

SUSTAINABLE FOREST HARVESTING OPERATIONS USING DIGITAL METHODS

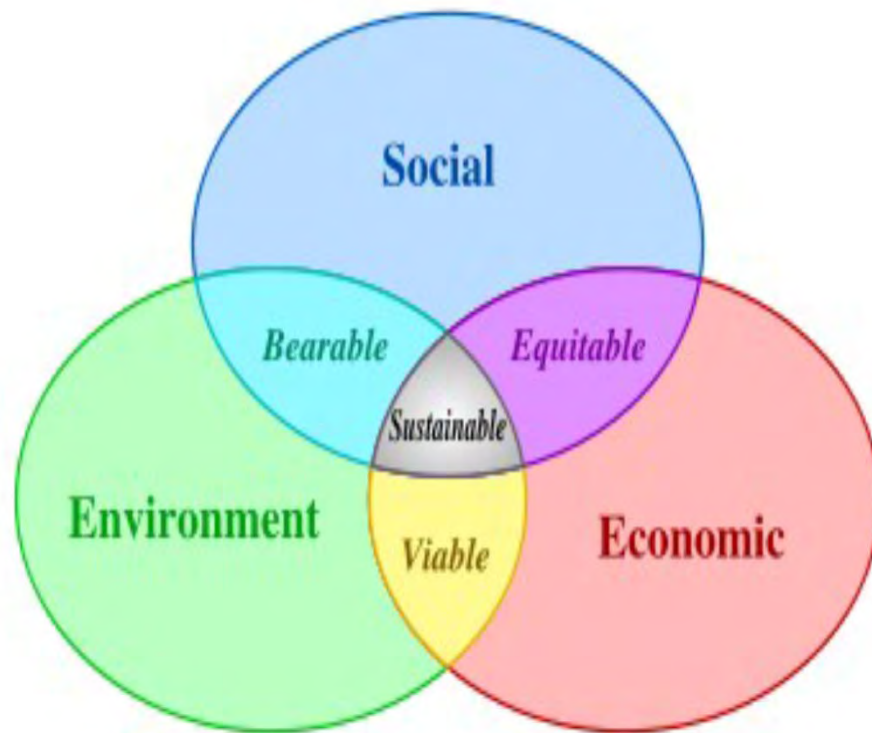
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Introduction



Pushing the Boundaries with Research in Forest Engineering
44th International Symposium on Forestry Mechanization, October 9-13,
2011, Graz, Austria



**Scheme of sustainable development: at the confluence of three preoccupations.
Source: Wikipedia.**

Sustainable development of the planet depends, in fact, on recycling of resources rather than their extraction and eventual discard following use. Sustainable development of mountainous regions has as objective to increase the economic investments to profit of residents of region, without however it influences drastic the natural environment. The respect to the natural environment and the goods that offers to us, gives the possibility of its sustained use. To exploit Greek forests, environmentally sound management procedures should be applied by forest managers.



Forest harvesting operations should be based on environmentally friendly principles, humanized labor and minimum costs of a carefully selected and optimum work method. The impacts of the logging technique on remaining stand have to be understood as complex. Skidding, as a part of logging, means transport through the forest. This means also taking into consideration, in addition to machines and techniques, the way the machine approaches the tree or timber. A closer look at the true interrelation between silvicultural and operational planning in respect of young forest damage can be achieved by examining tractor skidding only.

Until the late 20th century forest exploitation relied mainly on man, because felling and processing were made by axes and hand saws, and wood was transported by animals or by water, i.e. gravitation. Only in the late 20th century, the use of chainsaws for felling became more intensive, as well as the use of tractors for skidding and trucks for transport to greater distances.





When speaking about economic forests in the mountainous area of Greece, the interest should be focused on natural, mixed and uneven-aged forests managed by selection felling, group and individual tree felling with a 10-year felling cycle.

The forest harvesting operations are usually applied from the Forest offices or from enterprises. To estimate and choose a specific harvesting operation till now has to do only with the availability of machineries and workers knowledge.

Objective of the paper

In this paper we are going to provide an integrated harvesting planning solution for a characteristic mountainous area in Greece based on GIS techniques.

