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Archaeology and nature: hyblean cultural landscape and territorial regeneration

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Abstract

This study is the result of an interdisciplinary cooperation among specialists, scholars and different skills aimed at the requalification/regeneration of the archaeological park of Kaukana in Santa Croce Camerina (RG). It is a wide area along Mediterranean which becomes the driving force for economic and functional growth of territory, along with landscape valorisation and environmental restoration.

This area is one of the best Sicilian well preserved late antique period settlement. Over there archaeology and nature merge in a cultural landscape which is unique in its genre and that has been studied by means of innovative cognitive tools (3d laser scanning, photomodeling, and so on) which constitutes the first step towards a conscious territory government.

By acting without big distortions; by supporting the vocation to transformation through actions aimed at the restoration of the past; by qualifying spaces and reinventing green fruiting attractive paths; then the archaeological area becomes a resource, regenerated and inserted into touristic districts, which produces work and both material and immaterial richness.

It represents a regenerative model founded on virtuous values of nature and biological models, which are able to carry out a development "founded on the reduction of the waste of raw materials, human resources, assets". That is a conscious intervention which through the survey, the re-drawing and the analysis of existent places generates less wastes/more life improvement, less environmental impact/ more essentiality.

Keywords: laser scanning, archaeological landscape, 3D modeling, territorial regeneration.

1. Introduction

Franca Restuccia

Today's globalization destroys the history and the identity of places and it causes deep changes not only to society but also to economy and "cultural territories" development. Very often the state of neglecting and degradation of archaeological assets obscures the landscape and environmental values of territories.

Through processes of creative regeneration and new government methodologies these assets and/or sites could be culturally rescued. The purpose is to add more value to regions and places so that they become competitive in the image of the territory and in the promotion of local economic development [1].

By the requalification of spaces and the re-invention of attractive paths of green fruiting, the archaeological site can be regenerated without big changes and according to the vocation of place. Moreover as it is embedded into a touristic district, it becomes a resource of work and richness both material and immaterial.

This is a way to provide regenerative patterns based on virtuous values of nature and biological models, which are able to realize a development "based on the reduction of the waste of raw materials, human resources,

assets". Thus it is necessary to aim at coherent and conscious interventions that - through survey, re-drawing and analysis of existent places – create less waste/more life improvement, less environmental impact/more essentiality, less aesthetics/more essence. These interventions contribute to landscape enrichment, to the environmental recovery together with the economic and functional growth of the territory itself.

The archaeological site of Kaukana in Santa Croce Camerina (RG) is a good example of that recovery policy aimed at the regeneration of what already exists. This site is a wide territory along the Mediterranean coast in the area of Ragusa in which archaeology and nature merge in a cultural landscape unique in its genre: it represents one of the best Sicilian well preserved late antique period settlement. It is a place of deep Mediterranean identities, which offers wide opportunities of cultural and economic investments.



Fig. 1: Aerial photography of the state-owned area of Kaukana where the three contiguous areas cut by the littoral road are highlighted in red.

This study is an extract of the cooperation work between the Department of Cultural Heritage of Ragusa and the Laboratory of Architectural Photogrammetry and Survey "Luigi Andreozzi" of the Engineering Faculty of Catania. Through innovative cognitive tools (3d laser scanning) the interdisciplinary study provided the basic elements for a conscious government of the territory. As a matter of fact, this work has been a good opportunity to face with a wide extension and complexity theme due to archaeological, naturalistic and environmental values of the site. Actually this is a park of archaeological interest, a place of attraction and study where the culture inhabits the landscape. The potentialities of the place grant to it an active role in the project of cultural and environmental quality: it could be the driving force for economic and functional growth of territory.

The need to accurately document this archaeological asset and the relations which, during the time, it has established with the natural environment of the park – rich of landscape suggestions between the sea and the Mediterranean vegetation – has required the use of an operative methodology which renovates ways of documentation, perception, analysis, representation and management by using informatics technologies. Indeed, they have been applied renewed "models of doing" able to "catch" nature and built in a unique cognitive model aimed at the project of valorisation and fruition. It is a model of digital synthesis that prefigures the revaluation project founded on the global qualitative change and the identity of the area - as required by the Department of Cultural Heritage who manages and maintains the "hyblean" archaeological park.

