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**A STAND DENSITY MANAGEMENT DIAGRAM FOR MIXED STANDS OF *PINUS SYLVESTRIS*
AND *PINUS PINASTER* IN THE *SIERRA DE LA DEMANDA* (SPAIN)**

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Abstract:

Stand density management diagrams (SDMDs) are robust decision-support tools available to forest managers under limited information. SDMDs which are empirical models at stand level, graphically represent the temporal relationships among stand density, and different stand variables. They are used to define initial planting spacing or thinning interventions, in order to meet various management objectives. Nowadays, there is a growing interest in mixed-species forests as an option of adaptive forest management, where they are considered a guarantor to safeguarding a wide variety of ecosystem services. But there is still a lack of knowledge and efficient tools and models for mixed stands such as SDMDs.

The aim of this study is to develop an SDMD for *Pinus sylvestris* and *Pinus pinaster* mixed stands in the *Sierra de la Demanda* using data from the third Spanish National Forest Inventory.

Different variables can be used to develop an SDMD. In this case quadratic mean diameter, dominant height, total stand volume, number of trees per hectare and stand density index (Reineke index) were estimated. Moreover a simultaneous fitting was developed. These equations were fit including a new variable representing the proportion of both species to take into account the mixed stand. All statistical analysis and the construction of the SDMD were developed using the software R.

The results of the simultaneous fitting showed the new variable representing the proportion of both species was not significant. Based on that, the SDMD was constructed without including mixture degree. This SDMD can be used by forest managers as an efficient tool to plan thinning practices.

Key words: Reineke index, dominant height, silviculture, thinning, mixture degree.

POPULUS spp. DORMANT BUD PRODUCTION AND CHEMICAL CHARACTERIZATION OF BIOACTIVE PHENOLIC COMPOUNDS FROM BUD EXTRACTS AND SPROUT EDUCATES.

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Abstract

Poplar is a model plant for forest species because of its genetic variability and also fast growing species. Poplar has many added values (Biorefinery) including wood and biofuels. We conducted experiment on short rotation forest to estimate dormant bud production as well biomass. We used alcoholic: water (70:30) extraction method to obtain the maximum amount of bioactive phenolic compounds. Then we did qualitative analysis by using NMR spectroscopy, TLC chromatography. And also did quantitative analysis with Total Phenolic Content (TPC) estimation by using folin ciocalteu reagent. Initially we introduced very advanced chemical characterization by using Near Infrared spectroscopy (NIR) to classify preliminarily different genotypes (Cluster analysis). Finally we did comparative studies between dormant buds and sprout exudates in terms of chemical characterization. We would like to do furthermore qualitative analysis by using HPLC (High Performance Liquid Chromatography).

Key words: Poplar species, dormant buds, sprout exudates, NIR spectroscopy, Alcoholic: Aqueous extraction, NMR spectroscopy, PTC analysis, TLC analysis and HPLC analysis.

PUBLIC ACTORS IN SOCIAL INNOVATION INITIATIVES IN RURAL AREAS: A PRELIMINARY
OVERVIEW WITH A FOCUS ON MEDITERRANEAN COUNTRIES.

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Abstract

Social innovation (SI) has been recognized as an important tool that helps tackle a myriad of societal problems and challenges, especially rural development. With respect to marginalized rural areas (MRA), SI can trigger the establishment of new relations, the emergence of new actors, markets, and new governance arrangements that eventually contributes to solving problems such as, depopulation of rural areas, unavailability of resources, land abandonment, unsustainable use of resources, et cetera. Even though, different actors are often involved in SI initiatives, supported by the pivotal engagement of civil societies, current research puts less effort in systematically exploring the roles and influence of public actors in social innovation initiatives in marginalized rural areas. A systematized approach to literature review was adapted, focussing on key issues like innovation; innovation initiatives in the rural areas as relating to Agriculture, Forestry, and Rural Development; public or state actors' capacities in supporting innovation in the MRA; the kind of relationship that exists between the state agents and the rural people, and combining them with case study analysis. Using Mann-Whitney U Test, which is a non-parametric test, the influence of public actors on SI initiatives will be analysed. Other variables that will be analysed are; the level of communication; types/scales of involvement; levels of trust, and whether there has been change in trust in the last 5 years.