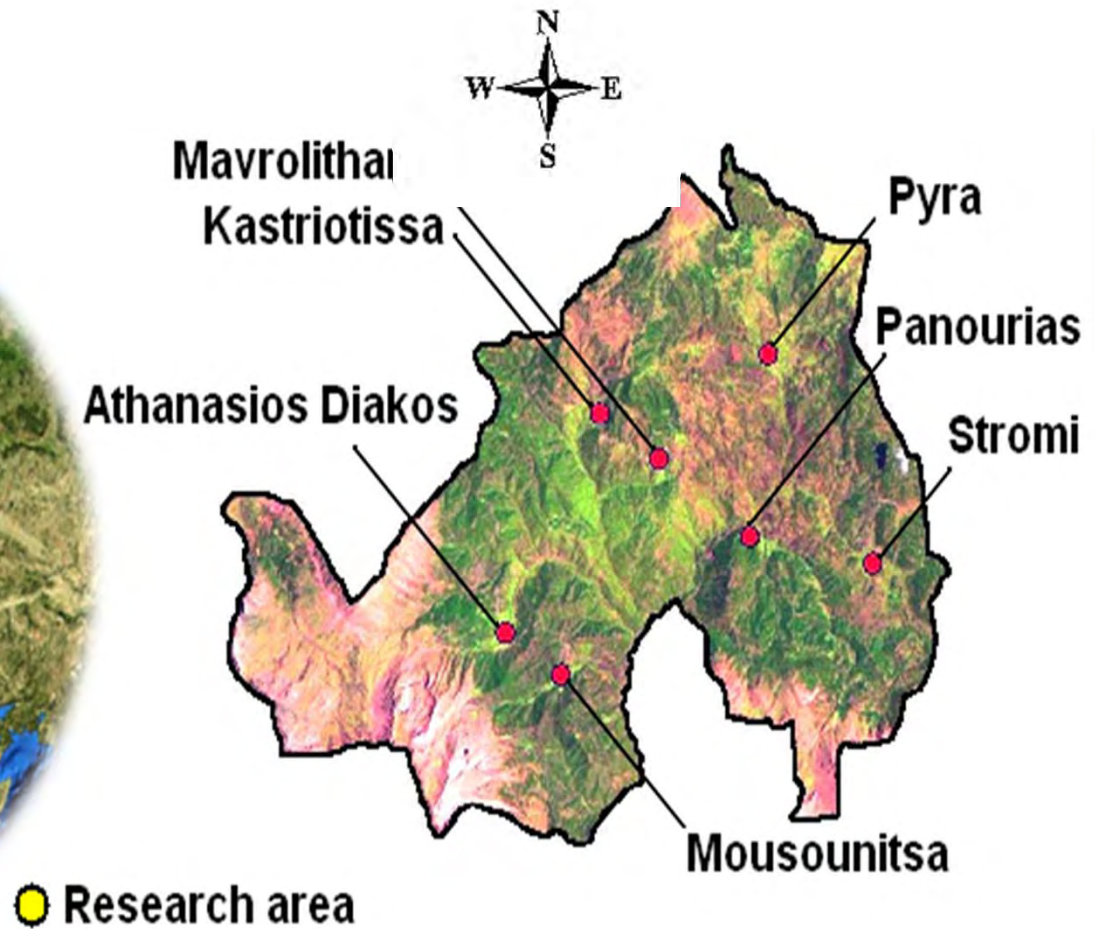


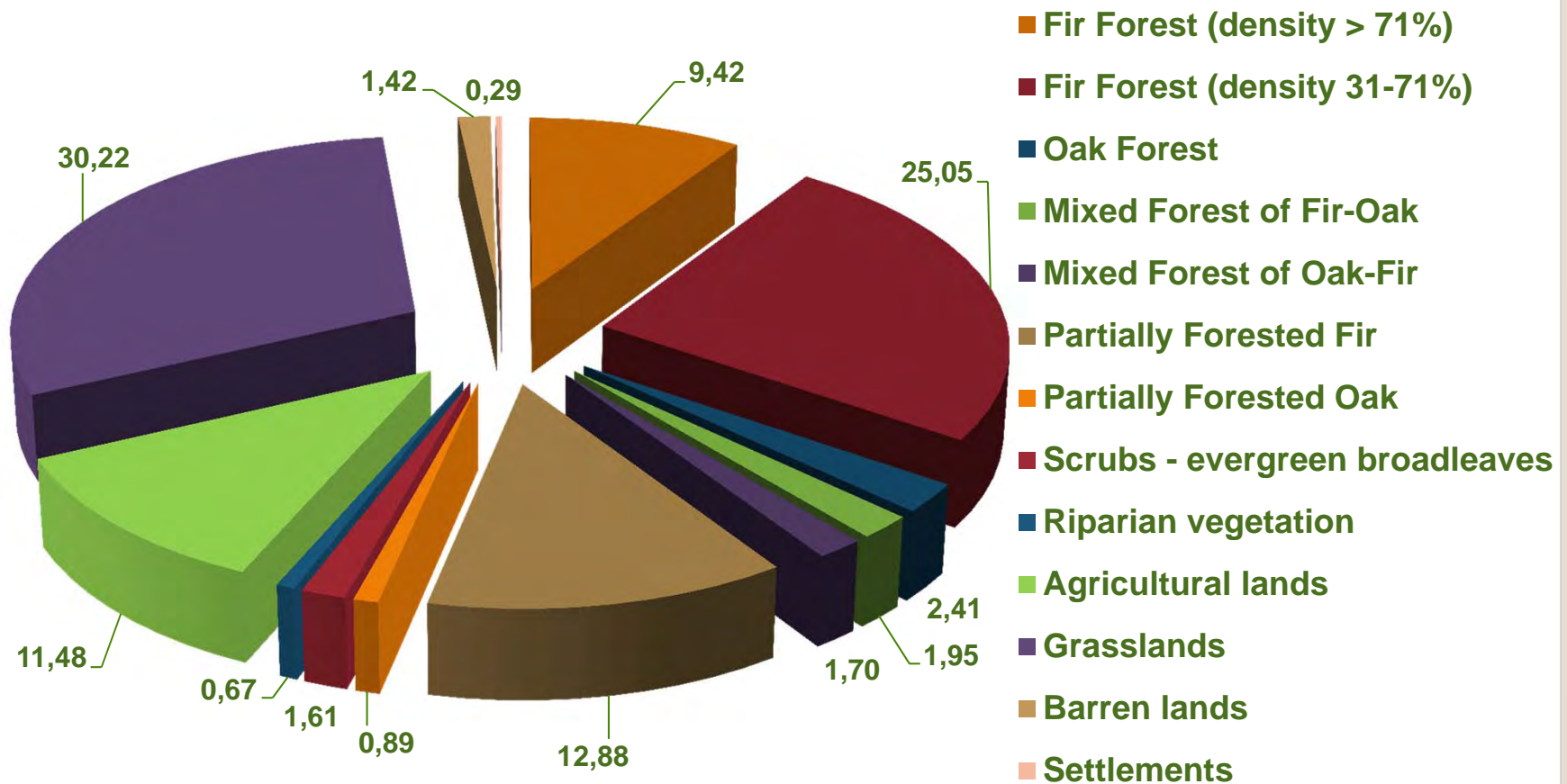
Material and methods