The Department plans to organize the area with operative interventions aimed at the quality and sustainability according to the existent resources. The purpose is to have a virtuous recovery of the site; to transform the heritage into a resource in favour of economic development and of cultural growth, avoiding morphological and structural changes of the natural area. That is, to act a reuse that - keeping readable the traces and the memories of the past - will recover them for collective fruition, according to a productive synthesis of nature and history: "less waste/more quality, research and ideas; less waste more ethics/more investments and sustainability".

2. Kaukana project: territorial regeneration between nature and archaeology

Venera Greco

Kaukana was a small village placed in the territory of the town of Santa Croce Camerina (Ragusa) which was used to be very important during byzantine age.

The Greek name (Kaukanae) was used to describe a series of villages in which Kamarina exiles in 258 b. C. found refuge. As a matter of fact, they choose this site thanks to its natural landing places, the fertility of the soil and the richness of water. In 535 A.D. the General Belisario left from Kaukana in the direction of Malta, during its campaign against Vandals [2]. In those years the settlement had an important urban development and its seaport growth in importance until it was destroyed by Saracens. It was an important commercial anchorage, very active between the IV and the VII century A. D.

The cover-up of the coast protected the late roman settlement with a layer of sand so that the walls of the buildings have been almost fully preserved. Today Kaukana hosts a large archaeological park that has discovered one of the best preserved late antique age settlements in Sicily.

The recovered complex consists of 25 buildings of different kind among which a small church (with three naves) which belongs to a burial area. Reported and studied by Paolo Orsi, the complex was brought to light in the '80s by the team headed by Dr. Paola Pelagatti, despite the strong contrasts of the private owners of the land, who planned to build very profitable touristic residences [3,4].



Fig. 2, 3: The remains of Kaukana late-roman age settlement (pictures by Giunta).

Definitely the entire surrounding area was already saturated by a lot of abusive constructions, the so-called "tourist" villages, realized during the building "boom" of the '70s and '80s. The excavations have reported an archeological complex of great value due to the rarity of the temporal dating and of the completeness of the settlement that, even if small, contains all the key elements: the small church, the "emporium", the public space, the stores, the houses, the dock buildings [5].

The peculiarity of being in a recent building fabric, asphyxiated and of poor architectural quality, together with being located in the historic palimpsest of late antiquity and the period of vandals raids, turned it into a main resource/good cultural archaeological and landscape. As a matter of fact, it represents a resource on which it is possible to found the process of requalification of the entire area, which is also enhanced by a beautiful beach recently nourished by the Regional Province of Ragusa.

Nowadays the archaeological park of Kaukana is one of the strategic and focal points of the community of Santa Croce Camerina, that considers it as belonging to his own territory and uses it for the best cultural events of the summer season. Thanks to the conjugation of the protection of archaeological goods together with the landscape one, the common notion of "public green" has been replaced by the specific meaning of identity of places.

The area of the archaeological park belongs to the regional Sicilian state property and it is managed by the Department of Cultural Heritage of Ragusa who has handled in these years the management, the fruition and the maintenance.

Over the last few years, in this area several excavations promoted by the university of Vancouver has been done: the team headed by prof Robert Wilson has excavated some parts highlighting rooms, furnishings and human remains that have confirmed both the dating and the religious cults celebrated in the village, even after it was abandoned [6].

Due to the strategic importance of the park of Kaukana the Department of Cultural Heritage has drawn up a project for enhancing the state-owned area that was financed on the chapter "freed-up Resources" of the previous POR 2000-2006 program.

The project forecasts a series of operations aimed at giving back the area to the fruition according to a clear didactic path that should give to visitors the reading key to interpret the archaeological ruins. This way it is possible to identify the ruins in a wider historic vision reconstructed according to rigorous Scientific criteria and combined with the comprehension of the place, the context and the naturalistic park.

