

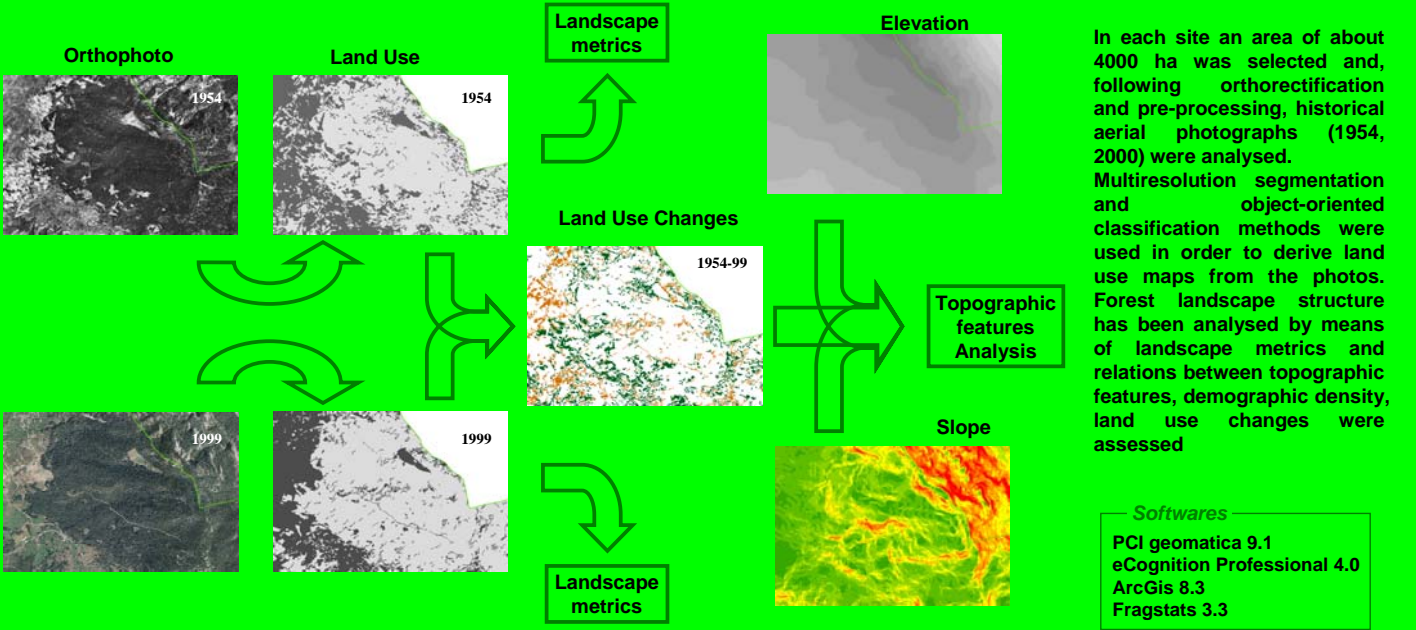
## INTRODUCTION



Pure Scots pine (*Pinus sylvestris* L.) stands occupy an area of more than 28,000 hectares in the western Italian Alps (Aosta Valley and Piedmont). The purpose of this study was to describe forest spatio-temporal dynamics over the last 50 years compared to the land-use change and to analyse the role of the Scots pine in two different ecoregions: intermediate and internal Alps. Two sites in north west Italy were chosen: St. Denis (Aosta valley) is located in the medium part of Aosta Valley characterized by an internal (continental) climate, and Toceno (Piedmont) characterized by an intermediate climate typical of the northern lake district of Piedmont region.



