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“Forest Harvesting and Roding in Environmentally Sensitive Areas”

BOOK OF ABSTRACTS



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INTRODUCTION

An environmentally sensitive area (ESA) can be defined as a sensitive site which needs special protection, strategies, and implementations because of its natural features, ecological functions, wildlife, aesthetic or historical value. ESAs include, but are not limited to, native forests, high quality successional forests, national parks, essential wetlands, riparian areas, water bodies, important watersheds, karst features, wildlife reserves, world heritage areas, sensitive sites with significant natural and cultural values, and areas of high visual value.

The resources management activities can be undertaken in ESAs by considering specific guidelines; however, the principal value is conservation, including the protection of biodiversity, ecosystems, and habitats. On the other hand, designated forestry activities have to be carried out in a manner that protects the identified conservation values in ESAs.

“1st International Symposium of Forest Engineering and Technologies (FETEC 2016): Forest Harvesting and Roding in Environmentally Sensitive Areas” will be organized on 02-04 June 2016 at Bursa Technical University, Faculty of Forestry in the city of Bursa, which is located in such a region that is very rich in terms of forest products, forest resources, and environmentally sensitive areas in particular. The symposium co-organizers include IUFRO Division 3.01.00 and FETEC Platform. V. Forest Engineering and Technologies Workshop will be held during the symposium.

The aim of the symposium is to discuss the most recent scientific researches and professional works related to forest harvesting and roding activities taken place in environmentally sensitive areas with attendance of relevant shareholders, practitioners and international researchers from various regions of the world.

On behalf of the entire organizing committee, I would like to thank all the participants of the symposium and express my best wishes to those who contributed during the preparation and organization stages of the symposium.

Prof.Dr. Abdullah E. AKAY
Symposium Chairman

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ORAL PRESENTATION

Analysis on Operational Efficiencies and Costs for Extracting Logging Residues in Small-Scale Forestry, Nasunogahara Area, Tochigi Prefecture

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Abstract

In this study, two operation systems to extract logging residues were investigated in Nasunogahara area, Tochigi prefecture in 2012. System 1 included manual extraction and light truck transportation. System 2 included mini forwarder forwarding and 4-t truck transportation. Furthermore, a chipper introduced in 2011 was investigated. As a result, costs of manual extractions within 10 m and 20 m were 942 yen/m³ and 1,040 yen/m³, respectively. On the other hand, forwarding cost of mini forwarder was 499 yen/m³ which was significantly lower than those of manual extractions. Transportation costs with light truck and 4-t truck were 7,224 yen/m³ and 1,298 yen/m³ with 28-km transportation distances. Chipping operation costs were 1,036 yen/m³ and 1,160 yen/m³ with 3 and 2 persons, respectively. Lastly, total costs of system 1 and 2 from extraction within 20 m to chipping were estimated as 9,300 yen/m³ and 2,833 yen/m³ with 28-km transportation distances and 3-men chipping operations (USD 1 = 119 yen).

Keywords: Nasunogahara area, Small stands, Logging residues, Productivity, Cost



ORAL PRESENTATION

Possibility of Efficient Forest Management and Utilization by SCM

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Abstract

The SCM, supply chain management, is commonly used at industrial product manufacturing. Their producing processes and material feedings are finely controlled through the huge fixed system. On the other hand, forest is the huge manufacturing plant itself to produce woods which continues production restlessly, and woods themselves are not uniform and homogenous material. Furthermore, their production processes are also not able to be standardized due to uneven terrain and ground conditions and the complicate operation procedures under natural environments. Here, SCM application is discussed for forest management and utilization. Time axial expansion is required for the long period growing to be the product by itself, and the space axial expansion is also required for the vast area of stands where face much diversity of environment's.

Key words: SCM, Management, Utilization, Time, Space

ORAL PRESENTATION

An Investigation of Forest Roads for the Recreational Usage (The Case of Bartin-Amasra)

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Abstract

Activities carried out in protected areas where environmental effects are very important with respect to forestry operations. This study was conducted Kuskayasi road monument, Bakacak scenic lookout and a picnic area which is a potential recreation site in Amasra. Recreation areas, extending along a hillside in the forest, transportation systems and technical aspects are examined. Strengths and weaknesses for the potential recreation areas have been determined by SWOT Analysis. 122 surveys consisting of 17 questions were given to tourists and people living in the region in order to determine the problems regarding usage and transportation in the recreation areas. The path planning in the monument routes is 1905 m long, 60-80 m wide with 10-30% slope. It takes about 55 minutes from the monument to the picnic area on foot. The road length from picnic area to high vantage point is 1985 m and its slope is 15%. According to the SWOT analysis, high tourism potential, proximity to Amasra town center, and the lack of adequate recreation areas in Amasra are strengths of the study area. The short seasonal conditions and insufficient information of the people living in the region about tourism are weakness of the study area. According to survey analysis, the participants noted that recreational areas are insufficient (80.4%) and new recreation areas and roads are needed for the region (90.1%). Asphalt road was preferred by the participants for all 3 recreation areas (52.3%) for transportation. Due to the high slope and current roads' being too narrow, they should be maintained (44.3%) according to the standards. As a result, the standard of current roads should be increased in the potential recreation areas and infrastructure facilities should be established to meet the needs of the people in the area. Kuskayasi road monument, Bakacak scenic lookout and the picnic area should be evaluated as a whole transportation network and technical standards of the region need to be improved.

Keywords: Amasra, Forest road, Recreation area, SWOT analysis



ORAL PRESENTATION

Infrastructure Layout at Forest Ecosystems Planning

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Abstract

Transport infrastructure is one of the most important activities at planning and managing of forest ecosystems. Forest land access is being provided by mostly forest roads in Turkey. The stages of evaluating and determining the adequacy of forest roads during forest ecosystem planning, although very important, is usually ignored in the current applications at this point. According to the official legislation in Turkey, the planning of forest road network requires general planning approaches considering road density, road spacing, and some technical limitations, somehow distinct from ecosystem planning approaches. The planning of forest road networks was first standardized according to the principles of “Edict Number 202” that was first published by General Directorate of Forestry in 1984. Today, the current principles were listed in “Edict Number 292” which was written in 2005 according to the changing conditions and new approaches. At the current planning applications, that form the basis of “Edict Number 292”, the amount of road has definitely been restricted. It is stated that the total of road construction area cannot exceed 1% of the total forest area (refers to 20 m/ha). However, current and future targets of forest structure, the expected economic and social benefits of ecosystem, and topography must be taken into account in determining the needs of roads in forest ecosystems. Turkey is located on a vast geography, business shapes the structure of the forest area, and the topographic structure greatly varies. Therefore, there should not be any absolute or general restrictions on road density. It is known that Austria, with similar characteristics to the conditions of Turkey, has higher road density value (45 m/ha) than the road density specified by “Edict Number 292”. Therefore, technical, ecological, economic, and social priorities should be all consider without any absolute limitations according to the goals set out in the planning of forest ecosystems and to manage properly.

Key words: Ecosystems planning, Forest infrastructure, Forest road, Road density, Infrastructure layout

ORAL PRESENTATION

Effects of Compaction on Topsoil Properties along Logging Roads in a Forest Catchment

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Abstract

Forest roads are very important in terms of providing access to forest products and other human needs. However, inadequately building of forest roads or roads adjoining forests can have certain ecological and hydrological effects. This study aims to present the hydrological effects of forest roads in the Gökçay Catchment, located in the southern slopes of Ilgaz Mountain. Geographic Information Systems/Remote Sensing (GIS/RS) techniques were used to identify the road network of the catchment, and sampling spots were determined from roads with different soil characteristics. Catchment roads were classified into Transport Roads (TR), Tractor Logging Roads (TLR), Human/Animal Power Logging Roads (HAPLR), and Asphalt Roads (AR). The road density of all the roads in the catchment was 2.5 km/km², and the ratio of road surface to total catchment area was 2%. The highest level of compaction was measured in TLR soil (0-10 cm) with 6.50 MPa, and the lowest level of compaction was measured in HAPLR soil with 0.25 MPa. The highest level of topsoil bulk density (1.87 gr.cm⁻³) and the lowest level of topsoil hydraulic conductivity (0.69 cm.hr⁻¹) were measured in TLR soil. In natural forest soil, compaction varied between 0.1 MPa as the lowest and 2.64 MPa as the highest, bulk density was 0.95 gr.cm⁻³, and hydraulic conductivity was 35.49 cm.hr⁻¹. Infiltration values were 0 cm.hr⁻¹ in TLR soil and 7.21 cm.hr⁻¹ in natural forest soil. There were statistically significant differences between the compaction values of different roads. Forest roads, in general, were observed to have poor hydrological characteristics, and low levels of hydraulic conductivity. Particularly during heavy or prolonged rainfall, surface runoff on the roads is a distinct possibility. Controlled transfer of this water to the catchment drainage system is very important for catchment hydrology, and to control floods and overflows.

Keywords: Forest harvesting, Forest road, Soil penetration, Catchment



ORAL PRESENTATION

**Determination of Physical Damages on Logs Arise From Forest Harvesting Operations
in Artvin Region**

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Abstract

In this study, physical damages of logs caused from forest harvesting operations were determined on the mountainous terrain in Artvin region. For this purpose, 400 logs were measured before stack in three forest selling storages. Maximum damage depth and length on the logs were measured and then damage level of logs was determined. Physical damages of logs were examined according to tree species, log diameter and length. As a result, end damage, cracks, crevices, bruises and fractures were verified on the logs. No damage was observed in 50% of the logs. In addition, the average damage length, depth, and degrees of damage were measures as 19.90 cm, 16.75 mm, and 0.62, respectively. Considering damaged levels on logs, it was found that 59% of the logs were undamaged, 24% of the logs were light damaged, 13% of the logs were middle damaged, and 4% of the logs were heavy damaged.

Key words: Forest harvesting, Logs, Physical damages, Artvin



ORAL PRESENTATION

Visual Quality Assessment along Road Corridor inside and at the Side of Forest of Some Habitats under Protection; the Case of Düzce

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Abstract

Basic elements of the landscape are expressed as patch-matrix-corridor. The road corridor inside and at the side of forest is a very important corridor in terms of perception of the landscape on which people wander. Road corridor plays an important role in determination of the visual impact of natural and cultural values that landscaping possesses; they are also essential components that express ecological transitions and borders. In this study a visual evaluation has been performed on the habitats and species that are scattered especially inside or at the side of forests in Düzce province. Within this purpose, phenological observations and visual photographing was performed between June and October in order to determine the visual potential displayed by *Bublero falcato-Pinetum sylvestris*, *Centaureo yaltirikii*, *Seselio resinosii* and *Eleocharietum quinqueflorae* habitats at the side of roads. These photographs including tree images for each habitat were then assessed by users and non-users so as to determine their meaning in terms of visual quality parameters. As a result, a visual quality value as regards all three areas under protection status and their perceptive implications were identified.

Keywords: Protected areas, Visual potential, Phenological observation



ORAL PRESENTATION

Environmentally Assessment of Thinning Operation in Mountain Forests in North of Iran

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Abstract

Environmental effect of different thinning intensity was investigated in 5 compartments in steep broadleaf even age stand in the north of Iran. The fundamental question was which of thinning intensity cause less soil disturbance and the least residual tree damage. A visual inspection was conducted after thinning operation. Post-harvest analysis showed about 28.33, 29.03, 32.53, 30.7 and 32.5 percent of five compartments soil (number 7, 8, 9, 10, and 11) were disturbed. Statistical analysis showed significant difference in the soil disturbance between the five compartments. There was significant variation among the various soil disturbance classes disturbed with litter, rutting, disturbed with rock and stumps, and skidding road and landing. Residual stand damage was determined, by counting the number of injured trees, and assigning a damage classification after harvesting. Statistical analysis results indicated a significant difference between the five compartments. Compartment with more thinning intensity had a higher incident of residual tree damage than the compartment with less thinning intensity.

Keyword: Thinning, Soil disturbance, Residual stand damage, Iran



ORAL PRESENTATION

The Role of Impervious Surfaces in Transformation from Precipitation to Floods: The Case of Artvin-Hopa

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Abstract

Impervious land covers which are known as impervious surface express every surface where water cannot enter. Impervious surfaces are surfaces which increase the surface flow by means of decreasing or preventing the permeability of surface. All kinds of roads (forest and village roads, highways etc.), buildings in settlement areas, impervious concrete surfaces are examples of such surfaces. Impervious and indirectly impervious surfaces damage the quality of water and in some settlement areas it can turn into flood depending on the level of precipitation, which results in loss of lives and property. With short-term high precipitation, stream and river surfaces are other surfaces that can cause and increase in the flowrate of stream waters. In an area where floods and landslides are witnessed, impervious surfaces are ignored for some reason. In this paper, the aim is to examine floods, overflows and landslides which led to loss of lives and property in and around Artvin-Hopa on 24.08.2015 in ecological terms. In the study the focus was on impervious surfaces which are effective in transformation of rain waters to floods and overflows. For this purpose, the watersheds where Hopa central, Sugören and Yoldere villages are located, which experienced the flood and overflow to the highest extent, were evaluated separately. Forest management plan belonging to Hopa Forest Management Office, meteorological measurements, satellite and radar images were used to perform this study. At the end of the study, it was observed that especially impervious surfaces (forest road, village road, highway etc.) and the amounts on stream surfaces were effective in leading to flood and overflow.

Keywords: Flood, Forest Road, Artvin-Hopa, Precipitation



ORAL PRESENTATION

Assessment of Helicopter Logging Method for Environmentally Friendly Harvesting Practices

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Abstract

Helicopter logging is an aerial harvesting method in which forest products are flown from stands to the roadside landing areas. Helicopter logging can be considered as a common method in the Pacific Northwest of the USA and in western Canada in timber production. They are preferred by logging managers for harvesting timbers from difficult salvage sites and for accessing unreachable areas due to terrain conditions or remoteness from the road network. Helicopter logging also provides important advantages of implementing environmentally friendly harvesting techniques in protected areas. However, the cost of helicopter logging can be much higher than that of ground-based logging due to high equipment costs, maintenance costs, the cost of flight crew, and fuel costs. Thus, the helicopter logging operation should be carefully planned to implement a cost effective and environmentally friendly logging operations. In this study, the stages of helicopter logging in protected areas were described and the main factors that affect operation cost and environmental impacts were discussed. It can be concluded that the helicopter logging can be effectively used for harvesting high quality logs and for extraction of timbers from environmentally sensitive areas where road construction and logging operations are usually restricted.

Keywords: Forest harvesting, Helicopter logging, Protected areas



ORAL PRESENTATION

Evaluating Deployment of Firefighting Teams for Timely Access to Protected Areas: The Case of Uludağ National Park

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Abstract

A variety of natural disasters (i.e. wild fires, storm damages, etc.) can have a great impact on forest resources. Among them, forest fire disaster can be the most detrimental factor affecting forest ecosystems. In order to reduce the potential effects of forest fires, the firefighters should reach the fire area within the critical response time in which the probability of controlling the forest fires rises markedly. Quick response to forest fire areas can be even more important in environmentally sensitive areas because of their natural features, ecological functions, wildlife, aesthetic or historical values. Thus, it is very important to determine the optimum route that minimizes the total travel time of the fire fighters for timely access to sensitive areas. In this study, deployment of firefighting teams were evaluated using GIS (Geographical Information System) based decision support system that searches for the optimum route with minimum arrival time to the forest fire areas. The study area was Uludağ National Park which is one of the important protected areas in the region of Bursa in Turkey. The National Park is located in Bursa Forest Enterprise Directorate which is specified as the first degree fire sensitive area. In the solution process, the network analyst method under “Network Analyst” extension of ArcGIS 10 platform was used to evaluate available firefighting teams. The results indicated that new firefighting teams should be located in the regions in order to access whole area in critical response time. Besides, new roads should be considered to provide alternative shortest paths to fire areas. Moreover, current road standards should be improved to increase current transportation speed that might reduce travel time to fire areas.