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Keywords: Innovation, Social innovation, Public actors, Transformative change

ASSESSMENT OF THE EFFECT OF LANDSCAPE HETEROGENEITY ON INTERANNUAL NET ECOSYSTEM EXCHANGE IN AN ITALIAN GRASSLAND ECOSYSTEM

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Abstract

Grassland ecosystems are important carbon sinks hence they play an impeccable role in regulating the global climate conditions. Eddy covariance technique has been instrumental in estimating ecosystem-atmospheric gaseous exchange, though spatially is limited to a small area known as the flux footprint. Thus, remote sensing technology has made it possible to scale eddy covariance measurements to cover an entire ecosystem. The data from eddy covariance is provided by the FLUXNET community for various uses. The heterogeneity of a landscape, represented by the vegetative components characterizing the ecosystem and their arrangement, has been observed to affect eddy covariance measurements. However, the influence of landscape heterogeneity on the variation of interannual net ecosystem exchange is yet to be explored. This study aims to use Landsat and Sentinel remote sensed images to quantify the heterogeneity of a grassland and assess its effect on the variation of interannual net ecosystem exchange. Pixels of an image share a spatial relationship that is considered in the gray-level co-occurrence matrix GLCM) in extracting textural features of the underlying vegetation. In order to determine the similarity or differences among pixels, textural features such as *Contrast*, *Dissimilarity*, *Entropy*, *Angular Second Moment*, *Homogeneity*, *Correlation* and *Mean*, are computed using an open source geographical information system. Bayesian models are explored using R statistical package in linking the heterogeneity of a landscape with interannual fluxes of carbon dioxide.

FOREST RESTORATION, BIODIVERSITY AND ECOSYSTEM SERVICES

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Abstract

Deforestation and forest degradation are global challenges negatively affect forests, biodiversity and ecosystem services. The concept of 'Forest Landscape Restoration' has emerged to address them and recover forests, restore biodiversity, improve ecosystem services and human well-being, and the Sustainable Development Goals. Forest landscape restoration creates opportunities for biodiversity conservation, food supply, and forest products. There is still a need to assess how different initiatives are put into practice. Project locations, main objectives, methods, biodiversity and ecosystem services addressed, nutritional benefits of trees, and how selection of tree species is done are topics this study considered.

For a complete picture of restoration practices around the world, this research focused on obtaining information through an online survey aimed at practitioners. Responses from 47 projects showed they mostly take place in the tropics. Increasing vegetation and recovering biodiversity are the most common objectives. About 60% of the projects mix artificial and natural regeneration. 90% of the tree species planted are native. Nearly half of the projects planted at least one tree with nutritional value. However, from the total tree species, only 34% have nutritional value. Project managers and local communities are more involved in species selection, often including men and women.

Keywords: Forest Landscape Restoration, Tree species, Biodiversity, Ecosystem services, Nutrition

TREE BIOMASS ALLOCATION IN TEMPERATE MIXED FORESTS

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Abstract

At this 21st century, one of the key landmarks in sustainable resource management is the estimations of forest carbon stocks and carbon balances at different geographical ranges and coming up with efficient forestry solutions to mitigate climate change. Thus, the comprehension of forest carbon cycles and dynamics for sustainable resource management needs quantification of forest biomass at the species both global and local level. This research work was mainly focused on illustrating how the forest stand mixture affect biomass allometric relationships and allocation of biomass in monospecific and mixed stands of *Pinus Sylvestris* L. and *Quercus petraea* (Matts.) Lieb. In Northern Spain. In this study, we fit 4 different height-diameter models for monospecific and mixed forest for Scots pine and Sessile oak species. The Korf curve for height-diameter models performed better than other models as the lowest AIC and highest R² obtained suggest. In addition, there is a no variation of height-diameter relationships for oak trees in monospecific or mixed stands. However, an extensive difference in the monospecific and mixed stands for Scots pine was found. The development of height-diameter models that estimate tree height using a subset of sampled trees presents an approach to supplement surveys where only diameter has been measured.