Research area



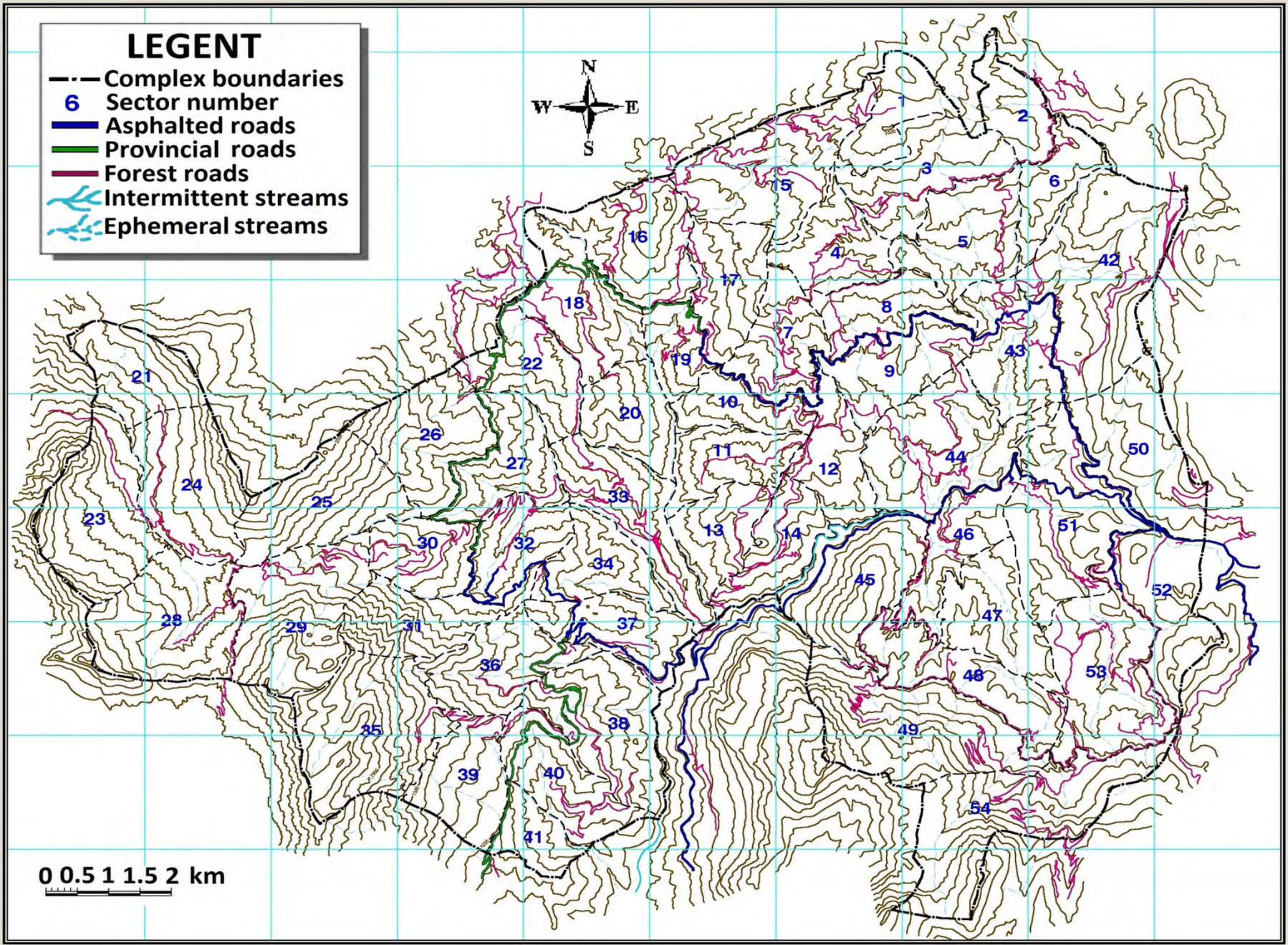
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LEGENT