Keywords: Forest fires, Firefighting teams, Shortest part, Road density



ORAL PRESENTATION

Salvage Logging of Winter Storm Damaged Trees in Environmentally Sensitive Areas

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Abstract

The planning and management of forest resources require a multidimensional approach that needs to consider varying and unpredictable nature of climatic conditions. Especially winter storms cause serious environmental damages on forest soil, biodiversity, and water quality. Besides, winter storms can damage huge quantities of woods, which then become vulnerable to deteriorations due to fungus and insect attacks. The logging managers should act quickly for extraction of salvage timbers from storm damaged areas. However, salvage logging operations after winter storms involve very difficult tasks and hazardous working environment comparing with regular logging operations. The most hazardous circumstance after winter storm is the entanglement of the trees and scattered woods on the ground. When winter storm occurs in environmentally sensitive areas, potential impact of salvage logging operations on forest ecosystem and forest products can be more serious. In this study, it was aimed to evaluate suitable logging methods and techniques that minimize occupational risks, avoid loss of wood quality and quantity, and minimize environmental damages. The main factors that affect efficiency of salvage logging operations were also presented. The results indicated that salvage logging of damaged trees should be performed by using specific strategies based on operational planning.

Key words: Winter storm damaged trees, Salvage logging, Work safety, Environmentally sensitive areas



ORAL PRESENTATION

Can Logging Be Better Organized In Environmentally Sensitive Areas: A Case Study of Ihsangazi Forest Directorate

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Abstract

The initial phase of forest operations, timber extraction (logging), involves felling of timber and removing them out of the stands. This phase of forestry, if not planned and supervised properly, is the reason for various adversities one never expects happening in forested areas, such as erosion, sedimentation, soil compaction and displacement, etc. Human intervention introducing the above-mentioned undesired effects starts with furnishing the forests with forest roads for administrative purposes. Other things set aside, forest roads originated erosion is related to “physical factors” i. e. soil type, geology and climatic factors, “road density”, “road location” and “road standards”. Studies show that the initial increases in erosion following road building subsides and the figures come to normal levels due to the facts that good road building practices were employed and exposed slope cuts and embankments got stabilized. Logging on the other hand, is a never ending process which will happen here and there as the forests continue to exist. That’s why this unavoidable part of forest management demands operational planning in micro detail because especially edaphic and topographic factors differ tremendously in close distances. Although extensively taught in schools, logging is contracted and practiced relatively unprofessionally in Turkey and creates far more serious circumstances to soil and the environment. In the scope of this study devised following a logging operation which occurred in Ihsangazi Forest Directorate in the spring of 2015 after an unexpected windstorm had swept a 100+ years old Scotch pine forest in February, 2015, what an unplanned logging operation would do to forest soil in an environmentally sensitive area.

Keywords: Operational planning, Skidding route planning, Soil compaction



ORAL PRESENTATION

Can Operational Planning Help Cut The Cost Of Logging: A Case Study Of Ihsangazi Forest Directorate

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Abstract

There are roughly 7 to 8 million people, called forest villagers, living in or around state forests in Turkey today. Their means of making a living for themselves and their immediate families are totally depended upon the possibilities and opportunities generated by the forest service and its subordinate enterprises, directorates, etc. The forest service is bound by Turkish constitution to offer such opportunities to these people. They form forest cooperatives, not very specialized logging companies, to carry out the forest operations starting from tending the stands in every stage of management practices to hauling the timber to log yards or mills. This is how they make a living, besides they are the first inline benefiting from none-wood forest products available to general public. After the completion of such an operation, the villagers are paid as per cubic meter of volume they process and deliver. The stages of such an operation involve felling the timber, debranching, debarking and bucking it on site, then skidding to roadside landing, finally loading to transport vehicles. Since the timber to be harvested is already stamped and taken a dbh reading during timber cruising, the responsible director already knows the approximate cubic meter of volume, which would be delivered to log yard. What he/she does not know is the exact location of particular trees so he/she relies upon the operation sheets delivered to him/her by the loggers after the completion of the operation. A simple GPS reading for each tree at this point, which will be incorporated with certain criterias such as type of species, coniferous vs broad-leafed, slope gradient, average length of skidding distance, etc. affecting the final payment at the end of the operation will help him/her almost finalize the cost of such operation even before the first logger sets foot on the stand. This particular study will compare the cost of removing a windthrown stand in Ihsangazi forest directorate to a hypothetical operation in which the locations of each tree to be harvested is known.

Keywords: Operational planning, Global positioning system, Google earth, Timber cruising

ORAL PRESENTATION

GIS Based Evaluation of Landslide Forest Roads Interactions: A Case Study of Two Forest Districts in Düzce Forest Directorate (Turkey)

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Abstract

Forest roads are indispensable constructions of managed forest lands for many forestry objectives such as timber harvesting, fire management among others. However, forest roads mainly responsible for instabilities of slopes (e.g. occurrence of landslides) where they are located, depending on interactions with different geomorphological, hydrological and ecological processes. In addition, occurrence of landslides renders roads unusable because the displaced material of a landslide can block the roads as well as destroy the road platform, resulting in serious maintenance costs. In present study, a GISbased overlay analysis was made using the forest road network (in total 322 km) and the landslide inventory map (including 109 landslides) in two forest districts (Odayeri and Çiçekli Forest Districts (FD)) in Düzce Forest Directorate (Turkey). While 69 landslides and 218.4 km of all road routes in network are located in Odayeri FD, remains are located in Çiçekli FD. In total, 84 of all landslides (i.e. 77%) are located over 109.9 km road routes and 30 km of roads remains directly in landslide areas. The outputs of analysis are real and general landslide frequency and real and general road landslide index values. These values were calculated using a simple algorithm developed in GIS platform and evaluated for both whole study area and two districts separately. Real and general landslide frequencies were calculated respectively as 0.76 and 0.26 in whole area, 0.74 and 0.27 in Odayeri FD, and 0.82 and 0.25 in Çiçekli FD. Real and general road index values were calculated respectively as 0.28 and 0.09 in whole area, 0.29 and 0.11 in Odayeri FD, and 0.22 and 0.07 in Çiçekli FD. According to real and general landslide frequency values in whole study area, one landslide in every 1.3 km and 3.9 km is observed, respectively.

Keywords: Forest Roads, GIS, Landslide Frequency, Road-Landslide Index



ORAL PRESENTATION

Evaluation of Forest Roads Conditions in terms of Landslide Susceptibility in Gölyaka and Kardüz Forest Districts (Düzce-Turkey)

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Abstract

Landslide susceptibility maps, used for different aims such as reducing the effects of landslides, decision making, and planning, have become common tools and relevant studies have increasingly made during the last few decades. One of the further usage of landslide susceptibility maps is to overlapping analysis with forest roads in order to get information about how planned road routes are located in terms of landsliding potential. Because unsuitable located roads cause slope instabilities such as landslides as well as landslide occurrence can result in serious maintenance costs destroying and/or causing deformations of road platforms. Statistical approaches such as logistic regression (LR) are well adopted to GIS based evaluation of landslide probability of slopes in larger regions. In present study, landslide susceptibility map of two forest districts (Gölyaka and Kardüz) in Gölyaka Forest Directorate (Düzce, Turkey) was generated using LR method based on an inventory of 52 landslides and eight conditioning parameters: elevation, slope, land-use, lithology, aspect, distance to faults, distance to streams, and distance to roads. Landslide susceptibilities in study area obtained between 0 and 0.57 with 0.85 AUC (Area Under the Curve) value. According to results, all parameters selected here has positive effect on landslide occurrences. Following normalization of generated susceptibility values between 0 and 1, obtained map was classified as very low (0-0.2), low (0.2-0.4), moderate (0.4-0.6), high (0.6-0.8), and very high (0.8-1) and then overlapped with forest roads in total 380.8 km. According to classified susceptibility map, more than 96% of total area is located in very low and low susceptibility classes. While 3% of the area has moderate landslide susceptibility, remains have high and very high susceptibilities. According to overlapping analysis, 1.3 km of roads is located in very high susceptibility, 5.1 km of roads is located in high susceptibility classes. Remains (more than 95% of all roads) are located in other susceptibility classes.

Keywords: Forest roads, Landslide susceptibility, Logistic Regression



ORAL PRESENTATION

The Estimation of Litter Accumulation by Using GIS and RS Techniques (Case Study: Semi-Arid Tatlıçay Watershed, Turkey)

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Abstract

Litter provides important functions (hydrological, nutrient, erosion etc.) in forest. Precise prediction of amount of litter from different forest types is very important to ecological function of litter. Remote Sensing (RS) data and Geographical Information System (GIS) were used to evaluate the usefulness of RS data to determine litter and forest properties in semi-arid forest areas in this study. The aim of this research is to determine the potential accumulation of litter in different forest properties by using RS and GIS data. RS/GIS data can provide more reliable and, low-cost data compared to conventional field and lab analysis methods. The field research was conducted in Tatlıçay Watershed, in Central Anatolia. Land use types in downstream are generally dry farming and degraded grasslands, in upstream are pasture, forests and cultivate area. The properties of soils in these areas are salty, dry, gypsum. Sloped and arid areas are only convenient for being used for dry farming with degraded grassland. Forest areas are mostly located north and northeast (upstream) of the watershed.

Keywords: GIS/RS, Litter, Semi-arid, Turkey



ORAL PRESENTATION

FOROR - A GIS Based Spatial Multiple Criteria Decision Support Tool for Forest Road Route in Steep Terrain

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Abstract

Forest road route determination process is a complex process involving many variables to be analyzed simultaneously, and is one of the important process steps for forest road projects. In this study, Geographic Information System for the detection of forest road routes (GIS) environment and Multiple Criteria Decision to give (MCDA) is a decision support system based on the introduction of a FOROR is aimed. FOROR decision support system; MCDA methods, the determination of weight, contains layers of normalization of the extent and Cost distance algorithm. FORCE is also a decision support system for MCDA, AHP, Simple Weighted Total, Promethee, Topsis and Fuzzy overlay; determining weights for sorting, grading and comparison, and dual linear scale transformation for normalization method can be used. In the linear scale transformation "maximum value" and "the smallest and largest values" it can be done with normalization. Layer resulting in normalization weight multiplied by coefficients from the desired layer MCDA method comprising the accumulated cost of the surface. When applied on the surface of the resulting accumulated costs Cost Distance algorithm optimal forest road optimal route can be determined. In conclusion, the determination of a forest road routes FOROR has been revealed on the advantages of decision support systems.

Keywords: GIS, Spatial Multiple Criteria Decision Support System, Forest Road Route, FOROR, Environmentally Sensitive



ORAL PRESENTATION

Determination of Environmentally Sensitive Forest Road Route with FOROR Decision Support System

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Abstract

In forest areas, noticeable changes resulting of the forest road construction has increased considerably in the past few years. Therefore, it is very important that the design of forest road routes takes environmental sensitivities into account. In order to accomplish this, the Geographical Information System (GIS) integrated with Multi Criteria Decision Making (MCDM) techniques is a useful tool for creating a FOROR. One such MCDM is the Analytical Hierarchy Process (AHP). In this study, AHP was applied to integrate environmental sensitive into the design of a forest road route. Using the current forest road route and the GIS-based S-AHP method, an environmentally sensitive optimum forest road route was determined according to environmental impact assessment criteria. The experimental studies confirmed that the environmentally sensitive forest road route was more accurately determined by S-AHP than by conventional methods.

Keywords: Geographical Information System, Multi criteria Decision Making, AHP, Forest road, Environmentally sensitive



ORAL PRESENTATION

An Assessment of the Protective Function of the Road Network in Beydaglari Coastal (Olympos) and Güllük Mountain (Termessos) National Park Sites

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Abstract

In the Mediterranean Region, Beydaglari Coastal (Olympos) National Park and Güllük Mountain (Termessos) National Park located within the boundaries of Antalya province are home to several plant and animal species. These national parks are visited intensively by tourists and preferred for leisure/ recreational purposes due to their historically important sites in addition to natural beauties. These features require the protection and utilization of these sites diligently. The purpose of this paper was to assess the road network within Beydaglari Coastal and Güllük Mountain National Park sites with respect to transport, protection and management needs. The maps of the national parks were processed using Geographical Information System (GIS), and the spatial distribution and features of the existing road network were determined, its capacity to met the needs of the national parks, whether it is sufficient, road density and convenience of the road condition in consideration of forest fires occurring frequently in the Mediterranean Region were checked. In this way, an effort was undertaken to propose some recommendations for forest roads in order to use the potential of the vulnerable sensitive areas, which are very important for our country and the world, in the most efficient way and ensure their sustainability.

Keywords: Road Network, Functions of Roads, Beydaglari Coastal (Olympos) National Park, Güllük Mountain (Termessos) National Park, GIS



ORAL PRESENTATION

Terrestrial Laser Scanning Based Pavement Degradation Monitoring in the Winter Season

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Abstract

Forest roads have been serving for different functional vehicle usages. Hence multi-functional forest roads should have a stabile pavement permanently for safe harvesting as well as for safe driving of the vehicles. For this reason, the high-cost maintenance and the renewal works take part in the periodic multi-functional forest road maintenance and repair works. Deformations on the forest roads have an important factor for the traffic safety and safer driving of the vehicles. Traditionally, the rutting method is one of the most common method for observation of a forest road. In this method, rut depths were measured manually using straight edge and wedge. But it is difficult to define a rut precisely. Recently, with the technological developments terrestrial laser systems have been used to observe the road pavement condition with high precision. The aim of the study is to accurately determine the degradation rate of the pavement with high precisions, exposed to deformation by meteorological conditions in the winter season, on the forest roads using with ZF 5010C Terrestrial Laser Scanner (TLS). TLS distance measurement accuracy is ± 0.4 mm at a distance of 25 m. The point spacing is 3.5 mm at 10 m and is inversely proportional to the distance point density. In accordance with the study goals, point cloud density is extremely high to process. In order to prevent the data heterogeneity and ensure easy processing monthly collected TLS point cloud data were transformed to raster terrain surface at 8 mm resolution. Changes were determined in successive months and during all the winter season.

