UNIVERSITÀ
DEGLI STUDI
FIRENZE

Scuola di Agraria

FIRST LEVEL MASTER COURSE

AGRICULTURAL HERITAGE SYSTEMS

The Green Pistachio of Bronte

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Academic Year 2019/2020

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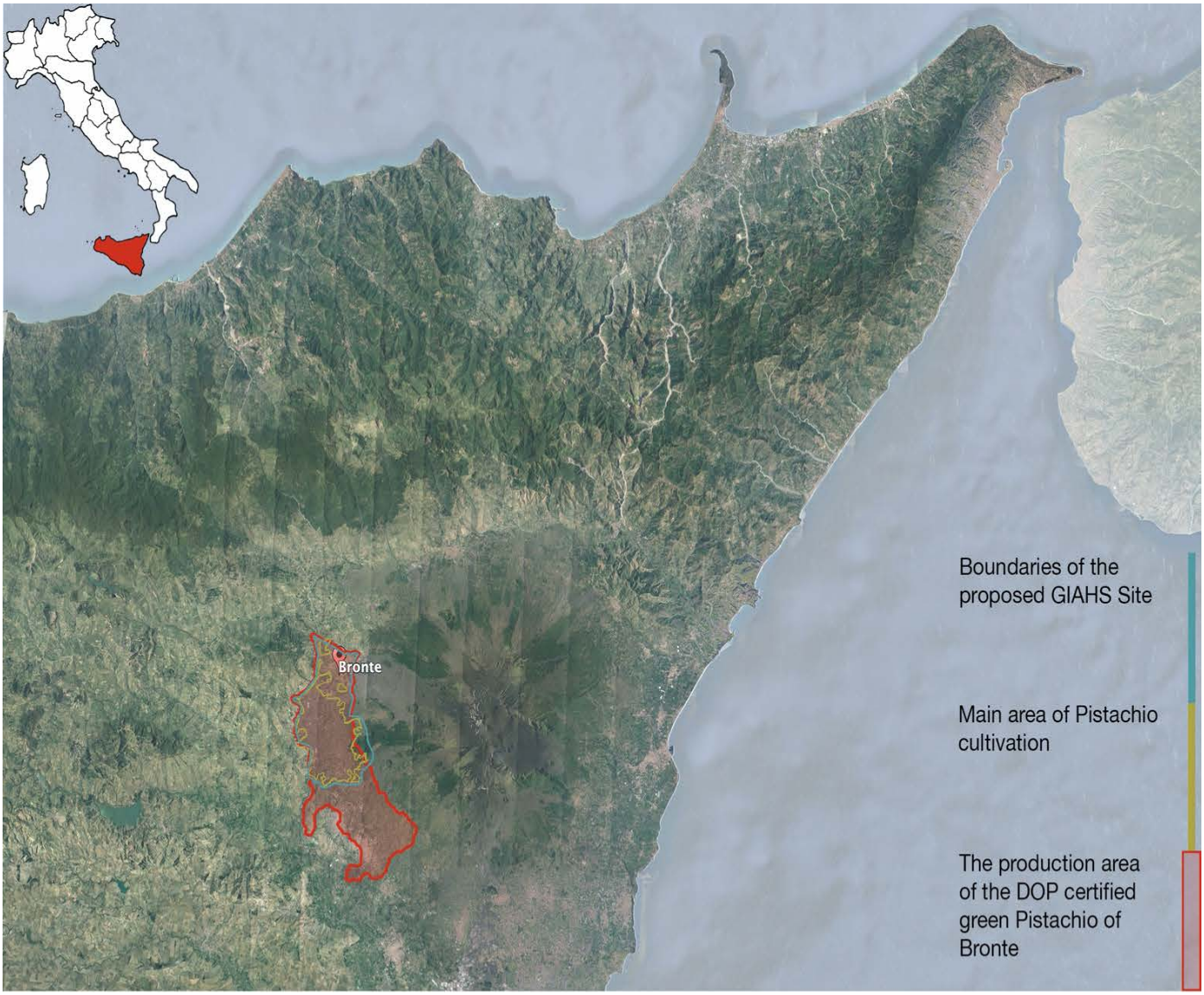
1. Summary Information

1.1 Name of the Agricultural Heritage System

The Green Pistachio of Bronte.

1.2 Location of the site

The production area of the Green Pistachio of Bronte taken into account falls in the territory of the communes of Bronte and Adrano (Province of Catania) between 400 m and 900 meters above sea level. Latitude: 37°47'25"80 N. Longitude: 14°50'6"00 E. In particular, the boundaries are identified as: BRONTE – west along the Simeto River, east to the height of 900 a.s.l., south to the Commune of Adrano and north along the road from Bronte to Cesarò.



1.3 Accessibility of the site to capital city or major cities

Bronte is located on the north-west slope of Mt. Etna. It can be reached from Catania, which is 54 km away, either by taking the highway 120 along the Ionian coast till Randazzo to then continue on the highway 284 or by taking the state roads that skirt the western slope of Mt. Etna. Furthermore, it is also possible to get to Bronte with the Circumetnea railway which connects several municipalities and leaves from Catania. There is also a wide range of pullman companies that take everyday people from Catania to Bronte. Finally, the closest airport is situated in Catania and it is only 49 away.

1.4 Area of coverage (hectares)

Approximately 6.150 ha.

1.5 Agroecological zone (http://www.fao.org/nr/gaez/en/)

Subtropics, warm/mod cool.

1.6 Topographic features

The western slope of Mt. Etna is an area characterized by topographically rugged terrain and by thin and rocky volcanic soils. The whole Mt. Etna region encompasses a wide territorial surface which has historically been affected and interested by eruptions that began to occur 200 thousand years ago. The current stratovolcano land structure, which resulted from the restless activity of Mt. Etna, has considerably reshaped the fields where pistachio is grown.

1.7 Climate type

The area interested by the cultivation of pistachio is defined by a semi-arid subtropical Mediterranean climate typical of the southern Italian regions. Summers are generally long and dry with just occasional heavy rains; the maximum temperatures can reach up to 35 °C with quite low levels of humidity and minimum temperatures of around 17 °C. Autumn and winter are the seasons that register the highest precipitation rates and the lowest average temperatures (6-8°C), sporadic snowfalls, and the most

significant temperature changes between day and night. Thus, winter is the wettest season with 235 mm, followed by autumn with 197 mm, spring with 145 mm, and summer with 54 mm. The average annual temperature is around 14 °C.

1.8 Approximate Population

The Bronte municipality counts around 20.000 thousand inhabitants.

1.9 Ethnicity

Italian.

1.10 Main source of livelihoods

According to the last data, nowadays around 60% of the population is actively involved in agricultural activities, 15% is employed in the industrial sector, 10% is devoted to trading activities, 8% works in the traditional artisan sector and the rest works as freelance.

Thus, the local economy of Bronte relies predominantly on the agricultural sector and to a lesser extent on the zootechnic, artisanry, trading and industrial activities. The cultivation of pistachio, in concert with the transformation and marketing operations associated with such a product and carried out within the same area, represents the primary economic resource and the major source of wealth for the local population. In addition to the highly specialized pistachio cultivation, farmers have olive groves and grow almonds and prickly pears. The production of fresh fruit gives, indeed, a great boost to the local economy. The valley further north than the Simeto river is particularly fertile and has allowed Bronte to become an important producer of pears and peaches.

Next page source: Land Use Map of the "Sicilian Department of Cultural Heritage and Sicilian Identity". Printing Scale: 1: 50.000.

