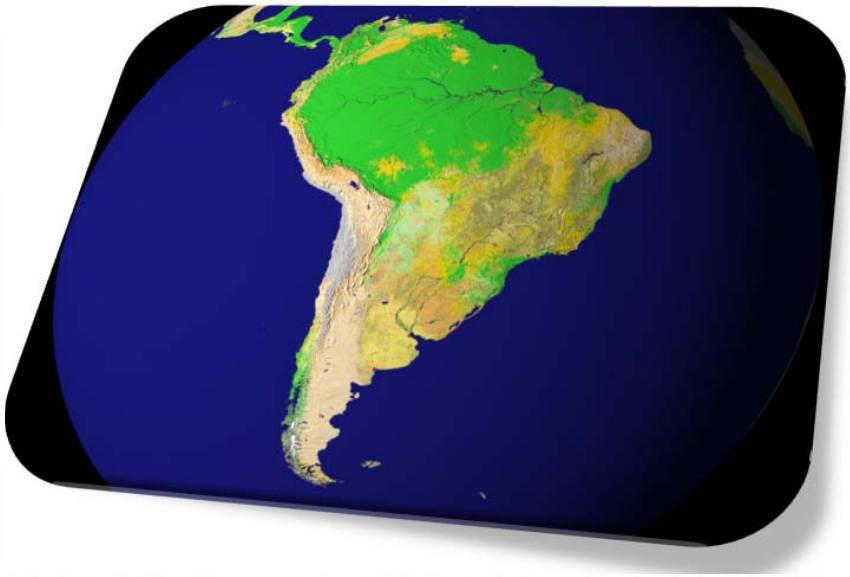
Thessaloniki, Greece

6 and 7 of June, 2011



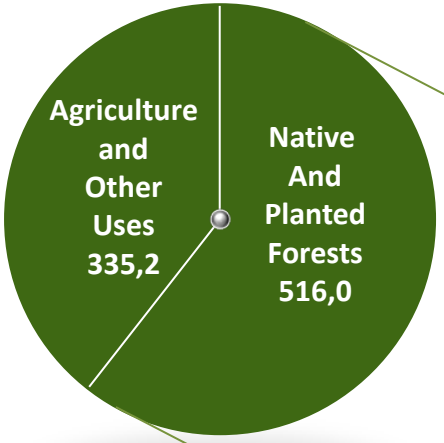
The use of Forest Decision Support Systems in Brazil

Luiz Carlos Estraviz Rodriguez
(lcer@usp.br)
Silvana Ribeiro Nobre
(silvana.rnobre@gmail.com)

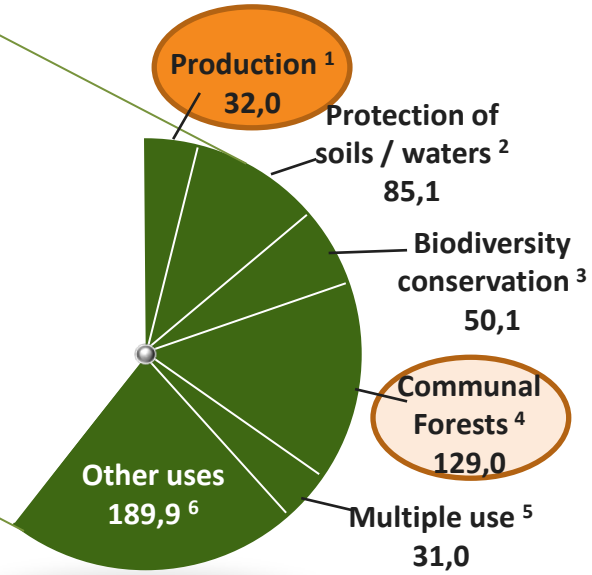
Brazilian Forests *(million ha)*

Source: Brazilian Forest Service (*http://www.florestal.gov.br*)

