XVII Young Researchers Meeting on Conservation and Sustainable Use of Forest Systems

Palencia (Spain), 25-26 January 2023

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PREFACE

One more year, we celebrate the Young Forest Researchers Meeting at the Institute for Research in Sustainable Forest Management (iuFOR) of the University of Valladolid. Due to our recent constitution as an R+D+i CSIC Associated Unit, researchers belonging to the Institute of Forestry Science (ICIFOR-CSIC) and the National Museum of Natural Sciences (MNCN-CSIC) have collaborated in the organizing committee and participated in the Meeting.

This Young Researcher Meeting represents an interesting platform for professional exchange among young forestry researchers from all over the world. Among the more than 80 participants, in which both MSc students and Ph.D. and junior researchers participate, there are 39 MEDFOR students (Erasmus Mundus programme) of more than 20 European, American and Asian nationalities. These students have participated in many Winter School training activities at the Campus of Palencia during January 2023. In addition, Ph.D. researchers of the Conservation and Sustainable Use of Forest Systems Program, as well as an important number of junior forestry researchers from the Higher Technical School of Agricultural Engineering of Palencia (ETSIIAA), the School of Engineering of the Forest, Agronomic and Bioenergy Industry of Soria (EiFAB), and the National Institute of Forest Sciences of Madrid (ICIFOR-CSIC) have also contributed with their research on this meeting. All these works are framed in the most relevant areas of the forestry sector, all represented in iuFOR: genetics and adaptation, forest health, forest fires, modelling, forest ecosystem services, hydrology or soil and climate studies among others.

In this edition, the researcher Miguel Delibes Mateos from the Institute of Advanced Social Studies (IESA-CSIC) has pronounced the inaugural lecture entitled "The complexity of Human-Wildlife conflicts in agro-forestry ecosystems". Furthermore, a round table has been held to discuss about "Forests and global change: an open future". This round table has been moderated by Luis Quevedo, director for Strategic Projects of the Spanish Foundation for Science and Technology (FECYT), with the participation of Miguel Delibes (IESA-CSIC), Delphine Grivet (ICIFOR-CSIC), Mercedes Guijarro, (ICIFOR-CSIC and chairperson of the Spanish Society of Forestry Sciences, SECF) and the IUFOR postdoctoral researcher, Clara Antón.

I want to thank the meeting organizers for the important work they have carried out and the effort they make, so that year after year the conference is held with great success.

Prof. Dr. María-Belén Turrión
Director of Sustainable Forest Management Research Institute
R+D+I Associated Unit to the CSIC
Universidad de Valladolid

XVII Young Rechearches Meeting
on Conservation and Sustainable Use of Forest Systems 2023

Welcome to the XVIIth Edition of this Meeting on Conservation and Sustainable Use of Forest System. This academic activity is adressed to young rechearchers from different Masters and PhD programs of the iuFOR and of the Erasmus Mundus Master in Mediterranean Forestry and Natural. For the first time this activity is integrated in the CSIC Associated Unit programme.

Wednesday January 25th

08:00-09:00 REGISTRATION (POSTERS WILL BE PLACED THE DAY BEFORE)

09:00-10:30 SESSION I
Chairpersons:
Eduardo Pastor
Aitor Vázquez Veloso
Speakers:
Sandra Mosquera
Irene Teresa Bocos Asenjo
Juncal Espinosa
Frederico Tupinambá Simões
Francisco Javier Bravo-Córdoba
MILENA PEREIRA KOZLOWSKI
CHAMODI THARUNI MAHANAMA DISSANAYAKE
DANTE BERTOCCI

10:30-11:00 COFFEE BREAK

11:00-12:15 OPENING SESSION

- Amalia Rodriguez, VR Palencia
- José Ramón González, Director of Doctoral School EsDUVA
- Belén Turrión, Director IuFOR
- José Reque Kilchenmann Academic Secretary ETSIIAA
Keynote Speaker: Miguel Delibes Mateos: An Overview of The Complexity of Human-Wildlife Conflicts In Agro-Forestry Ecosystems
Introduced by: Juan José Luque Larena

12:15-12:30 Short break

12:30-13:45 ROUND TABLE Forests & Global change: an open future:

Chairperson:
- Luis Quevedo (FECYT);
Participants:
- Mercedes Guijarro (ICIFOR_CSIC y SECF)
- Miguel Delibes (IESA_CSIC)
- Clara Antón (IuFOR Palencia)
- Delphine Grivet (ICIFOR_CSIC)
Introduced by: Elena Hidalgo

13:45 MEETING GROUP PICTURE
14:00-16:00 COMIDA_LUNCH at University

16:00-17:00 SESSION II

Chairpersons:
Irene T. Bocos
Frederico Tupinambá Simões
Speakers:
Lorena Caiza Morales
Hermine Houdas
Elena Moreno Amat
Miguel García-Hidalgo
MIRDA SYLVIA
LUCREZIA PROIETTI

17:00-18:00 Coffee break & Poster Session

18:00-19:30 SESSION III
Chairpersons:
Farooq Ahmad
Elena Muñoz
Speakers:
Matéo Bareyre
Tamara Sánchez Gómez
Rafa Villafuerte Jordán
Przemek Andrés Jankowski
MUHAMMAD AAMAD KHATTAK
GENEVIEVE KUYANYIM ADEYIGA
NATALIA CUBEROS SANCHEZ

19:30-21:00 Cold Dinner & Networking

Program

XVII Young Rechearches Meeting
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Thursday January 26th

08:30 Bus to"LA OLMEDA" site
9:30–10:00 Reception at La Olmeda

10:00–11:30 SESSION IV
Chairpersons:
Eric Cudjoe
Alba Magarzo
Speakers:
Ruth Martín Sanz
Spiros Michalakopoulos
Wilson Acosta
Eduardo Pastor
Ali Askarieh
FREDERICO DALTON SOUZA
SANDEEP TIMILSINA
ABHILASH DUTTA ROY

11:30–11:40 Short break

11:40–12:40 SESSION V
Chairpersons:
Ali Askarieh
Tamara Sánchez Gómez
Speakers:
Farooq Ahmad
Alba Magarzo
Eric Cudjoe
Natalia Cuberos
IRO SIPSA
MANUEL ALEJANDRO RINCON HERNANDEZ

12:45–14:00 CLOSING SESSION & DIPLOMAS DISTRIBUTION

Belén Turrión, IuFor Director
Felipe Bravo, MedFOR coordinator
Elena Hidalgo, Young Foresters Organization Committee
José Reque, Young Foresters Responsible

14.00–16:00 Lunch in a Restaurant

**16:00–17:00 Visit to the Roman Villa of La Olmeda.
Introduction by Ana I. Magide**

17:00 Bus back to Palencia. Arrival by 18h

Program

OPENING SESSION

AN OVERVIEW OF THE COMPLEXITY OF HUMAN-WILDLIFE CONFLICTS IN AGRO-FORESTRY ECOSYSTEMS

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Wildlife species are central parts of ecosystems. Such species can provide a wide diversity of benefits to people, such as ecosystem regulation, provisioning of food and other materials and non-material contributions as for example recreational and aesthetic experiences and inspiration opportunities. In contrast, wildlife species are also often responsible for detrimental contributions to people, such as damage to human livelihoods and safety and impact on biodiversity. In this context, human-wildlife interactions are prone to conflict. Human-wildlife conflicts (HWC) occur typically when two or more parties with strongly held opinions clash over wildlife management (objectives, actions, etc.), and when one party is perceived to assert its interest at the expense of another. HWC usually emerge from "wildlife impacts", defined as circumstances where wildlife negatively impacts the well-being or livelihood of people or biodiversity, or alternatively when people, consciously or unconsciously, affect adversely wildlife. In recent times, HWC have increased in terms of importance and magnitude, harming both wildlife populations and human livelihoods. HWC are in essence complex. In my presentation, I will go through this complexity of HWC addressing, among other things, their drivers, their dynamic nature, the stakeholders involved and their positions, the role played by the society, and the levels and dimensions of conflict. I will illustrate these topics using different case studies in Spain, including conflicts over the management of 1) predators that kill livestock or game species, 2) overabundant mammals that cause damage to natural ecosystems and/or crops, 3) game species that have declined over the past decades. The ultimate objective of my talk is stressing that understanding HWC complexity is of paramount importance to search evidence-based solutions that seek coexistence between humans and wildlife.

SESSION I

OVERVIEW OF THE DELIVERY OF dsRNA and siRNA IN RNAi-BASE TECHNOLOGIES FOR THE CONTROL OF PLANT-PATHOGENIC FUNGI

Mosquera, S., Bocos-Asenjo, I. T., Amin H., Ginésy M., Diez J. J., Niño-Sánchez J.

Keywords: double-stranded RNAs, small interfering RNAs, nanocarriers, SIGS, HIGS.

RNAi is a cellular mechanism in which the cellular machinery uses double-stranded RNAs (dsRNAs) and small interfering RNAs (siRNAs) to mediate transcriptional gene silencing. This silencing mechanism is a conserved cellular process and can lower the expression of genes relevant to fungi, insects, and oomycetes pathogenic to plants. Therefore, RNAi has become a promising alternative to chemical control against pests and pathogens in forest and agricultural ecosystems. Several studies have focused on understanding the mechanisms behind RNAi to develop RNAi-base technology suitable for field and forest application. The research has shown that RNAi-control alternatives are limited by the low stability of the dsRNA and siRNA in the environment and the difficulties associated with delivering the RNA molecules inside the targeted organism. Therefore, several strategies have been evaluated to overcome these challenges. Here, I provide an overview of RNAi, focusing on the delivery of dsRNA and siRNA and their uptake by pests and pathogens.

Phytophthora cinnamomi: first approaches in the control of oomycetes using SIGS

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Keywords: root rot, RNA interference (RNAi), gene silencing, double-stranded RNA, uptake.

Phytophthora cinnamomi is a pathogenic oomycete causing root rot in many plants, including some forest species such as Castanea Sativa or Quercus ilex. So far, there is no effective way to control this pathogen, and, moreover, phytosanitary products cannot be applied in forests, which makes it difficult to manage the disease. SIGS (Spray-Induced Gene Silencing) could be used as an environmentally friendly method to control P. cinnamomi. This strategy is based on RNA interference (RNAi), a conserved eukaryotic gene-silencing mechanism naturally occurring in cells. It is initiated by double-stranded RNA (dsRNA), which triggers the degradation of homologous messenger RNAs (mRNAs). The SIGS technique tries to mimic this natural phenomenon by exogenously applying dsRNA molecules that target essential genes of the pathogen. While this strategy is intensively being developed for mainly agricultural pathogens, it has been less investigated in forestry, especially for oomycetes which are devastating our forests. Our research group designed and produced dsRNA molecules to silence some essential metabolic pathways for the survival of P. cinnamomi, and their efficacy was tested on Lupinus angustifolius and Nicotiana benthamiana plants. Despite having observed a limited uptake of dsRNA in fluorescence microscopy assays (a feature that is key to silencing), we noticed a reduction and delay of symptoms in seedlings when dsRNA was applied to the root prior to infection, which may mean that the plant is taking up the dsRNA and transferring it to the pathogen. These findings suggest that dsRNA targeting essential genes may be useful in managing oomycete diseases, but further study is necessary to understand the pathogen uptake capacity and enhance silencing efficiency.