Keywords: Terrestrial laser scanning, Forest road, Pavement degradation



ORAL PRESENTATION

Comparison of Drone Based Photogrammetry and Terrestrial Laser Scanning for Forest Road Surface Modeling

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Abstract

Reverse engineering is the process of extracting knowledge of design information of solid models. Recently, reverse engineering applications increased with the technological development. Today, Laser Scanners technology are gained acceptance as a tool for 3D modelling. As well as drone technology combined photogrammetric solutions has also been an important method for 3D modeling. The main aim of this study to compare capability and accuracy of drone based photogrammetry and Terrestrial Laser Scanner (TLS) for modeling forest road surface. In this context, this study carried out in sample B-type forest roads located in Research Forest of Istanbul University. Total length of selected forest road was 100 m. Road surface was scanned with ZF 5010C TLS. Besides, DJI Phantom 3 Advanced drone system was used for photogrammetric data acquisition. Flight height was set to 5 meters high. Mosaicking and 3D modelling process was accomplished using Agisoft Photoscan Professional photogrammetry software. Also, Agisoft Photoscan Professional was used to generate ortho-mosaic, Digital Surface Model (DSM), and point cloud data. In both studies, common ground control points were used for spatial referencing. At the end of the study, both point cloud data were transformed and compared in ArcGIS geographic information software. Resulting TLS and drone based data were examined in terms of accuracy and capability of forest road 3D modelling.

Keywords: Terrestrial Laser Scanning, Drone, Point Cloud



ORAL PRESENTATION

Determination of Forest Canopy Gap Characteristics Using Unmanned Aerial Vehicles

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Abstract

Forest canopy gaps, which are formed as a result of one or a few tree-falls, create positive effects mainly on regeneration characteristics, forest species composition, and fauna. Due to this structure, they are accepted as one of the biodiversity centers of the forests. Light, soil moisture and temperature within canopy gaps vary depending on the size, shape and spatial distribution of the gaps. For this reason, determination of canopy gap characteristics, which are created by natural disturbances and managements activities, has a key role in defining the changes in forest dynamics. Using available spatial datasets in determination of gap structural characteristics are limited due to their low resolution. However, Unmanned Aerial Vehicles (UAV) provide data with high resolution which allow sensitive measurements. In this study, aerial photographs which were taken using UAV were used in the Research Forest of Istanbul University. In the forest, forest canopy characteristics were evaluated in two sampling areas one of which is coniferous and both have an area of 50x50m. Firstly, numbers, sizes, and spatial distribution of canopy gaps in each stand were determined. Gap perimeters were defined with the eCognition which is an object based image analysis software effectively used in remote sensing studies. Gap shapes were calculated from gap perimeter and gap size using Patton's diversity index or edge index. In addition, gap vegetation height diversity was calculated using Shannon diversity index. Then, every gap characteristics were compared between deciduous and coniferous stands.

Keywords: Gap size, Unmanned Aerial Vehicle, Stand structure



ORAL PRESENTATION

Monitoring of Forest Road Pavement Compaction in the Winter Season

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Abstract

Forest roads have been used for different forestry activities throughout a year. For this reason, these roads need to be open, especially to vehicle and traffic safety over all seasons. In this context, compaction and degradation in forest roads play an important role in the sustainability of forestry activities. The compaction ratio in road changes depends on the vehicle and climate. The aim of this study is the observation of the forest road pavement compaction ratios in the winter season. The study was carried out on B-type of forest road located in Research Forest of Istanbul University. The forest road was 630 m long and has 8 horizontal curves. Compaction ratio was determined with five points on the cross section of the road axis with 10 meter intervals along the road. Point coordinates were collected with Topcon GPT 9003M total station. Totally, in this study 315 points were measured. The compaction measurements were monthly performed by using Eijkelkamp digital cone penetrometer from October to January. Climate data were obtained from the weather station at the Istanbul University Green Roof Research Area in Istanbul University Faculty of Forestry. All measurement data were combined and evaluated in ArcGIS geographic information system software. For each month, data were spatially interpolated and compaction surface models were created. Changes were then determined in successive months and during all the winter season for the study area. Conclusion, compaction ratios showed fluctuations depending on time. The ratios were changed between 0.04 to 3.99 MPa. It shows that the road compaction ratio has a wide range distribution.

Keywords: Penetration resistance, Forest road, Pavement



ORAL PRESENTATION

The Effect of Forest Road Networks on Wildlife in the Protected Areas

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Abstract

Protected areas are one of the most important habitats for wildlife. Wildlife have been affected positively or negatively by the spatial distributions of forest road networks in the protected areas. The positive effects of forest roads on the wildlife are; sunbathing, scratching, rolling on the ground and increasing food variety. On the other hand, the negative impacts of forest roads on the wildlife are; (1) the wild animals are away from their areas during to construction of forest roads, (2) they get stress, (3) they are affected negatively in breeding period, (4) offsprings are covering the herbaceous plants on the road during the vegetation period and killed by vehicles. Therefore, the protected areas should be categorized for wildlife, before the construction of forest road networks. During the forest road networks planning, applicator should be pay attention for wildlife areas and especially breeding areas. If forest road construction is necessary in these areas, we need to put some signboards and information boards like speed limits, characterized in protected areas, animal species and the use of purpose (breeding, feeding, etc). In addition, these signboards are maintained regularly and become visible all the time. Furthermore, forest road networks should be weeded periodically. The offsprings can be avoided from possible mortality due to their cowering behavior.

Keywords: Protected areas, Wildlife, Forest road networks



ORAL PRESENTATION

The Role and Importance of Forest Road Networks in the Fight against Bark Beetles

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Abstract

Forest road networks can play important role in the fight against bark beetles. In Turkey, pheromone traps which are used to fight against bark beetles are hanged on forest roadsides and bark beetles entrapping these traps are annihilated. At the same time, diseased trees which are determined in forest stands are cut and transported to forest roads. Then these trees are removed from forest stands by vehicles. In this way, it is aimed that the population of bark beetles can be kept balance level. Nevertheless, pest control can't be done effectively because of forest road networks planned primarily for forest harvesting. In conclusion, increased bark beetle outbreaks causes stand death in the forest. And so, this situation leads to economic loss in the wood material. Therefore, while planning forest road networks, control of bark beetles, as well as wood harvesting, should also be taken into account.

Keywords: Forest road networks, Bark beetles, Pheromone trap



ORAL PRESENTATION

Estimating Aboveground Biomass of Even-aged Scotch pine (*Pinus sylvestris* L.) Forests using Remote Sensing Data in Gököy Forest Planning Unit

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Abstract

Accurate aboveground biomass (AGB) predictions are important forest inventory measurements and are required in the estimation of carbon stocks, greenhouse gas inventories and fuel accumulations, and in the management of fuel wood production for bioenergy. The use of remote sensing data can reduce cost and labor for inventory in forestry. The remote sensing data can produce more successful results with lower cost than classical methods. In this study, the relationships between the AGB and band values, vegetation indices and texture values with obtained from Landsat TM satellite image were evaluated by statistical methods in Gököy Planning Unit, Vezirköprü Forest Enterprise, Amasya Forest Regional Directorate. The AGB of individual trees were calculated by using the species-specific and regional allometric equations developed by Ulker (2010) for Scots pine trees. A statistical methods, the correlation analysis was used to investigate the relationships between the stand aboveground biomass and remote sensing data. In addition to the correlation analysis, multiple linear regression technique was used to assess whether remote sensing data are essential to predict the stand aboveground biomass. These linear regression models were fitted by ordinary least squares using PROC REG procedure of the SAS/ETS V9 software. The results from the developed models can be translated into practical recommendations that forest managers can use in predicting the AGB for Scots pine stands when particularly other forest functions, including the carbon stocks, greenhouse gas inventory and fuel accumulations, and the management of fuel wood production for bioenergy, are optimized.

Keywords: Remote Sensing, Aboveground Biomass, Landsat TM, Regression Analysis

ORAL PRESENTATION

Geostatistical Analysis for Predicting Some Stand Parameters Using Göktürk-2 Satellite Image

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In forestry, inventory data are based on both remotely sensed data and field survey with temporary sample plots. Stand parameters such as stand volume, basal area, number of trees, dominant height, and crown closures are fundamental information needed in preparing forest management planning. However, the traditional forest inventory evaluation is expensive and time-consuming to conduct. Remote sensing data have become indispensably important in forestry for several decades, particularly as a tool for acquiring information on the composition and spatial structure of forest ecosystems as part of forest inventory. Several studies have been carried out worldwide on use of remotely sensed data in forest inventory studies in Turkey. In these studies, regression analysis was commonly used. In this study, geostatistical techniques were used to integrate remotely sensed data and ground measured data to predict spatial pattern of subjected stand parameters (stand volume, basal area and number of trees) in the study area. Geostatistical analysis estimate more accurately than conventional statistical methods due to using spatial variability between sample plots. In this study, Göktürk-2 satellite image and 166 temporary plots were used. Semivariograms were made separately to assess anisotropy, spatial dependency level and model type for stand volume, basal area and number of trees. Kriging analyze then was done by obtained semivariance values (nugget, sill and range) and stand volume, basal area and number of trees values in unsampled area were estimated. Finally, surface maps were produced for visual interpretation of estimated values. The most appropriate semivariogram model was assessed as spherical for stand volume, basal area and number of trees. Nugget, sill, range, spatial dependency and anisotropy values were computed as 1720, 5042, 12220, %34 and 3.2 for stand volume; 56, 158.2, 16120, %35 and 1.9 for basal area; 28.8, 79.3, 8370, %36 and 1.8 for number of trees, respectively. Correlation coefficients that were determined cross validation were 0.59 and 0.51 with Band 3 for stand volume and basal area. It was determined 0.57 with Band 4 for number of trees.

Keywords: Stand parameters, Geostatistical analysis, Göktürk-2 satellite image



ORAL PRESENTATION

Effects of Logging Methods on Soil Properties, Organic Horizon and Soil Compaction

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Abstract

Kastamonu consists of 1.7% of Turkey's forested areas and 65% of the province is covered by forestland. When utilization of forested areas is considered, 5.4% percent of nation-wide industrial wood productions are provided from Kastamonu's forests. In general, three methods are known for the logging activities; manpower, animal power and mechanical power. However, the most widely used logging methods in Kastamonu region are recently manpower and farm tractors. In addition, the use of skidding through wire drawing is often applied for logging. Main aim of the present study is to determine the effects of logging activities on soil properties, organic horizon and soil compaction after the silvicultural activities in Kastamonu region carried out by manpower, agricultural tractors and the skidding through wire drawing at four different slope group in the forest (0-30%, 30-60%, 60-100% and >100%). Mineral soil samples were taken from three soil depths (0-5, 5-10, 10-15 cm) and analyzed for pH, permeability, water holding capacity, organic matter, soil texture, skeletal content, soil compaction, and dispersion ratio.

Key words: Skidding, Soil properties, Slope, Soil Compactions, Kastamonu



ORAL PRESENTATION

Spatial Impacts of Road Network in Sensitive Forest Areas

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Abstract

The sensitive sites are the protected areas where unusual ecosystems, habitats, and some geomorphologic features or etc. are conserved and the sites are at risk of degradation and/or extinction as a result of human activity. Unlike the concept of sensitive areas have not been protected by the legal status of protected areas, but the protection is required for this type sites, as well. Also a sensitive forest site - having surface disturbance, poorly drained, steep slopes, bad drainage networks, etc - is where alterations to normal forestry practices such as roading and harvesting are required to abstain from adverse impacts on the aesthetics, ecological, economic and social functions of the forest. In these areas, the roads have to be built up because of various purposes for transportation, conservation, and or silvicultural retention. The roads, especially forest roads, have many kinds of direct and indirect impacts on entire ecosystem. The integrated ecosystem polygon is fragmented into smaller polygons by (forest) roads and the result lead to interruption of natural processes. The focus of the study is on how to illustrate the spatial impacts that the roading can have on the sensitive forest sites. With this consideration, the adverse spatial impacts of (forest) road network were discussed with some experimental results from example forest areas.

Anahtar Kelimeler: Road adverse impacts, Spatial impacts, Road network, Forest roads, Sensitive areas



ORAL PRESENTATION

Life Cycle Inventory in Wood Harvesting for Sensitive Forest Operations

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Abstract

Life cycle inventory (LCI) is one of four main phases of life cycle analysis (LCA), which means a flow model of the technical wood harvesting system by using of data on inputs and outputs. LCA can help comprehensive outlook on environmental concerns by compiling an inventory of system inputs and environmental releases. The aim of the study was to generate a LCI on wood harvesting operation system for one cubic meter wood product to state that the assessment of the environmental impacts associated with the process, product, and/or operation. In this concept, harvest operations for clear cutting in brutian pine (*Pinus brutia* Ten.) forest of Turkey was analyzed and a flow chart model was developed to show that a clear picture of the technical system boundaries. The relevant input data (time, material, and energy) within the techno-sphere from cutting to unloading operations were calculated per cubic meter wood raw material with the outputs (emissions, noise, etc.) identifying for all activities within the system concept, as well. At the end of the analysis, it was obtained the results about operation time consumption, energy expenditure, and emissions to assess the environmentally impacts of the activities. It was determined that LCI/A could help to managers in decision making to select the most suitable technology for environmentally soundly wood harvesting operations for sensitive forest sites.

Keywords: Life cycle inventory, GHG emissions, Life cycle analysis, Wood harvesting, Environmental impacts

ORAL PRESENTATION

Artificial Neural Network for Predicting Stand Carbon Stock from Remote Sensing Data for Even-Aged Scots Pine (*Pinus Sylvestris* L.) Stands In the Kunduz Forests

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Abstract

Carbon storage in forest biomass and soil organic carbon are important elements of global carbon cycle, and the changes of their accumulation and decomposition directly affect forest ecosystem carbon storage and global carbon balance. Accurate estimation of stand carbon stocks are essential to forest managers and practitioners in decision making process. Modern technology such as Remote Sensing and Geographical Information Systems (GIS) provide new opportunities for the predictions of stand carbon stocks in forest inventory. Also, artificial neural network applications offer the ability to implicitly perceive complex and nested relationships between input and output variables, which are very helpful in stand carbon predictions from remote sensing data. In this study, Applications of Artificial neural networks (ANNs) were carried out to predict the relationships between stand carbon stock and remote sensing data including and vegetation index calculated from reflectance values of Landsat 8. The data were measured from even-aged and pure Scots pine stands located in Kunduz Forests, Northern Turkey. The individual tree carbon predictions were obtained by using the carbon equations. Application of ANN was carried out using MATLAB-ntool module including the development data set that was further subdivided into three subsets for ANN training (75%), verification (15%), and testing (10%). The ANN applications, including vegetation index based on the reflectance values as input variables, were trained to provide the lowest errors of stand carbon stock as target variable. When these predictions are obtained by ANNs, different neural networks such as Cascade-forward backprop, Elman backprop, feed-forward backprop, Layer Recurrent and radial basis were carried out and the predictive acquirement of these networks were compared by using criterion values. Therefore, the stand carbon stock predictions based Artificial Neural Network (ANN) may present an important tool in forest management planning and site quality evaluations of these studied stands located in Turkey.

Keywords: Artificial neural networks, Stand carbon stock, Network types,



ORAL PRESENTATION

The Usage Possibilities of the GIS and Google Earth to Determine the Skidding Distance of Raw Wood Materials

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Abstract

Decision support tools have been used increasingly with the technological developments in forestry. Nowadays, the data related to terrain can be obtained by remotely sensing implementations to planning of the forest operations. Thus, it is possible to save the time, money and labour force during the forest operations. With these programs designed for the terrain modeling, it is possible to provide new data which help planners to make quick decision for primary transportations of the raw wood materials. Especially, primary transport which is affected by skidding distance, production amounts and type, slope of the terrain, type of forest stands, the harvesting area size and its aspect, etc. factors can be evaluated with these programs. In this study, some logging compartments where the wood harvesting activities completed were selected at the Artvin Regional Directorate of Forest. The realized manual skidding distance data of the logging areas were obtained from archives of the forest enterprise. For the same harvesting compartments, the data was obtained from software (Google Earth Pro and ArcGIS 10.2) integrations. The data obtained from software and the realized data obtained from archives were compared and the reasons and the discrepancy of the results were presented. As results; the data was obtained for the quick decisions for the workforce and equipment planning for primary transportation of harvested woods.

