



EFORWOOD

Sustainability Impact Assessment
of the Forestry - Wood Chain



Project no. 518128

EFORWOOD

Tools for Sustainability Impact Assessment

Instrument: IP

Thematic Priority: 6.3 Global Change and Ecosystems

Deliverable PD1.0.6
Description of the EU-FWC

Due date of deliverable: Additional deliverable

Actual submission date: Month 54

Start date of project: 011105

Duration: 4 years

Organisation name of lead contractor for this deliverable: EFI

Final version

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Organisation of lead contractor for this draft report:

EFI

Partners involved:

ALUFR

INRA

KCL

Pöyry

Skogforsk

STFI-PF

UMP

vTI

Researchers involved:

Diana Vötter (EFI)

Marcus Lindner (EFI)

Taru Palosuo (EFI)

Risto Päivinen (EFI)

Wendelin Werhahn-Mees (EFI)

Staffan Berg (Skogforsk)

Katri Behm (KCL)

Helena Wessman (KCL)

Pia Nilsson (Pöyry)

Gero Becker (ALUFR)

Jean-Michel Carnus (INRA)

Janine Fischbach (ALUFR)

Hannele Lehtinen (Pöyry)

Gert-Jan Nabuurs (ALTERRA)

Leif Nutto (ALUFR)

Carl Olsmats (STFI-PF)

Anna von Schenck (STFI-PF)

Birger Solberg (UMP)

Petri Vasara (Pöyry)

Mitja Piskur (GIS)

Table of contents

- Table of contents 3
- 1 General structure of EU-FWC 5
- 2 Definition of the EU-FWC..... 9
 - 2.1 EU FWC System boundaries, its treatment, modelling and calculation... 9
 - 2.2 M2, Forest resource management 15
 - 2.3 M3, Forest to industry interaction 17
 - 2.4 M4, Processing and manufacturing 21
 - 2.5 M5, Industry to consumer interactions 21
 - 2.6 EU-FWC Indicators 23
 - 2.7 Country groups 24
- 3 Scenarios for EU FWC 25
- 4 Practical implementation..... 27
- 5 Management of the EU-FWC..... 28
 - 5.1 Nominated participants of the EU-FWC Task force: 28
 - 5.2 Partners assigned for data collection..... 28
- 6 Acquisition and Validation of Collected Data 31
- 7 Appendix 33
 - 7.1 Short indicator list EU-FWC 33

Summary

This report gives an overview of the agreed definition of the “EU FWC Analysis” case in EFORWOOD. It summarises discussions on the structure of the application, the selection of indicators, the specification of the Scenarios and possibilities for acquisition and validation of data.

This deliverable is to be updated, if necessary, four weeks after the EFORWOOD week in Freiburg, and once more as input to the final report.

1 General structure of EU-FWC

The EU-FWC is the widest application undertaken within the EFORWOOD project. This application aims to describe the European level FWCs.

The basic approach in the EU-FWC is that

- FWC topology is described at country level, starting the development with the country groups that include countries with similar chain topology
- volume flows are calculated at process level in each country– a processes may have zero volume in some countries,
- Indicators are given for processes in countries. Indicators within country groups may have the same value.

The topology development process has started by creating module templates for country groups (M3 – M5, figures 1-6 below). M2 is described with one process per tree species in each country (Figure 1). These templates were combined and copied for 25 EU- countries plus Norway and Switzerland.

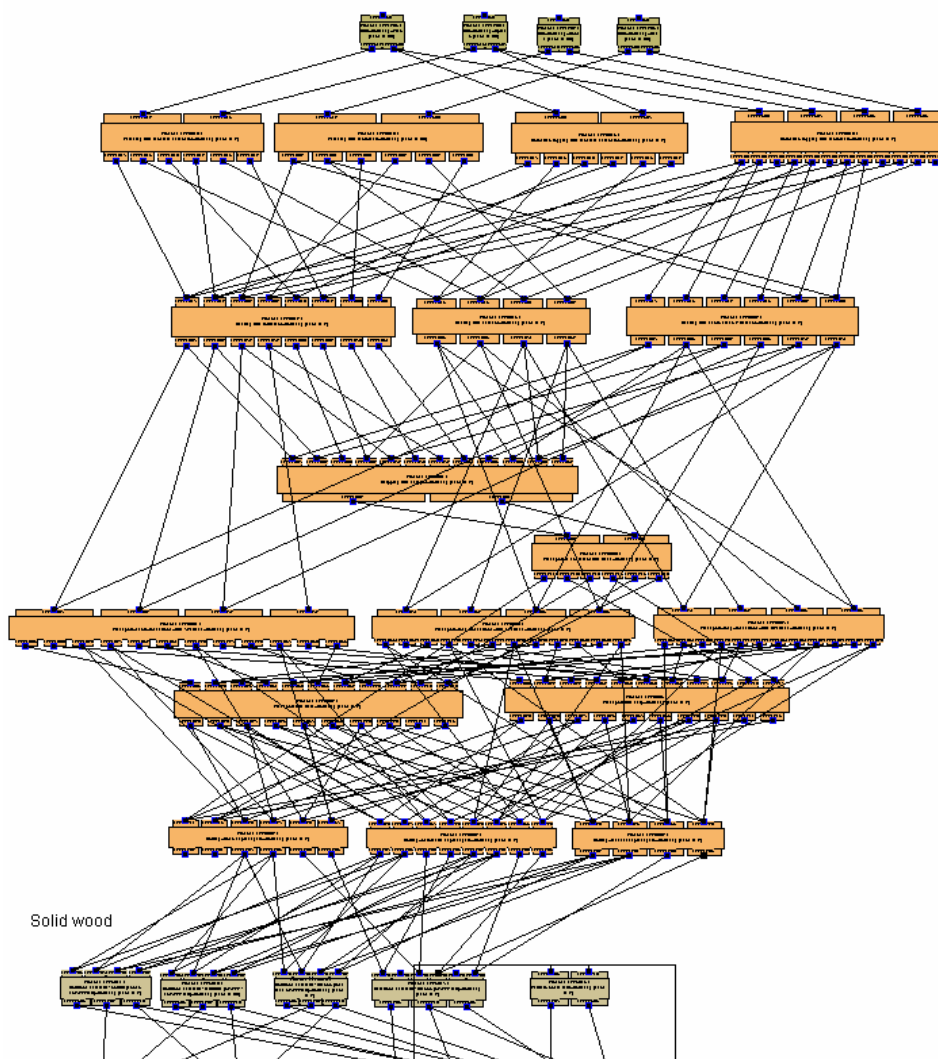


Figure 1: Current (12/02/2009) M2 (green boxes), M3 (orange boxes) and M4 (green boxes) chain topology for Germany..

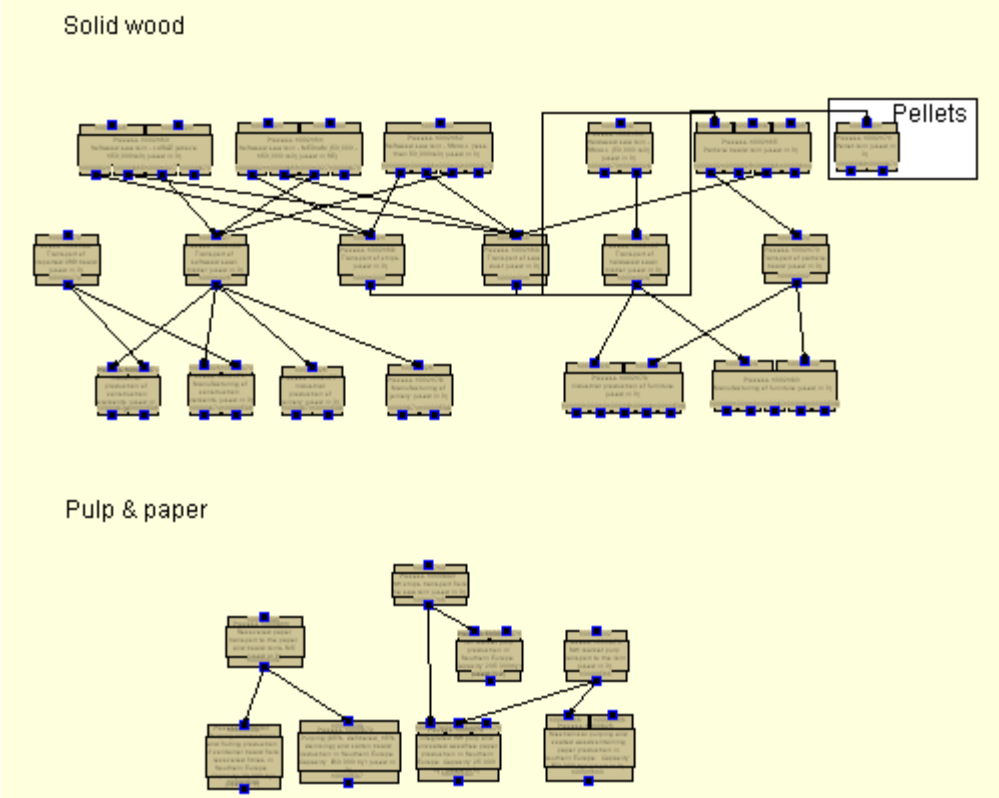


Figure 2: Current (18th Dec. 2008) M4 chain topology for southern country group.

