the United States, to reduce levels of GHG emissions to 1990 levels by 2020. California has since implemented a number of regulations and a cap-and-trade system to achieve this goal. California is currently working to establish an innovative 'jurisdictional REDD+' scheme to buy forest carbon offsets from subnational states in the developing world. This would make California the first official compliance market to formally incorporate REDD+ credits. This research examines the decision making processes that resulted in proposals for the adoption of compliance-grade jurisdictional REDD+ in California. Specifically, this research seeks to understand the involvement of various stakeholders in the decision making process, examine how various actors reconciled efficiency goals with social equity and biodiversity objectives, and identify likely distributional effects of jurisdictional REDD+ on different stakeholders, given design recommendations. This research informs strategies and decision making processes surrounding payment-based schemes for carbon capture and storage, and the ways that these can better address social equity at multiple scales.

How illegal logging policy is made – Discursive Agency in international forest policy

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Environmental policy attempting to address the trade of illegally logged timber has gained some popularity over the past years. The USA introduced the first policy against illegal logging in 2008 and the European Union followed in 2013. Several scholars have explored the global effects and possible future impacts of these policies. Fewer studies exist, however, on the conflicts surrounding their creation and implementation in the regulating countries themselves. This PhD project explores these conflicts by applying the approach of Discursive Agency. Specifically, it addresses (1) discursive struggles over political agency and their impact on policy outcomes and implementation in the US and Germany (as European case study), and (2) the impact of international discourses on national policy making. The study is based on a comprehensive analysis of policy-relevant documents (approx. 100), interviews with key stakeholders (approx. 50), and participant observation data. Results from the United States point to the high relevance of struggles over discursive agency for policy outcomes as well as their implementation. Diverse national as well as international discourses serve as crucial catalysers of policy change as political actors refer to them according to their needs as a speaker in illegal logging policy-making. Results from Germany will be available by October 2014.

Evaluation of market potentials and socio-economic contribution of some NTFPs in two ecological zones, Ondo State, Nigeria

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This research work was conducted in two ecological zones of Ondo State, South West Nigeria. The main objective was to evaluate the market potentials and socio-economic contributions of some NTFPs to rural livelihood in Ondo State. The study involved both on-farm and market assessment, two categories of pre-tested structured questionnaires were used to obtain information from the respondents (farmers and the marketers of the species). Data analysis was done using descriptive analysis while analysis of variance (ANOVA), was employed to test the significance of price variable across the three market structures. The results indicated that farmers in both ecosystems are old while the traders are middle aged. A high percentage of the NTFPs are found within farmlands in the two ecological zones. The analysis of variance for the three forest fruit species within the two ecological zones indicated that Irvingia gabonensis generated the highest annual income in rainforest ecosystem while Garcinia kola generated the highest annual income in derived savannah ecosystem. Among the three fruit species, Chrysophyllum albidum generated the least average annual income in the two ecological zones. Major constraints militating against the market of the three forest fruit species are poor market access and infrastructure development.

An economic assessment of the impact of *Raoiella indica* on the Nariva swamp, Trinidad and Tobago

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The Red Palm Mite (Raoiella Indica) is a great threat to terrestrial biodiversity, with particular interest in palm populations. In Trinidad and Tobago, the Coconut palm (Cocos nucifera) has been the most affected. The local Nariva Swamp, a designated Ramsar site, hosts large populations of various palm species. The impact of the Red Palm Mite on this ecosystem can be both direct and indirect. Its direct impacts include declining yields of coconuts and increased market prices. Indirect impacts of this invasion include the loss of non-market ecosystem goods and services such as the change to aesthetic values and demand for recreational services. The study was aimed at calculating the indirect costs of invasion, creating an awareness campaign and stating a case for the use of web-based surveys in local contingent studies. Contingent Valuation was used to estimate the non-market impacts. Data was collected for this study using both web-based surveys and interviewer administered questionnaires at the study site. The data was analyzed using mainly Logistic Regression, yielding a mean willingness to pay for the mite's removal of $237.34. Respondents' view of the swamp and attitudes to environmental degradation significantly affected willingness to pay for conservation. No significant differences were found between survey modes.