- Complex boundaries
- 6 Sector number
- Asphalted roads
- Provincial roads
- Forest roads
- Intermittent streams
- Ephemeral streams



0 0.5 1 1.5 2 km

Methodology



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In detail the stages of an integrated harvesting planning solution for a characteristic mountainous area in Greece are the following:

- Recognition of Forest (Location and boundaries of the forest, forestry species composition, forest structure, management form, management classes, and access roads, facilities and settlements, etc.).
- Data collection from municipalities (Socioeconomically-census data, grazing, hunting, tourism, protection, etc.).
- Data collection from Forest Service (meteorological data, proprietary conditions, maps, data of prior management, etc.).
- Supply additional cartographic and aerial material from the Military Geographical Service and the Ministry of Rural Development and Food (Topographic maps of various scales, recent taking aerial photos, orthophotomaps).
- Data collection, drawing up and creation of land uses map, scale 1:20,000.
- Creation of relief map scale 1:20,000 with the sectors of the forest.
- Installation of sampling surfaces from the crews of field data collection.

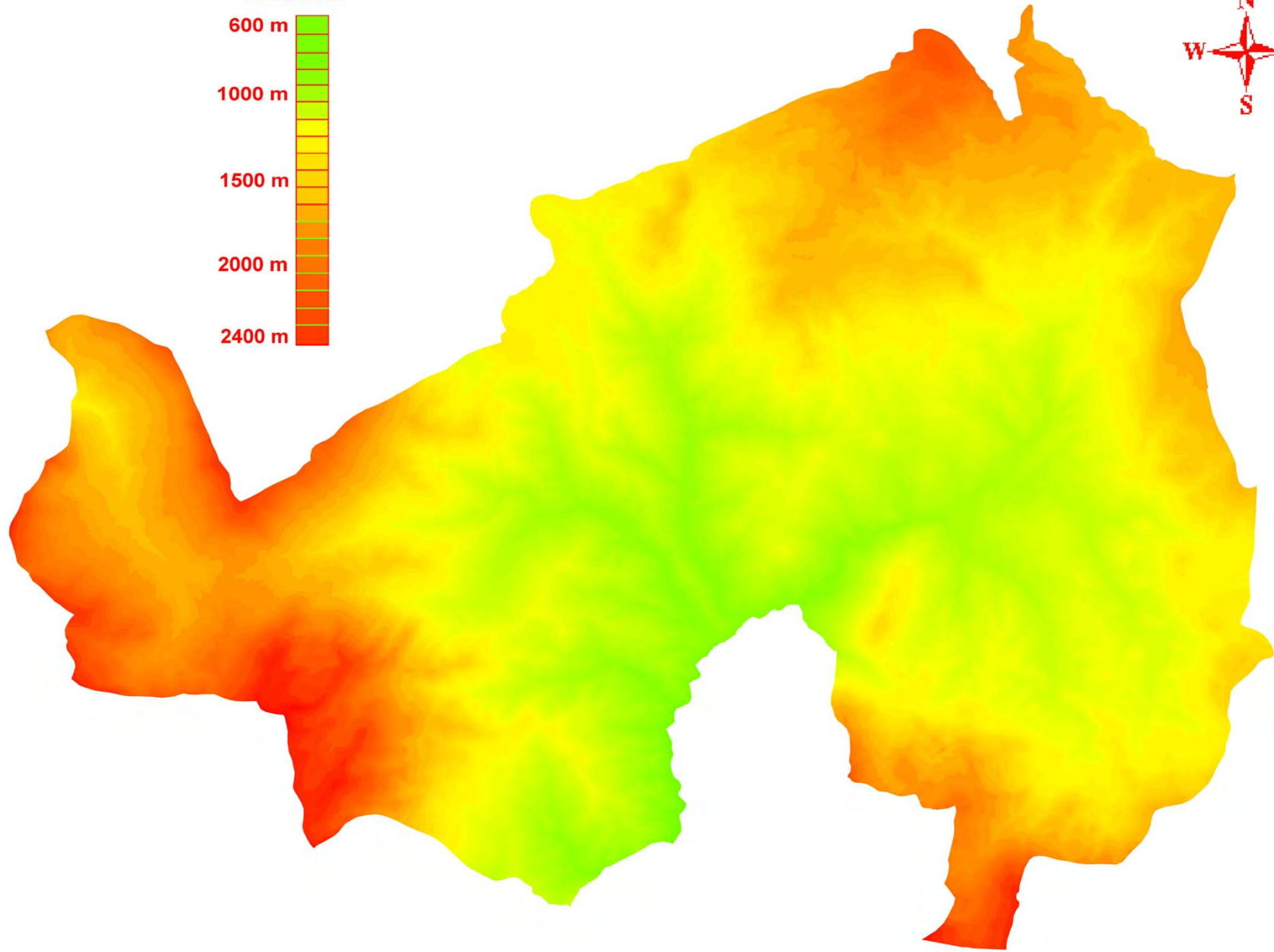
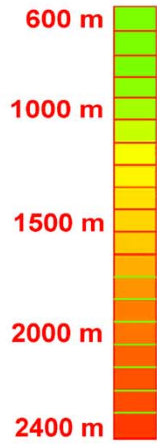
- Carrying out field investigation with data collection, based on sampling method and description of the stands.
- Drawing up and creation of additional forest maps of slopes and aspects.
- Data processing.
- Drawing up and creation of a forest harvesting operations 10 years map.
- Drawing up and creation of a two dimension map; proposed the different ways of harvesting for the research area. In this map we can see how they are applied to the research area.