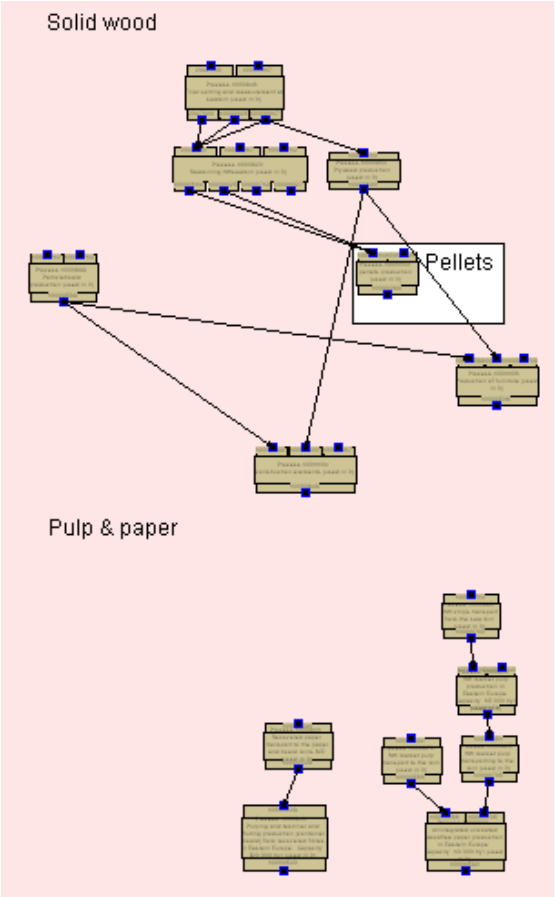


Figure 3: Current (18th Dec. 2008) M4 chain topology for eastern country group.

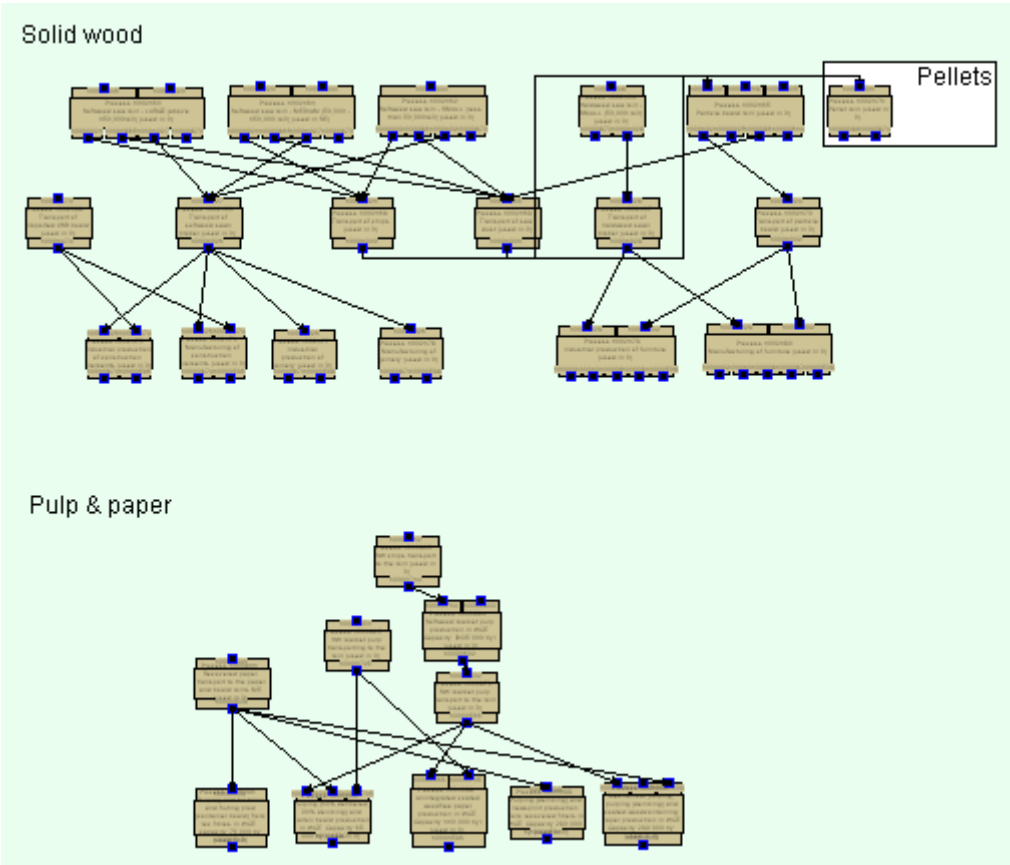


Figure 4: Current (18th Dec. 2008) M4 chain topology for western-central country group.

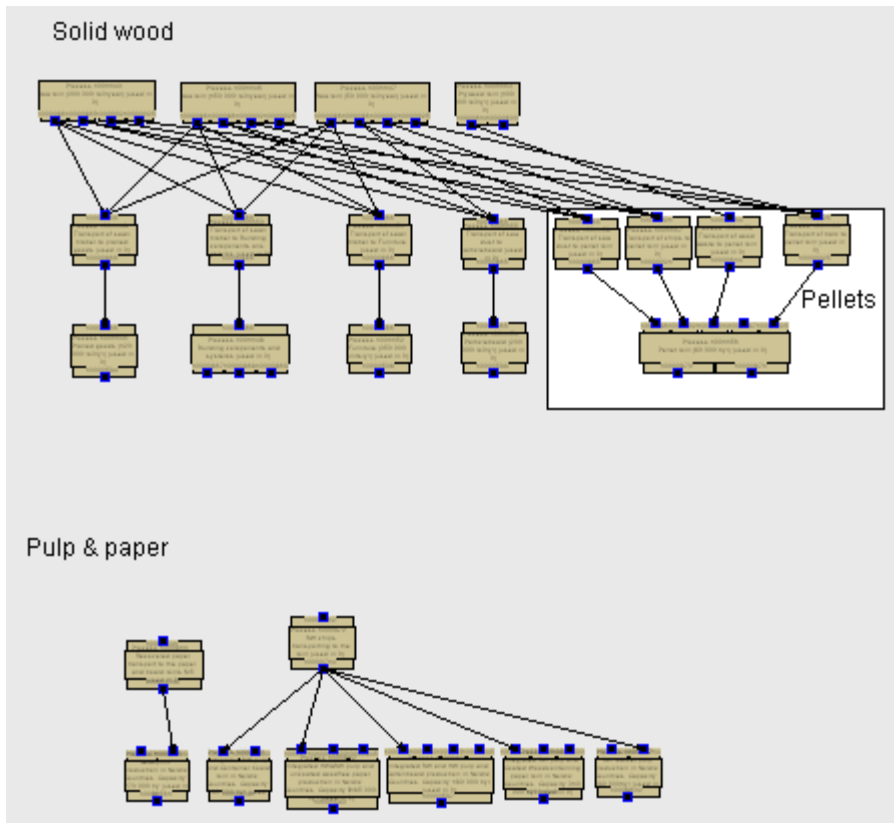


Figure 5: Current (18th Dec. 2008) M4 chain topology for a nordic country group.

