

FOREST PLANNING SOFTWARE DEVELOPMENT IN NORWAY

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INTRODUCTION

- = New pilot project
- = SGIS
 - biological models
 - economic calculations
 - simulation, optimization and GIS-features
 - Case



PILOT PROJECT - ORGANIZATION

- = Aim : Develop a research- and end-use strategy for new generations of decision-support systems for forest management planning in Norway

- = External partners and founders: Prevista and Norskog
- = Time schedule: year 2006, 4 labour months
- = Cooperation Finland and Sweden
- = Seminar (June): Researchers and users

- = Expected output:
 - Report: state of art and future research priorities
 - Application to the Research Council

SGIS IS A TOOL FOR:

1. Simulation of forest development
2. Optimization of forest treatments



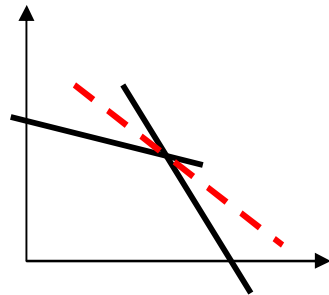
in a GIS-user interface!

BACKGROUND

- = This version of SGIS is based on a prototype developed in PC-ArcInfo (Næsset 1997).
- = This version of SGIS is based on ArcView version 8 (9) and is programmed in Visual Basic for Applications.
- = SGIS consist of a functionality specially made for forest related problems and standard ArcView GIS-functionality
- = SGIS is mainly used for teaching and research at the university. However, SGIS is being commercialized at the moment.

3 PARTS:

GAYA – stand simulator



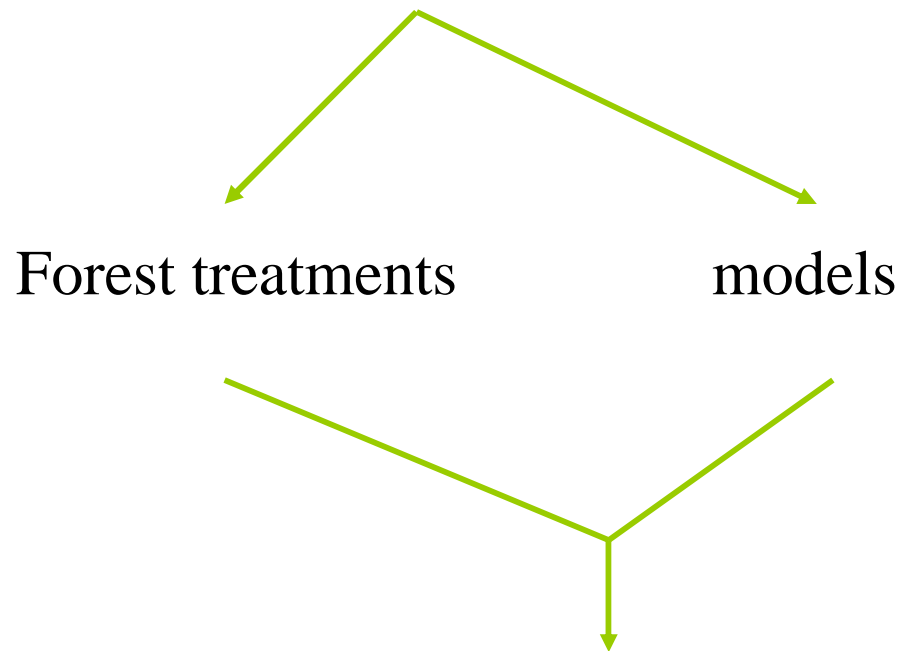
J – mathematical programming tool...

GAYA and J is hidden behind

SGIS – windows GIS-applikasjon (ArcView)

GAYA

A simulation tool to describe silvicultural regimes!



Calculations and "book-keeping" for up to 20 periods of 5 or 10 years

- = Developed by prof. Eriksson at the Swedish University of Agricultural Sciences in 1983
- = "Translated" to Norwegian conditions by Hoen & Eid (1988-90)
- = Since 1990 further upgraded and developed. (Ex.: C in wood products and forest soil)