The park completes its natural vocation of public space of the community through the realization of: a small but essential parking at the entrance; wood paths that drive visitors along the archaeological excavations; a space equipped for public open air shows; a restructured roof of the little church. This last offered the opportunity for an architectural reconfiguration that might give back to the public fruition the typological and spatial qualities of the church together with the new lights that emphasize its key role inside the whole complex. Furthermore, the new fence in fiberglass gives a vegetal boundary that partially hides the new roof. Moreover the vegetal component has been deepened too: the dangerous or sick plants have been cut and removed; autochthonous species such as carobs, almonds, wild olives have been re-planted. This way the allochthonous species could be gradually restructured and, during the time, the floristic-vegetal component will get closer and closer to the native one. The scope is to re-construct a piece of the historic landscape, which is of great value and unfortunately now it is readable only in few fragments. Moreover, in the didactic indications large emphasis will be given to the archaeological and historic components as well as to naturalistic and vegetal the ones.

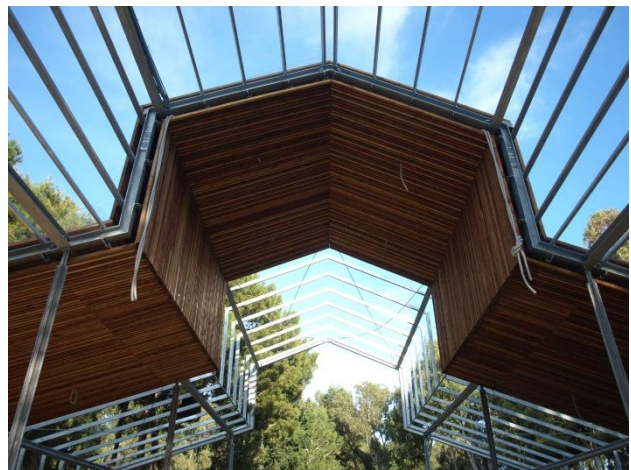


Fig. 4-5: The renewed roof of the little church merged with the vegetation (pictures by G. Manganello).

3. Less waste/more research for the knowledge and documentation: the project of the archaeological park of Kaukana between perception and dimension.

Mariateresa Galizia

The enhancement project of the state-owned area of the park of Kaukana is part of a regenerative policy focused on investments in local cultural heritage.

The planning intervention drawn up by the Department of Cultural Heritage of Ragusa is mainly founded on a plan that counts "less waste/more quality of life and places"; a plan where culture is the driving force for places development, saving them from devastating speculative projects.

The scope is to have "less environmental impact/more environment requalification" in order to improve economic, social, environmental and cultural forces that could give back this area to local inhabitants and to tourists.

The careful and accurate action of the Department of Cultural Heritage required a rigorous survey of the site aimed at "more knowledge and documentation/less imprecision" into planning choices.

The characteristics of the site – based on the indissoluble relation between landscape and archaeology – required a kind of survey aimed at the project of reuse of the park. This survey should be able to catch and represent, in their shape and measure, the late-roman settlement together with the natural features that during the centuries have modified the state of the places.



The main goal of the planning intervention is to give back to the community a proper interpretation of a piece of history told through the archaeological ruins as well as through the traces of an historic landscape with a peculiar floristic-vegetation component.

As a matter of fact, the archaeological park represents a wide and diversified presence of the human intervention and it's the memory of the changes undergone on this characteristic area of the "hyblean" territory. Therefore, there is the need to analyze and interpret the hierarchy of the elements which characterize the place – terrain morphology, autochthonous and allochthonous vegetation, the constructive tools – in a unique model of representation through which it is possible to properly identify the paradigms/models, natural and not, of the hyblean archaeological area. The study has been an applicative experience aimed at the creation of a possible "extended museum" according to a settlement connotation on which it could be possible to develop significant disciplinary elaborations (archaeology, architecture, history, conservation, geology, economics, agriculturalist).

