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EFORWOOD

Tools for Sustainability Impact Assessment

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Module 2 - Final Report

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PP	Restricted to other programme participants (including the Commission Services)	X
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)	

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Abstract:

The PD2.0.8 progress report of Module 2 summarises the main scientific achievements of and the activities carried out by the module 2 partnership during the final period of EFORWOOD project. It provides, for each WP, a description of progress towards the specific objectives of the project, the milestones and deliverables, the identification of the problems encountered and corrective actions taken for each work package. Four appendices provide details for each Work-Package and lists of deliverables and scientific publications. Overall, the M2 work has been accomplished according to the implementation plan for months 37-51 and most key objectives have been fulfilled.

CONTENTS

1 - Project objectives and major achievements during final year

Section 1 summarises M2 objectives and milestones for final period of the project and presents an overwiev of main activities and achievements during that period. A complete list of deliverables and milestones is provided in appendices 2 and 3.

1.1 - M2 overall objectives and milestones

The overall objective of M2 is to make a partial Sustainability Impact Assessment (SIA) of forest resource management strategies in the context of present and future forestry-wood chains (FWCs) while providing M1 with relevant data and results on the way forest management affects SIA indicators.

M2 specific objectives are: (1) to assess the impacts of forest management strategies on the economic, environmental and soicial aspects of sustainability; (2) to characterise environmental, economic and social functions of forests and their interaction with management options; (3) to evaluate main biotic and abiotic risks; (4) to improve integrated predictive and monitoring tools for sustainability assessment.

Module 2 is organised in six work packages (WP). Main milestones and deliverables for the duration of the whole project include:

- Development of a data platform on reference forest types and management alternatives;
- Provision of state of the art and synthesis reports on indicators for SIA of forest management;
- Development of databases, methodologies and improved modelling tools for indicator evaluation and partial SIA at various scales of the forest resource management component of FWCs;
- Preparation of scientific publications on the interactions between management and forest services and on improved SIA methodologies and tools within forest boundaries.

For the final year of the project, objectives and milestones are described in section 2 and appendix 1 for each work package.

1.2 - Summary of Module 2 work

The focus of the research activities in the final year has been on methods and tools development and testing for partial SIA and on completion of data collection and analyses (e.g. forest resource simulators, forest productivity and financial returns, forest recreational values, environmental services, multicriteria risk analysis).

Emphasis has been put on finalisation of deliverables, on preparation of manuscripts for a special issue of a scientific journal and other publications derived from module work (see list in appendix 4).

M2 activities have also concerned cross-module task forces (regional case studies and EU FWC) and data collection in case studies for further analysis in M1.

M2 has fulfilled most of its specific objectives for final period. M2 work has been mainly dedicated to:

(i) **planning,** including coordination between and within WP, and interfacing with other modules and task forces (3 module meetings, 4 MMT meetings, and 7 WP meetings);
(ii) **workshops and training** (2 workshops);
(iii) **data collection** for TOSIA (regional and EU case studies, 2005, 2015, 2025) and for module databases and partial SIA;
(iv) **data analysis and tool development;** including reporting on forest-based case studies; on improved versions of regional and EU forest resource simulators; on impacts of forest management alternatives (FMAs) on (a) productivity and land expectation values, (b) recreational values; and (c) on environmental services; on multicriteria risk analysis under various forest management alternatives; on papers for special issue of a scientific journal on SIA of FMAs.

Management and coordinating activities have continued in order to integrate effectively module work in the overall project development through linkages with task forces and contribution to case studies. A special attention has been given to the finalisation of manuscripts and harmonization of scientific publications between work packages in the module.

Dissemination activities have been important during year 4. These have included contributions (oral presentations, poster) to the EFORWOOD final conference in Uppsala in September 2009 and to Forest-technology Platform event in Stockholm in November 2009, organisation and presentations of module outputs to regionally-based seminars (Lisbon-Portugal, Aquitaine-France, Baden Wurttenberg-Germany); module 2 leaders have also contributed to the organisation of a special session on SIA of FWC at the next IUFRO world congress in Seoul in August 2010.

Main work achievements during year 4 concerned**:**

- SIA of forest-based case study (Westernbotten, Sweden);
- contribution to EU FWC design;
- completion of data collection and indicators evaluation for regional case-studies and European case;
- workshop on impacts of future forest management alternatives (FMA) on wood production and financial return for reference forest types in different regions;
- assessment of recreational values and risks for various European FMAs;
- preparation of 9 papers for a special issue of a scientific journal on SIA of Forest Management Alternatives.

Key objectives for the fourth implementation period (months 37 to 51) included**:**

1. to complete EFORWOOD case studies - including data generation for 2015 and 2025;
2. to provide prototypes of improved regional and EU forest resource simulators;
3. to carry out sustainability impacts analyses of forest management alternatives;
4. to complete the M2 database for reference forests;
5. to prepare scientific publications.

During final year 4, most deliverables (17) and milestones have been reached (appendix 2 and 3); key objectives 1, 2 and 3 have been entirely fulfilled and objectives 4 and 5 have been partially fulfilled.

2 - Work package progress in final period

Section 2 describes for each WP of module 2 progress towards objectives and provides an overview of work achievements including deliverables and milestones reached during final period of the project. Appendix 4 provides additional details on scientific publications.

2.1 - WP 2.0 Coordination

2.1.1 - A description of progress toward the objectives of the project

The general objective of this work package is to ensure module objectives are fulfilled and deliverables provided according to time schedule through efficient co-ordination of module activities and interfaces with other modules and task forces. All 5 specific objectives of the final period of the project have been fulfilled.