ANCOVA analysis proved that the tree biomass allometry of the monospecific show contrast from the mixed stand but the difference is not significative. Dirichlet fitting regression was used to select the best biomass models with the diameter at breast height (DBH) and total height (Ht) as independent variables/predictors for both species. The total aboveground biomass of mixed stands was not significantly different from monospecific stands. Also, the proportion of biomass in different tree component of mixed stand trees is similar to that of monospecific stand trees. The results illustrate that the largest biomass allocation for the 2 species was on stem and the least was on foliage. Therefore, the biomass allometric models developed from monospecific stands can be used to predict tree biomass in mixed stands without an important error.

Keywords: Scots pine, Sessile oak, Dirichlet regressions, aboveground biomass, biomass allocation

IN VITRO CHARACTERIZATION OF VETERAN MICROPROPAGATED PLATANUS ORIENTALIS UNDER HEAVY METAL (Cd) EXPOSURE AND BIO-INOCULATION

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Abstract: The plane tree (*Platanus orientalis*) is one of the long-lived trees in the Mediterranean basin and hence has become the centre of interest from the ancient time. In the Lazio region of Italy, it is considered the most characteristic species present in the historic villas. Moreover, currently it is widely planted in the urban areas considering its tolerance to pollution. However, the aim of this study is to evaluate the success of the micropropagation method applied to *Platanus orientalis* to maintain genetic fidelity of the ancient genotype taken from Villa Lante, Italy and to explore the potentiality of bio-inoculation with beneficial bacteria (i.e. *Pseudomonas fluorescens*) in the performance of heavy metal (Cadmium) tolerance to plant. In this regard, a total of 48 micropropagated plants were investigated under six treatments of different Cadmium (Cd) concentration along with potential bio-inoculation. It is expected that the study result will explore the efficiency of micropropagation method employed in *Platanus orientalis* and the potentiality of bio-inoculation for phytoremediation of heavy metals.

Key words: *Platanus orientalis*, micropropagation, Cadmium (Cd), Plant Growth Promoting Rhizobacteria (PGPR), phytoremediation.

THINNING OPERATIONS FOCUSING ON BIODIVERSITY CONSERVATION IN PROTECTED FOREST OF NORTHERN VIETNAM. EFFECTS ON HABITAT VALUE AND ECONOMIC YIELD

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With the support of the BioEcoN project (Erasmus +, Capacity Building in the field of Higher Education)

Abstract

The forest surface in Vietnam faced an overall increasing since the 90's when forest protection policy was applied. Despite its positive effects on reforestation, the combination of strict laws and low subsidies for close to forest areas, caused the marginalization of those areas and the deforestation displacement to the neighbor countries, as Vietnamese imports of wood increased significantly.

This study takes place in the marteloscope in northern Vietnam in regenerated forest. The aim is to assess the economic and the habitat values of each tree, then, four thinning operations are proposed, and their effects on the forest are compared. The habitat value is assessed by using the tree-related microhabitats (TreMs) as bioindicators.

Our findings show the influence of biodiversity conservation criterion among the four thinning simulations. Codominant trees with a higher diameter at breast height (DBH) resulted to have the highest mean habitat value which coincide with the findings of previous studies of Temperate forest. Furthermore, there are marketable and non-marketable tree species by Vietnamese government disposition. In our study area, the biodiversity conservation criterion has a marginal effect on the economic benefit. This finding, together with the positive DBH – habitat value relationship, show that a meeting point between profitability and biodiversity conservation is possible.

Key words: Tree related microhabitats, marteloscope, biodiversity, thinning, economic value, forest policy.