Piano Paesaggistico

Ambiti 8-11-12-13-14-16-17 Catania

Regione Siciliana

Assessorato dei Beni Culturali e dell'Identità Siciliana
Dipartimento dei Beni Culturali e dell'Identità Siciliana

Soprintendenza per i Beni Culturali ed Ambientali di Catania

Progetto finanziato con P.O.R. Sicilia 2000-2006 Misura 2.02 Azione C

Piano Paesaggistico

Ambiti 8-11-12-13-14-16-17 Catania

tavola **5.1**

Scala di stampa 1:50.000

Ambiti regionali 8, 11, 12, 13, 14, 16 e 17 ricadenti nella provincia di Catania

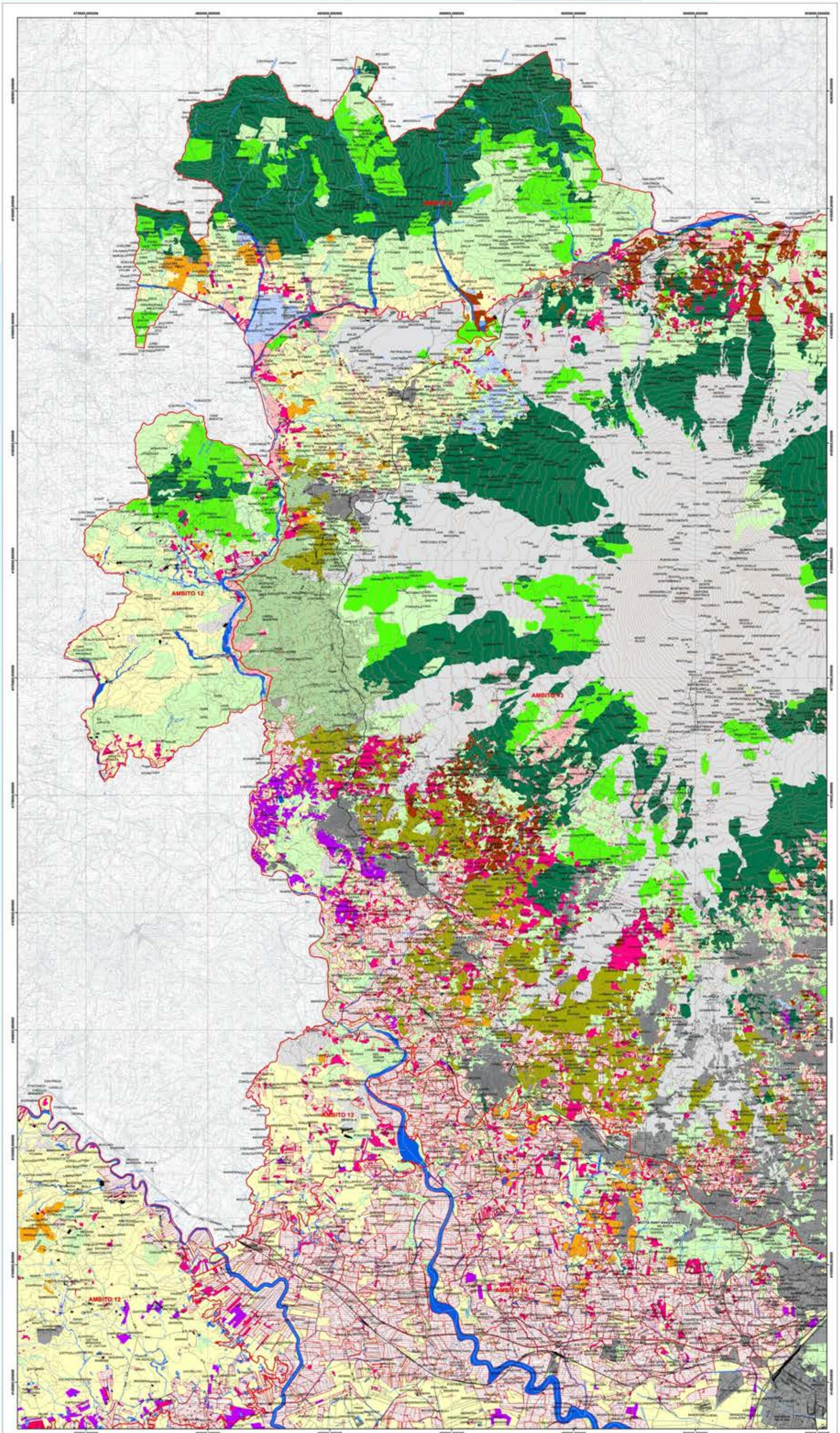
Tavole di Analisi
Sistema antropico

Paesaggio agrario

DIPARTIMENTO DEI BENI CULTURALI E DELL'IDENTITA' SICILIANA
Il Dirigente Generale
SERVIZIO PIANIFICAZIONE PAESAGGISTICA
Il Dirigente Responsabile
SOPRINTENDENZA PER I BENI CULTURALI ED AMBIENTALI DI CATANIA
COORDINAMENTO TECNICO-SCIENTIFICO
CONTRIBUTI TECNICO SCIENTIFICI
COLLABORATORI
CONSULENZA SCIENTIFICA
UNIVERSITÀ DI CATANIA

Legenda

- seminativi
- ortaggi da pieno campo
- vigneti
- frutteti
- oliveti
- seminativi arborati
- sistemi colturali complessi
- aree boscate
- pascoli incolti e agricoli abbandonati
- aree arbustive e boscate in evoluzione
- rocce nude affioramenti sciare e sabbie
- bacini d'acqua, valloni, torrenti e fiumi
- agrumeti
- mandorleti
- ficodindieti
- masserie
- serre tunnel e vivai
- consociazione ficodindia olivo
- pistacchieti
- noccioleti
- aree costruite, produttive e commerciali



2. Global Importance of the Proposed GIAHS Site

2.1 Historical Relevance

The history of pistachio and its relationship with mankind could date back to as far as the Bronze age. They are considered one of the oldest flowering nut trees as they have been cultivated in the middle east for thousands of years. Only two nuts have been regarded to be Biblical inasmuch as they are cited in Genesis 43:11, and one of them is pistachio.

"*If it must be so, then do this: take some of the best products of the land in your bags, and carry down to the man as a present, a little balm and a little honey, aromatic gum and myrrh, pistachio nuts and almonds*."

It is only through an accurate study of Plinius's "Historia Naturalis" that it is possible to claim with a high degree of confidence that the first pistachio trees (Pistacia Vera L.) were introduced in Italy by Lucio Vitellio, who was at the time Roman governor in Syria, around 30 A.D. It was, indeed, very common at the time to carry to Rome the exotic and bizarre plants found in the most remote corners of the empire.
Although, as pointed out above, the first appearance of this plant on the Italian territory could go back to almost two-thousand years ago, it was probably the Arabs that made its cultivation and the consumption of its fruits more broadly popular. As a matter of fact, it was around the IX-XI centuries A.D., with the expulsion of the Byzantines by the hand of the Arabs, that the history of pistachio entered on a new phase in terms of its relevance and distribution (Marino, 2012).

It is now crucial, for the purpose of this research, to attempt to trace back the origins of this specific nut tree in Sicily and to lay out how, as a result of long-lasting cultural developments and progressive interactions among different socio-economic and environmental factors, it came to be known worldwide either as "Green Gold" or "Sicily's Emerald Green Gem".

The first pistachio trees have allegedly been brought to Sicily by the Arabs from Campania, which is at the present-day a region located in the South of Italy. A simple etymological study has been of great use to support this hypothesis. First of all, the main cultivar still grown in Sicily is called “Napoletana”, suggesting that its use may have originally flourished in Napoli, the capital city of Campania. Secondly, the pistachio tree is usually referred to as “fastuca” by Sicilian farmers and this dialectical term does seem to recall the name Arabs used to indicate the same plant, that is to say “fastuq”. (Petino 2010).

Tab 1. Timeline of the history, terminology and diffusion of Pistachio.

B.C.	20-30 A.D.	X-XI Century	XIX Century
Old Testament	Lucio Vitellio	Arabs	Its cultivation becomes economically relevant
Assurbanipal’s Obelisk (Yemen)			
Genesis XLIII Vol. 11			
Alexander the Great in Greece			

Tab 2. Terms used for the dentification of Pistachio in history.