The Department of Cultural Heritage of Ragusa required a cognitive survey which would combine and support the planning choices focusing both on the recovery of the preexistences and on the new project of fruition of the park as resource/cultural assets, archaeological and landscape. This process of requalification has economic and cultural effects on the whole ragusan area.

We choose to use 3D laser scanning methodology in order to obtain an integrate representation made of analysis and measurements, survey and representation. Thus, a survey appropriate to understand and document the object in its completeness: from the morphology (territory/altimetry) to the geometry of the archaeological complex, to the topology of elements, to the state of conservation of the stones of the settlement.

The 3d laser scanner survey provided a product/model of the surveyed reality through which it is possible to carry out a diachronic and synchronic reading and to convey an analytic and synthetic evaluation already during the survey phase. A 3D model objective – inspected in the virtual space of the computer where it is possible to intervene and operate with subjective evaluations - has itself the fundamentals of the project.

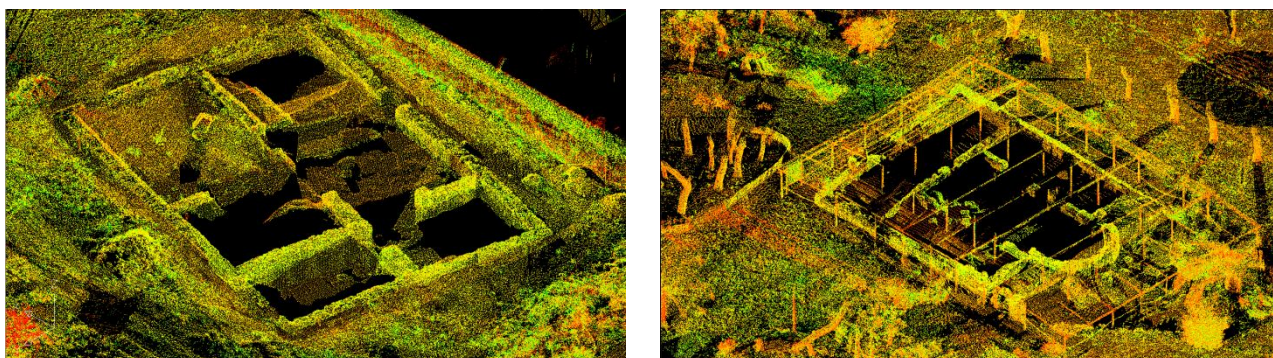


Fig. 6-7: Views of the cloud of points near to the remains of a house (on the left) and of the little church (on the right).

As a model of representation, it is a media of exchange of visual feelings and spatial descriptions and it allows to be observed according to the "perspicere" of the tradition. The coexistence of the perceptive feature and the metric-objective one represents the innovative component of the digital survey that allows, thanks to data correlation, the integration and the interaction of the specific disciplinary expertise.

This way the role of the traditional graphic representation - seen as interpretative media of the different languages and specialist expertise involved in the planning activity – is placed side by side to the model of digital synthesis. Through the model the following ideational phases of the planning process, the new shapes and the new volumes are inserted into the virtual scene of places, embodying the 3D digital space.

The visualization of the model – that for its intrinsic potentialities enriches the process of scientific discovery because it improves the hidden interiorities of the place – allowed us to transfer all the planning reasoning into digital form [7].

The elaborated product is not only a simple prefiguration that relates drawing and design but also a manipulable system that simulates the reality simultaneously to the work of the designer.

This model embody a hierarchic structure which allows, in the planning phase, a dynamic approach which goes from the critical analysis to the visual impact of the intervention, to the simulation of alternative hypothesis for restoring the materials and the vegetation. Moreover, the representation by means of 3D digital models gives the opportunity to create a "virtual museum" which has its dimension and which is able to host the whole archaeological site according to an efficient and attractive interdisciplinary didactic path.

The use of 3D scanning in the field of cultural heritage contributes to the elaboration of a new communicative and visual grammar which allows to combine the cognitive rigor of the metric investigation with the need to be an effective tool for understanding values, as well as to convey the meanings of the site making easier the integration among culture and economics, tourism and territory development [8].