CAMBIUM DAMAGE ON PINE TREES TREATED BY PRESCRIBED BURNING IN MEDITERRANEAN FOREST ECOSYSTEM

Espinosa, J.[1*], Rodríguez de Rivera, O.[2], Guijarro, M.[3], Hernando, C.[3], Vega, J.A.[4], Molina, J.R.[5], Martín-Pinto, P.[1,6], Madrigal, J.[3,7]

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Keywords: fire ecology; wildfire; modelling; tree mortality; prescribed burning; vulnerability

The knowledge about the interactions that exist in the variables involved in post-fire ecophysiological response after different season prescribed burning is very limited, especially if we consider the fire damage to the cambium. Although the tree does not die, the indirect damage of fire on cambium may also lead an increase of the vulnerability of surviving trees. Thus, it is essential to know the mechanisms of tree damage to determining the most suitable burn prescriptions. In this study, we propose a model to ascertain the influence of tree- and stand- descriptive variables, fire prescription, and fire behavior variables on cambium damage after prescribed burning treatment in different Mediterranean pine forest ecosystems, through easily measurable field variables. For this, six locations in Iberian Peninsula covering a wide climatic and ecological range were chosen. Prescribed burning in different season were carried out and the main variables used were measured before and after the burns. We proposed a random-effects hurdle model framework for estimating the probability of the time when the temperature is higher than 60°C as a better proxy of cambium damage. The results showed significant differences regarding cambium damage between burn treatments applied during autumn and those applied during spring and summer. Pinus nigra showed more resistance to fire than other pine species. Bark thickness is critical to cambium protection, especially in medium-intensity fires. The volume of crown scorch, the percentage of stem scorch and the maximum bark temperature are related to a higher time above 60ºC in the cambium. This study shown the fire resistance under canopy of the species studied in Spain that suggest prescribed burning grants low levels of cambium damage. Proposed models could help to managers to evaluate prescribed burning and to reduce potential cambium damage on trees.

DIFFERENT ALGORITHMS FOR SEMANTIC SEGMENTATION IN LARGE FOREST POINT CLOUDS

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Keywords: Deep Learning; Semantic Segmentation; Clustering; LiDAR; Point Cloud.

When talking about Artificial Intelligence (AI) we think of something futuristic, but the truth is that we have been consumers of AI for several years, perhaps the most recent worldwide resolution is happening around AI and its derivatives, such as machine learning (ML).

The ML is the science (and art) of programming computers so they can learn from data (Géron A., 2019). this revolution has brought us self-driving cars, the highly improved online translation, different recommendations, as well as the great advance in security and fraud prevention. Currently the forestry sector has increased the use of learning techniques rather than hard-coding, ML powered technologies are used in land cover changes detection, above ground biomass modelling, climate change prediction, among other key activities for the sector.

There are different learning techniques, for this we must have clearly established what result we expect, and what kind of data, and format we should use as input. The learning rate of an algorithm is a matter of finding statistical regularities or other patterns in the data. Here we get into a key point for the success of an algorithm. Data! It is well understood from literature that the performance of a machine learning (ML) model is upper bounded by the quality of the data. Before using a data set for an application, one of the key requirements is to understand the actual data set, otherwise inaccurate analysis and unreliable decisions may result.

The data generated from a high-resolution laser scanner can reach billions of points for a small area in the forest sector. In order to increase the performance and quality of semantic segmentation of the point cloud, this study aims to compare different algorithms for the processing of large forest point clouds.

FISH MOVEMENTS MONITORING 2.0 FOR ADAPTIVE MANAGEMENT OF HYDROPOWER PLANTS

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Keywords: fishway, freshwater, monitoring, sensor, smart

Most freshwater fish need to move freely upstream and downstream in the rivers to complete their life cycles. However, river barriers (e.g., dams, weirs, culverts, gauging stations) directly obstruct their reproductive, feeding, and refuge routes. The most extended solution to allow fish migration through barriers are fishways (also called fish passes), but to date, there are still many unknowns about fishways' efficiency as a holistic solution. Ideally, a fishway should allow directed, undistracted, and bidirectional fish migration between different habitats. To assess the effect of fishways on fish migration, we have monitored the bidirectional movement of fish through common and representative configurations of hydropower plants (HPP) equipped with fishways for the last 5 years and using mainly Iberian barbel (Luciobarbus bocagei) as target species. During those years, we have developed a state-of-the-art monitoring station able to track fish using passive integrate transponders (PIT telemetry) and radio telemetry, together with an IoT environmental sensor network (EU Smart Fishway project) able to record, process (edge computing), and send data in real-time. The collected information has shown the complexity of fish movements in the river. Indeed, these movements are not limited to reproductive season, and they present inter-annual and intra-annual variability. Moreover, to date, the collected information is used to fit predictive and self-learning models (e.g., Neural Networks, Survival analysis, and Random Forest). This work suggests that long-term monitoring of fish and environmental variables together with ensemble learning methods and real-time data processing can make possible the cost-effective adaptive management of HPPs to optimize the fish passage and hydropower production.

PERCEPTION OF THE "UNIVERSIDADE FEDERAL DO PARANÁ" COMMUNITY ON CLIMATE CHANGE

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Keywords: Forest education, climate change perception, social research, climate change awareness, university.

Climate change is everyday becoming more present in people's lives, direct or indirectly. Direct impacts are present in the form of extreme climate events, and indirect impacts can be related to the increases in food prices due to droughts, floods or frost on agricultural crops. Actions are thus needed in order to try to reduce the speed of these impacts. Considering that Universities are the main bodies for education and research and are huge creators of knowledge and of future professionals, it is vital to understand what these people know and think about climate change. In this way, the aim of this study was to both collect and analyze data on the community's view of climate change at Universidade Federal do Paraná, in the state of Paraná, Brazil. One future goal is for this data to be used by the university to build more tailored awareness programs inside it, considering the knowledge that the community already have. Data was collected through an online survey distributed throughout the whole university, via e-mails and posts on social media, focusing on students, teachers and administration and operational professionals. After analyzing the data, it was possible to see that almost half (42,9%) of the respondents consider that they have an intermediate knowledge level about climate change, however, 55,1% considers the subject as "very important". Besides, internet was the main resource used to find information about it for 95% of the sample. The last question of the survey was about where these people would like to receive further information about climate change, television being the preferred communication tool, followed by YouTube and Instagram. With these results in hand, the university can now create awareness programs focused on more deep knowledge, considering that half of its community already knows the basis, and this can be spread through television or social media, such as YouTube and Instagram.

MOST TOLERANT ROADSIDE TREE SPECIES FOR URBAN SETTINGS IN HUMID TROPICS BASED ON AIR POLLUTION TOLERANCE INDEX (APTI)

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Roadside trees help to mitigate air pollution by serving as a sink for gaseous air pollutants. However, in most of the humid tropics, roadside tree selection mechanisms remain uncertain due to the absence of selection criteria and lack of scientific research. The present study was designed with the objective of assessing the Air Pollution Tolerance Index (APTI) of *Terminalia catappa* (Indian almond), *Cassia fistula* (Golden shower tree), *Pongamia pinnata* (Indian beech), *Madhuca longifolia* (Butter tree) and *Peltophorum pterocarpum* (Yellow flame tree) using four biochemical parameters; pH, ascorbic acid content, relative water content and total chlorophyll content on leaves. The study was conducted in two environmental settings identified as least polluted and highly polluted in Colombo, Sri Lanka. Environmental settings were identified based on SO_2, NO_2 and $PM_{2.5}$ levels in ambient air. Selected five species with ten replicates from each site were assessed by estimating APTI values. Standard One Way ANOVA followed by Tukey's pairwise comparison was carried out to determine the differences in selected biochemical parameters among five selected roadside tree species at each site. In both sites, the highest APTI values were recorded in *M. longifolia*, followed by *P. pterocarpum*, *T. catappa* , *C. fistula* and *P. pinnata*.

SESSION II

MANGLEE: A TOOL TO MONITOR MANGROVE ECOSYSTEMS IN ECUADOR WITH GOOGLE EARTH ENGINE

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Keywords: Ecuador, Google Earth Engine, mangrove, mapping, remote sensing,

Mangroves are highly productive ecosystems that provide multiple ecological services: carbon storage, biodiversity, habitat for aquatic species, and cultural identity and ties for local communities. Despite their ecological, economic, and social importance, mangroves are threatened by natural and anthropogenic factors, hence the need of constant monitoring and mapping. Remote sensing technology has demonstrated its ability to map changes in mangroves and recent technological advances facilitate faster application of mapping methods, optimizing costs and time. To contribute to decision making and facilitate the sustainable management of mangroves, an open tool based on remote sensing data and machine learning (MANGLEE) was developed on the Google Earth Engine platform. MANGLEE comprises three modules: module one creates an optical composite and calculates spectral indices, module two makes a supervised classification based on the Random Forest algorithm combining optical and SAR data outputs binary maps of Mangrove - Non-Mangrove and calculates the measure of accuracy in the results. Finally, module three detects the changes and catalogues them into degradation or improvement. The performance of MANGLEE was tested in the mangroves of Guayas, Ecuador, the first producer of shrimp in the world. The practical use of this monitoring tool has shown that mangrove covered areas in Guayas still suffer deforestation processes, even in areas under legal protection. The expansion of infrastructure and maintenance of the aquaculture industry was the main threaten. These results show the potential of MANGLEE to quantify changes in mangrove cover.

TOWARDS A MORE PRECISE IDENTIFICATION OF PINE PROCESSIONARY MOTH DEFOLIATIONS

Houdas, H.[1]*, Hernández-Alonso, H.[1,2], Olano, J.M.[1] , Gómez, C.[1] , Domingo, D.[1,3], Sangüesa-Barreda, G[1].