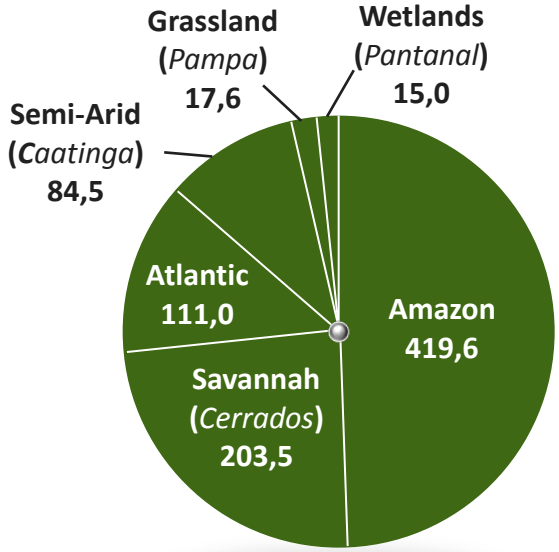
Brazilian Territory: 851,2



Land Use



FAO categories



Ecosystems

Communal Forests	Area
Tribe land	98,4
Other categories	30,5

Production Forests		Area	Assessed
Plantations		6,60	23%
Native Forests in National Forests	Under Concession	0,36	100%
	Other uses	14,5	-
Native Forests in State Forests		10,5	-

[1] Planted, National and State Forests

[2] Estimate *(10% assigned by law as Permanent Preservation Area)*

[3] Eight different categories of conservation units

[4] Extractive reserves, tribe land, sustainable development reserves

[5] Protected Environment Area

[6] Prevalent use still undetermined

Forest Managers in Brazil
who are they?

Public Forests

MMA – Brazilian Ministry of Environment
forest policy proponent is also empowered to sign forest concessions

SFB – Brazilian Forest Service
manager of public forests at the federal level in charge of producing forest goods and services

IBAMA – Brazilian Institute for Renewable Natural Resources and Environment
environmental licensing and monitoring

ICMBio – Chico Mendes Brazilian Institute for Biodiversity
manager of all federal conservation units

Public hearings are part of planning, decision making and destination processes
The process is lead by three councils gathering multilateral participation:

CONAMA	National Environmental Council
CONAFLOR	National Forests Commission
CGFLOP	Public Forests Management Commission

Communal Forests

Assigned to be used by traditional and indigenous peoples and communities, small landowners (subsistence agriculture) and land reform settlers

Private Forests

Pulp and Paper
Fiberboard
Steel Mills (charcoal)
Laminated Timber and Processed Wood

Problem types in Brazil

Regarding one of the dimensions used to establish FORSYS problem types in Brazil – "spatial context" – it is necessary to consider some aspects of the *Brazilian legal framework:*

- It directly interferes on how land owners use their rural properties and implement forest activities
- It directly controls environmental licenses, and rights for land use and forest management
- It explicitly predetermines the amount of land that a rural property has to preserve
  - ✓ as ***"APPs" (Permanent Preservation Areas)*** for environmental purposes or to remain uncultivated protecting soils and water streams; and
  - ✓ as "***RLs" (Legal Reserves)***, as a precautionary measure, to maintain a constant stock of wood and forest resources locally.

Problem types in Brazil

Consequently:

- Side banks of rivers, water springs, and hill tops must be excluded from production purposes in the property and become protected areas (***APPs***)
- Depending on the geographical location of the property, native forests have to be maintained as legal reserves (***RLs***) in 80% (Amazon Region) or 20% (other Brazilian regions) of the property
- Clear cutting is not allowed in ***RLs***, and a long term forest management plan is always required to implement harvest or plantation operations in these areas
- Conventional agricultural crops, perennial cultivation of coffee, rubber trees, fruit trees, forest plantations like Eucalyptus, Pine, Teak and Acacia, and other similar activities are, therefore, constrained to the remaining area.

Problem types in Brazil

The consequence is that **private forest plantations** are cultivated in patches neighboring *APPs* and *RLs* and, therefore*:*

→ **neighborhood interrelations** are obligatorily considered when these planted forests are spatially distributed in the property.

Problem types in Brazil

… and the management of forests in legal reserves (**public or private RLs**) and **public forests** in Brazil has to strictly follow a very comprehensive and detailed set of rules, where harvesting licenses and transportation permits can only be issued by state officials after a long term strategic plan is approved and an annual short term operational plan is submitted