Thanks to the processed model it has been possible to activate the project of requalification of the park that – preserving the memory of the past and the respect of the nature – would develop more growth and, at the same time, “less impact on the historic/cultural, floristic/faunistic, socio/economic environment”.

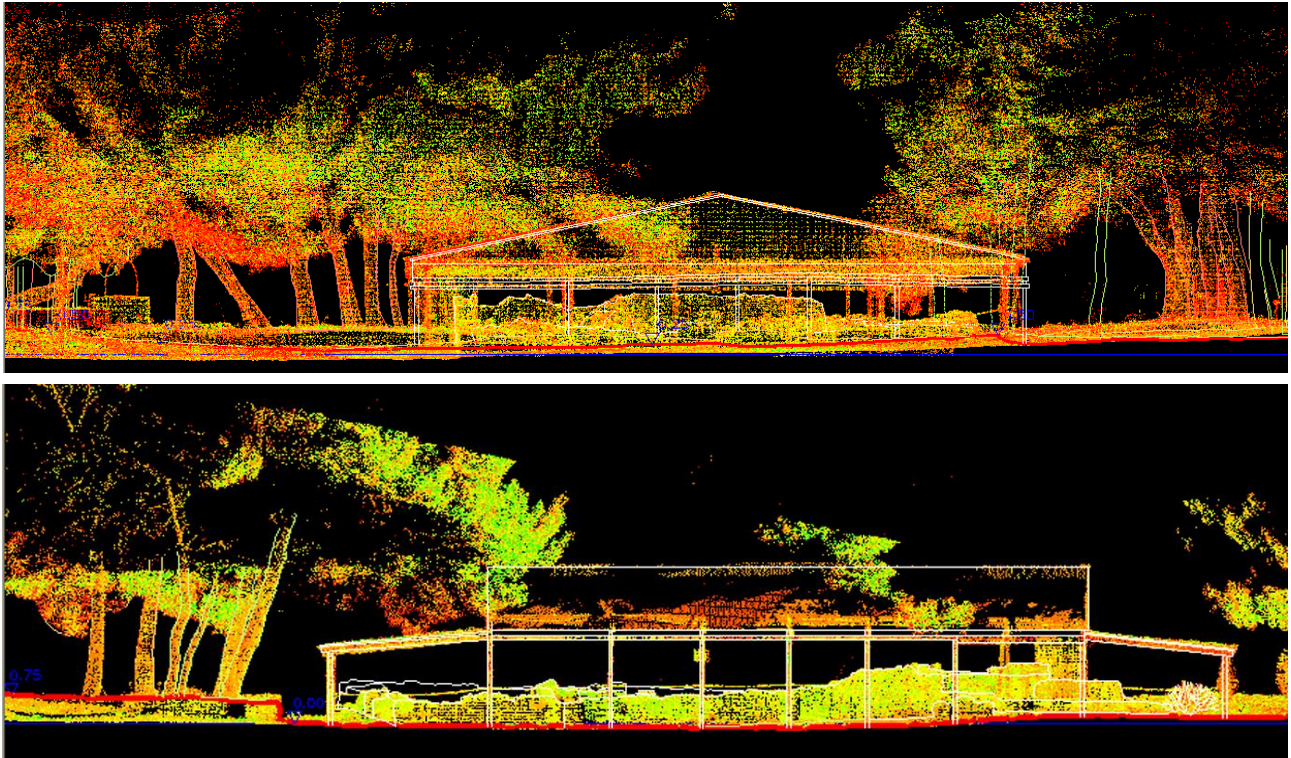


Fig. 8-9: Suggestive representations of the model among shape, measure and perception.

4. Less waste/more knowledge of Hyblean archaeological landscape: survey and representation of the archaeological park of Kaukana Cettina Santagati

The archaeological park of Kaukana stretches for about 3 hectares and half into the construction fabric built during the economic boom of the 70s and 80s.