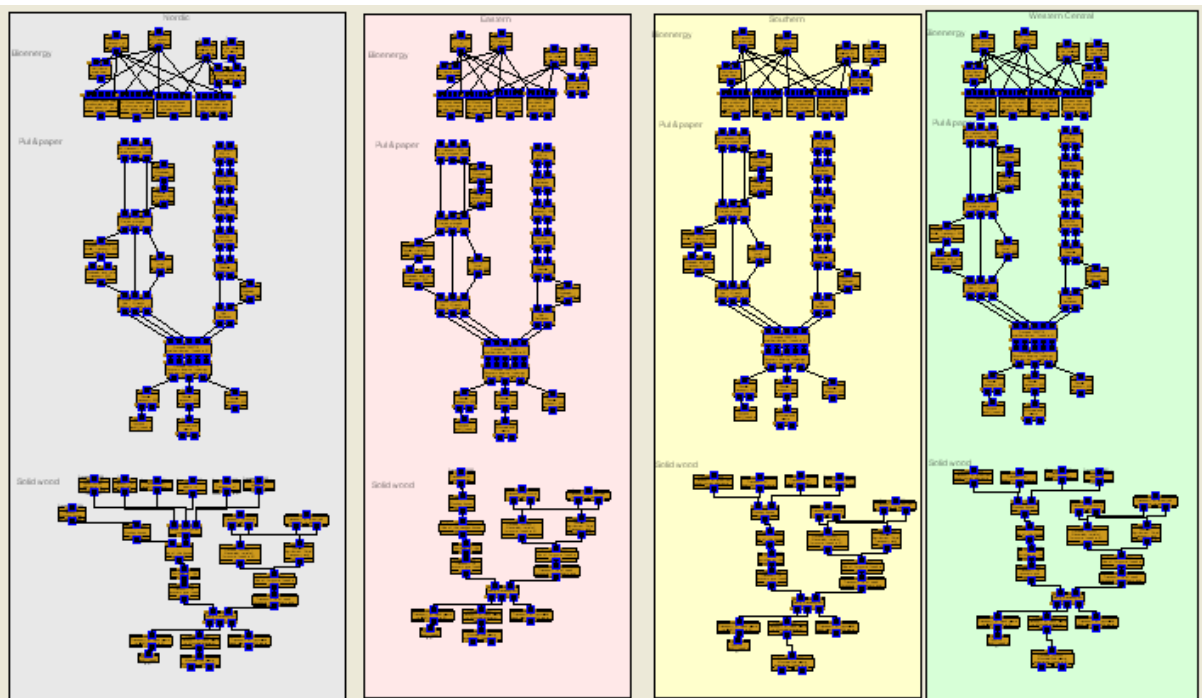


Figure 6: Current (18th Dec. 2008) M5 chain topologies for different regions (coloured boxes). The chain parts from top to down in each region are Bioenergy, Pulp and paper & Solid wood.

2 Definition of the EU-FWC

2.1 EU FWC System boundaries, its treatment, modelling and calculation

Geographical boundaries –Europe (*import-export harbour*)

The EU-FWC chain includes 27 countries (EU-25 + Norway and Switzerland). The system boundaries are set at the harbours of EU25+2, i.e. the transportation from and to the harbour within EU is considered, but not the transportation from and to the harbour outside EU27.

In this case EU25+2 (Norway and Switzerland) is the system boundary. Imported wood-based materials appear therefore at the EU border for the first time and are treated as all other input materials without pre-loaded indicator values. From then on they are treated as described below for inner EU25+2 trade flows



Figure 7: Scope of EU FWC study and its boundaries

(import/exports). Indicators are only calculated based on distances to/from the exporting/importing harbour, and for those the same procedure applies as for imports/exports within EU25+2 (see description below). Volumes go to/come from product buckets (see description there).

M2-M3 boundary:

Information about the available forest resource, the annual cuttings and shares of products is given and entered for the M2 processes (including information for the M2-M3 boundary) by MartJan Schelhaas, ALTERRA. This information is the starting point for the chains' flow calculations.

Example case for Germany pine (not real data!)

Total area of pine in Germany: 5000 ha, average stemwood volume 200 m³/ha ob, branch volume 30 m³/ha ob. In 2005, 1000 ha is thinned, with 50 m³/ha ob stemwood and 10 m³/ha ob branchwood. 500 ha is harvested (final harvest) with 300 m³/ha ob stemwood and 100 m³/ha ob branchwood.

Process: CEU_Germany_Pine

Time: 2005

Processes on the M2/M3 boundary (M2 specific)

Area of the managed forest:	5000 ha
Stem volume:	200 m ³
Volume of tree tops and branches:	30 m ³ /ha
Volume of belowground biomass:	YY m ³ /ha

Processes on the M2/M3 boundary (M3 specific)

Volume of harvested roots (stump):	ZZ m ³ /ha
Share of total harvested volume of the total standing volume:	0.2

Output products tab:

EU_PineTreesReadyforThinning share	0.67
Conversion factor from product unit to m ³ :	50
EU_PineTreesReadyforHarvest share	0.33
Conversion factor from product unit to m ³ :	300

Indicators tab:

Calculate indicators referring to the total area of the process (thus all pine area in Germany covered with EFISCEN).

Assumptions field:

Total area of pine in Germany: 5000 ha, average volume 200 m³/ha

In 2005, 1000 ha is thinned, with 50 m³/ha. 500 ha is harvested (final harvest) with 300 m³/ha.

Import/Export Material Streams

Incorporating trade between countries proved to be particularly challenging. Products are widely traded between European countries, leading to a huge number of possible connections between national FWCs.

Trade flows between countries were captured in a simplified way by the introduction of import/export buckets for 6 product groups: Roundwood; Primary conversion wood products; Secondary conversion wood products; Paper/board; Pulp; and (Bio-)Energy.

The information about the exports and imports from each country to/from the transport buckets have been derived using bilateral trade data of EUROSTAT of the respective goods represented in the EU-FWC. Average import and export distances (km) per country for all three transport modes (road, rail, water) and the 6 bucket product groups for all EU25+2 countries were estimated based on compiled NACE-classifications per bucket groups. Imports from outside the EU are only tracked as soon as they appear inside the EU-borders. Imported wood is thus not pre-loaded with any indicator values for e.g. greenhouse gas emissions or transportation costs.

For cross-border transport within EU countries the following assumptions were agreed upon:

Import-export-buckets:

- Use of import-export buckets for inner-EU25+2 transports per product group.
- Use of import-export buckets per product group also for volumes entering/leaving EU25+2
- These buckets cover all products and sub-products (more detailed, but not listed). Eg in M4, newsprint, magazine paper, coated woodfree paper, uncoated woodfree paper, container board and carton board are produced. All these are included in the “paper/board”-product group and will enter from the (intra-)country chains the transport process by their names (eg newsprint, magazine paper, coated woodfree etc.) and arrive there to/from the buckets as just “paper/board”.
- Those import/export buckets per product group are:
 - Roundwood (M3)
 - industrial roundwood including other industrial roundwood (in addition to C¹ & NC²)
 - Primary conversion wood products (after sawmilling, M4)
 - total sawnwood
 - total panels
 - Secondary conversion wood products (joinery, windows, etc, M4)
 - Wooden furniture

¹ C = coniferous

² NC = Non-coniferous

- Builders joinery
- Paper/board³ (M5)
 - Total paper
- Pulp (M4, M5)
 - Total wood pulp
- (Bio-)Energy (including forest wood chips, saw mill chips, pellets, other forms of wood-based material; M3, M4, M5)
 - chips & particles + wood residues

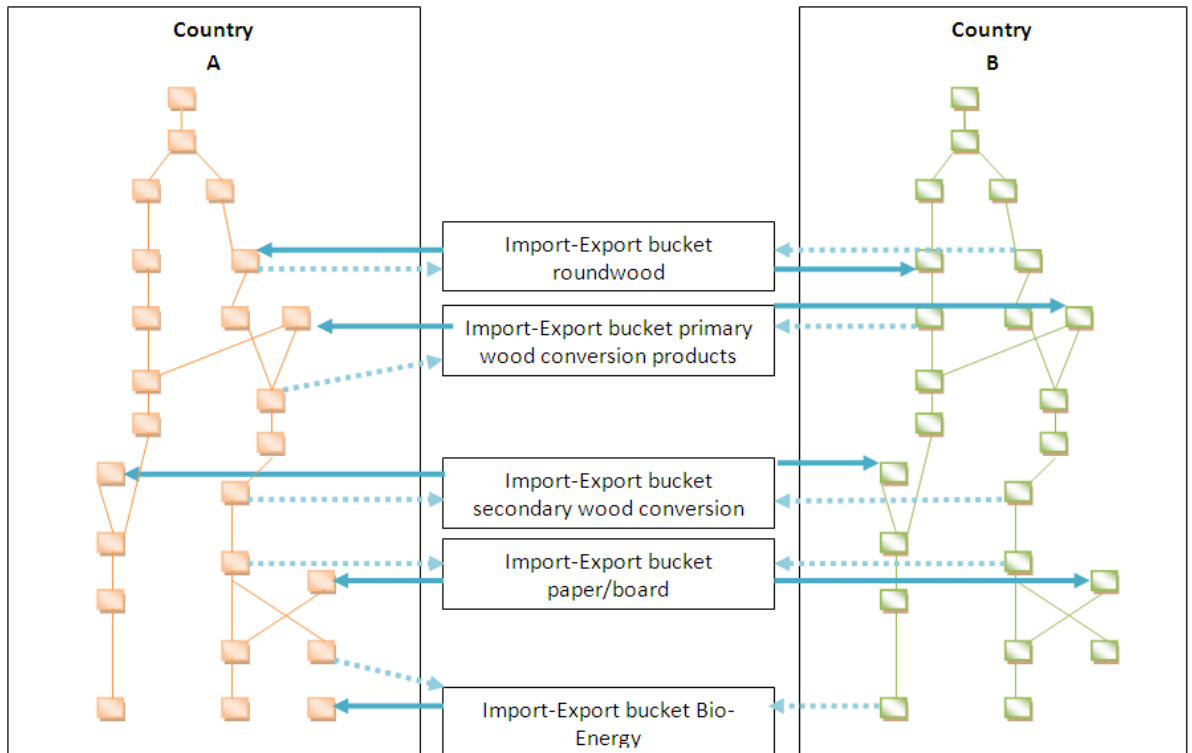


Figure 8: Application for import-export buckets.

