Interreg Alpine Space project - **NEWFOR**

Project number 2-3-2-FR

NEW technologies for a better mountain **FOR**est timber mobilization

Priority axis 2 - Accessibility and Connectivity

Workpackage 8: Logistical Planning Strategy

Recommendation paper for adaptation of national/regional legislation

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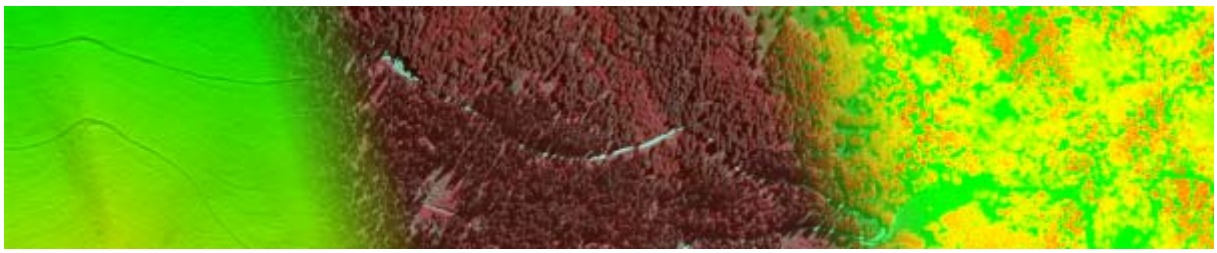
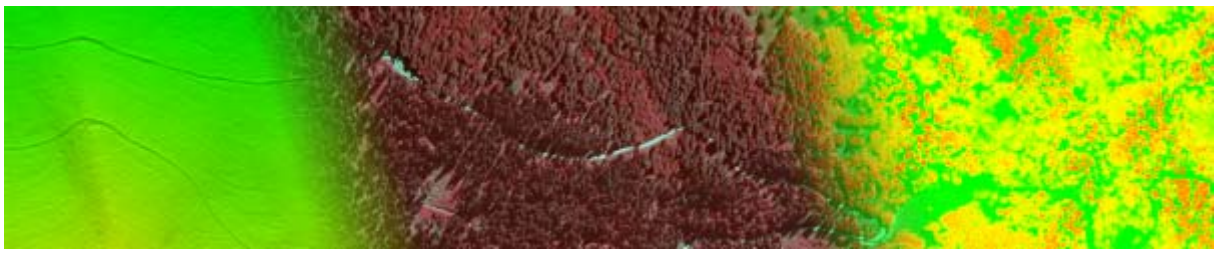
Final version 30/11/2014



The consortium of the project Interreg Alpine Space NEWFOR

This project has been, co-funded by the European Regional Development Funds, and achieved under the third call of the European Territorial Cooperation Alpine Space Programme 2007-2013.



CONTENT

1 ABSTRACT

In its project life NEWFOR handled several issues concerning the complexity of mountain forest resources management. By using new technologies, building and implementing new tools and testing them in pilot areas, the consortium applied some solutions to enhance a sustainable management of forests in the Alpine Space.

Based on this experience some general recommendation for an Alpine Space mountain forests action plan are provided. Furthermore some technical recommendation on how to deal with the technologies tested in the project, as well as the constraints that need to be solved in the Alpine Space are listed separately The need of a common strategy and a full harmonization of definition, rules (law), and data availability are by far the most important one.

2 A SYNTHETIC OVERVIEW OF THE INTERREG ALPINE SPACE PROJECT NEWFOR

2.1 THE CONTEXT

Although forests represent a key resource of mountain environments, their valorization is hindered by accessibility constraints that prevent efficiency in mapping, management, harvesting and transport of wood products.

Forests fulfil multiple functions in mountainous areas. They have an ecological function as host of many habitats and species. They also are a leisure area for social activities such as hiking, skiing… From the economical perspective, the production of renewable resources like timber and fuelwood has positive effects both at global scale, with climate change mitigation, and local scale with rural employment and the development of a regional value chain. The objective of preserving and improving the development of mountain forests is a point of public interest. However, managing forests in mountain territories is a difficult task as topography and climate set strong constraints inside a complex socio-economical framework.

