

MMA1-01 Industrial clusters of forest agribusiness in the south area of Brazil

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ABSTRACT: The article is the unfolding of the results obtained in an exploratory rehearsal, presented in the doctorate thesis, recently disclosed by the first author, where it presents important information about the technological innovation in the forest agribusiness of the South of Brazil. In reason of those results, the authors seek with this article, to advance a more little with information on the importance of the approach of Clusters in the study of the forest agribusiness of the South of Brazil, and that has the wood produced by means of the forest plantations for commercial ends, as its main raw material source for the industry of production of derived products of the wood. The conductive thread of the article is the theory on the commodity system approach and production chains, seen now under the approach of clusters, considered, as a tool of the largest importance in the support to the studies and government actions of the regional development. Leaving of a panoramic vision of the importance of the forest section to Brazil, it concentrates its information on the forest agribusiness of the South of Brazil, where the movements of the organizations, government and main financial agents come propitiating the necessary investments for the study and stimulate it to the regional development, based in the clusters approach, where they stand out the one of forest base. At the end, considerations are accomplished taking as base the importance of the clusters approach as support in the definition of the main local productive arrangements for the regional development, with base in the forest agribusiness agribusiness.

MMA1-02 Forecasting of *Eucalyptus* wood prices for cellulose and sawmill using radial basis function neural network and clustering method

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ABSTRACT: The mathematical description of dynamic systems and nonlinear time series it's not a simple task in which basic principles may be used. For complex systems, modeling using basic laws to determine the dynamic behavior of such systems is not always possible. An interesting alternative to solve such problems would be an experimental for system identification. Computational tools of system identification and prediction of time series allow the conception of mathematical models based on numerical data. The key problem in these cases is to find a suitable mathematical model. In real life, most systems are nonlinear and the use of linear models is limited, because they cannot represent the system dynamics, such as its hysteresis, amplitude dependency, bifurcations or singularities. This characteristics describes a nonlinear system and is necessary the development of nonlinear systems identification techniques that model such behavior. Nonlinear systems identification is normally a difficult task. When the system is dissipative, to develop a model through experimental data became a challenge due to its nature. In this context, the use of neural networks to nonlinear identification problems has attracted some attention in recent years. Artificial neural networks are originally inspired by biologic neural networks' functionality that may learn complex functional relations through a limited number of training data. Neural networks may serve as black-box models of nonlinear multivariable dynamic systems and may be trained using input-output data, observed from the system. The usual neural network consists of multiple simple processing elements, called neurons, interconnections among them and the weights attributed to the interconnections. The relevant information of such methodology is stored in the weights. In this work, a radial basis function neural network (RBF-NN) is chosen. This neural

network design can be seen as a curve adjustment problem (function approximation problem) in a high dimensionality space. For this, the RBF-NN learning is equivalent to find a surface in a multidimensional space that better fit the training data set, where the criteria for best fit is measured in statistic. The RBF-NN is a flexible tool in dynamic environment. They have the ability to quickly learn complex patterns and tendency present in data and quickly adapt to changes. Such characteristics make them adequate to time series forecasting, especially those ruled by linear processes and/or non stationary. This abstract proposes a RBF-NN design for forecasting of time series. In using the RBF-NN for nonlinear system forecasting it is quite difficult to choose an appropriate set of centers and spreads for the Gaussian activation functions to achieve a good network structure for minimizing, say, a minimum error criterion. In this work, the design of RBF-NN is based on a clustering method based on Gustafson-Kessel approach. The RBF-NN design is validated for the one-step ahead forecasting of eucalyptus wood prices for cellulose and sawmill to illustrate the effectiveness of this RBF-NN approach. The performance results show that RBF-NN can be a powerful tool to forecast of eucalyptus wood prices for cellulose and sawmill.

A methodology for the evaluation of the Production Cost of *Pinus* sp. implanted with tax incentives, in Itapeva - SP and Três Lagoas-MS.

MMA1-03

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ABSTRACT: The tax incentives for forest plantations of the decades from 60's to 80's had been responsible for the expansion of the sector of forest in Brazil in this period. The investment was assured to the people through the emission of Participation Quotas in Reforestation (PQR) that they would be rescued in the end of the investment. The changes in the economic scene during this period had made that started to exist a difficulty in establishing current values for the investment made since the moment of the implantation until the harvest. Based in this, the present work had the objective of calculate the value invested during the productive process of two forest of *Pinus* sp in the regions of Itapeva - SP (*Pinus elliotti* Engel) and Três Lagoas-MS (*Pinus oocarpa* Schiede ex Schlechtendahl). For the calculation were used the beginning investment values (the implantation), the costs to maintenance the forest during all the period. Three taxes of interests were analyzed: 6%; 12% and 18% by year. All the silviculture treatments costs for planting *Pinus* forests were considered, and also the costs of the administration of the forest. The silviculture treatments costs, which had not been found in the historical registers of the forest, were stimulated. To estimate the forest value production were made three diferents scenes: 1st) silviculture treatments costs, except the planting; 2nd) implantation and silviculture treatments costs; 3rd) weighed costs of implantation and silviculture treatments. All the costs in this work had been emitted in R\$/tree (Real for tree), because this was the measure considered in the PQR. The costs for the different localities and the different scenes follow: Considering the total value of the production in ITAPEVA-SP, to the 12% tax year. we have for the scenes, A, B and C, respectively: U\$ 10,63/tree; U\$ 13,58/tree and U\$ 12,29/tree. If the costs to maintenance the forest will not be considered the values would be U\$ 2,09/tree; U\$ 13,58/tree and U\$ 12,05/tree. In TRÊS-LAGOAS, considering the total value of the production to a 12% tax year for the scenes, A, B and C respectively, are: U\$ 5,40/tree; U\$ 18,36/tree and U\$ 15,41/tree. If the estimates of these treatments will not be considered, the costs would be U\$ 0,47/tree; U\$ 0,78/tree and U\$ 0,66/tree respectively for the scenes, A, B and C.

MMA2-01

Strategic and Tactical Forest Planning with Linear Programming Model Type I formulations

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ABSTRACT: Linear programming model type I formulations can easily generate economically optimal plans constrained by operational and productive plans. Brazilian forest managers are frequently faced with several challenges that constantly change the context under which they develop their analysis and plans. Among others, important sceneries have to be considered when planning for the future: mergers, fusions, acquisitions, expansions, logistic problems, social pressures and new environmental constraints. This paper describes a parameterization tool specially developed generate forest planning model type I linear programming matrices. Accounting variables offer the possibility to create and to calculate different outcomes, supporting the necessary flexibility demanded by the most common forest planning cases in Brazil. Some of these cases are: when, how much and where to plant new forests; when and how much wood to procure in the market; land rental procurement; definition of the correct wood loads to compose the right mix to be delivered to the mill; multiple products definitions; and quota definition by regions.

MMA2-02

The value of optimization in forest operations planning: two case studies in Canada

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ABSTRACT: Given the increasingly stiff competition in global markets, forest products companies are searching for innovative ways to increase their competitive advantage and to improve their profitability. Many of the best companies have applied optimization techniques to improve the operation of their processing plants with good – and sometimes stunning – results. The success of applying optimization to mill operations is causing companies to search for other controllable components of the supply chain where similar improvements to decision quality could be made. Since raw material procurement is the next greatest expense in the forest products supply chain, it is hardly surprising that these same companies are asking themselves whether their forest operations could not also take advantage of such techniques. Furthermore, for large integrated operations that generate a range of timber products for a variety of mills and markets, many see a great potential for increasing revenues from the same forest area through better allocation and timing decisions. Whether it is for reasons of cost reduction or revenue maximization, inventive forest products companies are beginning to see their forest operations as being ripe for “profit mining” through the use of optimization technology. OperMAX©, a mixed-integer programming (MIP) decision support system, has been designed and developed to help managers “mine for profits” in their forest operations. The system produces optimal multi-year and annual operating plans, facilitates re-planning as market or operating conditions change and supports strategic analysis and decision-making. By producing shadow price reports on resource and policy constraints, OperMAX© facilitates sensitivity analyses and provides insight into the cost of resource and policy decisions. A spatial analysis and visualization component, PORTeL©, has been incorporated in the decision support system in order to facilitate set-up, data input, spatial analyses and evaluation of results. OperMAX© was tested in a case study involving the operational planning problem of a large Canadian integrated forest products company. The company’s own traditional heuristic decision processes were used to generate a “simulated” operating plan for a 1.3 million m³/year forest operation. Then the heuristic decision constraints were removed and OperMAX©

was allowed to find the best solution for the physical, resource and policy constraints of the operation. Dozens of scenarios were run that analyzed the potential savings and revenue increases, as well as the cost of non-physical constraints. Analyses of the various plans revealed that the company could increase its contribution to profit by \$12 million over three years if all major resource and policy constraints were maintained, and up \$20 million over the same time frame if many of the changes revealed in plan analyses and shadow price reports were adopted. OperMAX© is now being tested in the Canadian operations of a major Northern European-owned transnational forest products company. In this case, however, the case study will involve a comparison of an optimal plan to the actual results of their previous three years of operations.