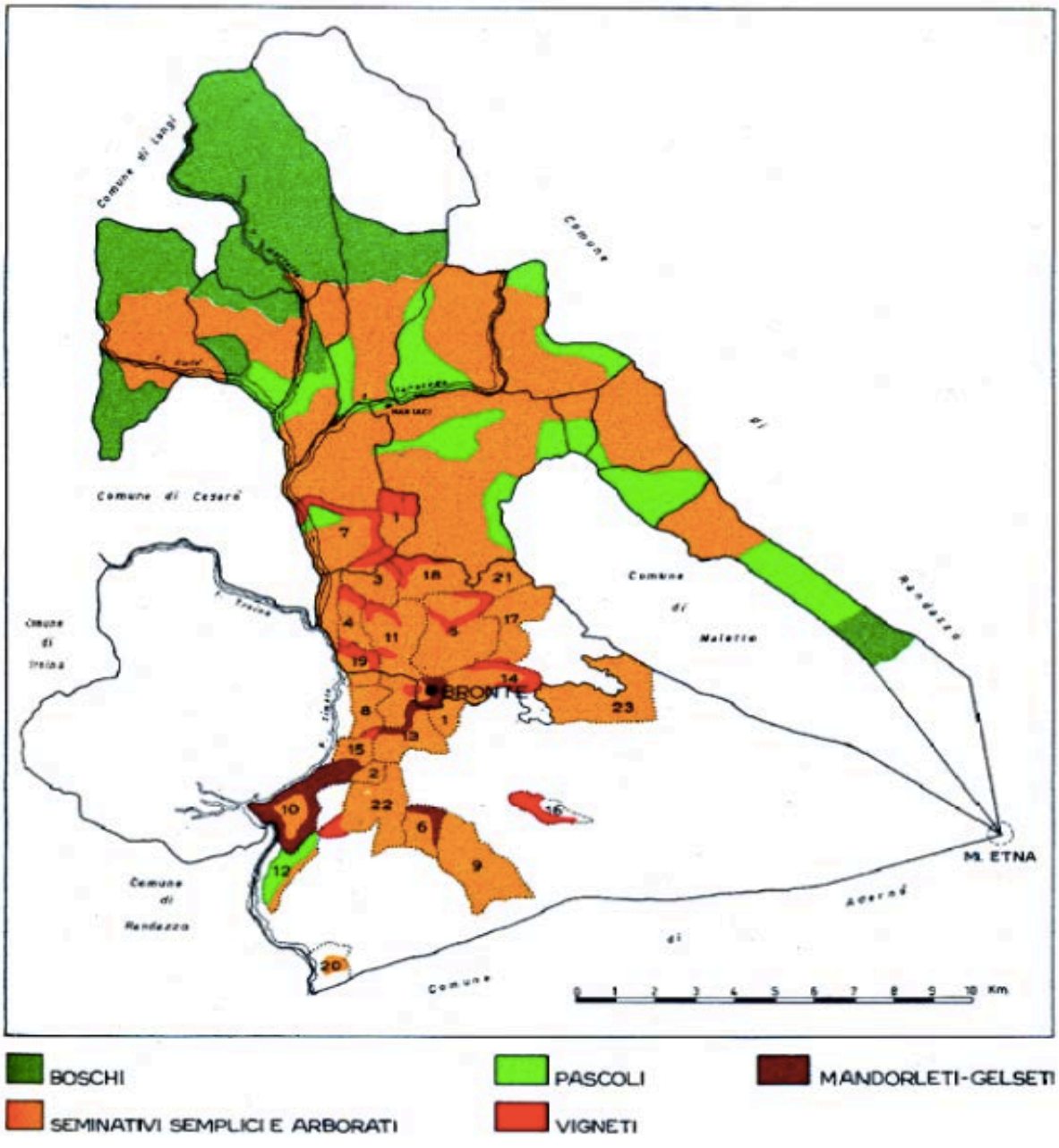
Persian	Greek	Arab	Latin	Sicilian
Pesteh (fruit)	Pistàkion (fruit)	Fristach (fruit)	Pistacia Vera (plant)	Frastucara (female plant)
Fisteh (fruit)		Frastuch (plant)	Piftecium (fruit)	Terebinto (plant)
Fistij (fruit)		Fustuaq (fruit)	Pistacium (fruit)	Scornabecco (male plant
Pistah (Pianta)				Frastùca (fruit)

Source Tab 1. and Tab 2.: Petino, 2010.

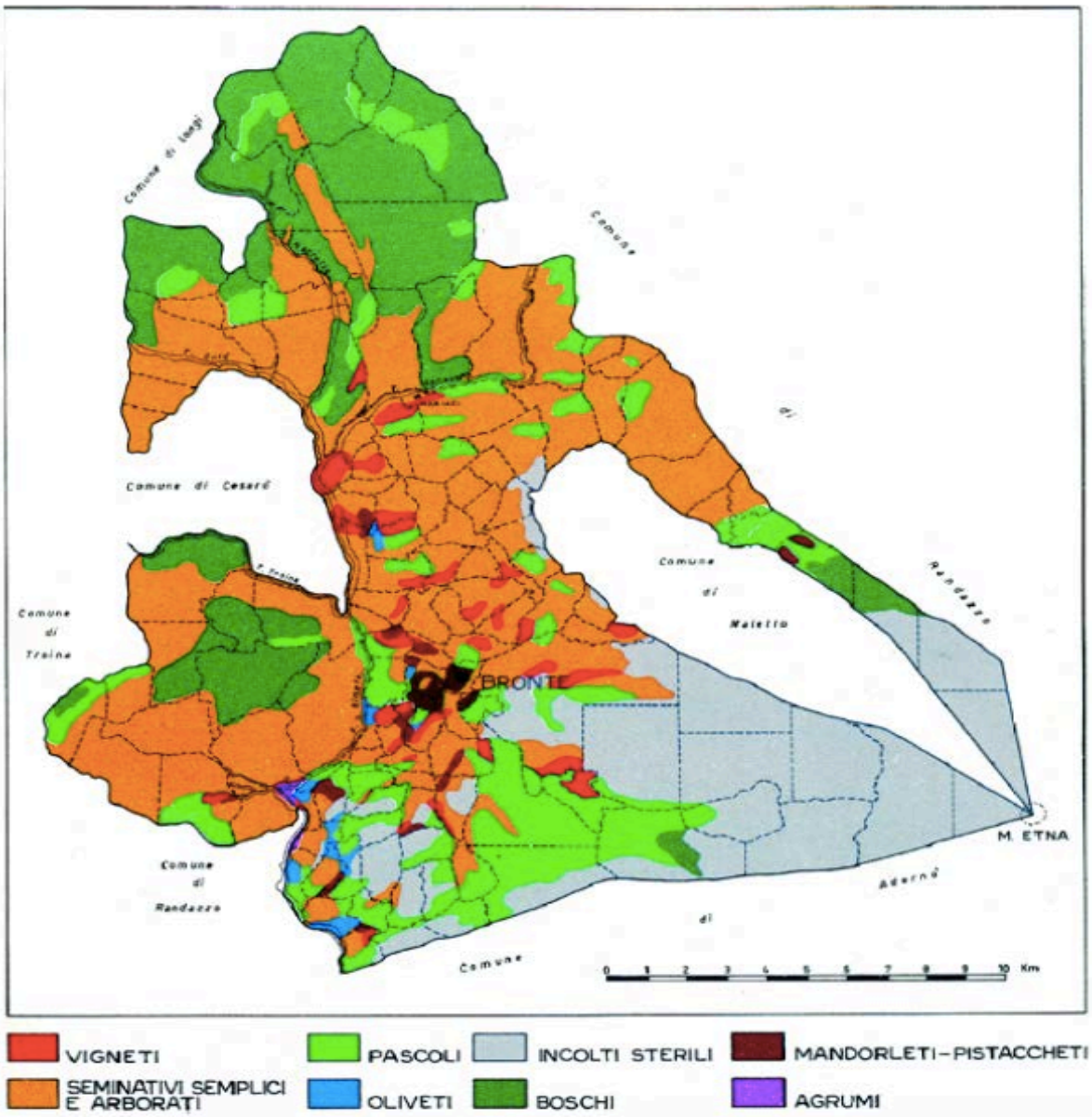
As hinted in Tab 1, it is especially throughout the 18th the 19th centuries that the cultivation of pistachio started to assume an increasingly considerable importance from an agricultural, geographic, and economic point of view within the provinces of Catania and Agrigento.

Several scientific writings give detailed testimonies of the growing relevance of this nut tree not only as a decorative plant stirring the curiosity of the noble households

but also as a source of livelihoods for farmers (Ventura, 2007; the author makes reference to the writings of, for instance, Paolo Silvio Boccone and Domenico Sestini). However, it is thanks to the "Rilievi del Regno di Sicilia" (Surveys of the Kingdom of Sicily) and to the "Catasto Provvisorio del Regno delle Due Sicilie" (Temporary land registry of the Kingdom of the Two Sicilies), which date back to the 1747 and 1853 respectively, that it is possible to interpret the various land uses in Bronte and how they changed over time.



Source: Lo Giudice, 1969. Crops distribution in Bronte in 1750.



Source: Lo Giudice, 1969. Crops distribution in Bronte in 1850.