## METHODS



In each site an area of about 4000 ha was selected and, following orthorectification and pre-processing, historical aerial photographs (1954, 2000) were analysed. Multiresolution segmentation and object-oriented classification methods were used in order to derive land use maps from the photos. Forest landscape structure has been analysed by means of landscape metrics and relations between topographic features, demographic density, land use changes were assessed

Softwares  
PCI geomatica 9.1  
eCognition Professional 4.0  
ArcGis 8.3  
Fragstats 3.3

## RESULTS

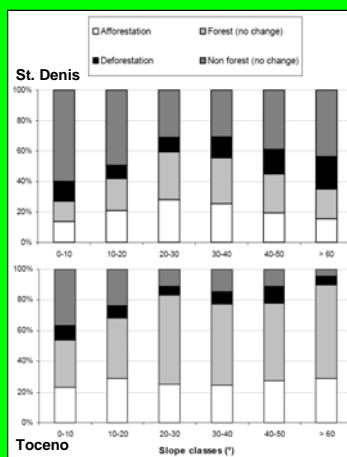


Figure 1: Land use changes in St. Denis (above) and Toceno (below). Percent area partitioned by slope.

The study areas showed a comparable increase in forest cover (about +30%). However, landscape composition in 1954 was quite different: forest cover was 35% in St. Denis and 53% in Toceno.

In St. Denis, land use change caused an increase in number of patches per unit area and a decrease in their mean size (figure 2). The trend towards fragmentation is not showing up in Toceno. Aggregation indices show opposite dynamics: in the first area the last 50 years resulted in a more dispersed pattern of landscape categories, while in Toceno a higher degree of clumping is evident. Mean shape complexity increased in both sites, especially in St. Denis.

The elevation pattern of afforestation rates is different between the two sites. In St. Denis we observed peaks of afforestation on two elevation ranges (700-900 and 1700-1900 m a.s.l.). In Toceno newly forested areas are more uniformly distributed (figure 3). Referring to slope, flat areas are not interested by significant afforestation processes in neither site (figure 1).

The highly prevailing southern aspects did not allow us to detect any clear pattern as an effect of this morphological attribute.

METRICS	Units	SD 1954	SD 2000	TC 1954	TC 2000
TA	Total Area	ha	3401.7	3401.7	3726.5
PD	Patch density	n/100 ha	111.8	145.8	97.8
LPI	Largest Patch Index	%	87.6	37.8	39.4
LSI	Landscape Shape Index	-	62.0	83.0	61.5
AREA_MN	Area Mean	ha	0.9	0.7	1.0
SHAPE_MN	Shape Index Distribution Mean	-	2.0	2.4	2.0
PAFRAC	Perimeter-Area Fractal Dimension	-	1.6	1.4	1.5
DCAD	Disjoint Core Area density	n/100 ha	21.8	27.6	20.4
CAI_MN	Core Area Index Distribution Mean	%	0.07	0.05	0.16
ENN_MN	Euclidean Nearest Neighbor Distance Distribution Mean	m	10.1	8.3	10.4
CONTAG	Contagion	%	66.0	62.8	64.1
AI	Aggregation Index	%	97.9	97.2	98.0

Figure 2: Landscape metrics computed for St. Denis (SD) and Toceno (TC) at two period examined

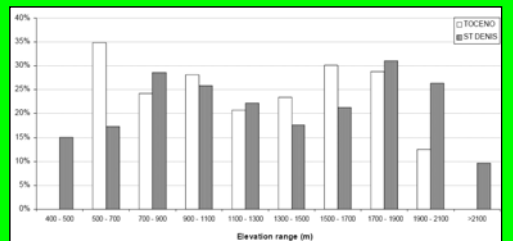


Figure 3: Percentage of afforested areas in the two sites according to different elevation classes.

## DISCUSSION



Differences in observed landscape patterns were attributable to the different initial land cover composition, i.e., more forests in Toceno, and to different economic propensity of the two sites (Toceno being a more marginal area than St. Denis).

The afforestation process in St. Denis was inhibited by local economic incentives encouraging a constant human presence on the land. In Toceno the positive influence of moist climate and rich soil conditions have intensified the afforestation process carried out by the early-seral species (e.g. Scots pine).

This increase in forest cover has led up to a more irregular landscape pattern in St. Denis and a more aggregated and regular pattern in Toceno. In the latter, the more homogeneous situation was probably due to a uniform abandonment of the whole area, while in St. Denis the maintenance of several pastures and croplands caused a more complex landscape mosaic.

Agricultural land uses were expected to occur on more favorable morphological positions. This was confirmed in St. Denis, while in Toceno the influence of morphological variables on cover changes was non significant.