- These buckets are just groupings of volumes of certain types of material and can be attached to any process. For example, material from the bucket “Bio-Energy” can be used for heating processes, but also for the production of OSB- or other boards. These uses are to be stated by the experts defining the respective processes under process assumptions.
- Volume flows at module level sum up to 60-80% and include imports, exports and within country processed wood-based material.

Calculation of transports (export/import)

Import and export processes are transport processes, and for the calculation of their indicator values the “transport tool” from FCBA is used.

³ IP Board 24: “At the system boundaries meeting on Nov. 20 (see Annex 2 to these IP Board minutes) it was among other things decided that products including more than 50 % wood/fibre should be included in the ToSIA analysis.”

As basis for these calculations a matrix of COMTRADE data in terms of (transported) import and export volumes (tons) were gathered per bucket according to the before mentioned product groups. These volume flows per country determine the absolute (available) volumes, as well as the input (=export volumes from countries) and output (=import volumes to countries) product shares of the buckets.

Distances (km) for all three transport modes (road, rail, water) and the 6 bucket product groups for all EU25+2 countries, based on compiled NACE-classifications per bucket groups from experts were used in combination with the volumes to calculate the indicator values for the import- and export processes.

Calculation of buckets

The buckets as such are only collecting and redistributing volumes. They are not genuine processes. For this reason they do not have any indicator values, only flow related data like products, shares, split ratios and conversion factors.

Conversion factors from

- product unit to tonnes,
- product unit to m³,
- product unit to tonnes of carbon

needed, for each processes linked to a bucket - from country to bucket

In order to have a harmonised and simplified approach, there is only one such set of conversion factors per bucket. And this set is a weighted average of the conversion factors from the linked products from the country chains (country to import process) (see picture below):

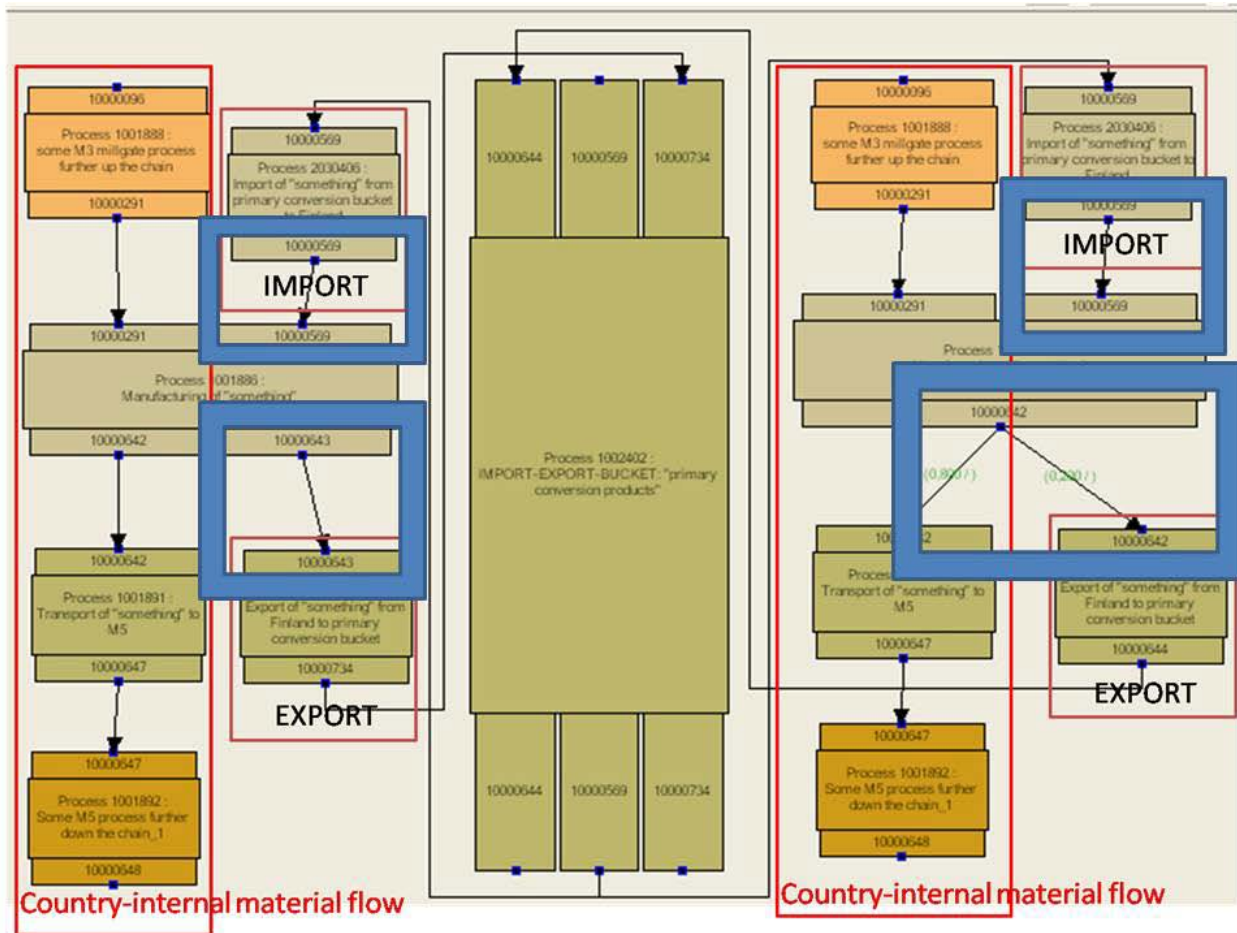


Figure 9: Concept of buckets in topology

Aggregation for process definition in Client:

- For exports and for imports via the buckets, all material flows of those six product group buckets are modelled as a transport process with an average standard single distance [km] and only for road transport at a default backhaul percentage [%] of 25% if no other values are stated in the assumptions.
- This includes that the individual volume follows are not followed up from country to country, but from a country via an export process to a bucket and from this bucket via an import process to a country.
- This means that in terms of data entry there is a “double counting”, as all exports within the EU are at the same time imports within the EU. This is on purpose as in the ToSIA calculation the user will have to decide, if (s)he wants to book the indicator impacts on the importing side, on the exporting side, or apply a ratio in which the impacted is shared
- For import/exports from/to outside EU25+2, transport from/to the country of the exporting harbour is calculated. The volumes go into the bucket.
- Assumptions for aggregation (volumes, distances, etc) dealing to the average values have to be stated clearly in the assumptions (eg by referring to an external file in which those basic data are saved). Most of the assumptions however are already laid down in the calculation modes of the FCBA “Transport Tool” and based on national statistics.

2.2 M2, Forest resource management

Forest resource management was studied in each EU country by Module 2. In the EU forest wood chain, only **25 countries** out of 27 were finally taken into account for the following reasons:

- Malta's forest surface is non significant, therefore this country has been excluded,
- Cyprus is merged with Greece, as there is no precise information available on its forest and these 2 countries have similar bio-climatic profiles.

In the EU chain topology, M2 processes were defined as **Species/Country combinations** based on the EFISCEN database (see file "EforwoodSpecies_Efiscen.xls").

The species were chosen to cover between 60 and 80% of total European wood flow. The ones with increment under 1% of national total or representing a very minor part of national harvest were excluded (ex. oak and beech in UK).

For M2 part of the chain, species groups were defined as follows:

1. pine (Scots pine + Maritime pine)
2. spruce (Norway + Sitka)
3. Beech
4. Birch
5. Eucalypt
6. Other broadleaves (mainly oak, all oaks merged).