In particular, a precise mapping of forest characteristics (e.g. biomass) and mobilization conditions (harvesting and accessibility) is a prerequisite for the implementation of an efficient supply chain for the wood industry. The available information is currently insufficient to provide, at reasonable costs, the required guarantees on the wood supply and on its sustainability. With the recent development of new remote sensing technologies and modelling tools, major improvements regarding the evaluation of the forest growing stock and accessibility are now possible. Upon this highly valuable information, decision-making tools must be build to optimize the investments in forest infrastructures required for a cost-effective wood supply while securing the sustainable management of forests, and to support the implementation of an efficient European policy for mountain forest management.

2.2 OBJECTIVES OF THE PROJECT

According to this context and based on the use of new technologies for forest and topography characterization (LiDAR: light detection and ranging and UAVs: Unmanned Aerial Vehicles), the project NEWFOR is dedicated to enhance and develop tools and adapted policies for decision making in the field of a sustainable and adaptive mountain forest resources management facing the sustainability of mountain forest ecosystems services.

The main objective of the NEWFOR project is the improvement of mountain forest accessibility for a better economical efficiency of wood harvesting and transport in a context of sustainable forest management and wood industry in changing climate.

The 14 partners involved in the project consortium tackle this objective within five thematic workpackages (wp):

- Forest resources and LiDAR

Recent developments in LiDAR technology, combined to other available data sources (aerial photographs, aerial photo series by UAVs, …), are now allowing a precise and fine mountain forest resource quantification, qualification and mapping. Integrating this technology will provide an innovative response to the challenges of a precise and robust knowledge on the available growing stocks. The project aims at testing (e.g. benchmarks) and developing tools that will help forestry end-users to benefit from this technological advance.

- Forest accessibility

After the identification of forest resources, the second step of an efficient forest management is to evaluate the accessibility to these resources. In mountain areas, topography is the main constraint to a technical and economically efficient exploitation. The project demonstrated how to use topographic LiDAR data coupled with geographic information systems (GIS) for an optimal planning of forest harvesting and logging while taking current and scheduled accessibility of forest resources into account.

- Forest and industry connectivity

Once the forest resources and accessibility are characterized, the remaining issue is the connectivity between wood piles in the forests and wood yard of mills. This link is often neglected but is crucial for a comprehensive assessment of the wood supply efficiency.

- Costs and benefits evaluation

NEWFOR aims at developing decision-making tools dedicated to the definition of strategies for sustainable mountain wood supply chain. To fulfil this objective, tools for identifying forest resources, their accessibility and connectivity to the wood market are considered separately. In order to achieve the line of action, and to choose the optimal strategy, it is necessary to evaluate the whole workflow from the economical aspect by comparing the costs and benefits of each possible strategy.

- Logistical planning strategy

There is a need to frequently adjust the planning of forest management to new economical evidence as well as to unforeseeable developments. Such an adaptive management needs to balance ecological, social and economic factors. The final objective was to provide forest managers and decision makers with reliable information for the evaluation of technical and economical conditions for their decision-making on timber supply chain logistical planning and land use strategies.

3 RECOMMENDATION PAPER FOR ADAPTATION OF NATIONAL/REGIONAL LEGISLATION

3.1 RECOMMENDATION FOR AN ALPINE SPACE MOUNTAIN FORESTS ACTION PLAN

From the beginning of time, man has modified the environment he lived on and therefore the forest has been one of the key point of land management strategy for developing a sustainable liveable space. The simplest definition of a forest is the following one: a plant community dominated by trees and other woody plants growing relatively close to each other. Traditionally, in mountain areas man has assigned three main functions to forest as 1) the production of timber and (or) other forest products (mushrooms, berries, etc.), 2) protection against natural hazards and 3) watershed protection (soil stabilization, water regulation...). Man has then exploited it regularly by entrusting these specific functions (production, protection, ...).

Nowadays, the term "forest functions" has evolved to the one of ecosystem services provided by forests. Due to the evolution of the human society, these services includes also landscape protection, fauna and flora protection, carbon sequestration, the economic sector including the whole wood supply chain.