2.1.2 - An overview of the activities carried out

During the final year, main activities of this WP included**:**

- module co-ordination: organisation of module meetings as part of the EFORWOOD weeks and Module Management Team (MMT) meetings during EFORWOOD weeks and in between, as well as preparation of meeting minutes. WP 2.0 participated in overall IP co-ordination (IP Board meetings) and contributed to EFORWOOD final conference in Uppsala;
- linkages with other modules & task forces: WP2.0 organised the data collection for the socio-economic indicator values for the forest component of the EU FWC. WP2.0 contributed to EU FWC design and task force;
- reporting: including two deliverables
    - PD 2.0.7 describing the Special Issue on "SIA of Forest Management Alternatives" delivered in month 46 (INRA). WP2.0 has organised with other WP in M2 a special issue of a journal on SIA of Forest Management Alternatives. The submission of all papers will be made in first half of 2010 to the journal *Ecology and Societ (ES)y*;
    - PD 2.0.8: final progress report currently being prepared for month 51 (INRA).

2.1.3 - Description of progress towards the milestones and deliverables foreseen

The three milestones (M2.0.15 to M.2.0.17) scheduled in year 4 have been reached. PD 2.0.7 report was approved in month 46 and PD 2.0.8 will be submitted by the end of month 51.

2.2 -WP 2.1 Sustainable Forest Management Strategies

2.2.1 - A description of progress toward the objectives of the project

The general objective of this work package is to characterise and analyse currently recommended and future forest management alternatives for relevant forest types across Europe for the maintenance of sustainability and their impacts on the Forest-Wood Chain. The specific objectives of this work package for the final period are to:

- analyse the impact of current and future forest management alternatives on wood resources quantity and quality in close relation with WP 2.5 and M3. Due to difference between forest types across the EU , this analysis will be done on a regional basis;
- complete the reporting and publication of research carried out by WP2.1.

2.2.2 - An overview of the activities carried out

During year 4, WP2.1 has characterized the first link, i.e. the forest management segment (M2) of the Forestry-Wood-Chain within the three EFORWOOD Regional Case Studies and contributed to the corresponding gathering of information for the European Case Study. The corresponding regional reference forest types and their potential development in years 2005, 2015 and 2025 were simulated under the assumption of alternative reference futures and scenarios. Quantified indicator values were delivered to the EFORWOOD database client for further analysis.

WP2.1 has analyzed the impact of alternative forest management approaches (FMA) on productivity of nine European reference forest types based on the elaborated standard framework. The forest management approaches, forming a gradient of intervention intensity into natural processes, included both, currently recommended strategies as well as future alternatives thereof. The impact on forest resource was assessed in mean annual (solid) wood production and in land expectation value at various interest rates based on simulations. The regional results are compiled in PD 2.1.5: Impact analysis on production of alternative forest management strategies based on simulations for European reference forest types. Further, a synthesis overview including cross regional comparison of forest management options is presented in D2.1.6: Comparative impact analysis of alternative forest management approaches on production based on simulations for European reference forest types.

WP 2.1 specific achievements will be published within the M2 special issue of "Ecology and Society".

2.2.3 - Description of progress towards the milestones and deliverables foreseen

During year 4, the three milestones regarding analysis of FMA on wood production, the conceptual outline of contributions to M2 special issue and the reporting and publications have been reached successfully.

2.3 - WP 2.2 Environmental services

2.3.1 - A description of progress toward the objectives of the project

The objective of this work package is to evaluate environmental services from forests at local and regional scales and to provide quantitative environmental service indicators associated with forest management alternatives and future FWC scenarios. The following environmental services are included: *carbon sequestration, water quality and quantity, biodiversity,* and *maintenance of soil quality.* The specific objectives of this work package for the 37th to 51th months are to:

- maintain the information flow with other WP in module 2 and assist with data collection where appropriate;
- complete a systematic overview of the quantitative impacts of forest operations on environmental services ("response functions");
- integrate impacts of various FMA on environmental services by use of a generic approach at regional level;

- complete the reporting and publication of research carried out by WP2.2.

2.3.2 - An overview of the activities carried out

During the final year of the project, activities of this work package have focused on:

- systematic overview of forest operations quantitative impacts on environmental services ("response functions", PD 2.2.4) has been finalised and published on the Eforwood-Portal;
- integrated impacts of five FMA's on environmental services by use of a generic approach at regional level (PD 2.2.5); all modelling work has been completed for a case study, and a final manuscript is under preparation for the special issue of ES;
- The manuscripts on Forest management effects on each of the environmental services (PD2.2.3) are under final editing work for submission in first term of 2010 to Annals of Forest science.

Activities have included organisation of two specific WP meetings in fourth year (Feb 2009 in Freiburg and June 2009 in Copenhagen) and participation in module meetings (Freiburg and Uppsala EFORWOOD weeks).

2.3.3 - Description of progress towards the milestones and deliverables foreseen

The D 2.2.3 and PD 2.2.5 are delayed until the end of the project. The milestone M229 has been reached in month 40 and M2210 is delayed until the end of the project.

2.3.4 - The identification of the problems encountered and corrective action taken

The two deliverables D 2.2.3 and PD 2.2.5 are behind schedule and efforts are being made to speed up their final delivery.

