



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 resources and LiDAR

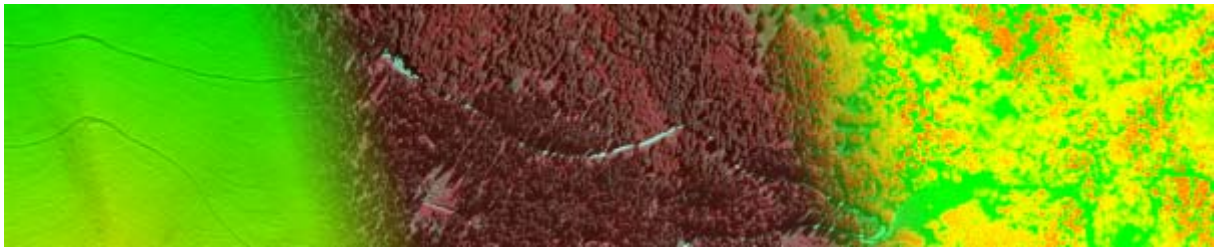
NCW – NewFor Cableway, a software solution to visualize skyline design in cable yarding

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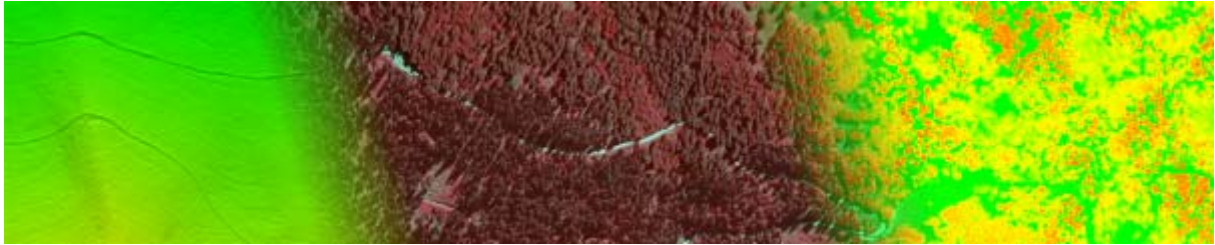




The consortium of the project Interreg Alpine Space NEWFOR

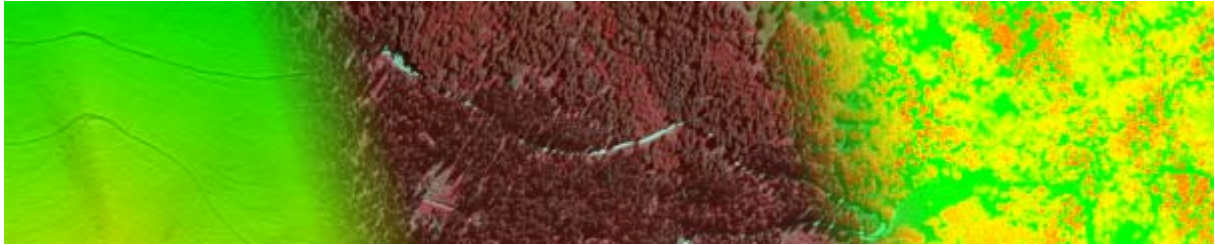


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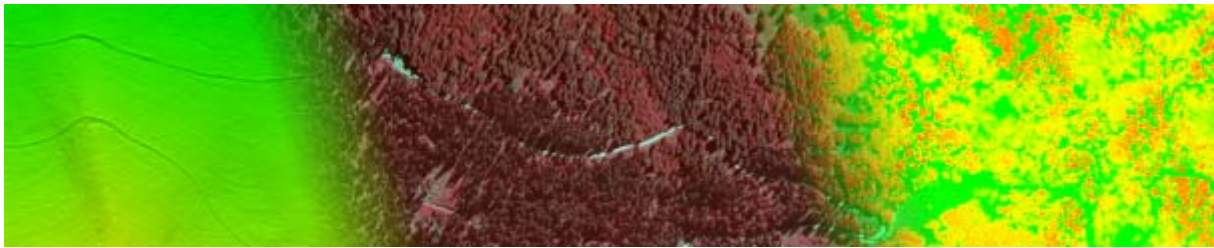
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1 ABSTRACT