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The Pine Processionary Moth (*Thaumetopoea pityocampa*; PPM) is the main defoliating insect of pine and cedar forests in the Mediterranean Basin. PPM larvae feed on needles during the winter, leading to growth reductions of thousands of trees in one episode. Global change could potentially rise the frequency and intensity of defoliation events, however, we currently lack the tools to assess the incidence of PPM in tree wood. We aimed to identify changes in tree-ring traits as proxies of PPM defoliations at tree-level. We checked out the veracity of potential PPM events by satellite data and by departure from expected secondary growth based on climate. We selected five forests of *Pinus nigra* (3), *P. halepensis* (1), and *P. pinaster* (1) recently defoliated by PPM. We sampled thirty trees per forest from the edge to the center of the stand. Two cores per tree served to identify tree-rings with conspicuous growth reductions presumably indicative of PPM defoliations. Secondary growth reductions at stand-level were verified by spectral values of Landsat data of potential defoliation years. We fitted linear mixed-effects models of Basal Area Increment (BAI) using a multiscale drought index as predictor to discern the growth reductions due to PPM outbreaks from climate effects. Our results indicate a BAI suppression over 70% in *P. nigra*, ca. 50% in *P. pinaster* and 25% in *P. halepensis* in the growing season following a PPM event. These proxies enable the detection of PPM defoliations, providing a tool to monitor PPM incidence over time and for a long term spatio-temporal characterization of insect defoliations and dynamics.

ASSESSING THE CONCORDANCE BETWEEN TREE DISTRIBUTION AND SECONDARY GROWTH RATE UNDER CLIMATE CHANGE SCENARIO

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Keywords: Climate change, Pinus nigra, Species Distribution Models, Tree growth, Vaganov–Shashkin model.

Evaluating the effects of climate change on species distribution and fitness is essential for decision-making in landscape conservation and management. Models suggest that climate change might drive species out of their current optimum environmental niche (in equilibrium with the climate) resulting in extinction debts. Simultaneously, climate change is modifying tree growth affecting its ability to fix carbon with potential negative feedbacks in terrestrial carbon cycle. However, we still lack information on the relationship between species climate suitability and secondary tree growth rates. In this study, we deepen the correspondence between habitat suitability and tree growth for black pine (*Pinus nigra* J.F. Arnold) in the Iberian Peninsula as a study case. We evaluate a possible mismatch between areas with the highest growth and the areas with the greatest habitat suitability and check whether this mismatch would be enhanced under climate change conditions. We ran Species Distribution Models (SDM) with Maxent algorithm for Pinus nigra with presence/absence data from Spanish Forest Inventory under current climatic conditions and projected the models under future climate change scenarios including: i) three temporal periods 2006-2040, 2041-2070 and 2071-2100, ii) four Shared Socioeconomic Pathways (SSPs) and iii) ten climatic models. Past and future tree growth was modelled using the Vaganov-Shashkin-Lite (VS-Lite) approximation. This model was initially calibrated with dendrochronological data measured in 125 P. nigra trees across 5 sampling plots in Soria. Later, tree-growth was derived for each cell of a 1x1 km grid and compared to habitat suitability obtained from Species Distribution Models under different climatic conditions.

ADVANCES IN DATA COLLECTION FOR DENDROCHRONOLOGY IN THE DIGITIZATION ERA

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Keywords: deep learning, dendrochronology, hardware, open-source, wood anatomy.

Dendrochronological techniques are paramount in forest research. The current climate change scenario and the central role of forests in biogeophysical cycles enforce the importance of novel techniques to get accurate data from trees and their relationship with the environment in faster ways. Recent technological advances and the place of open-source software and hardware are making free and user-developed tools for forest research available to the research community. In this contribution, I present three reliable tools for dendrochronological research. The first focuses on the development of a do-it-yourself tool based on open-source hardware for image acquisition and wood sample digitization at high-resolution. This tool derived on the publication: "CaptuRING: A Do-It-Yourself tool for wood sample digitization" in Methods in Ecology and Evolution, 2022; 13:1185–1191.The second tool describes an open-source software, for the analysis of X-ray films from dendrochronological samples to get microdensity values automatically segmented through a graphical user interface. The open-source tool and manuscript are published as: "ρ-MtreeRing. A graphical user interface for X-ray microdensity analysis" in Forests. 2021; 12(10):1405. The final section comprises the potential of deep learning methods to automatically segment xylem vessels and ring limits from stained wood microsections in diffuse-porous species. The results show the ability of these techniques to obtain accurate anatomical segmentation for quantitative wood anatomy, reaching similar or even outperforming conventional manual delimitation in most of the evaluated cases. Advances on digitization and image analysis in the current digital era are opening the room to move dendrochronology into a new era.

GENETIC DIVERSITY ON FOUR BUTTERFLIES (FAMILY: NYMPHALIDS) USING MOLECULAR MARKER RANDOM AMPLIFIED POLYMORPHIC DNA (RAPD) IN BARU BEUREUM SITE, MANGLAYANG MOUNTAIN, WEST JAVA

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Keywords: diversity, RAPD, primer, genetic, Nymphalid

Landscape changes around Manglayang mountain is potentially declining its biodiversity as well as butterflies. The diversity declining can be evaluated using genetic diversity studies. Genetic diversity is expected to represent organism ability in adapting towards environmetal changes. The aim of this research was to determine genetic diversity on four Nymphalid butterflies namely Ariadne specularia, Neptis hylas, Junonia almana and J. orithya and assess relationships between them. We used random amplified polymorphic DNA (RAPD) and data were analyzed descriptively. The results showed that there were 10 primers out of total 15 primers selected to amplify DNA successfully. The total bands produced was 179 bands. The average of polymorphic percentage was 95%. Alelles were sized between 179 bp to 2189 bp. PIC values ranged from 0.84 to 0.93. Dendogram constructed based on Jaccard's similarity coefficient divided four species into two clusters. There was a difference between dendograms constructed based on molecular marker and morphometrics. Based on the research it can be concluded that there was genetic diversity on butterflies species (family: Nymphalids) inhabiting Manglayang Mountain Baru Beureum Site.

QUALITATIVE COMPARATIVE ANALYSIS: POSSIBLE USE OF LOGIC-MATHEMATICS IN SOCIAL RESEARCH. AN EXERCISE IN THE FIELD OF THE EVALUATION.

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Keywords: social science, methodology, logic operators, configuration, outcome

This thesis is a general overview of Qualitative Comparative Analysis (QCA), a methodological approach and technique for social research, and an application of it in the field of evaluation.
QCA was born in the late 1980s to provide qualitative research a formal method of comparing case studies; initially was mainly used in historical sociology and comparative politics. The method involves using mathematical logic operators to simplify the complexity of cases. Researchers can then rewrite cases into configurations of variables and can easily compare them with each other. The analysis results are assumptions about the relationship between variables and outcomes and, consequently, the possible causal paths between the cases and the observed change.
A rich debate has developed around this novelty, which has produced varied literature on the subject and two different analysis techniques, fsQCA and mvQCA.
This method can be applied in many other disciplines, such as political economy, management studies, criminology, and psychology. As for political science, most applications can be found in public policy analysis, specifically in the field of evaluation.
In this thesis, I experiment with QCA in an evaluation exercise on a data set consisting of interviews I conducted during an internship experience for the Italian NGO Fratelli dell'Uomo. The study object is Social Day, a project involving many organisations to raise awareness of sustainable development and international cooperation among children from elementary to high school.
In 2017, the project received AICS funding for the first time, which, among many objectives, included the consolidation of relationships among the entities participating in the network. In the exercise, I apply the first version of QCA, which uses Boolean algebra to understand whether this goal was achieved and what variables helped or hindered the outcome.

SESSION III

THE MYCOTOXIN BEAUVERICIN AS A BIOLOGICAL CONTROL METHOD AGAINST PINE WOOD NEMATODE (*Bursaphelenchus xylophilus*)

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Keywords: Beauveria spp., Nematophagous fungi, integrated management strategy, Pine Wilt Disease, Nematicidal compound

Bursaphelenchus xylophilus, commonly known as Pine Wood Nematode (PWN), is the responsible agent for Pine Wilt Disease (PWD) which can lead to sudden death of conifer trees. So far, the disease management strategy has been focused on the nematode insect vector, including the use of entomopathogenic fungi (Beauveria spp.). Recently, the predacity of these fungi was identified against the nematode itself. In this context, it was essential to better understand this antagonistic interaction. After corroborating that Beauveria species were able to naturally produce the mycotoxin beauvericin (BEA), our work aimed at testing the nematicidal activity of this compound. In this experiment, commercial beauvericin ($C_{45}H_{57}N_3O_9$) was used. The nematode suspension was exposed to 3 different concentrations of the mycotoxin (0.1mM, 1mM and 2mM). Living nematodes were counted at the beginning and 72h post-treatment to calculate the survival rates. A significant reduction of B. xylophilus survival rate under the three concentrations was found, stronger in 1mM and 2mM BEA concentrations treatments. These results confirm the nematicidal effect of beauvericin and paves the way to design biological control strategies.

Beauveria bassiana AS A NEMATICIDAL AGENT AGAINST PINE WOOD NEMATODE (*Bursaphelenchus xylophilus*)

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Keywords: Pine Wilt Disease, nematicidal fungus, in vivo pathosystem, integrated management, nematode load

Beauveria bassiana is an ascomycete well-known to be a potent entomopathogenic agent, with numerous commercial formulations widely used for biological control of many pest insects, among them Monochamus galloprovincialis, vector of Pine Wood Nematode (PWN), the causal agent of Pine Wilt Disease (PWD). However, the nematicidal effect of this fungus has barely been investigated. For that reason, we decided to test a native strain of B. bassiana (EABps 11/01-Mg) on PWN, with in vitro trials and then using an in vivo pathosystem. Nematode and the insect vector larvae were placed together inside an artificial pupation chamber on pine bolts for loading beetles with nematodes. Once the adult insects emerged, half of them were inoculated with a concentrated suspension of B. bassiana spores, and after 3 days was checked the state of the initial nematode load. The results were very promising, as more than 50% of treated insects showed much fewer or no live nematodes compared to the control insects. Although further experiments are needed, these preliminary results may indicate the potential of B. bassiana as an effective biological agent for integrated control of PWD.

DIFFERENCES IN HOW ATTITUDES TOWARDS RED DEER ARE BUILT IN SPAIN AND SWEDEN

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Keywords: attitudes, values, Cervus elaphus, abundance, survey, Europe

Ungulate population have grown in number and size range across most Europe, often impacting detrimentally ecosystems and forestry, farming and human safety. The management ungulate species and their damage is usually conducted through lethal control, which frequently lead to social opposition due to increasing people´s mutualistic values. In this context, assessing attitudes of Europeans towards ungulate species is challenging due to the differences on culture along the countries of Europe. For this purpose, we surveyed the views of 800 people in total from Spain and Sweden through an online questionnaire, considering a representative sample of the society in terms of gender, age and considering proportional urban/rural populations along the territory. Participants were asked about their values, concerns and attitudes towards the red deer (Cervus elaphus) and its management. We focused on this species because it is a high-abundance ungulate that is widespread in Europe. Our preliminary multi group analysis showed how attitudes towards red deer and its management are built in the north and the south of Europe. In particular, it revealed variations between Swedish and Spaniards in the relations among values, worries and attitudes as well as significant differences between on how values and worries are related to attitudes in both countries. These results are discussed in relation to differences in the governance systems related to deer management existing in Sweden and Spain.