2.4 -WP 2.3 Social values

2.4.1 -A description of progress toward the objectives of the project

The objective of this work package is to collate information on Social and Cultural Values (SCVs) which stakeholders attach to major European forest types and, by relating SCVs to existing criteria and indicators for sustainable management, to explore the sensitivity of SCVs to different forest management alternatives (FMA). This study will be the first time that the interaction between SCV's and forest management is explored over a range of major European forest types. This work will provide a basis for refining the existing criteria and indicators of SCVs and so support the implementation of resolution 3 of the 2003 Vienna MCPFE. The specific objectives of months 37-51 are to:

- maintain the information flow with related WPs in Module 2;
- derive scores for the recreational value of different age classes of FMA in Europe;
- further develop and implement approaches to modelling the impacts of changes to forest management on the recreational value of forests in Europe;
- Complete the reporting and publication of research carried out by WP2.3.

2.4.2 - An overview of the activities carried out

During the fourth year of the project, WP 2.3 maintained the information flow with related WPs in M2 : i) meetings of WP2.3 members in Copenhagen (Feb, 09), Uppsala (as part of EFORWOOD

final conference, Sept, 09), and Edinburgh (Oct, 09) ii) meetings and presentations with other M2 members during meetings in Freiburg (Feb, 09 and May, 09) and Uppsala (Sept, 09), and at EFORWOOD final conference, Uppsala (Sept 09) iii) regular inter-WP communication within FR and beyond regarding the work of WP2.3.

WP2.3 has derived scores for the recreational value of different age classes of FMA in Europe. Delphi surveys were carried out to obtain recreational scores involving 46 European experts in landscape preference research organised within 4 regional panels (United Kingdom, Nordic region, Central Europe, and Iberia) to reflect the diversity of forest types in Europe. The recreational scores derived from the four panels have been extrapolated to the European level and combined with outputs from EFISCEN to estimate percentage changes to the recreational value of forests under different future scenarios including different levels of implementation of Natura 2000. This is the first time that recreational use has been incorporated into European level impact assessment of forest management.

The WP2.3 has also completed the reporting and publication of research carried out by WP2.3 partners :

- D2.3.3: Public preferences for silvicultural attributes of European forests – final version to be submitted before end of project. Submission was postponed to allow findings from the Delphi survey to be incorporated. Will be reworked to produce a journal article for submission after the end of the project.
- PD2.3.5. Research protocol to derive recreational scores for European FMAs – submitted. The focus of a journal article published in Ecological Indicators.
- D2.3.6: Assessment of the recreational value of European FMAs – draft prepared. To be submitted by end of project. Will become the focus of a journal article for submission to M2 special issue of Ecology and Society after the end of the project.
- D2.3.7: Modelling the impacts of FMA on recreational values in Europe – draft prepared. To be submitted by end of project. Will become part of a journal article for submission to M2 special issue.

2.4.3 - Description of progress towards the milestones and deliverables foreseen

D 2.3.3 has been delayed and will be submitted in month 51. Milestones M2311 to M2314 have been reached; M2315 will be reached in month 51.

2.5 -WP 2.4 Risk assessment

2.5.1 - A description of progress toward the objectives of the project

The general objective is to develop standardised tools at EU-level for the prediction of forest damage in order to provide quantitative indicators and to forecast risks associated with forest management alternatives (FMA). The specific objectives of this work package for the final year are to:

- complete analysis of risks under various FMA in reference forests including case studies forests and at EU level;
- complete the reporting and publication of research carried out by WP2.4 ;
- contribute to M2 final reporting, project final conference, and assist with data collection where appropriate.

2.5.2 - An overview of the activities carried out

During the fourth year, WP24 has developed and tested a methodology of Multi Criteria Risk Analysis which has been applied to four FMAs (the unmanaged forest nature reserve alternative was not considered) as designed by WP2.1 in eight regional cases studies. The main outcomes are reported in the deliverable D246. All work-package partners were involved in the different steps of this activity and contributed to the final conference of EFORWOOD via the preparation and presentation of a scientific poster reporting on the main outcomes of the Multi Criteria Risk Analysis.

All WP24 partners designed guidelines for specific risk analyses aimed at estimating the effects of the different FMAs on biotic and abiotic damage and their consequences for forest productivity (tree mortality and biomass production). Specific risk analyses were then conducted for five different reference forests and associated risks (insects and wind) by corresponding partners in each region. The outcomes of these analyses are reported in PD247.

2.5.3 - Description of progress towards the milestones and deliverables foreseen

The PD 244, PD 245 and D 246 have been delivered and milestone M2413 has been reached (WP meeting organised during EFORWOOD week in Freiburg – 4-7 May). The PD 2.4.7 and the milestone M2414 have been delayed and will be achieved in month 52.

2.6 - WP 2.5 Integrated Modelling Tools

2.6.1 - A description of progress toward the objectives of the project

The general objective of this work package is to provide the models and tools to estimate forest based sustainability indicators for current forest management strategies and future alternatives and options that take multifunctional aspects into account and allow full chain analysis. The specific objectives for months 37-51 are to:

- complete the regional forest resource simulators that will be used to predict long-term development of the forests in a region under different scenarios with the estimation of the associated sustainability indicators;
- finalize the new version of the European forest simulator that will be used to predict long-term development of the European forests with the estimation of the associated sustainability indicators;
- provide forest simulation data for case studies and EU FWC under various scenarios;
- complete the reporting and publication of research carried out by WP2.5 and contribute to the project final conference.