What can be reasonably inferred from the two cartographic representations above illustrated is that it was not until the mid-19th century that pistachio cultivations were sufficiently extended on the territory to be officially recorded in the land registry, and it occurred concomitantly with the disappearance of the mulberry trees.

The "Catasto Provvisorio del Regno delle due Sicilie" also tells us that such cultivations covered a surface of just 337,95 ha across the whole island. Anyway, it is worth mentioning that pistachio trees tend to thrive in specific areas characterized by thin volcanic soils and rugged terrain. These areas were often regarded as "terre inutili"

(useless lands) because, due to farmers' still poor and deficient knowledge of agricultural techniques on the subject, it was widely believed that no crop could survive the particularly severe environmental conditions typical of the slopes of Mt. Etna and that they were naturally doomed to be abandoned. As a consequence, the use made of these rocky volcanic lands was probably not adequately registered for quite a long time.

Tab 3. Allocation of productive land uses (Bronte, 1853)

COLTURE	SUPERFICIE (HA.)	%
Giardini	7,45,38	0,02
Orti alberati	8,08,73	0,03
Orti semplici	16,70,98	0,05
Seminativi irrigui	66,41,33	0,22
Seminativi alberati	62,21,25	0,20
Seminativi semplici	13423,59,24	43,31
Pascoli	6639,60,54	21,43
Oliveti	163,14,56	0,53
Vigneti alberati	115,46,09	0,37
Vigneti semplici	701,69,27	2,26
Ficheti d'India	71,51,05	0,23
Mandorleti	99,73,99	0,32
Pistacchieti	*101,21,16*	*0,33*
Boscate	5547,88,39	17,90
Colture miste	3964,46,55	12,80

Source Tab 3.: Ventura, 2017.

The entire agricultural scenario went through a radical transformation when the P. Terebinthus, popularly known in Sicily either as "Scornabecco" or "Spacca sassi" (smashing stones) for its ability to penetrate and crack even the harshest volcanic soils, began to be adopted as the main rootstock. The terabinth has, indeed, remarkably distinguished itself for its capacity to develop an outstanding root system that allows it to explore dry and shallow soils in order to seek water and vital nutrients. By virtue of its extraordinary characteristics, which will be examined in greater detail in the

following sections of this paper, farmers in Bronte have been able to create an environmentally friendly, economically profitable, and culturally unique agricultural system where there was no other viable alternative, that is to say where land abandonment seemed an unavoidable state of affairs because any other cultivation was apparently meant to fail.

The data collected over the first three decades of the 20th century are illustrative of how the pistachio production turned into a driving force for the local economy in Bronte and of its rising presence in both national and international markets. Seven enterprises were already operating within the municipality's boundaries with the aim of transforming and marketing pistachios. The number of pistachios exported directly from the port of Catania rose from 5.160 kg in 1898 up to 27.393 kg in 1912. However, it was not until 1929 that Bronte finally outgrew the municipalities of Belpasso, Regalna and Adrano, and established itself as the main hub of pistachio production within the city of Catania with its 3.808 ha, amounting to 67.38% of the whole province, covered with the crop under examination (Ventura, 2017). Nowadays, as it will be spelled out throughout this paper, Bronte is undisputedly the most significant and extensive center of pistachio production in Italy.

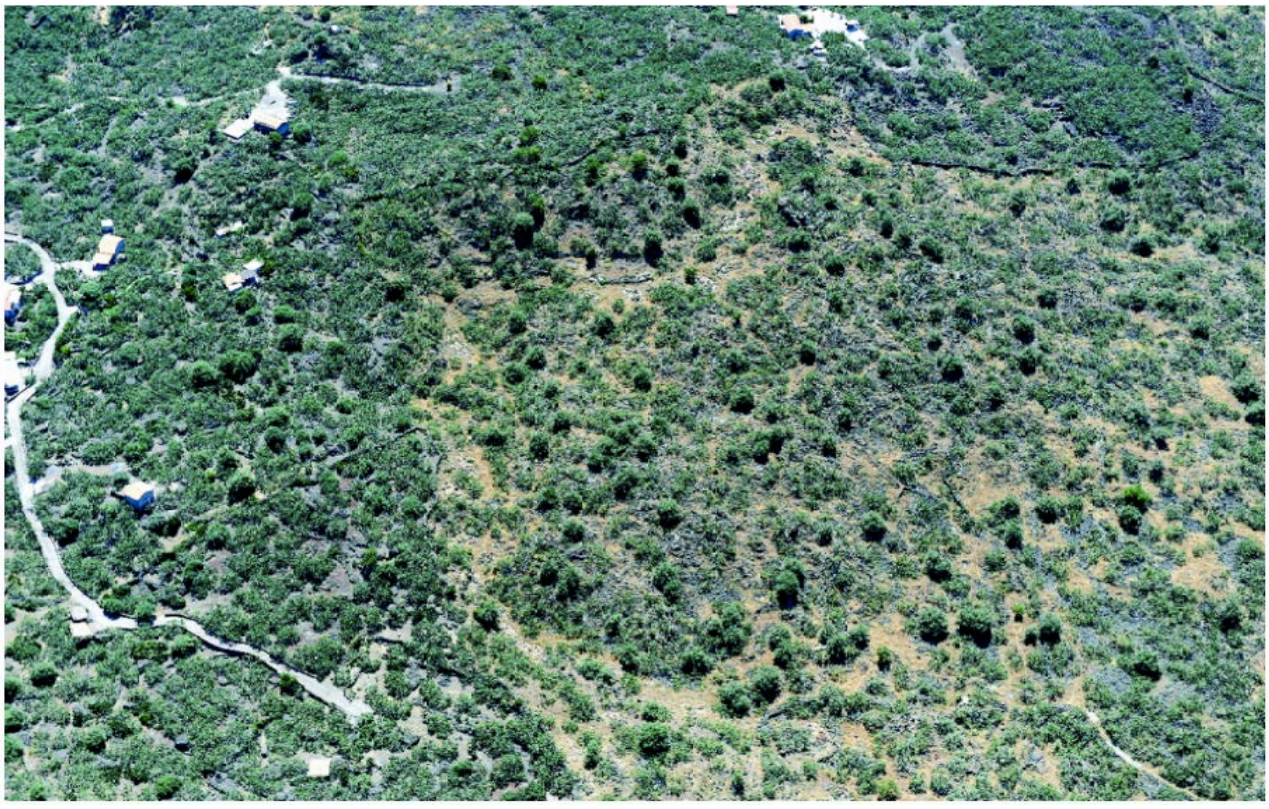
2.2 Specific features of the proposed GIAHS site

The main purpose of this section will be to outline the pivotal characteristics which make the cultivation of the pistachio of Bronte one-of-a-kind. It is, indeed, my intention to highlight why it such a valuable economic, environmental, and cultural resource for the community whose livelihoods it contributes to sustain and why it can be considered as an exceptional case-study that further demonstrates how a prolonged interaction between man and nature may give rise to fascinating landscapes and ecologically sustainable agricultural systems. Most of the topics that will now be briefly touched upon will be analyzed more meticulously in the following sections.

First and foremost, the pistachio cultivation perfectly embodies the co-adaptation of the local community to the specific environmental conditions of the area in question. The natural plantations of pistachio are harmoniously integrated within the wonderful scenario composed by the steep slopes of Mt. Etna. It has been vigorously and repeatedly advocated that these plantations should be safeguarded for their ecological and landscape functions via the creation of natural protected areas and the enforcement of rigorous management plans. The most noteworthy endeavors to move in this direction to date are represented by the creation of the “Parco dell’ Etna” (Etna Park) in 1987, declared UNESCO Heritage Site, and the establishment of nine Natura 2000 sites which, to a large extent, overlap the same area. The surface of the park abovementioned covered in pistachio amounts to almost 700 ha, of which 415 falls within the district of Bronte and 300 within the district of Adrano (Sturiale et al., 2020).