Key words: Manual skidding, Primary transport, GIS, Google Earth



ORAL PRESENTATION

Classification and Future Trend Evaluation of Forest Road Network in Relation to Logging Machine Size and Cost Balance on Mountainous Areas in Japan

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Abstract

Density of forest road network is restricted by steepness of slope, concerning slope failure potential, especially on mountainous areas. It is also affected with the width of roads on which logging machines operate. The authors classified combination of road network and logging system over mountainous areas in Japan into three types; A: wide road with low density used with long range cable systems, B: middle road width with middle density used with short span cable systems, and C: narrow road width with high density used with small machines equipped with winch. Cost analysis revealed that the larger the machines, the lower the resulting harvesting cost, when operated by entrepreneurs or hired labor force. However, the type C is often preferred in cases of which the labor is self-hired or the managing organization is family based ones, because of inherent labor cost reduction. As of the expected future trend, the type between A and B would be increase in number. That is because most of Japanese man-made forests are aging, accompanied with larger individual trees. In some cases roads of type B or C have been upgraded to those of A or B in order to be fitted for larger machines.

Key words: Road network, Road width, Logging system, Machine size, Operational cost



ORAL PRESENTATION

High Resolution Digital Terrain Model Generation from UAS-Based Point Clouds

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Abstract

Digital Terrain Models (DTM) have been widely used in many forestry applications, especially in determining the stand parameters. Generally, LiDAR (Light Detection and Ranging) point clouds have been used to generate DTMs, since LiDAR technology is able to provide multiple returns, which is very useful to separate the ground surface and non-ground objects such as trees, buildings etc. However, LiDAR technology generally requires a high cost and this, of course, has a negative effect on the use of LiDAR point clouds. In this study, the DTM of the study area was generated by means of the point cloud extracted from the aerial images taken from a UAS (Unmanned Aerial System). As a first step, the UAS-based point cloud was filtered to separate the points belong to the ground and non-ground objects. Thereafter, the filtered point cloud was interpolated to obtain the DTM of the study area. Finally, field measurements were conducted by using Real-Time Kinematic GPS (Global Positioning Systems) measurement technique to evaluate the accuracy of the produced DTM. Accuracy evaluations revealed that it is possible to generate high-resolution DTMs by using UAS-based point clouds.

Keywords: Point Cloud, Ground Filtering, Unmanned Aerial System, Digital Terrain Model, Forestry



ORAL PRESENTATION

Development of New Multifunctional Machinery for Forest Operations in China

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Abstract

With the increasing of labor cost in forest operations in China, the demand of new machinery which can be used to accomplish the forest operations environmentally has been boosting for last decade. A new set of forest machinery, including multifunctional skidder, bucking machine with automatic scanning and the combination of debarking-chipping machine, was developed in 2013. The multifunctional skidder can be used as skidder, loader and forest road machine. The bucking machine with automatic scanning can accomplish the operations for tree-length in the forest including scanning, measuring, optimal bucking decision making and auto-bucking. Meanwhile the debarking-chipping machine can finish the works of debarking and chipping of low quality tree-length in the same machine at the operation sites. A series of testing for those machines were carried out in the state owned forest in Heilongjiang Province of China. The testing results showed that these machines can match the operation conditions in the forest, and can reach the evaluation expectations for the operations, such as low cost, low damage to forest environment, and moderate operation efficiency.

Keywords: Forest machinery, Multifunction, Forest operations, Considerations of forest environment.

ORAL PRESENTATION

Geographical Information System (GIS) Derived Site Index Model of Oriental Beech Stands in Göldağ Planning Unit

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Abstract

The accurate prediction of forest site index is important to effective forest management and useful for stratifying forest areas into productive classes. To evaluate forest site quality, the site index, defined as the average height of dominant or co-dominant trees at a specified index age, has been commonly used as a measure of site quality in both pure and mixed stands. Traditionally, these forest site index predictions have been obtained through national forest inventories at sample plots. Although this method provides highly accurate measurements of forest stand parameters, it is very expensive and timewasting. However, the applications of Geographical Information System (GIS), seems to be more promising and practical, since the model can be easily applied to large areas. Especially, the topographic variables that can be obtained from GIS provided better information for decision making in the management of forest resources, and is likely to fulfil the needs of field foresters in assessing productivity as a measure of site potential when suitable site trees are not available in forest areas. In this study, some GIS- derived variables, including altitude, slope, aspect etc., will be regressed with site index values that can be measured in sample plots. This study was performed in Oriental Beech (*Fagus orientalis* Lipsky) stands located in the Goldag planning unit, Sinop, the Northeastern of Turkey. In this study, multivariate regression analysis will be used to model the relationship between stand site index values, as dependent variables, and the GIS-derived variables, as independent variables. The stepwise variable selection technique was used to choice the predictive variables with p values equal to or less than 0.05 for the best the highest adjusted R² values. The multiple stepwise regressions analysis was performed using PROC REG procedure of the SAS/ETS V9 software. Thorough this study, it will be evaluated that these GIS-derived variables can be used to predict stand site index values as forest site quality, which these results provide alternative solutions to obtained expensive and timewasting site index variable.

Keywords: GIS- derived variables, Site index, Regression analysis



ORAL PRESENTATION

Effects of Roads on Wildlife in Azdavay / Kartdağ Wildlife Reserve Area

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Abstract

The roads might have various negative effects on wild animals such as habitat deterioration, vehicles collision and poaching. But, there are very limited studies on this subject in Turkey. In this study, effects of roads on wildlife were examined in Kartdağ Wildlife Reserve Area (WRA) of 11494 hectares, considering Red deer (*Cervus elaphus*) as target species. This study was conducted through intensive field works, especially during the period when development plan was performed in the reserve area between 2010 and 2012, and including later individual field works. In these researches, the results of indirect observations (i.e. tracks, signs, dead and injured wild animals) and direct observations were performed monthly for 3-4 days and both night and day times. Road density was 24 m/ha and this figure is at the core zone in the area of 17 m/ha. In this area, with high road density, the main negative effects of the roads on wildlife were habitat deterioration, vehicle disturbances (noise, vehicle lights), vehicle collisions, pollution, and becoming easy prey to predators due to barrier effects of roads. To minimize these negative effects, it is necessary to take measures such as closing some forest roads, introducing suitable road plans, and constructing ecological passages for wildlife.

Key Words: Wildlife, Road, Habitat Effect, Kartdağ Wildlife Reserve Area, Azdavay



ORAL PRESENTATION

Effects of Green Road on Wildlife in Eastern Karadeniz Mountains

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Abstract

In this study, the effects of green road on wildlife, which has been planned for connection of high plateaus and for increasing the potential of tourism in the scope of Eastern Blacksea Project, were studied. The green road of totally 2600 km long provides the transportation between the highlands to provide a separate road to beach and it is formed by new methods as an improvement over current roads. The roads potentially have a negative effect on habitats of wild animals such as degradation, fragmentation, conversion, loss, and as well as vehicle collision and poaching. In order to find out the effects of green road on wildlife, researches and studies have been done on the construction part of the road in Uzungöl, İkizdere and Kaçkar Mountains in 2014 and 2015. As a result of these studies, the main negative effects of green road on wildlife habitat were deteriorations, increased poaching, unsuitable and unnecessary barrier effect caused by the retaining wall, lack of appropriate vents and access areas to the passage of wild animals, and increased vehicle collision. This project is to minimize these negative effects not only from the aspects of tourism and transportation but also aspects of wildlife habitats in accordance with the wishes of wild animals.

Keywords: Green Road, Wildlife, Negative Effect, Tourism, East Blacksea region



ORAL PRESENTATION

Operational System Selection by Slope Threshold Procedure for Sensitive Forest Sites

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Abstract

The sensitive forest sites require sensitive applications in both forest operations and also conservation activity. This study focused on the system selection for logging operations in sensitive forest sites and having steep slope forests where must be maintained, by means of multi criteria decision-making method, Analytic Hierarchy Process (AHP). The study site was selected from the forest area of Isparta Regional Directorate of Forestry, which was the sensitive sites in the managed forest and protected forest. The decision on whether a forest area was a sensitive site or not was made according to functional terrain classification subject to slope gradation. To determine the sensitive areas, the spatial analysis was realized in CBS environment with the geographic database system. Firstly, a terrain classification was performed via slope gradient and secondly, possible logging techniques were sorted, and a well-known system selection procedure was applied by means of AHP for sensitive forest operations.

Keywords: System selection, Logging, Functional terrain classification, Slope gradient, Operational decision making



ORAL PRESENTATION

Determination of Particle Matter and Noise Isolation of the Buffering Effect of Forest Cover

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Abstract

Noise and air pollution come in the first place among environmental pollution types that have negative effects on the quality of the environment we live in currently and human health. Particularly, settlements close to motorways are adversely effected from particulate matter (PM) and noise pollution arising from the traffic. Diminishing such effects can only be possible with natural or artificial obstacles. This study discussed the type and extent of the buffering effect of the forest cover, which can act to isolate the PM and noise pollution based on the characteristics of the forest cover. With this study, criteria will be established for isolating the PM and noise pollution, which will have adverse effects on settlement areas and wild life, depending on the characteristics of the forest cover around the highway. Determining these criteria will allow determining the area sufficient to ensure PM and noise pollution based on the leaf type, closure and forest stand age characteristics of the forest cover adjacent to the highway.

Keywords: Noise pollution, Particulate Matter, Forest Cover, Highway



ORAL PRESENTATION

Software-based Forest Road Planning for Forest Engineering Students

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Abstract

Recently, human demands on forestlands show variety types of forest use as recreational or production purposes. Increased demand on forest use put forward newly engineering approaches, and suggested strategies for sustainable management in and around forests. Thus, new techniques and more sensitive measurement tools have been developed to be used in forestry operations. Considering with fragmentation effect of roads, forest road planning is one of the most important element among to other forestry operations. Consequently, pre and post-process of road network planning should be evaluated under the precision forestry discipline at forestry faculties. Road planning education in bachelor level of forest engineering departments is given by conventional methods with paper-based design. Even though paper-based studies are exactly enough for the explanation of basic principles of forest roads, it is hard to make more sensible calculation and measurements by man. At this point, software-aided dynamic road designing can reduce the residual errors from calculations and measurements in addition to make more alternatives do for road alignment costs. In the concept of this case study, forest road planning for bachelor degree was done by using AutoCAD Raster Design, and Plateia. First, affine transformation for the scanned sample topographic map was done considering 1/2000 scale, and then elevation contours were vectorized. Second, principles of forest road planning applied dynamically on vectorized map by using Plateia software. Then changes made at any stage of the study are to ensure the implementation of all the projects simultaneously by Dynamic CAD based software.

Key words: Technology, Forest engineering, Road planning, AutoCAD



ORAL PRESENTATION

Assessment of Portable Hand Winch in Winter Logging Operations

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Abstract

Wood production tasks are usually carried out in the summer season in Turkey. However, increased demand on raw wood material and the lower income rates for workers during summer season suggest winter logging methods in which high quality wood material with minimizing environmental damage can be produced on snow cover in winter season. Usage of mechanized harvesting equipment is very limited in Turkey, thus, winter production activities are usually carried out by human-animal power based traditional methods. On the other hand, these methods reveal high amount of time losses (lower productivity) and environmental damages (i.e. sapwood and bark damage), as well as hard working conditions for forest workers in winter season. Besides, manual timber extraction may cause losses on the quality and quantity of wood material. In this study, as an alternative method, portable hand winch was examined in winter logging operation in the border of Çınarpınar Forest Enterprise Chief in Kahramanmaraş Regional Directorate of Forestry. This study investigated the productivity of portable hand winch integrated with synthetic rope during pulling the timber uphill on snow cover. The possible damages were also detected on the remaining residual trees. As a result of this study, it was suggested that the winter logging using portable hand winch can be more economic, practical, efficient, and environmental friendly alternative, comparing with conventional logging methods.

Keywords: Forest harvesting, Winter logging, Portable hand winch, productivity, stand damage



ORAL PRESENTATION

Creating Level of Occupational Health and Safety Culture in Forestry

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Abstract

In recent years, precision forestry approach has been implemented in forestry in order to ensure receiving optimum efficiency from forest resources, while minimizing environmental damages and satisfying social objectives. One of the most important social aspects in forestry could be workers safety during forest operations. It is highly anticipated that creating "Occupational Health and Safety Culture" for the sake of forest operation employees could provide important outcomes to meet the objectives in forestry sector. In this study, it was aimed to create level of "Occupational Health and Safety Culture" for employees working in forest operations in Daday Forest Directorate where Forest Stewardship Certification (FSC) process was started in June 2011. For this purpose, educational seminars have been applied to the target group for creating level of Occupational Health and Safety Culture. These seminars constituted behavior changes in forest workers, based on a public relations activity Survey that was applied two target groups before and after educational seminars (May 2011-December 2011). The frequency analysis and independent T-test with two samples were implemented on survey data and results were evaluated according to PR activity measurement method.

Keywords: Precision forestry, FSC, Public relations, Occupational health and safety



ORAL PRESENTATION

Productivity of the Manual Felling and CTL Operations in Artvin Forests

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Abstract

The determination of the degree of efficiency and how to upgrade the degree of efficiency of working people without harming the workforce are the main issues for the research of ergonomics. Environmental conditions, personal characteristics and the tools used by human are effective on the productivity of employees. In variable operating conditions, by analyzing these effects, it is essential to reveal the employee's productivity. The forests on the Eastern Black Sea region of Turkey are located on the mountainous and steep terrain. The mountains spread from sea level up to 4000 m altitude within Artvin forming a typical example of Eastern Black Sea Region. The harvesting areas of spruce, fir and pine forests are located on hilly and steep slopes in the region. During the manually harvesting operations, the steep terrain conditions negatively affect the productivity of forest workers. This research was conducted while the Cut to Length (CTL) method was applying on two different compartments and four stand types in Artvin forest during the summer period. Work-time studies have been performed in order to determine the operating efficiency of the felling and CTL process with a chainsaw. A work cycle for each operation consisted of certain elemental functions and factors. The times for each function and the value of each factor were recorded in the field. The workers who used chainsaw productivity were determined under the influence of the independent variables.

Key words: Time analysis, Chainsaws, Operation efficiency



ORAL PRESENTATION

Technical analysis of the Geosynthetic Reinforced Retaining Wall Construction in Forest Roads: A Case Study of Yenice Şeker Canyon in Karabük, Turkey

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Abstract

There has been increasing interest in constructing geosynthetic reinforced retaining walls in many parts of the world, due to their advantages over traditional retaining walls such as cost efficiency and ease of construction. In particular, it is even more important to build environmentally friendly constructions in protected areas. The objective of this study is to perform technical analysis of using geosynthetic material on re-construction of reinforced retaining wall in damaged section of the forest road in Yenice Şeker Canyon in the city of Karabük in Turkey. In this context, the effects of stream's vegetation on retaining wall were investigated, specifications of current retaining wall were identified, and causes of damages on the retaining walls were determined. Then, technical information about surveying, planning and construction of geosynthetic reinforced retaining wall were presented. In the study, four different profiles of retaining walls with total length of 48 m and total height of 6.8-9.2 m were applied. Finally, suggestions were provided in order to apply geosynthetic reinforced retaining walls that are in harmony with the nature for forest roads in protected areas.