MODEL SELECTION AND FITTING FOR BASAL AREA INCREMENT IN VIETNAMESE TROPICAL FOREST

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Abstract

Modeling forest growth is essential to understand the dynamics of forests and predict future productivity. In this study, models were adjusted for six (6) species and three (3) different groups called class I, II and others. The species for which there were not enough observations were grouped according to their wood density values and classified according to the Vietnamese system of grouping of tree species wood quality by density. Height diameter relationships were adjusted for the trees (by species and class) present in the marteloscope. The crown width was modeled by using the normal diameter and the crown ratio as independent variables. In order to study the influence of diversity on size, diversity indices were included as independent variables in the previous models. The models thus adjusted were significant. The linear candidate models were classified according to the Akaike information Criterion and the R-adjusted. The diversity indexes affected the size of the crown and the height-diameter relationship. From the growth of five growing periods of *Cinnamomum iners* we found that the basal area increment is affected only by the diameter at breast height and not by the crown ratio.

Keywords: Tropical Forest, Marteloscope, Model Selection, Incremental Core, Structural Diversity

THE ROLE OF FORMAL INSTITUTIONS IN FORESTS DECLINE: ANALYSIS OF MECHANISMS, EFFECTS AND THEIR EVALUATION

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Abstract

Globally, forests are estimated to be declining 0.13-0.08% annually with higher rates of decline experienced in tropical countries. Critical to the forest decline phenomenon are its associated causes, which are numerous, complex and having simultaneous and often compounding effects. Assuming “forest decline” as the common denomination of these global phenomena, its numerous causes, agents and effects are critical issues that must be investigated further. Here we view forest decline as a bi-product of ineffective or absent sustainable forest management paradigms where formal forest institutions are recognised as the relevant and sometimes de facto ministerial or administrative authority for forest management. Because institutions play a key role in developing and implementing forest policy, institutional failures are a vital but often-overlooked dimension of the processes that drive forest decline. This thesis offers a systematic theoretical exploration of the linkage between institutional failure and forest decline, including an examination of policy goals and state changes to the forest ecosystem through the application of a modified conceptual framework. Our DPAESMR (drivers-policy-actions-effects-state-monitoring-response) modified from the original DPSIR (drivers-pressures-state-impact-response) framework, aims to demonstrate differences between policy goals and state changes observed through implemented actions and their effects, derived from established drivers and highlights the importance of monitoring and reporting. We test this framework across four specific regional case studies. Each having identified decline phenomena despite, in some cases, having robust formal forestry institutions. Initial analysis suggests several institutional failure mechanisms associated with capacity, dialogue, resources, dependency, information and coherence.

Keywords: Forest decline, Institutional failure, Forest policy, Forest management, DPSIR

**MODELLING THE ROLE OF SEED DISPERSERS IN DETERMINING FOREST SPECIES
DISTRIBUTION PATTERNS**

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Seed dispersal by birds plays a crucial role in structuring landscape dynamics and supporting biodiversity. It is composed of a complex network of animal-plant interactions that have been studied in small scale extents, but the knowledge of landscape-wide processes is still scarce. Different biodiversity indicators can be used to study seed dispersal: the abundance of birds is related to the capacity of the frugivore assemblage to disperse seeds and influence the landscape structure, bird richness is related to the resilience of the assemblage to disturbances and change, and functional traits are related to the actual capability of each species and individual to disperse seeds. In this study, we aimed to develop general seed dispersal indicators to understand the distribution patterns of *V. album* at different spatial scales in Catalonia, Spain. We used generalized linear mixed models to determine the indicators prediction capabilities. Results show that different drivers influence the distribution of *V. album* on a regional level (North vs. South). Species richness clearly dominates southern distribution patterns, whereas northern patterns could not clearly be linked with the indicators. This suggests that on a landscape scale different processes (present and historical) influence seed dispersal patterns of birds and consequently forest plant species distribution.