Long-term outlook for European wood products markets

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Due to major ongoing structural changes in the forest sector, there is an increasing need to explore and discuss the possible long-term developments facing the sector. However, this task seems to grow ever more challenging due to the structural changes and complexities that induce such needs. In the thesis, approaches from the field of foresight are adopted and combined with the more conventional approaches from the field of forest economics, to explore the long-term prospects of the European wood products markets. The thesis consists of three phases: Firstly, establishing the factors affecting sawn wood consumption using econometrics, secondly, exploring the long-term trends and drivers of change in the operational environment using scenario analysis, and thirdly, establishing a preferable state of future and the means to achieve it using participative backcasting. The preliminary results show that even the historical drivers of change are not well known, and many of the emerging structural changes relevant for the future prospects of the sector have been overlooked by previous outlook studies. There are also major methodological challenges on how to improve the relevancy and informational value of outlook studies for decision-making.

A gender sensitive analysis of the marketing of agroforestry tree products associated with cocoa cultivation in Sierra Leone

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Although removing gender inequalities is recognized as an important strategy to reduce food insecurity and alleviate poverty in Sub-Saharan Africa, women often still lack opportunities for empowerment. Their role has often not been addressed adequately in value chain development and little is known about their specific involvement, needs and opportunities. By analysing current marketing strategies and domestic uses and identifying upgrading opportunities, this study aims to contribute to gender-sensitive value chain development of tree products associated with cocoa agroforestry systems in Eastern Sierra Leone. Endogenous and exogenous factors that facilitate the involvement and financial success of women in identified value chains on household level will be identified through a household survey. The impacts of gender-sensitive value chain upgrading on household dynamics regarding income, nutrition and empowerment will be researched through focus group discussions and participatory rural appraisals. A Monte Carlo simulation will serve to estimate the effect of upgrading strategies and interventions on incomes from these tree products. Recommendations for upgrading strategies from the findings of the study are intended to benefit value chain actors and local NGOs in Sierra Leone.

Can local inhabitants of the Monarch Butterfly Biosphere Reserve manage their forests for timber sustainably?

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Community Based Forest Management in some parts of Mexico has been reported as successful way to achieve conservation of forest cover and biodiversity, a fair distribution of income, and social stability. However, little has been researched on the feasibility of communities which possess forested areas to consolidate sustainable forest management plans. In this study, we evaluated how four rural communities with different degrees of forest cover in the Monarch Butterfly Biosphere Reserve (MBBR) compare with communities from other parts of Mexico which have been certified by the Forest Stewardship Council. We based our comparison social, ecological and economic criteria such as forested area per number of family units; whether these communities derived their main income from agriculture or from forestry operations, and whether the four communities had internal institutions that could derive in labour division associated with successful forest management. We found that the four communities in the MBBR have much lower forested area per family unit than certified communities in other parts of Mexico. They also derived most of their income from agriculture, rather than from forestry; and had no or very incipient institutional subdivision. We found that conservation of forested area in these four communities is variable, and is at large subsidized by agricultural income. We suggest this might be an alternative path to forest cover conservation that might very common in central Mexico.

Monarch Butterfly Biosphere Reserve 2012 Forest Fires: characterization and institutional responses

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The Monarch Butterfly Biosphere Reserve is an emblematic Natural Protected Area located in Central Mexico. Vegetation is dominated by fir, pine, and pine-fir forests, all with apparently contrasting fire regimes. In this study, we evaluated the extent, severity and intensity of 16 of the 45 fires reported in 2012, and also described the relationships between different government agencies, NGO's, and local inhabitants in response to fires. We found that the large majority of fires were < 2 ha, and had mixed severities and intensities, with no difference between fir and pine dominated stands. We found that fire related policies within this Biosphere Reserve differ between the two Mexican States it covers, and that the involvement of local inhabitants in response to fires is highly variable. Most of the institutional efforts on fire management are based in combat and prevention, with little input from traditional knowledge.

Finnish forest professionals' attitude towards uneven-aged forest management

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The study was aimed at finding out Finnish forest professionals' attitude towards uneven-aged forest management. Uneven-aged management was prohibited since mid-20th century in Finland and permitted again this year. The study first decomposed the professionals' attitude into affective, behavioural, and cognitive components. Next, it identified other factors that affect the forest professionals' recommendation and the relative importance of them. Finally, the study measured whether the forest professionals' attitude would change given a number of situations. On average, forest professionals think they have neutral attitude towards uneven-aged forest management. Although they do not see it very beneficial except ecologically to forests, they are willing to do something positive with it, at least to learn about it. Emotionally, forest professionals do not like the method itself in particular, but they like the recent change in law. The three major factors that forest professionals consider when they make recommendations are the silvicutural properties of the forests, customers' preferences, and their own preference (attitude, style, etc.). Accumulation of experience and knowledge has the most positive effect, and current research has the least (almost no change).