The use of simulation model FORRUS-S in the ecological management of forested: strategic and tactics planning

MM2-03

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ABSTRACT: Following international level Helsinki and Montreal processes criteria and indicators for evaluation of sustainable forest development at local scale are currently being created. These C&I can serve as instruments for assessment of quality of strategic and tactics planning of silvicultural activity, and a tool for decision-making at Forest Management Unit (FMU) level. It is very important to bridge the gap between considerable research work done on developing the framework for measuring sustainability of forest management and a lack of similar efforts in monitoring and using these indicators as a formal part of the planning system. Computer program package FORRUS-S has been developed for simulation modeling of forest stand ecosystems dynamics. The program package FORRUS-S consists of the model of natural development of multi-species uneven-aged stand, the model of exogenous influence (including silvicultural activities) and a set of accessory programs (standard GIS, reference databases, modules recoding input and output information, 3D visualization etc.). Model utilizes the standard input data that have traditionally been using in forestry of the Russian Federation and available for virtually all Russian territory. Analysis of modeling results has shown that the model adequately responds to simulation of different forestry regimes. These results can be easily interpreted in terms of population biology and ecology of forest tree species. Application of FORRUS-S demonstrated that based on the results of forecasting modeling it is possible to make a sound evaluation of biodiversity at FMU level, select and substantiate necessary and sufficient number of biodiversity indicators for forest ecosystems, and provide an integration estimate of biodiversity level and other criteria of sustainable forest development at different scenarios of management. All this makes the programme set FORRUS-S an effective instrument which to undertake a pilot effort between policy makers, scientists and managers to develop a prototype evaluation C&I for SFM at the FMU level. We believe this instrument to be very useful in consecutive realization of an adaptive management approach that leads to multi-stakeholder decision-making, in which different interests and agencies work together to achieve sustainable forest management. This study was supported in part by EU INTAS Project 01-0633 SILVICS

Structure and conduct of the market for timber products in the state of Acre

MMB1-01

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ABSTRACT: This study addresses the tropical timber production in the Brazilian Amazon. Its main objective is to approach economics aspects of the sawtimber market established in the State of Acre-Brazil. In specific terms, this research aimed to analyze two of the structural aspects of this market: structure and conduct. Data processed in this study were obtained from a survey in the sawmills acting in this State during the years 1996, 2002 and 2004. The method used focused points related to the differentiation degree of the product as well as price and promotion policies adopted by the local timber firms. The main results obtained were: (1) the timber firms of Acre sought to differentiate from each other through the quality of their products; (2) although the average price played in the market was the main source of information for the Acrean sawmills to price their products in 1996 and 2002, in 2004 this pricing policy changed when the production cost turned to be used as basic data for this managerial process and (3) about one third of Acre's timber firms did not use promotions in order to increase their sales.

MMB1-02

Recent evolution of forestry certification in Brazil

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ABSTRACT: The forestry certification emerges from the necessity to find some ways to explore the natural resources in a more sustainable system, aiming to reduce the negative impacts of this economic activity on the environment. In this context, recently, new concepts of low impact of forestry exploration come out; the sustainable forestry management has been stimulated by the increasing demand of the market and by the environmental and social tendencies controlling the tropical deforestation. The objective of this research is promote a critical analysis of the evolution of the forestry certification process in Brazil, based on statistics of the certification from 1995 to the present moment. Moreover, based on the identification of the certified products and businesses, and also on studies already developed about benefit-cost analysis and about identification of possible trade barriers related to certification processes. The scientific methodology consisted of a bibliographic review followed by a comparative analysis with the study performed by Bauch & Miranda (2001); correlating the primary data obtained in this study with the data found in the literature. Due to the low information available about the CERFLOR forestry certification, the results discussion is concentrated on the FSC forestry certification. The results reveal that the environmental responsibility, given by the activity of the sustainable forestry management certified by FSC, is bigger in the geographical region of the North and South than others. The process of the forestry certification started in Brazil, around a half decade, with the undertaking focused on managing the planted forests; after 2000, the undertaking was concentrated more on managing native forests, and these type of forests have started to integrate the certified market. However, for both sectors, the most expressive growth of the certified undertaking was from 2002 on. The study shows that among the buyers of certified forestry products, the design and joinery furniture sector should be pointed out, representing 49% of all business taking part in this market. Based on primary data research and on the bibliographic review, this study concludes that the forest certification has not been considered an environment barrier for the Brazilian forestry sector exports. However, the certification has been like a regulatory mechanism of the competitiveness of the companies, because of the growing environmental conscientious.

MMB1-03

The Amazon Timber Sector: Market and Challenges

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ABSTRACT: The forest sector plays an important role in the Brazilian Amazon economy. There are approximately 3,132 forestry companies generating more than 340 thousand jobs in the region. In 2004, IMAZON (Instituto do Homem e Meio Ambiente da Amazônia) researchers collected timber sector data by interviewing 680 companies (27% of the total) distributed along 82 logging centers in the Amazon. A similar survey was carried out by IMAZON in 1998. Both of these surveys are the most accurate diagnosis of the timber sector in the region. In 2004, the timber sector harvested 24.5 million m³ of roundwood, producing 10.4 million cubic meters of processed wood (sawnwood, finished wood products, veneer, boards, plywood etc.) resulting in a US\$ 2.3 billion gross income. The states of Pará, Mato Grosso and Rondônia were the main producers. Amazon Timber Sector Market: Our results show that most (63%) of the processed wood in Amazon has a low-value added. Brazilian domestic market consumed 64% and the international market 36% of this production. This represents a great increase. In 1998, only 14% of the production (1.5 million of cubic meters) was exported. The state of São Paulo in Brazil is still one of the main consumers of Amazon timber (consuming 15% of the total production), although its consumption showed a modest decrease between 1998 (2.1 million of m³) and 2004 (1.6 million of m³). In the international market, the main consumers are USA (31%), China (12%) and France (11%). According to the Brazilian Ministry of Development, Industry and Foreign Trade (MDIC), the export of Amazonian timber products amounted to US\$ 943 million in 2004. Sawnwood is major exported product (48%). However, Finished Wood products exportation has become more significant, increasing 19% between 1998 (US\$ 12 million) and 2004 (US\$ 178 million). Amazon Timber Sector Challenges: The forest sector has serious deficiencies and problems that result in unsustainable practices and poor public perception. Some of the major improvements required for the sector to become sustainable are (1). An increase in forest management; (2). Halting the use of illegal wood; (3). Raising industrial processing yield; and (4). Increasing the value of timber products. For these changes to occur, the forest sector must make some serious progress. Some public policies could facilitate this process, such as: (1). Increasing control and monitoring; (2). Zoning appropriate areas for logging; (3). Supporting industry to increase efficiency and value addition; (4). Supporting research concerning forest management, wood processing and lesser known species use; and (5) Stimulate markets for forest products originated in recognized sound forest management practices systems, as forest certification by FSC (Forest Stewardship Council).

Multi-temporal, high-resolution analysis of forests in southeastern Georgia, USA, based on three decades of Landsat satellite imagery and ground-measured inventory data.

MMB2-01

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ABSTRACT: I describe an analysis of the relationships between multi-temporal satellite imagery and forest age in southeastern Georgia, USA. The analysis has been conducted by the Fiber Supply Assessment group at the D. B. Warnell School of Forest Resources, University of Georgia. The data consisted of Landsat Multispectral Scanner (MSS), Thematic Mapper (TM) and Enhanced Thematic Mapper (ETM+) imagery spanning 30 years, which was used in conjunction with various GIS and ground inventory data from private forest industry and the USDA Forest Service FIA inventory surveys. The results of this analysis will be used for refining our high-resolution large-scale forest inventory of Georgia, which covers about fifteen million hectares with sixty-six percent forest cover. Furthermore, information describing stand boundaries and age class fragmentation and its distribution derived in this study will be used as an input for large-scale estate simulations and analysis of impacts of various forest management practices and regulatory constraints on the future fiber supply in the state.

MMB2-02 Spatially explicit long-term sustainability analysis in Georgia, USA

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ABSTRACT: We describe spatially explicit statewide analyses of impacts of various forest management options and regulatory constraints on wood production sustainability for the state of Georgia, USA. We discuss results in terms of the observed trends and regularities of the simulation outputs and in terms of the prediction summaries. The main focus of the presentation is on impacts of various adjacency constraints on magnitude of short- and long-term harvest reductions. Other discussed aspects include analysis of impacts of riparian zones and intensive management practices on resource sustainability and the analysis' applicability to pulp mill siting feasibility studies and policy deliberations.

MMB2-03 Constraints and opportunities for improving the forest practices in communal lands of northern Spain

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ABSTRACT: This paper examines the owners' values, practices and prospects of agroforestry management on communal lands. The study was conducted in Galicia, region of NW Spain, where Montes Veciñais en Man Común- MVMC- constitute a singular type of its land tenure regime and unique in the Spanish context. Galicia has more than 2,800 forest communities which embrace the 30% of its forest lands. This paper describes the main constraints and opportunities of managing and improving for these agroforestry landscapes. A systematic analysis and discussion of key determinants identified an important set of goals with a high potential to rural economy and social well-being that, nevertheless, are being left by an increasing economic recession of these lands. Nowadays, the lack of agroforestry profitability threatens the management continuity and practice of sustainable activities on Galician communal lands. With more than 400 face to face interviews to communal landholders (comuneros), we explore the particular reluctance of communal owners to change the current agroforestry practices, and we expose how the application of policy measures exclusively orientated to agrarian or forest activities are not the most effective. In this sense, communal lands require strategic programmes focused on rural development, combining and managing all issues related with social tradition and future goals or perspectives.

MAA1-01 Descriptive analysis of Brazilian wood exports during 2003 and 2004.