SUB-MODELS IN GAYA

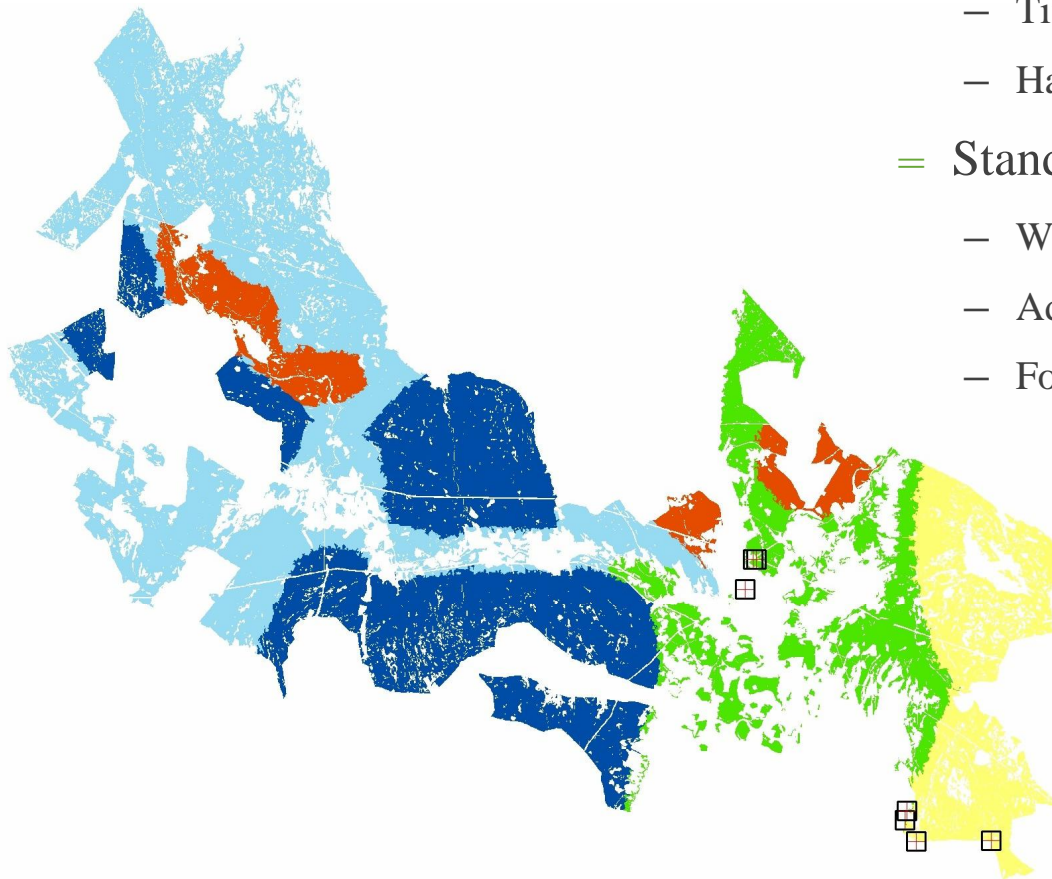
= Simulations are based on:

1. «mean tree» ($d_{ba} + h_L$), and 2. number of stems ($N \text{ ha}^{-1}$)

= Important functions:

- mean diameter growth (Blingsmo, 1984),
- height development (Tveite 1976,1977; Braastad, 1977),
- natural mortality (Eid & Øyen 2003)
- tree volume (Braastad 1966, Brantseg 1967 og Vestjordet 1967)
- timber prices (Blingsmo & Veidahl, 1992)
- harvesting and forwarding costs (Anon., 1994)

GAYA: ASSUMPTIONS:



= General:

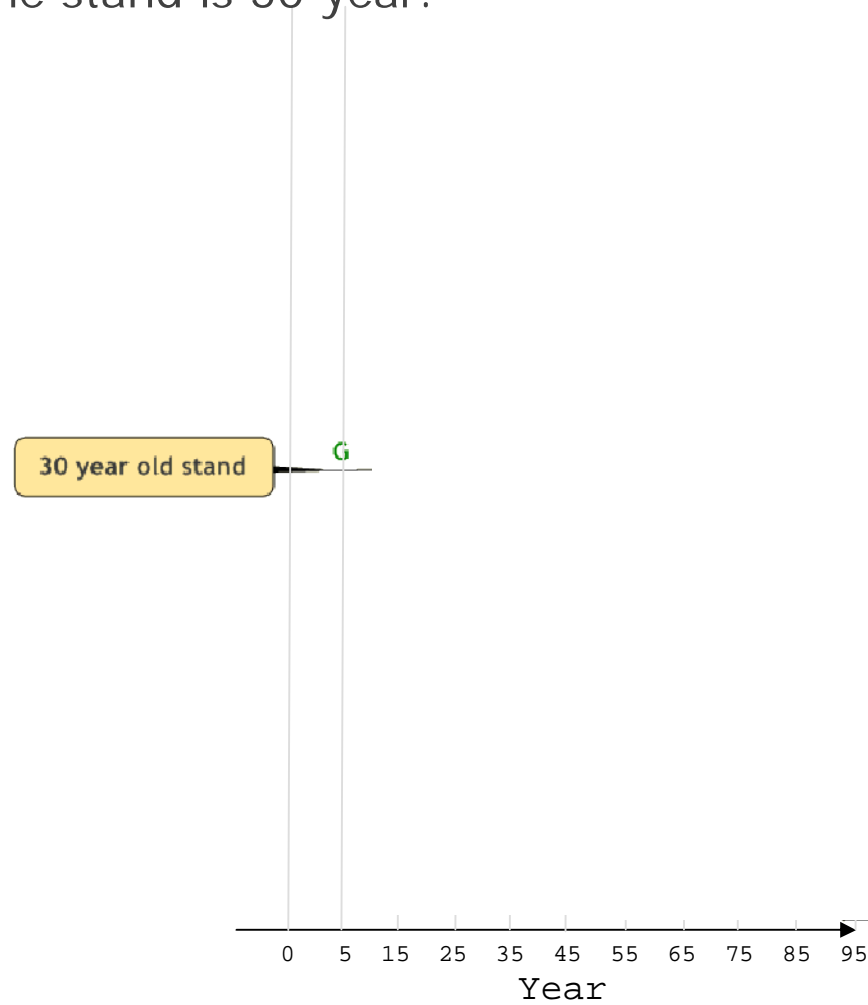
- Interest rate
- Timber prices
- Harvest and cutting costs

= Stand level:

- Wood quality
- Additional harvest and cutting costs
- Forwarding distance

GAYA: TREATMENT SCHEDULES

- = Example: stand i is 30 year. The stand can not be cut before the stand is 50 year.



J SOFTWARE

- = A commercial software package for general linear programming (LP) package for solving forest management planning and conventional LP problems.
- = Developed by Dr. Juha Lappi at the Finnish Forest Research Institute (METLA), Finland, in 2003-2004

LP

= Objectives:

- Maximizations of net present value!
- Maximizations of standing volume!

= Restrictions/constraints:

- Non declining harvest
- Non declining income
- Standing volume
- Old growth forest
- Dead wood
- Broadleaves
- Protected area

The whole forest
or
smaller parts

What is SGIS?

- = SGIS is an interface between a Geographical Information System and the long-term forest management planning model, GAYA-J.
- = From the SGIS graphical user interface a complete vector GIS is available, and in addition biological simulations and optimizations with GAYA-J may be done.
- = "Forecasted states" for the next 100 years can be presented as tabular reports, figures or thematic maps.

Case study

- = Data from the forest at the Norwegian University of Life Sciences at Ås.

Data sets

- Stream/river
- "Important species"
- Roads
- Forest roads
- Contour
- Arboretum
- Research areas
- Preserved areas
- Forest stands
 - Hogstkl
 - Other
 - I
 - II
 - III
 - IV
 - V
- Site index
 - BG
 - 6
 - 8
 - 11
 - 14
 - 17
 - 20
 - 23
 - 26
- Orthofoto