Stakeholders' perspectives on ecosystem services of Sweden's last cultural oak landscapes

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Agroforestry as mixed systems of agriculture in combination with trees and grasslands, have formed key elements of European landscapes throughout historical times. These cultural landscapes are still examples of long term perpetuation of traditional activities and practices, and form integrated socio-ecological systems. Their importance has thus been recognized and promoted at international level. Today intense and rapid social and economic changes in many European countries exert a significant impact on cultural landscapes as sustainable multi-functional systems. While the favoured agricultural landscape perception is characterized by a predominance of provisioning ecosystem services, valuable delivered public goods without market prices are usually hindered. To cope with this imbalance holistic analyses are needed in order to understand multi-purpose interests. Swedish policy states that "The value of cultivated landscapes shall be protected, while the biodiversity and the cultural heritage values preserved and strengthened". Focusing on the largest area of cultural oak landscapes in Östergötland (Sweden) we identify and analyze the diversity of delivered ES as perceived by different stakeholder categories at different levels.

We found a bias towards provisioning ecosystem services by landowners, farmers and cattle holders, whereas environmental NGOs, nature conservation organizations, administrative boards and tourist companies highlighted the importance of biological values (regulating and supporting ES), and cultural services in terms of recreational values and landscape beauty respectively. The ecosystem services concept is a useful tool to communicate multiple perceptions on landscape use. Additionally, holistic analyses such as systems thinking and causal loop diagramming techniques could be an important tool in order to identify and analyze complex realities at different levels among stakeholder categories. To conclude, we stress the need for holistic analyses as a base for a process towards multi-purpose landscape management.

Bamboo resource commercialization options for Ethiopia

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The study objective was to explore the options for innovative commercialization of bamboo resources of Ethiopia. The country possess about 1million hectare of bamboo resource which is being used traditionally for low quality constructions, furniture and crafts. To enhance the economic returns from bamboo to local development, Ethiopia needs to improve its production system to produce high quality products to get entry to the growing competitive global value chain. The study based on empirical data on local technology development options and literature on technology transfer, provides insights on range of technology development and commercialization options for Ethiopia. The result showed that partnership among the public and private enterprises at the raw material production level and enterprise incubation and graduation at the processing level of the value chain are significantly improving entrepreneurs' capacity and product industrialization. Institutional actors facilitate the selection, transfer and adoption of technologies from foreign sources. Thus, combining local and foreign technologies under the auspices of dependable institutional actor may accelerate bamboo commercialization and improve entrepreneurs' income and competitiveness in the market.

Conservation education and motivations of farmland and woodland owners in West Virginia—A pilot assessment

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Environmental conservation practices are promoted by natural resources management agencies to protect or improve the quality of ecosystem services and enhance productivity of privately held forest and agricultural lands. Landowner outreach programs are often geared to bring information about these conservation incentive programs to diverse audiences, however it is difficult to distinguish between the interests and priorities of woodland owners and agricultural producers. For education purposes, there is a need to continue to refine our understanding of the needs and objectives of landowners in order to assure relevant programming. We undertook a pilot research project in West Virginia to explore opportunities for landowner engagement and better tailor our educational outreach programs to support their efforts and encourage an increased level of land stewardship. Our primary research questions were:

1. Do conservation attitudes, practices, and production values differ between landowners with primarily agricultural holdings compared to those owning mostly or all woodlands?

2. Are educational needs similar between those with and without woodlands.

A mail-based questionnaire was used to assess the education needs and conservation tendencies of landowners in 3 rural counties.

Wildland fire risk assessment for structures: A National Park Service case study

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Risk based decision making has been recognized by many federal land management agencies as a means to promote effective and efficient wildland fire management. Structure protection during wildland fire incidents also represents a growing concern. This study assesses the National Park Service (NPS) efforts to measure the wildland fire risk associated with NPS owned structures. The study results indicate that the NPS approach is more consistent with concepts of hazard assessment and that a formal risk assessment is yet to be performed. The NPS assessment attempts to assign a value to hazards without considering each hazard's relationship to the specific events that contribute to wildland fire risk. This study builds on the NPS approach and proposes a risk assessment model that provides a clearer understanding of the relationship between hazard and risk, and a clearer context for assigning value to hazards.