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ABSTRACT: Brazilian exports reached US\$ 158,693 millions from 2003 to 2004, and the forest products contributed with 6.41% of this value. The objective of this paper was to identify the main forest products exported and Brazilian trade partners of those products. The products are classified under the Harmonized Coding System (HS) divided into 99 chapters with forest products classified under chapters 44, 47 and 48. The chapter 44 include wood, articles of wood and wood charcoal; for this study it was divided into five groups: fuel wood (positions 4401 and 4402), timber

(4403; 4404), plywood (4408; 4410 to 4413), sawnwood (4407; 4409), and others wood products (4405; 4406; 4414 to 4421). The chapter 47 includes pulp of wood or of other fibrous cellulosic material, waste and scrap of paper or paperboard and was divided into three groups: chemical wood pulp (4702 to 4704), mechanical wood pulp (4701; 4705) and recovered (4706; 4707). The chapter 48 includes paper and paperboard; articles of paper pulp, of paper or of paperboard and was divided into six groups: newsprint (4801), wrapping paper (4804; 4805; 4807; 4808; 4819), special papers (4802; 4806; 4809; 4811; 4812; 4813; 4816), toilet paper (4803; 4818), office and print (4810; 4817; 4820; 4821), and others papers (4814; 4815; 4822; 4823). Brazil wood exports reached US\$ 10,865 million and the Iberoamerican countries share 15% of this value. The exports of articles of wood (chapter 44) represented 47% of the forest exports on this period, pulps of wood share 32% and 21% belongs to paper products (chapter 48). For chapter 44, the main groups was: sawnwood (US\$ 1,920 millions), plywood (US\$ 1,867 millions) and other wood products (US\$ 1,168 millions); the main countries of first group was United States of America (USA) (40%) and China (13%); USA (42%) and United Kingdom (UK) (13%) for plywood; USA (68%) for other products of wood. For chapter 47, almost the entire exports was from chemical wood pulps with US\$ 1,501 millions and the main partners was USA (23%), China (15%) and Netherlands (14%). The main groups of chapter 48 were special papers with US\$ 1,015 millions followed by wrapping papers with US\$ 667 millions. The main partners of special papers exports were USA (17%), UK (8%), Argentina (7%) and Chile (6%); considering the wrapping papers group, Argentina (25%), Italy (11%) and Chile (10%) were the main export partners. The USA and China role are highlighted because they increased its participation on total value of Brazilian forest products exports from 22% and 1% in 1997-1998 respectively, to 32% and 8% in 2003-2004. The Iberoamerican countries reduced its participation from 25% to 15% in the same periods.

Financial analysis of forestry sector contractors

MAA1-02

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ABSTRACT: Due to wood increasing demand and a necessity of cost reduction, the forestry operations are being more mechanized, but this process is limited to bigger companies, because of the higher investment necessary to buy machines with higher technology. The objective of this study was to describe the financial conditions of forestry contractors, collecting information from the owners by means of a questionnaire. The collected data were company size, type of services, equipments, credit line utilized to buy forestry machines, certification and kind of difficulties faced when running the company. 30 companies' owners were interviewed on August 2003, from different regions around Brazil, with most of them offering services for more than one area. Three companies had been working with harvesting, planting, forest management and wood transportation; three with harvesting, planting and forest management; seven with harvesting and wood transportation; seven with harvesting only; six with wood transportation; two with planting and forest management; and two more with support services. The tree cutting process was done with chain saw in most part of the companies, with some of them utilizing second hand harvesters bought from forestry companies. Eight companies used “native” excavators as base machines, with a harvester head, because of lower price and higher residual value, around 50% of the investment. The annual income of those companies varied from US\$42,000 to US\$21,000,000, with 36.6% of them presenting an average income from US\$ 1 million to US\$ 2 millions. 42.9% of the contractors worked for only one forest company and 35.7% worked for two companies, 43.3% had a service time from 10 to 20 years and had employed from 50 to 100 workers. The main difficulties faced by owners to buy forest machines were high financial tax, more than 12% a year, and a lack of long term contracts to guaranty there payment capability. Those were the main reasons of their impossibilities to be update with the technology evolution of the forest machines. All companies which had bought harvesters were considered as average or big companies, by SEBRAE classification, with more than 100 employees, and 33% of harvesting contractors also worked with forest transportation, reaching a higher investment capacity.

MAA1-03

Evaluation of water risks in forest enterprise

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ABSTRACT: In the last decades, water resources comes more being each disputed time, as much in amount how much in quality, mainly in reason of the accented demographic growth and the proper economic development. The water is a peculiar resource between the natural resources, playing different roles, being however seen as product for direct consumption, however as raw material and however as constituent of the ecosystem. The pressures caused for the water demand in an environment of offer varied, characterized for the abundance in some e regions the scarcity in others, translates a preoccupying picture for the forest companies, who depend on this natural resources to produce and simultaneously they have ambient and social responsibilities. In this context, Suzano Paper and Cellulose Co. developed this project of evaluation of water risks, where, considering the watershed where she is inserted, they had been evaluated and classified the following factors of risk: Basins water availability, where it entered way was considered precipitation, demands for irrigation, public, industrial supplying and the proper water consumption; Proximity of forest with urban water capitations, evaluating itself availability aspects; Proximity with Units of Conservation, considering itself ambient and legal aspects of each involved unit; Agricultural proximity with urban centers and communities, where one considered the problems caused for the forest proximity to communities. Internal factors of risk had been also evaluated as forest age, quality of Permanent Preservation Areas, ratio between forest and native and the density of roads. All forest unit had been analyzed about to risk that represents for water resources in relation to these factors and had received notes, what came possible the classification of risk degree, later combined with the individual perception of external technician of the company, that results in a general classification.

MAA2-01

Silvicultural treatments and financial risk for *Pinus taeda* within two forestry regions in Uruguay

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ABSTRACT: Forestry is undergoing a phase of rapid industrial expansion in Uruguay, which includes the sawmilling, pulping and MDF manufacturing processes. A significant part of future industrial supply will come from vertically integrated company owned plantations. The remaining segment of demand should be satisfied through direct purchase or by production contractors. *Pinus taeda* has been grown in Uruguay for both pulpwood and sawlog production. The latter comprises a wide variety of quality classes, from scaffolding boards and pallets to clearwood lumber. Production of higher grades involves more complex silvicultural regimes, which in turn imply increasing investment rates, longer production periods and higher financial risk levels. Three silvicultural systems were devised for loblolly pine grown in the two forestry regions with highest industrial potential, West Litoral (lat. 32°40'–33°S; long. 57–57°W) and Northeast (lat. 31°–32°20'S; long. 55–55°30'W). The systems were I) extensive, low pruning and no thinning, rotation 12 yr., for pulpwood or particleboard logs; II) intermediate, 2-lift pruning to 5 m, thinning at ages 5, 10 and 15 yrs., rotation 24 yr., for sawlog production; and III) intensive, 4-lift pruning to 10 m, thinning at ages 3, 7, 12 and 16 yrs., rotation 24 yr., for sawlog production. All yield values quoted below are commercial volumes. Growth and yield were simulated for each system. Commercial volume was graded in 5 small-end diameter and clearwood content classes, viz. Ø > 25 cm, pruned; Ø > 25 cm, unpruned; Ø 15-25 cm, pruned; Ø 15-25 cm, unpruned; and Ø 12-15 cm pulpwood or MDF logs. Financial returns assessment criteria were Annual Forest Rent (AFR) and Internal Return Rate (IRR) values. The latter was adopted after testing financial flow by Vincent's theorem. Probability distributions

were referred to product and relevant input prices. a higher deviation was attributed to products with incipient or non-existent markets, such as MDF. Probability of negative returns was computed using Montecarlo simulation; minimum risk productive profiles were determined for each region. On West Litoral sites, system I yields 196 m³ ha⁻¹, 61% pulpwood or MDF logs, 37% small sawlogs. Even when system I is economically feasible, negative return likelihood is 70%. Only third thinning in system II is commercial, which results in low volume yields (154 m³ ha⁻¹, 24 yr. rotation) and high probability of negative returns (95%). System III yields 209 m³ ha⁻¹ on a 24 yr. rotation; only 11 % of this is pulpwood logs, and 63% is harvested as pruned sawlogs. Average IRR is 6.4% and the likelihood of negative returns is 5%. On Northeast sites, all three systems appear to have technical and financial feasibility. System II is the most efficient, with 309 m³ ha⁻¹ on a 24-yr. rotation; 44% is harvested as pruned sawlogs and only 9% as MDF logs. This system appears to be financially preferable to system III, possibly because of earlier income and lower intermediate cut costs. High-intensity feasible silvicultural regimes are less likely to result in negative returns than low intensity systems, which yield low proportions of sawlogs. West Litoral sites show poor aptitude for high quality sawlog production. Northeast sites are more versatile, as both MDF log (system I) and sawlog (systems II and III) production is feasible. As regionally-based industry develops, the disadvantages of distance to markets will decrease and silvicultural systems yielding high additional value products should become increasingly competitive.

The development and research stage of a forest evaluation performance system - The Monitor

MAA2-02

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ABSTRACT: The Monitor is a system that is being developed by the company Athena Recursos Naturais and has the support of the Program of Technological Innovation in Small Companies – PIPE of the FAPESP (Foundation of Protection to Research of the State of São Paulo). This system contemplates the performance indicator use for realize the environmental monitoring, operational, economic, social and of production of the forest organizations. Treats-itself of an instrument of management that will supply information for evaluate the conditions of the forest, the performance of the forest products, the activities of management and his environmental, economic and social impacts. Beyond that, the system make available with great facility parts of the information required in certifications process, audits, licensings, evaluation of environmental impact and control and others. The development of the system Monitor was based in studies of case realized in two forest companies already certified, a located in the north region of Brazil representing the reality of the native forests and another one in the southeast region representing the reality of the forests planted. Helping also the development of the Monitor, exists a work of Scientific Initiation of the ESALQ/ FAPESP whose objective is going to list, group and standardize indicator of performance of the sustentabilidade productive, social, economic, operational and environmental for the monitoring of forests companies. All that research contemplates the main sources specialized in forest management, being these the Forest Stewardship Council (FSC), International Tropical Timber Organization (ITTO), Center for International Forestry Research (CIFOR), Tratado de Cooperação Amazônica (TCA) e Grupo de Manejo Colaborativo Adaptativo do Pará (MCA). Beyond those, it was consulted a source of general indicator, proposed by the United Nations Global Compact. The objective of that research is to present the process of research and development that is being utilized for the creation of the System MONITOR – a forest performance evaluation system. Initially, it will be presented the procedures that caused to creation of the prototype. Then will be presented the System Monitor and the even will be illustrated with some examples of forest indicators.