Keywords: Forest road, Geosynthetic, Retaining wall, Road construction, Protected areas



ORAL PRESENTATION

Comparison between ICONA and CORINE Methods in Determination of Erosion Risk Potential

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Abstract

Turkey is among the countries influenced by erosion due to its topography, climate and soil properties. Erosion susceptibility must be determined for avoiding erosion and reducing direct and indirect problems arising from erosion. Various erosion risk analysis method was developed by using Remote Sensing (RS) and Geographic Information Systems (GIS). Parameters used in these methods are more or less different from each other. In this study, erosion risk of Haman Stream Watershed located in Kahramanmaraş city was evaluated by using CORINE (CooRdination of Information on the Environment) and ICONA (Institute for the COnservation of the NAture) models and then compared with each other. According to results, 23.22% and 76.78% of the area was subject to medium and high erosion risk, respectively, in CORINE model, while 91.77% was subject to high erosion risk in ICONA model. Differences in erosion risk ratio of the models result from parameters used in each model. Results obtained from models share similarity that the large part of watershed has high erosion risk. Thus, soil protective measures should be taken in the watershed especially in agricultural area with high slope and rangeland which have high erosion sensitivity.

Keywords: ICONA, CORINE, Soil erosion, GIS



ORAL PRESENTATION

**Harvest Scheduling and Operational Planning for Nature Parks:
A Case Study for Beşkayalar Nature Park**

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Abstract

Protected areas are designed for a broad range of missions from strict protection to give permission of utilization at a certain rate such as recreation. On the other hand, some of those areas should ideally have forest management plans to provide health and sustainability of forest ecosystems, serving goods and services to public. One of those protected areas is Nature Parks (NP). Turkey has more than 200 nature parks today. Forest and operational plans should be prepared for NP's when intervention is considered to maintain the sustainability, improvement or rehabilitation of forest ecosystem. However, the effects of harvesting and operational activities should be minimized to its environment. In this study, annual allowable cut and wood extraction system was determined for a mountainous Beşkayalar NP in Turkey using integer linear programming model. Different levels of allowable cut and wood extraction systems were incorporated into model and dissimilar operational planning strategies were developed with LINDO™. Among them one strategy was selected due to the availability of the machineries, legal arrangements, staff and economic conditions of the forest enterprise. Eventually, it is understood that the determination of allowable cut and wood extraction system in advance, could bring us benefits especially in environmental awareness, time, labor and money when compared to the classical approaches.

Keywords: Forest management, Harvest scheduling, Operational planning, Wood extraction systems, Beşkayalar Nature Park



ORAL PRESENTATION

Forest Road Retaining Technologies on Difficult Slopes in Japan

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Abstract

In Japan, soft and sandy soils and steep slopes are native problems and usually cause troubles for forest road construction. In addition, there are so many crushing belts in mountainous forested area, and underground water sometimes spring out among from these crushed stone and rocks. This underground water often causes road degradation. Some forest road retaining technologies have been introduced recently. One is L-shaped steel retaining wall technology, whose product name is L-shaped mesh wall, which is easy to construct and has high ability of drainage. The other is reinforced soil wall using thinned logs and geotextile, whose product name is TK wall. These bearing capacity and usage were analyzed. Although L-shaped mesh wall costed higher compared to conventional earthworks, it was effective when applied to crossing a short section of crushing belt. TK wall technology was easy to construct on steep slopes with narrow clearing width for roadway by its perpendicular fill slope, and provided environmental friendly landscape with revegetation work on the surface. It, however, required the appropriate drainage and the regular maintenance because of its soft road surface.

Keywords: Crushing belt, Forest road retaining, L-shaped steel retaining wall, Reinforced soil wall

ORAL PRESENTATION

Using Remote Sensing Techniques in Conjunction with Very Few Land Measurements to Produce Stand Maps in High Protection Forest: A Case Study in Mihaliççık-Çatacık Forest Planning UnitOğuz GÜNGÖR^{1*}, Ali İhsan KADIOĞULLARI², Volkan YILMAZ¹, Emin Zeki BAŞKENT²¹Karadeniz Technical University, Engineering Faculty, Trabzon, TURKEY²Karadeniz Technical University, Faculty of Forestry, Trabzon, TURKEY*E-mail: ogungor@ktu.edu.tr**Abstract**

Despite the fact that the production is not the primary objective of planning the forests, which are in protection status, it is essential to exhibit the actual status. In this context, collection of field inventory, which is one of the most important steps in planning, turns into a hard and time consuming process. In areas like this, it is necessary to use very few control points and high-resolution aerial photos in order to estimate the stand maps and stand parameters (i.e. volume, increment, carbon segregation etc.) by using remote sensing technologies in conjunction with geographical information systems. In this study, Çatacık forest planning unit, which has a wildlife protection and development area, a deer production station, seed stands and gene protection forests, was chosen as the study area. First, the types of trees were identified by means of the supervised classification of the orthophoto image. Height of each tree was then calculated by means of the Digital Surface Model (DSM) and Digital Terrain Model (DTM), which were generated by using the point cloud extracted from aerial photos. Closure map of the study area was also generated with the script written in MATLAB environment. The methodology followed in this study enables the analysts to identify the stand types accurately and to plan large-scaled protection areas in a short span of time.

Keywords: Stand parameters, DTM, DSM, MATLAB, Stand type maps, Digital aerial photograph



ORAL PRESENTATION

Comparison of the Use of Aerial Photos Taken from Manned and Unmanned Aerial Vehicles in Terms of Estimation of Stand Parameters: A Case Study in Mut Forest Enterprise

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Abstract

Recently, forest resources are planned in the sense of based multiple use forest planning, in which the actual status of forests are needed to be identified accurately to present the products and services offered by forests, except for the wood products. In this regard, precise estimation of stand types and stand parameters affects the accuracy and applicability of forest management plans in a positive way. In this study, aerial photos taken from a manned aerial vehicle and used by General Directorate of Forestry to produce forest management plans, were compared with the aerial photos acquired from an unmanned aerial vehicle in terms of stand parameter estimation. Stand heights, crown diameter, closure maps and stand maps were determined by using the aerial photos taken from manned and unmanned aerial vehicles. Determined stand parameters were compared to each other and also be checked by means of the terrestrial measurements conducted in August 2015. The reason for choosing the Mut Forest Enterprise as study area is because this area is an important ecosystem, which is sensitive to fire and includes gene protection areas, in which different planning approaches (Gazipaşa Mut Model, Classical Planning, Ecosystem Based Functional Planning) are conducted, seed fields, wildlife development areas, old growth forests, natural parks, natural monuments and natural/cultural protected areas. PhotoScan Professional software was used to generate the point cloud from aerial photos. MATLAB programming language was also used to determine the position and crown diameter of each tree. Tree closure map was generated in MATLAB environment. The spatial resolution of the orthophoto image generated from the aerial photos taken from the unmanned aerial vehicle was 10 cm.

Keywords: Stand parameters, PhotoScan, Ortophoto, Stand type maps, Aerial vehicles, Height



ORAL PRESENTATION

Examining the Changes in Work Related Health Conditions of Harvesting and Transportation Workers in Forestry

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Abstract

Today, protection of worker health is one of the most important problems of work life. In recent years despite of technical developments forestry workers are at the limit of the ergonomic pressure that human body can tolerate. Due to different features of living conditions in forestry sector application of legislation provisions remain insufficient and the social security of workers working in forestry sector cannot be fully provided. This situation prevents forestry workers to pay necessary attention on their health problems and affects work efficiency. In this study, medical body examinations of the workers working in harvesting and transportation works in forestry sector (measurement-logging, cutting with chainsaw, ground skidding with tractor, transportation by truck) were conducted in hospital environment at certain time intervals. Accordingly the changes in their health conditions were revealed and the health problems occurred due to work effect was determined. In this context, although a distinctive duty distribution does not exist in forestry harvesting and transportation works, detailed information could be gained about the health conditions of totally 12 forestry workers occupied at a certain work stage (three workers in each work stage, namely 2012/2013-2015/2016 harvesting periods) by determining the differences after comparing all their body examinations. Work amount performed by forestry workers within these periods, their working methods and habits were analyzed together and suggestions were submitted.

Keywords: Body examination, Occupational health, Forest worker, Harvesting



ORAL PRESENTATION

Planning the Intervention Areas of Forest Fire Fighting Vehicles in Effective Fire Protection Organization

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Abstract

Turkey has a sensitive structure in terms of forest fires due to its vegetation and climate. Accordingly it is vitally important for the firefighting team and vehicles to reach the fire area as quick as possible (i.e. critical intervention period of 15 minutes). Various studies related with firefighting are being conducted from the air and overland and various tools and equipment are being used. From this point of view, firefighting tools with different quantity and with different features exist in the inventory of each forest enterprise directorate and forestry sub-district directorate depending on the risk and sensitivity level of the fire. In this study, it was aimed to develop the effective organization techniques for forest fire fighting and to decrease the intervention period to fire in order to minimize the fire losses, the distance (km) covered by each suitable fire fighting vehicle (sprinkler truck and first intervention vehicle) on each road (considering they start moving from fire operation center) within critical intervention period (15 minutes) were measured and the points they finally reached were marked. These points were later connected on GIS environment in order to determine the areas to be intervened by each fire fighting vehicle within critical period. Within the scope of developing technologies, planning was made related with effective intervention to fire and the precautions to be taken in firefighting were presented.

Keywords: GIS, Critical intervention period, Forest fire, Fire fighting vehicle



ORAL PRESENTATION

Defining and Assessing of Existing Forest Road Standards with Use of Google Earth

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Abstract

Forest roads are essential structures providing access to forest for various purposes and understanding the standards of existing forest roads are very important whether they fulfill their functions or not. Forest roads are classified into three main groups considering the amount of load to be carried, the objective of construction, traffic density and tonnages in Turkey as: primary forest roads, secondary forest roads (Type A and B) and tractor roads. Most of the existing forest roads were planned and constructed according to secondary forest road (Type B) standards, with 4 m platform, 3 m roadway-superstructure, 1 m ditch widths, 12 m minimum vertical curve diameter and 12% maximum longitudinal slope in Turkey in the past. By the increment of standing tree sale applications in recent years, knowledge of the existing forest roads standards gained greater importance. Therefore, the standards of existing forest roads mentioned above should be determined to exhibit the suitability of the roads for trucks. But this can be difficult, expensive, and time consuming tasks involving serious field work, thus, it was aimed to investigate whether this can be done with use of remote sensing technics or not. For this purpose, free Google Earth program was used during the applications. All of the specified dimensions and standards were determined for the sample forest road with use of Google Earth. Then, the results were checked with the ground measurements and the results were found really reliable and applicable.

Keywords: Remote sensing, Vertical curve diameter, Longitudinal slope



ORAL PRESENTATION

Determining Informal Forest Roads by Using Gokturk II Images (Ilgaz Sample)

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Abstract

Almost all of the forests (99.9%) are state forests in Turkey and they are managed by General Directorate of Forestry. Forest roads are regulated with the “Edict number 292”, which contains planning, construction, and maintaining technics of forest roads. Forest road network plans and maps contain existing and planned roads, but it is highly possible to encounter some informal roads in the forests. For delineation of these informal roads, map revision based methods are known as time consuming and expensive activities, thus, this study aimed to identify informal forest roads based on remote sensing data captured by using Gokturk II images. All existing roads from aerial image were extracted, superposed and then matched with existing roads using forest road network maps within the study area of Ilgaz region. The results showed that there is a significant amount of informal forest roads in the study area and mapping of informal forest roads is possible based on remote sensing data.

Keywords: Road extraction, Road detection, Forest road network, Aerial image



ORAL PRESENTATION

Research on Possibilities of Timber Extraction with Snowmobile in Kastamonu Region of Turkey

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Abstract

Mechanization ratio for timber harvesting operations is relatively low with the percentage of 8% machine power and 5% skyline harvesting in Turkey. Timber harvesting is still carried out by manual and conventional methods due to economical, social and environmental restrictions, which result mostly ground skidding in forests. Farm and forest tractors are generally used to skid logs from stump to road side landings and some damages occur to residual trees, soil and raw wood materials as a result of these activities. Benefitting from forests without any damage is impossible but reduction of damage degree can be possible with varied applications like winter harvesting. It is well known that winter harvesting operations, especially ground skidding on snow reduces the damages. Ground skidding with farm tractors on snow is applied in Kastamonu Region every year. We wondered, if timber extraction with snowmobile would be possible or not. For this purpose, we made some observations and investigations during ground skidding on snow with farm tractor. The geographical features and coordinates of skid trails, landings and study area were identified, the snow thickness on the skid trail and minimum-maximum temperature during the work were calculated. The possibility of timber extraction with snowmobile is discussed by considering the technical specifications of snowmobile and conditions of the study area.

Keywords: Winter harvesting, Logging, Wood extraction, Ground skidding

ORAL PRESENTATION

Forest Road Network Planning Strategy by Using GIS-based Multi-criteria Approach under the Scope of Coppice Forest Conversion to Productive Forests

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Abstract

The forest road planning in opening-up activities of production forests requires appropriate short-term and long-term plans. In the planning process of forest roads, the important decision variables are quantity and quality of forest products. On the other hand, the most important decision variables for planning of forest roads are topographic factors. Although low-volume forest roads do not require very complex engineering works, they have to be planned to be in use for long period of time with optimal costs for the purposes of forest operations. Engineering activities taken place in the forest ecosystems should be certainly evaluated and planned under the scope of multi disciplinary approaches. Thus, advance GIS techniques and decision support systems integrated with GIS have been used as important tools for developing spatial suitability models. This study presents new methodology for forest road planning approach in the areas subject to conversion of coppice forest into the productive forests. The designed methodology for study area was planned by using GIS-based multi-criteria approach based on linear fuzzy logic. The methodology was implemented for three periods of planning steps in the study area. Site-specific forest road planning was performed based on cost surface established with four decision variables (i.e. distance to major river, aspect, slope, and land use). Least-cost path analysis was used to find the best route between forest depots and specified landing areas on the cost surface raster. The results indicated that new methodology can provide decision makers with important assistance for the short and long-term planning of forest roads in the areas subject to conversion of coppice forest into the productive forests.