2.6.2 - An overview of the activities carried out

The following activities were undertaken and achievements made during the last year of the project:

- the final versions of the regional forest simulators – sIMfLOR for Portugal, RegWise for Sweden and Sylvogene for France– were obtained and used to predict long-term development of the forests in each region under different scenarios with the estimation of the associated sustainability indicators;
- the final version of the European forest simulator that will be used to predict long-term development of the European forests with the estimation of the associated sustainability indicators was also completed (EFISCEN-space);

- the final results were presented at the final EFORWOOD Conference and are included in the final deliverable D2.5.6.

2.6.3 - Description of progress towards the milestones and deliverables foreseen

PD2.5.6 has been completed in month 41 (instead of 38) and D257 has been delayed until month 51. Milestones M2.5.8 to M2.5.10 have been reached; the submission of scientific papers to a scientific journal has been delayed until after the end of the project and M2.5.11 will be reached in month 52.

APPENDIX 1: WP-reports for s 37- 51

Period: November 1, 2008 - January 31, 2010

WP leader	Jean-Michel CARNUS	WP number	WP2.0
Date	November 1, 2008 – January 31, 2010		

Work package objectives

The objective of this work package is to ensure module objectives are fulfilled and deliverables provided according to time schedule through efficient co-ordination of module activities and interfaces with other modules.

- to coordinate module management team and WP teams and organise MMT and module meetings
- to coordinate the forest-based case study and contribute to EU forest wood chain task force
- to coordinate data collection for regional and national levels and monitor data supply to other modules
- to review deliverables and compile elements for annual report
- to organise with other WP in M2 a special issue of a journal on SIA of Forest Management Alternatives

Progress towards objectives

MMT meetings were organised every three s with WP leaders to review progress, data collection, and reporting; they included 3 physical meetings (Freiburg on 05/02/2009 and during EFORWOOD weeks on 4-7 May and 20-21 Sept. 2009) and 1 telephone meeting (07/07/2009). Two overall module meetings were organised by WP 2.0 during EFORWOOD weeks.

WP2.0 has contributed to the EU FWC task force meetings and workshop in January 2009, and organised the data collection for the socio-economic indicator values for the EU FWC. As part of WP2.0 tasks, SLU coordinated successfully the forest-base case study.

Review of 17 module deliverables was organised and completed in final year. An editorial team was set up after M2 workshop in Freiburg (4-5 February 2009) for the preparation of a special issue of a journal on SIA of Forest Management Alternatives. The submission of all papers will be made in the first half of 2010 to *Ecology and Society*.

Deviations from workprogramme (if any).

Some difficulties in collecting M2 socio-economic indicators values for EU FWC (e.g. production costs, GVA, wages and salaries) have been pointed out by M 2 partners; Alterra supported and coordinated other M2 partners to calculate them.

WP leader	Prof. Dr. Heinrich Spiecker (ALUFR)	WP number	2.1
Date	November 1, 2008 – January 31, 2010		

Work package objectives

The overall objective of WP 2.1 is the characterisation and analysis of currently recommended and future forest management strategies for relevant forest types across Europe for the maintenance of sustainability and their impacts on the Forest-Wood Chain. The specific objectives of this work package for the final period are to:

- complete data for reference forest types and key indicators on wood production and related economic parameters to be used for regional case studies, collected in the generated data platform.
- analyse the impact of current and future forest management alternatives on wood resources quantity and quality in close relation with WP 2.5 and M3. Due to difference between forest types, this analysis will be done on a regional basis.
- complete the reporting and publication of research carried out by WP2.1

Progress towards objectives,

WP2.1 has characterized the first link, i.e. the forest management segment (M2) of the Forestry-Wood-Chain within the three EFORWOOD Regional Case Studies and contributed to the corresponding gathering of information for the European Case Study. The corresponding regional reference forest types and their potential development in years 2005, 2015 and 2025 were simulated under the assumption of alternative reference futures and scenarios. Quantified indicator values were delivered to the EFORWOOD database client for joint analysis.

WP2.1 has analyzed the impact of alternative forest management approaches (FMA) on productivity of nine European reference forest types. The forest management approaches, forming a gradient of intervention intensity into natural processes, included both currently recommended strategies as well as future alternatives. The impact on forest resource was assessed in mean annual (solid) wood production and in land expectation value at various interest rates based on simulations. The regional results are compiled in PD 2.1.5. Further, a synthesis overview including cross regional comparison of forest management options is presented in D2.1.6.

WP2.1 specific achievements will be published within the M2 special issue of "Ecology and Society". ALUFR is lead author of two contributing manuscripts including further partners (working titles):

- "A Classification of Forest Management Approaches in European Forestry: A Conceptual Introduction"
- "Comparative impact analysis of alternative forest management strategies for spruce and pine on production based on simulations for European reference forest types"

Deviations from workprogramme (if any),

None

WP leader	Karsten RASMUSSEN	WP number	2.2
Date	November 1, 2008 – January 31, 2010		

Work package objectives

The general objectives are to evaluate environmental services from forests at local and regional scales and to provide quantitative environmental service indicators associated with forest management alternatives (FMA) and future FWC scenarios. The following environmental services are included: *carbon sequestration, water quality and quantity, biodiversity, and maintenance of soil quality.* The specific objectives of this work package for the 37^{th} to 51^{th} months are to:

- maintain the information flow with other WPs in module 2 and assist with data collection where appropriate
- complete systematic overview of forest operations quantitative impacts on environmental services ("response functions")
- integrate impacts of various FMAs on environmental services by use of a generic approach at regional level
- complete the reporting and publication of research carried out by WP2.2

Progress towards objectives,

- The systematic overview of forest operations quantitative impacts on environmental services ("response functions", PD 2.2.4) have been finalised and published on the Eforwood-Portal.
- The integrated impacts of five FMA's on environmental services by use of a generic approach (PD2.2.5) are almost finalised for the regional case study of Baden-Wurtenberg. All modelling work has been done, and we are in process of writing the final manuscript.
- The manuscripts on Forest management effects on each of the environmental services (D2.2.3) are almost finalised, the last editing work will be done in January and February 2010.