In the steep Alpine terrain, wood production with the use of cable yarders is the prevalent wood extracting technology. Planning of pilot tracks of cable lines (skylines) is crucial for optimal functioning and rationalization of costs. With known procedures, we shall be able to calculate suspension cable sags, assume the number and places of intermediate supports and ascertain the possible load that the system will safely bring from working site in the stand to the standing place of the yarder on the forest road.

This document is a quick guide presenting and for the use of the tool Newfor Cable Way (NCW) specially build up for allowing the foresters to test their project of cable yarder lines.



2 A SYNTHETIC OVERVIEW OF THE INTERREG ALPINE SPACE PROJECT NEWFOR

2.1 THE CONTEXT

The role played by mountain forests is extremely varied. Their contributions to the stability and overall development of life and economic factors in mountainous regions are highly significant. Due mainly to topographic conditions, managing mountain forests is significantly more cost intensive than in plain ones. A good knowledge of forest biomass location, characteristics, mobilization conditions and connectivity to wood industry is a prerequisite for the development of a sustainable timber supply chain in mountain territories. This knowledge is currently insufficient to provide at reasonable costs, the required guarantees on the wood supply and on its sustainability. Improving an efficient and robust evaluation of the forest growing stocks (volume and quality) and its accessibility are the efficient measures to mobilise sustainably more wood from mountain forests. As building forest roads and other infrastructures are often complex and expensive, the availability of financial resources is a key challenge. This could be achieved by providing technology and financial support. With such knowledge and tools it will be then possible to develop an active and sustainable cultivation of mountain forests and an efficient European mountain forest management policy.

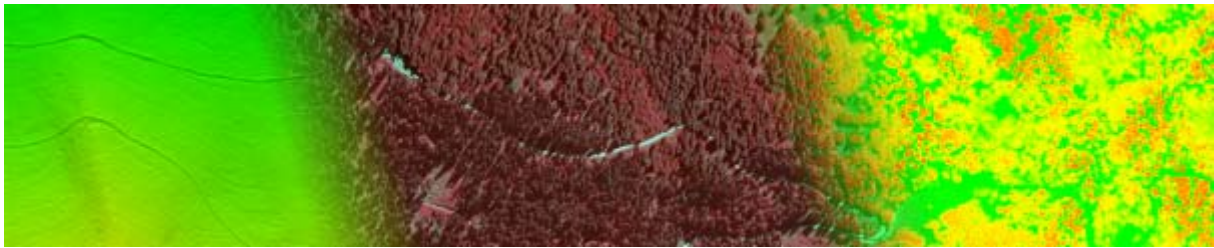
2.2 OBJECTIVES OF THE PROJECT

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 has been 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 goal of the project NEWFOR is the improvement of accessibility to the forest for an economically effective wood harvesting and transport related to a sustainable forest management and wood industry in Changing Climate. The 14 partners involved in the project's consortium, have broken down this main goal into 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 actions of this wp had for objective to test and develop tools for the use by foresters of data coming from this new technology.



- 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 area the slope is the main constraint to a technical and economically efficient exploitation. This wp demonstrated how to use topographic LiDAR data coupled with geographic information systems (GIS) for an optimal planning of the opening-up of forests according to the current accessibility of forest resources.

- Forest and industry connectivity

Since the forest resources and its accessibility are characterized, then the question of the actors of the wood supply chain is how to feed the wood market from the forest to the wood users? In other terms, the question is: what is the real connectivity between the wood at the road side (inside the forest) and the wood at the mill's timber yard? The objective of this wp was to answer to this question.