Keywords: Forest roads, Strategical planning, GIS, Coppice forest management

ORAL PRESENTATION

Delicate Determination of Slope Values of Stands /Sub Compartment for Planning and Production Works With Geographical Information Systems (GIS): The Examples of Mut-Alahan and Mihaliççık Kızıltepe Forest Planning Units

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Abstract

From the past to the present, the expectations from the services and products offered by forests have shown diversity and change. These expectations are generally taken into account in plans in the form of conflicting purposes for the same forest sub compartment and the functions of forests are being determined within the rules identified. In this paper, the accurate calculation of slope, which is an important factor in choosing of techniques used in production activities along with the usage of Geographical Information Systems (GIS) has gained importance. In the present system, slope values calculated in arithmetic mean and calculation with area weighted method provide very diverse values. Within this scope, when the slope value of a forest sub compartment is taken into account, it can be evaluated in soil preservation function based on arithmetic mean value, and it can also be evaluated as production forest according to area weighted calculated value. Likewise, exactly opposite situations can also occur, and selection of production technique can show difference. In this study, two planning units with different forest ecosystems (Mihaliççık-Kızıltepe and Mut-Alahan) the manner with which the difference created in calculation of a sub compartment with these two methods can affect the wood extraction techniques and ground skidding expenses was analyzed. From the chosen study areas, most part of Mihaliççık- Kızıltepe planning unit is a delicate transition ecosystem which is in dam basin with soil protection, wild life development and protected areas, natural protected areas. The other area, Mut-Alahan planning unit, is also an ecosystem sensitive towards fires, but is also an ecosystem which hosts gene protection forests, seed gardens, wild life development and protected areas, natural old-age forests, forests with aesthetic purposes and historical cultural protected areas. These characteristics of the study areas require more delicate attitude during planning.

Keywords: Slope, Area weighted method, Spatial data, Fire break, GIS, Arithmetic mean method, Protected areas



ORAL PRESENTATION

Silvicultural Practices in Relation to Alleviating Wind and Snow Damages in Turkish Forests

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Abstract

Large forest areas are affected by wind damages in Turkish forest in decades. These damages have especially been occurred on coniferous tree species such as *Pinus nigra*, *Pinus brutia*, *Pinus sylvestris*, *Picea orientalis*, *Abies* spp.. Many factors affect wind and snow damages such as stand structure, past silvicultural treatments, wind traits, topography, soil conditions, aspects, snow load, alteration of temperature in the damaged sites, icing circumstances, etc.. The major tool for alleviation of wind-snow damage is silvicultural treatments especially tending operations. The sensitive forest sites for wind-snow damages can relatively be predicted from past occurrences. Thereby, deliberate tending operations can be focused on sensitive sites to mitigate the damaging effects. On the other hand, there is detailed data need for the damages types such as stem breakage, tree leaning, tree uprooting, and curves in the trunk. The major damaging factors such as wind, snow, and ice-storm should also be investigated. In this paper, silvicultural treatments for alleviating wind and snow damages in Turkish forests have been examined. Stand characteristics, climatic conditions of damaging periods, damaging agents, and damage types have also been discussed depends on the available data.

Keywords: Windthrow, Snow damage, Ice storm damage, Stand characteristics



ORAL PRESENTATION

Necessary Planting Measures in Forest Roads in Terms of Slope Stability and Exemplary Slope Planting Model

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Abstract

Just after forest road building, slopes are usually left without any plantation assuming that slopes will be covered with natural vegetation. However, in the case of insufficient seed or unsuitable seed cast time, expected precursor plant succession does not occur or happen late, especially on roads building with steep slopes. As a result of this, slopes can be subject to serious soil erosion and soil loss. In following years, conditions might be even more unsuitable for late plantings due the soil loss. If seed cast time and soil conditions are favorable sometimes natural plant cover can develop and prevent damages to some degree caused by erosion. Especially, just after the first year after building of roads, slope stability is not secured yet. Ground materials (rocks, debris) fell or toppled onto roads which might cause accidents or sometimes close the road for transportations. Road slopes with high vehicle traffic or tourism potential (i.e. Uludağ region) is at the earliest should be planted with suitable methods. In this study, planting principals and an exemplary planting model is suggested for cut-slope and fill-slopes of the roads to kept them always open for transportation.

Keywords: Forest road slopes, Slope stability, Slope planting model



ORAL PRESENTATION

Impact of Wounding During Forestry Operations on Root Rot and Stem Decays

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Abstract

Reducing the wounding of trees during harvesting and roading activities is of great importance, since wounds can result in stem deformities and significant losses of timber volume and value to decay. While the role of wounds as foci for subsequent wood decay is well known, development of decay in stands subjected to different harvesting and/or roading practices is relatively poorly understood. Moreover, in Turkey, the impact of wounding during forestry operations so far has received little attention from the pathological point of view. This work therefore reviews and underlines the importance of wounding in the incidence and severity of root and stem decay fungi after harvesting or roading activities.

Key words: Armillaria root disease, *Heterobasidion annosum*, Logging wounds



ORAL PRESENTATION

Monitoring Aesthetics Values Using Geographical Information Systems

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Abstract

Nowadays, the importance of natural resources and forest ecosystem have been recognized well and people's use of the forest is shifting from timber harvesting to recreation and tracking. Visual beauty attracts visitors to the forest for outdoor activities in their leisure time. Aesthetic beauty helps to achieve well-being effects of nature like refreshing, relaxing, calming, mood enhancing. Moreover, visual quality of the forests would help to human's physical and mental health. The concepts of forest aesthetics, determination, analyzing and evaluating of landscape beauty gained importance in recent years. Two component of forest aesthetics values are silhouette value and mosaic value. Their common effect determines the aesthetic value of a forest landscape. The aim of this study was to estimate and monitor forest aesthetics values using Geographic Information Systems (GIS) in the northwestern Turkey. First of all, criteria and indicators of aesthetics values were described and how to determine silhouette value and mosaic value was explained.

Keywords: Aesthetics value, GIS, Silhouette, Northwestern Turkey



ORAL PRESENTATION

Evaluating Effectiveness of Forest Fire Watchtowers in Mediterranean Region Using GIS Techniques

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Abstract

Forest fires have negative affect on sustainability of forest ecosystem, wildlife and, biodiversity. Fire detection on time is critically important for preventing large forest fires and take necessary fire distinguishing activities. The most effective way for detecting and monitoring forest fires is fire watchtowers. The fire watchtowers should be carefully located in such a way that forest rangers monitor forest areas in the region. The sooner the fire is detected and the better the information such as its spatial location, accessibility, and actual size is. Geographical Information System (GIS) has gain importance and used many forestry applications such as forest fires, forest protection, and forest management due to collecting, storing, manipulating, and analyzing spatial data. Visibility analysis is generally used to determine areas that are visible from a specific location. In this study, locations of fire watchtowers built in Kahramanmaraş Regional Directorate of Forestry were assessed by using GIS. All fire watchtowers located in the study area and border the study area were examined. Visibility analysis was performed by using several data layers including Digital Elevation Models (DEM), stand type map, tower layer. The forested areas that can be seen and not seen by the watchtowers were determined and then the locations and numbers of existing fire watchtowers were evaluated. Besides, forest fire happened in the case study area between 2002 and 2014 were evaluated with respect the fire watchtowers.

Keywords: Forest fire, Fire tower, GIS, Visibility analysis



ORAL PRESENTATION

Evaluating Forestry Activities in Riparian Forests

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Abstract

The forest adjacent to surface water network such as lakes, streams, and wetlands are defined as riparian forests and it has important ecosystem values such as water quality, wildlife and fish habitat, aesthetics. Besides, riparian forests help stabilizing the soil, preventing sediment and preventing erosion. The riparian forest buffer is generally separated two buffer zones including management zone and reserve zone. The forestry and agriculture activities are restricted in reserve zone and environmentally friendly forest activities should be carry out in management zone. The importance of protecting aquatic ecosystem and water quality are increasing due to harmful human impacts around and within waterways. The road constructions must be restricted in the riparian forest zones or minimized considering necessary stream crossings points. Roads were generally built along streams because it was more cost effective and easier than the other alternative. Unfortunately, there was no consideration on the impacts of road construction to riparian forest areas. The roads in riparian forest areas can have ecological impacts up to 100 m on each side of the road. These impacts are the removal of riparian vegetation, alteration of topography, and reduction in infiltration rates. The aim of this study was to investigate road construction and harvesting activities in reserve and management zone of riparian forest area using Geographic Information Systems (GIS). The study was implemented in Odayeri planning unit in Düzce, Turkey. For the riparian buffer zone maps, firstly, streams in the study area were classified and then, the map of riparian reserve zones and management zones were generated by using GIS. The road maps and riparian forest maps were overlaid and road construction and harvesting activities were evaluated with respect to environmentally friendly forest activities.

Keywords: Harvesting activities, GIS, Riparian forest, Road construction



ORAL PRESENTATION

UrbanParks - A Web-Based GIS Application: A Case Study of 12 Subat Park - Kahramanmaras

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Abstract

Urban trees provide many tangible and intangible benefits to city residents. The total number of current tree species, individual properties, location, health and maintenance status of each tree can only be gathered by tree inventory studies. The main objective of this study is to develop a web-based tree information system for trees in 12 Subat Park, Kahramanmaras. The first step of this study was conducting an inventory for trees in the park. With this study, location and individual attributes of each tree were gathered by doing ground measurements and field observations and these data gathered were imported into ESRI ArcGIS. At the final step, all data were shared with public by developing a web-based GIS application using ArcGIS Online. In this study, the location of each tree was obtained using GPS and then imported into ArcGIS software. Furthermore, an attribute table was created for each tree in ArcGIS and an ID number was assigned to each tree in the park. Scientific name, common Turkish name, height, dbh, and canopy diameter of each tree were measured and all these records have been entered into the database. Finally, a web-based GIS application was developed using ArcGIS Online.

Keywords: Tree, inventory, GIS, database, ArcGIS Online



ORAL PRESENTATION

Investigation of Harvesting Operations after Forest Fire in Turkey (A Case Study of Adrasan Forest Enterprise)

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Abstract

Forest fires potentially cause important damages on forest resources in Turkey. Especially, forest fires have inflicted great losses on the Mediterranean and Aegean forests. Besides, forest fires cause important harm to the wild life and result in great economic losses. After the fire, the fire killed or damaged trees are to be immediately extracted from the site and burned areas are subject to plantation in a year. Therefore, damaged trees within the burned areas should be completely harvested in short time. In this study, forest harvesting operations are investigated in burn area. The study area was located in Adrasan, which is a very touristic site in the Mediterranean city of Antalya. Adrasan forest fire has occurred in June, 2014. In this fire, 140 hectares area was burned and 4500 m³ trees were damaged. Burning area was completely covered by *Pinus brutia* forest. Average slope of region was between 40% and 50%. The main wood products extracted from the site were in the form round wood and industrial wood. Within the Adrasan logging site, firstly, skid roads and skid trails were located. The slope of skid roads and trails varied between 10% and 18%. The different type farm tractors were used during logging operations in the burned area. Tractors were employed in skidding and transporting operations. During logging operations in burned area, chute system was also used for short distances. Time measurements were performed in every stages of wood extraction including tree cut, skidding or transporting, and loading. Finally, average productivity was estimated of every stage taken place in this burned area.

Keywords: Forest fire, Salvage logging, Productivity, Tractors, Skidding, Transporting



ORAL PRESENTATION

The Importance of Forest Roadsides for Biodiversity, Wildlife, and Nonwood Products in Turkish Forests

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Abstract

Light, soil moisture, and temperature are very important factors in the formation and diversity of vegetation. The total area of forest roads in Turkish forest occupies large areas, often breaks the integrity of forests, and creates diversity and complexity. Forest roads provide important alterations in the forests. Forest road platforms, cut slopes, fill slopes, and roadsides into forest have relatively different light, soil moisture content, and temperature than those of adjacent forests. Altered areas create niches for light demanding plants, especially small woody plants and herbs around big trees. These plants support diversity and wildlife in forest. In plantation forest, forest road edges can be utilized for biodiversity, wildlife, and Nonwood forest products. Plant selection is very critical for road edges in plantation forest. The plants should have multifunctional characteristics including strong root system for cut and fill slope stability, wild fruit bearing for wildlife, and ornamental value for visual purposes. Forest roadsides also provide opportunity for native light demanding small plants. On the other hand, forest road edges also provide possible entry corridors for invasive plants, which create risks for native plants.

Key words: Forest roads, Silvicultural practices, Biodiversity, Wildlife, Nonwood forest products



ORAL PRESENTATION

Mechanized Harvesting Operations Processes on Quality and Quantity of Timber Products in the Natural Broadleaved Forests of Iran

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Abstract

The natural broadleaved forests of Iran known as Hyrcanian Forests are located in north of Iran close to Caspian Sea. These forests cover 1.8 million hectares and have uneven age and distributed from 26 m elevation to 2500 m above sea level. About 30 years ago, the Shelterwood was a common silviculture method which changed to the selection method for two decades. By the new strategies of forest management based on ecological aspects and increasing mechanized logging operations, there are significant differences between quality and quantity of timber products. The statistical results showed that logs timbers, squared timbers, charcoals, pulp and paper timbers averaged 15%, 10%, 17% and 55% during the Shelterwood method, respectively, and they reached up to 34%, 6%, 0.5% and 58% during the Selection method, respectively. In this paper, the effects of developments of logging operations and silvicultural managements on quality and quantities of timber products in the Hyrcanian Forests of Iran during last three decades have been discussed.

Keywords: Mechanized logging operation, Timber products, Shelterwood method, Selection method and Hyrcanian Forests



POSTER PRESENTATION

Sensitivity of NUM-PCM Numerical Snow Avalanche Software to Model Parameters

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Abstract

NUM-PCM 1.0, a software developed for 1D calculation of snow avalanche dynamics such as velocity, and maximum run-out distance, applies five numerical models to PCM snow avalanche model. These numerical methods are Euler (1st and 2nd order Taylor Polynomial), Midpoint, Modified Euler, and Runge-Kutta order four method. In the present study, sensitivity of developed software to model parameters such as friction parameter, mass-to-drag parameter, and delta (horizontal distance) were tested with different scenarios. According to results of different scenarios, when the other parameters are constant with increasing of friction value run-out distance decreased. While mass-to-drag is increasing, velocity of the avalanche is increasing although the run-out distances are close to each other. In addition, as expected in numerical approaches, lower horizontal distance (or step size) provide more stable results. According to results, when the horizontal distance exceed 50 meters, albeit the velocity values of avalanche are close in each methods, avalanche is stopped at high velocity harshly without the avalanche could arrive the run-out zone.

Keywords: Friction parameter, Numerical Approach, PCM Model, Run-out distance, Velocity



POSTER PRESENTATION

Assessment of Forest Crimes by Using Geostatistical Methods and Modelling

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Abstract

Conserving the forestlands can provide with the sustainable management approaches. Binding international conventions and the membership process of European Union (EU) with awareness projects about nature conservation has been quite effective in the increase of sustainable forestry work and nature conservation. Depending on the development level of human rights in countries, the social nature defines two approaches as "protection or observation". Because of protecting the forests and leaving to future generations, engineering operations and managements practice in the scope of precision forestry. Guiding and providing decision-makers with realistic models that facilitate the work of forestry, and Geographic Information Systems (GIS) applications are one of the best tools in this regard. Statistics from spatial distribution modelling are mostly derived from eco-geographic variables. Indeed, the study of causality in the events of human oriented as like forest crime studies are inconceivable without sociological variables. Hence, GIS-based geostatistical methods were performed and tested with the help of direct and indirect variables for forest crime evaluations. Three (3) different forest management units where covers 48 villages within the boundaries of Kahramanmaraş Regional Directorate, was surveyed and assessed according to actual forest crimes for last 5 years. Villages and its' spatial data (sociologic, demographic and topographic) were evaluated and modelled by using Ordinary Least Squares (OLS) and Geographically Weighted Regression (GWR) studies. As a result of this study, density map of potential forest crime for the study area was produced, and spatial distribution models figured out the estimation of crime density with using the most effectual four factors (forest area size, slope, population and the distance to districts). The differences in aforementioned models for the distribution of crime can explain the distribution ratio 54.4%. In this study, increasing the reliability of used data, increasing the sample area or the determination of more effective decision variables depend on to increase the factors. Beside, GIS as rapid and effective method are preferred in socio-politic studies, and help in making a significant predictions and the right decisions for decision-makers. According to the study results; it will achieve to the creation of economic and demographic (the effective factors on forest crime) measures in order to take decision for the regional distribution of forest crime.