Deviations from workprogramme (if any),

The two deliverables D 2.2.3 and PD 2.2.5 are behind schedule due to quality requirements for their subsequent publication in scientific journals; efforts are being made to ensure their final delivery before the end of the project.

WP leader	David Edwards	WP number	2.3
Date	November 1, 2008 – January 31, 2010		

Work package objectives,

The objective of this work package is to collate information on Social and Cultural Values (SCVs) which stakeholders attach to major European forest types and, by relating SCVs to existing criteria and indicators for sustainable management, to explore the sensitivity of SCVs to different forest management alternatives (FMA). This study will be the first time that the interaction between SCV's and forest management has been explored over a range of major European forest types. This work will provide a basis for refining the existing criteria and indicators of SCVs and so support the implementation of resolution 3 of the 2003 Vienna MCPFE. The specific objectives of months 37-51 are to:

(i) maintain the information flow with related WPs in Module 2.
(ii) derive scores for the recreational value of different age classes of FMA in Europe.
(iii) further develop and implement approaches to modelling the impacts of changes to forest management on the recreational value of forests in Europe.
(iv) complete the reporting and publication of research carried out by WP2.3.

Progress towards objectives.

To maintain the information flow with related WPs in Module 2.

Meetings of WP2.3 members in Copenhagen (Feb, 09), Uppsala (as part of EFORWOOD final conference, Sept, 09), and Edinburgh (Oct, 09).

Meetings and presentations with other M2 members during meetings in Freiburg (Feb, 09 and May, 09) and Uppsala (Sept, 09), and at EFORWOOD final conference, Uppsala (Sept 09).

Regular inter-WP communication within FR and beyond regarding the work of WP2.3.

To derive scores for the recreational value of different age classes of FMA in Europe

A Delphi survey was carried out to obtain recreational scores involving 46 European experts in landscape preference research organised within 4 panels (United Kingdom, Nordic region, Central Europe, and Iberia) to reflect the diversity of forest types in Europe. Scores were obtained on ten-point scale for 60 forest stand types in each region.

The scores were also analysed using conjoint analysis to determine the relative importance of the three main variables in each region: FMA, phase of stand development, and tree species type.

The Delphi survey also produced data on the relationship and relative contribution of 12 key silvicultural attributes to the overall recreational value of forests in each region.

To further develop and implement approaches to modelling the impacts of changes to forest management on the recreational value of forests in Europe

The recreational scores derived from the four European Delphi panels have been extrapolated to the European level and combined with outputs from EFISCEN to estimate percentage changes to the recreational value of forests under different future scenarios including different levels of implementation of Natura 2000. This is the first time that recreational use has been incorporated into European level impact assessment of forest management.

To complete the reporting and publication of research carried out by WP2.3

D2.3.3: Public preferences for silvicultural attributes of European forests – final version to be

submitted before end of project. Submission was postponed to allow findings from Delphi survey to be incorporated. Will be reworked to produce a journal article for submission after the end of the project.

PD2.3.5. Research protocol to derive recreational scores for European FMAs – submitted. The focus of a journal article accepted by Ecological indicators for special issue on impact assessment of land use change in Europe.

D2.3.6: Assessment of the recreational value of European FMAs – draft prepared. To be submitted by end of project. Will become the focus of a journal article for submission to M2 special issue of Ecology and Society after the end of the project.

D2.3.7: Modelling the impacts of FMA on recreational values in Europe – draft prepared. To be submitted by end of project. Will become part of a journal article for submission to M2 special issue.

Deviations from workprogramme (if any),

Submission of final version of D2.3.3 (review of public preferences for silvicultural attributes in Europe) was postponed to the end of the project to allow findings of Delphi survey to be incorporated.

WP leader	Hervé JACTEL	WP number	2.4
Date	November 1, 2008 – January 31, 2010		

Work package objectives,

The general objective is to develop standardised tools at EU-level for the prediction of forest damage in order to provide quantitative indicators and to forecast risks associated with forest management alternatives (FMA). The specific objectives of this work package for the final year are to:

- complete risks analysis of various FMAs in reference forests including case studies forests and at EU level
- complete the reporting and publication of research carried out by WP2.4
- contribute to M2 final reporting, project final conference , and assist with data collection where appropriate

Progress towards objectives,

- The innovative methodology of Multi Criteria Risk Analysis has been developed. It has been applied to four FMAs (the non-intervention nature reserve alternative was excluded) as designed by WP2.1 in eight regional cases studies. The main outcomes are reported in the deliverable D246 under review. All WP24 partners were involved in the different steps of the work.
- The WP24 group of experts contributed to the final conference of EFORWOOD via the preparation and presentation of a scientific poster reporting on the main outcomes of the Multi Criteria Risk Analysis.
- The WP24 (whole group) designed guidelines for specific risk analyses aimed at estimating the effects of FMAs on biotic and abiotic damage and their consequences for forest productivity (tree mortality and biomass production). Then specific risk analyses were undertaken in the following regional case studies by corresponding partners: Aquitaine – *Pinus pinaster* – insect defoliator, Portugal – *Eucalyptus globulus* – Insect defoliator and wood borer, Scotland – *Pinus sylvestris* – wind, Poland – *Picea abies* – insect wood borer, Austria – *Picea abies* – insect wood borer

Deviations from workprogramme (if any),

- The scientific publication about methodology and results of the Multi Criteria Risk Analysis was delayed due to agenda difficulties and will be submitted during first term of 2010 as part of the special issue of a scientific journal.
- The deliverable reporting on specific risk analyses (PD247) was delayed due to time consuming modelling operations. It is planned to be delivered by the end of January 2010.