Results



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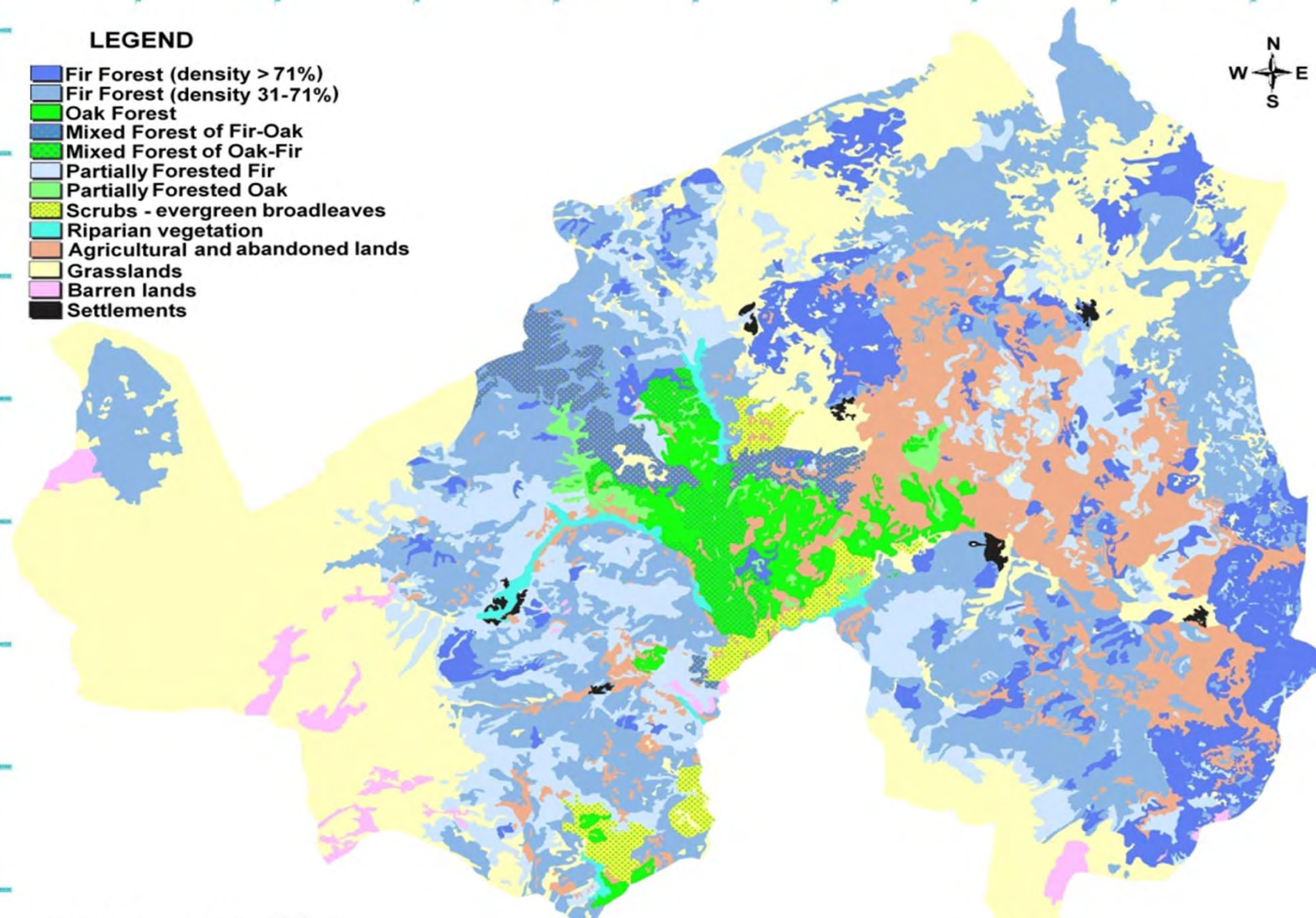