TEMPORAL COMPLEMENTARITY INFLUENCE ON INTERANNUAL GROWTH RESPONSE OF TREES TO DROUGHT IN PURE AND MIXED STANDS OF THE SPANISH NORTHERN PLATEAU

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Keywords: drought stress, Lloret indices, distance dependent competition indices, Mediterranean forests, linear mixed models

Climate change forecasted for the Mediterranean region will be reflected in even more severe and frequent droughts. Forests in the region are already being brought to their limits of physiological resistance, experimenting processes of decay and dieback. Previous studies have reported that tree species mixing is a way to alleviate the impact of drought and guarantee the functioning of the forest, including growth and carbon uptake. This investigation analyses the response to past drought events of four co-occuring Mediterranean species: *Pinus pinea* L., *Pinus pinaster* Ait., *Juniperus thurifera* L. and *Quercus ilex* L. at an interannual scale, both when growing alone or mixed. The main question posed is: Is the reaction of trees to drought, in terms of resilience and growth, significantly different between mixed and pure stands? More explicitly, our hypotheses are: 1) The response to drought in terms of resilience differs in pure and mixed stands; and 2) The growth varies significantly between pure and mixed stands. In order to contrast the main question, we measured tree ring widths on increment cores obtained from 268 trees (*P. pinea, P. pinaster, J. thurifera*) and stem discs from 35 trees (*Q. ilex*). Trees were selected on seven plots, with sizes ranging 0.15 – 0.48 ha. Four of the plots represent pure stands of the analysed species, while three of them represent mixed stands. The composition of the mixed stands is *P. pinea – J. thurifera – Q. ilex and P. pinea – P. pinaster – Q. ilex.* Core increments were used to calculate basal area increment (BAI) for each tree. Years with significant drought occurrence were identified using SPEI and P – PET indexes. We quantified the relationships between growth before, during and after drought using ecological Lloret's indices. The proposed hypothesis is contrasted by fitting and comparing different linear mixed effects model using either Lloret's indexes or BAI response as variables, and stand composition variables as potential predictors. The traits of recovery and resilience resulted to be influenced significantly by stand composition, likewise growth. In mixed stands, trees of all analysed species showed lower recovery and resilience, the only exception being Pinus pinaster. The tendency of growth dependency on type of stand was opposite: the greater growth rate was accomplished by all species in mixed stands, apart from Pinus pinaster. The highest growth rate in pure stands was accomplished by, subsequently, *P. pinaster, P.pinea, J. thurifera, Q. ilex.* In mixed stands the mentioned order changes slightly, as P. pinea gains in terms of growth above P. pinaster. The resistance index was not dependent on type of the stand. *Juniperus thurifera* was the species with the highest resistance to drought. The sequence of restant species according to descendent resistance index, was*: P. pinaster, P. pinea, Q. ilex.*

THE IMPACTS OF CLIMATE CHANGE AND FOREST LOSS ON COMMUNITIES AROUND BOBIRI FOREST RESERVE, GHANA

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Forest plays an important role in the lives of people, especially those in rural areas. Much interest is placed on communities around the forest because of the misleading idea that they are least affected by the changes we observe now in the environment, owing to the presence of the forest around them. The forest provides numerous benefits to humanity, which has repercussions for the climatic and livelihood patterns of people, especially the poor, and those who depend on the forest for its products as a form of livelihood. It is in this vein that the study was undertaken to assess the impacts climate change and forest loss have on the livelihood activities of communities around forest. Four communities fringing Bobiri forest reserve were selected. These communities were Kubease, Anumso, Krofrom and Motokrodua. A total of 60 respondents were purposively sampled to include only people aged 40 years and over. Data was collected using questionnaires and the respondents to the study included mainly farmers and traders. It is also realized that men and women are both changing their livelihood activities in response to climate change and forest loss but a greater percentage of men (75%) are still into farming as compared to women and a greater percentage of females (60%) are also into the trade of general wares as compared to men. Studies should be carried out to identify ways of engaging women in farming activities and also extension education should be carried out to help the people come up with suggestions that will minimize the impacts of climate change and forest loss.

SESSION IV

IMPROVING AN ADAPTIVE TRAIT, DOES WORSEN OTHERS?

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Forest trees must optimize resource investment to life-history functions (growth, reproduction and maintenance) but investment in one function may occur at the expense of other functions, resulting in trade-offs that limit maximization of all processes. Pine trees produce extremely large amounts of oleoresin, a main resistance trait against herbivores and pathogens. Resin production requires large amount of carbon resources and likely suppose huge physiological costs. Resin tapping of Pinus pinaster in Central Spain is an important economic and social resource for rural areas. Our objectives were determine intrapopulation genetic variation in constitutive and induced resin production and to explore the existence of phenotypically- and genetically-based trade-offs with other life history traits. We used a half-sib families progeny trial in Central Spain with high resin production selected families and control trees. Selected families showed higher constitutive resin yield, but we did not find genetic gain for other adaptive traits, not even for induced resin flow. We found high genetic variation among families in height, reproductive investment, wáter use efficiency and defenses (constitutive and induced resin flow). Finally, we did not find trade-offs at the additive genetic level between resin yield and other adaptive traits, that is, no side effects of selection on other life-history traits were found. Therefore, selection to improve resin yield in Pinus pinaster did not negatively affect other key adaptive traits, being a valuable opportunity to enhance P. pinaster resin tapping sector in Spain.

SIMANFOR v.3.0

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Keywords: IBERO, SMARTELO app, Forest Explorer, Scayle, supercomputing

SIMANFOR is a Decision Support System (DSS) for the Simulation of Sustainable Forest Management Alternatives that allows users to access previously programmed models and inventory data for simulating silvicultural alternatives. Originally programmed in C#, the first release in 2009 supported only one model (IBERO, an individual tree growth model independent from distance) and one language (Spanish). In 2012 an updated version was released which included new IBERO parametrization, new models, and an English language interface for non-Spanish speakers. Eight years later, SIMANFOR is rewritten in Python, improving the simulator and updating some functionalities. Finally, in 2022, the webpage is rebuilt with a more modern framework (Angular & JavaScript) which hooks up to the Python simulator. New models and model typologies were also implemented while other new languages were included in the interface. With this version, SIMANFOR can be run on a local computer, or in the cloud via simanfor.es, which is deployed on a supercomputer hosted here in UVa Palencia. It has also been installed and can run on the HPC cluster at Scayle (Supercomputación Castilla y León). In version 3.0, together with improving the simulator and the usability of simanfor.es, we are currently working (with the technology company Sngular, sngular.com) on SMARTELO app which allows foresters to plan their harvest directly in the field, and use their tree harvest selection as input to simulate the stand evolution directly on SIMANFOR. Other improvements in the pipeline include making the modeling task easier, by providing a simple method for Python-agnostic users to be able to develop their own models. Furthermore, we are currently working on allowing filtered Open GIS Data from Forest Explorer (https://forestexplorer.gsic.uva.es/es/index.html), which contains data from the Spanish National Forest Inventory, to be directly imported into SIMANFOR for simulations. Finally, we plan on leveraging the power of Scayle's cluster to allow users to seamlessly execute their simulation jobs, however big they may be, in a more efficient time frame. The idea being that jobs are sent to the supercomputer automatically when the inventory data and scenarios require more processing power.

FOREST HEALTH IMPROVEMENT AND PEST/PATHOGEN REDUCTION BY USE OF NATURAL MYCO-CONTROL PRODUCTS AND NATIVE FUNGAL SPECIES

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Mediterranean forests are filled with microorganisms that can affect the overall health of the ecosystem. The balance of pests and pathogens with other mycorrhizae or biocontrol microorganisms may either weaken and kill forest flora or contribute on helping the forests thrive. For this reason, we are interested in searching for natural myco-control products and native fungal species that may be found in our local ecosystems. These microorganisms could be cultured and reapplied in our local forests for reduced pest/pathogen presence in forests, and so the objectives of our work include the identification of possible fungal endophytes that may serve as biocontrol against fungi and or insects, as well as the description of diversity in the field. For the purpose of fulfilling our objectives, four sites were selected in different areas of the Salamanca region. In each selected site the predominant tree species were different, being Quercus Ilex, Quercus pyrenaica, Quercus suber and Castanea sativa. At these four different sites, wood, bark, branches and leaves were sampled from 5 healthy trees and 5 sick trees. With these samples a metabarcoding analysis was performed to characterize the fungal populations present in the area, simultaneously, these samples were cultured in petri dishes to isolate as many native fungi as possible. Identification of biocontrol endophytes against fungi and insects is ongoing.

ISOLATION AND CHARACTERIZATION OF *PHYTOPHTHORA* OOMYCETES CAUSING ALDER DIEBACK IN SPAIN

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Keywords: Oomycetes, Phytophthora alni species complex, Phytophthora plurivora, alder, alder dieback, alder population decline

Alder dieback is caused by the oomycetes Phytophthora alni species complex and P. plurivora, affecting alder (Alnus glutinosa) (Brasier et al., 2004), one of the most ecologically important tree species due to various factors, such as the contribution to the formation of ecological niches in riparian areas or its ability to fix nitrogen thanks to symbiotic relationships with organisms such as Frankia alni (Claessens, 2003; Handa et al., 2014; Waring & Running, 2007). The pathogens mainly affect the root and the lower parts of the trunk, producing bleeding cankers, as well as crown dieback and yellowish leaves (Claessens, 2003). Europe has suffered a severe decline of alder population in the last three decades due to this disease. Pintos Varela et al. (2010) detected P. alni complex species in Spain for the first time and Galicia is thought to be one of the most affected areas (Ministerio de Agricultura, Pesca y Alimentación of Spain, 2017). Also, in Spain a decrease in alder population has been detected in recent decades in the northern and central river basins (Tuset et al., 2006), related to the presence of the pathogens in Galicia in 2010 (Pintos Varela et al., 2010; Solla et al., 2010). As a response to this problem, we have initiated a project with the aim of performing a research program on alder protection and restoration against the Phytophthora alni species complex and P. plurivora decline. Also, we are collaborating with the government of Galicia to characterize the pathogens associated with the alder dieback in this region. Now we are isolating the pathogen from bark samples from Galicia and from soil samples from Zamora, extracting DNA once the organisms are isolated, performing PCRs with specific primers to amplify the ITS region in Phytophthora species and sequencing the samples to identify the present species. The next steps will be to characterize the genetic variability of alders in Spain and the interactions in the Alnus-Phytophthora pathosystem and to study the possibilities of environmental-friendly methods for the management of alder dieback.