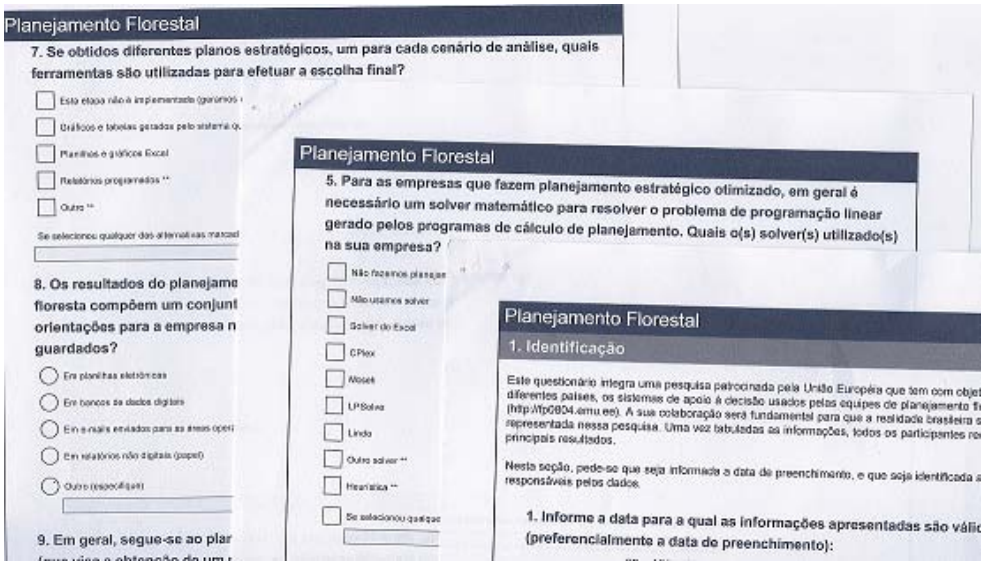
→ **All other dimensions become** predetermined by norms.

Problem types in Brazil

Dimensions		Types			
		B1	B2	B3	B4
Temporal scale	Long term (strategic)	X	X	X	X
	Medium term (tactical)				
	Short term (operational)				
Spatial context	Non spatial				
	Spatial with neighborhood interrelations			X	
	Spatial with no neighborhood interrelations	X	X		X
Spatial Scale	Stand level				
	Forest level	X	X	X	X
	Regional/national level				
Parties involved	Single decision maker				
	More than one decision maker/stakeholders	X	X	X	X
Objectives	Single	X			
	Multiple		X	X	X
Goods and services	Market non wood products				X
	Market wood products	X	X	X	X
	Market services				X
	Non market services				X

Report´s sources of information

The set of laws and regulations that rule the management of **public forests**,



and a questionnaire to characterize the management of **private forest** plantations

Report´s sources of information

Distribution of valid questionnaires among FORSYS problem types

Problem type	Number of responses	Area effectively planted
B1	6	378.974 ha
B2	15	1.012.802 ha
B3	1	94.500 ha
B4	1	356.000 ha

Report´s sources of information

Valid questionnaires among classes of effectively forested area

Class interval	Number of responses	Total area planted
< 50.000 ha	11	172.228 ha
50.000 to 100.000 ha	6	518.684 ha
100.000 to 150.000 ha	2	258.000 ha
150.000 to 200.000 ha	2	325,699 ha
200.000 to 250.000 ha	1	211.665 ha

Results for problem types B1, B2 & B3

Problem types	Dimensions	
B1, B2 and B3	Temporal Scale:	Long Term (strategic)
	Spatial Context:	Spatial with no neighborhood and with neighborhood interrelation
	Spatial Scale:	Forest level
	Parties involved	More than one DM
	Objectives:	Single/Multiple
	Goods and services:	Market wood products

Results for problem types B1, B2 & B3

Phases	Participants	Methods/Tools used (if any)
Intelligence	Planners and non-planners from other departments, including board of directors and operational managers	(1) Spreadsheets with production goals per product type. Basically, commercial expectations are informed. (2) Also available resources like budget, machinery, investments resources are informed using spreadsheets. (3) Product expected prices, and market growing expectations and scenarios are defined using spreadsheets. (4) Interviews to clarify cost assumptions. (5) Interviews to clarify main directives and strategies like maximize NPV, or maximize production, or minimize costs, etc. (6) Analysis of previous contracts to generate for example assumptions on alternative harvesting and thinning ages. This generates data that will be part of a model. (7) Workshops to validate the strategy. (8) In all cases data are typed into matrix generator software by the planning team.
	Planning team (experts)	(1) Workshops and Training Sessions (2) Prepare requests for goals, prices, assumptions and constraints using spreadsheets. According to 64% of our sample, goals and assumptions come from people from other departments of the company such as the board of directors, and commercial and operational managers. (3) 19% of our sample shows that they create scenarios according to assumptions given in this intelligence phase.

Results for problem types B1, B2 & B3

Phases	Participants	Methods/Tools used (if any)
Integration to DSS & Participation type		There is **no digital integration** in this phase; amount of data does not demand specific software. Data is taken as input to the design process. In this phase, we have a participatory process to exchange information. The aim of the participatory process in this phase is to create an environment of cooperation. Whenever possible, the expert team creates a representative model. Parties involved must agree on basic assumptions in this phase.

