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: Forest and industry connectivity

Recommendations for making forest roads data usable for route guidance systems

Coordinator: Stéphane GRULOIS (FCBA)

Contributors: Thomas CARRETTE (FCBA), Andrej GRUM (SFS), Elisabeth HAINZER (TORG), Marco PELLEGRINI (TESAF), Thomas CARRETTE (FCBA), Elisabeth HAINZER (TORG), Dieter STÖHR (TORG),

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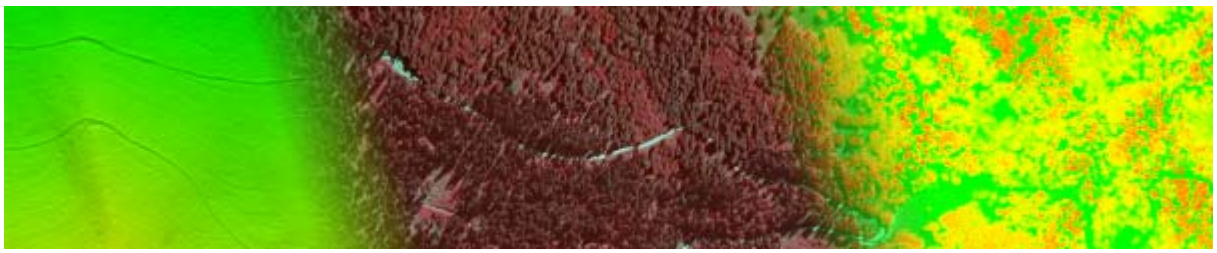

The consortium of the project Interreg Alpine Space NEWFOR

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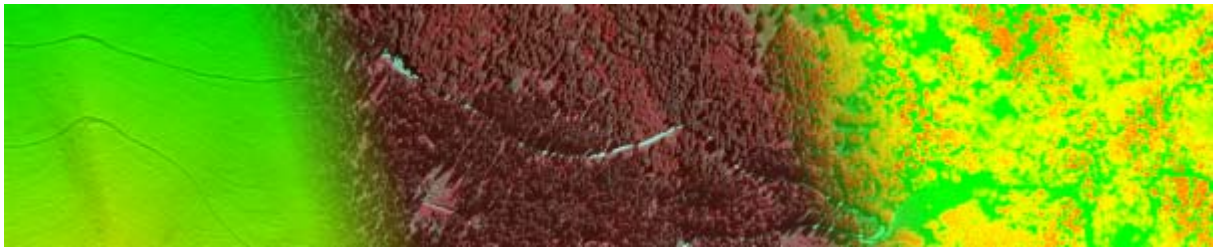

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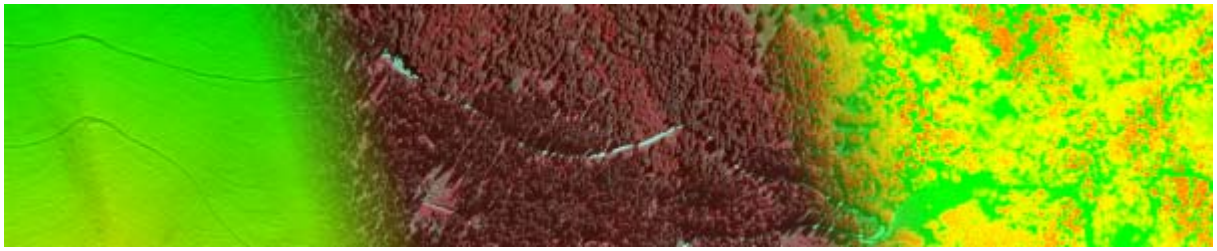
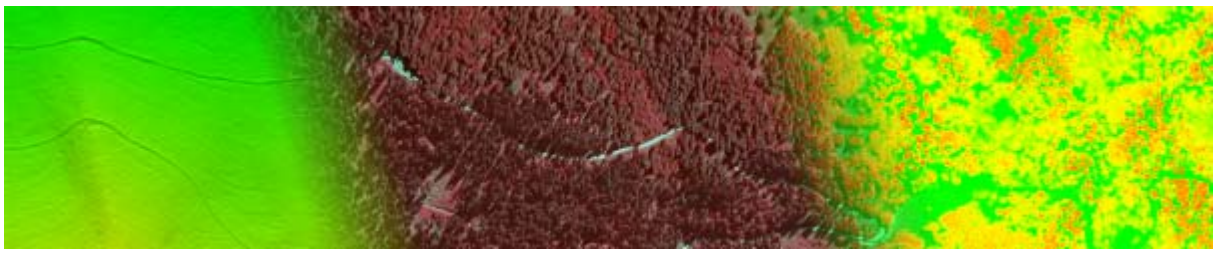