In some cases, assumptions had to be made when it was logical and facilitates further development of the forest-wood chain. For example all broadleaves are assimilated to birch in Norway. In France, Fir and Spruce are considered together as Spruce, and broadleaved are all treated as beech and conifers as spruce in the cases of Slovenia and Switzerland.

The M2 processes established for the EU-FWC are represented in the following matrix (country x species group):

Country	Pine	Spruce	Beech	Birch	Eucalyptus	Oak	Total nb of processes per country
Austria	X	X	X				3
Belgium	X	X	X			X	4
Czech Rep	X	X	X			X	4
Denmark	X	X	X			X	4
Estonia	X	X		X			3
Finland	X	X		X			3
France	X	X	X			X	4
Germany	X	X	X			X	4
Greece and Cyprus			X			X	2
Hungary						X	1
Ireland	X	X					2
Italy	X	X	X			X	4
Latvia	X	X		X			3
Lithuania	X	X		X		X	4
Luxembourg		X	X			X	3
Netherlands	X		X	X		X	4
Norway	X	X		X			3
Poland	X	X	X	X		X	5
Portugal	X				x	X	3
Slovak Rep	X	X	X			X	4
Slovenia		X	X				2
Spain	X		X		x	X	4
Sweden	X	X		X			3
Switzerland		X	X				2
UK	X	X					2

These M2 processes in EU-FWC include the full rotation cycle of the forest, which means there is only one process level in M2. The various development stages are not described as separate processes as was done for example in EFORWOOD case study applications.

Output products of M2 for M3:

EU_Pine_TreesReadyForThinning
EU_Spruce_TreesReadyForThinning
EU_Beech_TreesReadyForThinning
EU_Birch_TreesReadyForThinning
EU_Eucalypt_TreesReadyForThinning
EU_Oak_TreesReadyForThinning
EU_Pine_TreesReadyForHarvest
EU_Spruce_TreesReadyForHarvest
EU_Beech_TreesReadyForHarvest
EU_Birch_TreesReadyForHarvest
EU_Eucalypt_TreesReadyForHarvest

EU_Oak_TreesReadyForHarvest

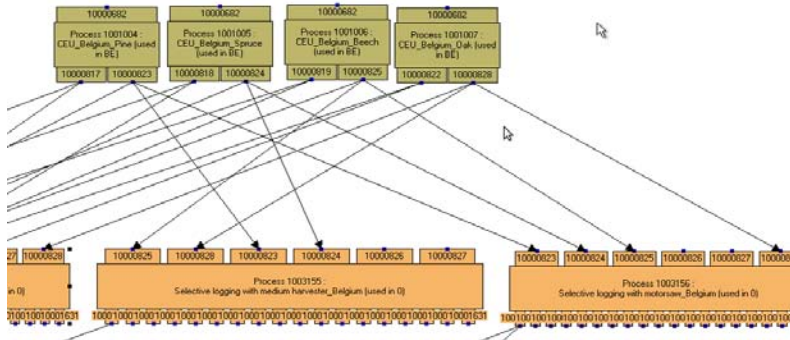


Figure 10.: Example of M2-M3 link in EU-FWC Client. Green boxes represent the M2 processes and orange boxes the first M3 processes.

The flows leaving M2 are the harvested trees, expressed in hectare. They were provided by EFISCEN database.

Then these values were transformed, **as inputs into M3 are volume of fellings in m³/year**, further divided to size classes of stems per each tree species. Transformation factors equivalent to productivity data per species were integrated within M2-M3 link. EFISCEN database can also provide those transformation factors and the distribution into size classes (Cf. M3 chapter).

Besides, the first M3 processes are harvesting systems, which means that harvested volumes leaving M2 are also distributed into various **harvesting methods** in M2-M3 links.

Forest management alternatives (FMA):

M2 defined various FMA which describe existing and prospective forest management strategies in European forests. These FMAs can be arranged along a gradient of management intensity, from non-intervention to intensive stand management, and associated with typical sets of forest operation processes (Cf. Eforwood Deliverable 2.1.3). The sustainability indicators related to M2 are affected by the type of FMA implemented in a region. This is the purpose of an M2 Special joint issue (in progress).

Furthermore, in references futures and scenarios, the distribution of these FMA in the European forest should change, for i.e. toward more intensive management or at the contrary more forest preservation. Each forest management alternative will produce different sets of felling volumes, provided by EFISCEN model.

2.3 M3, Forest to industry interaction

In M3, a process template with the central processes in the EU-FWC was build at the Workshop of chain designing in Prague (September 2008). This general template was copied for all 25 countries, as M3 is working on a country specific level. If there are no data available for one country indicator values of another

country may be used. Therefore, countries with the same harvesting/ hauling operations were put together in country groups.

The following country groups were defined

CEU: Central EU25+2	Germany, Austria, Benelux, Denmark, Switzerland, France,
NEU: Northern EU25+2	Sweden, Norway, Finland, UK, Estonia
SEU: Southern EU25+2	Cyprus, Greece, Malta, Italy, Portugal, Spain
EEU: Eastern EU25+2	Czech Republic, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia, Rumania

The following key-countries and contact persons were nominated in case of no data availability in a country:

Contact persons for these country groups are:

In Central EU25+2:	Germany	→ ALU-FR, contact Janine Fischbach
In Northern EU25+2	Sweden	→ Skogforsk, contact Staffan Berg
In Southern EU25+2	Greece	→ FCBA, contact Mikaël Poissonnet
In Eastern EU25+2	Poland	→ALU-FR, contact Janine Fischbach

It is the task of the responsible partners to specify/ adjust the processes of the template chain according to the structure of the specific country/ country group (e.g. cable crane in Austria) and to delete or set the split ratio to zero of the processes which are not selected/ applicable.

Output of M2 for M3: The 'volume of fellings', further divided to size classes of stems per each tree species. (Furthermore, each 'forest management alternative' will produce different set of felling volumes.)

For setting up the M3 chains in the EU-FWC and to deliver the M3-mMaterials to M4, M3 needed the size classes of the trees. Tree species and volumes has been simulated with EFICEN and delivered at the EFORWOOD Week in Bordeaux. In November 2008 M1 has made an attempt to disaggregate the EFISCEN output for A1 into size classes, for the combinations of countries and species as it was decided earlier. There are the Classes 0 (<9,99cm dbh), Class1 (10-19,99cm dbh), Class2 (20-29,99 cm dbh), etc. up to Class5 (>50cm dbh).

The disaggregation was based upon diameter development (dbh) over age as provided by yield tables. Therefore, a range from the worst to the best growth classes was taken. The unit is 1000 m³ ob per 5 years (=time step of EFISCEN).

A general conversion factor of 12% for bark (overbark=112%*underbark) was used.

The provided table „Output_By_Size_Classes_A1_xls” was not the final output. By collecting data, calculating indicator values and working with the size classes

and tree species which were provided by EFISCEN some problems in M3 were figured out. At a M3 Meeting in Paris at 2nd and 3rd of march 2009 it was decided that the responsible partners check if missing and/ or wrong volumes were presented by other species (e.g. Sitka spruce and spruce) and that there will be a revised calculation by EFISCEN with that corrected data until the end of march 2009.

As residues were not included in the removals, a second table with harvest residues will be provided. The basic of EFISCEN therefore is stemwood volume. Furthermore Alterra uses expansion factors for each country and species to convert that into whole tree biomass. Alterra has information about the ratios between fellings and removals, to define how much has to be felled in the forest in order to get a certain removal amount. The difference is harvest residue (topwood). This information will be provided together with the volumes of fellings.

M3 /M2 division of machine use: all machine use before pre-commercial thinning are reported in M2. Pre-commercial thinnings would (if defined like this by M3 for the respective chains) need to be included in M3 (but currently are left out in some countries because of data limitations).

The M3 processes are divided into the following systems:

Stage 1. Harvesting systems

Those harvesting systems were chosen which reflect the systems and consider all conditions (restrictions-environmental, resources, assortments...)

Processes:

1. motormanual
2. partly mechanised
3. fully mechanised

Stage 2. Forwarding and processing systems in forest

Those forwarding and processing systems were chosen which reflect the systems and consider all conditions (restrictions-slope, environmental, resources...)

Processes:

1. skidder (with or without winch)
2. forwarder
3. cable systems
4. bundler and chipper
5. *(Other - tractor, animals, etc..- if necessary to cover the targeted coverage)*

Stage 3. Transport systems

Those transport systems were chosen which reflect the systems and consider all conditions (short / long distance transport, short or long logs...)