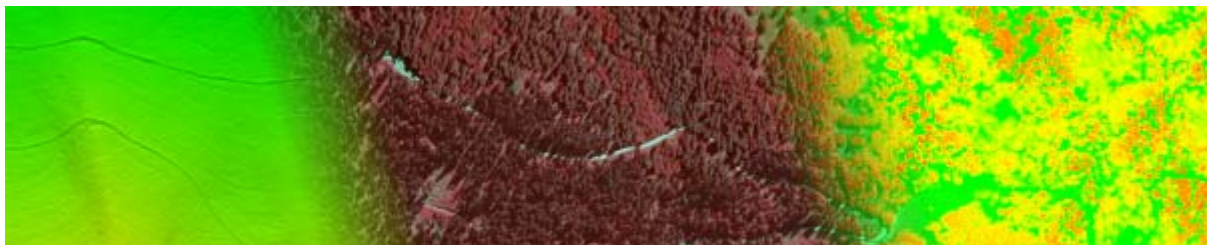
- Costs and benefits evaluation

NEWFOR aims to develop helping decision tools dedicated to defining strategies for sustainable mountain wood supply chain. To fulfil this objective the 3 first workpackages (see above) have been building up with the objective of developing tools for identifying forest resources, their accessibility and connectivity to the wood market. In order to achieve the demarche, and to choose the optimal strategy, it's necessary to evaluate, from the economical aspect, the costs and benefits of each possible strategies. This was the objective of this wp.

- 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 main objective of this wp 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.

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3 A QUICK GUIDE FOR USING NCW

In the steep Alpine terrain, wood production with the use of cable yarders is the prevalent wood extracting technology. Planning of pilot tracks of cable lines (skylines) is crucial for optimal functioning and rationalization of costs. With known procedures, we shall be able to calculate suspension cable sags, assume the number and places of intermediate supports and ascertain the possible load that the system will safely bring from working site in the stand to the standing place of the yarder on the forest road.

For more accurate calculations, certain input parameters need to be known. The most important, however, is the use value of data originating from terrain itself, given that the key conditions for setting-up a forest cableway after the preliminary plan are often associated with professional on-site estimates. Important answers, e.g. is the machine's scheduled standing place adequate, or are there enough suitable trees available for anchoring, or is there a solid enough tree standing at the place where intermediate support is predicted, or is the final support situated in the scheduled cable line, etc., are usually obtained when laying-out yarding cableway in the field. Accurate LIDAR data, on the other hand, enable us to determine the cable line on the basis of realistic and up to date information through the cabinet study as well.