1 ABSTRACT

Based on the learnings from NEWFOR project, this report gives general recommendations toward the professional end-users, the providers of software and the political decision makers in charge of the forestry sector.

Main recommendations are dealing with forest road data bases because they are the pavement for new tools on the road to improve the logistic of wood delivering.

A list of parameters to characterise the forest roads is proposed and should be adopted for the building of a new typology of forest roads and their practicability in the AS.



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 hampered by accessibility constraints that prevent an efficient mapping, management, harvesting and transport of wood products.

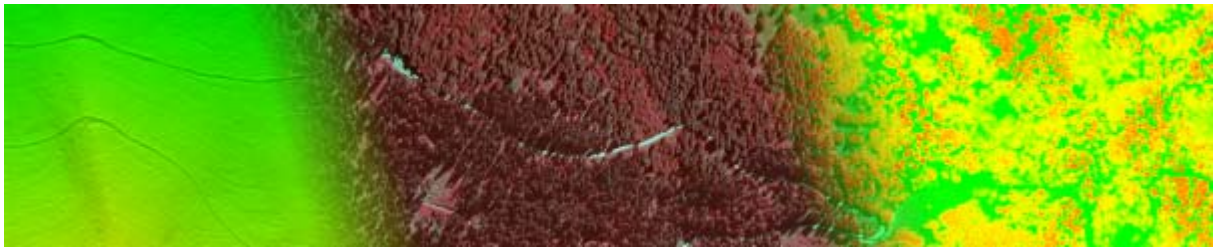
Forests fulfil multiple functions in mountainous areas. They have an ecological function as host of many habitats and species. They also are a leisure area for social activities such as hiking, skiing… From the economical perspective, the production of renewable resources like timber and fuelwood has 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 biomass characteristics 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 (LiDAR: light detection and ranging, Unmanned Aerial Vehicle,...) for forest and topography characterization, 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.

So, 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 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

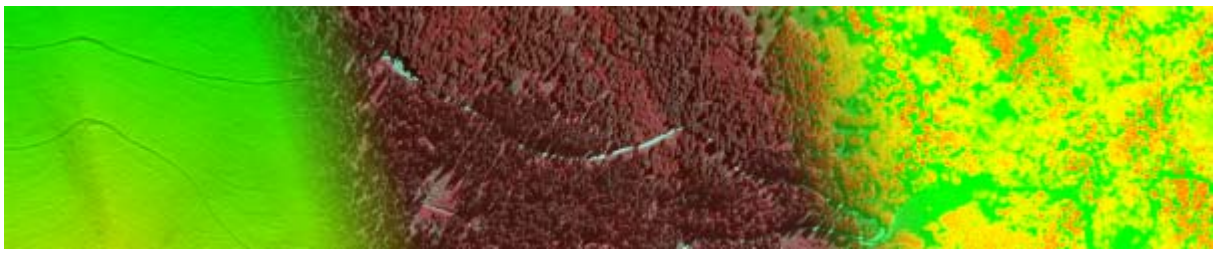
Once the forest resources and accessibility are characterized, then remains the issue of the connectivity between wood piles in the forests and wood yard of mills. This link is often neglected but is crucial for a comprehensive assessment of the wood supply efficiency.

- 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 first considered separately. In order to achieve the demarche, 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 RECOMMENDATIONS FOR MAKING FOREST ROADS DATA USABLE FOR ROUTE GUIDANCE SYSTEMS

Based on NEWFOR project activities, the following recommendations can be formulated.