The territory here under analysis cannot be found and replicated elsewhere because of its pedological features. The pistachio trees are farmed on markedly rugged and irregular terrains where the presence of outcropping rocks makes agricultural mechanization impractical. The land consists in ancient lava flows which have been progressively colonized by a natural vegetation that withstood and took advantage of

the shallow and poor layers of soil which had, in the past, made this same area unsuitable and unfavorable to the growth of any other crop. As a matter of fact, the pistachio of Bronte is cultivated in small plots of land that have not always been deemed arable. In order to overcome this obstacle, the previous generations of farmers intervened by working the surface of the ground and building retaining walls with the same lava stones they had removed. These operations were carried out without negatively reshaping or damaging the morphology and the orography of the area. The lava stone, usually hammered out or carved to a certain extent, constitutes also the paramount building material and it has been traditionally used for the construction of valuable artifacts which fulfil precise functions in agricultural activities, such as drywalls to support the terraces, rural houses and their fences, and water management infrastructures. An accurate examination of the widespread use of this building material would tell us a story of a long-lasting interaction between man and nature which has resulted in environmentally sound anthropization processes and in a balanced landscape (Barbera et al., 2015)



Source: Petino, 2010. Aerial view of pistachio extension on volcanic terrains.

Source: Barbera et al., 2015. Basic and typical construction: "la casedda".

Bearing in mind that the singular features of the area do not allow for the introduction of machineries, another crucial aspect of this system is that most agricultural operations, such as cultivation, harvesting, and pruning, are still done primarily by hand. This situation makes pistachio farming burdensome and labor-intensive and leads, in turn, to a significant rise in production costs (Mipaaf, 2012).

The natural plantations of pistachios stand out from an agronomic point of view as they favor the adoption of dryland farming techniques, in other words they can prosper even in arid and semiarid areas with less than 500 mm of annual precipitation. From a strictly environmental standpoint, this element is deserving of particular attention. The ability of this crop to weather adverse climatic conditions and to grow without irrigation should be regarded as an invaluable trait for the following two reasons. First, Bronte is located in a region where water constitutes a scarce and precious natural resource that needs to be preserved. Second, it expresses the genuine and effective adaptation strategy of this nut tree to climate change, a phenomenon

that has long had a detrimental impact on agriculture and whose effects jeopardize the livelihoods of millions of rural households around the globe. This last point must be briefly elaborated upon because, although the interlinkages between agriculture and climate change are utterly undeniable, it is the very nature of their relationship that is often neglected or misunderstood. There is a wide range of human activities that are precipitating the changes we observe in our climate and it would be far beyond the scope of this paper to list them all, but it is the role played by agriculture that usually goes underreported. While it is generally claimed and it appears more evident that climate change is adversely affecting the production of the food we eat, I believe it is crucial to shed light on and pay attention to the tremendously negative repercussions of agriculture on air pollution and on water and soil degradation. However, it has become steadily clearer that when agriculture is practiced in a sustainable fashion it can turn into a driving force for positive environmental change. To sum up and in relation to what just said, I believe the cultivation of pistachio has represented for Bronte and its landscape that positive driving force, and this is what I will try to emphasize throughout this paper.

Pistachio trees growing on the rugged terrains typical of the site.

Hand picking of in-hull pistachio.

Thus, it was through the strategic adoption of ingenious and resilient agricultural techniques that farmers have managed to valorize their territory and to increase their wealth in spite of the harsh pedoclimatic circumstances.

The choice of the P. Terebinthus as the primary rootstock has provided renewed vitality to a territory that would have otherwise been likely marked by trends of rural depopulation. Farmers have taken advantage of its capacity to develop a deep and powerful root system and to crack even the harshest volcanic soils by grafting on it the only species belonging to the Pistacia family that produces edible fruits, that is to say Pistacia Vera L. The majority of the steep slopes of Mt. Etna covered in pistachio are considered “natural pistachio plantings” because they have been attained by grafting spontaneous P. Terebinthus plants scattered all over the territory (Barone and Marra,

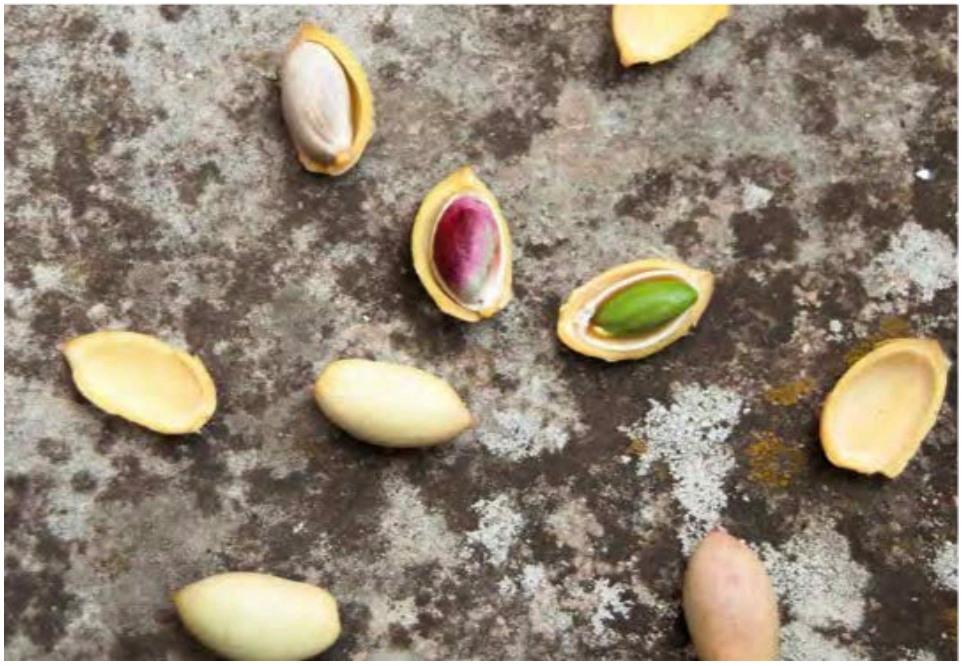
2004). The cultivar Napoletana (also known as “Bianca”) is the only one broadly used and it amounts to more than 95% of the overall pistachio production.
There is an old Sicilian saying that reads “*Essiri comu lu fastuca and lu scornabeccu*" (be like the pistachio grafted on the terebinthus) and it is popularly used to suggest that two people are indissolubly bound together (Avanzato and Vassallo, 2008).
Secondly, farmers have had to cope with a critical physiological issue manifested by this nut tree. The latter is, indeed, affected by a phenomenon commonly known as “alternate bearing” which has urged the adoption of particular training techniques to follow the nutritional and vegetative requirements of the plant and to maximize the yield. In a nutshell, it is a cultural and traditional practice that consists in the harvesting of pistachio on a biennial basis in order to allow the plant to rest during the “off” year, to put the water and nutrients collected over the “off” year to good use during the “on” year for production purposes, and to biologically control the main dangerous pests by inhibiting the realization of their life cycle (Marino and Marra, 2019).

In conclusion, it is of utmost importance to conclude this section by stressing some of the qualities that have led the “Green Gold” of Bronte to draw international attention. It has long been appreciated on the national and international markets in virtue of the intense green color of the cotyledons, the stretched shape, the high monounsaturated fat acids content, the weight, the strong flavor, and the delicate aroma of the fruit after removing the hull (Giuffrida et al., 2006). These features have been obtained through the combination of the superior organoleptic qualities of the autochthonous cultivar “Napoletana” with the sui generis ecological and cultural forces at play in the area. Finally, as far as the nutritional and healthy factors of the pistachio of Bronte are concerned, D’Evoli et al. (2015; 9) argue that:

Pistachios are a worth component of a healthy dietary pattern providing high protein, unsaturated fat, dietary fiber, micronutrients and a variety of bioactive compounds like sterols, tocopherols and lutein. (…) Our findings suggest that a regular pistachio’s

consumption improves well-being and seems to significantly contribute to the health preserving Mediterranean diet.

Source: Barone and Marra, 2004. Cultivar Bianca peeled pistachio.



The Pistachio of Bronte with the hull, in-shell, shelled (with the endocarp), and peeled (without the endocarp.

2.3 Contemporary relevance

The pistachio of Bronte still plays a crucial role because it perfectly embodies the idea of a multifunctional agricultural system and because it represents one of the purest instances of an agricultural landscape. I will shortly delve into and break down the meaning these buzzwords assume in this particular case study in the attempt to properly emphasize the features that make this system contemporary relevant.