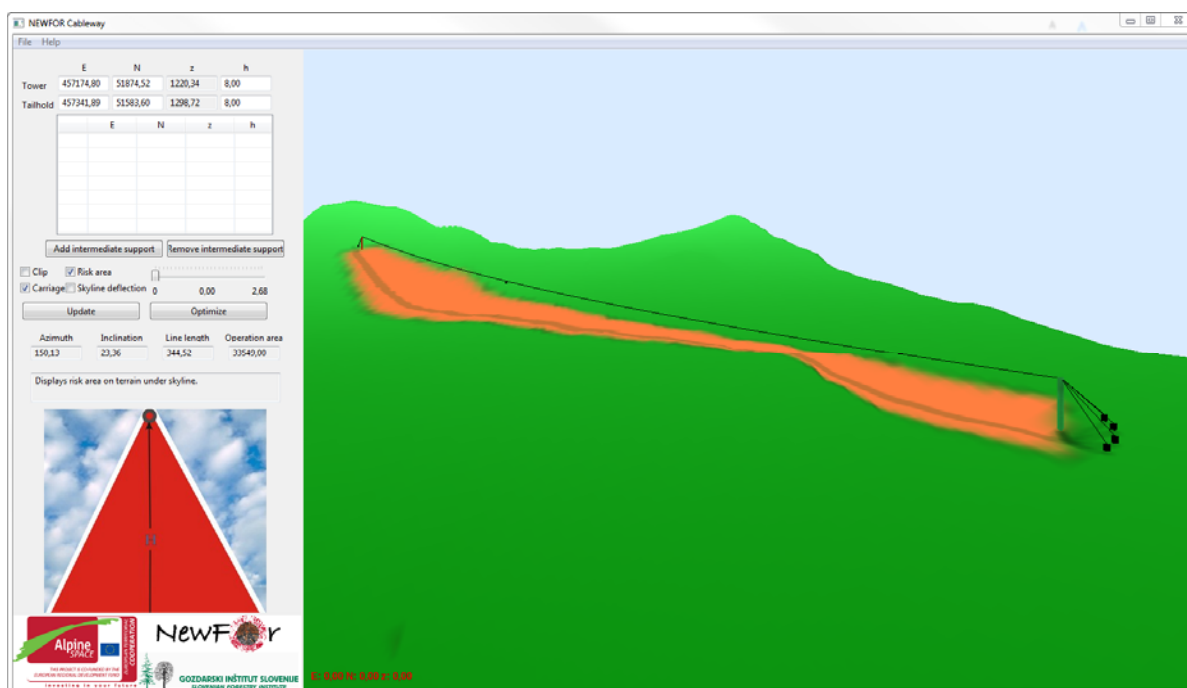
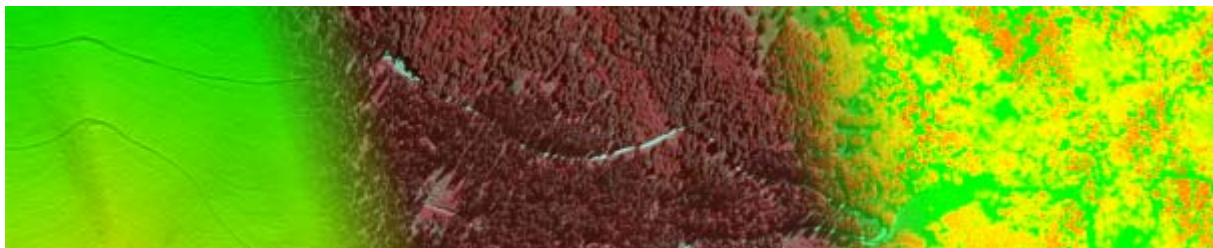


Figure 1: 3D visualisation of LIDAR topographic data and Skyline Tower and Tailhold/End-support tree location

Irrespective of the chosen method of detailed cable line planning, it is important that the user visualizes the line and by changing certain parameters (such as heights of intermediate supports) optimizes the envisaged costs or effects. Such active visualization is enabled by the



NewFor Cableway (NCW) software tool. Based on Java programming language, this tool enables 3D visualization of cable line and of optionally selected snapshot of the terrain. In these parameters, the parameters of the machine and cables are also presupposed, which indeed can be changed by the user to a certain degree, but the purpose of the programme is aimed at presentation of the selected line in space, optimization of intermediate supports and load, and visualization of dangerous zones.

