Iptim

a new generation forest planning DSS

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What are forest planning DSSs like?

- **A good forest DSS** consists of:
  - forest inventory database,
  - a growth model and an optimization model,
  - interfaces to other relevant data sources,
  - GIS functionality, and
  - a friendly UI.
- However, **the typical planning system**:
  - is based on a spreadsheet with forest inventory data
  - does not include optimization models

Obstacles in taking full advantage of DSS tools

- Most forestry DSS tools are:
  - very **difficult to use**, or
  - very **expensive** (e.g. tailored software for big companies), or
  - very **inflexible**.
- So, experts need to be hired to run most forest DSSs.
- Therefore, many companies dont want to hear about it!

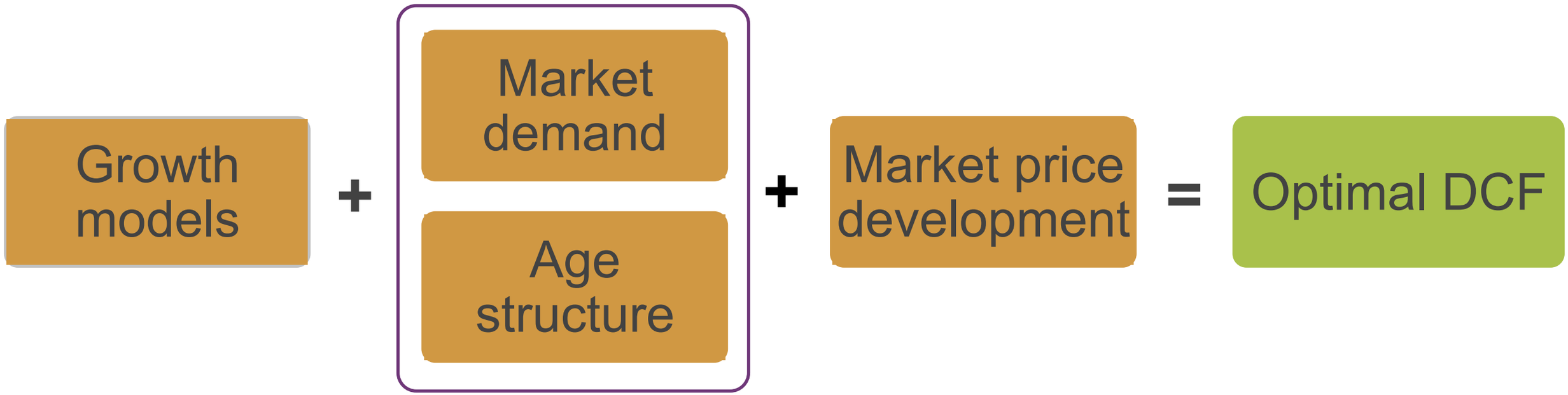
How DSSs could be more widely used in Forest Planning?

- DSSs tools should be:
  - More **accessible**
  - More **flexible** in terms of input data requirements and applicability,
  - Easier to **integrate** to IT infrastructures (e.g. ERPs),
  - **Extendable** (easy to modify and tailor),
  - **Affordable**,
  - **Easy to use**.

A Forest DSS in use: use case 1, valuation

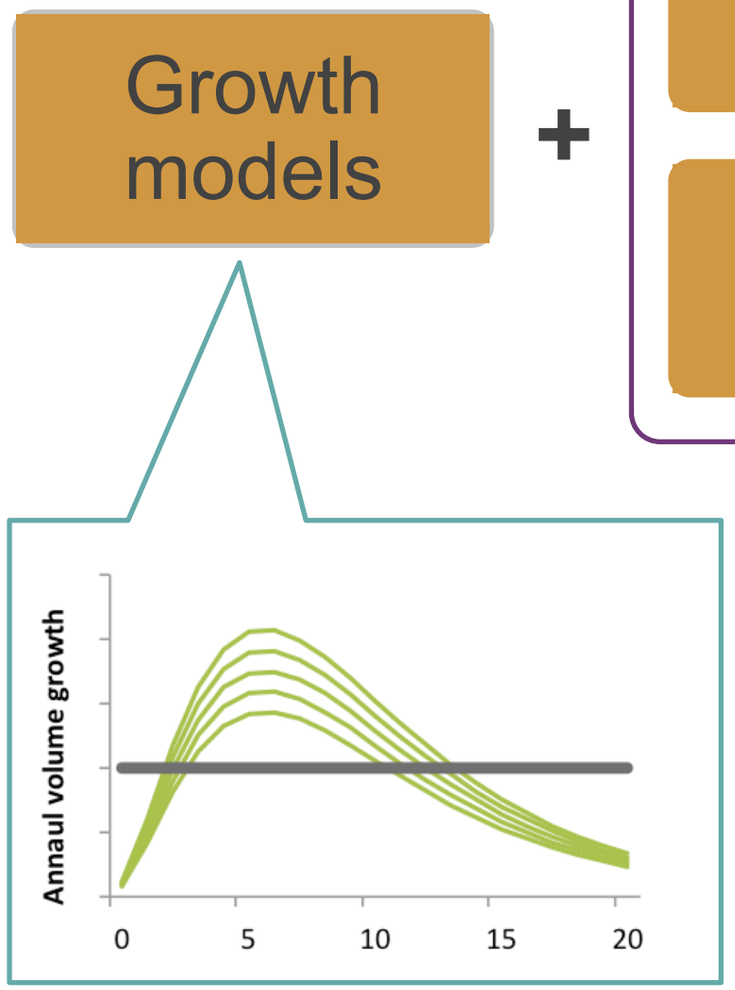
- Valuation of a forest estate, how much is it worth?
  - This decision problem can be analysed with a discounted cash flow analysis
  - Predict all the harvest and other silvicultural operations for the forest area far into the future
  - Discount their net cash flow into the present day with a discount rate (determined with for example Weighted Average Cost of Capitall, WACC, method)