LIFE CYCLE ANALYSIS OF *PICEA ABIES* WOOD AND WOOD PLASTIC COMPOSITES USES IN ROOFING

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Keywords: Life Cycle Assessment, mechanical properties, environmental impact.

Changes in consumer perceptions of environmentally friendly products encourage a continual increase in demand for goods that are not only sustainable and economically appealing, but also of high quality and perform the desired functions. Thus, wood can be considered a sustainable material because it has several beneficial properties, such as a low carbon footprint when all harvesting, manufacturing, and transportation processes are considered up to the point of usage. Similarly, wood plastic composites (WPC) can be an interesting alternative because these are products that contain waste, both plastic and wood, during their production process. Due to the increasing demand for housing, it is intriguing to consider green buildings, the goal of which is to reduce a house's energy consumption and its negative effects on human health. However, one of the key topics of discussion is the selection of greener materials that can withstand the mechanical stresses required in these architectural circumstances. To determine the difference in environmental impact, the mechanical properties related to the ability to withstand flexural and compressive stresses of both Norwegian Spruce (Picea abies) wood and a WPC (consisting of approximately 70% natural fibers and 30% thermoplastic polypropylene) were characterized during the development of this work. Based on the research and calculations performed throughout the testing, the beam constructions of both materials could be dimensioned to carry the load of a hypothetical roof. The necessary volume discovered in the sizing calculations enabled the development of a life cycle analysis (LCA) based on data from the IDEMAT 2018, which concluded that wood has a positive environmental impact because it is a material provided with sustainable forest management, promoting a high carbon sequestration, whereas WPC has a negative environmental impact, even when recycled plastic sources are used.

ASSESSING FACTORS DETERMINING USERS' PARTICIPATION IN COMMUNITY FOREST MANAGEMENT: A CASE STUDY FROM CENTRAL NEPAL

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Local community participation in forest management is pivotal since they are familiar with the forest environment. Males and females, as well as representation of disadvantaged groups, are critical to the successful administration of Community forestry. This study examines the relationship between the independent factors of gender, caste, educational level, and age and the dependent variables of financial mobilization sponsored by donors and produced by the sale of wood and involvement in forest operation and management. Reconnaissance surveys, key informant interviews, focal group talks, and household surveys were used to obtain primary data. Secondary data were gathered from the Division Forest Office, Community Forest User Group Operation Plans, and the Constitution, as well as the internet and verified websites. The c2test was applied to test separately association variables gender, caste, educational level, and age with participation. Using ordered logit regression, the variables affecting participation in fund mobilization and Forest management & operation activities were quantified. Gender, education, and caste are the most promising factor influencing participation in both fund mobilization and forest operation and management. However, age is found to be less significant with participation than other studied independent variables.

EFFECT OF THE CHOICE OF DIAMETER ON CROSS-SECTIONAL AREA OF TROPICAL HARDWOODS

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Keywords: Forest biometry, Cross-sectional discs, Eccentricity, Planimeter, Northeast India

One of the most important components of forest inventory has historically been accurate assessment of standing tree volume, which varies based on the cross-sectional area along the tree stem. For measuring diameter at breast height (DBH), foresters assume that stem cross-sections to be circular, though this is rarely the case in nature for tropical hardwoods. It is therefore crucial to choose a suitable way of measuring DBH for gaining a better accuracy in further calculating volume, biomass, or other derived tree level variables. In this study, 8 formulas of assessing DBH using measurement tape and tree callipers were tested for their accuracy. The areas of cross-sectional discs at breast height from 18 hardwood species from northeast India were measured and then extracted. To test the accuracy of formulas for different shapes independently, the discs were grouped into several classes of eccentricity, which was defined as a measure of their out-of-roundness, expressed as the ratio between the maximum diameter and its perpendicular. An eccentricity value close to 1 conforms to a circular shape. A digital planimeter was used to determine the actual area of each sampled disc. The relative biases that formulas yielded were compared with the actual area using two-tailed paired t-test at 95% confidence limit, % bias, and root mean squared error (RMSE). The findings suggested that the measurement tape performed good for only the higher eccentricity values from 0.95 to 1, showing an overall % bias of +9.98%. Meanwhile, the area calculated using the geometric mean, arithmetic mean, and quadratic mean of the maximum and minimum diameters by callipers had no significant difference from the actual area values at $\alpha=0.05$. They also produced the lowest % bias, between -2.47% to +1.44% and the lowest RMSE values, between 8.67 to 26.63. Therefore, any of these three methods can be recommended to be used for measuring DBH with highest accuracy in field for tropical hardwoods.

SESSION V

IS EVERYTHING EVERYWHERE?
POPULATION GENETICS OF INVASIVE PATHOGENS AND THEIR HYPERPARASITES

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Keywords: Chestnut blight, forest invasions, biological control, pine pitch canker

Fungal invasions cause significant damage to forests by weakening or killing local trees. The best-known example of this damage is the one caused by Cryphonectria parasitica which killed around four billion trees in North America. Using hyperparasites is an optimal way to biologically control invasive pathogens. However, little is known about fungal invasions and their hyperparasites, making it harder to avoid and control them. This study aimed to use population genetic tools to test "is everything everywhere"? Different molecular markers were utilized to investigate C. parasitica and Fusarium circinatum invasions to Spain and Italy and to optimize their biocontrol through hyperparasites. A high genetic diversity of C. parasitica in Italy and a low genetic diversity in Spain showed that Italian populations are older and better established than the Spanish. A high diversity of hyperparasites in Italy also corroborated the hypothesis. In addition, we found evidence of independent introduction events of C. parasitica from France to Italy. In contrast, F. circinatum populations in Spain were clonal and indicated a single introduction event. Best fungal-viral combinations were identified to control the disease in the region. This study would help to avoid future fungal invasions and help control the invasive pathogens already present in Europe.

LANDSCAPE FOREST MANAGEMENT FOCUSED ON FUNGAL PRODUCTION AND WILDFIRE PREVENTION

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Keywords: Cistus ladanifer, Quercus, fungi, forest succession, Non-wood forest product.

Mediterranean oak (Quercus) forests alternating with Cistus scrub are among the most widespread Mediterranean ecosystems. Both species have a great fungal production, including edible species of great gastronomic value, constituting a very important source of income in many rural economies, even surpassing the wood value. Despite the ecological and economic value that these ecosystems may have, they are highly threatened by forest fires due to the presence of flammable components of Cistus ladanifer and the invasion of scrub caused by the decrease in population in rural areas. This increase in available fuel, together with increasingly extreme climatic conditions, favors more intense fires that affect more and more areas. Given the importance and extent of these systems, it would be important to know the factors on which fungal production and diversity depend, especially of fungi of economic value, either mycorrhizal or saprophytic and how to promote these factors through forest management by protecting forest stands from the fire risk. For this purpose, sporocarps were collected during four consecutive years in (2 x 50 m) plots of Cistus at a younger and more advanced stage of development and in Quercus-dominated plots, in which the influence of both the species and its stage of development on the composition, diversity and fungal production was evaluated. Preliminary results suggest that favoring a landscape rejuvenating the stands while leaving areas in senescence, will favor an increase in fungal diversity by favoring stands at different stages of development.

SCOTS PINE (PINUS SYLVESTRIS L.) EXHIBITS A DECREASE IN WOOD DENSITY AND LIGNIN CONTENT FOR DRY VERSUS NORMAL YEARS AND MIXED VERSUS MONO-SPECIFIC STANDS

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Keywords: Wood density, Lignostation, ATR-FTIR, lignin content, mixed species, and drought.

The quality of wood can be assessed by two key factors: wood density and lignin content. These properties play a major role in determining the strength, stiffness, and fire resistance of wood. Historically, research in forests has focused on the impact of drought and mixture of different tree species on wood quality. However, there is still a considerable gap in understanding how wood density and lignin content are altered in normal to dry conditions. In this study, we aimed to examine the influence of drought and the mixture of Scots pine (Pinus sylvestris L.) and European beech (Fagus sylvatica L.) on wood density and lignin content at two sites in Central Europe. The analysis was carried out using the LIGNOSTATIONTM and ATR-FTIR spectroscopy techniques on increment cores and wood discs from 30 trees. Our findings showed that in mixed stands, Scots pine trees had lower lignin content at the root and stem level compared to pure stands. Furthermore, tree ring wood density in different organs such as stems, roots, and branches was lower in mixed stands compared to pure stands. On the other hand, our results indicated that lignin content and tree ring wood density were unaffected by drought years. Given these results, the wood industry must take into account the effects of tree ring density and lignin content when considering global change.

DIFERENCIAS EN LOS PATRONES DE BIODIVERSIDAD DE ARTROPODOS EN LOS CAMPOS DE MAÍZ DE MEDIA Y BAJA ALTITUD DE LA ISLA TERCEIRA (PORTUGAL)

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A total of six cornfields from Terceira Island (Azores, Portugal) located in low and medium- areas, were sampled to describe the arthropod communities of the different altitude fields. Comparing composition patterns, abundance, and species diversity. The sampling was carried out using pitfall traps. A total of 16 traps were set per field, in three different periods of corn development. The beginning of flowering, flowering, and fruit maturation. The following biodiversity markers were calculated according to the Hill Numbers series: Species richness, Shannon-Wienner exp, Simpson inverse, Berger-Parker inverse, and finally Pielou's Eveness. The diversity of medium and low altitude was compared by means of the t-student contrast statistic, for various groups of arthropods: all species and for six subgroups; two of Indigenous and Non-Indigenous species; two of Predatory and Herbivorous species and two for the orders Araneae and Coleoptera. It was observed that the communities of the studied subgroups and the total of species have tendencies of a higher richness of species and more balanced populations in the populations located in the low altitude fields, with the exception of the Indigenous species where these trends were observed in the mid-altitude fields. Significant differences were observed between some of the abundance and rarity markers of the Coleoptera, Herbivorous, and Non-Indigenous subgroups. In these subgroups, the communities were significantly more balanced in the low-altitude corn fields. These differences in the structures of the communities may be a consequence of the harder climatic conditions with the elevation gradient, and of the more turmoil of the low-altitude habitats, which favor the colonization of the Non-Indigenous species.

COMPARISON OF MAMMALIAN SPECIES PRESENCE, DAILY ACTIVITY PATTERNS AND ANTHROPOGENIC DISTURBANCE IN OITI AND TZOUMERKA NATIONAL PARKS

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Keywords: camera traps, frequency of occurrence, biodiversity.