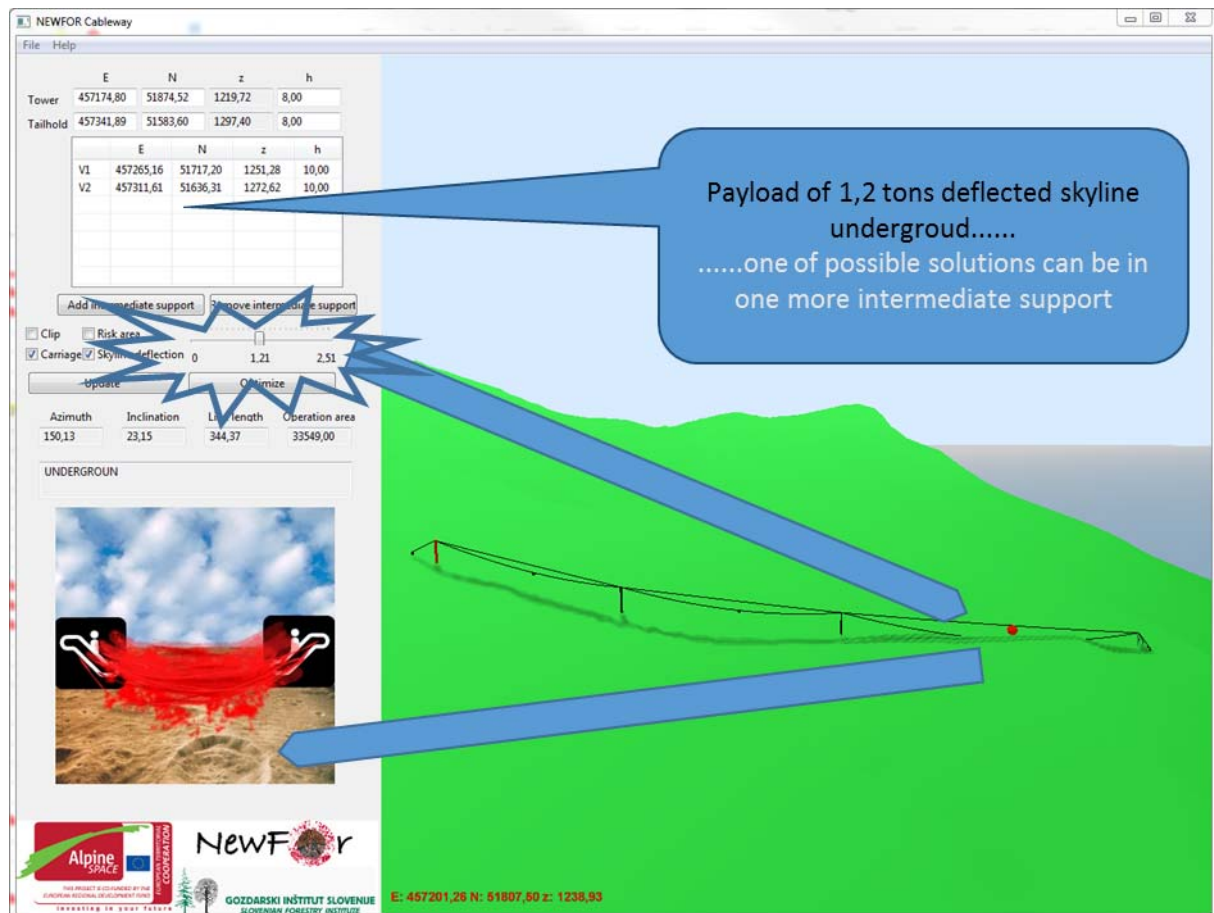
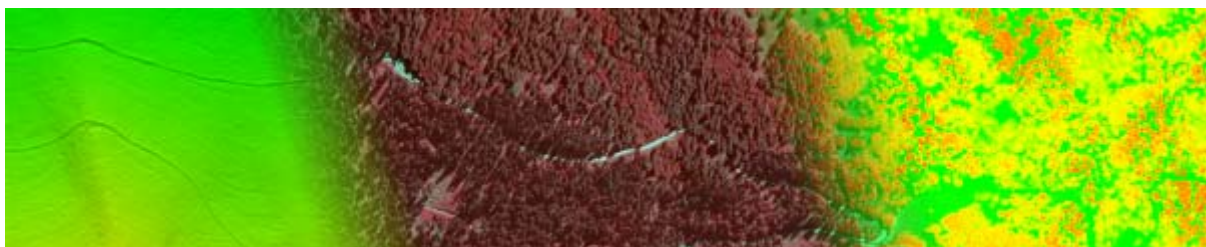


Figure 999999: 3D visualisation of predicted intermediate supports and deflection of skyline under payload

The tool is applicable in combination with "Web-GIS tool" web application, which will enable export of data of individual cable line to NCW program data folder. Own data (e.g. GPS survey of the field) or other records (e.g. topographic data) in .txt format can of course be used as well.