First of all, the quintessential characteristic of a multifunctional agricultural system is the provision of services of a different nature and the cultivation of pistachio does supply economic, cultural, and environmental services. It has been estimated that it boasts a turnover of over 20 million euros per harvest year. Since this product displays distinctive organoleptic qualities and enjoys a remarkable international reputation, it can sell for twice the price of the pistachio grown by competitor countries. Its rising importance for the local economy is also documented by the fact that the number of pistachio processing factories actively operating within the district of Bronte went from 4 in 1995 to 9 in 2005. The average annual yield, that over the first five years of the new millennium did not even amount to 2000 tons, now exceeds 3000 tons. More than 90% of the overall national pistachio surface is concentrated across the districts of Bronte, and to a limited extent, of Adrano. Finally, it is possible to maintain with a good degree of confidence that the entire industry has achieved such a considerable economic weight that it has become the leading engine of growth and rural development (Briamonte, 2007; Putrino, 2007).

Besides being rightfully defined as an agricultural landscape, it has been persuasively reiterated that the green pistachio of Bronte has come to acquire the elements of a cultural landscape. The traditional agricultural practices have been passed on from generation to generation since the mid-18th century, when the productive potential of the steep volcanic slopes of Mt. Etna was more purposefully explored for the first time. The biennial harvest, which is carried out primarily by hand, is perceived and experienced as a moment that brings the community together to celebrate the

product that has strengthened the sense of belonging of the local population and built up a strong cultural identity (Barilaro, 2011). During the harvest period the streets of Bronte become, indeed, unusually deserted because a great number of people from every age group wishes to participate and to be involved in a process so imbued with social values (Lombardo, 2015). This farming activity takes place mostly between August and September, and, when it is about to come to an end or soon after its conclusion, the municipality of Bronte sets up and runs its renowned “Sagra del Pistacchio di Bronte” (pistachio festival).

From an environmental point of view, the ecosystem balance has not been negatively impacted from economic externalities, but it has rather been protected by the constituting elements of the agricultural system. One of the fundamental tenets of sustainable development concerns the challenging but necessary combination of protection and fruition objectives. In the case that one of these two targets evidently outweighs the other, the survival of the system might be critically jeopardized. The vital economic activities that sustain the livelihoods of a rural community should not be a priori subordinate to environmental and conservation interests, and vice versa, especially when anthropization processes have played a crucial role in the green valorization of a marginal area. The slow and progressive development of a rural landscape which has, over a long period of time, witnessed the harmonious integration of natural and human influences can give rise to ecologically, culturally, and economically balanced agricultural systems. The case study under scrutiny in this paper represents, in my opinion, the example par excellence of what has been pointed out above. The cultivation of the pistachio of Bronte has not negatively transformed the geological and geomorphological components of the territory where it is grown, it has not endangered the biodiversity, it has not intensified erosion or desertification problems, it has not put at risk the quality of life of the rural population, it has not increased soil, air or water pollution, it has not generated potentially damaging deforestation issues, it has not implied a modification of the hydraulic and

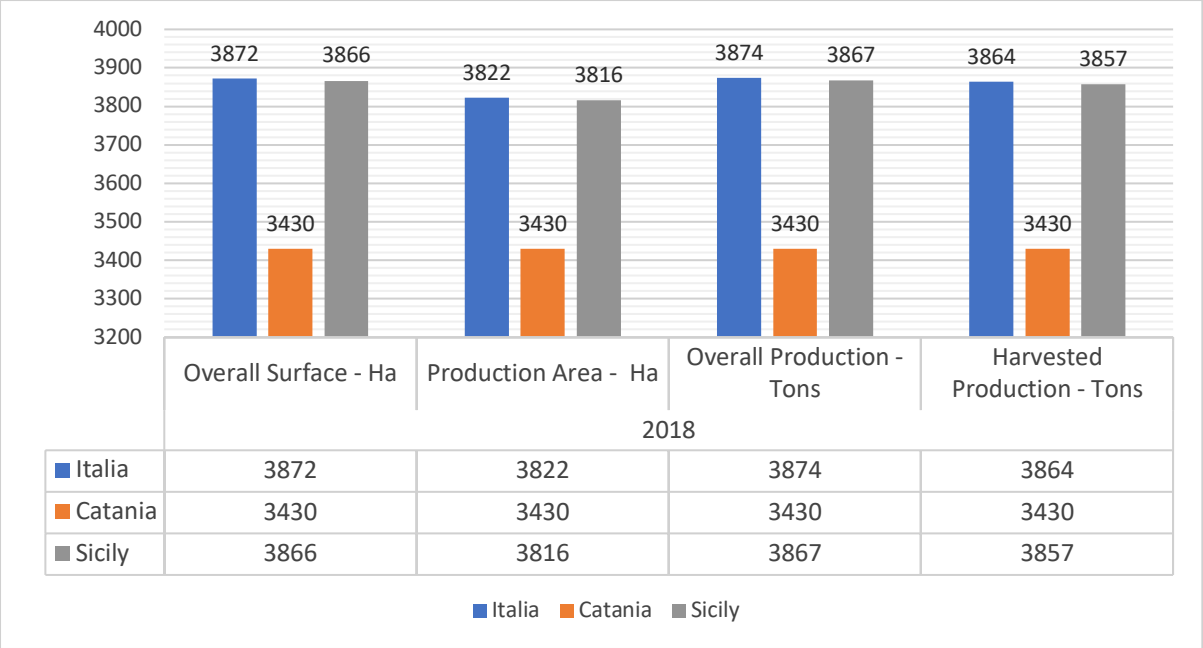
hydrogeological structure, and, finally, it has not led to an uncontrolled anthropization which could have threatened the architectural building patrimony. To the contrary, as it has already been partly delineated and will be spelled out in this paper, the pistachio groves have enhanced the ecosystem resilience without compromising the services it provides; their sound and effective adaptation to the orographic features of the land, their favoring of agroecological practices that reduce to a huge extent the need of chemical inputs, and the wise management of water resources due to the low requirements of the plant, are some of the factors that render this produce a part of the landscape embedded within it in a holistic manner.

In conclusion, the following steps have been taken to achieve specific dynamic conservation objectives and to advance different levels of protection. In 1971, the producers cooperative called “Pistacchio Smeraldo” was established. In 1990, the pistachio festival was inaugurated for the first time. In 2000, the “Pistacchio di Bronte Presidio Slow Food” was set up. In 2004, the “Consorzio di Tutela” (Consortium for the protection of Pistachio) was instituted. Finally, in 2009, one of the most important European awards has been conferred to the pistachio of Bronte, the PDO (Protected Denomination of Origin) designation. In my opinion, these policies and actions indicate the will to preserve a contemporary relevant agricultural system, to recognize the positive spillover effects on the social, landscape, and environmental domains produced it, and to adequately reward the link between local specificity and a traditional first-class quality product.

3. Food and Livelihood Security

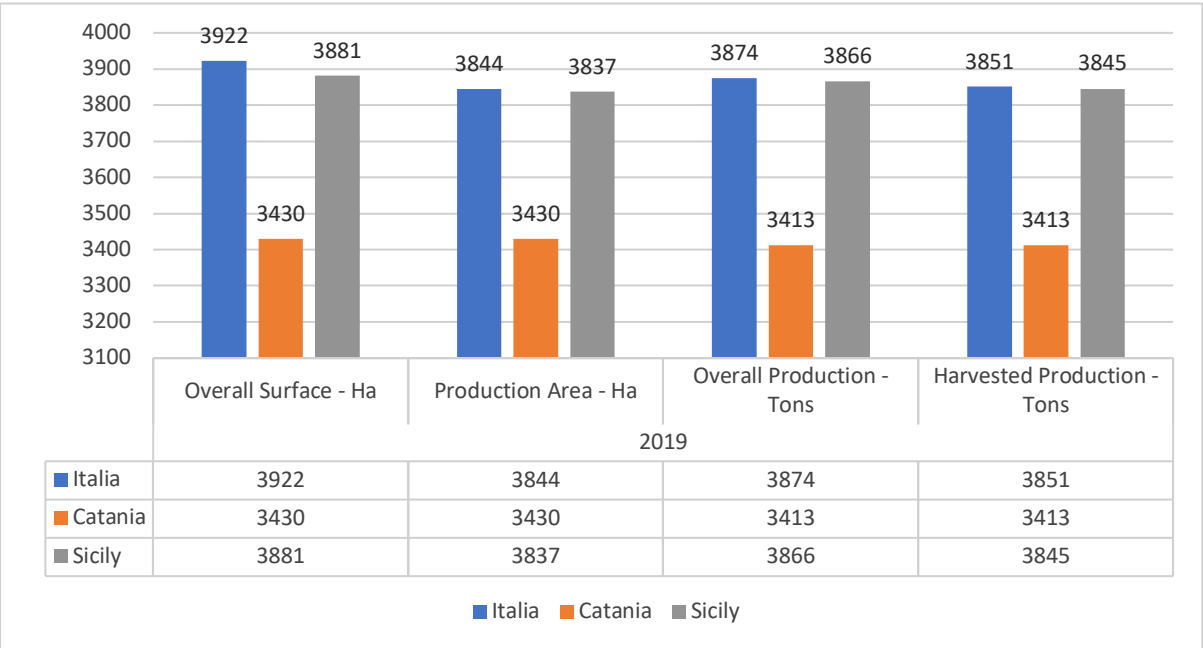
The production of pistachio in Italy accounts for slightly less than 0.8% of the overall world production. An interesting figure shows that, in the two-year period 2018 - 2019, more than 99% of pistachio groves cultivated on the Italian territory were situated in Sicily and more than 89% within the city of Catania alone.