MAA2-03

Deforestation in Amazon River basin area: An econometric study

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ABSTRACT: This paper analyzes the deforestation in Amazon River Basin area, highlighting its causes and modeling this phenomenon. Amazon River Basin area adds up 490.6 million hectares, equal to 57.6% of the Brazilian territory. Until the first half of 1970s, this area was little deforested, but since the second half of 1970s, deforestation is growing very fast. From 1975 to 2004, 57,253,600 hectares of rainforest were destroyed, an area equal to 6.2 times Portuguese territory and almost equal to Iberian Peninsula. Among the main causes of deforestation are cattle breeding, agricultural expansion and roundwood exploitation. This paper demonstrated how these activities are put into action in the region, their relationship and also econometric models are running to demonstrate different impacts of these causes among Amazonian states. Our findings show cattle breeding is more important to explain deforestation in the state of Rondonia than in the state of Mato Grosso. At the latter, crop areas together with roundwood exploitation are explaining the most part of deforestation. At the end, the paper suggests some policies that can minimize the deforestation in the Amazon River Basin area and protect a share of biodiversity.

MAB1-01

Economic use of biosolid in the forest production

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ABSTRACT: Due to the recent Brazilian investments in basic sewage programs one observes a increase in the amount of residues (biosolids) generated in the Wastewater Treatment Plants (WTPs) and, as a result, the reduction of the lifespan of the landfill used for final destination. In the São Paulo State, Brazil, they use in eucalypts production is promising. However, the long distances between the WTPs and forest stands can result in large transport costs. This work objectives demonstrated that the high moisture in biosolid reduce the economic use radius. It was considered that the use of biosolids is only advantageous to the user when the Net Present Value (NPV) of forest is null or positive. For that purpose, we estimated the minimum wood production in the stands for biosolid economic use as an input in forest (Minimum Productivity Level - MPL). The numerical results for the MPL and economic radius were obtained adopting average values of wood sale and biosolid transport and application costs. Considering the transport distance of 100 km and a biosolid moisture of 10% (obtained by thermal drying), the estimated cost of the biosolid application was US\$ 10.95 per ton. In the same conditions, the cost raised to US\$ 24.63 when considered 60% of moisture (similar of the 385 ton.day⁻¹ produced in the largest WTP of São Paulo city). The economic use radius was estimated using experimental results, at 7 years of age, of the biosolid application to *Eucalyptus grandis* stands. The application of 10 ton.ha⁻¹ of biosolid (dry matter) resulted in an increment of 23,3m³.ha⁻¹ in the wood production, in comparison with the conventional chemical fertilization. Considering this application rate, at 10% of moisture and this wood production, the economic radius was 330 km. But for 60% of moisture this value was dropped to 17 km. These results indicate that if the user of the biosolid has to afford with the total cost of the transport and application the economic radius of use will probably be limited. In order to reduce the cost of biosolid and, consequently, increase the economic radius, the generating companies could consider affordable part of all these costs, to reduce the biosolid moisture, to improve the transport systems.

The Carbon Projects in Brazil

MAB1-02

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ABSTRACT: The Kyoto Protocol, established in February 2005, determined that the developed countries (called Annex I) will have to reduce their emissions, in average, 5% below the 90's levels, during the period between 2008 and 2012. For that, one type of mechanism that was conceived, as a means of attainment such goals of reduction of emissions, is the Clean Development Mechanism (CDM). Through the CDM, each ton of green house gases not emitted or removed from the atmosphere by a developing country could be negotiated in the world-wide market. The developed countries are the main players of the carbon credit market. Between 2003 and 2004, Japan was responsible for more than 40% of this market share. On the other hand, the main suppliers are the developing countries. In this same period, Asian countries sold 51% of total carbon credits, while Latin American countries sold 27%. Brazil has had a significant importance in this process, already with several of projects presented in different areas (e.g., energy, industry, agriculture, landfill and sewer), at different stages of the process of getting the credits. In the energy sector, the use of renewable energy and fuels less intensive in terms of production of green house gases can be considered the great opportunities of this market. In the industrial sector, technological improvement of processes and power source substitution can be a source of carbon credit. In the beef industry and agriculture, projects related to the bovine feeding and manure handling systems, for example, allow the framing of the CDM. The capture of landfill methane emission and the industrial sewers treatment are the main CDM projects verified and approved in Brazil. Despite the importance of forest sector, responsible for about 75% of Brazilian emissions of CO₂, no appropriate methodology for this carbon absorption in this area has been approved yet. For the development of CDM projects, there are lots of demands for enterprise advisory services that involve legal and operational aspects of modeling projects for the carbon credit market and search for partners and potentials buyers of the generated credits, amongst other demands. The CDM project structuring resembles project finance and requires the negotiation of some complex contracts depending on the basic action line that is adopted inside the CDM, which evidences the participation of an economical, financial and legal advisory in the project conception. Additionally, the structure of the Project Design Document involves also a specialized advisory in the model development of quantification of the green house gases reduction from scenarios built to investigate the effect of the investment in the gas emission. It is important to stand out that modeling the necessary investments and the return obtained with the credits are relevant for the more accurate knowledge of the risks involved in this market and also for the cost-benefit relation of the project.

Estimated cost of reforestation in permanent preservation area in the west of São Paulo state

MAB1-03

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ABSTRACT: The Brazilian environmental legislation is considered worldwide modern and current, however its applicability becomes difficult due to its complexity. In order to help the rural producer to regularize legally regarding the Permanent Preservation Areas (PPA), this work objectifies an estimated cost for hectare (ha) of a PPA, within the legal parameters, observing the basic principles of the 1965 legislation – Federal Law 4771, 1998 – State Law 9989, Conama Resolutions 302 and 303 of 2002, and finally the SMA Resolutions 21 of 2001 and 47 of 2003, where criteria are fixed for implantation of these areas. The data of samples

and technical coefficients, were risen in a PPA in the west region of São Paulo State, with a 180 ha area, effected by a company that provides electricity, some of the estimated cost were adapted for the rural context. It was used the methodology of production cost adopted by IEA (MATSUNAGA et al., 1976), getting the Effective Operational Cost (EOC) and the Total Operational Cost (TOC). The EOC is constituted in the sum of expenses effectively spent by the producer, in other words, the sum of direct expenses, such as, mechanized operations, manual and material operations (manure, herbicide, seedling). The TOC is got from the sum of the EOC value and the other expenses (inherent in each particular case of project of reforestation in PPA = 5%), and the interest cost of the capital, work and earth remuneration, weren't computerized. The implantation system of reforestation differs from the conventional, (ploughing and disc harrowing), for the use of herbicide in total area and subsequent furrow of the plantation line, where the company that provides electricity, using this technique, has got better results in the implantation of the these reforestations, besides this technique reduces the soil desestructure, promotes a dead covering and less risk of erosion. We must observe the existing native vegetation, preserving species in the beginning of spontaneous regeneration (small young trees). Seedling of arboreal species were used for the formation of a 180 ha PPA, with natural occurrence in the biome of the Stational and Semidecidual Forest and Cilia Forest, in the Ecological Region in the West of São Paulo State. The chosen species contemplate two ecological groups: pioneers (180.000 seedling) and non-pioneers (120.056 seedling), considering the minimum limit of 40% for any of groups. With reference to the number of individuals by specie, none of the specie exceeded the maximum of 20% of the plantation total (according to the SMA Resolutions in 21 and 47). The cost estimates indicate that the final value of implantation and maintenance for two years, of one hectare of PPA, is high (US\$ 2.183,00). By being an investment of compulsory legal character for the agriculture owner, it's necessary an economic planning before starting the activity. We must emphasize that from the total cost, 20% related to the seedling, can be abated through ONGS, which donate seedling of native species, for establishment in Permanent Preservation Area.

MAB2-01

The use of geoprocessing to assist it of the recovery and conservation of vegetation riverbank

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ABSTRACT: São Tomás River's riverbank vegetation, in the boundaries of Santa Helena de Goiás County is going through a deforestation process due to the expansion of agricultural areas and pasture formation. Because of this deforestation several projects have been developed with the aim of restoring and conserving the riverbank vegetation. For the elaboration and implementation of such projects it is necessary the collect and analysis of great amounts of data from nature, origin and diverse forms. The current work approaches the use of a geographic data bank as a support tool in the analyses and monitoring of the Rio São Tomás riverbank vegetation restoring. The goal was to elaborate a cartographic and registration basis through digital ways. The cartographic basis set up was made up through the use of vectorial files and satellite image. The execution of the registration basis was made with the registering of the rural areas which margin São Tomás River. The data integration was carried out with the help of a Geographic Information Management Program, the ARCVIEW, making the checking and georeferenced data analysis possible. The results permitted characterize the situation of the rural sites because of the obligation of restoring the riverbank vegetation, as well as its monitoring. They also showed the possibility of the project continuation viewing the elaboration of a geographic information systems (GIS).