We investigated frequency of occurrence and daily activity patterns of mammalian species in relation to human disturbance in 13 and 14 sampling sites at Oiti (8th-9th/2015) and Tzoumerka (4th- 6th /2015), with the use of automated infrared camera traps, for 497 camera trap nights per area. Ten mammalian species were recorded (N=1284 records). Overall recording intensity of mammals was higher in Oiti than Tzoumerka (6.95 and 3.81 records/100h respectively). Hare and fox were the most common species in both mountains (>23%). Bear, wolf and wild boar were recorded more frequently in Tzoumerka, with the latter being very common (25% of records), than in Oiti. Most of mammal species presented their maximum activity during the night. Roe deer was recorded quite frequently (7% of records) and mainly during daytime in Oiti, but very rarely (1%) and mainly during sunset in Tzoumerka. Human disturbance was quite intense (3159 records) during daytime (76 & 90% of total recordings in Oiti and Tzoumerka respectively). The main source of disturbance was traffic by motorized means in Oiti (64% of local records) and livestock presence in Tzoumerka (83%).

GENETIC IMPROVEMENT OF STEVIA REBAUDIANA
(PROFESSIONAL PRACTICE INTERNSHIP)

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Keywords: Stevia, Glycoside, Sweetener, mutations, radiation,

Stevia rebaudiana Bert. Belongs to is a shrubby plant that belongs to the Solanaceae family, this plant is native to South America (Paraguay) and produces a compound called stevioside, the major sweetener inside the stevia leaves. This compound has been considered as a sugar substitute since the late 20th century. The importance of this glycoside as a noncaloric compound leads to work in research to enhance the productivity of stevia plants. During this internship, the plants were induced to random mutations using physical and chemical methods such as gamma rays and EMS. The results are confidential, due to this research was carried on for a private company and the data are protected, but there were observed several changes in morphological characters and in the genome.

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POSTERS

HUMAN WILDLIFE CONFLICT IN CHITWAN NATIONAL PARK, NEPAL

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Keywords: Buffer zone, Crop damage, Livestock depredation, Human casualty, Constructive measures

Human-wildlife conflict results from interactions and competition for resources between people and animals due to a rise in human population and the resulting demand for space.Its frequency and severity have been rising annually, especially in Chitwan National Park.This research assessed damages caused by wildlife, crop damage, livestock depredation and human casualty and explore the constructive measures applied by local people and national park to minimize Human wildlife conflict in the study area. The study was carried out in Ratnanagar Municipality (ward-7) in Mirgakunja Buffer Zone of Chitwan National Park. Data were collected through social survey including Questionnaire survey, Key Informant Interview, Focus Group Discussion and also a field observations. A household survey of minimum 108 households out of 893 using simple random sampling with 12% sampling intensity was conducted. Secondary data were collected from government offices, local authorities, Mirgakunja Buffer Zone User Committee (MBZUC) and stakeholders. The data of the study were analyzed using quantitative methods in Microsoft Excel. Among the sampled households 73% of households have faced damages caused by wildlife and 27% were not affected. Crop damage (87%), livestock depredation (37%) and human casualties (5%) were major problems caused by rhino, elephant, deer, wild boar, python and tiger. Trend in human casualty from the year 2014-2019 was analyzed through secondary data collection from buffer zone office. Scare crow (36%), natural physical barriers (28%), wire fence (17%), watch tower (12%) and trenches (7%) were the constructive measures applied by local people along with Plain Cement Concrete (PCC) wall with barbed wire and power fence by National park to mitigate damages caused by wild animals. Conflict between humans and wildlife showed a direct impact on the local population's economic and social well-being.

HOUSEHOLDS BIOGAS TECHNOLOGY ADOPTION IMPACT ON FOREST CONSERVATION IN NORTHWEST ETHIOPIA

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Keywords: Biogas adoption, Fuelwood, Charcoal, Household, Forest conservation

Implementing domestic biogas technology program is vital role for developing countries like Ethiopia to provide a decentralized modern renewable. This study examine the adoption of biogas technology Impacts on forest conservation in Motta District Northwest, Ethiopia. The total 198 households (65 adopters and 133 non-adopters) were involved in the household survey. The binary logistic regression model were used to determine factors affecting household decision on biogas adoption. The kitchen performance test method was employed to quantify the daily mean fuelwood consumption on 25 households from each categories. The result revealed that the annual firewood and charcoal saving capacity of regularly functioning biogas plant was found to be 1306.70kg/hh/yr, 400.05kg/hh/yr of dried biomass wood respectively. Accordingly; the mean fuelwood saving capacity of regular functioning biogas 1706.75 kg/year that estimated three Eucalyptus globulus trees which is dominantly fuelwood tree species for the households. Sex, Age, Farmland size, Total annual income, Number of livestock, and Awareness were found to be the most important factors that affect households' decision on adoption of biogas technology. For better scaling-up and sustainable domestication of biogas technology for reducing deforestation experts in biogas energy sector should work in association with experts of agriculture, forest sector, as well as environment, and climate change.

REAL-TIME MONITORING OF FISHWAY PERFORMANCE USING A CUSTOMIZABLE SENSOR NETWORK ARCHITECTURE

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Keywords: environmental sensors, sensor networks, fishways, open source, adaptive management

In today's world, real-time data collection and processing is essential for the management of natural environments, research, and the implementation of adaptive management strategies. However, the available sensors and sensor network architectures often are expensive and offer limited customization options, limiting their use.

The EU-funded Smart Fishways project (Grant agreement ID: 101032024), has addressed this issue by developing a custom sensor architecture to assess the impact of hydrological variability on fishways and create a new generation of fishways that are capable of self-deciding their optimal management and configuration. The developed sensor network architecture is a key component of this project, and the aim of this work is to showcase the system as it has direct applicability in the study of other natural environments.

The network follows a star architecture with independent, custom-made nodes (e.g., environmental sensors, water quality sensors, depth sensors), remotely connected via radio communication and autonomously managed by a central gateway. The open software architecture of the system allows for nodes to work independently as loggers, and the gateway is a fully functional Linux system, making it highly customizable and equipped with edge computing capabilities such as running custom Python scripts and machine learning algorithms. Furthermore, the network is cost-effective and customizable, making it an ideal solution for other monitoring applications such as air and water quality, wildlife monitoring, and many other environmental monitoring needs.

To date, the sensor network has successfully demonstrated its use in optimizing the timing of maintenance on fishways in real-time, and in detecting hydraulic configurations that maximize fish passage. Additionally, it enables the development of adaptive management strategies that optimize fish passage and improve the overall effectiveness of fishways.

Comparative Assessment of Ecological Diversity and Environmental Conditions under Two Different Plantations

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Keywords: participatory plantation, forest plantation, canopy cover, basal area, soil measurements

After the logging ban government undertaken massive program of participatory plantation to meet the demand of forest resources and also for the conservation of nature and wilderness. Now these participatory plantations possess a vast area of forest lands. In some areas, the volume is more than the actual natural or non-participatory plantations. It happens that in same area, participatory and non-participatory plantations are being carried out simultaneously by dissimilar plants though we don't know how these plantations are affecting the microclimate of the area. The study was carried out to reveal the ecological and environmental attributes and how they vary from participatory to non-participatory plantations. This study was carried out in the north-eastern region of Bangladesh by taking 60 plots (10m X 10m) in the Habiganj district to assess the criteria and variation of those attributes within two plantations; as species composition, canopy coverage, basal area, air temperature, humidity, soil temperature, soil moisture, soil biomass, soil organic matter, soil total nitrogen. Finding shows that; canopy coverage significantly varies between the two plantation types where it is 7.7% more in the participatory plantation, whereas air temperature and soil temperature also significantly varies which is 1ºC lower in non-participatory plantation. In the two plantation types, variations also exists in the species composition and attributes like humidity, and basal area showed large differences; but they didn't vary significantly. Further comprehensive study can be carried out by comparing the findings of the research with one of the natural forests of the study region to assess the naturalness of the two plantation types.

SEX-STRUCTURED CONTINUOUS TIME POPULATION DYNAMICS MODEL OF THE GREEN SEA TURTLE (*CHELONIA MYDAS*) POPULATION IN THE GALAPAGOS ISLANDS

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Keywords: population dynamics, Chelonia mydas, local & global stability, Routh-Hurwitz stability criterion, Poincare-Bendixon's Theorem

The green sea turtle, *Chelonia mydas*, is the only species that nests in the Galapagos Islands, considered one of the main nesting sites in the East Pacific. The nesting monitoring of the green sea turtle in the Galapagos Islands is carried out annually since 2010 and allows the Galapagos National Park to evaluate its conservation status, to establish an updated information base on the behavior of the nesting females during the breeding season, and to establish the hatching and emergence success of the nests deposited during each season. However, the methodology used by the GNP to monitor the green sea turtle only offers a record of the trends and fluctuation of the nesting population and their possible causes. This information is insufficient to assess the population of green sea turtles, as females represent only a small component of the total population. To represent the population dynamics of the green sea turtle (*Chelonia mydas*) in the Galapagos Islands a sex-structured-continuous-time model was developed. Through the qualitative mathematical analysis of the model, the following is demonstrated: 1) The flow induced by the system is positively invariant in the region of biological interest (Ω); and 2) The condition ($R_0>1$) is necessary and sufficient for the only non-trivial equilibrium point (I^*) to be globally and asymptotically stable in that region. The condition ($R_0>1$) is derived from the linearization of the three-dimensional system and the use of the Routh-Hurwitz stability criterion for the analysis of local stability of the equilibrium points. For the study of global stability, the original system was reduced to a two-dimensional one, to later apply the Bendixon's criterion and the Poincare-Bendixon's Theorem and conclude that the non-trivial equilibrium point is globally asymptotically stable. When implementing the estimated values for our parameters in the numerical simulations, it was observed that indeed the population of Galapagos green sea turtles complies with the conditions for which the non-trivial critical point (I^*) is globally asymptotically stable; that is, the asymptotic stability is maintained for any initial value within the set Ω. In contrast, when altering the estimated values of the parameters so that the established condition is not met, the trivial critical point (I_0) becomes globally stable, and the population falls towards extinction regardless of the values taken within the positively invariant Ω set. Therefore, based on the historical data of the nesting population records, together with the results of the qualitative analysis and the numerical simulations, it can be concluded that the green turtle nesting population in Galapagos is a healthy population, with a significant number of individuals.

Estimating the biomass of a burnt brutia pine Forest in the province of Latakia, Syria:

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Keywords: Forestry, Mediterranean, Pine, Biomass, DBH, Forest-Fire, Syria

Four samples of a burnt brutia *Pine forest* have been chosen in the south western Province of Latakia, in the west of Syria, with a radius of 11.3 m and a space of 400 m2, with the objectives of estimating the biomass of that forest, where a DBH of 1.3 m has been chosen, and 11 trees that covers all the diameter classes were cut down, the method of non-linear Regression has been used between the DBH and weight to create an equation to estimate the biomass, the gathered data has been processed using Microsoft excel, and after obtaining the values of the constants, the equation has been applied on all the trees of the samples. the resulting equation has given very good results with an excellent variance value of 0.95, the final results and recommendations are using the exponential equation to calculate the biomass of the burnt brutia pine trees gives good results, and the utilization of the computer technologies in forestry is encouraged, which would make the management of forests easier for foresters.