Their economic value, the functions they must provide and the management required for maintaining and improving these functions state that forests have to be considered as a real heritage. A heritage is all the property, rights and duty of a person or a system. According to all the services provided, mountain forests are the woody ecosystems for whose heritage aspects are the most pronounced. This notion of heritage is one of the expression of the multi-functionality of these forests. So they should be considered not only as primary production units (timber production and investment income) serving particular interests but as heritage and cultural assets for the human society. So, forest ecosystems serve the interests of the community.

All these functions must be taken into account in the development of adapted forest management, forestry actions and forest policy. But according to its natural dynamics, the forest is changing and only certain stages of development meet the various functions that are expected of it. This inventory determines the first baseline that decision and policy makers have to keep in mind for defining a sustainable and adapted mountain forest action plan:

People need the forest, and the forest needs our support.

The concepts of sustainable development, biodiversity and multi-functionality, have become essential for the management of natural environments. Management is the art of making decisions guided by the pursuit of goals that vary depending on the systems studied. Forest management is therefore all the means and methods used to manage a forest to ensure its ecological balance and allow it to optimize its various functions. Managing mountain forests is significantly more expensive than managing lowland forests. This is mainly due to the constraints generated by the slope and climatic conditions, but also by the ones coming from human implementations and associated activities (i.e. leisure activities that create new constraints on land uses).

The main result of all these constraints is the spatially and time limited access to mountain forest resources. Merely to manage mountain forest according to the general principle of sustained yield (to use no more than the forest can produce), is currently no more efficient to sustain all the mountain forest ecosystem services.

In relation with these statements and according to the results gained by the consortium of the project NEWFOR **the following 10 baselines for defining an efficient Alpine Space mountain forests action plan should be considered** :

1. Mountain forests are multifunctional ecosystems but **an efficient and sustainable forest management and land use strategy have to be based on the definition of priority functions.** This could only be done if efficient decision support systems (DSS) are developed in order to identify, qualify, quantify and prioritize the different forest ecosystems services.

2. A such DSS is only a tool, **this is so necessary to develop a real governance policy** for its uses:

    a. The DSS and the tools associated have **to be developed using geographical information systems i**n order to provide maps that should be used as negotiation support with the different actors.

    b. The DSS and the tools associated have to be actors oriented by offering the possibility to each actor **to propose is own weighting and set of priorities**. **The confrontation of each result then will encourage the search for consensus.**

3. **The prioritization of mountain forest ecosystems services have to be based on the optimization of the natural dynamics of forest stands**

4. **If the production function is not sufficient** for covering all the management and resources extraction costs then, as preserving and improving the efficiency of mountain forest are key points of public interest**, an adapted economic context has to be settle.** A specific attention should be paid to the monetisation of ecosystem services.

5. **The monetisation of mountain forest ecosystems services can only be done if all the actors are identified and if the public general interest is well defined and displayed.** Cost-benefits analysis should be carried on in order to clearly analyse the added value of this "bio-based" land use management. These are the necessary and sufficient conditions for the acceptance by all of this ecosystems services' monetisation. All the users or beneficiaries of these services should be clearly identified and a financial solidarity should be build up in order to help the forest owners and managers to sustainably manage the mountain forest functions of public interest.

6. **All the methods and associated tools for defining and prioritizing mountain forest ecosystems services should be harmonized at the Alpine Space** scale in order to develop a rational utilisation of forest resources and European funds taking into account the potential benefits and costs of actions. For reaching this goal the development of a **global European strategy for providing, producing and disseminating high resolution data** consistent with the outcome of the foresters' and more generally user's requirements should be pursued.

7. The **access and mobilization to mountain timber resources should be enhanced in respect to the different mountain forests ecosystems services**. This also requires optimising the uses of timber and wood in the local, regional and national economies.