**SUSCEPTIBILITY OF PINUS PINASTER'S FAMILIES TO PINE PITCH CANKER CAUSED BY
FUSARIUM CIRCINATUM.**

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Abstract

Fusarium circinatum is the causal agent of Pine Pitch canker disease which is an introduced non-native disease on pines in natural and planted stands of Europe. It is an exotic pathogen of recent introduction in Spain that threatens *Pinus pinaster* stands. PPC has been detected in all over the world and especially in north of Spain, France, Portugal and Italy concerning its presence in Europe. The disease is causing damages in forests and nurseries. Variability between the families of the same specie even from the same provenance area may affect the level of susceptibility of each family to *Fusarium circinatum*. In this study it has been tested the resistance or the susceptibility of 22 different families of *Pinus pinaster* from Galicia (North of Spain) to F.C. and each family is a "family of genetic improvement program of Galicia". It is good to know the more resistance families amongst those tested in order to achieve better management with Pine pinaster populations in Galicia. Therefore, 550 seeds were sown and inoculated with 250 spores/ml of the fungal suspension of *Fusarium circinatum* in the laboratory conditions. The same amount of seeds was sown and inoculated with distilled water as a control for the previous assay. The results revealed that the families 50,105 and 5 are the most susceptible to F.C. and in the other hand, the families 109,33 and 35 are the most resistant to *Fusarium circinatum*, consequently the families 109,33 and 35 are the most suitable families among those tested in this experiment for better management option in order to slow down the negatives impacts of Pine Pitch canker caused by *Fusarium circinatum* in the *Pinus pinaster* stands plantation in Galicia.

Keywords: Susceptibility; *Pinus pinaster*; family, *Fusarium circinatum*; Pine Pitch Canker;Galicia.

QUERCUS SUBER L. AND QUERCUS ILEX L. IN SPAIN. UPDATING THE PROVENANCE REGIONS MAPS AND CALCULATING CONSERVATION INDICATORS FOR THEIR GENETIC RESOURCES.

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Abstract.

The Region of Provenance of forest trees is a system used in Spain and in many other countries in order to provide guidance for the selection and commercialization of reproductive forest materials (FRM). In addition, in the sense of the conservation of the genetic resources and selection of FRM, Basic Materials (BM) and Genetic Conservation Units (GCU) are also important strategies to manipulate and preserve the adaptive capacity of tree species and populations. This work aimed to analyse and updated the information of the RP maps of Quercus suber L. and Quercus ilex L. in Spain using the most updated Spanish Forest Map (MFE50) as the most recent source of information on the forest distribution in the country. When analysing the MBs and GCUs for the two species, the location of more than thirty percent of them did not correspond to any forest stands in the MFE50 map, what supposes the necessity of a field verification on face to the location of these. It was possible to conclude that the data available in the official sources are not accurate at all scales and should be revised to provide appropriate data and information regarding RPs, MBs and UCGs.

Key words: Region of Provenance, Spanish Forest Map, update, Basic Material, Genetic Conservation Unit.

COMPARATIVE ANALYSIS OF SALINITY TOLERANCE IN TAMARIX AFRICANA AND TAMARIX GALICA ORIGINATING FROM TWO ITALIAN PROVENANCE POPULATIONS

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Abstract

In recent times, one of the starring abiotic stresses to plant survival in the ecosystem is salinity. This has resulted in massive loss of habitat, biodiversity, native vegetation and water resource value. Halophytes form 2% of plants and can tolerate 200-1000 mM levels of salt concentration. Among them is Tamarix species which have been reported to be highly tolerant to salinity, occupying coastal dunes and the riverbanks of Southern Italy. They are used in the conservation and restoration practices under the perspectives of global climate changes. Authors had carried out experiments on Tamarix spp, however their tolerance to flooding, and the combination of the two stresses are incompletely known or few studies reported. To address this gap, the thesis analyses the salinity tolerance in different provenances of Tamarix spp.(africana and gallica), available in the EcoPhysLab in-vivo collection. Here, we measure the growth and physiological responses of Tamarix spp.(africana and gallica) of two Italian provenances (Simeto and Baratz) cuttings grown (87 days) in a controlled environment over three NaCl concentrations (200 mM NaCl and 550 mM NaCl) of 35 days flooding. The measurements were conducted prior and after the commencement of flooding, to test the possible cumulative effects of the treatments and effects on twig aging. Tamarix spp photosynthesis (A), stomatal conductance to water (gs), water potential (Ψ_w), and the maximum quantum yield of photosystem II (Fv/Fm) would be analyzed as well as the length, diameter, leaf mass by area (LMA), nitrogen content, proline and extruded ions.