LEGEND

- Fir Forest (density > 71%)
- Fir Forest (density 31-71%)
- Oak Forest
- Mixed Forest of Fir-Oak
- Mixed Forest of Oak-Fir
- Partially Forested Fir
- Partially Forested Oak
- Scrubs - evergreen broadleaves
- Riparian vegetation
- Agricultural and abandoned lands
- Grasslands
- Barren lands
- Settlements

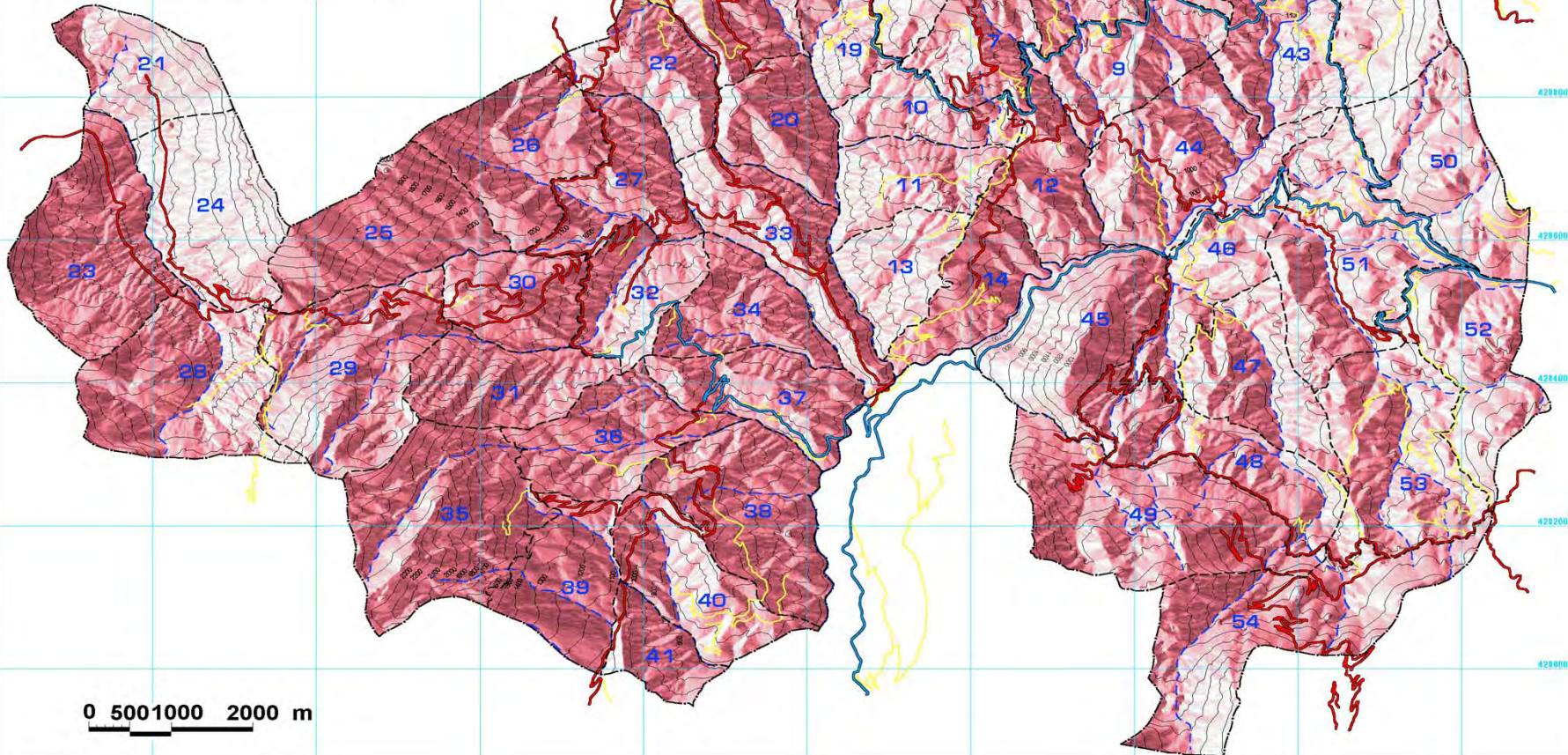


0 500 1000 2000 3000 4000 m



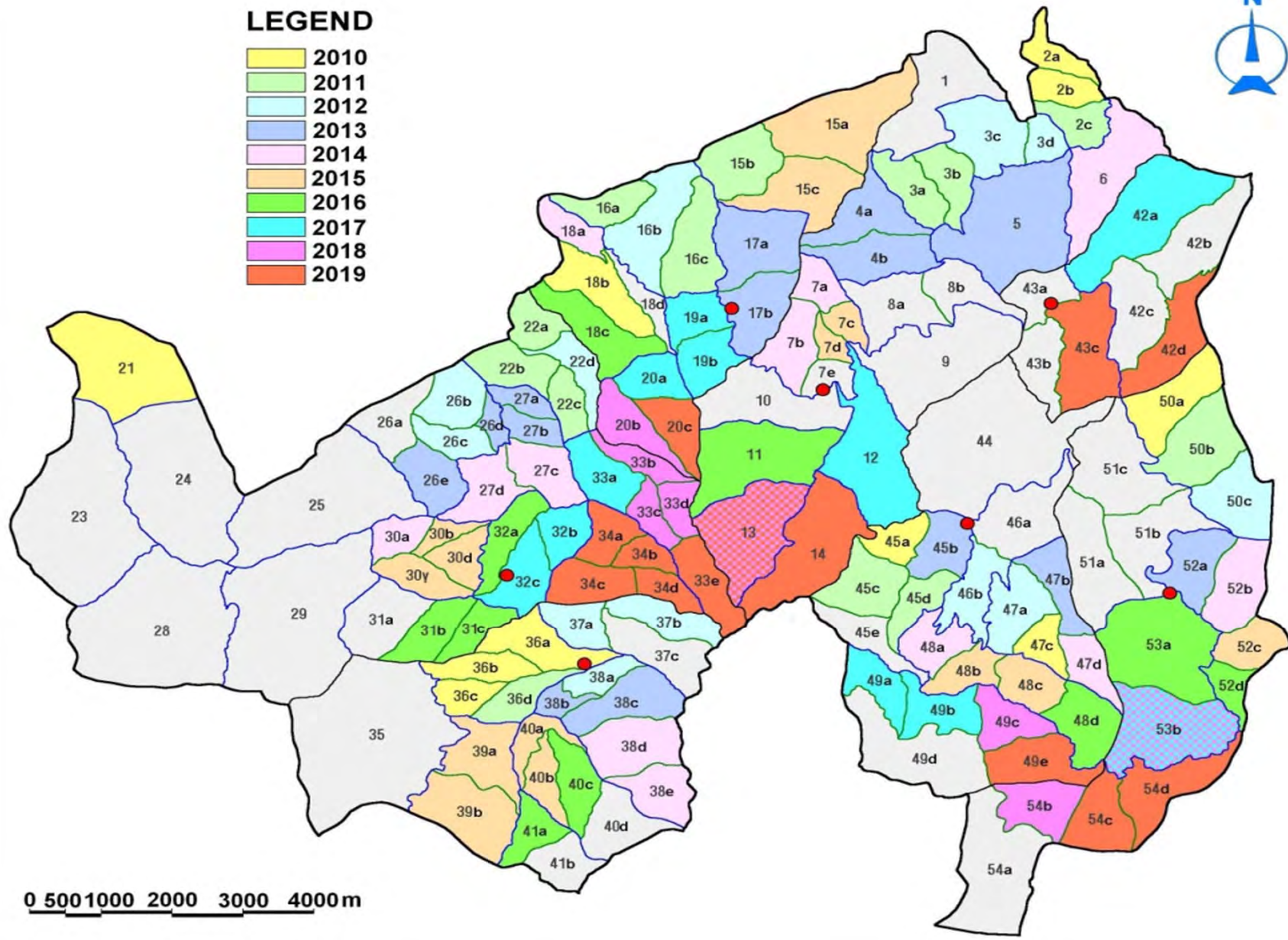
LEGEND

- Complex boundaries
- - - Sectors boundaries
- Asphalted roads
- Forest roads B category
- Forest roads C category
- Intermittent streams
- Ephemeral streams