Assessing landscape perceptions and preferences to improve CVM scenarios for landscape changes. A case study for Serra do Açor, Portugal

MAB2-02

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ABSTRACT: Environmental perception is not only a matter of reception of sensory stimuli, as it implies, as well, people's ability to constitute and recognise particular distinctions and similarities among the objects. This is why most individuals are able to react to particular scenes (even if only partly depicted in photographs) as particular instances of general types or categories (Clamp, 1981). Identifying these categories of perception enables us to list the distinctions and similarities that individuals establish in their visual and physical involvement in the scenery. The identification of landscape perceptions is based on immediate reaction to visual input, and in our case, photographs (Santos, 1998; Herzog, 1984; Kaplan and Kaplan, 1989). This method - the cognitive-psychological method - avoids verbal descriptions. It identifies perceptual categories by using preference ratings given by participants to each one of the scenes in appreciation. The fact of two scenes being highly correlated means that individuals who strongly prefer (dislike) one of them will also have a strong (weak) preference for the other. This reveals that the two scenes are perceived as similar. Pair-wise correlation of preference ratings is, therefore, used as a measurement of perceived similarity (Santos, 1998). Thus, a perceptual category can be identified as a group of scenes internally high correlated with other scenes, and scenes with similar vectors of correlation coefficients are then grouped by cluster analysis. Assessing preferences is based on the absolute values of preference ratings given by participants to the different scenes. These ratings are first averaged across respondents to estimate the mean preference rating for each scene. Average ratings are then compared across categories and across scenes within the same category. Inter-category comparisons enable us to check whether there are well-defined preferences for the states of landscape associated with different management options Santos (1998). Inter-scene comparisons, within each landscape category, lead to the selection of the particular landscape attributes that are supposed to affect preference judgements. Using these selected attributes as the explanatory variables in a multiple-regression model of the scenes' average preference ratings enables us to test whether the selected attributes significantly affect preference judgements. The preference predictors adopted are the biophysical attributes of the scenes, that can be objectively measured (Santos, 1998; Rudell et al., 1989) and are the support for the psychophysical approach, which is the one adopted by planners, landscape architects and foresters. Thus, although not generating results with general validity (they are not based on a general theory of landscape preferences), these resulting models (psychophysical) are effective in dealing with individual management problems. The findings of a study of preferences like the one proposed are suitable to show whether respondents have preferences for broad management-related landscape changes, as well as for more detailed management-related attribute changes. This will surely help CVM scenario designers to focus on those attributes for which people have well defined preferences, and avoiding the imposition of artificial choices that may occur when people have no well defined preferences for the states of landscape associated with alternative management options.

Forest Engineer, Desing and Architecture

MAB2-03

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ABSTRACT: Scientist invent Technologies, engineer put them at work, marketers sell them, but only designers combine all those elements and change them into something desirable (KEHL, 2004). Design has been one of the most promising fields of professional expertise within the last years, bringing together form and use, resulting in products that inspire not only consumers, but society as a whole to search for the best within their own working aesthetic. Forest engineering has exhaustively looked for improving production rates by breeding and improving tree species, adjusting nutritional levels at plant and soil, and recently with genetic engineer of better trees. Forest architecture appears as an option for going over those limits and help to increase forest yields by improving site quality. Forest architecture models proposition are strongly based on forest biology and its elements (trees, animals, birds, insects etc), as well as on local physical conditions (winds, terrain, rain etc). There are seven major principles defended as keystones for having a forest architecture project: Better design of forest interiors; Territorial Planning – considering natural features; Energy production from alternative sources; Managing growth/ development; Using plants as indicators and cleaners; Recycling; Specification of materials. Combined, they can bring nature and people to the same level and by that provide a better room for forest within society. As useful tool within forest management, those principles are to be used for generating a “certification” scheme, which can answer to consumers regarding their concerns about quality of life within rural scenarios.

TMA1-01

Economic analysis of stand establishment for Scots pine

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ABSTRACT: Experimental data, a process-based forest growth model and stand-level economic optimization are combined to investigate financial returns from investments for establishing Scots pine (*Pinus sylvestris* L.) stands in southern Finland. Four regeneration methods (planting, sowing, and natural regeneration with 25 or 100 seed trees ha⁻¹) and three intensities of soil preparation (unprepared, harrowing, intensive harrowing) are compared. At 1% rate of interest, artificial regeneration by planting or sowing and high investments in soil preparation yield the highest net present values. Natural regeneration involves no material or labor costs, and becomes optimal regeneration method at 3% rate of interest. Sowing and natural regeneration yield equally good economic outcomes at 5% rate of interest. Constraints limiting density and retention time of seed trees involve additional costs with natural regeneration. Owing to overlapping rotation periods, natural regeneration with a high number of seed trees yields long-run timber supply comparable to that of artificial regeneration. Optimal thinning aimed at artificial regeneration may create an attractive option to convert the stand to natural regeneration. According to preliminary analysis, intensive management paying attention to stand establishment yields higher net present values than extensive management emphasizing periodic clearcutting and zero investments in reproduction.

TMA1-02

Process of Innovation in the public institutes of research and mixed institutes of research, in forest agribusiness of the south area of Brazil: A comparative analysis

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ABSTRACT: The process of technological innovation of the Institutes of Research involves activities related to the generation, diffusion and the technology transfer, tends as final prod-

uct technologies, products and services, placed the disposition of the society. That is well evidenced in the forest agribusiness in the South area, with the presence of the Mixed Institutes of Research (MIRs), which render services directly for the associated companies. They also act in this activity type, the Public Institutes of Research (PIRs), which have its activities of RD&I addressed to the attendance of the needs of a wide clientele and diversified in the rural way. With the objective of identifying the possible differences in the generation models, diffusion and transfer of technology of PIRs and MIRs and which the model now in use for those institutes is that the present study was idealized and implemented. Supported in a theoretical base on technology transfer, RD&I in collaboration and action of the stakeholders, complemented by the notion of the National System of Innovation (NSI), the methodology of study of cases was used for the accomplishment of the research. The data were collected main PIRs and MIRs close to, now in operation in the South area of Brazil. The reached results demonstrated the existence of significant differences in the posture of those institutes, mainly, taking into account its clientele, the most competitive posture than colaborative, so much among the users of the researches as in the relationship among the own research institutes. The simultaneous analysis of NSI and of the action of the stakeholders, it allowed to end that, important institution of that system has been limiting more than facilitated the actions of IPPs and IPMs, mainly in the regulation aspects and fiscalization of the forest activity, in detriment of actions that stimulate the economic, social development and of the forest agribusiness of the South area, results that also take to conclude the influence of SNI in addressing the model of research of those more institutes for a model market that technological.

Advances in the development of an individual tree simulator model for *Pinus radiata* D.DON in Chile.

TMA1-03

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ABSTRACT: New development of a growth and yield simulator for *Pinus radiata* D.DON in Chile are described. The simulator projects growths and yield of a plantation from 0 to 30 years. The simulator (INSIGNE) allows for projections at stand level, individual tree level and a mixed of both. The mixed model allows taking advantage of the better resolution of the individual tree projection and the stability and consistency of the stand level projections. The simulator allows for pruning, thinning and bucking. The individual tree model increasing considerably the resolution of the projections, especially on intensively managed plantations, keeping track of the tree history in process such as wood quality assignment, pruning and any other management characteristics related to individual trees. In the development of this version different techniques were used to incorporate variance to the diameter and height distribution. Another interesting feature is the conciliation between the Individual tree and Stand projections, generating the mixed simulator. In the future the simulator will incorporate the evolution of quality of each tree on the tree list, strategies under development. The grading algorithm is designed to represent classes of diameter for the stand simulator and for each tree on the tree list in the individual tree simulator. This method will allow simulating different industrial products obtained from the forest and their associated grades.

Application of MRP concepts to the definition of annual operational forest plans

TMB1-01

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ABSTRACT: Strategic and tactical production plans schedule and orient production activities in the medium and long run. These plans determine what, where and how much must be produced over the years for a given planning horizon. Operational production plans define a specific course of action, for a planning horizon usually less than one year long, and normally chosen among several different possible alternatives. Strategic and tactical forest production plans have been defined in Brazil with the help of well known mathematical programming techniques. Short term operational plans still lack a conceptually standard scheduling technique. These scheduling exercises are routinely and frequently executed, in some cases on a daily basis, to define what should be accomplished today to achieve a near future goal. In the particular case of an annual forest operational plan, managers are faced with an enormous quantity of operational productivity and efficiency parameters, which are the basis for setting production times and movement of working crews. Brazilian forest managers have intuitively applied traditional MRP (manufacturing resources planning) concepts to organize their planning and budgeting routines. These experiences have in fact been largely used by most of the ERP solutions found in the IT market. This paper presents a standard MRP model to formulate the annual operational forest planning problem, and utilizes concepts like production lines, planning matrices, resources demand (labor, machinery and other resources), capacity check and production goals. The MRP logic, using needs and capacity checks, has prevailed as the planning tool due to its simplicity and pragmatism. Its use forest wise, though, demands a few important adaptations. This paper presents the needed adaptations made to turn a manufacturing planning tool into a forest management short term operational planning tool.

TMB1-02

Solving Spatial Forest Planning Challenges Integrating Linear Programming and Heuristics

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ABSTRACT: Solving spatially explicit harvest scheduling problem represents a significant challenge. Not only are large amounts of data/information required, but the algorithms and methods available to solve these problems are complex, and individual algorithms may not address the entire scope of the problem. In this presentation we will describe and demonstrate some of the underpinnings of a hierarchical decision support system that uses both optimization and heuristics to address these issues. This approach has been proven to work and is used extensively by industry leaders in Canada, United States, Australia, and New Zealand, largely because it is extremely flexible and allows for a cyclical approach to re-optimization.