8. According to the specificities of topographic and climate conditions in mountain areas, **the preservation and enhancement of the protective role of forest stands against natural risks have to be considered as the key drivers for the development of an efficient action plan for strengthening the liveability of the Alpine Space**. This has to be done in consideration to the principle of sustainable production in order to also guarantee the sustainable use of forests as one of the most important reservoir of renewable raw material.

9. The success of all these baselines can only be guaranteed if a **public awareness based on an efficient communication strategy** is developed. In other terms the forester has to get out of his forest and communicate!

10. The future forest action plan should be build up on the concept that foresters and associated policy have **to guarantee and leave a value environmental legacy for future generations**

3.2 SPECIFIC AND TECHNICAL RECOMMENDATION

According to the activities conducted during the three years of the NEWFOR project, recommendations are provided in the next sections of the document. These were formulated from the project's experience in (i) applying new technologies, (ii) testing several tools with data from the Alpine Space region and (iii) using several expert hearings and feedback from stakeholders and potential end-users.

3.2.1 FOREST STRUCTURE EVALUATION

3.2.1.1 UAV FLIGHT PLANNING AND LAW LIMITATIONS

Many developments in national and European legislation, related to restrictions and permission for UAV surveys, have occurred mainly during the concluding year of the project, through all the Alpine Space region. Some issues are likely to cause confusion or even be a source of problematics in handling data collection through UAV surveys. Detailed information on legislation concerning UAV are provided by the national aviation authorities and mostly also local model aircraft associations. On the website of the European Aviation Safety Agency – EASA – useful links to national UAV regulations can be found (http://easa.europa.eu/unmanned-aircraft-systems-uas-and-remotely-piloted-aircraft-systems-rpas). See also the homepage of the "German Speaking Association for Unmanned Aerial Vehicles" (www.uavdach.org) for news concerning legislation, certification, technologies and actual research in Austria, Switzerland, Germany, Italy and the Netherlands.

Recommendations for a safe and proper data acquisition:

- Follow the national legislation and certification regulations;
- Select the appropriate aircraft for the application purpose (multicopter / fixed wing aircraft). Remember to consider flight time, flight range and visibility of and to the UAV;

- Find an area close to the test-site for starting, piloting and landing. Carefully take into account that the UAV has to be ALWAYS visible from the pilot´s position;
- Care for wind and position of the sun which may cause reflection hampering visibility;
- Use automatic mode only in case you receive enough GNSS-related signals and thus proper positioning at all times;
- Preparing an intelligent flight plan saves battery, flight time and processing time. Try to hold a constant height above ground and follow a regular flight pattern. Plan a high image overlap in all directions;
- For forestry applications it is better to avoid extreme wide-angle lenses due to strong radial distortions;

3.2.1.2 LIDAR DATA ACQUISITION

For forestry related LiDAR data acquisitions the following recommendations are formulated:

- Minimum point density: 4 laser pulses per m^2;
- At least first and last echoes, beneficial are intermediate echoes or even full-waveforms, even if the latter require skilled personnel for post-processing;
- High positional accuracy: strip differences less than 5 cm; accuracy in XY less than the footprint size;
- Delivering the 3D point clouds and not only derived raster models;
- In addition to the 3D point clouds also the trajectory information should be delivered;
- Detailed information about the coordinate system used as well as other metadata (e.g. date and time of flight, company etc…).

3.2.2 FOREST ROADS PLANNING AND INDUSTRY CONNECTIVITY

3.2.2.1 NOMENCLATURE AND DEFINITION PARAMETERS

The definition of a common nomenclature and standard technical parameters is definitely the most important goal to achieve within the alpine territory. Indeed, the movement of forest companies among the different Countries in the Alpine Space in the last years have become more and more frequent. Is then often necessary to be able to offer to a foreign company a proper planning overview, both for harvesting and later mobilisation.