WP leader	Margarida TOME	WP number	2.5
Date	November 1, 2008 – January 31, 2010		

Work package objectives,

General objective of this work package is to provide the models and tools to estimate forest resources sustainability indicators for current forest management strategies and future alternatives and options that take multifunctional aspects into account and allow full chain analysis. The specific objectives for months 37-51 are to:

- complete the regional forest resource simulators that will be used to predict long-term development of the forests in a region under different scenarios with the estimation of the associated sustainability indicators
- finalize the new version of the European forest simulator that will be used to predict long-term development of the European forests with the estimation of the associated sustainability indicators
- provide forest simulation data for case studies and EU FWC under various scenarios
- complete the reporting and publication of research carried out by WP2.5 and contribute to project final conference

Progress towards objectives,

The following activities were undertaken and achievements made during the last year of the project:

- the final versions of the regional forest simulators – sIMfLOR for Portugal, RegWise for Sweden and Sylvogene for France – were obtained and used to predict long-term development of the forests in each region under different scenarios with the estimation of the associated sustainability indicators
- the final version of the European forest simulator that will be used to predict long-term development of the European forests with the estimation of the associated sustainability indicators was also completed (EFISCEN-space)
- the final results were presented at the final EFORWOOD Conference and are included in the final deliverable D2.5.6.

Deviations from workprogramme (if any)

No major deviations have occurred, just some delays against the previously predicted deadlines.

APPENDIX 2 : List of deliverables

List of Deliverables during the period November 1, 2008 – January 31, 2010

Del No.	Deliverable name	WP No.	Due date	Actual/ Forecast delivery date	Lead contractor
PD2.0.7	Report on special issue "SIA of Forest Management Alternatives in Europe	2.0	46	46	INRA
PD2.0.8	Final M2 report	2.0	48	51	INRA
D2.1.6	**Comparative impact analysis of alternative forest management approaches on production based on simulations for EU reference forests**	2.1	46	51	ALUFR
PD2.1.5	Impact analysis on production of alternative forest management strategies based on simulations for European reference forest types	2.1	39	50	ALUFR
D2.2.3	**Paper on impacts of forest management on environmental services**	2.2	38	52	KU
PD2.2.4	Report on quantification of environmental impact of forest operations (response functions)	2.2	40	47	KU
PD2.2.5	Report on time and scale integration of environmental impact of forest management alternatives by use of generic modelling approach	2.2	44	52	KU
D2.3.3	**Report on the impacts of forest management on social and cultural values in Europe**	2.3	38	52	FR
PD2.3.5	Research protocol to derive recreational scores for European FMA	2.3	42	46	FR
D2.3.6	**Assessment of the recreational value of European forest management alternatives**	2.3	48	52	FR
D2.3.7	**Modelling the impacts of FMA on recreational values in Europe**	2.3	48	52	FR
PD 2.4.4	Report on methodology to test the effects of FMA on wood volume loss using hazard specific risk analysis	2.4	38	45	INRA
PD2.4.5	Report on feasibility of using multi criteria analysis to evaluate effects of FMA on risks	2.4	38	40	INRA
D2.4.6	**Synthesis report on main outcomes of the simulation on the effects of FMA on forest damage indicators**	2.4	44	51	INRA
PD2.4.7	Report on specific risk analysis in regional forests of Europe under various FMA	2.4	48	52	INRA
PD2.5.6	Report describing version 1 of regional simulators and the European forest resource simulator	2.5	38	42	ISA
D2.5.7	**Description of the regional simulators and the European simulator (final version)**	2.5	44	52	ISA

APPENDIX 3 : List of milestones

List of Milestones during the period November 1, 2008 – January 31, 2010

Mile-stone No.	Milestone name	WP No.	Date due	Actual/Forecast delivery date	Lead contractor
M2.0.15	meetings with all module partners and MMT meetings every three months	2.0	43, 47	40, 43, 45, 47	INRA
M2.0.16	M2 special issue group meeting	2.0	40	40	INRA
M2.0.17	annual and final activity and management reports	2.0	48	52	INRA
M2.1.11	Specific WP meeting on impact analysis of FMA on wood production	2.1	37	37	ALUFR
M2.1.12	Conceptual outline of contributions to M2 special issue	2.1	40	40	ALUFR
M2.1.13	Complete the reporting and publications	2.1	48	51	ALUFR
M2.2.9	specific WP meeting - response functions for environmental services	2.2	40	40	KU
M2.2.10	complete the reporting and publications	2.2	48	52	KU
M2.3.11	Develop research protocol for deriving recreational scores	2.3	42	46	FR
M2.3.12	Establish an expert group to derive recreational scores	2.3	42	46	FR
M2.3.13	Derive recreational scores for forest management alternatives in different European regions	2.3	44	48	FR
M2.3.14	Use forest simulators to forecast changes in area of FMA under relevant scenarios and hence estimate impacts on recreational value	2.3	46	50	FR
M2.3.15	Complete the reporting of all activities of WP2.3 and submit publications	2.3	48	52	FR
M2.4.13	specific work package meetings	2.4	40, 43	43	INRA
M2.4.14	4 scientific papers submitted	2.4	48	52	INRA
M2.5.8	Regional and European forest simulators - version 1	2.5	37	43	ISA
M2.5.9	Specific WP meeting	2.5	43	43	ISA
M2.5.10	Final version of regional and European forest simulators	2.5	44	51	ISA
M2.5.11	5 scientific papers submitted	2.5	48	52	ISA