The ruins of the late-roman settlement are plunged into a thick woody density (about 1170 trees among autochthonous and allochthonous species) in an indissoluble union between nature and archaeology generating a cultural landscape of remarkable historic-naturalistic value.

The knowledge process of this archaeological area – nowadays fragmented by the littoral road into three adjoining areas, one of them along the coast – required a selective methodological approach, alternative to the traditional investigation methods. As a matter of fact, the survey of the site has taken into account the archaeological emergencies issues together with the naturalistic element in order to develop a requalification project of the park aimed at “less wastes/more knowledge” by planning fruition and enhancement paths along the ruins and the green.

It has been investigated on the field the 3d laser scanning technology which is, until now, the most suitable for measuring and documenting the reality in terms of acquisition speed, quantity and accuracy of measured data and capacity of providing, in real time, the 3D representation of the surveyed object [9,10,11].

The Time of Flight 3d laser scanner HDS 3000 by Leica Geosystem, belonging to the laboratory of Architectural Photogrammetry and Survey, has been used.

Through a conscious pre-knowledge of places, some innovative operative protocols have been tested on the field. That was essential to fully understand the complex and multiple issues of the cultural asset we were about to study and of the whole environment, anthropic and natural, to which it belongs.

The procedural logic, experimented and adopted during the data acquisition steps, supplies to the peculiarities of the site, to the need to document the trees, to integrate and to geo-reference the surveys of future excavations. It has been conceived and arranged an almost regular grid of station points (34), arranged at about 30-50 mt one from each other, so that each station is connected to the previous and the next one. This way, besides a good overlapping between the scans, a better error compensation in the following phase of the model alignment is granted.

In the absence of well recognizable reference points, the chain between each station and the following is assigned to a set of 3D targets (69 polystyrene spheres with 12 cm in diameter) univocally identifiable and well visible. The targets are uniformly arranged in relation to the station points so that from each station point it is possible to acquire at least 4 targets in common with the direct adjacent stations.

The choice to use polystyrene spheres instead of pre-calibrate 3D targets (more expensive) has been based on some tests performed in our laboratory. These tests gave good results about the alignment of adjacent stations. The only condition is that a redundant number of spheres should be used so that it is possible to balance the error due to their un-calibration [12].



Fig. 10: Experimentation on the field with 3D spherical target.

Particular attention has been paid to the visual connection between the passage stations from one area to another one and - even if adjoining - they are cut by the littoral road and the surrounding buildings: thus, intermediate stations have been planned when the points were too far.

The in situ survey for each station provided: a fully 360° scan with a density of 1 cm to 15 mt; a thickening in presence of the archaeological ruins and the 3D targets (4 mm). In total, 34 scans have been performed and 185 millions of points have been acquired.

Before merging the overall model, raw data have been cleaned and spherical targets have been recognized and identified by creating, in the embedded software, the corresponding spheres (through proper fitting algorithm) and by assigning them an ID label.

The assemblage of the 34 scans into a unique reference system - in order to have a close mesh of connected scans - has generated 77 chains (cloudmesh).

The alignment error has been reduced to 1,5 cm by optimizing the computation parameters. This result can be considered more than acceptable because of the wind which introduced a strong disturbing element in the survey of trees leaves (essential for an accurate documentation of the foliage overall dimension). Moreover, considering the required scales of representation (1:200; 1:500) this value fits the graphical error.

The obtained 3D model is a digital document that holds the morphological, geometric, natural, environmental and perceptive characteristics of the homologous real model but only with a later manipulation-interpretation it might become an intelligible space.

The overall model constituted the base for the following elaborations aimed at obtaining a full documentation of the condition of things. Thus, they have been represented: plani-altimetric relief of terrain (by contour lines at each 25 cm), the ruins of the settlement, the arboreal species (localization, foliage overall dimension and denomination), the walls, the fences and all the elements useful for the comprehension of the spatial and

environmental contest of the archaeological park and very important for the enhancement project of the state-owned area.