When the user selects his topographic data and enters data of the yarder crane's standing place or of the final and scheduled intermediate supports, the NCW visualizes to him on this basis the optimal load, suspension cable sags in work fields, displays the data on the line such as cable length, azimuth, line inclination and worksite's predicted surface area, which is productively covered by the line.



Additionally, visualization of risk areas during wood yarding is enabled, as well as visual warning of the exceeding sags, suspension cable's unsuitable angles of refraction or inappropriate anchoring, if the optimized data are supplemented or entered individually.

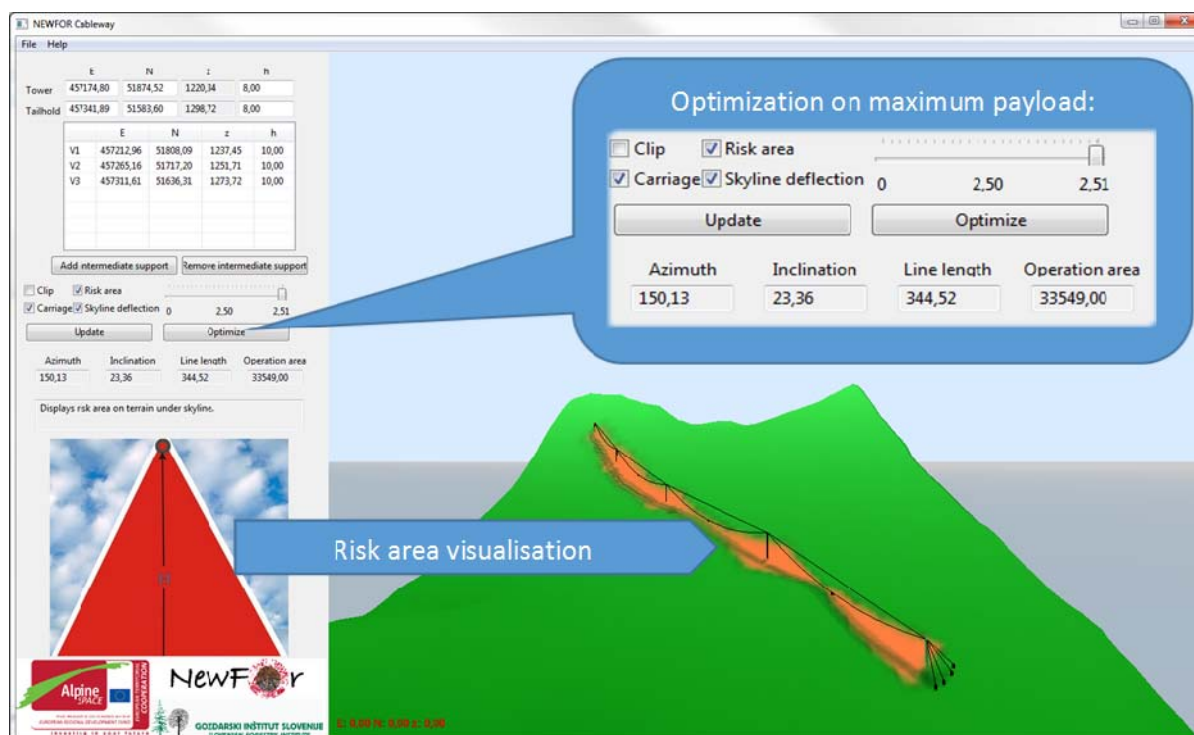


Figure 2: 3D visualisation of skyline and working risk area after adding third intermediate support and maximized payload