Results for problem types B1, B2 & B3

Phases	Participants	Methods/Tools used (if any)
Design	Planning team (experts)	(1) The expert team creates a basic model in a modeling environment to the Matrix Generator software (Woodstock, Planflor, Optimber, Homemade software). (2) Software that reads data from a relational database (integrated data from the register, inventory, GIS and operational modules) and exports it to Excel spreadsheets and text files that are used a input files by Matrix Generator software. (3) VB Macros that transform data and prepare it as input to the Matrix Generator. (4) C#, SQL-Server and Oracle procedures that read data from the database, process, format and generate the preformatted components of the model (yield tables, stands current situation, prices, costs, etc.) (5) Use of the matrix generator environment to test many scenarios and objectives.
Integration to DSS & Participation type		Digital integration to other tools is intensive, aiming to provide input data that is related to stand information, inventory, costs and maps. The aim of these integrations is also to reduce “manual data processing”. However, 9% of the respondents declared that they still have intense manual and spreadsheet preparation of data before the matrix generator processing phase. Participation here is focused on data preparation. Parties involved (operational, logistics, controllers, GIS team) participate indirectly. These parties have the responsibility to provide good quality data and they are asked to check them before planning design process starts. In this sense, this phase is characterized as a participatory process due to the fact that the model building phase depends on the previous work of other teams that share the responsibility for accuracy and data quality.

Results for problem types B1, B2 & B3

Phases	Participants	Methods/Tools used (if any)
Decision making	Planners and non-planners from other departments, including board of directors and operational managers	(1) 40% of the survey respondents use graphs and tables generated by the report writer of the matrix generator and solver software. These graphs and tables are discussed in workshop, or shared through e-mail in documents named “scenario analysis”. (2) 68% of the survey respondents complement their analysis using graphs and dynamic tables built in Excel®
	Planning team (experts)	Calculation and preparation of tables and graphs to compare scenarios using Excel® or the Matrix Generator specific tools.
Integration to DSS & Participation type		The survey showed the existence of three different participatory decision processes: (1) All scenarios are submitted to all parties in a workshop or meeting and the group chooses which scenario is the best depending on company’s strategy. (2) The planning team chooses the best scenarios and present advantages of each one in a report or in a meeting. Then, a small group (or the company main stake holder) chooses the best. (3) The planning team chooses the best according to predefined criteria and validates it in a small group of DM such as the board of directors.

KM tools in planted industrial forests

Intelligence phase
The basic KM tools used in this phase are: (i) a set of pre-defined and pre-formatted spreadsheets to contain, organize and share information about goals, prices, objectives and assumptions; and (ii) workshops and interviews to clarify information and share responsibility on goals and objectives. The same set of knowledge management tools is used in this phase, independently from the decision support system used in subsequent phases.

KM tools in planted industrial forests

Design phase		
DSS main component	**Description**	**Use of KM Tools & Techniques**
1 – Simulation systems	DSS based on data analysis and simulations using VB Macros, Delphi, etc.	(1) DBMS MS SQL-Server® modular systems to store and manage stands information (register), inventory and operational data. (2) Agents programmed in Transact-SQL to retrieve data from database sent afterwards to Excel spreadsheets to be analyzed. (3) Excel back to register and inventory modules.
2 – Homemade optimization system	DSS based on optimization techniques. Matrix generator programmed by internal team of experts.	(1) DBMS MS SQL-Server® modular systems to store and manage stands information (register), inventory and operational data. (2) Agents programmed in MS VB Excel to treat information and prepare to be used in a Matrix generator.
3 – *Optimber* and *Planfor*	DSS based on Linear Programming optimization techniques. Matrix Generator programmed and supported by a local software provider.	(1) DBMS MS SQL-Server® and Oracle® modular systems to store and manage stands information (register), inventory and operational data. (2) Excel to manage data from register and inventory modules. (3) Agents programmed in Transact-SQL and in Oracle® language to retrieve data from database sent afterwards to Excel®. From Excel® data is formatted to become part of the model.
4 – *Woodstock* & *Stanley*	DSS based on Mixed integer Programming optimization techniques. Matrix Generator and modeling environment programmed and supported by a Remsoft (global software provider).	(1) DBMS MS SQL-Server® and Oracle® modular systems to store and manage stands information (register), inventory and operational data. (2) Agents programmed in Transact-SQL and in Oracle® language to retrieve data from database which is sent afterwards directly to become part of a model.