Processes:

1. truck
2. train
3. ship

Stage 4. Mill gate operations

Those millgate operations were chosen which reflect the systems and consider all conditions

Processes:

1. No sorting at millgate
2. Automatic sorting at plant gate
3. Manual sorting at plant gate

Output of M3 for M4: The volume of assortments (short/long logs per tree species, bioenergy assortments as tops and branches, stumps or chipped product thereof), measured and sorted, at the millgate.

M3 has added several input and output products to the M3 processes before the country chains were copied. To define the output products from M3 to M4, M3 took over those products, which were already in the M4-chains or those products were taken over, from which information was available (communication between M4 and M3).

The following output products from M3 to M4 were defined.

Process at Mill gate	Product
Sorting_Automatic at plant gate	EU_Oak_Short roundwood after sorting
	EU_Birch_Short roundwood after sorting
	EU_Eucalypt_Short roundwood after sorting
	EU_Beech_Short roundwood after sorting
	EU_Pine_Short roundwood after sorting
	EU_Spruce_Short roundwood after sorting
Sorting_None at plant gate	EU_Coniferous chips at plant
	EU_Broadleaf chips at plant
	EU_Bundles of coniferous harvest residues at plant
	EU_Bundles of broadleaf harvest residues at plant
Sorting_Manual at plant gate	EU_Oak_Long roundwood after sorting
	EU_Eucalypt_Long roundwood after sorting
	EU_Birch_Long roundwood after sorting
	EU_Beech_Long roundwood after sorting
	EU_Pine_Long roundwood after sorting
	EU_Spruce_Long roundwood after sorting

Short roundwood is roundwood <6m and long roundwood is roundwood longer >6m.

When entering M4 the separation is into the following categories:

- Coniferous

- Non-coniferious
- Sawlogs
- Pulpwood
- chips

2.4 M4, Processing and manufacturing

In M4, only one stage has been defined. Model mills are defined representing the different manufacturing processes for these products (see Deliverable D4.1.9 Report describing the Manufacturing Processes in the European Cases).

Fibre processes (6 processes)	Solid wood processes (4)	Bioenergy (1)
Integrated newsprint	Sawn timber	Pellets
Woodcontaining paper	Panel products	
Woodfree paper	Furniture	
Containerboard	Building components	
Cartonboard		
Bleached market pulp		

For each product, one typical model mill is defined for each region. The production rate, the furnish used and the product of the model mill will be defined. In one country group indicators have by default the same value for all countries for the same product but will be adapted per country if data are available. Further description of the model mills used is given in PD 4.1.9 (due in month 40). There will also be internally M4 transport processes. From the saw mills, chips will be transported to the pulp and paper mills and saw dust to the pellets plants. There will also be transport processes of the primary conversion products in the solid wood chain to the secondary manufacturing processes.

Output from M4 to M5:

The production volume of the defined products in the different countries/country groups

2.5 M5, Industry to consumer interactions

M5 defines 2 stages, Processing (19 processes) and Transport/distribution (4 types of processes)

Volume coverage of selected processes:

Fibre products (covering approximately 89 % of consumption (Source CEPI)):

- Graphic products, 50 %
- Packaging products, 39 %

Solid wood products (covering approximately 68 %?? of consumption (Source: EPF)):

- Building/ construction, 17 %??
- Living (furniture/ interior), 51 %??

Bioenergy (covering approximately 80 % of consumption (Source: Pöyry)):

- Power/heat
- Pellets/Fire wood

Processsing

Fibre processes: (7)

Printing

Packaging conversion

Packaging filling

Use (packaging)

Use (graphic product)

Recovery logistics (paper)

Waste management (paper)

Solid wood processes (5):

House construction

Use (furniture/ interior)

Use (building)

Recovery logistics (wood)

Waste management (wood)

Bioenergy (7)

(Wood-based) Combined heat and power production outside forest industry

(Wood-based) Power (electricity) production outside forest industry

Home scale heat production

Wood-based heat production outside forest industry, small plant

Wood-based heat production outside forest industry, large plant

Municipal solid waste incineration

Transport and distribution

(Common process types):

Wholesale and retail

Bulk transport B2B (sheets/rolls/sawn timber etc)

Regular transport B2B (converted products)

Local distribution B2C

Recovery and waste logistics

Comments:

1. Use processes are important to highlight as these reflect the benefit/ value of the products and services that the FWC produce. However, it will be very difficult and sometimes impossible to find indicator values for these processes.
2. Volume coverage of selected processes: Fibre products (covering approximately 89 % of consumption (Source CEPI)): Graphic products, 50 %, Packaging products, 39 %. Solid wood products (covering approximately 68 % of consumption (Source: EPF)): Building/ construction, 17 %, Living (furniture/ interior), 51 % Bioenergy (covering approximately 80 % of consumption (Source: Pöyry)): Wood based biomass (e.g. Pellets/Wood waste/Forest residues)

Output products to M4

Collected wood and paper for recycling in M4

2.6 EU-FWC Indicators

Indicators collected and analysed in EU-FWC application of EFORWOOD are defined in data collection protocols and its amendments. Due to the sheer size of the EU FWC case, the number of demonstration indicators (minium set of indicators to be collected) was reduced even more than in the case studies, an overview can be found in the Annex of this document.

Indicators selected for demonstrating TOSIA in EU-FWC are:

Economic indicators:

- GVA
- Production costs
- Resource use:
 - Sub-indicators of woody material (calculated in ToSIA)
- Total production

Environmental indicators:

- GHG emissions
- Energy generation and use (including energy generation)
- Biodiversity
- Waste generation (only for M4 and M5)
- Forest resource
 - Forest area
 - Growing stock
 - Annual increment

Social indicators

- Employment
- Wages and salaries
- Occupational safety and health (accidents only)
- Provision of public forest services (M2 to specify which sub-class(es))

2.7 Country groups

To set up the topology of the EU-FWC national-level templates of the most important FWCs were defined for country-groups. These were later adapted to better reflect individual country characteristics. Indicator information was also collected for the country groups, but adjustments were made for example to represent differences in salary levels between neighboring countries.

Different modules have different grouping (see Fig 11.).

EU-FWC data collection by countries (M2, M3)
and by country groups (M4,M5)

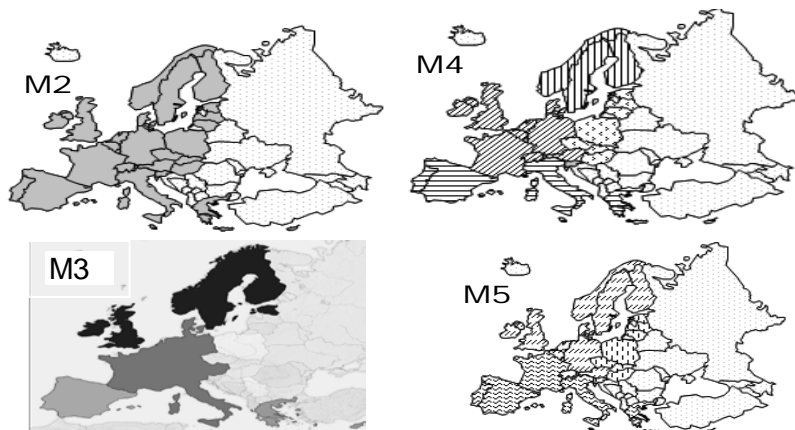


Figure 11: Country groups applied in different modules. In M4 the solid wood chain applies 3 country groups, (the Central Western Europe and Southern Europe will be one group) but for the fibre chain and bioenergy chain there will be four groups as showed here.

3 Scenarios for EU FWC

Forest conservation scenario

Forest management in Europe is changing towards a more multifunctional orientation. Current percentages of forest in each EU country managed with the protection of biodiversity as a prime objective are given in Figure 5. The policy further implementing this demand from society under the Habitats Directive from 1992 is Natura 2000. It aims to establish a European network for conservation of biodiversity and to promote sustainable activities. It is intended that the network will eventually grow to cover 15% of EU territory. Thus further integrating multi-functional forest management (ecological, economic, protective and social functions) into the EU forestry strategy.

Minimum percentage of EU forests under forest conservation scenario designation in Levels 0-3:

Level	A1 2015	A1 2025	B2 2015	B2 2025
0	7	7	7	7
1	8	10	8	10
2	10	15	10	15
3	15	25	15	25

Detailed in Table 3, are estimates of percentages of EU forests to be designated under the forest conservation scenario. Level 0 is an estimate of the current forest area (averaged across all countries) covered by Natura 2000 designation status, while level 2 assumes the documented expectations of Natura 2000 coverage is achieved by 2025. Levels 1 and 3 are variations in coverage shares that respectively highlight the possibility of not meeting or surpassing targets.