Keywords: Forestry, Conservation Policy, Forest Crime, Geostatistics, Crime Mapping



POSTER PRESENTATION

Environmental Friendly A New Product: Natural Dye Production From Waste Tea Extract And Effects Of Color Changes On Wood

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Abstract

This study aimed to develop natural dyes for wood material that are harmless to humans and the environment. For this purpose, a tea stain and polyurethane single- and double-component water based varnish were applied by brush on the wood surfaces of pine (*Pinus silvestris L.*), beech (*Fagus orientalis L.*), fir (*Abies*), and poplar (*Populus sp.L.*). The color change (*i.e.*, ΔL , Δa , Δb) and total color change (ΔE) of the samples was determined based on the ISO 2470 standard. According to experimental results, the highest color brightness change (ΔL : -52.49) was seen in pine wood with tea dye, the highest red color change (Δa : 11.50) was seen in pine wood with tea dye+water-based varnish, and the highest yellow color change (Δb : 97.19) was seen in fir wood with tea dye+borax. The highest value of total color change (ΔE : 99.512) addition of borax Fir wood in tea dye is obtained. Developed tea extract to waste paint, furniture processing industry has the aesthetic appearance of surface processes can be used.

Keywords: Wood, Waste Tea extract, Natural dyes, Environmental.

POSTER PRESENTATION

Determination of Biological Activity of Some Wood Decaying Fungi

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Abstract

The use of fungi since ancient times has increased the importance of fungi in terms of medical and nutritional aspects. Numbers of pharmaceutical studies on fungi are quite lower compared to studies that are being done on plants. This study was aimed to determine and compare DNA protective activity, antioxidant level and heavy metal content of the wood decaying fungi, *Trametes gibbosa* (Pers. ex Pers.) Fr., *Trichaptum biforme* (Fr. in Klotzch) Ryv., *Fomes fomentarius* (L. ex Fr.) Kickx. ve *Fuscoporia torulosa* (Pers.) T. Wagner & M. Fisch., collected from one location of Belgrad forests. Laboratory dried mushroom samples were very finely grinded in mechanical mill. Then, it was weighed 30 gram of each mushrooms for the test. They were extracted using ethanol in Soxhlet extractor for approximately 6 hours using at 75 ° C. The antioxidant activity of fungi were analyzed using both DPPH and Rel Assay kits (TAS, TOS) methods. DNA protective activity was determined according to Lee et al. (2002) by using the supercoiled pBR322 DNA. Heavy metal content and analysis of fungi were carried on via atomic absorption spectrophotometry using wet decomposition method on one g sample per analysis. The highest DPPH, TAS and TOS activities were determined on *F. fomentarius*, *T. gibbosa*, and *T. biforme* , respectively. DNA protective activity of fungi was observed in all tested samples. The heavy metal content of the fungi species as follows; In all species, Pb was found to be higher than reported values while Ni content was observed only in *T. gibbosa* species with 0.5 mg.kg⁻¹. The amounts of other tested elements were varied among the Fungi species.

Keywords: *Trametes gibbosa*, *Trichaptum biforme*, *Fomes fomentarius*, *Fuscoporia torulosa*, Biological activity.



POSTER PRESENTATION

Determination of Hydrologic Properties of Forest Floor According to Different Stand Types

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Abstract

Forest floor plays an important role in the occurrence of a regular flow regime with rainfall basins significantly affect stream flow and delays the time to reach maximum currents. Recently studies about forest floor is stated that an important function of water storage and stop erosion. In additionally, forest floor has characteristics such as permeability increase, partly to prevent evaporation, upgrade ability water capacity and water quality. Therefore, forest floor properties performs the functions must be known. In this study, Sivas-Central Forest Management Office area, forest floor and soil properties were investigated changes according to different stand types (Poplar, Pine and Poplar+Pine). To determine different forest floor properties from stand types, were kept constant parent material, elevation and aspect factors. In research area, were taken 12 soil samples according to "Factorial Experiment Design" in order to determine of different stand types soils hydrophysical characteristics. And 81 forest floor sampling were taken from different stand types. Soil samples were evaluated sand, clay, silt, dispersion ratio values according to different stand types. Forest floor properties were evaluated saturation capacity, loss on ignition and bulk density values according to different stand types.

Keywords: Forest floor, Stand type, Sivas, Soil



POSTER PRESENTATION

Erosion Risk Analysis by Using Analytic Hierarchy Process

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Abstract

Soil erosion, which has negative effects on diverse ecosystems especially natural resources, agriculture and dams, is one of the most serious environmental problems in the world. Beginning of rational and effective erosion control works is to determine priority areas that are very sensitive to erosion. The aim of this study is to determine and mapping erosion risk of study area by using analytic hierarchy process (AHP) which consider interaction among parameters. Study area is within Terbuzek Stream Watershed which is 100 km away from Kahramanmaras city and about 19696 ha. Slope, bedrock, land use and vegetation density parameters was used with the aim of determining erosion risk with AHP method. Remote Sensing techniques (RS) and Geographic Information Systems (GIS) were used for preparing maps regarding the parameters. Pairwise comparison matrix in among parameters and weight scores of the sub-factors were reached by the help of expert opinion and literature. According to results, 0.6% of area was subject to very high erosion risk, while 40.6%, 30%, 27.8% and 1% was subject to high, medium, low and very low erosion risk, respectively in Terbuzek Stream Watershed. Consistency ratio of pairwise comparison matrix was 0.04.

Key word: AHP, soil erosion, GIS, RS

POSTER PRESENTATION

Delicate Determination of Stand Parameters of Natural or Artificial Stands Using Different Tree Volume Tables: A Case Study from Mut Forest District

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Abstract

Determining the volume and increment of forest is important for the purpose of sustainable planning of forest resources based on multiple use principles. In this way, the forests are determined as artificial and natural forest according to the ecosystem-based functional planning principles. According to one hypothesis, the volume of trees in natural and artificial stands will be different because of differences of stand conditions and tree form. Based on this hypothesis, volume tables for each natural and artificial stands are regulated. Forest management plans applicators say that current tree volume tables do not sufficiently explain the growth potential. In this study, volume and yield tables of 6 planning units on Mut forest district which using our regulated tree volume tables for natural and artificial stands and current tree volume tables were compared. Mut forest district was chosen because it has more standing timber sales, gene conservation areas, seed orchards, wildlife protected and improvement areas, old growth forests, aesthetic forests, nature parks, nature monuments, historical cultural sites and fire sensitive species. For example, were compared with volume of natural stands and artificial stands on Alahan planning unit that each one has 30 cm mean diameter were found to be more than 26 m³ at the artificial stands volume. Take into account both current and our regulated tree volume tables, carbon storage capacity, stumpage volume and yield are calculated for standing timber sales and other productions on Mut forest district.

Keywords: Artificial Forest, Natural forest, tree volume, Stand parameters, tree volume tables



POSTER PRESENTATION

Forestation Studies in Sensitive Areas, Kayseri Region Example

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Abstract

Kayseri region comprise large sensitive areas in terms of forestry practices. One of the major forestry activities in the region is forestation in semiarid sites with poor soil conditions. This study aimed to evaluate forestation studies carried out in Kayseri region for 14 years (2000-2013). During the period, forestation studies were performed in 36 areas with 20 204.8 ha in Kayseri. Mechanization was very intense in the studies. Special equipment for forestation studies, KAYOR, was developed locally for more successful and efficient works. The studies were classified into five different purposes: soil conservation and erosion erosion control (29.7%), forestation of multi-purpose application (26.8%), forestation of soil conservation (24.1%), greenbelt plantations (13.8%), and rehabilitation studies (5.7 %). 11 tree species were used in the studies including black pine (*Pinus nigra*), Taurus cedar (*Cedrus libani*), Scotch pine (*Pinus sylvestris*), mahaleb (*Prunus mahaleb*), acacia (*Robinia pseudoacacia*), almonds (*Amygdalus communis*), Juniper (*Juniperus sabina*), oleaster (*Elaeagnus angustifolia*), walnut (*Juglans regia*), birch (*Betula verrucosa*), and oak (*Quercus petraea*). The most used tree species are black pine (30 areas), mahaleb (27), and Scotch pine (22). The percentages of success in the studies were between 15% and 90%. The overall average success rate was 67.4%. The number of tree species used in one area varied between 1 and 8, the average was 3.6 species/areas. The number of woody plant species to be used in forestation studies of the region should be increased regarding nonwood products, wildlife, biological diversity, and ecological restoration approach. There are many wild fruit species and other woody plant species in the region potentially usable in the studies.

Key words: Kayseri, Forestation, Native woody species, Arid and semiarid areas



POSTER PRESENTATION

Non-Destructive Detection of Decay in Living Trees as a Precision Forestry Tool and in Urban Tree Risk Assessment

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Abstract

It is very well known that root and stem decays in living trees significantly reduce the quality of timber in production forests. On the other hand, in urban landscapes, tree or limb failures induced by decays can be hazardous to people and property. Visual assessment of trees in forests or urban areas can underestimate the extent of internal decay in trunk and limbs or in roots. Therefore demand for more accurate and reliable methods has lead to development of non-destructive evaluation methods over recent years, especially in urban and environmentally sensitive areas. Even though non-destructive evaluation methods have been extensively tested and are beginning to be widely used to detect internal decays either to evaluate hazardous trees in urban areas or to assess quality of the timber in forests worldwide, in Turkey, utilization of these methods in forestry and urban tree management programmes is almost non-existent. The aim of this work is to introduce advanced methods used for non-destructive detection of decay in living trees as precision tools for forestry and urban tree risk assessment.

Key words: Sonic tomography (SoT), Electrical impedance tomography (EIT), Wood decay fungi, hazard tree



POSTER PRESENTATION

Forestry practices affecting the incidence of *Heterobasidion* and stump treatments to infections in managed forests of Turkey

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Abstract

Root and butt rot caused by fungi belonging to the *Heterobasidion* complex cause severe economic losses in the managed forests of the northern boreal and temperate zones. Forest practices are a major contributing factor to increased infection by *Heterobasidion*. Airborne spores of *Heterobasidion* colonize freshly exposed stump surfaces, and during thinning operations, the fungus can establish in pine plantations where it was formerly absent. Forest management practices can provide a periodic supply of fresh stumps, increasing the size of the fungal population. Several biological and chemical control agents have been used experimentally against stump infection in many coniferous stands, and a small number have found practical use. Stump removal is a direct control measure to remove inoculum from infested sites and reduce carry-over of the disease to the new stand. Among the different control measures available for *Heterobasidion*, the most effective and practical is the prophylactic application of biological or chemical control agents to the surface of freshly cut stumps. Several stump treatments have been tested, a few of which are successfully applied in practical forestry. The most frequently used chemicals have been urea and borates, which are widely available, easy to handle, cheap and of low toxicity to other organisms. In this work, we review the forestry practices affecting infection by *Heterobasidion* and stump treatment to prevent the disease in Turkey.

Key words: Thinning, Urea, Rotstop, Root rot



POSTER PRESENTATION

Sediment Production on Unpaved Forest Road

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Abstract

This study investigates the studies on the formation of the surface flow on the forest roads without superstructure and the transportation of sediments in Bartın. In order to compare the data from different parts of forest roads, mobile precipitation simulator was used. 45 precipitation simulations were carried out in 15 sample plots. The breakdown of 45 simulations on road parts is as follows: 15 roadbanks, 15 sidecast fills and 15 road surfaces. Surface flow coefficient at road bank is almost 67% whilst it is 27% in sidecast fill and 52% in road surface. Due to high slope and sparse vegetation, the highest soil loss was seen in road banks with 158 g/m². This rate is almost 8 times more than the results from both sidecast fills and road platform. It was found that sediment concentration increased in the first 6-8 minutes as of the start of the simulation but then with the decrease of loose surface material, it started to decrease steadily. Statistical analyses revealed that slope, vegetation and rocks, organic material content had a significant impact on surface flow on the parts of the road. As a result, it was revealed that road banks were the main sediment sources in the field of study.

Key words: Forest road, Rainfall simulation, Runoff, Soil erosion, Bartın



POSTER PRESENTATION

Environmentally Friendly Logging Operations in Riparian Forests

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Abstract

The riparian forests, which are located adjacent to streams, lakes, and wetlands, have vital functions in terms of enhancing biodiversity and strengthening the forest ecosystems. They support nutrient cycling, protect water quality, and improve aquatic life and wildlife. In order to ensure sustainability of riparian forests, forest operations are mostly restricted or only limited operations are performed based on the riparian zones. Riparian areas are usually divided into two zones including riparian reserve zone and riparian management zone. The logging operations are fully restricted in the reserve zones and only environmentally friendly logging operations are permitted in the management zones. In this study, it was aimed to discuss specific logging systems that protect reserve zones in riparian forests, while ensuring sustainable use of management zones. Several logging methods including portable winch system, plastic chute system, and tractor winch system were evaluated considering residual stand damage, as one of the most common stand damage indicator in forest operation studies. Based on previously conducted studies and literatures, ground skidding logs using a portable winch integrated with skidding cone provides cost efficient and environmentally friendly alternative for logging operations. Using a skidding cone greatly reduces the risk of hanging logs on residual trees, stumps, and other obstacles greatly reduced, which leads to minimal stand damage. A downhill sliding log through plastic chute system is also effective logging method for reducing environmental damages during logging activities. However, winching logs by using farm tractor potentially result in the highest residual stand damage comparing with other logging systems.

Key words: Sensitive areas, Riparian zones, Environmentally friendly logging, Portable winch, Chute system, Tractor winch



POSTER PRESENTATION

Evaluation of Firebreaks and Firelines in Highly Sensitive Protected Areas

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Abstract

Forest fires are considered as the most detrimental natural disaster that damages forest vegetation and wildlife, causes economical losses, and threatens human lives. Based on several factors (i.e. fire type, topography, climate, vegetation, etc.), forest fires can expeditiously move across the forested areas and spread out large areas, which then leads to huge damages on forest ecosystems. Installing permanent firebreaks and firelines in fire-sensitive forested areas is considered as one of the effective methods to prevent forest fires quickly spreading among forest compartments and damaging large areas. They also provide fire fighters with easy access to reach front line of forest fires in fire sensitive forested areas. When there are environmentally protected areas within these fire sensitive forests then it is of great importance to locate appropriate firebreaks and firelines. However, locating, constructing, and maintaining these structures in protected areas may require special measurements considering minimal soil and water disturbance, reduced sediment movement, while ensuring fire prevention corridors and access roads. In this study, the types of firebreaks and firelines were described, proper techniques for installation, construction, and maintenance of these structures were presented, and additional measurements for firebreaks and firelines in highly sensitive protected areas were discussed. Firebreaks and firelines have crucial functions in terms of protecting environmentally sensitive areas against forest fires, but they should be planned and managed with intensive care in order to minimize land disturbance and sediment production in protected areas.