KM tools in planted industrial forests

Decision-making phase
The basic KM tools used in this phase are: (i) a set of spreadsheets containing graphs and tables, organized in such way that can be used to share information about calculated scenarios; (ii) a set of graphs and tables produced for instance by Woodstock and Stanley analytic environments to share results and explore other scenario calculations; (iii) workshops where the expert team presents scenario results. The same set of knowledge management tools is used in this phase, independently from the decision support system used in previous phases.

Results for problem types B4

Problem types	Dimensions	
B4	Temporal Scale:	Long Term (strategic)
	Spatial Context:	Spatial with no neighborhood and with neighborhood interrelation
	Spatial Scale:	Forest level
	Parties involved	More than one DM
	Objectives:	Single/Multiple
	Goods and services:	Market non wood and wood products; and market and non market services

Results for problem types B4

Phases	Participants	Methods/Tools used (if any)
Intelligence	Brazilian Forest Service	Public forests in Brazil are regulated by the Law for the Management of Public Forests, which determines the annual preparation of a document called PAOF (SFB, 2010), an acronym in Portuguese for Forests Concession Annual Plan. The PAOF plan is annually prepared and establishes which public forests will become available for concessions in the next year. The document is annually prepared by experts in the Brazilian Forest Service ("*SFB*"), a branch of the Brazilian Ministry of Environment. A registry of all public forests is maintained by the SFB. Most of these forests are legally bounded to provide protection and sanctuary for biodiversity and communal cultures. Some, like National Forests, are available for sustainable forest management.
	Planning team (experts)	An expert team in the SFB collects national and regional data using GIS and spreadsheets as the main tools for data compilation and analysis. Meetings involving many representatives from federal and state agencies – in charge of issues related with the environment, transportation infrastructure, energy, agriculture etc – are held to evaluate interactions and common objectives. Many public hearings are held annually to discuss the possibilities of opening certain areas in National Forests for concessions.

Results for problem types B4

Phases	Participants	Methods/Tools used (if any)
Integration to DSS & Participation type		The process does not benefit from systems that integrate data. Participatory processes try to exchange information. Expert teams involved do their best to figure out relevancies and to establish reasonable conditions to filter the overwhelming amount of information that will indicate which areas in National Forests will contribute the most for regional and local development.
Design	Planning team (experts)	A catalogue of data describing all public forests in Brazil maintained by the BFS is filtered to provide a list of forests bounded to provide legal and justifiable concession offers. An expert team in the Brazilian Forest Service relies basically on exploratory tools provided by Excel spreadsheets and GI systems.
Integration to DSS & Participation type		The designing process is manual in terms of processing data collected from several sources, including reports produced in many public hearings and meetings with local communities.
Decision making	Brazilian Forest Service	No formal DSS is used Basic filtering of the data provided in previous phases constitutes a set of basic rules that are used to identify the list of forests that becomes available for concessions auctions in a specific year. A provisional document is produced and submitted to public hearings again until an agreement is reached. Suggestions collected during the public hearings are integrated in a final version of the document, which is signed by the Minister of Environment and published in July every year.
Integration to DSS & Participation type		Although not supported by modern information technology, the process is reasonably well integrated to participatory process.

Conclusions

- The use of Forest Decision Support Systems in Brazil is still confined to almost exclusively the pulp and paper industrial sectors.
    - Very few among these systems tend to be complex applications, relying heavily in modern information technologies. In fact, most of them are still struggling to incorporate the full potential of mathematical optimization, multi objective techniques, expert system support etc.
- Results show that there is plenty of space for the development of knowledge management tools and decision support systems in Brazil.
- Expert teams using more advanced optimization techniques, and working in the industry sector, are more motivated and have better access to more updated information technology.
- The survey among forest managers of industrial planted forests reveals that the planning process involves collaborative participation.
    - There is involvement of many DM in all phases, and there are exchanging of information and sharing of responsibilities.
- The whole process of planning and managing public forest concessions, characterized as problem type B4, can immensely benefit from more elaborate decision support systems and from the integration with modern information technologies.
    - The enforcement of the legal framework to professionally manage public forests is still a recent event in Brazil, and some innovative initiatives can be foreseen in the near future.

Thank You!

Obrigado!

Luiz Carlos Estraviz Rodriguez
(lcer@usp.br)
Silvana Ribeiro Nobre
(silvana.rnobre@gmail.com)

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