Do landscape properties affect the process of post-fire vegetation recovery? A case study from the Taygetos Mountain, Greece

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Quickbird-2 Worldview-3





ABSTRACT

ires of 2007 have consumed large areas of Black pine and endemic fir forests in Greece. The current research aims at examining the role of geomorphology and lithology that govern the soil properties upon the post-fire vegetation recovery at the landscape level. A case study from Taygetos Mt, a large part of which was burned in 2007, is presented. Based on the interpretation of a high spatial and spectral resolution satellite image (WorldView-3, 4/2015), GIS thematic layers have been created showing unburned and regenerated patches over various lithological types. A network of sites was selected for field sampling representing various combinations of the above. Data on recovery of the main tree species as well as on total vegetation cover were collected.

esults prove the relationship between regeneration ability and plant species traits as well as the existence of unburned patches near the burned ones. Black pine had regenerated from seeds dispersed from cones that have remained intact on unburned or scorched trees, close enough to the burned patches, while Greek fir presented remarkably low regeneration, lacking of any response mechanism. Plant species recovery seems to be controlled by the geology as it was found weaker in plots overlying carbonate, permeable, not easily erodible formations as compared to that observed over clastic, impermeable, erodible formations of schists, even for the same species. In conclusion, post-fire vegetation recovery at the landscape level seems





High resolution ortho-georeferenced satellite images of the study area, acquired at several time periods before and after the fire of August 1st, 2007, (the burned area is delineated by the dashed line). All three figures are pseudo-color images as the Red color is assigned with the Infra-Red band and Green/Blue are assigned with bands at visible spectra. Therefore, the vegetation is represented with red colors due to the high reflection properties of the chlorophyl at the infra-red area of the spectrum. Note the gray and green colors at the middle figure representing the burned forests, as well as the isolated reddish unburned forest stands in between.



Aspect of the two main lithologies of the Mt Taygetos, which are in contact along the valley (dotted line).



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to be a complex process controlled not only from species biology but also from the landscape features.

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Classes of coniferous tree species regeneration	Mean saplings and seedlings density (individuals/m²)	Carbonate formations	Clastic formations
Low	< 0.1	95%	30.7%
Medium	up to 0.5	4.4%	66.2%
Satisfactory	> 1	0.6%	2.9%



(II) the outcrops of the lithological formations, which are observed on the Taygetos Mt. (middle). The formations were unified into two main units according to their properties.



Auger core soil sampling on schists whereas towards the opposite slope carbonates outcrop appears. Samples were acquired at every lithology that cropped out at the study area. Several measurements took place during the fieldwork as well as in the laboratory including soil texture, pH, nutrients etc.



unburned forest stands, clearly obvious at the landscape. Note the unburned strips of Abies *cephalonica* that have escaped the fire.



Failure of post-fire natural regeneration in Abies cephalonica, usually growing over limestone, despite the presence of unburned stand.



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Comparison between NDVI values calculated on the atmospherically corrected satellite images of Ikonos-2 (2007) and Worldview-3 (2015). Red pixels represent at least 10% reduction of NDVI values, whereas green pixels represent more than 10% increase of the NDVI values. Note small patches of vegetation increase within the burned area.



Classification of forest regeneration after the 2007 fire. Several information layers combined in a G.I.S. platform led to the conclusion that higher recovery has been achieved in *Pinus nigra* stands.



Relief map of the broader study area of Taygetos Mt. The dashed line surrounds the 2007 fire event. The inset map shows the location of the relief map at the Peloponnese peninsula (Southern Greece). Village locations are also displayed.



Presence of unburned *Pin*us *nigra* islets contribute to medium to high regeneration through seed dispersal, at a location where schists comprise the main lithology.



Young saplings of regenerating Pinus nigra at close proximity of an unburned mature stand.

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