ABOVEGROUND BIOMASS MODELS FOR INDIGENOUS TREE SPECIES IN DRY AFROMONTANE FOREST, CENTRAL ETHIOPIA

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Keywords: Allometry, Dendrometric variables, Generic equation, Menagesha Suba, Wood density .

Species specific tree biomass models are important tools to quantifying forests' above-ground biomass which is essential for sustainable forest management. However, lack of knowledge in modelling biomass of individual tree growth, hinder the sustainable management of Dry Afromontane forests. In this study, models to estimate above-ground biomass were developed for Rhus ruspolii, Ekebergia capensis, and Nuxia congesta. To develop the models, a total of 45 trees from different diameter classes were selected, felled, and divided into different biomass compartments. For the model's development, diameter at breast height (DBH), total height (TH), diameter at stump height (DSH), and wood density (WD) were used as independent variables. Models' performances were evaluated using RSE, adjusted coefficient of determination, and AIC. Also, model validations were done by using rRMSE, mean absolute deviation, bias, and coefficient of variation. Model 5 (Adj- R2 = 0.92), model 6 (Adj- R2 = 0.97) and model 8 (Adj- R2 = 0.82) were the best fitted model for Nuxia congesta, Ekebergia. Capensis and Rhus ruspolii respectively. The average wood density of Ekebergia capensis, Nuxia congesta and Rhus ruspolii were 0.59, 0.50 and 0.69, respectively. The variation between observed biomass and estimated biomass using new models was statistically not significant (p > 0.05). Thus, biomass models developed here can be important tools to accurately estimate above-ground biomass in the Menagesha Suba forest and can be integrated into decision support tools.

TRANSCRIPTOMIC APPROACH TO FUNTIONAL MODIFICATION IN SCION AND ROOTSTOCK STEMS OF GRAFTED MARITIME PINES

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Keywords: Pinus pinaster, grafting, stem transcriptome, drought-tolerance, conifer.

Grafting is a vegetative propagation method used for centuries in agriculture. It also constitutes an excellent research system to study the molecular regulation of traits based on long distance communication between organs through the stems, such as drought tolerance. In angiosperms, grafting has been used for a wide variety of purposes and a vast number of grafting-based studies have been published. However, in gymnosperms, it has been traditionally focused on maintaining elite genotypes and producing high quality seeds. Therefore, studies on the effects of grafting in gymnosperms, in general, and in conifers, in particular, are scarce. Pinus pinaster Ait. is a Mediterranean native conifer which shows remarkable intra- and inter-population genetic variability and variation in traits such as growth, water use and tolerance to abiotic and biotic stresses. These characteristics make it an excellent model to investigate the molecular basis of drought tolerance of conifers. In this study, rootstock-scion interactions on grafted P. pinaster stems were analysed using transcriptomic approaches. Four constructs combining genotypes with contrasting response to drought were studied: Gal1056 (drought-sensitive) and Oria6 (drought-tolerant), used as scions and grafted onto the vegetative propagated F1-full-siblings (Gal1056 x Oria6) R1S (drought-sensitive) and R18T (drought-tolerant), used as rootstocks. Our study revealed transcriptional variations on stems that depended on the interaction between scion and rootstock genotypes, highlighting the importance of the rootstock selection in conifers. On the one hand, drought-sensitive scion stems showed significantly higher number of DEGs when grafted onto drought-sensitive rootstocks, affecting several biological functions related with drought tolerance, i.e responses to external, biotic or abiotic stimulus, cell wall modification... However, the number of DEGs included in those biological functions did not vary when grafted onto the drought-tolerant rootstocks. Other functions that depended on rootstock genotype were terpenoid, flavonoid, ROS, and amino acid metabolism pathways. On the other hand, no significant functional effect was observed in rootstock stems associated with the different scion genotypes grafted onto them. The results of this study can be used to unravel the drought tolerance of conifers and to consider the use of grafting as a possible propagation tool which is key in the current context of a changing climate.

EFFECT OF BIOPRIMING WITH PLANT GROWTH PROMOTING FUNGI *TRICHODERMA VIRIDE* ON EAST INDIAN SANDALWOOD

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Keywords: germination, regeneration, seed treatment, tree nursery, seedling.

Biopriming of plant seeds with growth-promoting fungi is a practiced and feasible method for improving germination and seedling growth in a variety of agricultural crops. Sandalwood (Santalum album L.) is one of the most valued timber tree species in the world. But, it is categorized as vulnerable by IUCN because of its declining natural populations. Besides, raising seedlings in tree nurseries is also difficult due to low and inconsistent germination and poor quality of germinated seedlings. The current study looked at the effect of biopriming on sandal germination and seedling performance. Fresh mature seeds obtained from the Nachivayal Reserve Forest, Marayur Sandal Division, Kerala, India, were bioprimed with Trichoderma viride at four concentrations (25, 50, 75, and 100%) and four durations (2, 4, 6, and 8 days). The biopriming at 100% for two days produced the highest germination percentage (76.4%), followed by four days with a germination percentage of 71%. Simultaneously, the 25% biopriming for eight days showed the lowest germination percentage (4.5%). In terms of seedling growth, biopriming significantly increased the seedling's growth qualities. The study recommends biopriming with Trichoderma viride at 100% for two days as a viable strategy to enhance seed germination and seedling development in sandals. Biopriming, followed by systematic supervision of seedling development, ensures quality stocks of sandals in tree nurseries and conserves the species from the threatened category.

EFFECT OF FIRE AND CUTTING ON VEGETATION PROPERTIES IN THE GRASSLAND OF BARDIA NATIONAL PARK, NEPAL

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The study aimed at comparing species composition and plant physical properties i.e., height and biomass in burned and mowed grassland patches in the Bardia National Park, and to study effect of management on grazing pattern by herbivorous. The study was carried out at Bagaura Phata of BNP. Vegetation assessment was carried out using point intercept method using 1 m2 quadrant and vegetation samples were hand separated to grass parts (green leaf, green stem, dry leaf and dry stem) to compare the physical properties between burnt and cut plots. Likewise, grazing intensity (or pattern) was quantified by pellet group count and direct observation. Grass physical properties and grazing pattern is compared between burnt area and un-burnt areas and tested for statistical significance. Species diversity index for herbivores was estimated using Shannon's diversity index. Proportion of green leaf difference (40% vs. 27%, respectively) in mowed and fire plot and Proportion of dry leaf (13.26% vs. 4.3%, respectively), proportion of dry steam (5.4% vs. 22%, respectively), in mowed and fire plot and was found statistically significant. Similarly, no significant difference is found in terms of height, biomass and green stem proportion. The grassland contains more than 60 grass species of different families, mostly dominated by grasses of family Fabaceae, Poceae, Cyperaceae, lamiaceae and Asteraceae. There was no difference in the presence of individual grass species but differences between the fire and cutting treatments resulted primarily from an increase in the species richness of forbs in the fire treatment. The correlation calculated between grass height and grazing intensity in grazing lawns with Fire and cutting treatment resulted negative i.e., r= -0.6351 and r=-0.4534. The study of grazer's diversity revealed as H'=0.83. Grazing intensity was higher in burnt plots compared to cut plots.

SOLUTIONS TO MULTIDIMENSIONAL POVERTY ALLEVIATION: A CASE STUDY IN PHAN DINH PHUNG WARD, THAI NGUYEN CITY, VIETNAM

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Keywords: multidimensional poverty index, poverty alleviation, poverty line, poor and near-poor households, Thai Nguyen

This study aimed to understand the reality of multi-dimensional poverty and analyse the factors affecting multi-dimensional poverty, thereby providing some recommendations for the implementation of national target programs and general poverty reduction programs in Thai Nguyen province. According to the multidimensional poverty approach being applied in Thai Nguyen, most of the poor are not single-dimensionally poor (based on income standards) but are poor in all social dimensions (multidimensional poverty), the most common being poverty-stricken poverty regarding social insurance, health insurance, housing. The main method used in the study is a quantitative method to understand data on poor and near-poor households and a qualitative method to understand the causes of poverty. The results of this study indicated that Phan Dinh Phung Ward has 40 residential groups, of which 23 groups with poor households (41) and near-poor households (16) and that the levels of lack of access to education, health, housing, living conditions, information, and basic social services as well as causes of poverty among the surveyed households. However, a small shock can also make a household that has just escaped from poverty become a poor household again due to these near-poor and poor households are mainly the elderly and disabled so they are easily affected by changes in natural disasters and pandemics. Therefore, in order to reduce poverty sustainably and improve the quality of life for people, it is necessary to continue to have suitable solutions to actual conditions.

PHYLOGEOGRAPHY OF THE CAIMAN YACAREAT TWO GEOGRAPHICAL SCALES BY USING MITOCHONDRIAL DNA POLYMORPHISM

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Keywords: Caiman yacare, mitochondrial DNA, hybridization, gene markers.

The mitochondrial DNA sequences of the cytochrome b gene (Cyt B) of the 45 Caiman yacare samples collected locally (Beni River Basin -Alto Madera) were analyzed with the purpose of studying the Caiman yacare phylogeography and comparing them at scale. region (Amazon basin -Bajo Madera) with respect to the 94 sequences available in GenBank of Caiman crocodilus. The phylogenetic relationships of C. crocodilusand C. yacare showed that these two species share mitochondrial haplotypes, this exchange occurs specifically between individuals belonging to the Madeira river drainage above the Teotonio – Jirau cachuelas, considering this an area where the hybridization of both species is geographically and biologically possible. At the local scale, within the sub-basins of the Beni river, it was observed that there is no significant degree of genetic structuring, the effective number of migrants per generation is 2.58 and it could be having a homogenizing effect on the study population. However, of the 6 haplotypes found in this study, 3 are present in the group downstream of the Beni river and the 6 in the group upstream, from this haplotype distribution it is necessary to strengthen conservation efforts in the sub-basin of the river above (Cachichira), in order to preserve the gene pool of this area.

It is necessary to complement these analyzes with nuclear markers specifically designed for Caiman yacare together with other complementary mitochondrial markers, in addition to generating genetic data of this species in the departments of Beni, Santa Cruz, and Pando to understand and compare their biodiversity to contribute to the measurements of conservation of the species. In addition, the collection of hunting pressure data should be emphasized and optimized, accompanied by policies to control the illegal trade of the species throughout the Beni river basin, in this way having real data to estimate the effects of hunting on these populations and thus take appropriate action measures.