Ingredients for obtaining an optimal Discounted Cash Flow (DCF) analysis

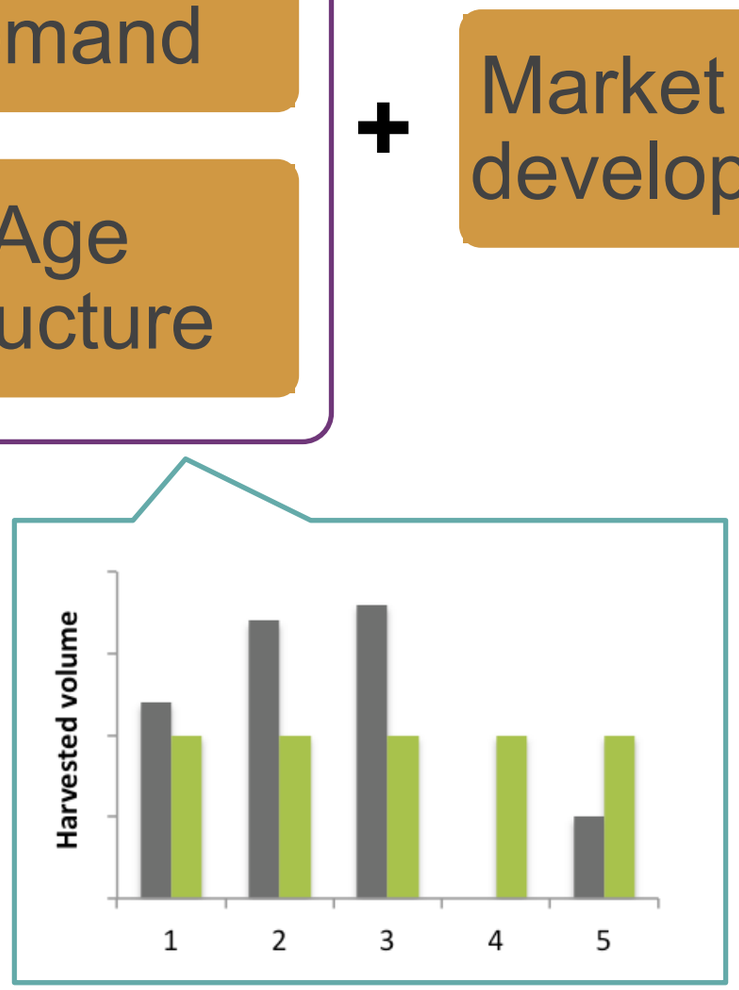


Typical pitfalls of the “non-DSS solution” in valuation

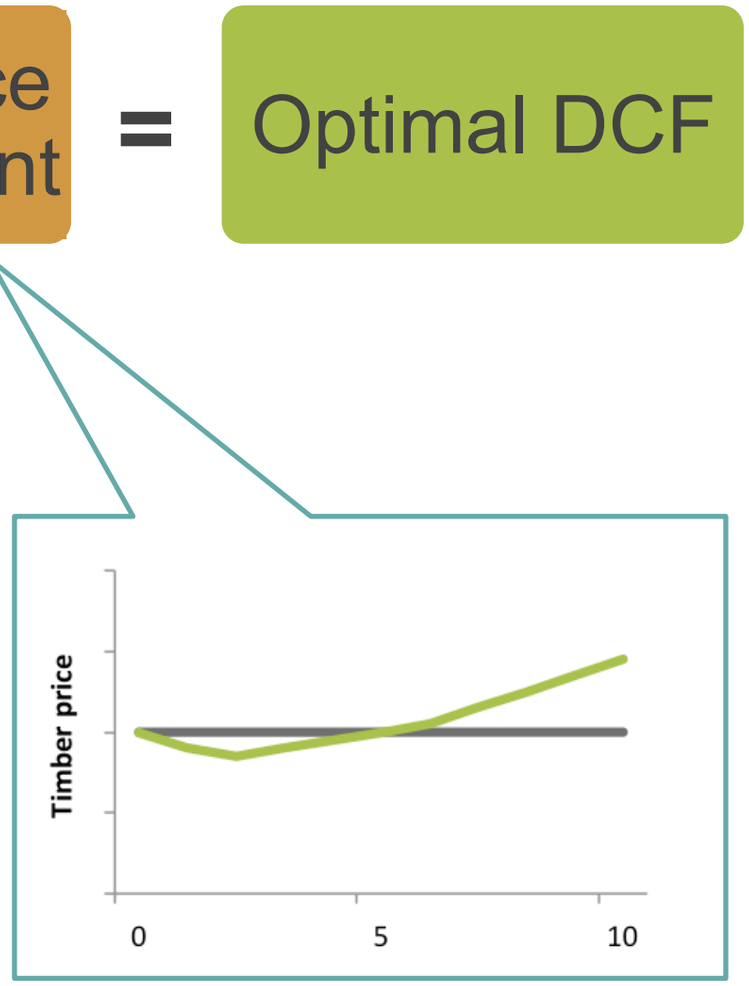
Growth models + Market demand + Age structure + Market price development = Optimal DCF