Display Source

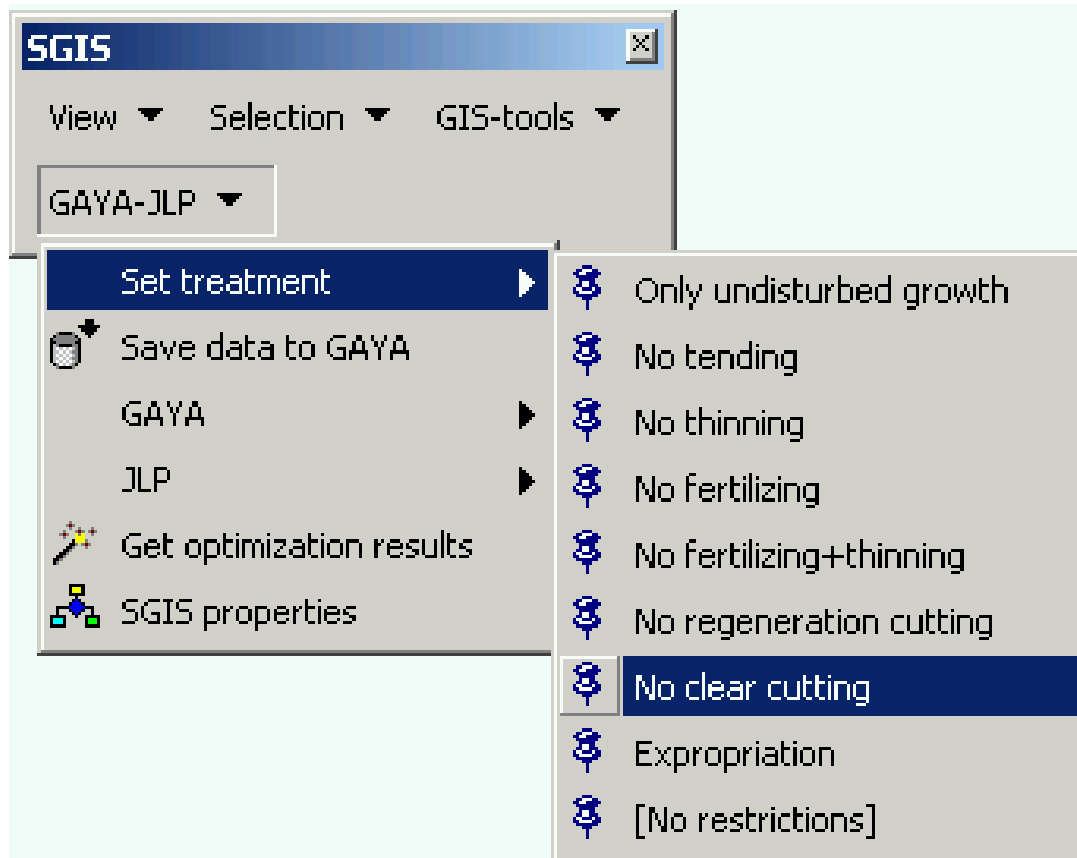


SGIS

View Selection GIS-tools

GAYA-JLP

Menu: GAYA-J

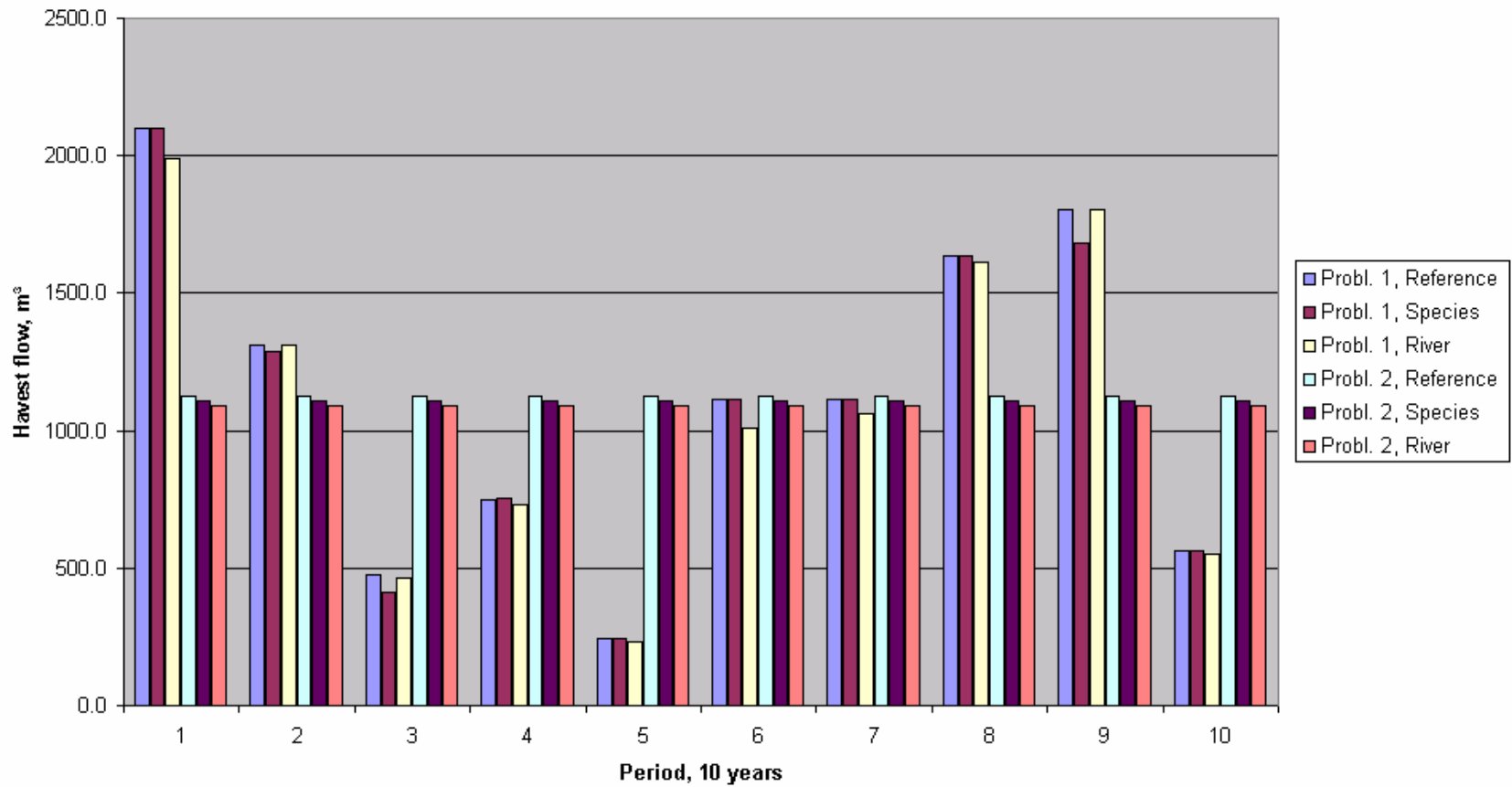


Menu: GAYA-J

Select objective functions ✕

<input checked="" type="checkbox"/> Faustmann's formel	<input type="checkbox"/> Maks NPV + dyr ungsogpl.	<input type="checkbox"/> Min. st.vol og ISA	<div style="border: 1px solid gray; padding: 5px; margin-bottom: 5px;">Ok</div> <div style="border: 1px solid gray; padding: 5px;">Cancel</div>
<input checked="" type="checkbox"/> ISA	<input type="checkbox"/> ISA + dyr ungsogpl.	<input type="checkbox"/> Maks. NPV + kantsone	
<input type="checkbox"/> Max NPV-(0-områder)	<input type="checkbox"/> Maks NPV og dyr etabl/ungskogpl.	<input type="checkbox"/> ISA + kantsone	
<input type="checkbox"/> ISA-(0-omr.)	<input type="checkbox"/> ISA og dyr etabl/ungskogpl	<input type="checkbox"/> Maks NPV + %-vis arealred.	
<input type="checkbox"/> Max NPV-biotopvern	<input type="checkbox"/> Maks NPV og vurd. av hogstkv.	<input type="checkbox"/> ISA + %-vis arealred.	
<input type="checkbox"/> ISA-biotopvern	<input type="checkbox"/> Maks. NPV og vern	<input type="checkbox"/> ISK	
<input type="checkbox"/> Maks. NPV og spar gammelskog	<input type="checkbox"/> ISA og vern	<input type="checkbox"/> Max NPV Tømmer + CO2	
<input type="checkbox"/> ISA og gammelskog	<input type="checkbox"/> Maks NPV - Samleproblem		