DETECTION OF FOREST COVER CHANGE AND SPATIAL PREDICTION OF GROWING STOCK IN SATCHARI NATIONAL PARK, BANGLADESH

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Keywords: geographic information system, image classification, map, modelling, remote sensing, vegetation index, volume

Planners and decision-makers in Bangladesh are increasingly facing the challenges of responding to issues regarding the management of forest ecosystems at national and regional level. Therefore, monitoring forest cover changes and quantification of forest growing stock are necessary for better forest management planning. This study mapped the forest cover and estimated the change of Satchari National Park (SNP), Bangladesh, over a period of 20 years. Supervised classification of imageries and Normalized Difference Vegetation Index (NDVI) approach were applied to classify the forest into four classes; namely dense forest, medium dense forest, low dense forest and bare land. Overall mapping accuracy of the forest cover was 81.81% (with associated kappa value 0.635). During the period, dense forest increased and medium and low dense forest decreased and bare land showed no significant changes. This research also developed a regression model for predicting growing stock of the forest. Hence, six different vegetation indices (independent variables) were regressed with volume (dependent variable) of training plots to get the models and testing plots were used for validating those models. The result indicated significant relationship between the volume and Normalized Difference Vegetation Index (NDVI) on the basis of model selection criteria for selecting the best fit model. The equation for best fitted model was Y = 144.415 X4.956. The volume in each plot resulted from the developed regression equation ranges from as 0.26 m3 to 36.96 m3. The growing stock map showed a total of volume 51231.083 m3 and volume 205.8 m3 ha−1 in the study site. The model presented acceptable standard error ± 0.82 when tested with 10 validation plots. Thus, the study advocates that multi temporal satellite imagery plays a vital role in quantifying spatial and temporal phenomena which is otherwise not possible to attempt through conventional method.

POPULATION ESTIMATION, NEST DISTRIBUTION AND THREATS TO CRITICALLY ENDANGERED WHITE-RUMPED VULTURE (GYPS BENGALENSIS) IN BAGHMARE COMMUNITY FOREST, DANG, NEPAL

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Keywords: endangered, community forest, habitat, transect line, threats

Vultures are valued for their ecological, social, and cultural significance. Nine species of vultures have been recorded in Nepal so far. Out of them, White-rumped Vulture is categorized as one of the critically endangered species. Considering the scenario of Nepal, Community Forest has been found as a pioneer habitat for them. In this context, the understanding status of the vultures in community forest of Nepal is very crucial. Therefore, we undertake Baghmare Community Forest, situated in Shantinagar Rural Municipality ward no. 2, Baghmare, the north-western part of Dang, which doesn't lie on the annual road site count of Bird Conservation of Nepal to understand its local status. We carried out the absolute count in 4.1 km transect line for the five times in a week gap in the early morning 7:00 am to 10:00 am to estimate the current population of white-rumped vultures and their nests from April to May 2019. In addition, 77 semi-structured questionnaires were administered to assess the current threats in the area. The study found 34.6± 6.94 (mean± standard deviation) individuals of White-rumped vultures in the study area varied from 25 to 44 (min-max) individuals. The 12 nests have been recorded in the study area out of which 6 were found to be active. Large tree species mainly Shorea robusta and Terminalia tomentosa were used by the vultures for nesting. Poisoning on food carcasses was found to be a major threat to vultures (24%) as per the respondents. It is followed by habitat destruction (23%), veterinary drugs use (20%), shortage of food (18%), and electrocution (15%). Though small, we see our study area as a potential habitat for vultures holding an isolated small Whire-rumped Vultures population

ROOST TREE SELECTION OF INDIAN FLYING FOX (*Pteropous giganteus*) IN NORTHERN KERALA

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Keywords: Fragmentation, Exotic, Evergreen, Native, Invasive.

Bats are one of the most fascinating creatures in the mammalian group of animals. Their nocturnal habits and their diversity in biology make bats, not only a fascinating group of animals to study but also a difficult one. But as a result of more fragmentation and other land use changes the roosting sites are bats are diminishing. The study focuses on finding the roosting sites of Indian Flying fox and identifying if there is any preference for any kind of trees. About 21 sites across four districts in Kerala (Northern), India, are the selected study areas. The idea is to count the number of individual bats in the camps from each roosting site (trees). The trees were grouped into two categories as evergreen – deciduous trees and native–invasive species. The study also focused to find whether bats show any preferences over evergreen or deciduous and native or invasive species for the selection of roosting sites. The data relating to the tree species with the maximum number of individual bats and the most frequently represented family of trees are also recorded. Trees that belong to about 38 species were found as roosting trees of bats of which 20 species are evergreen, 18 as deciduous and 28 species as native, and 10 species as exotic The independent t-test at a 95% confidence interval was carried out to find if there is any significance in the finding related to bat abundance in each tree species. The final result of the t-test reveals there is not enough significant difference in the collected data to conclude that the Indian Flying fox prefers native trees over exotic trees or evergreen trees over deciduous trees for the roost site selection. The study reveals that the selection of roosting sites of Indian Flying fox in Northern Kerala doesn't show any particular selection of deciduous over evergreen or native over exotic species.

SEMI-DESTRUCTIVE APPROACH IN DEVELOPING ALLOMETRIC BIOMASS FOR CHUKRASIA TABULARIS IN SYLHET REGION OF BANGLADESH

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Keywords: Allometry, above-ground biomass, biomass estimation method, species-specific model, tropical forest.

Species-specific biomass allometric model is crucial for measuring tree biomass because of the ecological and economic significance of key forest tree species. Since tree structure and development can vary between species and locales, relying on common biomass models during forest inventory may lead to erroneous estimations. In this aspect, the study aimed to derive the best-fit allometric model to estimate the aboveground biomass of Chukrasia tabularis in Sylhet Region of Bangladesh. A semi-destructive method in which total height (H), and diameter at breast height (D) were used as independent variables to test the efficacy of the commonly used pan-tropical models to estimate the biomass of the species. A total of 120 individual trees were purposively selected for model development and validation. Ten regression equations were tested in the study for the biomass allometric model and seven for predicting height with diameter at breast height. The best-fit model was selected based on adjusted R2, residual standard error, the Akaike information criterion, and Akaike weights. Finally, the derived model was compared with the commonly used pan-tropical biomass models in terms of model efficiency and root mean squared error. The best-fitted biomass allometric model for C. tabularis was Ln (TAGB) = -3.571 + 1.006 × Ln (D2 × H). Moreover, the derived best-fit model showed higher efficiency in biomass estimation compared to the commonly used pan-tropical models.

EFFECT OF LANDFILL LEACHATE ON THE GROWTH OF CHLORELLA SP.

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Keywords: Chlorella, leachate, landfill, Algal production.

The growth of Chlorella sp. was assessed in landfill leachate, in order to evaluate the potential of leachates as a possible growth media and cheap alternative source of nutrient for Chlorella sp. Axenic culture of Chlorella cells was collected from the Phycology unit of the Department of Plant Science and Biotechnology, University of Nigeria (Nsukka), and maintained by culturing in modified Bold's Basal Medium (BBM). Fifty (50) millilitres of the cells were then cultured in 150 mL aliquot leachate solutions containing 0.5 g, 1.0 g, 1.5 g, 2.0 g, 2.5 g and 5.0 g solid waste contents which were obtained by decomposing 5 g, 10 g, 15 g, 20 g, 25g, 50 g of solid waste in 1500 mL of distilled water respectively for a period of two weeks. A control (0 g) was then set up with modified Bold's basal medium (BBM) without leachate. Each treatment was replicated thrice. The increase in biomass (individual/mL) was monitored at two-day intervals for 14 days. One-way analysis of variance (ANOVA) was carried out on the data obtained and tests of significance were at $P < 0.05$. The test plant Chlorella was not favoured by the leachate media when compared with BBM.

SMARTELO APP: AN ANDROID APP TO PLAN YOUR HARVESTS

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Keywords: SIMANFOR, TreeCollect, forest inventory, silviculture, forest management

SMARTELO app is a mobile Android application for planning harvests directly in the field. Having your field inventory previously done using tools like the app TreeCollect, your inventory can be uploaded to SMARTELO app. Since an internet connection is not always available in the forest, SMARTELO app allows prepared forest inventories to be viewed and worked offline. This allows users to physically look at each tree while checking its information on the app through a list, a map, or a graph. The user can label each tree with an action (to harvest or preserve), following different criteria (biodiversity, technological, ...), while saving this information in a list of actions and reasons. The list of trees view allows the user to set the same label to different trees in a fast way; the map view can be used to find the current plot location; the graph view provides information about the relative location and size of the trees inside the plot, as well as their species. SMARTELO app comes with a search facility which allows the user to find a tree using different filters, such as labels, species, and size. When eventually the mobile device is online, the inventory and list of actions (the labels that have been set), can be exported to the user's own device, email, or SIMANFOR account. Finally, the most interesting functionality of the app is that it can provide a simulation of your tree selection by running SMARTELO via the SIMANFOR website. This provides a huge amount of information about the stand after the harvest operation. SMARTELO app will be soon available at the Android Play Store.

STUDYING THE UTILIZATION OF WILD PLANTS BY THE LOCAL COMMUNITIES IN THE REGION OF   AL-KADMOUS-TARTOUS GOVERNORATE

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Keywords: Ethnobotany, Medicinal Plants, Plant Biodiversity, Documenting Local Knowledge, Traditional Knowledge.

The study was conducted in 33 administrative sites in the Alkadmous region in Syria during the years 2020-2021, with the aim of listing the wild plant species used by the local population in the study area, by documenting local knowledge about the different uses of these species, and characterizing and evaluating the relationship between Population and Natural Flora within the Framework of Ethnobotany. The data was collected through questionnaires and personal field interviews, which included 387 people from the general and specialized knowledge categories. Plant species were classified based on this data into major groups, the most important of which are medicinal and edible. The number of plant species registered in the studies site and mentioned by the general knowledge category is 80, and 79 are mentioned by the specialized knowledge category, used by the two study categories for purposes (medical- edible…).The results of the study also showed that there is consensus among the residents of the studied area on their use of the largest part of the medicinal plants mentioned by them for the treatment of diseases of the digestive system and respiratory system in the first place. The percentage of local knowledge of wild plants and their uses among the elderly group increased more than the youth group. The study also showed that wild plants are collected from multiple habitats, and used for medicinal purposes in different ways and to treat various and various diseases, and are prepared according to local traditions and knowledge. The study recommended completing the documentation of the uses of wild plants and documenting the local knowledge of the population about wild plants at the level of the Syrian coast, and then at the level of Syria, and passing it on to future generations before the gradual disappearance of the generation that possesses traditional knowledge of wild species of the elderly and centenarians, and to preserve this Important cultural heritage.

YOUNG RESEARCHERS MEETING

Conservation and Sustainable Use
of Forest Systems

Palencia (Spain), 25-26 January 2023