Simplified growth models lead to unreliable projections

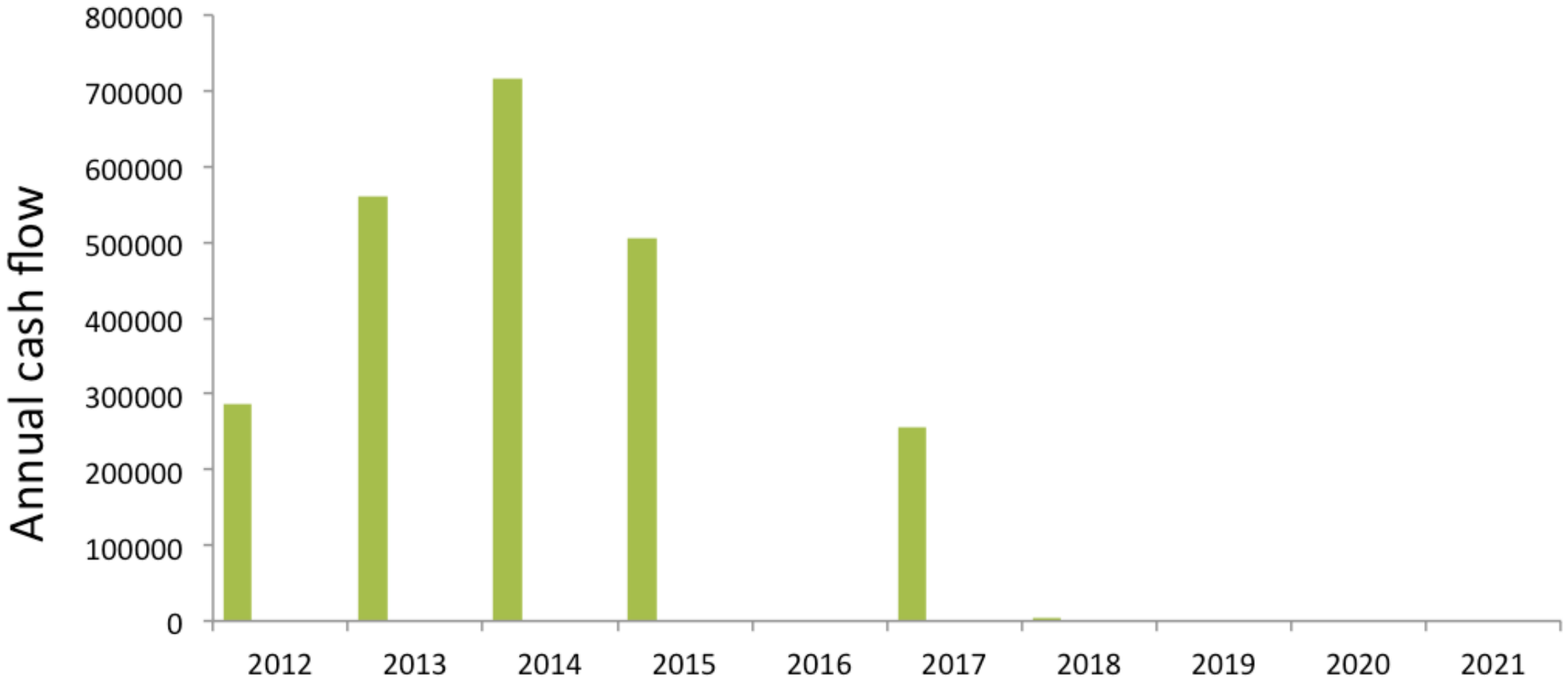


Market capacity is often exceeded in harvest plans



Price trends are difficult to integrate into valuations

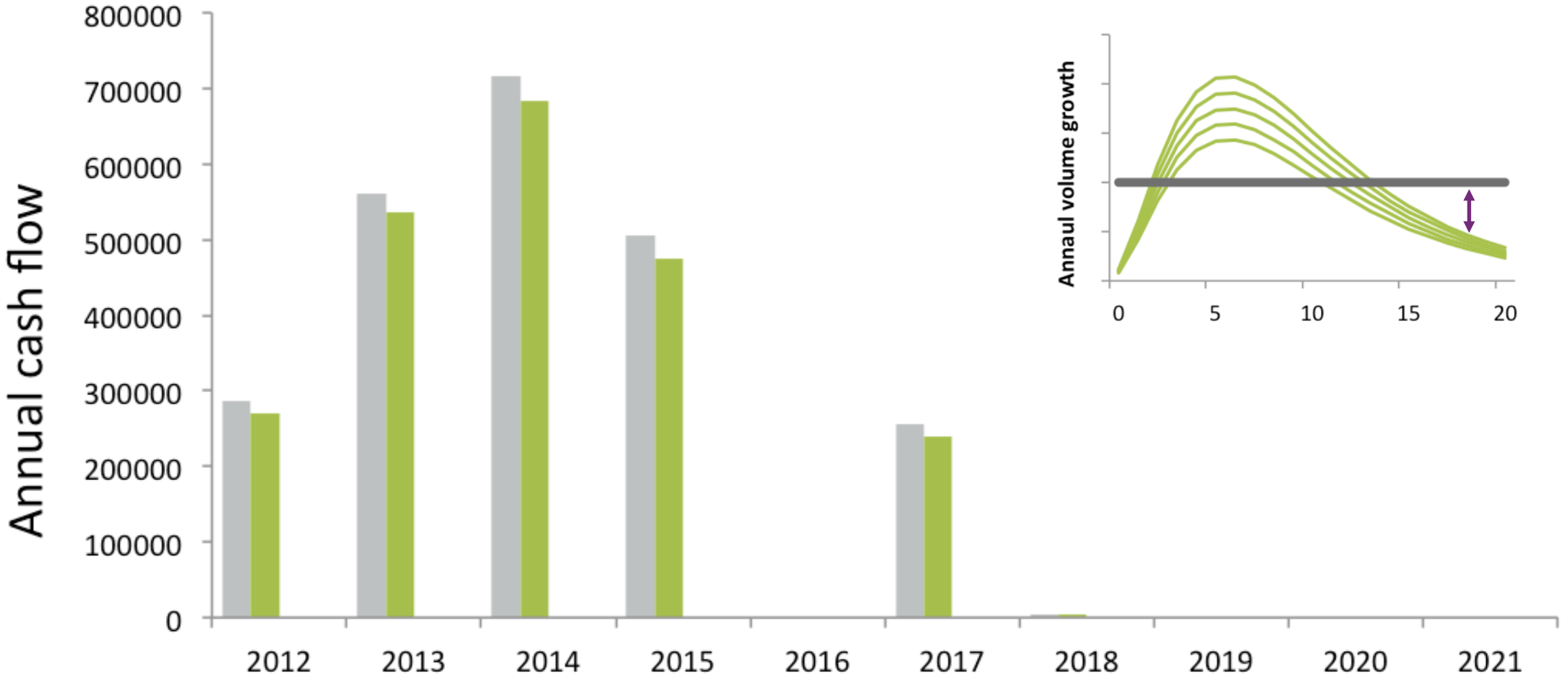
Example of DCF valuation case



- Annual cash flow for a 10-year period, forecasted using a simple MAI value as the growth model and a fixed regime for harvests and silvicultural operations

Example of DCF valuation case

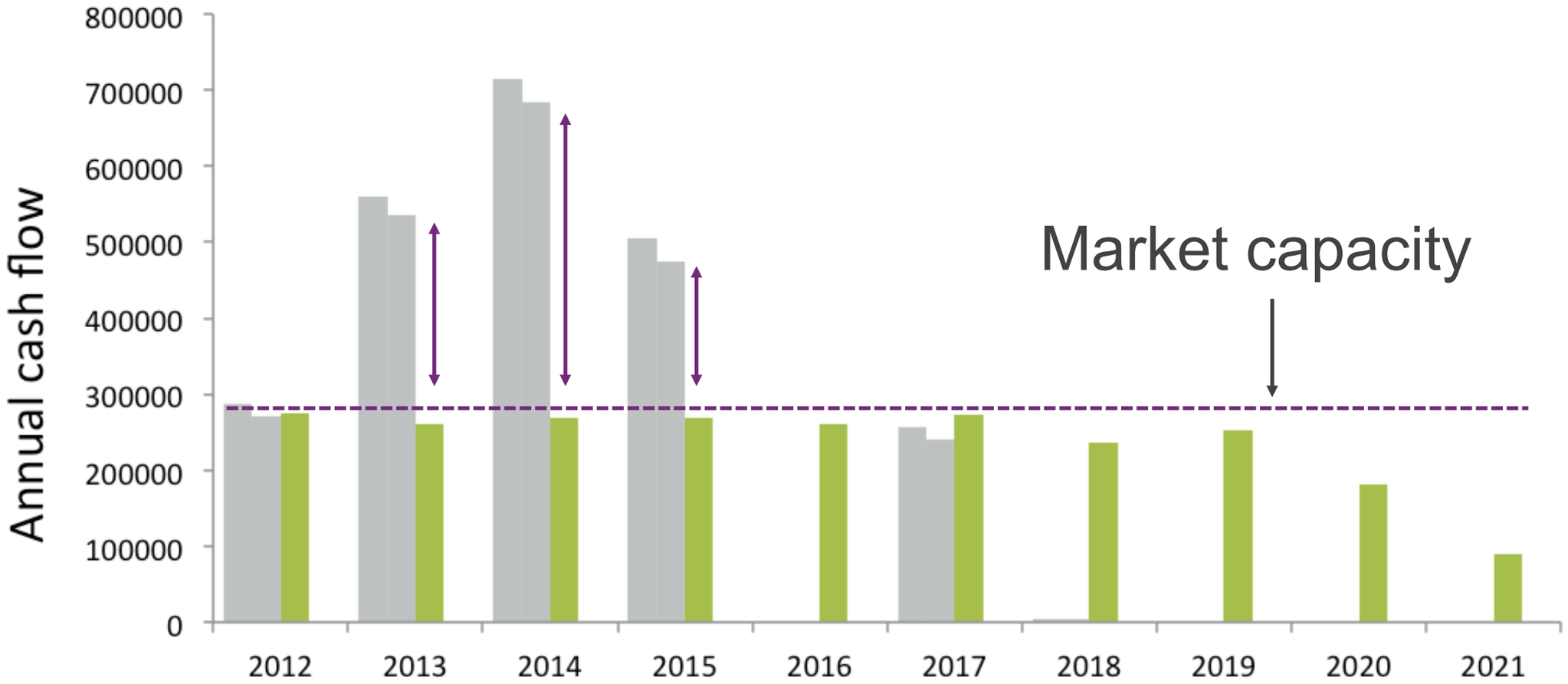
GROWTH MODEL ADJUSTMENT



- The simple growth models were systematically overestimating the harvest potential (as well as the DCF) by an average of 5%

Example of DCF valuation case

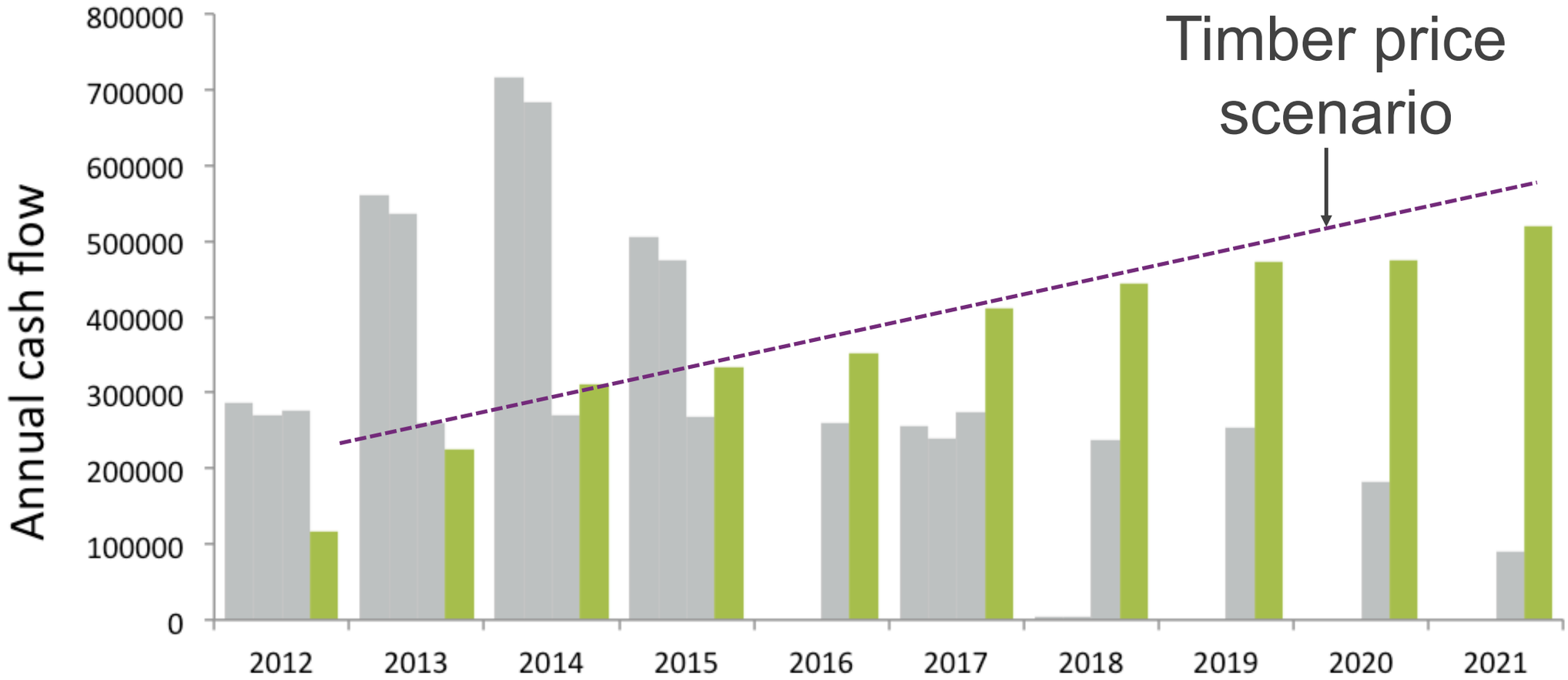
AGE STRUCTURE AND MARKET CAPACITY



- The fixed regime recommended harvests that significantly exceeded market capacity, and overestimated the DCF by over 10%