NCW zipped file (25 MB) is available to download on NewFor Website link: <http://www.newfor.net/newfor-cableway-forestry-cable-crane-skyline-in-3d/> Long distance cable yarding skyline visualization based on parameters and calculation of skyline design-project methodology originally published by Pestal, E. (Seilbahnen und Seilkrane für den Holztransport, 1961)

Authors are not responsible for any unauthorized or/and commercial application of software, which is developed to the stage of testing. Video introduction of NCW was presented at [French mid-term conference](http://www.newfor.net/wp-content/uploads/2013/11/Cable_way.avi) in presentation linked here: http://www.newfor.net/wp-content/uploads/2013/11/Cable_way.avi. NCW software provides in Menu bar also Help Tab opening Help window with basic instructions, button descriptions and controls instruction for 3D view.

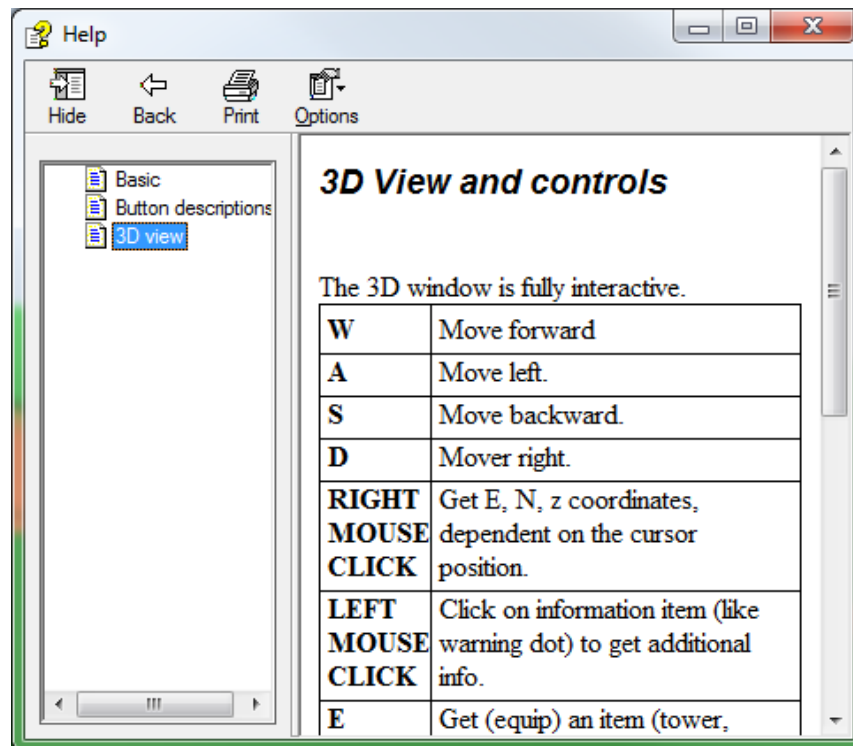
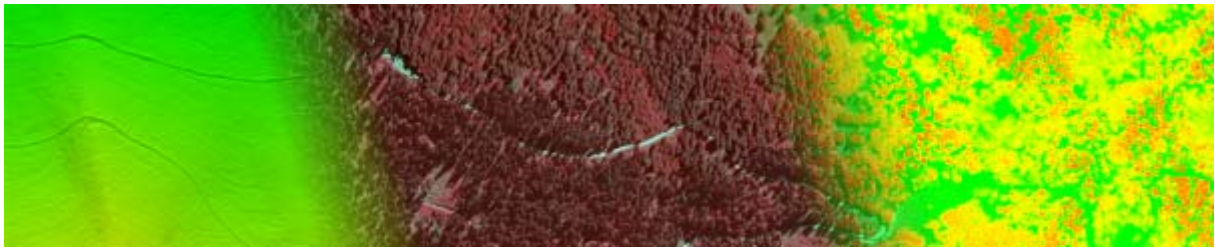


Figure 3 : NCW software user's manual in help window