APPENDIX 4: List of M2 scientific publications and dissertations

Scientific publications

Title	Journal	Author(s)	1. published 2. accepted 3. submitted 4. in prep. 5. in plan (yr.)	Based on D/PD no.	Work package no.
Forest Management Alternatives for comparable analysis of European Forestry – A Conceptual Introduction	Ecology and Society journal	Duncker, et. al.	3. internal review *	D2. 1.3	WP2.1
Sustainability Impact analysis of FMAs based on simulations for reference forest types in various European regions	Ecology and Society journal	Duncker P, Barreiro, S, Hengeveld,G, Lind, T.	3. internal review *	D2.1.6	WP2.1
Silvicultural strategies for Adapting European Atlantic forests to climate chhange	Japanese Journal of Forest Planning	Mason, W.L., and Meredieu, C.	3. Journal review	D 2.1.3	WP 2.1
impacts of forest management on environmental services: (1) biodiversity	Annals of Forest Science	De Jong et al	3. internal review	D2.2.2	WP2.2
Impacts of forest management on environmental services: (2) soil quality	Annals of Forest Science	Hansen et al	3. internal review	D2.2.2	WP2.2
Impacts of forest management on environmental services: (3) carbon cycle	Annals of Forest Science	Loustau et al	3 internal review	D2.2.2	WP2.2
Impacts of forest management on environmental services: (4) water cycle	Annals of Forest Science	katzensteiner et al	3. internal review	D2.2.2	WP2.2
Impacts of forest management on environmental services: (5) water quality	Annals of Forest Science	Gunsersen et al	3. internal review	D2.2.2	WP2.2
'Recreational use' as an indicator to assess the impacts of forest management on quality of life in Europe.	Ecological Indicators	Edwards, D., Jensen, F., and Marzano, M.	1. published 2009	D2.3.3	WP2.3
Public Preferences for Forest Attributes: Towards a European Synthesis	Ecology and Society	Edwards, et al.	4. in prep.*	D2.3.4	WP2.3
A Delphi Approach To Assess The Impacts Of Forest Management On The Recreational Value Of European Forests	Ecology and Society	Edwards, et al.	4. in prep.*	D2.3.6	WP2.3 WP2.5
A fire probability model for forest stands in Catalonia	www.edpsciences.org	González J.R., Palahí M., Trasobares A., Pukkala T	1. published 2006	D2.4.3	WP2.4
Optimising the management of Pinus nigra Stands under endogeneous risk of fire in Catalonia	Investigación Agraria 17(1)	González J.R., Palahí M., Trasobares A., Pukkala T	1. published 2008	D2.4.3	WP2.4
Predicting stand damage and tree survival in burned forests in Catalonia	Annals of Forest Science, 64	González, J.R., Trasobares, A., Palahí, M., Pukkala,T	1. published 2007	D2.4.3	WP2.4
Introducing tree interactions in wind damage simulation	Ecological Modelling, 207	Schelhaas, MJ, Kramer, K, Peltola H, van der Werf, DC, Wijdeven, SMJ	1 - Published 2007	D2.4.3	WP2.4
Influences of forest stand management on biotic and abiotic risks	Annals of Forest Science	Jactel, H et al	1 - Published 2009	D2.4.3	WP2.4
Multicriteria Risk analysis in EU forests under various forest management alternatives	Ecology and Society	Jactel, H et al	4. in prep.*	D2.4.6	WP2.4 WP2.1