Example of DCF valuation case

PRICE SCENARIO AND DCF GENERATION



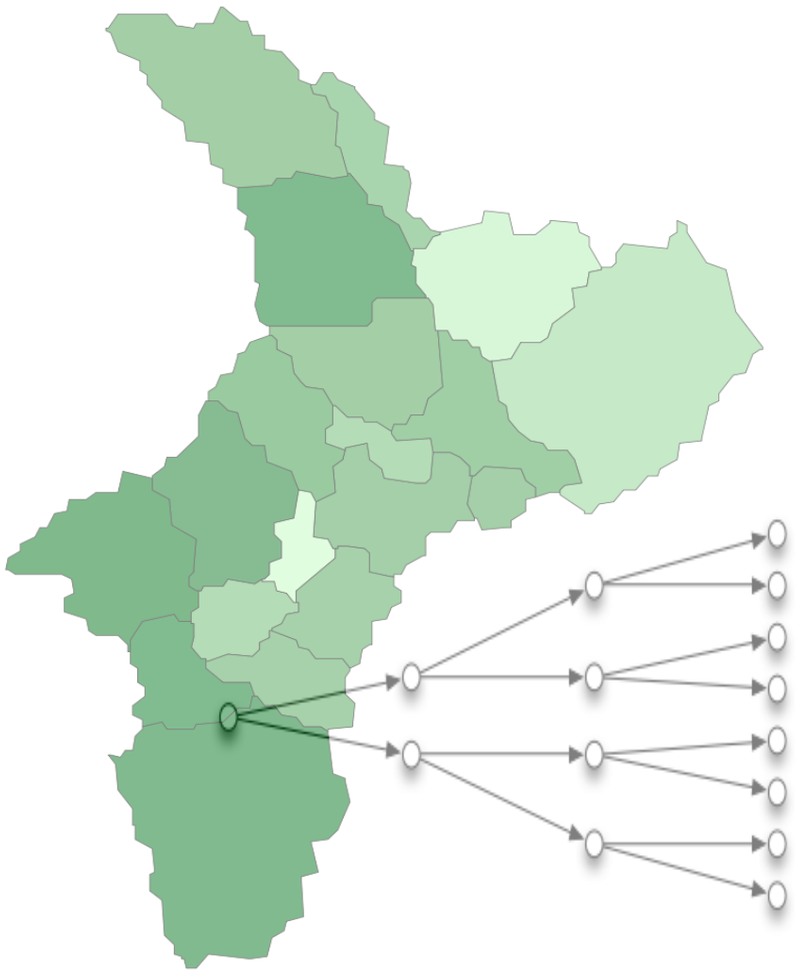
- Market price scenarios did not affect the DCF optimisation, as there commonly is no DCF optimisation in spreadsheet tools

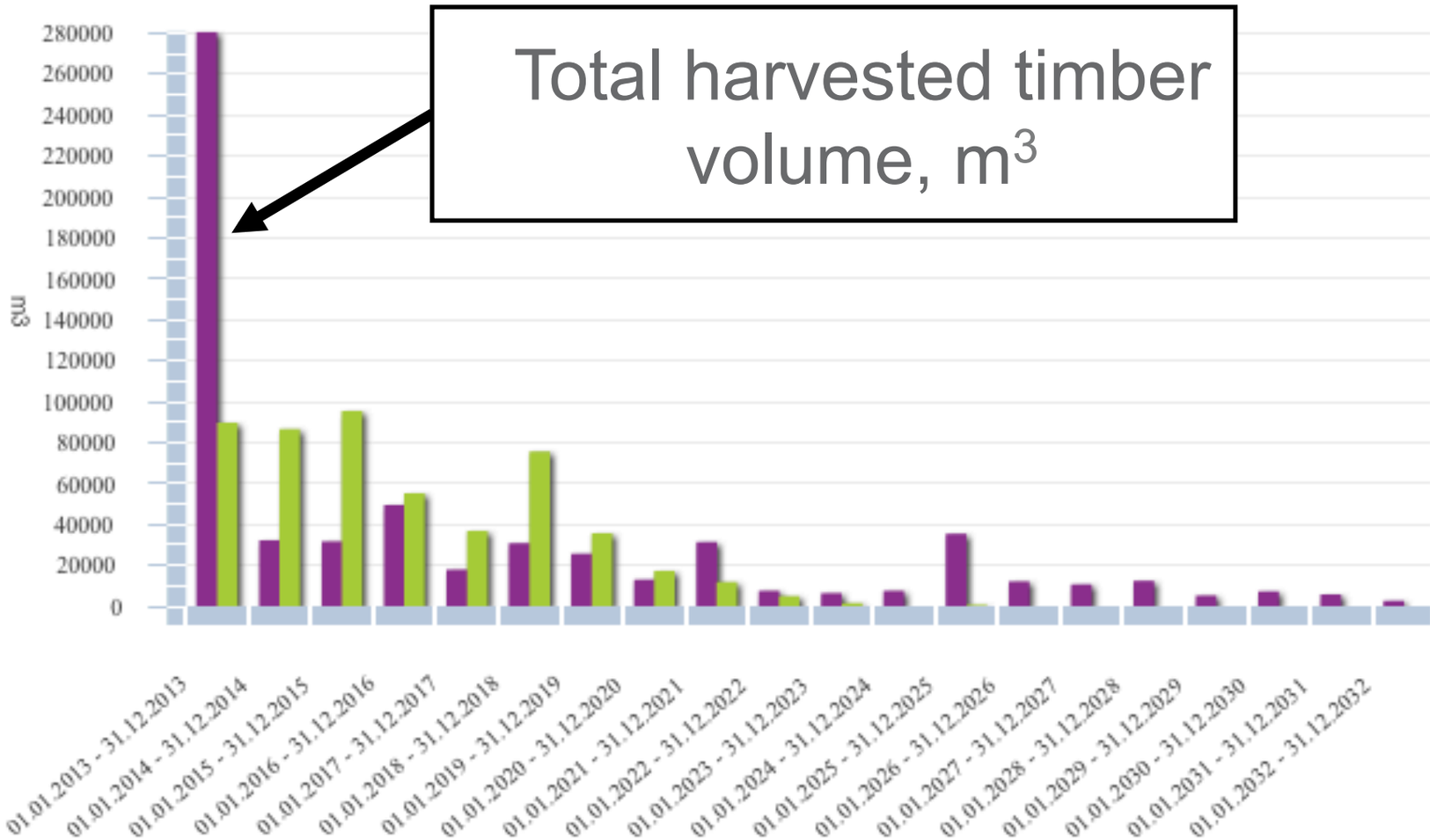
A Forest DSS in use: use case 2, optimal management

- A sibling of the first case, but now concentrating on long-term management planning for a forest estate
  - How to time the harvests to maximize the net present value of the forest estate?
  - Usually here some operational constraints apply, for example you simply can’t harvest more than X m^3 per year.

Example of NPV maximization with and without operational constraints

- **PURPLE:** Maximize Net Present Value
- **GREEN**: Maximize NPV and subject to operational **constraints**





Iptim – a new generation Forest DSS

- Iptim (Integrated Planning for Timberland Management)
- Based on SIMO (SIMulation & Optimization)
  - SIMO is an open source platform: flexible, extendable, NOT accessible.
- Lightweight desktop client
- All of the magic happening in the cloud.
- Easy to use UI on top of SIMO.