Finally, to document the plani-altimetric relations between nature and built area –essential for the project of fruition of the park – they have been performed some sections of the model aimed at the elaboration of representations which give the perception of the state of places.

The digital survey of the park has constituted a valid analysis tool for the comprehension of the cultural, natural and landscape worthiness of places, allowing a “less static/more dynamic methodological approach” to the regeneration project of the Hyblean territory.

Indeed, the possibility to be able to extract at any time new information, to compare with the planning solution being formulated, allowed a better control of the project through “less wastes/more quality choices”.

“Less randomness/more ideas” would contribute towards the development of a sustainable project based on the strategies of enhancement of the archaeology and of the related landscape.



Fig. 11: Plan graphical restitution of the archaeological park where is highlighted the project of survey.



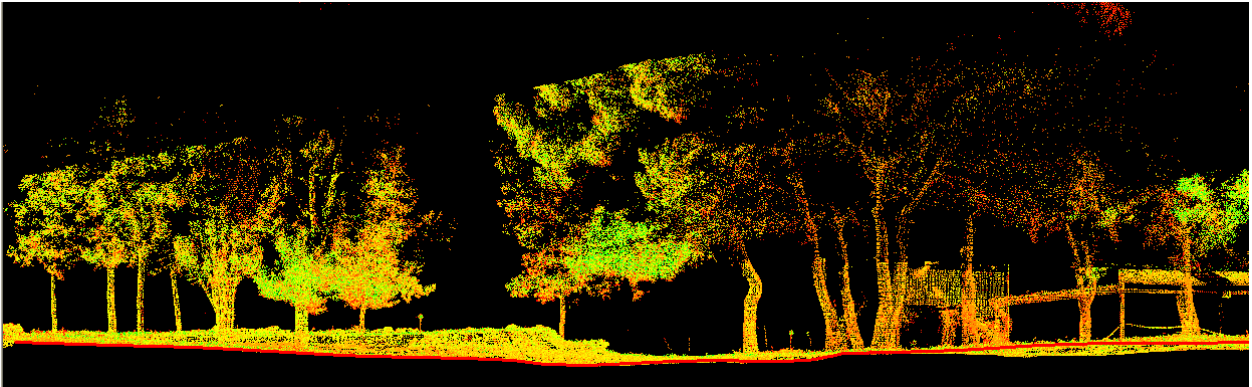


Fig. 12-13: The archaeological landscape between natural and built environment.

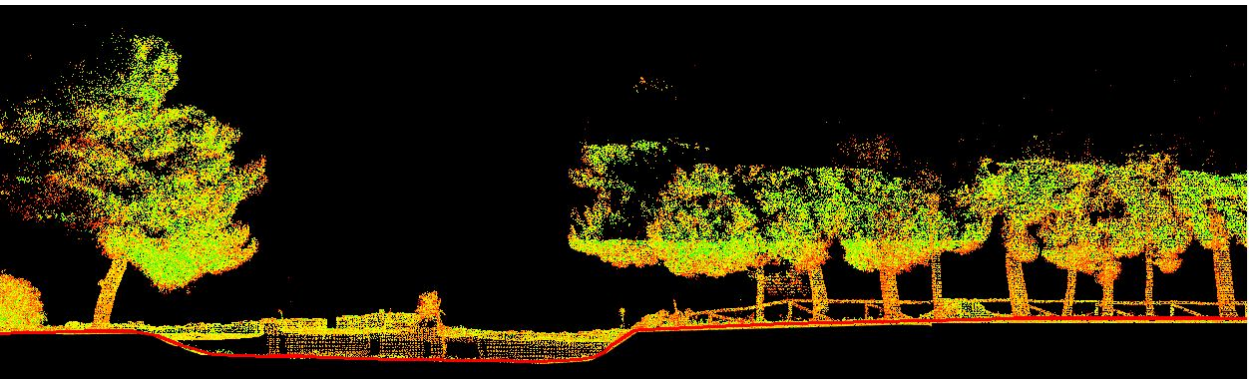


Fig. 14-15: The remains of Kaukana settlement in the environmental context of the park.