TMB1-03

A study of adequateness of the economic and financial

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ABSTRACT: There are many methods for the economic and financial analysis of the companies. Among them, for many reasons, the most used one is the analyses through the Index. Although a research in the specialized Brazilian bibliography enabled to identify more than two hundreds of different indexes. It's selection by the usage criterion for the biggest number of authors reduced them into twenty-six indexes. From the specific operational features of forestry companies – his long operational cycle - it's assumed that the usage of those indexes of generalized use in the economic and financial analysis of any company – whose

operational cycle are relatively short - it isn't adequate for the forestry companies analysis. It's assumed that this difference between the operational cycles would result in economic and financial performance, as well as in totally diverse patrimonial conditions. Although it has initiated its development for more than a hundred years, the multivariate statistics is the recently usage. This delay in the development and usage derived from the operational difficulty to effect vector and matrix of many variables calculation without the computerized resource. Thus, this statistical tool just initiate its factually process of complete theoretical and applicable development from the last century fifties, when the computerized resources feasibility calculation up to there extremely difficult and of impracticable execution, when even though impossible. Among others, one of the algorithms of big utility for the research is given by the factorial analysis. This technique let classify them according to its participation in the totally variable data. Therefore, this research investigated, with the factorial analysis usage, measured the indexes usually used for the economic and financial of any company, can be used in the analysis of forestry companies. The twenty six indexes selected were applied on the balance of two hundred and thirty seven companies built up the legal modality of anonymous society of open capital, within which three wood companies, and eight paper and cellulose producer companies. There aren't in Brazil companies constituted on the legal modality of anonymous society of open capital, that are dedicate exclusively to the wood production and thus this research was conducted in relation of these eleven companies linked to the forestry area: three wood companies and eight paper and cellulose producers. Though this obtained a data matrix of two hundred thirty seven lines by twenty six columns, about which applied the statistical multivariate techniques, in particular the factorial analysis. The classification of the companies, by the factorial scores, make possible to test which indexes are adequate to analyze what kind of companies. The result showed that some of these twenty-six indexes are not adequate to the analysis of those eleven companies linked to the forestry area.

Is the forest certification an option or a barrier for small-scale forestry?

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WMA1-01

ABSTRACT: The significant depletion and current state of the world-wide forest resources have generated important discussion with regard to sharing and developing knowledge in sustainable forest management by numerous research groups, at diverse disciplines and at different levels. Nowadays, the range of possibilities related with forest sustainability is diverse and have taken shape in standard patterns of forest certification and systems of Criteria & Indicators (C&I) at different work scales. In 2002, there were 124 million of forest hectares certified in the world, especially forest plantations with criteria of sustainable wood production. Nevertheless, sustainability patterns mainly have been developed in public forests or private forests of important industries, forest managers with the sufficient extension and resources to carry out this program. For non-industrial private forest (NIPF) owners, forest certification as standard to follow supposes an important obstacle to overcome, given the scarce formation in the matter, the high production cost and maintenance, the competitive market conditions, and the scarce implication in multifunctional management. With these circumstances, it is not surprising that forest certification approaches more a barrier than an opportunity for small landowners. Before this challenge, policy and researchers have to re-orientate, define and optimize the current standards of forest certification and, therefore, motivate sustainable practices by individual forest owners. Regional certification, as collective model less discriminatory and more economic facilitates the certification system in areas dominated by individual owners.

WMA1-02

The Forestry-wood industrial chain in Uruguay

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ABSTRACT: Traditional rural landscape in Uruguay, where cattle farming is a dominant feature, has evolved during the 1990s with the establishment of extensive forest plantations. New forestry law (15.939/89), which came into effect early in the past decade, became a relevant policy instrument which enabled the attainment of present plantation surface in excess of 650.000 ha. Forest companies were granted tax exemptions on several assets, access to forest plantation loans and direct plantation subsidies. After the 2002 major financial crisis, plantation loans were withheld and subsidies began to be gradually withdrawn. The current decade is characterized by industrial development within the forest complex, from the production of raw material to increasing value added within the forestry-wood industry chain. The objectives of this paper is to review main forestry enterprises currently operative in Uruguay and to describe future challenges faced by the forestry sector. Uruguay features four plantation forest regions. Two of these are evolving into industrial development nuclei. Northeast region concentrates 78% of *Pinus* spp. and 36% of *Eucalyptus grandis* wood supply. Two veneer and plywood mills are being built. Other industrial projects, such as sawmills, veneer, plywood and fiberboard mills are under study. A second nucleus, in the West Litoral region, includes two pulp mills under construction, whose joint roundwood demand is estimated at 5 million m³ yr⁻¹. Large sawmills in the Region, with raw material processing capacities in excess of 2800 tons yr⁻¹, work with either *Pinus* spp. or *Eucalyptus grandis*. Until recently, largest forest products sector companies have operated under full vertical integration. However, mill managers are ensuring future wood need provisions through supply contracts. Forest products exports in 2002 amounted to US\$ 105 million, representing 5.5% of total exports value. The forestry - wood industrial chain can be expected to reach over US\$ 1.100 in 15 years; wood products would thus rank first among agricultural, fish and wood products, replacing cattle farming product categories, which have been traditionally foremost. The forest sector faces several challenges during the present decade, which are here considered by qualified informants.

WMA1-03

Análise sócio-econômica do manejo florestal comunitário de terra-firme no baixo Amazonas: Comunidade ACAF – Boa Vista do Ramos/AM

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ABSTRACT: The community or “small scale” forest management is expanding more and more in the Amazonian, becoming as the solution for the control of deforestation and social development. However there are few studies referring to the social benefits of the community forest management (CFM). In virtue of this fact, this work will accomplish a complete socio-economic research of the community forest management in the “low amazon region”, a non-flooded area, but where the only transport is fluvial. The community capacity building process started in 1999, and the forest management activities began in 2001. The main objectives of the study are to determine: i) i) the production cost of wood from community management; ii) social benefits and readiness of the Community to be devoted to CFM; iii) the costs of training the community to become capable for the “good forest management” (in order to guide state policies) iv) the cost extra-exploration necessary minimum the accomplishment of the iv) the minimum additional costs necessary for the accomplishment of the regularized forest management: (legal taxes - IBAMA, technical consultantship, Certification process - FSC,...

Sistemas de gestão florestal utilizando soluções Datasul e Brisa para planejamento e controle da produção florestal

WMA2-01

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ABSTRACT: In 2002, BRASCAN BRASIL the controller of Comfloresta, a Catarinense Forest Enterprise Company from SC, Brazil, decided to restructure the corporative and forest control systems. Until that time, Comfloresta had ERP PROSYST system used for financial and accounts activities; The RUBI system to manage the pay roll; and two others independents systems to elaborate the Forest Inventory. In July of 2002, the FSIGN system, developed by BRISA CONSULTING, began to be implanted as well as the ERP DATASUL MS2 and MS5 versions, as each application. At first the access control module was implanted to define the rights of each one of the users and after a second module for all the contractors registration, employees, cost centers, accounts and all the others parameters requiring by the system. Following the sequence, Forest and Land Registration module was implanted using the SQL Server 2000 database, which all the others modules are connected from. Afterwards the Nursery Tree module was implanted to control the production activities of approximately 3 millions seedling / year. Subsequently the Forest Services Control module was implanted, in which all silviculture activities services orders are get started and finished monthly, all data concerning daily specialized of own personal work and machinery are also typed, and it generates all payment extracts for harvesting and forward activities. In October of 2002 BRISA CONSULTING started the development of Forest Activities Costs module concerning aspects connected to forest formation and deferred generated in the projects by silviculture activity, building and maintaining roads, as well as all costs per cost centers. At the end of each month the system receives all expenses originated from accounts of their related cost centers, activity processed in the ERP DATASUL, which makes the distribution needed from pre-defined rules and definitions, leading the deferred and forest formation values to the Forest Exhaustion module, which was rebuild to fulfill the company needs and to integrate with the ERP DATASUL, and provides the final cost of the wood to the monthly report. During that October the Commercial Administration module was also implanted to control the wood buying orders monthly issued by more than one hundred clients. To the emission of approximately three thousand per month of invoices Forest Turnover module was implanted in four trailers equipped with computers and STAR-ONE antennas, one for each working station. The integration between BRISA and DATASUL systems occur in a digital way in: Forest Turnover module, Forest Costs module and Forest Exhaustion module. In February of 2003 the Forest Inventory system started to operate. Through 2002 and 2003 BRISA developed the Forest Planning module which from Forest Land Registration module, inventory and growth curves makes the forest production optimization, respecting the aims and restrictions established by the company managers. The process of implantation stabilized in June of 2003. The main benefits gained by this system implantation are the standardization model and integration of the information process in the company data base; the implementation of a management model through information; hand work elimination; unification of the company information providing liability and consistence to the data; parallels control elimination; on-line availability of information through the internet and faster monthly closure.

Harvesting and transportation planning: a Genetic Algorithm approach

WMA2-02

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ABSTRACT: In the forest companies where wood can be distributed to more than one mill, the annual harvesting planning influences the wood flow and consequently the transportation costs. It happens, for example, if the crews harvest in a first moment areas close to the mills and in a second moment far enough to affect the optimal wood flow. Harvesting planning includes decisions such as which forest areas to harvest, when to harvest them, which harvest crew to use in each area and the exact amount of assortments to distribute from the forest areas to the mills. The main objective of this research was to develop a Genetic Algorithm Model (Heuristic Method) for the harvesting planning problem to minimize the costs associated with harvesting and transportation. Klabin S.A. – a Brazilian pulp and paper company – supplied the data set used to test the present model. In the present study was made an annual planning to supply two pulp mills and the regional market with two wood assortments from 26 forest areas. In addition, the sequence of forest areas assigned to each crew and the wood flow were defined on a weekly level. The results indicated that the production capacity of the harvest crews was above the predicted wood demand for the year 2004. The best Genetic Algorithm solution was compared to the solution obtained with a Relaxed Linear Programming solution. The results of the Heuristic Method showed costs of harvesting, transportation and exceeding wood stock 2% higher than the solution provided by the Linear Programming Model.

WMA2-03

Enterprise resource planning (ERP) in the management of the forest production – The relation between the solution of abilities for the efficient operation of the technological solution.