Iptim – a new generation Forest DSS

DATA MANAGEMENT – FOREST DATA

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Home | Project | Model | Plan | Report | People

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Data

Inventory results

save revert close

stand

filter

stand id	region	estate	area	soil	bare land	regeneration t...	species	planting date	inventory date	age	age class	basal area	hdom	index age	max. diame...	min. diame...	diameter	height	density	site index	volume	vol...
	South	IV	2.25	medium	no	planted	maximinoi	28.06.2006	31.12.2012	6.5	6	4.23	7.06	20	10.4	4.6	8.03	5.85	893.8	23	15.44	
10298	South	IV	3.09	medium	no	planted	patula	15.02.1994	31.12.2012	18.8	18	10.07	19.94	20	29.9	16.6	21.8	17.7	281.2	21	71.89	
10295	South	IV	2.21	rich	no	planted	patula	18.04.1992	31.12.2012	20.7	20	16.46	23.25	20	33.2	16.7	25.67	20.57	337.5	23	123.39	
10294	South	IV	1.3	rich	no	planted	patula	21.09.1996	31.12.2012	16.2	16	13.64	20.94	20	30.1	15.6	22.35	18.44	366.7	23	98.14	
10297	South	IV	0.42	medium	no	planted	maximinoi	15.04.2008	31.12.2012	4.7	4	1.52	3.58	20	6.1	2.8	4.58	2.71	975	20	1.64	
10296	North	II	7.13	medium	no	planted	maximinoi	19.08.1992	31.12.2012	20.3	20	19.4	24.33	20	30.7	18.9	25.83	21.35	387.5	24	145.75	
10291	South	IV	0.25	rich	no	planted	maximinoi	26.01.2008	31.12.2012	4.9	4	1.78	4.07	20	7.2	3.7	5.14	3.18	906.2	21	2.77	
10290	South	IV	4.35	medium	no	planted	maximinoi	03.02.2002	31.12.2012	10.8	10	10.7	13.29	20	18.2	9.5	14.3	11.58	700	21	63.71	
10293	South	IV	2.89	medium	no	planted	patula	26.05.1989	31.12.2012	23.6	23	17.04	22.49	20	29	18.5	26.32	20.83	325	21	128.73	
10292	North	II	5.33	medium	no	planted	patula	01.04.2002	31.12.2012	10.8	10	6.04	12.11	20	16.5	8.8	13.01	10.26	487.5	20	33.91	
10109	North	I	7.62	poor	no	planted	patula	25.08.2006	31.12.2012	6.3	6	3.42	5.44	20	9	3.7	6.84	4.39	1,000	18	9.91	
10108	South	III	2.72	poor	no	planted	patula	26.09.2006	31.12.2012	6.2	6	2.61	5.53	20	9.2	3.2	6.78	4.41	808.3	19	7.42	
10105	South	III	0.3	poor	no	planted	patula	24.11.1989	31.12.2012	23.1	23	16.06	20.49	20	28.4	15.9	23.47	17.62	400	19	117.07	
10104	South	IV	1.48	rich	no	planted	patula	20.04.1988	31.12.2012	24.7	24	22.67	24.04	20	37.1	20.4	27.26	21.47	412.5	22	172.4	
10107	South	III	2.98	rich	no	planted	patula	11.08.2006	31.12.2012	6.3	6	3.6	6.88	20	9.8	5.1	8.16	5.81	725	23	13.51	
10106	South	IV	14.38	medium	no	planted	patula	08.06.1992	31.12.2012	20.5	20	14.58	20.4	20	26.9	14.9	22.96	17.67	375	20	105.64	
10101	South	III	0.52	rich	no	planted	patula	14.12.2003	31.12.2012	9	9	8.46	11.92	20	16.5	9.9	13.01	10.2	675	24	47.54	
10100	North	I	1.29	medium	no	planted	maximinoi	05.03.2002	31.12.2012	10.8	10	10.06	13.71	20	18.7	10.7	14.79	12.08	608.3	22	61.1	
10103	South	III	16.05	rich	no	planted	maximinoi	03.08.2003	31.12.2012	9.3	9	9.08	13.85	20	18	7.6	14.24	11.9	593.8	26	54.01	
10102	South	III	1.03	medium	no	planted	patula	10.08.2002	31.12.2012	10.3	10	7.42	13.08	20	16.9	8	13.27	10.8	575	22	42.25	
10206	South	IV	0.98	poor	no	planted	maximinoi	19.01.1999	31.12.2012	13.9	13	6.44	16.36	20	21.6	10.1	17.34	13.93	300	21	41.86	

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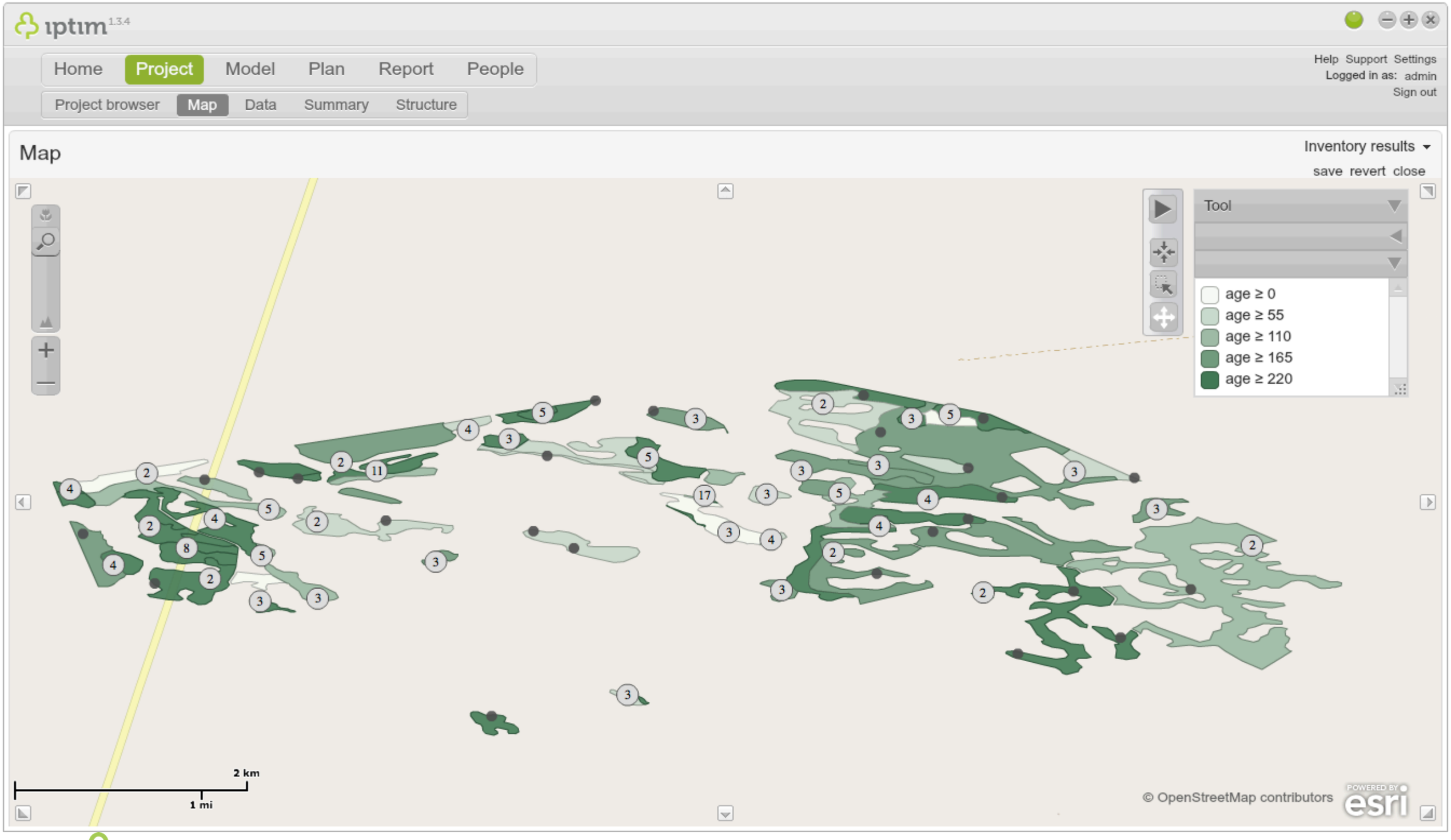
DATA MANAGEMENT – SPATIAL DATA



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DATA MANAGEMENT – SUMMARY STATISTICS