Key words: Flooding, Chlorophyll Fluorescence, Gas Exchange, Salt stress

DOES THE NATIONAL AND PROVINCIAL FOREST POLICIES IN COHERENCE WITH UNSPF GOALS? A CASE STUDY OF PAKISTAN

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Abstract

UNCED Rio de Janeiro summit 1992, was recognition of climate change phenomenon and understanding common responsibility of international community to enhance coordination, cooperation and synergies to tackle the situation. Forests are important in enhancing biodiversity, socio-economic benefits and climate change mitigation. FRA 2015 report exhibited that global net forest loss rate was 0.13% from 1990 to 2015. Realizing criticality of circumstances, UN devised strategic plan for forests (2017-2030) for SFM. Coherence of UN and national forest policies are imperative for achieving supranational SFM goals. We chose case study of Pakistan to analyse level of coherence in adoption and implementation of forest policies with UNSPF Goals. We performed content analysis to analyse coherence of international and national forest policy documents and comparative analysis to see level of coherence of goals for implementation of policy at national level. The results are significant for explanation of level of national forest policy coherence with UNSPF goals. The Risk ratios (RR) of 0.86, 1.15 and 0.85 for thematic areas 1,2 and 5 shows high coherence while RR 0.45, 0.69 and 0.21 for thematic areas 3,4 and 6 demonstrate low coherence towards achieving UNSPF goals. It provides insight to policy makers in formulation of future forest policies.

Keywords: Forest policy, Coherence, UNSPF goals, Sustainable forest management, Content analysis.

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LAND COVER CHANGES IN EASTERN MEDITERRANEAN ECOSYSTEM: THE CASE OF HAIFA AND JERUSALEM METROPOLITAN AREAS

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This paper examines changes in land cover and its fragmentation in time and space by comparing two time periods, 1881 and 2019. For this purpose, we compared land cover derived from historical map to a present land cover. Land cover classification, mapping, and change detection were done in the ArcGIS environment while fragmentation examined using FRAGSTATS landscape metrics. The classification was categorized into seven classes: agricultural land, built-up, forest land, open space, scrubland, water body, and woodland. In Haifa area, woodland was the dominant (59.1%) in the past while in the present day, forest land (35%) was the dominant land cover. In Jerusalem, the result identified agricultural land, built-up, open space, scrubland and woodland in the past. Conversely, in the present day, forest land and water body identified in addition to what has been already identified in the past. Land cover transformation results in Haifa ,revealed that a substantial decline in woodland (-43.7%) with time. About 20.5% of woodland was converted to Built-up and agricultural land. In Jerusalem, the second-highest percentage cover of scrubland (23%) was converted to built-up. Alternatively, a substantial increment in forest cover in both studied areas was observed. Massive national program to reclaim and restore Israel's degraded Mediterranean landscape has a significant role in increasing forest cover. The result also showed dynamic temporal and spatial variation trends in land cover fragmentation. Patch number was higher in the present period. A greater dispersion in the forest land and woodland categories was observed and fragmentation seems to be driven by socioeconomic development need of the growing population. Generally, this study provides important knowledge on spatiotemporal land cover patterns and each of the results has a fundamental role to play on planning conservation works that aim to protect fragile land covers that are subjected to anthropogenic disturbances in the studied areas.

Keywords: Fragmentation, GIS; historical maps; land cover; transformation/changes

ABOVEGROUND BIOMASS AND BIODIVERSITY RELATIONSHIP IN MEDITERRANEAN FOREST, LLANO DE MARUGAN, VALLADOLID IN CASTILLA Y LEON PLATEAU, SPAIN

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Abstract:

Tree biomass and diversity relationship in mixed forest has become one of the attractive research subjects for ecologists in recent decades due to an importance of multicultural mixed forest for better provision of goods and services than monoculture. The questions "Does mixed forest produce more productive and the productivity increase as tree diversity increases?" have been subject of many researches that lead to two contrast results. This study was conducted to contrast the result of previous studies by investigating the tree biomass and diversity relation in Mediterranean multicultural mixed stand, Llano de San Marugan, Spain, at stand and individual species level. A variety of models that developed from linear and nonlinear regression equations were employed to reveal tree biomass and diversity relation. 10 diversity indices that fall in 3 categories: species richness indices (Sm, Sn, D, E); species compositional/mixing indices (Mi, MS, S); vertical structural indices (W, A, TH) were used as predictor variables for the models to characterize different structure of diversity in the stand. Our result revealed that tree biomass and diversity relation varies among species. A combination of negative relation of D- Berger-Parker index (abundance of dominant species) and positive relation of TH (height heterogeneity) explains the variation of biomass at community level and for *Pinus pinea*. Biomass of Quercus species (*Quercus faginea* and *Quercus ilex*) was positively related with basal area proportion of species (Gp); the tested diversity indices didn't show any relation with biomass of *Quercus* species and *Juniperus thurifera* as concerned by metrics and models in this study.

Key words: tree biomass, tree diversity, mixed forest, diversity indices, species richness, species composition, stand vertical structure.

HOW DOES PRECIPITATION PATTERN AFFECT ANNUAL TREE GROWTH? A MULTI-YEAR DATA ANALYSIS CASE STUDY OF SEMI-ARID YATIR FOREST, ISRAEL

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Abstract

Climate change associated recurring phenomenon of drought causes a threat to the global forest resource. Particularly in arid and semi-arid regions, the climate change forecast predicted a decrease in annual precipitation (P) and an increase in the intensity of rainstorms. In this study, we investigated the effect of the P pattern on soil water content (SWC) dynamics in relation to the respective tree radial growth. The study was conducted in Yatir *Pinus halepensis* plantation forest of semi-arid region of Israel. Long-term meteorological, measured SWC and dendrochronological data sets and field observations have been used for subsequent analysis of P pattern, soil moisture dynamics and tree radial growth response. Higher temporal variability in annual P (CV=36%) and seasonal P (monthly P). Annual P of the last 5 decades did not show a statistically significant trend of change. However, the number of storms (NS) show decreasing trend attributed to the smaller and frequent storms with < 5 mm which have < 10% contribution to the annual P. Dry, intermediate and wet years showed a significant difference ($p=0.01$) in number of storms (NS) while there was no significant difference in LRS and LDS. Wet, intermediate and dry years have about four, two and one months of growing length seasons, respectively. To conclude, annual P, NS, length of rainy season, length of growing season and length of the growing season were a significant predictor of tree radial growth. But P was the best predictor of the most parsimonious model for tree radial growth (BAI). Monthly distribution of these bigger and infrequent storms determines the SWC seasonal dynamics and respective GSL of the HY.

Keywords: drought, dry and wet years, SWC, semi-arid forest

EFFECTS OF WATER STRESS ON ALNUS GLUTINOSA POPULATIONS ACROSS THE SPECIES DISTRIBUTION RANGE

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Abstract:

Decline of *Alnus glutinosa* (alder) is an emerging threat which has been devastating native priority forests across Europe, with alarming repercussions due to the key role of alder at ecosystem-level. Alder decline is specially threatening riparian forests in the Mediterranean Region under the projected scenarios of climate change. Regional differences on genetic and functional traits of alder point to the potential natural adaptation of this riparian tree species across environmental gradients. Yet, substantial knowledge gaps remain about the level of impact of alder decline under climate change. In this study we investigate the variability in alder response to drought across five populations ranging the species distribution range. Using a water-controlled greenhouse experiment, we simulate progressive (100%, 75%, 50% and 25% of Field capacity) imposed drought to 120 one-year seedlings across target populations. We perform structural (height, diameter, SLA, above and belowground biomass) and physiological (Leaf hydric potential, chlorophyll content and fluorescence, stomatal closure through Thermal imaging) measurements and destructive samples at the beginning (end June) and end (end July) of experiments. We expect to find contrasting response to drought stress between northern vs southern (Mediterranean) populations and between marginal and central distribution populations.

Key words: *Alnus glutinosa*, Progressive imposed drought, Population distribution range, Destructive samples.