The A1 storyline describes a future of intensive globalisation both economically and technologically, with a mid-century peak and subsequent decline in world population. These advances in technology coupled with an increase in consumer and commercial demands will lead to a rapid increase in the competition from international timber supplies within the EU domestic market. The EU timber industry then will be severely challenged by this volume of foreign imports making timber production from Natura 2000 sites uneconomic. With lower investments in forest management and decreasing harvesting levels in Europe, such areas effectively will be removed from production.

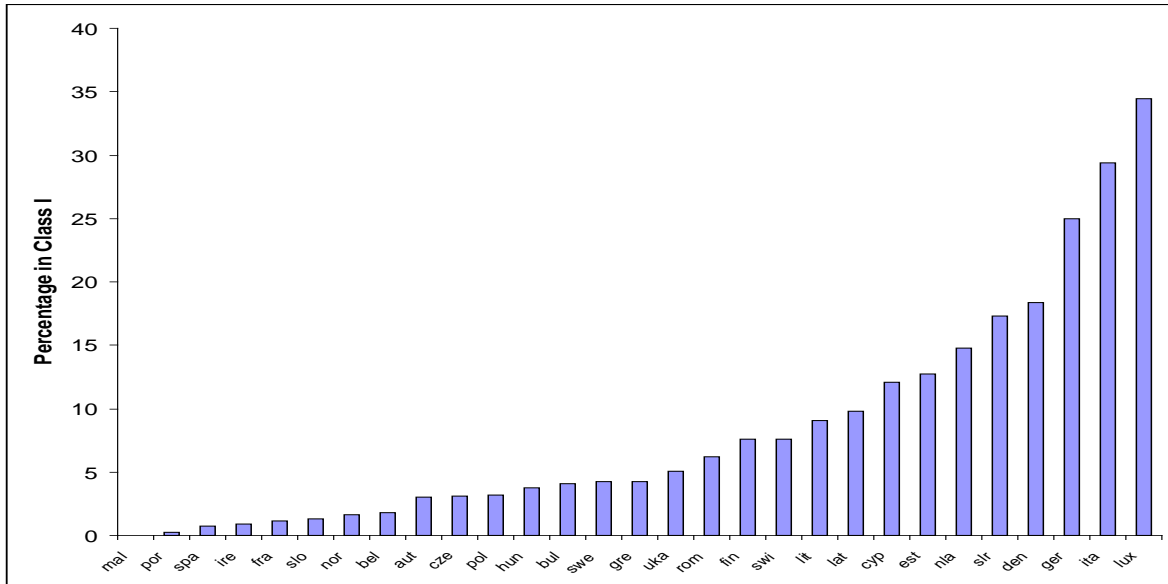


Figure 12.: Percentage of the national forest with biological protection as primary objective in 2005 (classes 1.1. to 1.3 according to MCPFE) (MCPFE 2007).

The B2 storyline describes a future where social, environmental and economic sustainability is addressed at a local level with local solutions. Even though global populations would be steadily rising, the economic and technological development occur on a less rapid and diverse scale. There is a higher demand for high grade timber and an increase in demand for biofuel while there would be less competition from wood imports and more competition from agricultural development. Interpreting the impact on Natura 2000 designated forests is uncertain but it seems likely that there would be a combination of strict set aside and management changes, probably under a form of ‘close-to-nature’ (ProSilva) type management (EC, 2003). This would presumably result in longer rotations, more thinnings and less clear felling, a change to mixed species in plantations and an overall decrease in yields (perhaps by 20-30% on a per hectare basis compared with conventional management).

So we therefore proceeded as follows.

We used the MCPFE statistics to provide a country by country estimate of protected forest areas in 2005 under Natura 2000 (Fig 5). If the country already has a protected forest area exceeding that required by the Table 3 and appropriate level 0-3, then no changes were made in the set up of EFISCEN which covers forest area available for wood supply only. So, strict reserves are anyway out of EFISCEN simulations.

However, if the area of figure 5 is below that suggested in the Table 3, then the protected areas were increased to meet the Table. This can be done by removing part of the forest estate from the simulation, and still trying to achieve the same total national demand for wood. Under the A1 storyline, these changes amount to withdrawing all these protected forest areas from timber production. Any

reduced fellings (compared to ref future) were reported as input to EFI-GTM simulations as a reduction in available wood.

Under the B2 storyline, it was assumed that the area in classes 1.1 and 1.2 are not available for production. However, for class 1.3, we assume timber production is possible following ‘Pro-Silva’ principles, which accords with the Natura 2000 document. In classes 1.1 and 1.2 we did the same as sketched above, but for class 1.3 forests we apply a mixture of measures. We reduced the final felling chances, so as to prolong the rotations, we set some final felling chances at ‘0’ for old deciduous forests, and we regenerate part of the coniferous forests with deciduous forest. This represents a shift along the FMA’s as set up in WP2.1.

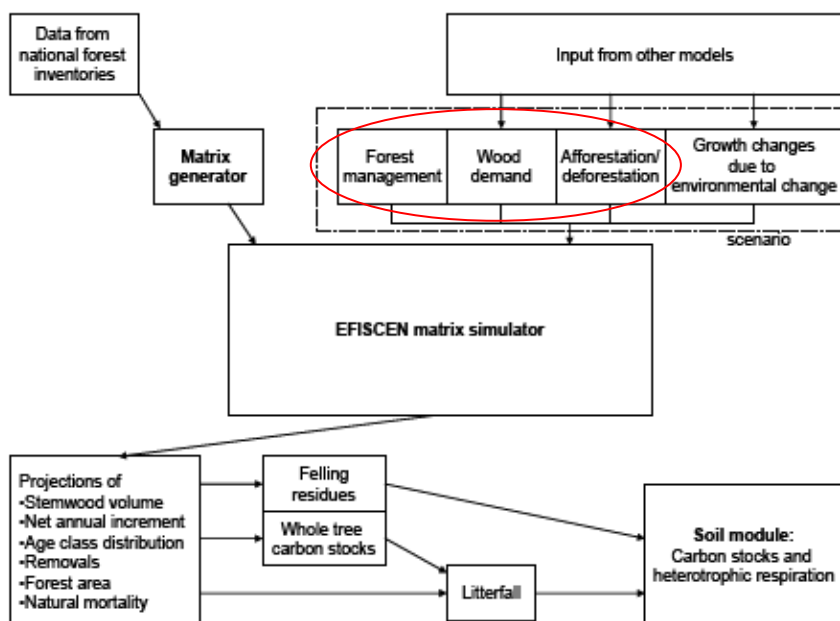


Figure 13:. Outline of the structure of EFSCEN with the scenario options indicated in the circle.

4 Practical implementation

EU-FWC is implemented as one huge chain structure including country sub-chains. Country sub-chains are aimed to be as identical as possible (not in the process level, but visually similar countries) to help perceiving the chain structure. The first step to build the country sub-chains was to build sub-chains for country groups, the relevant topology was then copied for each country in the particular country group. To do this, a new functionality to the database client had to be added. The country groups are: Eastern Europe, Nordic countries, Southern Europe, Western Central Europe.

5 Management of the EU-FWC

The EU-FWC is coordinated by Module 1. Partner 2 (EFI) acts as the coordinator and will ensure that the agreed terms of references are met. Modules 1, 2, 3, 4 and 5 will be presented in the task force group by the nominated participants.

5.1 Nominated participants of the EU-FWC Task force:

M1	M2	M3	M4	M5
Risto Päivinen, Marcus Lindner, Birger Sohlberg	Jean-Michel Carnus (INRA), Gert-Jan Nabuurs (ALTERRA)	Staffan Berg (Skogforsk), Janine Fischbach (ALUFR)	Helena Wessman, KCL	Carl Olsmats (STFI), Petri Vasara (Pöyry)

5.2 Partners assigned for data collection

Data Collection: M2

Depending on which indicator, responsibilities for data will be shared between Alterra (national data in EFISCEN database) and the 8 partners responsible for each main species (representing also 8 EU countries) as indicated in table 2 in annex.