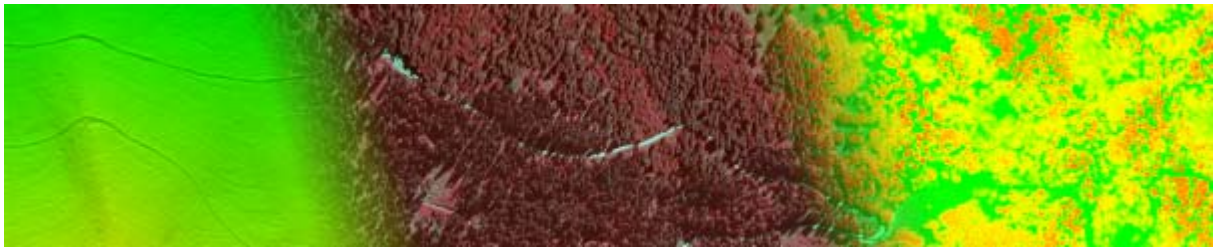
Forest road data bases

- Data must be compatible or easily convertible for integration in rout guidance system. In the future, transport companies will use more and more routing guidance system for navigation and optimization/planning of wood transport.

ICT and GIS based tools (rout guidance system…) should improve greatly the efficiency of the wood logistic in the AS.

- Upgrading the data must be done in a collaborative way by the end-users[1]: 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 the public network and the (private) forest road network.

[1] Other stakeholders could also be involved in upgrading FR data but we mainly consider the professional actors in this document.



- R&D on the way to use automatic acquisition of data on forest road qualification (Lidar, embarked equipment in trucks….) should be continued as conventional methods – men on the field with GPS measurement - are very time consuming and consequently very expansive.

  TUV and TESAF works on Lidar data acquisition seems to be very promising (see report of WP5). FCBA shows interesting preliminary results on data acquisition with embarked GPS-tracks in trucks. Both methods are complementary. The second approach gives information about the time and the average speed of the trucks on the different portions of the forest roads. Those information are very important to obtain precise data on navigation time and then for optimization calculation.

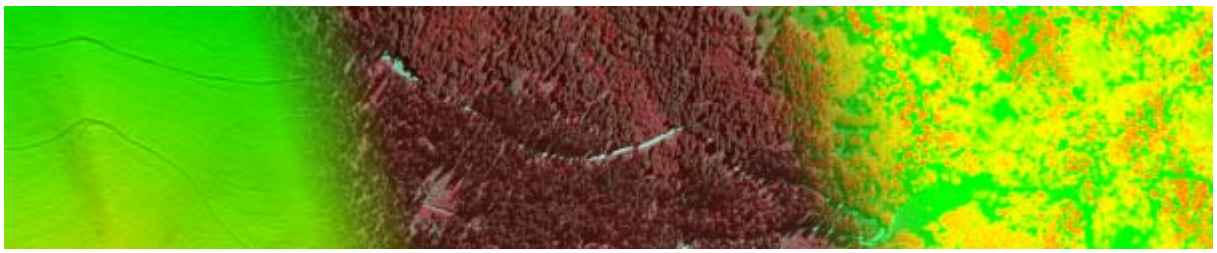
- Public organization responsible for Geographic Information can also provide "first level" data and could provide the general frame housing the forest road data.

  Discussions with IGN in France and GIP in Austria are ongoing to go further for strengthening the collaborations between foresters (and their organisations) and these public institutions so that the needs of the forestry sector can be taken into account. During such discussion, transport companies point of view and needs have to be considered.

- The qualification of forest roads must be uniform and consistent and based on criteria adopted by all.

  A first set of parameters to take into account in the FR data base have been defined with all the partners. The idea is to have a common set of parameters. Each region in the AS is free to add new items according to the need of the professional end-users and the other stakeholders (see ANNEXE). This work on a common set of parameters has to be continued.

- A good connection between the public road and forest road network need particular attention and post data processing is necessary to make sure that connection are well established. As seen from the test with NavLog, there are potential problems coming from a bad junction between the public and the forest road network



Transport planning tools

- Specific national regulations must be easily integrated and taken into account in the algorithm used for optimization e.g. public road network with specific regulations in terms of allowable payload or with particular tax (Toll Collect in Germany). Optimization should consider the utilization rate of the truck fleet but also the cost of transportation, including toll and taxes.