<input type="checkbox"/> Maks. NPV med økt hogstalder	<input type="checkbox"/> Maks NPV + ISA - Samleproblem		
<input type="checkbox"/> ISA + økt hogstalder	<input type="checkbox"/> Utelukke behandl. og maks. NPV		
<input type="checkbox"/> Max NPV og livsløpstrær	<input type="checkbox"/> Utelukke behandl. og ISA		
<input type="checkbox"/> ISA og livsløpstrær	<input type="checkbox"/> Min. st.vol og Faustmann's formel		

Annual harvest flow for the management alternatives



ECONOMICAL RESULTS

Table. Annual income reduction (NOK year⁻¹) for the mangement alternatives

	No restrictions	Buffer zone	
		River	Important species
Problem 1	*	3313	2388
Problem 2	8658	11533	11063

* The Max. NPV with no restrictions was = $6.962 \text{ NOK} * 10^6$

Example of some previous studies with GAYA-J/SGIS

- = Næsset, E. 1997. A spatial decision support system for long-term forest management planning by means of linear programming and a geographical information system. *Scand. J. For. Res.* 12 (1):77-88.
- = Næsset, E., Gobakken, T. & Hoen, H.F. 1997. Economic analysis of timber management practices promoting preservation of biological diversity. *Scand. J. For. Res.* 12 (3):264-272.
- = Eid, T., Hoen, H.F. & Økseter, P. 2001. Timber production possibilities of Norwegian forest area and measures for a sustainable forestry. *Forest Policy and Economics*. In press.