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Summary

stand register
save revert close

summary

summary relationships

Data level: stand — has 128 stands

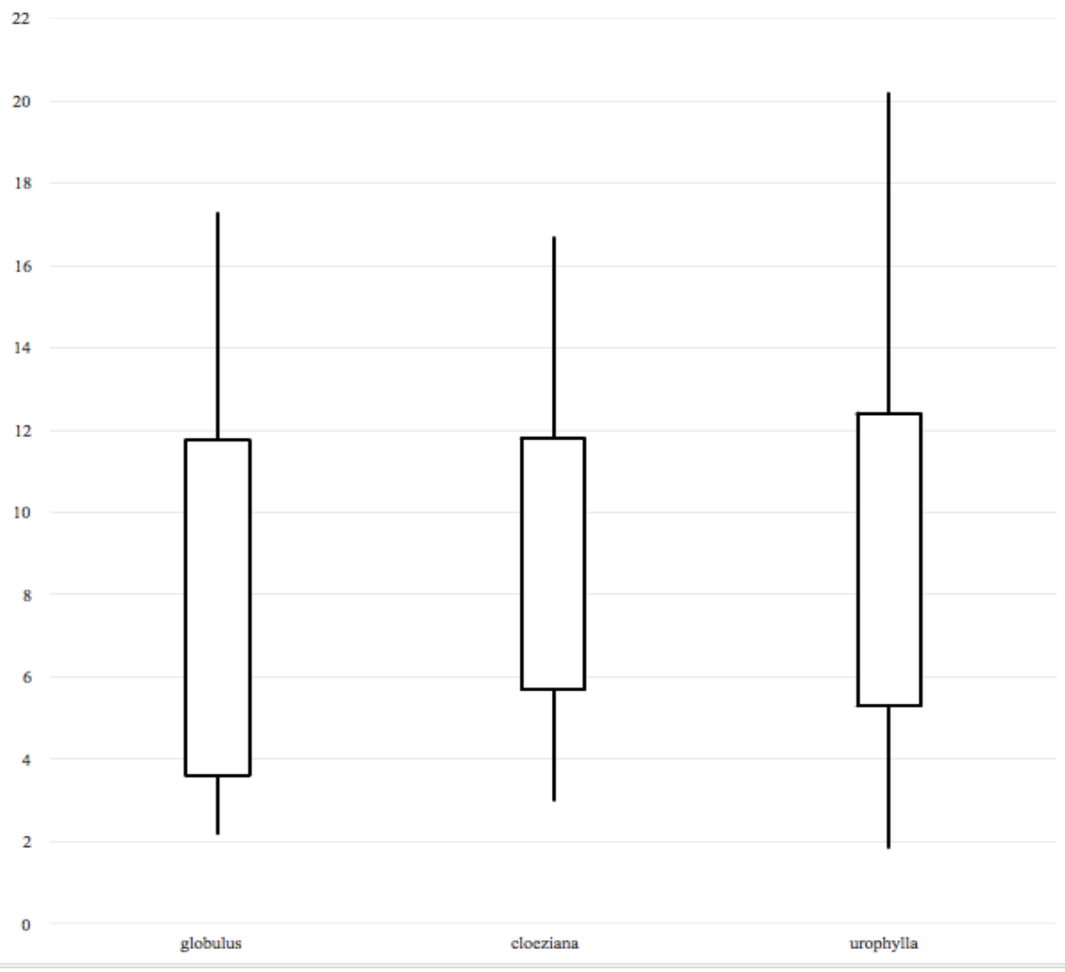
Classify by:

- region
- soil
- bare land
- regeneration type
- species

Numerical properties:

- stand.area
- stand.age
- stand.diameter
- stand.hdom
- stand.density
- stand.basal area
- stand.volume
- stand.site index

Species	Min	Max	Mean	St.dev	Count
globulus	2.19	17.26	7.68	4.113	45
cloeziana	3.01	16.67	8.74	3.101	44
urophylla	1.87	20.18	8.86	3.597	39
TOTAL	1.87	20.18	8.41	3.672	128



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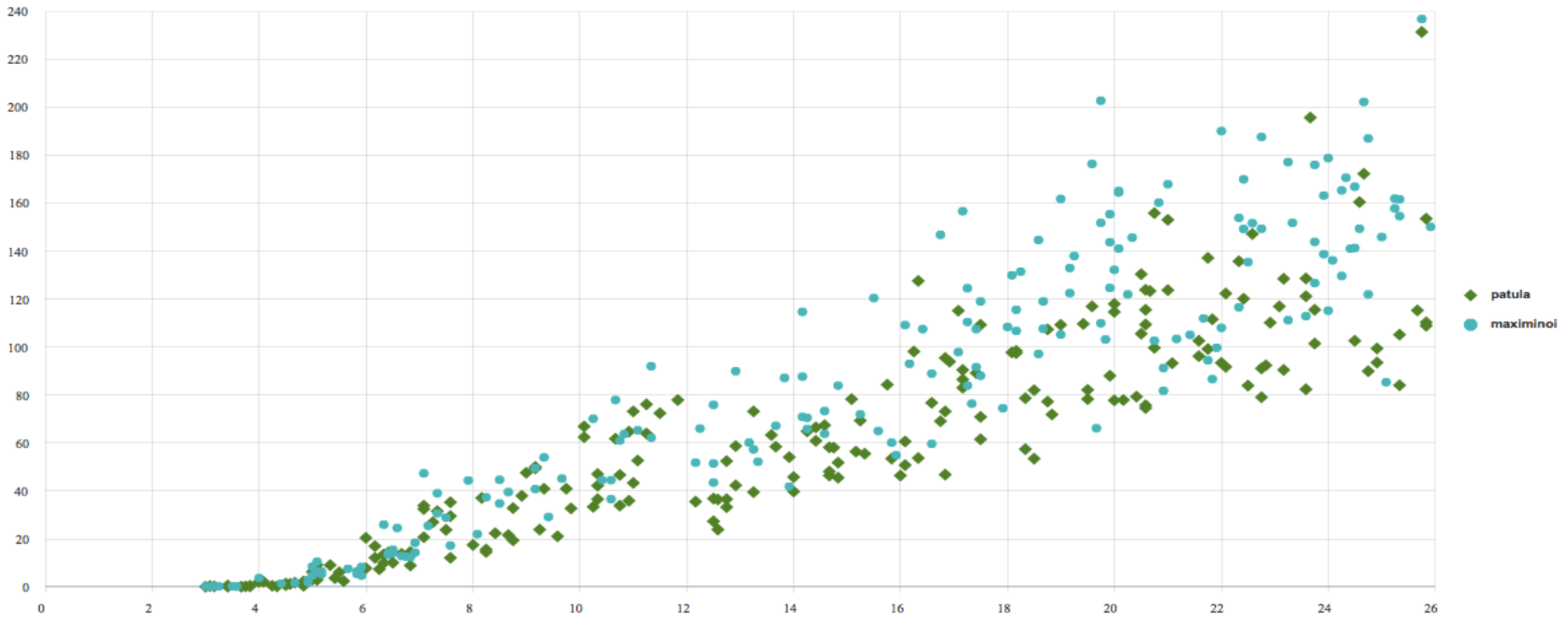
Summary

Inventory results
save revert close

relationships

summary relationships

Data level: stand
X-axis attribute: age
Y-axis attribute: volume
Categories: species



region	estate	area	soil	bare land	regeneration t...	species	planting date	inventory date	age	age class	basal area	hdom	index age	max. diame...	min. diame...	diameter	height	density

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MODELLING – FOREST GROWTH

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Inventory | Taper curve | Growth and yield | Timber prices | Regime