M2	Topology	Flow parameter (shares, split ratios, conv. Factors)	Economic indicators	Environmental indicators	Social indicators	M2-specific indicators
NEU	Mikaël Poissonnet + (Véronique Cucchi)	Mart Jan	Mart Jan (1)	Mart Jan	Dave Edwards (recreation) + Mikaël Poissonnet (wage and salary)(1)	
CEU	Mikaël Poissonnet + (Véronique Cucchi)	Mart Jan	Mart Jan (1) + Dunker (Germany), Mason (United Kingdom), Najjar (France)	Mart Jan	Dave Edwards (recreation) + Mikaël Poissonnet (wage and salary)(1)	
EEU	Mikaël Poissonnet + (Véronique Cucchi)	Mart Jan	Mart Jan (1) + Ambrozy (Poland)	Mart Jan	Dave Edwards (recreation) + Mikaël Poissonnet (wage and salary)(1)	
SEU	Mikaël Poissonnet +	Mart Jan + Margarita Tomé for Portugal	Mart Jan (1) + Barrero (Portugal)	Mart Jan	Dave Edwards (recreation) +	

	(Véronique Cucchi)	+ Eucalyptus in Spain			Mikaël Poissonnet (wage and salary)(1)	
--	--------------------	-----------------------	--	--	--	--

In the case of any data gaps for some countries / species, arrangements are made to cover them using data from reference forests in the same biogeographic zone (Nordic, Central-Eastern, Western-Atlantic, Mediterranean).

Data Collection: M3

Responsibilities for data collection in different European countries:

	Data from:	Responsible partner	Contact person
1	Sweden	Skogsforsk	Staffan Berg
2	Finland	Skogsforsk	Staffan Berg
3	GB	Forest Research	Barry Gardiner, Stefania Pizzirani
4	Ireland	Forest Research	Barry Gardiner, Stefania Pizzirani
5	Denmark	Skogsforsk	Staffan Berg
6	Estonia	Skogsforsk	Staffan Berg
7	Latvia	Skogsforsk	Staffan Berg
8	Lithuania	ALUFR	Janine Fischbach
9	Germany	ALUFR	Janine Fischbach
10	Netherlands	FVA	Franka Brüchert, Torsten Bensemman
11	Belgium	FCBA	Elisabeth Le Net, Mikaël Poissonnet
12	Luxemburg	FCBA	Elisabeth Le Net, Mikaël Poissonnet
13	Austria	FVA	Franka Brüchert, Torsten Bensemman
14	Spain	FCBA	Elisabeth Le Net, Mikaël Poissonnet
15	Portugal	FCBA	Elisabeth Le Net, Mikaël Poissonnet
16	France	FCBA	Elisabeth Le Net, Mikaël Poissonnet
17	Italy	FCBA	Elisabeth Le Net, Mikaël Poissonnet
18	Greece	FCBA	Elisabeth Le Net, Mikaël Poissonnet
19	Poland	ALUFR	Janine Fischbach
20	Slovakia	FVA	Franka Brüchert, Torsten Bensemman
21	Slovenia	Skogsforsk	Staffan Berg
22	Czech Rep.	ALUFR	Janine Fischbach
23	Cyprus - Greece	Forest Research	Barry Gardiner, Stefania Pizzirani
24	Hungary	FVA	Torsten Bensemman
25	Malta - Italy	Forest Research	Barry Gardiner, Stefania Pizzirani
26	Norway	Skogsforsk	Staffan Berg
27	Switzerland	FVA	Franka Brüchert, Torsten Bensemman

It was decided at the EU-FWC Task Force Meeting in Espoo (12+13/01/2009) that Malta should be lumped together with Italy, Cyprus should be lumped with Greece.

Data Collection: M4.

For the data collection in the Fibre chain the partners will be (Coordinating partner:KCL)

- JPC (Economic);
- KCPK (Social) and
- KCL/STFI-PF (Environmental)

For the data collection in the solid wood chain the partners will be Coordinating partner: BRE)

- JPC,
- VTT,
- BRE and
- TUZVO

For the data collection in the Bioenergy chain the partners will be (Coordinating partner:VTT)

- JPC and
- VTT

Data Collection: M5.

The general arrangement regarding data collection is that

- STFI-Packforsk covers fibre products in all countries,
- AIDIMA covers wood products in Latin/ Southern Europe country group. AIDIMA will primarily use Spanish data to represent this group,
- FCBA covers wood products in Western/ Northern Europe and East Europe country groups. For Western/ Northern Europe, FCBA will primarily use French data, and,
- Pöyry covers bio-energy in all countries.

Data for common processes will also be the responsibility of respective partner, e.g. transport of fibre products by STFI-PF. For transport processes we hope that the Transport Working group will define and inventory some "standard" transports which can be used to get data for our processes. For wholesale and retail we have not decided on any task force or similar, but there are definitely synergies, between the different product groups in M5.

In general through the application of three country groups, indicator data is only collected in 3 representative countries (or other representative unit) to cover all 25+2 countries.

6 Acquisition and Validation of Collected Data

Given the rather detailed structure of the EU-FWC and its broad spatial coverage, the data needs to describe the EU-FWC are huge.

To maximise transparency, data from public statistics had first priority. Especially the international databases of EUROSTAT, the OECD, the UN and the FAO and national websites of statistical offices, ministries, universities, national research institutions, libraries, NGOs and other institutions proved to be very useful.

However, a big lack of data exists on forestry and wood industry related topics. Data was often lacking or missed the required level of detail. Data gaps were filled by developed models, like the transport model from FCBA, assumptions in the FWCs, like model forests in M2 and model mills in M4 and dM5, as well as by educated guesses from country-specific experts.

The concept of country-groups per module was introduced. This comprised a template of e.g. a Nordic country, e.g. Sweden, which covered topology and indicator values. In case in neighbouring countries of that country group (e.g. Norway, Denmark, Finland) values were missing, the template country's value (e.g. here: the Swedish) was used instead.

Due to the complex and broad approach of the EUFWC within EFORWOOD the collection of data is based on numerous and different sources. Furthermore the data collection was undertaken by a multitude of partners. To ensure the provision of the data as consistent and as homogeneous as possible certain information systems and guideline were implemented. One major milestone for this task was e. g. the data collection protocol as a manual for the collection of indicator data in order to ensure a common format for each indicator. Additionally, the Database Client (DBC) supported the data collectors to input data in a common format.

Albeit the data input should be accomplished according to the defined formats and guidelines deviations can occur due to differences in interpretation, errors while data is entered or uncertainty caused by lack of information on a certain issue. For this reason a validation of the inputted data was necessary. The validity of the data has been tested on different levels. Tests have been carried out to check the completeness of inputted data, mainly regarding the material flow, e. g. products shares, split ratios, and conversion factors. Additionally a routine for consistency checking of the material flow data has been developed. Due to time constraints, only a completeness check and filling of 2005 data for material flows could be carried out, however no final flow validation in terms of right magnitude. It was also not possible to carry out these measures for the variants; thus no correct material flows can be guaranteed within the lifetime of the EFORWOOD project.

The relative indicator values were evaluated using constraints based on the logic of the indicator structure and undertaking statistical tests in order to identify outlier of the values. The results of these different tests were compiled in separate files and sent to the respective partners in order to check the data and correct it if necessary.

Validation of absolute indicator results and material flows could only be carried out for M2 to M3. As the results of the variants (Natura 2000 Scenario in different levels) mainly affected M2's forest resource, the initial flows and indicator results could also be validated up to M3.

All together the EU FWC comprised in the baseline:

Processes: 20 314

Products: 488

Links: 10 157

Indicator values: 366 408


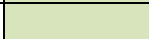
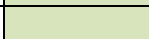
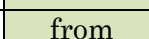
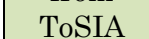
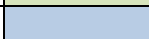

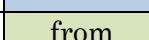
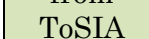
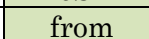
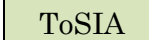

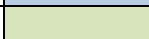

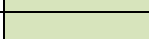







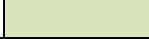


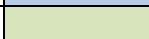
This amount of data was also collected for 16 further variants (reference futures and Scenarios in two time steps, 2015 and 2025).

7 Appendix

7.1 Short indicator list EU-FWC

Legend: Selected or not?

Demonstration Indicators 
 Not selected for demonstration 

Indicator	Selected
1. Gross value added	
2. Production cost	
3 Trade balance	
4. Resource use	from ToSIA 
5. forest sector enterprise structure	
6. Investment and R&D	
7. Total production	from ToSIA 
8. Productivity	from ToSIA 
9. Innovation	
10. Employment	
11. Wages and salaries	
12. Occupational Safety and Health	
13. Education and Training	
14. Corporate social responsibility	
15. Quality of Employment	
16. Provision of Public Forest Services	
17. Consumer Behaviour and Attitudes	
18. Energy generation and Use	
19. Greenhouse Gas Emissions and Carbon Stock	
20. Transport	
21. Water use	
22. Forest Resources	
23. Soil Condition	
24. Emissions to Water and Air	
25 Biodiversity	
26. Forest damage	
27. Generation of Waste	