Key words: Forest fires, Firebreaks, Firelines, Protected areas



POSTER PRESENTATION

Comparison of Forest Planning Systems Implemented in Turkey So Far

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Abstract

Forest management plans were made with traditional planning approach from 1918 until 2008 in Turkey. The Plans were completed across the whole country in 1972. After 1978, it has begun to implemented different planning systems in some regions. Forest management plans have began to be made with functional planning approach since 2008. In this study, traditional plans implemented according to the principles of the Forest Management Regulations in 1973 and model plans implemented by different organization groups in different regions of our country (Operational management plans organized within the framework of the Mediterranean forest utilization project, Model plans organized within the framework of the Western Black sea broadleaved species project and Functional plans) were reviewed. Review of plans were compared in terms of forest inventory, planning unit size, rotation, distinction of working circle, management objective, period length, optimal forest structure (composition), forest functions, the regulation of silvicultural works and the regulation of harvest. As a result, similarities and differences between the plans were analyzed.

Keywords: Planning systems, Traditional plans, Model plans



POSTER PRESENTATION

Effects of Farm Tractor on the Skid Trails in Plantation Forest Areas

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Abstract

Forest roads are main facility for wood harvesting. Besides, skid road and skid trail in harvesting areas were used forest harvesting operations in Turkey. Especially, the skid trails are required for movement of tractors and animals within harvesting areas. This paper presents research results of the effects on skid trails of farm tractor using whole stem harvesting method in pine plantation in northern Turkey. In this study, the study area is selected Sahilkoy Forest Management located within Sile Forest Administration. In the plantation area, different skid trails are selected and the changes on surface of skid trail were investigated. These changes are soil compaction, soil disturbance, soil losses and rutting. These changes was directly related to tractor type, tractor weight, load dimension, soil type, skidding distance and skidding techniques. In this study area, soil compaction, rutting and soil losses have seen more. The results indicated that soil displacement increased as number of passes increased. During initial passes, the soils especially on the center of skid road became very dusty, and then dusty ground was removed from the skid road and trail due to factors such as wind, rainfall, and operating vehicles. Thus, deep gully formations occurred in this section in following passes. The soil compaction and rutting can be reason erosion in next years. Especially, the rutting causes serious erosion problems during heavy rainfalls.

Keywords: Farm tractor, Skidding, Skid trail, Rutting, Compaction



POSTER PRESENTATION

Tree Identification with RFID Technology

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Abstract

Smart Nails are designed and constructed to mark both living wood (trees) and round timber and for all kinds of wooden products and semi-products. Marking means that each wooden object gets a unique code and, if necessary, additional markings or properties which are entered into the Smart Nail. Outside surface of Smart Nails are mainly made of a material similar to wood. The Smart Nail includes an available design structure to penetrate the wood along the fibers with minimal force. They contain a unique identification code and have available free memory dedicated to entering random data. They also use radio waves to communicate their identification codes and other data stored in the memory. Each tree has its own typically history, its aspect and its character. If you want that the tree shares all this with you, then you are on the right website. By labelling a tree with a smart nail and entering basic data of the tree to the database, you can share it with internet users. You can also just view the data and widen your view to the green side. Application which enables this is simple to use and is available for all internet browsers. This study contributes to various aspects such as scientific and production and traceability of timbers.

Keywords: RFID nail, Tree, Identification, Database, Trace



POSTER PRESENTATION

Precision Forestry in Conservation Areas (Case Study-Bolu Regional Directorate)

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Abstract

Protected areas provide long-term conservation of nature and associated ecosystem services and cultural values. They have geographical boundaries and are managed through legal or other effective methods. Conservation areas are protected by law in Turkey and timber production is prohibited. The size of the conservation area is 5.65 million hectares in Turkey. Forest management plans determine silvicultural treatment in conservation areas. Assuring of natural processes in conservation areas and monitoring are basic protection principles, besides, silvicultural treatment may be necessary in conservation areas. For instance, before assigning their conservation status, natural or artificial regeneration thinning should be implemented and alien species in ecosystems should be eliminated. In addition, biological, biotechnical, and mechanical measures should be taken for the sustainability of the ecosystem especially when insect, fungus etc. damages increased in conservation areas. The least harmful treatments should be applied when it comes to mechanical treatment in conservation areas. The most appropriate season and extraction method should be determined. In this study, the mechanical treatment was investigated in conservation areas and methods that minimize the impact on the environment were determined.

Key words: Conservation areas, Precision forestry, Mechanical treatment, Turkey



POSTER PRESENTATION

The Effect of Final Cutting on Juveniles

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Abstract

The production which is known to fulfill the limitless demand of humanity with insufficient resources, come out as harvesting of wood material in forestry. The purpose of logging operations in forestry, either to implement the methods with minimum damage on forest ecosystems or to investigate the minimum-risky new techniques. Still, the harvesting operations proceeds traditionally and in direct line, together with see and learn way, in Turkey. In Turkey, owing to the rough and sloping terrains mostly occupied by the forests, wood extraction are mainly carried out through labor, animal and tractor skidding. So, some damages take place on remaining stand, soil, wood material and juveniles. In this research, the new procedural-approach will try to be defined for clarifying the effect of final cutting on juveniles and mitigating the adverse effects on them. For that reason, in one research plot, skidding was done on snow in winter season. In response to this, wood extraction was done in autumn season by rolling the wood material in another research plot. By comparing the two methods, by means of adverse effects on juvenile, the minimum-risky method is to be defined. Thereby, some suggestions also offered for minimizing the adverse effects of final cutting on juveniles.

Keywords: Juveniles, Wood-extraction, Skidding, Rolling



POSTER PRESENTATION

Study on Digital Terrain Modelling by Using Total Station for Precision Forestry: A Case study from Kahramanmaraş Sütçü İmam University Campus, Turkey

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Abstract

Digital terrain models (DTMs) produced in the help of various measurement tools are mostly use in forestry operations. DTM is mostly used in forest operations in order to do the balance between cost and ecological disturbances. The recent use of developed technology and photogrammetric techniques may expensive in general. Measurable and comparable results derived from LIDAR technology is the most familiar selection because of its sensitivity and time-saver benefits. Ground- and aerial-based LIDAR is the best tool for pre-evaluation of forestry operations but, as a result of high-cost rates of LIDAR is still very expensive. Even though DTM data from high technology or conventional one, forestry operations should be environmental-friendly with using ecotechnics to provide sustainability. Total station (TS), which is easy to use for terrain modelling and also less expensive with providing measurable and comparable data, is another alternative optic equipment. In this study, we produced terrain model by using TS derived from collected data from the field. The process of this study involves (1) office studies and (2) field measurements. Reference points were previously determined by using of Real Time Kinematic-GPS (RTK-GPS). Then, TS measurements were carried out in at least cm sensitivity, according to the RTK-GPS control points and careful usage of TS. For further analysis, we produced elevation, slope, aspect maps with ArcGIS software. Last, satellite image was overlaid on produced terrain model to compare more realistic visualization model.

Key words: Forest operations, Technology, Total station, DTM, KSU



POSTER PRESENTATION

The Influence of Different Canopy Gap Sizes and Litter Depth on Regeneration Density in Beech Communities, Case Study: Asalem, Guilan

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Abstract

This study was conducted to investigate the effect of different gap sizes and litter depth on regeneration density (number of tree regeneration/ha) in (*Fagus orientalis* Lipsky.) Asalem Beech forests, Guilan province. For this study, fifteen gaps in small (100-200 m²), medium (200-300 m²), and large (300-400 m²) sizes were randomly selected. Then, regeneration assessment was evaluated in 4 m² micro plots within the gaps. In addition, within each micro plot litter thickness was measured by ruler. The results indicated that Regeneration density in the medium gaps was significantly higher than small gaps. On the other hand, the mean litter depth has been significantly decreased with increasing gap size and was higher in small gaps than in large gaps. The results of Pearson correlation coefficients indicated that litter depth (cm) has negative and significant (0.05%) correlation with regeneration density. It suggests that tree regeneration in gaps is affected by litter depth. Finally, it can be stated that natural tree regeneration in beech forests of north of Iran, tends to be best at intermediate levels of opening the canopy and litter depth.

Keywords: Cover of litter, *Fagus orientalis*, Gap size, Natural tree regeneration



POSTER PRESENTATION

**Edge Effect of Forest Road and Skid Trail on Plants Species Composition, Case Study:
Asalem Forests in The North of Iran**

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Abstract

This study was conducted to investigate effects of an approximate one kilometer forest road and a skid trail on composition of edge herbaceous species. In total, 210 sampling plots using random-systematic in 7 transects were taken. To test the hypothesis, Two Way Indicator Species Analysis (TWINSPAN) in Pc-ord software, and for determine the relationship of ecological and environmental factors RDA test in Canoco software were used. Based on the results of the first test, six ecological groups on the margins of the road, skid trail and within the forest were identified and the results of the second test showed that the considered factors significantly ($P < 0.001$) affect distribution of the groups. Entering forest roads and building skid trails within the forest has caused a disturbing in composition of herbaceous plants, and provides suitable conditions for the entry and growth of invasive species.

Key words: Forest roads, Skid trails, RDA, TWINSPAN



POSTER PRESENTATION

Evaluation of Forest Openings Considering Network of Skid Roads

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Abstract

In the Bosnia and Herzegovina the most used type of timber skidding is logging by tractor through skid roads. This kind of timber transport requires comprehensive economic analysis because the timber transport by tractor is slow and expensive for longer distances. This is the main reason for necessity of construction of dense and branchy network of skid roads. In this paper the existing network of skid roads has been recorded and measured with the objective of the determination of it's quantity and quality. The results of this analysis have shown "barely good" relative openness which amounts 72.29% despite of high absolute openness by existing network which amounts 117.34 m/ha. In the purpose of improving existing network the detailed analysis of technical features and condition of existing skid roads has been carried out. On the basis of this analysis some of existing skid roads have been eliminated because they don't contributes to better results of openness in terms of quality or spatial position. In addition to this, during planning of opening by secondary network called Variant I it was taken into account to enable accessibility for skidding as many as possible trees designated for cutting, in the purpose of escaping areas unsuitable for building which have been presented by created thematic maps: water-protection areas, streams, swallow-holes, rocks and steep terrain slopes, as well as opening unopened areas by existing network and determining position of skid roads to minimize damages on the stand in the phase of skidding. Variant II given as the theoretical model of the analyzed forest area has shown that it was possible to achieve significantly better results of opening such as relative openness, larger number of trees accessible for skidding etc. by smaller length of skid roads. In this way it is possible to make impact on better environmental and economic results.

Key words: Skid roads, Skidding, Openness



POSTER PRESENTATION

Vegetation and Soil Response to Edge Effects of Forest Road

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Abstract

This study was carried out to assess the impacts of forest road upon adjacent vegetation and on some physical and chemical soil properties. For this purpose, type and number of regeneration species of trees and shrubs in plot area of 100 m² and type and cover percentage of herbaceous species using minimal area method were recorded in plot area of 64 m². Herbaceous species was classified into two groups using Two-Way Indicator Species Analysis (TWINSPAN). Samples of soil were taken in depth of 0-10 cm. Multivariate analysis methods (PCA and CCA) and ANOVA were used to recognize the most important soil variables and determine relationship between species composition and soil factors. Results indicated that species composition of plots in near the road has been varied in comparing with plots of inside the forest and it was classified into two separate groups. Moisture content, saturation moisture, clay, porosity and organic carbon in plots near to road decreased, while the amount of sand, silt, bulk density and pH were increased in this site. The findings showed that the roads affect to adjacent ecosystem effectively and it is essential to reduce the disturbance in construction of forest roads.

Keywords: Herbaceous species, Minimal area method, Soil properties, Multivariate Analysis



POSTER PRESENTATION

Soil Impact on Skid Trails in the North Mountainous Forest of Iran

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Abstract

The generation of surface runoff was studied on skid trails in the temperate forest of Iran. The aim of this study was to evaluate the effects of traffic frequency and skid trail slope on runoff and soil physical properties. Three levels of passes (i.e. 5, 10 and 15), and three levels of slope (i.e. < 10%, 10%-20% and > 20%) were studied. Surface runoff volume was greatest at the skid trail in the 15 passes and > 20% slope, and was the lowest at the skid trail with the 5 passes and < 10% slope. The undisturbed area did not generate any runoff during the observation period. The results of correlation analysis showed that the bulk density, macroporosity, rut depth, and litter cover of the skid trail had statistically significant effects on runoff. Surface runoff volume is negatively correlated with litter mass and macroporosity, but also is positively correlated with compaction and rut depth.

Keywords: Bulk Density, Macroporosity, Runoff, Rut Depth, Skidding



POSTER PRESENTATION

Calculating Actual Evapotranspiration in Adana, Turkey using Landsat 8 Imagery with the METRIC Model

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Abstract

Water is the most important constraint facing agriculture in most of the countries, including Turkey. Irrigated lands are extremely vital to the economy of Turkey. Evapotranspiration (ET) can be defined as the loss of water to the atmosphere from the ground, lake, pond, and vegetative surfaces due to vaporization of water. ET is usually the largest hydrological flux through the summer months in Turkey. The ability to accurately estimate the magnitude of this flux is crucial for the water balance and planning the use of available water resources. The main objective of this study is to calculate the actual ET for the city of Adana, Turkey via the METRIC (Mapping Evapotranspiration at High Resolution using Internalized Calibration) model using Landsat 8 imagery. Landsat images are a useful resource for estimating ET when high spatial resolution is desired.

Keywords: ET, LST, Remote Sensing, GIS, Water



POSTER PRESENTATION

Assessing Urban Forest Canopy Cover Using Aerial Photography: A comparison of two sampling approaches

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Abstract

Urban tree canopy cover provides a number of benefits to society. In this study, two different sampling approaches were applied to two medium-sized cities in the United States to determine their effectiveness in quantifying urban canopy cover. In addition, two freely available remotely sensed imagery products were employed to estimate urban tree canopy cover. With respect to the sampling approaches, a random point-based sampling approach was compared against a plot/grid sampling (cluster sampling) approach. The imagery products included temporally consistent Google Earth imagery and aerial photography from the U.S. Department of Agriculture National Agricultural Imagery Program (NAIP) (viewed within ArcGIS). For Tallahassee, Florida, the estimated tree canopy cover was about 49% using both sampling approaches, when viewed with Google Earth imagery. When using NAIP imagery within ArcGIS, about 45% of the land was estimated to be covered with tree canopy. The result of statistical tests suggested that the two sampling approaches produced significantly different estimates using the two different imagery sources. For Tacoma, Washington, our estimate of tree canopy cover was about 19-20% using the two sampling approaches, when viewed in Google Earth imagery. The estimate of tree canopy cover was 17-18% when using NAIP imagery within ArcGIS. Here, there seemed to be no significant difference between the random point-based sampling approaches, whereas using the plot/grid sampling approach resulted in a statistically significant difference, when used with both image sources. Our findings showed some similarities between the two sampling approaches, and we suggest that the random point-based sampling approach might be preferred due to the time and effort required, and because fewer opportunities for classification problems might arise. Continuous review of urban canopy cover estimation procedures suggested by organizations interested in this resource can provide society with information on the accuracy and effectiveness resource assessment methods employed for making wise decisions about climate change and carbon management.

Keywords: Aerial photography, Tree canopy cover, Urban forestry, Sampling, Google Earth