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ABSTRACT: Through this thematic shaft invironment information tecnology, this work has the subject to process of decision and implantation of a software ERP to forest management, that goes since the importance of a management model very well done, with standardization of process for valorization of actions faced for vocationals and its skills. It gives emphasize in characteristics of inovations, in forest segment, of a paramentized model in ERP's standard platform, accosting the advantages, benefits on integration to the process of bussines. Showing the subjetics that promoves the criation of a cultural barricadein acception of a platform ERP for a forest management in function of mistaken interpretation of factors , attributed only for tecnology, that configures as difficulties for the operation the ERP, based on these experiences of the GRUPO SUZANO, in projetos of implantation, management and review of process and companies fusion. Showing interruption of paradigms unilateral perspective of mistaken implatation of tecnologies solution, like justifying to complexity, the inefficiencies to reach positive results and incompatibility, for approaching that includes and gives emphasize the vision of necessity of adequated implantation of solution abilities to mitigate these problems. The text gives emphasis the impacts provocated by inefficient abilities of concerning experts, what suggests necessities of migration only technical for image with sistemic vision and knowlegde of multidiscipline of forest bussines, a vision by process , among other skills faced it managent , joining worthto the cultural impacts defing the function of Information Tecnology and of Forest Departament in this process, at least the relation of partnership and complicity that must exist among these two areas ,so responsibility by success is shared by all. This study concluded that the differential, isnt in a efficiency of the process only, and in a good tecnologic solution , however mainly in the dissemination of knowlegde in communication process, and in a perfect task of change management toward to the culture, the people in the abilities.

Forest Management Information System

WMB1-01

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ABSTRACT: This work shows a computational system that adds geographic information and routines with intention of management use applied to a forest company and as it can be developed making use of the unified modeling language - UML (Unified Modeling Language) as language of modeling and its characteristics, showing the exactly cycle of life for its conception. The notation suggests using standardization form for the development of the project and, after that, providing ways of implementation in a guided language objects (OOP - Object Oriented Programming) as well as the interaction of these tools in a platform of development OO (Guided Objects). The use of a data base management system (DBMS), in this case SQL (Structure Query Language) Server 7,0, also is boarded, with its interaction in the tree tier system of development systems layers, using itself packages for better management the modules. The system will be useful to supply and given information that could be used by agent administrators of forest companies when taking decisions on its strategically tasks – or support the decision. The level of data must be kept and be monitored by the operational level of the company, guaranteeing the exactness, allegiance, coherence and persistence of data in the system, in terms of biological data, of climate, maps, seeds, beyond constants of growth and variable of productivity. The reports will be supplied in graphical units interface (GUI) or printed matters.

A strategic information system as a tool for forest management for Brazil

WMB1-02

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ABSTRACT: This work aims at presenting the Integrated System to Monitor and Control Forest Resources and Products - SISPROF, which has been developed and is being used by the Brazilian Institute for the Environment and Renewable Natural Resources - IBAMA. The main objectives of SISPROF are to maintain the integrity of the forests, to reduce illegal deforestation, to monitor the permanent preservation areas and the legal reserve areas in rural properties, to promote the use of sustainable practices through forest management and to combat the illegal timber trade. The System is established on three areas of support: a) geo-processing for the monitoring of properties by remote sensing; b) database for the information registered the properties, forest projects (forest management plans, forest exploitation plans for alternative land use, reforestation and replanting projects) and control of the movement of forest products as timber transport and trade by means of a computerized system of forest origin stamps; and 3) data validation in the field by means of technical inspections carried out within the forest management plans, authorization for forest clear cutting, capacity building and training of technicians, development of manuals, planning of field work and technical evaluation of the forest management plans. The main products and documents generated by SISPROF are: management reports for decision making, statistic reports as management tools, auditing reports for system control and monitoring, permits for exploitation in forest management plans and permits for alternative land use systems. When this system is consolidated, the Brazilian society will have at its disposal an important database with precise information about properties adopting sustainable forestry practices and those engaged in illegal and unsustainable deforestation. Only with a better understanding and knowledge will be society be able to press for the implementation of public policies for a more efficient exploitation, control of deforestation and uncontrolled forest fires.

Consideration on the pulp and paper from 1990 to 2004

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ABSTRACT: The forest sector has presented in the last decades, as a booster instrument of development in the Brazilian economy, participating with almost 5% of the GIP. This sector is one of the few sectors that generate surplus in the Brazilian Trade Balance. Brazil is one of the most efficient producers of white cellulose extract from Eucalyptus all over the international market. This article has the objective to analyze the exportations of pulp and paper during the period from 1990 to 2004. The Brazilian exportations of cellulose and paper represent about 4% of the Brazilian guideline of this business. This participation is the result of a notable effort for increase the capacity of production as well as of efficiency profits during the decade of 90 (BRACELPA, 2003). The performance of the pulp exportations has guaranteed surpluses and increases for the trade balance. The main markets for the Brazilian exportations are Europe, North America and Asia. The 90's was the stage of significant changes in the Brazilian external politics, characterized for a wide open market process, that began during Collor's government and extended until the Cardoso's government testifying the notable increase of the regional commerce in general followed by the increase of barriers or the reform of mechanisms of institutional support. Brazil has assumed protected and liberal positions in way to manage internal questions that had gradually reduced the level and the degree of local industry protection. The Brazilian exportations of paper had its increasing trajectory interrupted caused by the good performance of the domestic market, and the cellulose exportations had been also affected for the "Real Plan in 1994", even so in less dimension than the paper, once it is less commercialized in the local market. In 1995, the trade balance of the sector registered surpluses, having contributed with about 6% of the total Brazil exportations, despite the great appreciation the Brazilian currency between 1994 and 1998 and the impressive collapse of prices after 1995 (BNDES, 2002). The performance of products of complex P&C exportations in the second half of the decade of 90, as well as, the majority of main products of Brazilian exportations was influenced by:

- the stabilization of internal prices,
- the reduction of the incentives and
- the elimination of the indexation of the cambial politics.

The stabilization, moreover, affected the demand structure of exported products among them the products that use the cellulose as raw material. The period from 1997 to 2000 was marked by the strong instability of the domestic and international conjuncture with deep economic crisis in Asia, Russia and in proper Brazil. In consequence, particularly caused by the Asian crisis, occurred a significant fall in the world-wide demand of important products of Brazilian exportations with the interruption of the credits for the foreign commerce, reflecting in the trade balance and postponing the effect of the cambial depreciation from 1999 to 2000. In 2003, despite the domestic and international conjunctures, the Brazilian trade balance was influenced by changes in the politics for promotion of exportations, by the entrance of foreign firms and its strategies in the foreign commerce. The politics and actions of protection and incentive have been used habitually for the main competitor countries of Brazil in this sector. To this governmental set of direct and indirect incentives and aids, it must be added the favorable macroeconomic conditions, the existence of physical and science and technology infrastructure. The Brazilian industry still faces a series of challenges and to surpass them it depends on some factors, among them: to take care of the competitiveness and investments. The perspectives for the next years are positive for the world-wide market and the tendency for the sector is the increase of its representation in the international scene (NEVES, 2004).

How government preferences and interest group interaction can affect policy choice in the Brazilian forestry sector

WMB2-01

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ABSTRACT: The choice of policies to be implemented is a problem faced by the governments that has several influencing factors. In the environmental regulation literature, several models try to explain government behavior, single interest group behavior, interaction among interest groups, and efficiency result relating to welfare, losers and winners, and tax deadweight loss. In our paper we argue that government preferences in relation to the source and use of revenue determine the decision of which public policies are implemented. Consequently, interest groups that support the policy of choice are favored and others are not. Setting this as background, we construct a game theoretical model with three players: government, and two interest groups. We argue that the objective of all players is to maximize their individual profit, and apply the results of this maximization to verify possible behavior by interest groups. We assume that the interest groups earn a percentage of the government's profits according to their support of the chosen policy portfolio. Sequentially, we apply this model to analyze the interaction of interest groups in determining policy choice in the Brazilian forestry sector, in specific, the approval of the forest concession legislation. We verify in the case of conflicting interests, interest groups do not cooperate, a result that mimics reality. Finally, we argue that this non-cooperation leads to efficiency, since it allows the dissemination of information to all players.

Assessment of the vegetation structure influence on bird communities' occurrence in Iberian agro-forestry systems

WMB2-02

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ABSTRACT: The main objective of this study is to identify the vegetation/habitat measures having a greater influence on the presence of avian species in two types of agrossystems located in the South of Portugal. This approach for classifying habitat types allows a consistent development of wildlife management strategies. Four line transects were defined. Two were located near Évora (Santa Sofia and Valverde) and the other two in Apostiça (Lagoa do Golfo and Marco do Grilo). Several variables were measured to describe the vegetation as a habitat. The linear transect technique was used in the bird sampling. Multivariate statistics were used to analyse the relation between the presence/absence of avian communities and the different vegetation cover measures. These include vegetation vertical structure, percentage of vegetation cover types, and vegetation diversity measures. The relation between avian diversity and vegetation structure descriptors, as well as the vegetation diversity, was analysed using simple regression methods. Physiognomic gradients were identified based on structural variables. The bird communities seem to respond to the above mentioned structural differences. Moreover, the diversity of these communities is related to the percent cover of shrub and tree layers.