Beliefs, attitudes and behaviour in relation to farm-level tree planting and deforestation in Malawi

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Trees play a key role in farming landscapes in Malawi, where they can provide important benefits in contributing towards soil fertility, food security, shelter, medicine, fuel wood, and income. This thesis examines the beliefs, attitudes and behaviour in relation to farm-level tree planting and removal of forest trees. Using the theory of planned behaviour as a conceptual framework, an attitude scale was developed to explore three attitude components: attitudes, subjective norms and perceived behavioural control. Household questionnaires were administered to 200 farmers in Mzimba and Chiradzulu districts in Malawi. The study found that farmers are generally in favour of tree planting and more positive attitudes were linked to higher levels of tree planting. However, farmers prioritized other, more urgent, household needs such as buying food and fertilizer over investing in tree planting. In contrast, attitudes towards cutting down forest trees were mostly negative and farmers expressed low intentions to cut down forest trees. However, most farmers were highly dependent on the forest, mainly for firewood, due to poverty and limited alternative livelihood opportunities. This suggests that poverty is the main barrier to tree planting and primary driver of deforestation in Malawi.

Appraising climate change in rural forest dependent communities of South Africa: community perceptions and attitudes

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This study examined the perception and attitude of household's in rural forest base communities' situated in Vhembe Biosphere Reserve of South Africa to climate change. With consideration to forest type and settlement pattern 21 communities were selected and using simple random sampling with proportionate representation, sample size of 400 households was determined. Questionnaire survey and structured interview was used for data collection. Climate change perceptions were analysed in terms of views and awareness about climate change. Attitude towards climate change were analysed in terms of beliefs about causes of climate change, concerns about climate change and actions people are prepared to take in order to adapt to climate change. Results showed that households are aware of climate change and identified increasing frequency of erratic rainfall and increasing frequency of forest fire as visible manifestation of climate change in their community. Households are strongly concerned about climate change effect on availability of forest resources. However, they are strongly willing to accept training on good farming and forest exploitation practices in order to mitigate climate change challenge. The study therefore concludes that adaptation programmes in the community are most likely to succeed given the people's perception and willingness to adapt.

Social considerations in community forest management:
A case study in Sault-au-Cochon forest, Côte-de-Beaupré, Québec

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Under Quebec's 2013 Forest Regime, the management of community forests established on public land will be devolved to local and indigenous communities. However, it is unclear how these changes will address the needs and expectations of the local population, while ensuring that the socioeconomic benefits return directly to the community.

The aim of this study was to develop consultative methods for identifying local needs in the community forest. We tested our approach in Sault-au-Cochon forest, in the municipality of La Côte-de-Beaupré, by targeting three groups of stakeholders: the general population, forest managers and forest users.

Our study used both quantitative and qualitative methods to define the specific needs of each stakeholder group, including internet surveys, individual interviews and focus groups.

Environmental values were paramount for a majority of respondents, while most agreed that a protected area should be established. However, opinions differed on how to achieve multiple objectives; forest managers preferred flexibility in permitted usage, while users themselves favored specific zoning.

Using the approach proposed in this study, it will be enabled us to build a comprehensive picture of the values and expectations of the local population in relation to the establishment of a local community forest.

Crop diversity of upland farms in Apayao, northern Philippines

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This study was conducted to determine the socio-economic characteristics of the upland farmers, document their existing farming systems and practices and assess the crop diversity of their upland farms in Apayao Province in Nothern Philippines. A structured interview schedule was designed to generate data for the socio-economic profile of the farmer respondents and actual field observation, documentation and validation is undertaken for their farming systems, practices and crop diversity. The results showed that the respondents were mostly in the working age group, majority are males, with elementary graduate as their average level of education. Majority of them are Isnegs, although just a percent higher than that of Ilocanos. The upland farming system can be considered as varied in terms of the variables in classifying agroforestry farming systems such as component combination, spatial arrangement, and time sequence. The agroforestry farming system of the area can be generalized as: a) improved fallow, b) multistorey cropping system, c) rice terracing with woodlot, d) Taungya, e) alley cropping and f) boundary planting. On the other hand, the soil and water conservation practices were fallowing, multiple cropping, mulching, contour farming, crop rotation, terracing, woodlot establishment and protection, small pond establishment and hedgerows or belting for soil and water conservation. The species crop diversity index (H') of the upland farms using the Shannon-Weiner diversity index formula has a mean of 1.0002 (range: 0.0046-2.3877).