Impact of the Eucalyptus snout beetle (*Gonipterus scuttelatus*) in wood production.	Annals of Forest Science	Branco, M.; Reis, A., Jactel, H., Tomé, M.	4. in prep	PD2.4.7	WP2.4 WP2.5
The influence of stand structure on the susceptibility of eucalyptus forests to fire.	Annals of Forest Science	Branco, M., Navalho E., Moreira, F., Tomé M. & Tomé. J.,	4. in prep	PD2.4.7	WP2.4 WP2.5
Stand attributes and location define wind and snow damage in conifer mountain forests in the Eastern Pyrenees	tbd	Martín-Alcón, S., González-Olabarria J.R.	4. in prep	PD2.4.7	WP2.4
Prevalence of biotic and abiotic hazards in European forests	Forest Ecology and Management	Jactel, H et al	4. in prep.	D2.4.2	WP2.4
Using expert knowledge to model forest stand vulnerability to fire	Computers and electronics in agriculture, Elsevier Vol. 55	González, JR., Kolehmainen, O., Pukkala, T.	1. published 2007	PD2.5.3	WP2.5
Future harvesting pressure on European forests	European Journal for Forest Research	G.J Nabuurs, A. Pussinen, J. van Brusselen, M.G Schelhaas	1. published 2006	PD2.5.3	WP2.5
SIMPLOT: Simulating the impacts of fire severity on sustainability of eucalyptus forests in Portugal.	Ecological Indicators	Barreiro, S. & Tomé, M.	1. published 2009	PD2.5.6	WP2.5
A compatible system for prediction of total and merchantable volumes allowing for different definitions of tree volume	Canadian Journal of Forest Research	Nunes, L., Tomé J. & Tomé, M.	1. published 2010	D2.5.7	WP2.5
Modelling dominant height growth of maritime pine in Portugal using GADA and considering the influence of climate variables.	Annals of Forest Science	Nunes, L., Patrício, M. S., Tomé, J., Tomé, M.	3. submitted 2010	D2.5.7	WP2.5
Modelling diameter distribution of eucalyptus plantations with Johnson's SB probability density function parameters recovered from a compatible system of equations to predict stand variables.	Annals of Forest Science	Mateus, A. & Tomé, M.	3. submitted 2009	D2.5.7	WP2.5
Equations to estimate tree biomass in Pinus pinaster AITON stands in Portugal.	Annals of Forest Science	Faias, S., Teixeira, A., Morais, P., Correia, A., Páscoa, F. Lopes, D. Ocoa,P., Tomé, J. Tomé, M.	3. submitted 2010	D2.5.7	WP2.5
EFORWOOD – A research program designed to assess the performance of the forestry and forest-based industries in respect of sustainable development	Revue Forestière Française vol. LIX n°4, 359-364.	Poissonnet M., Cucchi V., Carnus J.-M., 2007 .	1. published 2007	D2.0.2	WP2.0
Downscaling socio-economic and trade scenarios for more strategic policy support and management planning in the European forestry sector	Ecology and Society journal	Arets, Mason, Nabuurs, Schelhaas, Moiseyev	4. in prep.*		WP2.5
Synergies and trade-offs between production, land expectation value and ecological services in relation to forest management.	Ecology and Society journal	Duncker, Raulund-Rasmussen, et al.	4. in prep*.	PD225	WP2.1 WP2.2
Assessing impacts of increasing the use of eucalyptus biomass for energy in wood available for pulp industry in Portugal	Ecology and Society journal	Susana Barreiro , Margarida Tomé et al	4. in prep*	PD256	WP2.5
Impacts of different Natura2000 implementation levels on European forest resources	Ecology and Society journal	Schelhaas, Hengeveld, Nabuurs, Mason, Lindner, et al.	4. in prep.*	PD256	WP2.5
Implementation of FMA's in a high resolution European Forest Resource model – EFISCEN-space	Ecology and Society journal	Hengeveld, Nabuurs, van den Wyngaert., Schelhaas	4. in prep.*	PD256	WP2.1 WP2.5

** contribution to special issue of journal on SIA of FMAs*

Conference proceedings, Book chapters etc.

Title	Publication	Author(s)	1. published 2. accepted 3. submitted 4. in prep. 5. in plan (yr.)	Based on D/PD no.	Work package no.
Biodiversity and sustainability impact assessment of forestry-wood chains in Europe	IUFRO D8 conference 2008	Carnus, JM, Rasmussen, K, DeJong, J	Oral presentation	D2.2.2	WP2.2
Capturing the social and cultural values of European forests: insights from EFORWOOD	proceedings of the IUFRO European Congress in Warsaw, 2007	Edwards, D. (2007)	1. published 2007	PD2.4.1	WP2.3
Floodplain Forests of the temperate Zone of Europe	Book	Emil Klimo, Herbert Hager, Slavko Matic, Igor Anic, Jirí Kulhavý	1. published 2008	D2.2.2	WP2.3
Impacts of natural disturbances on the development of European forest resources	Alterra Scientific Contributions 23	Schelhaas Mart-Jan	1. published 2008	D2.4.2	WP 2.4
A Swedish regional level simulator for forest projections and analyses	SENSOR Conference 2008	Lind, T, et al	Oral presentation	PD2.5.3	WP2.5
EFISCEN-Space: high resolution modeling of forest resources at a pan-European scale	SENSOR Conference 2009	Van der Wygaert, I, et al	Oral presentation	PD2.5.3	WP2.5
Estimating future forest sustainability indicators at national/regional level using NFI data: the impact of data aggregation	SENSOR Conference 2009	Barreiro, S, Tome, M,	Oral presentation	PD2.5.3	WP2.5
A Delphi approach to assess the impacts of forest management on the recreational value of European forests	Eforwood conference 2009	David Edwards et al.	1. published 2009	PD2.3.4	WP 2.3
SIMPLOT : Regional Simulator for the Portuguese Forest Resources	Eforwood conference 2009	Susana Barreiro, Margarida Tomé, Sónia Faias and João Palma	1. published 2009	PD2.5.6	WP 2.5
Impact of different levels of nature conservation designation on European forest resources	Eforwood conference 2009	M.J. Schelhaas, M et al.	1. published 2009	PD2.5.6	WP 2.5
Risks for European forests under new management alternatives: a Multi Criteria Analysis	Eforwood conference 2009	Jactel et al.	poster	PD2.45	WP 2.4

PhD and Master theses

Title	Author	Expected date of dissertation	Related to Work package no.
impacts of forest management alternatives on recreational use of forests in Europe	Brendan Rawlinson	2008	WP2.3
Modeling the impact of biotic damage on the productivity of maritime pine plantation forests	Christophe Orazio (PhD)	2011	WP2.4
Development of a simulator of forest development including sustainability indictors for eucalyptus in Portugal	Susana Barreiro (PhD)	2010	WP2.5
Analysis of biomass expansion factors for the most important forest species in Portugal	Sonia Faias (Msc)	2008	WP2.5
A model to predict sustainable forest management indicators for maritime pine stands in Portugal	Luís Nunes (PhD)	2010	WP2.5
A system of equation for the prediction of stand biomass per tree component for eucalyptus plantations in Portugal	Tânia S. Oliveira (Msc)	2008	WP2.5