WMB2-03

Wood potential use of *Acacia melanoxylon* growing in pure or mixed stands with *Pinus pinaster* by the portuguese forest industry

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ABSTRACT: *Acacia melanoxylon* R. Br. (Blackwood) grows well in Portugal, in pure or mixed stands with *Pinus pinaster* Aiton though it faces strong ecological and legal constraints. In spite of some difficulties, for instance with drying, Blackwood timber is used for furniture and craft wood products due mainly to its texture and dark colour. It can also be used for pulp, being planted in many countries for that purpose along with *Acacia mangium* and *A. dealbata*. Its pulping and paper making potential have been studied by several authors (Clark et al., 1991; Guigan et al., 1991; Furtado, 1994; Gil et al., 1999; Paavilainen, 2000; Santos et al., 2005). Forest industry in Portugal depends strongly in maritime pine and eucalypt, with the consequent negative competition between the various industries for the same raw material. In Portugal there are many spontaneous stands with *Acacia* species, namely *A. dealbata* and *A. melanoxylon*. While *A. dealbata* species is considered a problem (at ecological level), *A. melanoxylon* is well adapted to Portuguese conditions. Therefore, it should be considered as an alternative raw material for sawmills and pulp industry and can avoid large monoculture areas and spread the risk of fire. Concerning growth, Table 1 shows that acacia exceeds maritime pine and comes close to eucalypt on diameter annual increment.

Table 1 – DBH annual increment of *P. pinaster*, *E. globulus* and *A. melanoxylon* in Portugal (L=littoral; C=centre; I=interior; N=north; S=south).

Species	Region	Mean DBH annual increment (dg - cm.year ⁻¹)
<i>P. pinaster</i> (prime stand until 20 to 30 years old) (1)	L	0.58
	C	0.85
	I	0.71
<i>E. globulus</i> (until 12 years old) (2)	N/C L	0.96
	N/C I	0.88
	S L	0.93
	S I	0.84
<i>A. melanoxylon</i> (until 45 years old)	N L	0.89
	N I	0.89

(¹)Tavares et al., 2004; (²)Tomé et al., 2001.

Acacia solid wood properties (Table 2) allow this species to be considered as an alternative to maritime pine.

Table 2 – Solid wood properties of *P. pinaster* and *A. melanoxylon*. (figures reported to 12% moisture content)

Species	Average density (kg.m ⁻³)	Average bending strength (N.mm ⁻²)	Average modulus of elasticity (N.mm ⁻²)	Average axial compression strength (N.mm ⁻²)
<i>P. pinaster</i> (¹)	630	130	10500	47
<i>A. melanoxylon</i>	650	146	14200	61

(¹)Machado et al., 2005

Maritime pine and acacia wood can be, in general, classified as light to medium density showing medium strength and stiffness. Maritime wood pine quality shows a high variability being its potential claimed from data obtained from high quality forest stands (Table 2) (Machado et al., 2005). Concerning papermaking potential, at a given drainage resistance (30 °SR), the

papers produced with acacia present higher apparent densities than eucalypt (0.80 to 0.66 g/cm³) (Santos et al., 2004). This is due to the lower coarseness and higher flexibility and collapsibility of its fibers. Despite the slightly higher fiber length, this fiber leads to papers with good relationship of light scattering and smoothness, still to good tensile strength and at low refining energy consumption. This behavior demonstrates that acacia fibers show an interesting potential use, at least in conjunction with eucalypt fibers for writing and printing paper. This paper addresses analysis of acacia potential as raw material source for Portuguese industry (as solid wood and pulp and paper), getting together information from forest management, wood and fiber quality. It will be using knowledge acquired from previous research projects and preliminary results from an ongoing research on *A. melanoxylon* from mixed (with *P. pinaster*) or pure stands in the north of Portugal.

Modelling forest growth - the portuguese case study

WAA1-01

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ABSTRACT: Modelling forest growth has been a concern since early stages of forest management: the simple guess of what will happen in the future to the most complex use of statistical and IT processes based on real data, build a whole history on this types of models. Besides reporting the most important references in Portugal, a perspective of the possible near future will be discussed.

Growth model for Ipê Felpudo (*Zeyhera tuberculosa* (Vell.) Bur.) at the age of 6 years.

WAA1-02

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ABSTRACT: The Ipê Felpudo (*Zeyhera tuberculosa* (Vell.) Bur.) is a native and pioneer species, which possesses a high silvicultural potential. It has been threatened of extinguishing in its original places due the intense predatory extraction. The elimination of the complex forestry ecosystem for agricultural, farming, lumber and industrial activities has induced to the drastic reductions of its genetic base. Forest modeling initiates through the inventory of permanent plots that suffered re-measurements. Therefore, forests are biological systems that are always changing and requires a projection of these changes, in order to permit management adjustments in this ecosystem. This decision is based on information of the current and future situations of the stand. The aim of this paper is to define a growth model for this species, with stand and climatic variables, collected in the Experimental Station of Linhares, Espírito Santo.

Mixed-effects model applied to forestry modeling

WAA1-03

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ABSTRACT: The main purpose of this study was to apply the mixed-models theory in fitting improvement of the biometric relation in forest stands. The database is from clonal *Eucalyptus grandis* and *E. urophila* plantation. It was verified significant improvements in the precision criteria of the biometric equations, such as mean standard error and residual distribution, when compared to the models fixed effects model. Also we confirmed the adequacy of the mixed-models by improvement of the statistical information criteria (Akaike Information Criterion – AIC and Bayesian Information Criterion - BIC) and the logarithm of the maximum likelihood. As a result, the fitting process, based on the mixed-effects theory, implied in significant improvements in the biometric equation generated by the estimate process, when compared to the fixed effect equations.

WAB1-01

Factors of the Adoption of Technology of Production of Wood in Forest Agribusiness of the South Area of Brazil

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ABSTRACT: The decisive factors of the adoption of new technologies for the users, are dependent of the perception degree that those users develop or they possess in relation to inherent characteristics to the process of technological innovation presented in this study as Perceived Characteristics of the Innovation (PCI). In the forest agribusiness the technologies of wood production, they are introduced to the users by the research institutes, which work with the Research, the Development and the Innovation (RD&I), seeking the offer of technologies, products and services, as the final product of its activities for the society. With the objective of identifying some degree of perception of NCI among the users of technology of production of wood (TPW), gone back to the forest agribusiness of the South area of Brazil, a survey was accomplished for the obtaining of the data for the analyses. The found results demonstrated the existence of a good level of the users' of TPWs perception in relation to those characteristics as important in its decision of adoption of new technologies.

WAB1-02

Addition of pluviometric precipitation on the growth and yield modeling of unthinned *Pinus taeda* L. stands

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ABSTRACT: This study had as main goal to analyze the behavior of the modifiers introduction in Richards's model, containing climatic variables. Thus, data of 422 permanent plots of *Pinus taeda* L. (measurement and remeasurement) was used unthinning stands, from Klabin S.A., in Santa Catarina/Brazil, varying among 5 - 35 years old. Modifier additions happened in models, which estimate dominant height and in site index classification model. So, it was possible to represent the site index not only for the dominant height and age, but also with an environment variable. Modifier addition in dominant height model propitiated better estimates of this variable, being the dominant height the key variable in the whole prognosis system, because it interferes in all inferences and it improves the system prognosis completely. However, that improvement was not observed in the model, which expresses site index, but the best contribution is the flexibility increase in estimating the productive capacity of the site according to the environment aspects. An important factor to be stand out in that

methodology is that inferences are possible in areas where there is no reforestation, what is not very advisable with traditional biometric models. Thus, it has caused a direct impact on the inventory costs, because it can be updated the inventory data with the climatic base reducing the implantation of a great number of samples. The complete system considered the modeling of trees survival, basal area, diameters variance, medium arithmetic diameter, minimum diameter, maximum diameter, generic hypsometric relation, taper function and parameters recovery of Weibull function, adjusted by the method of the moments, to describe the diametric distribution. Climatic variables were considered as medium precipitation, precipitation logarithm, precipitation variance, total precipitation and inverse precipitation. The choice of climatic variable was done through the technique of Multiple Regression Analysis by the procedure of "backward" variables elimination where the chosen variable for the largest correlation with the average increment in dominant height was the medium precipitation. Improvement with the inclusion of climatic variable in the modeling was 7.5% in relation to the model that did not present the climatic variable included in the model. Hybrid modeling is still little used, but makes flexible the modeling of growth and yield, and it is an excellent tool for forest management.

Smoothing basic density of supply wood flow at a forest pulp and paper industry through a harvest stand scheduling MILP model and a heuristic approach.

WAB1-03

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ABSTRACT: Wood basic density is one of the most important factors that affect the pulp and paper properties and final quality in the forest industry. It should be controlled and smoothed at the earliest moment, because the impact of these oscillations can affect the entire pulp and paper production. In extreme adverse conditions, the sell cancellation can occur due to the excessive variations in the final pulp and paper quality. At present work, we present an MILP model that considers this issue by means of a specific set of constraints, together with several others such as 1) the compromise to maintain each harvest crew at the same stand until total volume has been shipped; 2) the impossibility to harvest some stands in the raining season months (October – April); 3) the limitation in the number of stands that can be simultaneously harvested due to the number of harvest crews; 4) the initial harvesting stand for each harvest crew, so that the solution can be implemented at any time; 5) the starting harvest time of a stand occurring only if the remaining volume equals total volume, avoiding the interrupted harvesting schedule of the stands by more than one starting time; 6) the ending harvest time of a stand occurring only if no remaining volume is encountered, avoiding more than one ending moment. The classical volume, area and daily crew harvest capacity constraint was also considered. The MILP model was implemented using a daily time unit, indicating how many volume of which stand should be shipped to the industry every day, in order to reduce oscillations of basic wood density in consecutive days at the mill entrance. A complete annual harvest data set, provided by Votorantim Celulose e Papel (VCP), a Brazilian pulp and paper company, was used to test the present model. A small study case with a few stands in a weekly planning horizon is presented, and the difficult to implement this MILP model in longer planning horizon is discussed. In addition, an alternative heuristic approach is presented, and the resulting developed solver software is showed.