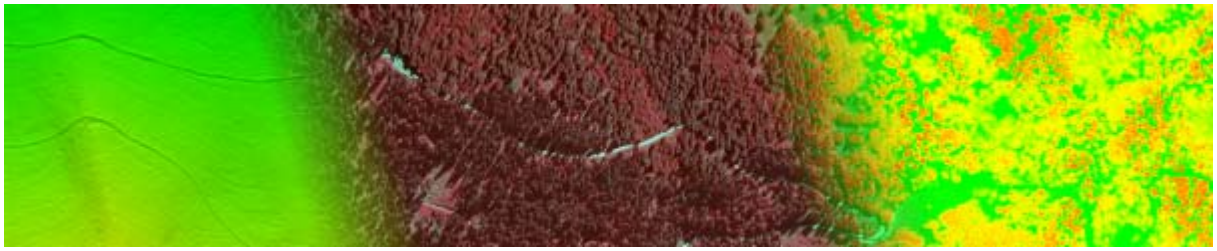
- Calculation of the software has to be simple and rapid so that it can suggest new options in case of changes linked to climatic hazards, engine failure on truck or harvesting material in the forest, difficulties on forest road network or any changes in the delivery program to the mills….

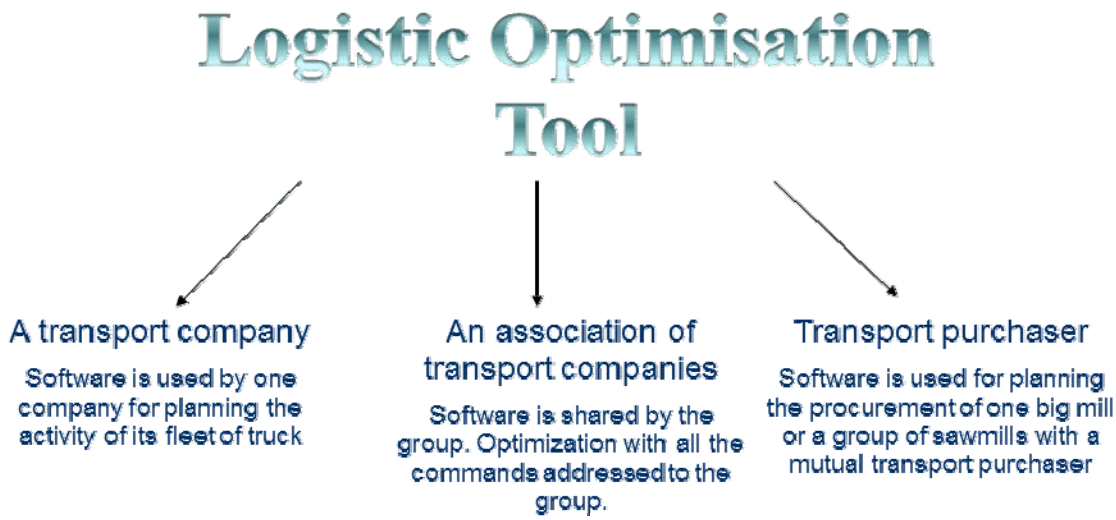
- Back haulage should be taken into account by the optimization model as it is an important lever to decrease the cost of transport when using non-specific truck such as tractor + semi-trailer.

Organisation

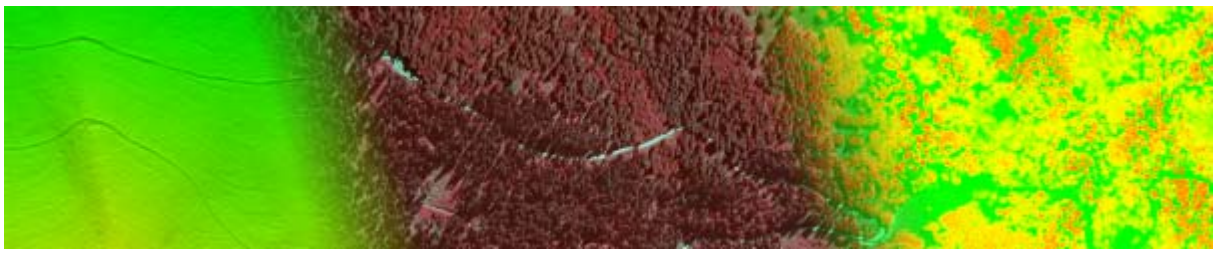
New organisations must be found for an improved efficiency!