Tab. 4. Pistachio production areas (ha) and tons in 2018.



	Overall Surface - Ha	Production Area - Ha	Overall Production - Tons	Harvested Production - Tons
	2018			
Italia	3872	3822	3874	3864
Catania	3430	3430	3430	3430
Sicily	3866	3816	3867	3857

Tab. 5: Pistachio production areas (ha) and tons in 2019.



	Overall Surface - Ha	Production Area - Ha	Overall Production - Tons	Harvested Production - Tons
	2019			
Italia	3922	3844	3874	3851
Catania	3430	3430	3413	3413
Sicily	3881	3837	3866	3845

Source Tab.4 and tab.5: My own elaboration of ISTAT data.

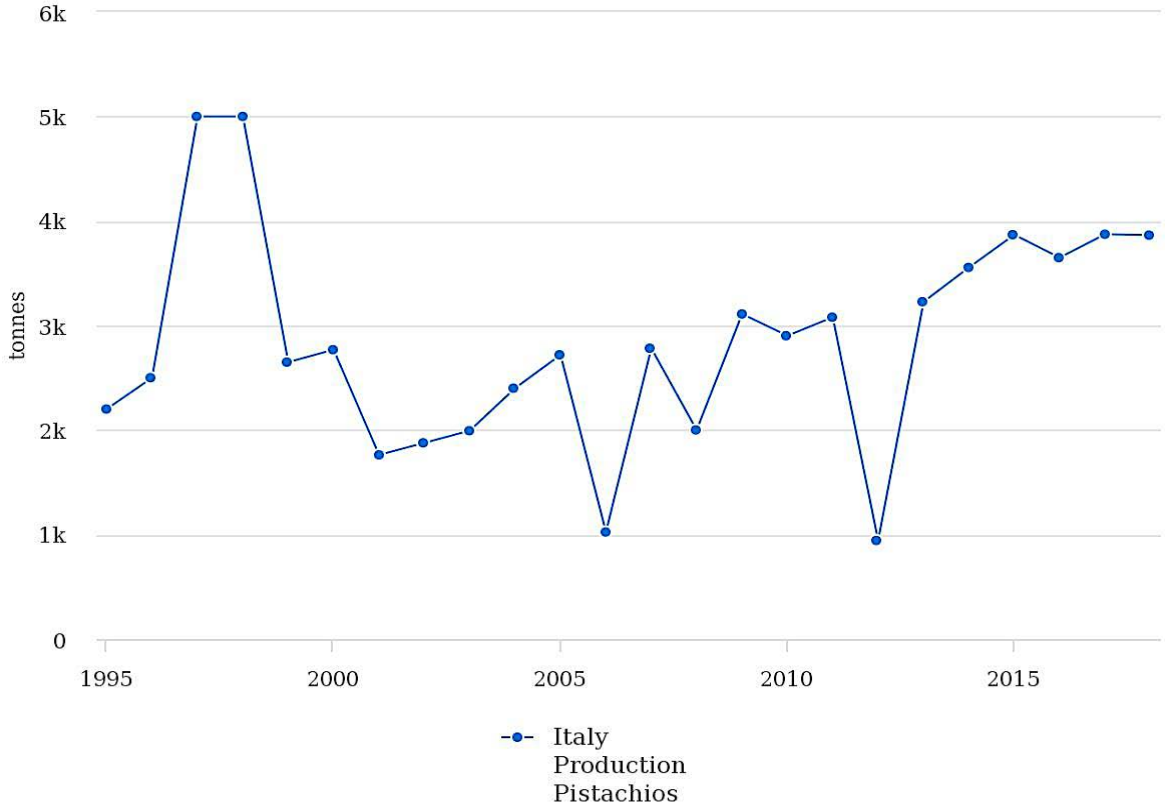
Bronte holds the position of core center of production within the country with around 3000 ha devoted to pistachio farming (Manuelli, 2019). The area under scrutiny is located along the western slopes of Mt. Etna between 400 and 900 meters above sea level and includes the municipalities of Bronte and Adrano. The bulk of the farms have a clear-cut orientation towards the exclusive cultivation of pistachio, but, nonetheless, it is possible to encounter fields where this produce is grown in association with other crops, such as prickly pears, and olive and almond groves (Mipaaf, 2012; Putrino, 2007). The entire Etnean territory has been affected by a gradual and long-lasting process of land property pulverization which has, in result, created the conditions for the existence of a significant number of small-medium entrepreneurial activities in the primary sector (Petino and Incognito, 2009). About 3500-4000 farms are involved in the production of pistachio and, although their dimension is subject to a certain degree of variation, the average size is less than 1 ha; as a matter of fact, 80% of them extends over a surface of roughly 1 ha, while the rest generally reaches a surface that ranges from 5 to 10 ha. The planting density is of 400-600 trees per hectare (CORERAS, 2005).

At this stage, it is necessary to make a short detour from the main topic of discussion in order to give a reason for and clarify a methodological and analytical choice which has been made to carry out this part of the research. In this section, some statistical data concerning the Italian pistachio industry will be used as a benchmark for assessing the current economic dynamics in Bronte for the two following reasons. First, I have experienced some difficulties in acquiring pertinent and recent economic data that were specifically related to the agricultural system in question. Secondly, as it has been pointed out above and shown in tabs 4-5, the Italian pistachio industry is constituted almost entirely by and would not exist without Bronte's agrarian landscape both in terms of surface (ha) and quantity (tons).

Thus, in regard to the production capacity, the district of Bronte confirms itself as the primary hub in Italy since it boasts an annual harvest of approximately 3000 tons. If

we looked at the same figures over a longer span of time, we would notice that the production capacity of the whole country has waxed and waned over the last three decades.

Tab. 6: Italian Production of Pistachio (tons). Source: FAOSTAT.