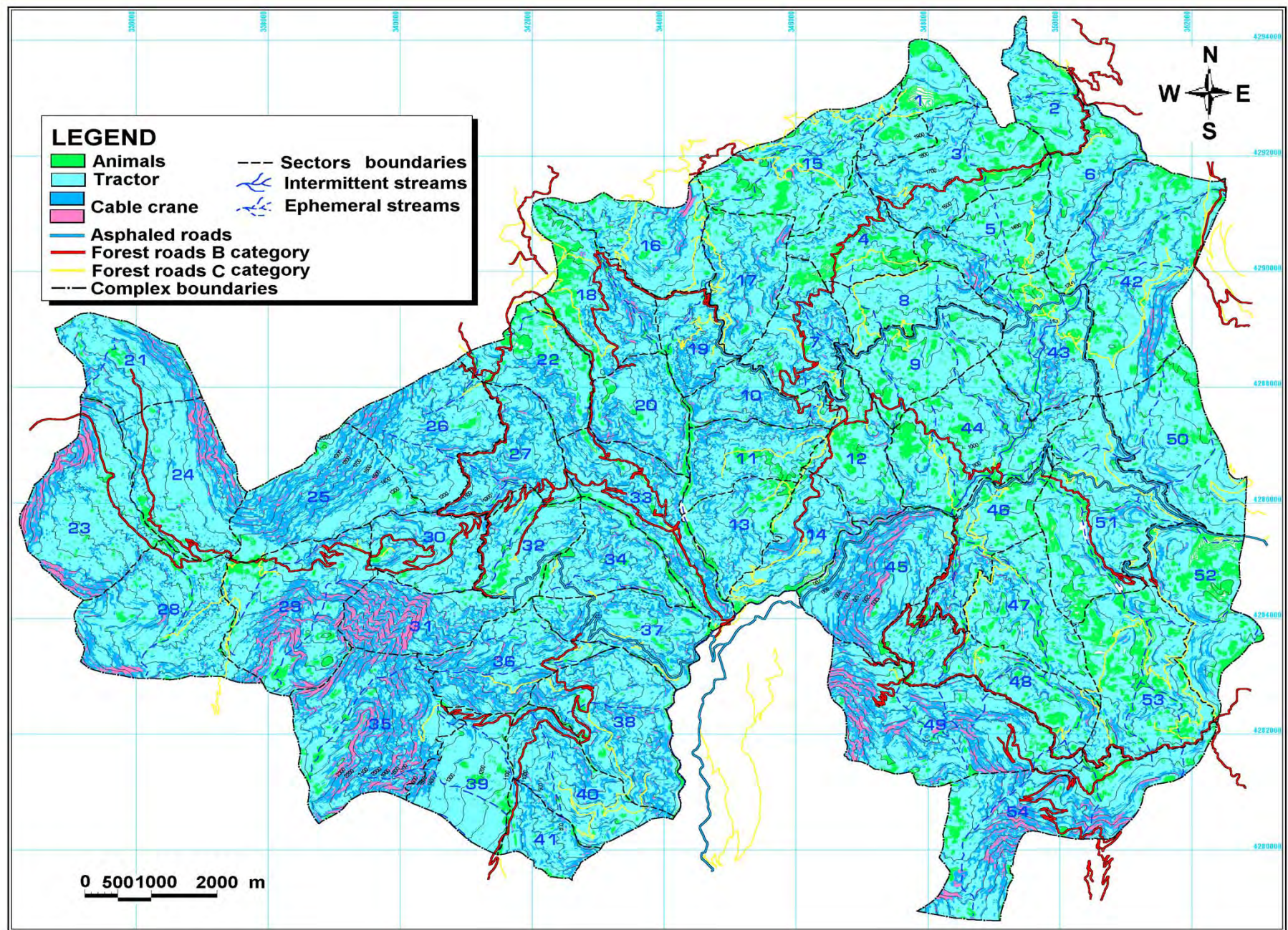


0 500 1000 2000 m

LEGEND



0 500 1000 2000 3000 4000m



Discussion



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In 2009 was the first time of using small size forestry tractors for skidding wood in the particular area, but because of extremely steep slopes prevailing in the harvested stands it would be good to use small scale mobile crane or tracked or articulated tractor that is capable and for farm work in agricultural farms which are an important part of land uses.

The model that has been applied is a Spatial Decisional Support System based on rules that have been set by the forest harvesting experience for an integrated harvesting planning proposal. Concluded the main benefits expected are:

- a) The better planning of coverage of individual needs of residents in firewood, and technical timber.
- b) The setting of sheep and goats stockbreeding in space and time, with the use in grazing barren lands of the forest complex that may be available for this reason, improved, but this proves to be no way at the expense of forest and its rational management.
- c) The satisfaction of all kinds' needs of society related to the existence and function of forests as part of multipurpose forestry, such as hunting, tourism, recreation, hiking, fishing, work, etc.

d) Ensuring the greatest possible of financial revenue from the marketing of the produced forest products.

e) With the proper management of the forest due the proposal integrated harvesting operation planning maintaining and improving the protective-hydrologic role of the forest, particularly in relation to the increase of its water supply, the reduction of sediment, ensuring smooth and proper functioning of the lake Mornos. Lake Mornos supplies with water Athens, the capital of Greece.

The key problems are the following:

- Harvesting operations in the field often results in environmental damage,
- Human presence demands exploitation of the natural environment.
- Yet it causes interference sometimes with a negative effect.

Any kind of interventions in forests should be governed by the following three principles:

- The principle of preserving and protecting the natural environment,
- The principles of landscape architecture and
- The principle of resistance (limit) of the ecosystem in the various activities exerted on it.

Finally, there are potentialities for forest harvesting operations development under the slogan “environmental design for sustainable development and management” where they will offer various benefits as for the area as for the whole country.

Similar issues can be also addressed by the research project dealing with forest road network density, forest roads layout in relation to the environment and the choice of skidding means mainly comparison between the tractor and cable skidding or between animals and tractor skidding.



**THANK YOU FOR THE
ATTENTION**