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Growth and yield

Strata

All strata

Brazil pines, model II

clone save close

Select model | Select data | Estimate

Model timestep year

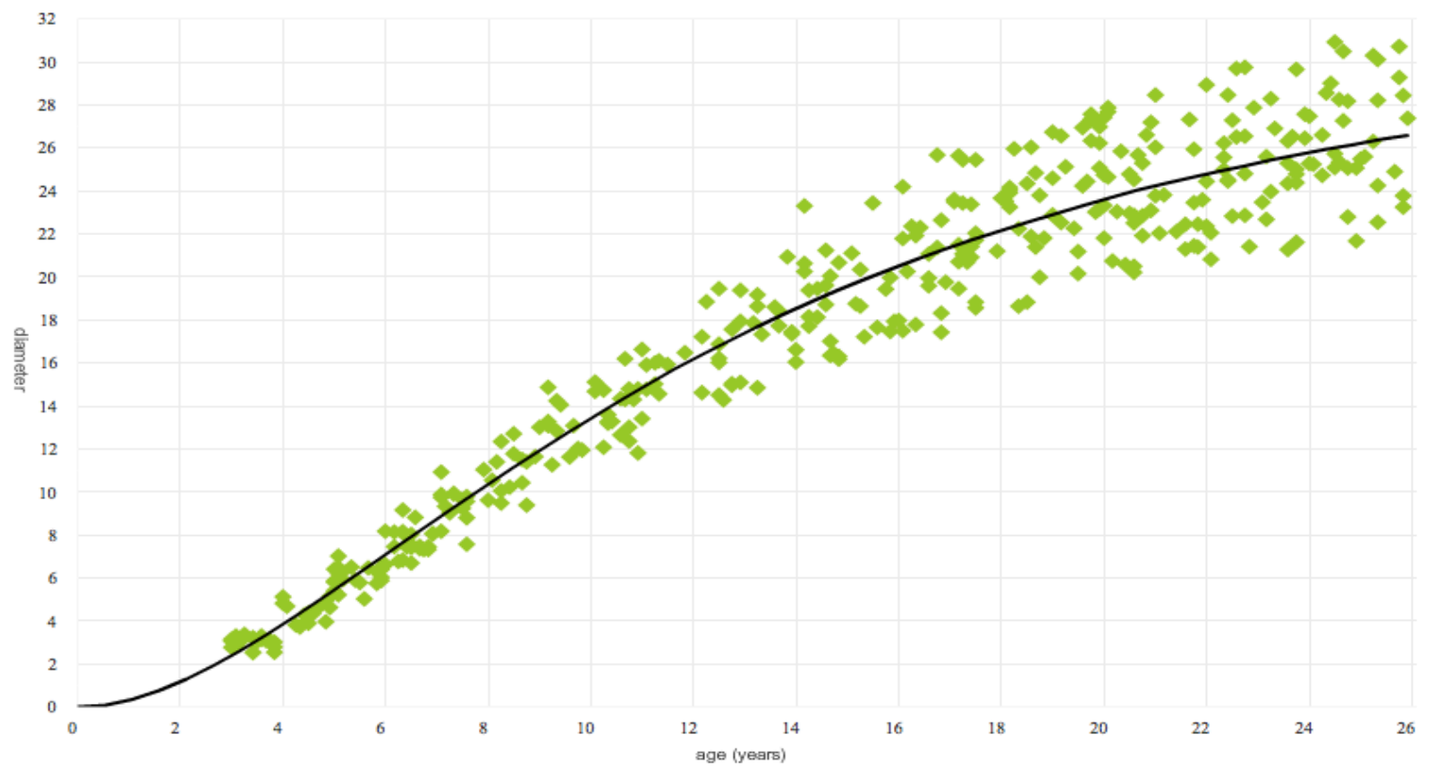
stand attributes logarithmic with weibull 2, years

Model equations

- Dominant height, Chapman-Richards
- Mean height by dominant height
- Mean diameter, logarithmic
- Maximum diameter, logarithmic
- Minimum diameter, logarithmic
- Basal area, logarithmic

Selected equation

D = exp(B0 + B1 * log(A) - B2 * log(N) + B3 * log(Hd))



Variable	Name
A	age

Coefficient	Estimate	Std. error	t value	prT
B0	0.49291822	0.07	7.33	0
B1	0.22393927	0.01	18.52	0
B2	0.02614222	0.01	3.08	0
B3	0.69940558	0.01	75.71	0

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PLANNING – PROBLEM DEFINITION

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Plan

Pines plan VI

save close

Input and objective | Overheads | Capex | Constraints

"variable compared to value" -constraints
"variable compared to variable" -constraints

Variable	From (year)	To (year)	Factor	Conditional to	</>	Variable	From (year)	To (year)	Factor	Conditional to
Harvested volume	2	2	1	add	>	Harvested volume	1	1	0.9	add
Harvested volume	3	3	1	add	>	Harvested volume	2	2	0.9	add
Harvested volume	4	4	1	add	>	Harvested volume	3	3	0.9	add
Harvested volume	5	5	1	add	>	Harvested volume	4	4	0.9	add
Harvested volume	6	6	1	add	>	Harvested volume	5	5	0.9	add
Harvested volume	7	7	1	add	>	Harvested volume	6	6	0.9	add
Harvested volume	8	8	1	add	>	Harvested volume	7	7	0.9	add
Harvested volume	9	9	1	add	>	Harvested volume	8	8	0.9	add
Harvested volume	10	10	1	add	>	Harvested volume	9	9	0.9	add
Harvested volume	11	11	1	add	>	Harvested volume	10	10	0.9	add
Harvested volume	12	12	1	add	>	Harvested volume	11	11	0.9	add
Harvested volume	13	13	1	add	>	Harvested volume	12	12	0.9	add
Harvested volume	14	14	1	add	>	Harvested volume	13	13	0.9	add
Harvested volume	15	15	1	add	>	Harvested volume	14	14	0.9	add
Harvested volume	16	16	1	add	>	Harvested volume	15	15	0.9	add
Harvested volume	17	17	1	add	>	Harvested volume	16	16	0.9	add
Harvested volume	18	18	1	add	>	Harvested volume	17	17	0.9	add
Harvested volume	19	19	1	add	>	Harvested volume	18	18	0.9	add
Harvested volume	20	20	1	add	>	Harvested volume	19	19	0.9	add
Harvested volume	21	21	1	add	>	Harvested volume	20	20	0.9	add

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PLANNING – ANALYSIS

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Home Project Model Plan Report People

Plan Analysis

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Analysis

update

Pines plan III

Pines plan V

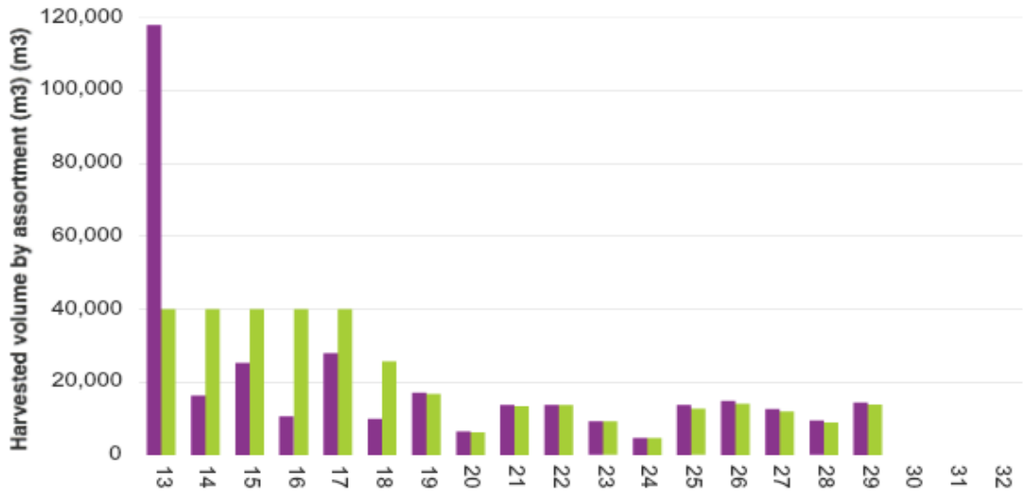
From 2013

To 2032

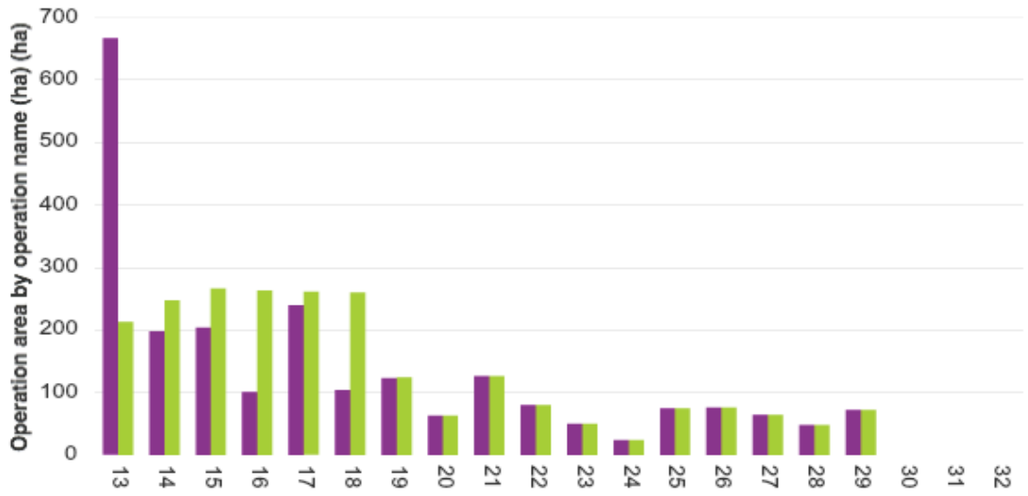
Time Step Year

- Harvested volume by assortment
- Harvested volume by operation name
- Operation area by operation name
- Income by operation name
- Cash flow by operation name
- Area by tree species
- Volume by tree species
- Operation list
- Operation map
- General information