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





- 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, and 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 road side, in the factories.



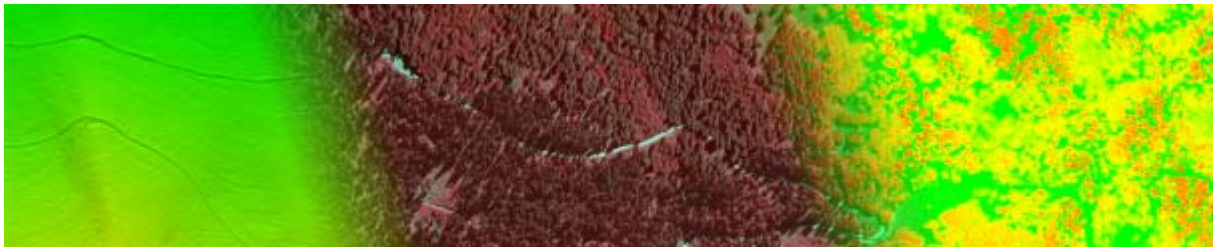
ANNEXE

List of parameters taken into account in the existing FR data bases

and parameters to add in future development.

	Attribut	English Description	France	TYROL	ITALY (Veneto Region)	SLOVENIA
LINEAR INFORMATION						
LINE	ID_ROAD_SECTION	*ID of the section*	2	2	2	2
	NATURE	*Street type*	2	2	2	2
	NAME	*Toponym track if available*	2	2	2	2
	DIRECTION	*Flow direction*	2	2		2
	WIDTH	*Average width of the section in m*	2	2	2	2
	ACCES	*Opened to traffic*	2	1	2	2
	LIM_HEIGHT	*Limiting height in m*	2	1	1	2
	LIM_WEIGHT	*Weight limit in t*	2	1	1	2
	LIM_WIDTH	*Limiting width in m*	2	1	1	2
	LEGAL STATUS	*Legal status of the road*	2	2	2	2
	FONCTIONALITY	*Functionality of the track*	2	2	2	2
	CIRCULATION	*Regulations for logging*	1			1
	ACCESSIBLE	*Accessibility section by an expert*	2	2		2
	WEATHER CONDITION	*Accessibility in all weather or dry weather only*	1	1		2
	PRODUCER	*Name of the producer of the data*	2	2	2	2
	UPDATE	*Date of last update*	2	2	2	2
	Number of attributs		*16*			

2	recorded
1	not covered by now but planned to be recorded
	Not recorded



EQUIPMENT	ID_EQUIPMENT		1	2	2	2
	ID_ROAD_SECTION	*IDof the section corresponding*	2	2	2	2
	NATURE	*Nature of the equipment (see below)*	1	2	2	2
	SURFACE	*Surface m²*	1			2
	PRODUCER	*Name of the producer of the data*	1	2	2	2
	UPDATE	*Date of last update*	1	2	1	2
	Nature of equipment recorded	*Place of piling*	1	2	2	2
		Place for turn back	1	1	2	2
		Place crossover	1			2
		tank DFCI	2			
		panel	2	1		2
		Gate	2	1	2	2
BLACK SPOT	ID_BLACK_SPOT		1	2	2	2
	ID_ROAD_SECTION	*IDof the section corresponding*	2	2	2	2
	NATURE	*Nature Black Point*	1	2	2	2
	MAX SLOPE	*Maximum slope in%*	2	1	2	2
	MAX BENDING	*Bending m*	2	1		2
	MAX HEIGHT	*Maximum height in m*	2	1	2	2
	MAX WIDTH	*Maximum width in m*	2	1	2	2
	MAX WEIGHT	*Maximum weight in t*	2	1	1	2
	PRODUCER	*Name of the producer of the data*	2	2	2	2
	UPDATE	*Date of last update*	2	2	1	2
	Nature of black spot recorded	*steep*	1	1	2	2
		hairpin	1	1	2	2
		tunnel	2	1	2	2
		bridge	2	1	2	2
		narrowing	1	1	2	2
		regulation	1	1		2
		degradation	1	1	2	2
		Ford or strike	2		1	2
		other obstacle	1	1	1	2
Attribut		**English Description**	**France**	**TYROL**	**ITALY (Veneto Region)**	**SLOVENIA**