



4C user manual

Socio Economic Analysis (SEA)

The Socio Economic Analysis (SEA) allows analysing a wood stock due to the aspects of costs, revenues and subsidies in a given time frame.

SEA uses the 4C information about the harvested wood, standing stock and silvicultural operations of a simulated area, sorts the input analog to WPM into different timber grades and computes the costs, assets and subsidies per year. Unlike the WPM it analyses also the standing stock in respect to its financial value. As further input SEA needs a “sea_prices.wpm” input file with the current prices. This file contains timber prices, silvicultural costs and possible subsidies.

1 GETTING STARTED

To get started following is required:

- Set the “flag_wpm” to the desired value
- Make sure forest management took action
- A “sea_prices.wpm” file must exist in the input directory (can not be a dummy file).

Flag Options

flag name	value	description
flag_wpm	0	no calculation of sea and wpm
	1	calculation of wpm with the German parameter set
	2	SEA calculation
	3	WPM and SEA calculation
	21, 31	WPM with other parameter sets

2 THE OUTPUT

Four output files are generated. The output includes the different sorted timber grades of standing stock and harvested wood, estimated costs, assets and resumed values as liquidation value, net present value (NPV) and NPV+.



Output Files Description

extension	description
"_sea"	costs and revenues for standing stock, harvested timber, silvicultural costs, fixed costs and subsidies
"_sea_ms"	timber grading of harvested wood
"_sea_st"	timber grading of standing stock
"_sea_npv"	liquidation value, NPV, NPV+ (NPV with four different interest rates a-d, the first rate a is 0)

The liquidation value indicates the value of the standing stock over the years. NPV contains the revenues of harvested timber in regard to the given interest rates.

3 THE IMPLEMENTATION

The Implementation of SEA contains following components

- data module
- SEA functions
- implemented interfaces in the 4C simulation
- initial, allocate and deallocate functions

4 DATA MODULE DATA_WPM

This table lists variables stored in the *data_wpm* module used for SEA.

data_wpm Description

stored in	description
mansort, standsort, manrec	data from the 4C simulation mansort: harvested timber standsot: standing stock manrec: management information
nr_years	simulation years number
mansort_tg, standsort_tg	sorted timber grades of harvested wood and standing stock
chainsaw_prices, harvester_prices,	prices from the SEA prices file



stored in	description
planting_price, planting_subs, fence, fix, brushing, tending_prices, ext_for	
int_rate	interest rates for NPV
sum_costs	cumulative costs: entire sum of all costs and partial sums (subsidies, silvicultural costs, harvested timber costs, standing stock costs) per year
subsidy	stores subsidies calculation values
npv	the estimated NPV values
net_prices	timber prices per species
hsystem	percentage of chainsaw to harvester methods of harvesting (usually set to 0.2 to 0.8)
plant_year	year of planting
flag_plant	planting flag for estimation of the planting
ms_costs, ms_assets	the costs and revenues for harvested timber
st_costs, st_assets	the costs and assets for the standing stock

5 THE SEA FUNCTIONS

The SEA consists of following steps:

- sorting of standing stock and harvested timber into timber grades
- calculation of costs, silvicultural costs, subsidies and revenues for sorted timber grades per year
- calculation of summation values: liquidation value, NPV, NPV+

5.1 The Sorting of Timber Grades

The assortments from *mansort* and *standsort* inputs are sorted in the way similar to the first step in WPM. The single timber grades results from sorting the wood according to the type, specification and the diameter of the trunk. The *mansort* input (harvested timber) must be summed up due to the years of management listed in *manrec* input (s. WPM). The standing stock grading is done for each year.

Timber Grading of Harvested Wood and Standing Stock



type	spec	diam in cm ²	timber grade index	number of timber grades
fue	1, 2, 3, 4		1	4x
in1 + in2	1, 2, 3, 4		2	4x
sg1 + sg2	1, 2, 3, 4	<15	3	20x
		15-20	4	
		20-25	5	
		25-30	6	
		> 30	7	
ste1 + ste 2	1, 2, 3, 4	25-30	8	12x
		25-30	9	
		> 35	10	

The volume per year v specified in the timber grades is calculated by the following equation:

$$v = \text{volume} * \text{number},$$

where volume and number are estimated in the *timsort.f* subroutines.

A fix part (0.4) of timber grades values are shifted to the timber grades of the lower quality.

$(sg1, sg2, ste1, ste2) \Rightarrow (in1, in2)$

$(in1, in2) \Rightarrow (fue)$

The results of timber grading are stored in “sea_ms” and “sea_st” output files.

5.2 The Economical Analysis

The sorted timber amounts can now be evaluated due to the timber prices, silvicultural costs and subsidies.

The harvest costs, also the virtual harvest of the standing stock, are calculated. For the amount of harvested timber the actual harvests are taken into account. For the standing stock potential harvest costs are calculated yearly. Analog the revenues due to the given prices are computed.

The silvicultural costs and corresponding subsidies are estimated due to the management in certain years. Management operations are:



- tending
- brushing
- felling
- shelterwood system 1 and 2
- felling after shelterwood system
- thinning,
- planting

Planting costs are down to the amount of the planted trees per ha and the tree species. The planting method is estimated by the stored *flag_plant*. Some management activities combine several costs and subsidies categories.

Costs and revenues can now be aggregated over the years to the NPV and NPV+ due to the interest rates.

The costs and revenues for every tree species are aggregated per year in the output file “_sea”. NPV and NPV+ values can be found in the “_sea_npv” output file.

The overview of the SEA subroutines are shown in the following table.

Subroutines and their Description

subroutines	description
read_sea_prices	read the SEA prices file
sort_standsort, sort_standsort	timber grading of harvested timber and standing stock
sort_industrial	fix part (0.4) of timber grades is shifted to the grades of lower quality
calculate_harvest_costs	calculate harvest cost
calculate_assets	calculate revenues for the standing stock and actually harvested wood due to the net prices
calculate_costs	calculate costs and corresponding subsidies due to the management method: tending, brushing, felling, shelterwood system 1 and 2, felling after shelterwood system, thinning, planting
calculate_npv	calculate NPV, NPV+ due to the interest rates



5.3 The Coupling to the 4C implementation

The coupling of the SEA and the 4C implementation can be distinguished into two parts:

- the input interface and
- the output interface

As mentioned above, SEA uses *mansort*, *standsort* and the *manrec* data modules. Also the information about planting, such as planting year, amount of planted trees and the stock mixture is a matter of concern. Some general information such as number of simulation years are needed, too.

For the output the changes were made to match the 4C output interface in three files: *amod_out.f*, *old_out.f*, *output.f*.

The deallocation of wpm is called after the one simulation run is over in *finisim.f*

Input Interface

data	where
<i>mansort</i>	sorting of timber in <i>timsort.f</i> , harvested timber
<i>standsort</i>	sorting of timber in <i>timsort.f</i> , standing stock
<i>manrec</i>	management subroutines in <i>management.f</i>
<i>year etc.</i>	import of the data_simul module
<i>plant_year</i>	planting subroutines in <i>planting.f</i>
<i>num_plant</i>	planting subroutines in <i>planting.f</i>
<i>flag_plant</i>	planting subroutines in <i>planting.f</i>

SEA Subroutine Calls in 4C

content	Fotran files
SEA subroutine calls	simul.f finisim.f
SEA data, subroutines etc.	wpm.f wpm_wood_proc.f amod_wpm.f



content	Fotran files
output interface	amod_out.f old_out.f output.f
input interface	timsort.f management.f planting.f simul.f amod_simul.f