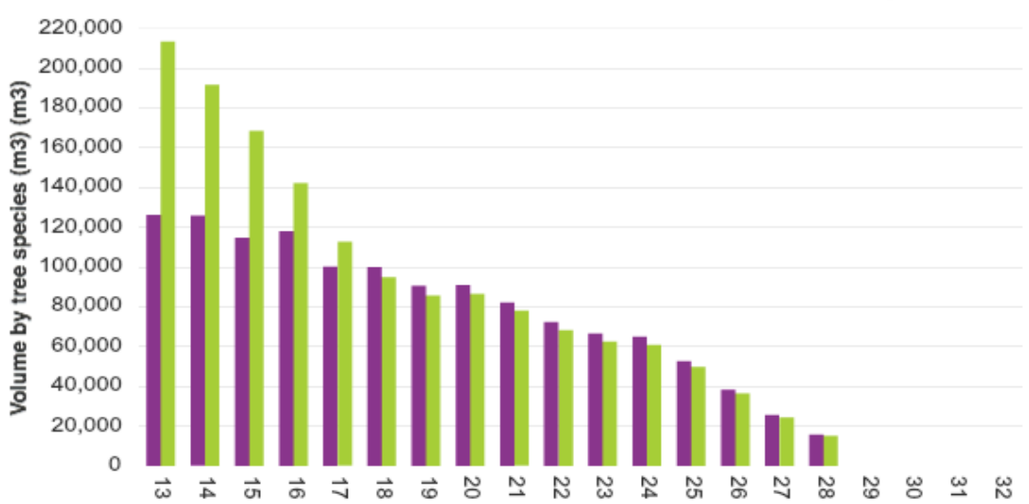
Harvested volume by assortment — view categories export



Operation area by operation name — view categories export



Volume by tree species — view categories export



	Pines plan III	Pines plan V
Total area	1,435	1,435
Net present value	3,713,600	3,121,634
Net present value per area unit	2,587	2,175
Average annual cash flow	267,333	289,845

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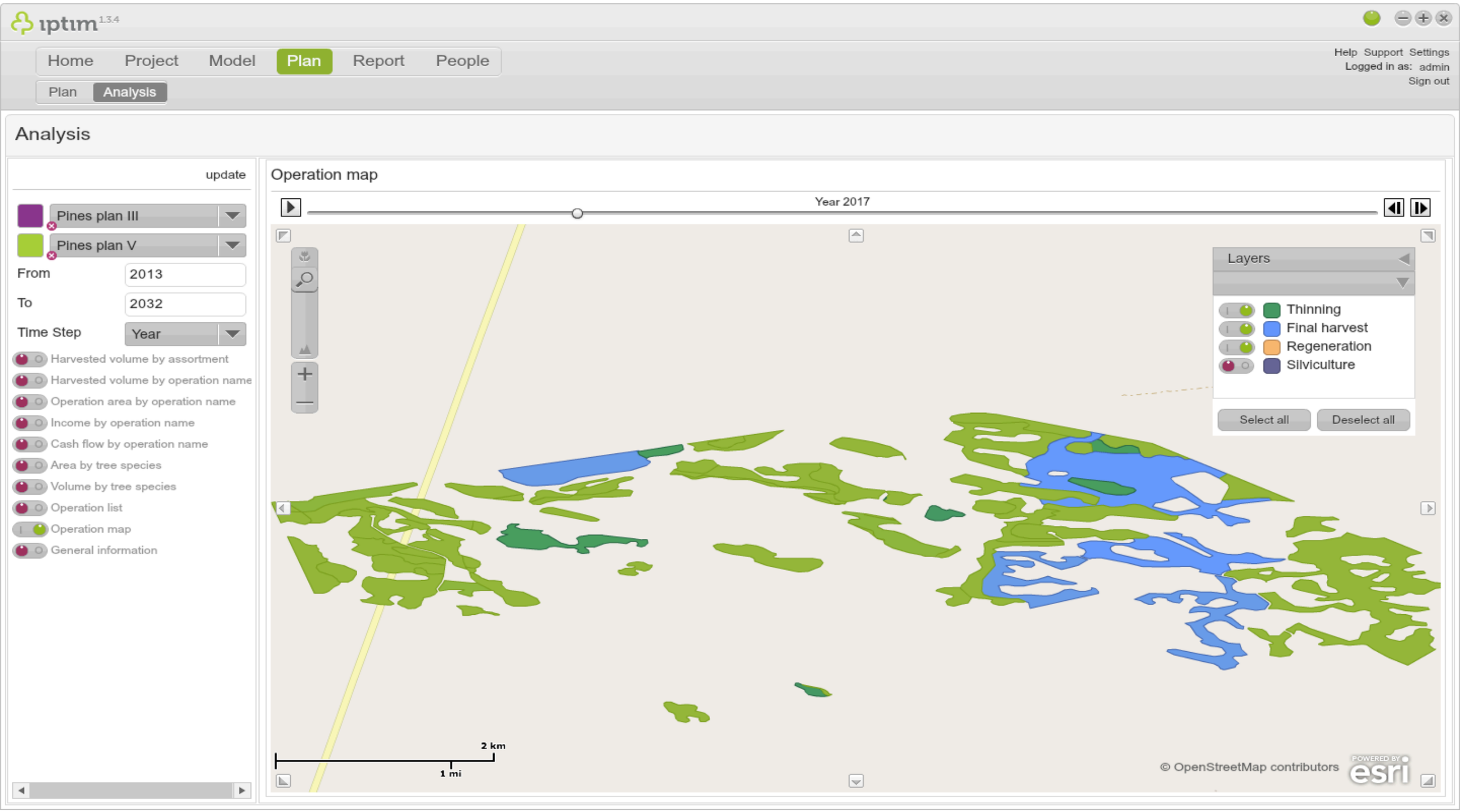
PLANNING – OPERATIONAL MAPS



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PLANNING – OPERATIONAL MAPS

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Plan | Analysis

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Analysis

update

Pines plan III
Pines plan V
From 2013
To 2032
Time Step Year

- Harvested volume by assortment
- Harvested volume by operation name
- Operation area by operation name
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- General information

Operation map

Year 2017

iptim

date	type	name	age	species	area	volume	income	total cost	assort ments	code
31.12.2014	thinning	2nd thinning	12	Pinus patula	42.86	2,512.84	41,461.93	-25,296.58	open	
31.12.2022	final har	Clearcut	20	Pinus patula	42.86	6,810.58	183,885.7	-74,452.72	open	

stand id	soil	bare land	regeneration type	species	planting date	age
10227	medium	no	planted	patula	20.03.2003	9.83

Back

Layers

- Thinning
- Final harvest
- Regeneration
- Silviculture

Select all | Deselect all

2 km
1 mi

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Iptim+ is the system plus services

- Assessment of our client's **strategic plans**.
- Periodical **data** import
- Creation of optimized strategic plans to support their **objectives** while considering restrictions.
- Personalized **models** with the best data available.
- Precise **projections** of harvest volumes, volume of standing timber, cash flows, etc.
- Tailored **Reports**

About us

Simosol is a leading provider of services for forest asset valuation and management optimization.

Planning support for over 15 million hectares valued at 40 billion EUR

Active projects in Europe, Latin America and Asia.

Thank you!

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