History of Russia's timber frontier through mapping forest use history

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After three centuries of wood harvesting in natural boreal forests with high stand volumes Russia sees the need to increase wood production on previously harvested land. The aim is to contribute to the understanding of regional and local barriers and bridges for intensification of wood production in Russia. Using a local logging frontier in the Komi Republic as a case study we employed an environmental history approach. To implement this we recreated forest harvesting history for the period 1700-2013, identified the main actors that produced the history, and analysed values, perception and ideology that underpin it. To recreate harvesting history we reviewed literature, analysed forest land cover, roads and settlements, and conducted land cover change detection of Landsat imagery. To identify and describe the main actors and ideologies we reviewed literature and conducted focus group interviews. The results show that after a long history of selective harvesting for local and regional use and international export before the Russian Revolution, forest ecosystems were under high harvesting pressure during the last three decades of the Soviet period. Today, to intensify wood production in study area we need to take into account lessons from the past and current status of forest landscapes and society in Russia.

Rehabilitation of war veterans with posttraumatic stress disorder in a healing forest garden

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The aim of the study is to explore, how war veterans with Posttraumatic Stress Disorders experience the impact of nature environment and nature based activities in relation to their well being the Healing Forest Garden Nacadia (The research garden is part of University of Copenhagen). A group of 8 veterans participated in a 10 week intervention. Activities were structured and led by a horticultural therapist and a master in forestry. Mindfullness, yoga exercises, walking and jogging were combined with e.g. chopping wood, making bird boxes and planting. Also stories about the various plants and wildlife in the forest surrounding the garden were part of the intervention.

The study has a qualitative approach, and interviews with the participants were conducted before the intervention, midway, and by ending of the intervention, additional interviews were carried out 6 and 12 months after the competition. Participants filled out log-books and noted places of special attractiveness in the garden, change in mental state etc. Data collection took place between August 2012 and November 2013. The analyzing process is still ongoing, but points in direction of a general benefit in relation the PTSD symptoms, and an increasing motivation for being in the nature of long-term.

Qualitative study of user-specific behaviour in, and preferences of different categories of nature environments in the Healing Forest Garden Nacadia

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This explorative study is conducted in the Healing Forest Garden, 'Nacadia', located in the Arboretum in Hørsholm, Denmark. Choice of location was based on several factors, e.g. the expected nature preferences of aimed patient group, and research indicating that forests successfully and cost-beneficially can constitute a supportive component in (self)therapeutic processes.

The study identifies the user-specific preferences and use of nature and nature components in context of nature based therapy in 'Nacadia'.

Informants: N40, age:20–60, incapacitated due to stress or stress related symptoms.

Methods: Landscape analysis: Based on factors of dimensions and attributes forming the environments, and on human's general experience and perception of different environments, various environments are categorized in the garden. This is used as a framework for factor-, correlation- and comparative analysis.

Data collection: Behaviour mapping, qualitative interviews and log books is used and inter-supportively studied several times during and after informants' participation in the therapy in the forest garden.

Findings: Results from data illustrates a behaviour pattern showing use of the forest garden, suggesting preferences of nature types, -attributes and -components, and data leads to a better assumptions of how, why and where informants prefer to use the forest garden in a therapeutic purpose.

Contingent valuation of biodiversity in primary Koa-dominated forests in Hawai'i

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Globally, people value biodiversity but since there is no market to derive a monetary value, its value needs to be estimated. Koa (Acacia koa) forests are endemic to Hawai'i and provide habitat for other endemic plant species. Koa is also an important commercial tree in Hawai'i. This study is researching biodiversity, defined as species richness of endangered plant species, and is using the contingent valuation method to estimate the value of biodiversity in a Koa forest. Contingent valuation obtains a monetary value for non-market goods by asking people their willingness-to-pay for that good. This study surveyed 253 residents of Hawai'i County asking their willingness-to-pay for preserving endangered plant species richness in Koa forests. These results were extrapolated to the population of Hawai'i County and preliminary analysis calculated that residents would be willing to pay $7,596,255 to maintain endangered plant species richness in primary Koa forests in Hawai'i County. These results can be included in cost-benefit studies such as preservation versus timber harvesting and in policy and impact analyses. These results will also fill a data gap in ecosystem service values of Hawaiian forests and prevent biodiversity from being discounted in policy and land-use decisions.