3.2.2.2 FOREST ROAD DATA BASES

- Data must be **compatible** or easily **convertible** for integration in **route guidance** system because in the future transport companies will use route guidance systems for navigation and optimization/planning of wood transport.
- **Upgrading** the data must be done in a **collaborative** way by the end-users, not only forest management organizations but also transport enterprises and logging companies. Specific procedures must be defined to control the proposed upgrading (new forest roads, temporary obstacles, unpractical section both on public and forest roads).
- The qualification of forest roads should be **uniform** and **consistent** and based on **European harmonized criteria**
- A good connection between the public road and forest road network need particular attention and post processing data is necessary to make sure that this connection is well established.
- According to the fact that classical field survey (men + GNSS) for forest roads mapping are highly time consuming for a low accuracy results, the research and development action on how to use **automatic acquisition** of data for **forest road qualification** (Lidar, embarked equipment in trucks….) should be followed up in order to provide a new and cheaper conventional methods. Public organizations responsible for Geographic Information have also to provide “first level” data and could provide the general frame housing the forest road data.

3.2.2.3 TRANSPORT PLANNING TOOLS

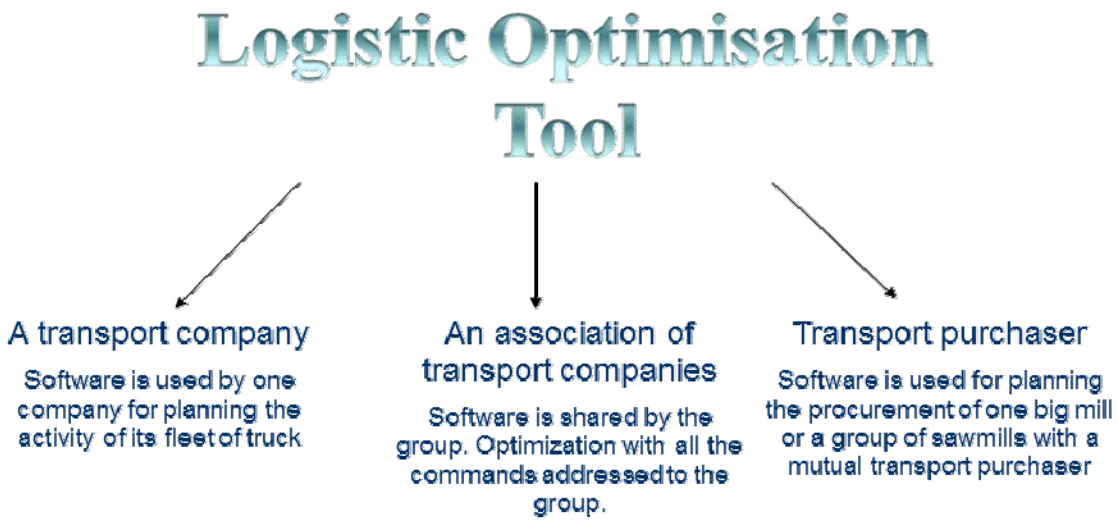
- The specific **national regulations** must be easily **integrated** and taken into account in the algorithm used for **timber transportation optimization** from the forest to the users (e.g. public road network with specific regulations in terms of allowable payload or with particular tax). This research of optimization should of course considers the **utilization rate** of the trucks fleet but also the **cost of transportation**, including **toll** and **taxes**.
- The **software**'s which will be developed in the future should be **high speed** calculator in order than they can quickly propose new options in case of unexpected perturbations and changes (climatic hazards, engine failure on truck or harvesting material in the forest, difficulties on forest roads, and changes in the delivery program of the mills….)
- Transport companies must work in a common way. Optimization is even more efficient when possibilities of allocation are higher.

- **Back haulage strategy** should be taken into account in the optimization tools as it is an important lever to decrease the cost of transport when using non forest-specific truck such as tractor + semi-trailer.
- Transport planning tools must be considered in a global logistic optimization with **data exchanges** (Electronic Data Interchange) between all the enterprises involved in the supply chain (transport companies, logging companies, sawmills, pulp mills and chipboards mills. The objectives are to have **up-to-date data** for planning and a good knowledge of the wood stocks all along the supply chain: in the forest, at the roadside, in the factories.

3.2.2.4 ORGANISATION

New organisations must be found for an improved efficiency!

- Transport companies must work in collaboration. Sawmills should also collaborate because optimisation is even more efficient when possibilities of allocation are higher.



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