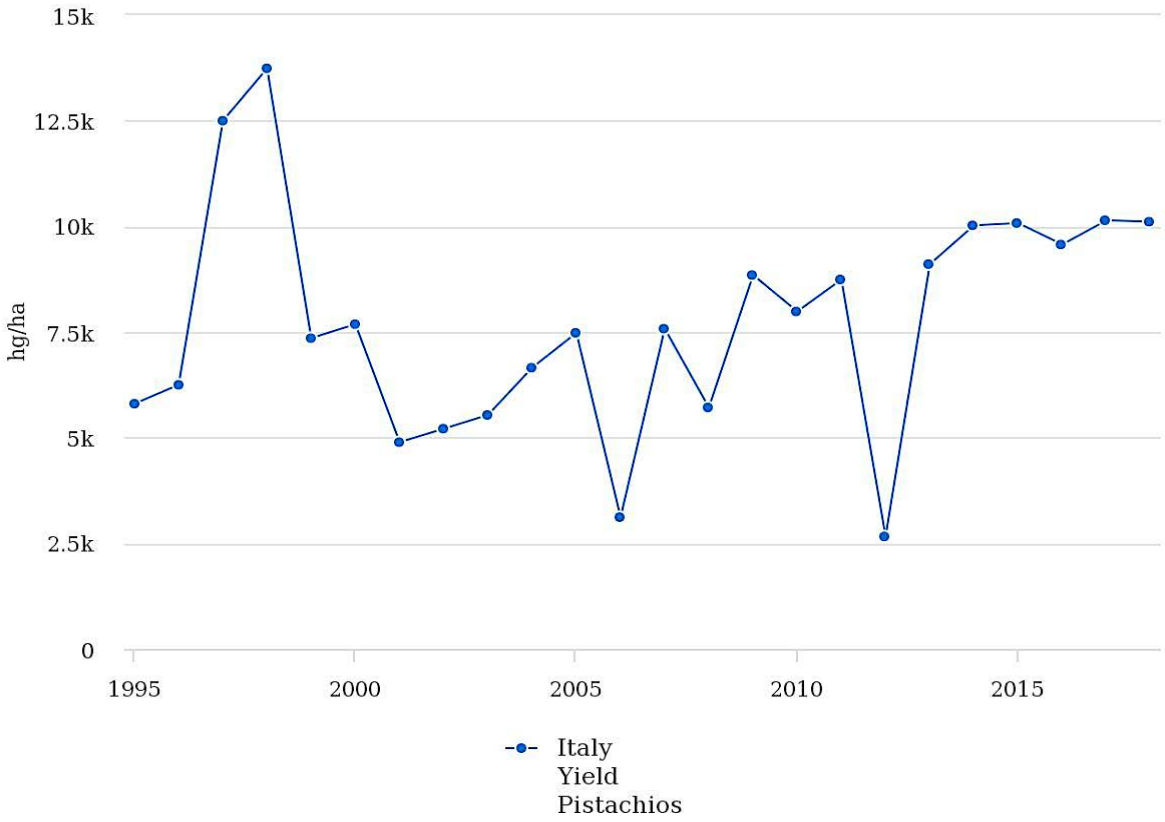


However, what emerges from tab. 6 is that the industry was far less meaningful at the beginning of the millennium than it is now and that, despite it plummeted in 2006 and 2012, it has basically kept prospering ever since. The average production (tons) recorded in the five-year periods 1990-1995, 1999-2004, and 2006-2010 was 1120, 1662, and 1860, respectively (Briamonte, 2007; Mipaaf, 2012). In the last five years, it seems to have stabilized around 4000 tons, a figure that compared to the previous averages indicates a steadily and markedly positive trend. The graphic also highlights an evident will and desire on the part of the farmers not to further abandon a crop which has contributed to support them financially and whose uniqueness is increasingly being recognized both in Europe and abroad.

The same conclusions could be drawn as concerns the land productivity, that consists in the quantity of tons produced per ha. The five-year period going from 2006 to 2010 witnessed an average value of 0.53 tons/ha (Mipaaf, 2012), whereas the same interval of time applied to the period going from 2014 to 2018 presents a different outcome, that is to say 0.99 tons/ha.

Years	2014	2015	2016	2017	2018
Land Productivity (ton/ha)	1.00	1.00	0.95	1.01	1.01

Tab. 7: Land Productivity (ton per/ha) of the Italian Pistachio Industry over the 2014-2018 timespan. Source: My own elaboration of FAOSTAT data.



Tab. 8: Land Productivity (hg/ha) of the Italian Pistachio Industry. (1000 hg equal 0.1 ton). Source: FAOSTAT.

Additional issues that must be scrupulously addressed concern the economic value of the product, the variety of semi-processed and processed goods made out it to satisfy buyers' diversified demand, and the national and international target markets.

In the past, the pistachio kernels were exclusively employed to obtain basic products which could be used in the confectionary or in the bagged meat industry. Nowadays, the fruit is commercialized in various ways as there is a wide range of goods and pistachio by-products the industry is able to deliver and to place directly on the market, and these are: “Tignosella” (in shell pistachio), “Sgusciato” (shelled with the endocarp), “Pelato” (shelled without the endocarp), granulated, pistachio flour, cream, pesto, and paste.

“Tignosella”.

“Sgusciato”.

“Pelato”.

Granulated.

Pistachio Flour in the picture on the bottom left and Pesto in the picture on the bottom right.

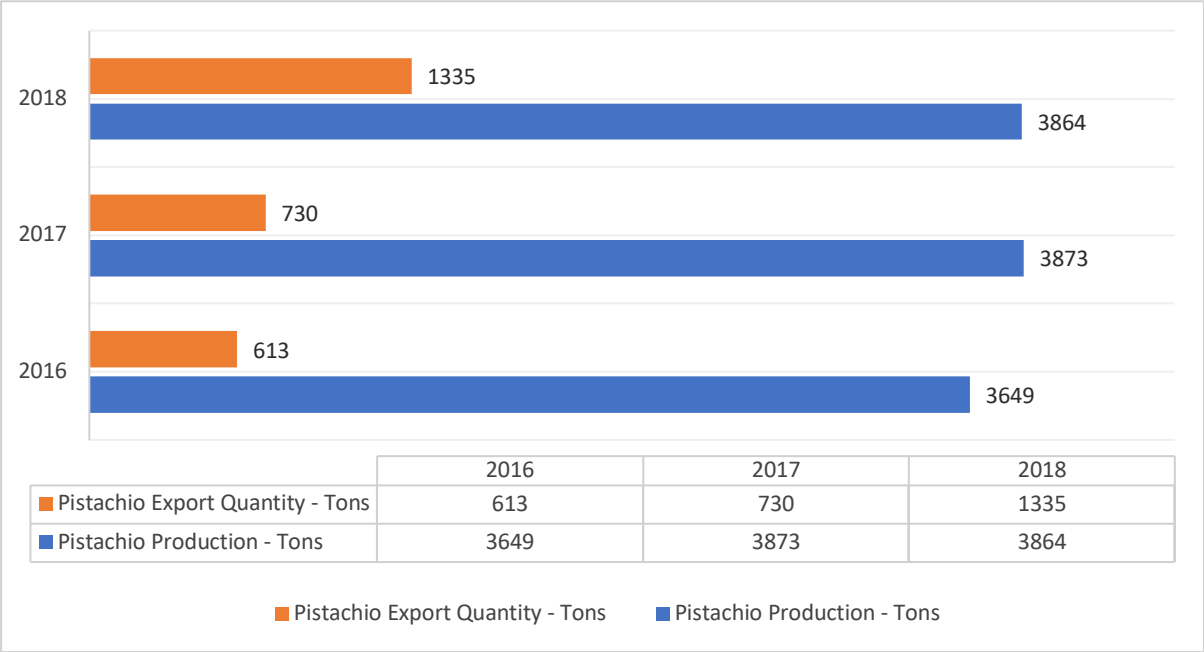
“Tignosella” is commonly served as a snack or as an appetizer to accompany drinks. The shape and the size of pistachios are the qualities most looked for and that is why the produce imported from central Asia has been historically preferred over the Italian one. The pistachio harvested in Bronte is to a very large extent sold after it gets semi-processed or processed. Indeed, in the five-year period going from 1998 to 2003, 53% of the entire production was sold as “pelato”, 38,7% as “sgusciato”, and the remainder either as pesto, cream, granulated or flour. The first semi-processed good aforementioned is predominantly purchased by the bagged meat industry in virtue of the aroma and the taste of the kernels, whereas the second one is mainly destined to the confectionary industry because of the bright green color of the cotyledons which are generally grinded (CORERAS, 2005; Briamonte, 2007). The most popular goods among the ones belonging to the “pistachio processed” category are pesto and cream. Diverse strategies have been adopted to retail the commodities under examination. Pistachio “sgusciato” can be found in plastic boxes of 100gr or in bags of 25kg, “pelato” in plastic packs of 500gr or in bags of 25 kg, pistachio granulated and flour do not differ much as they are sold in boxes of 100gr, and, finally, the cream and the pesto are marketed in glass jars of 200 gr (Putrino, 2007).

The pistachio produced on the western slopes of Mt. Etna is transformed in processing and marketing facilities which are located right within the boundaries of the district of Bronte. The firms buying and working on the spot the raw material are a pivotal part of the value chain inasmuch as they add market value to the produce harvested by farmers and contribute to the welfare of the whole community. The success experienced by the industry is proven by the fact that the number of processing facilities has regularly increased over the last thirty years; it went from the 3-4 active centers of transformation in 1995 to 8-9 in 2005, to eventually reach 16 centers in 2019 (Barilaro, 2011; Marzialetto, 2019).

Therefore, farmers are still primarily engaged in trading activities with local businesses which then proceed to the processing and commercialization of the product.

According to recent data, 35-40% of the processed and non-processed goods obtained from the pistachio of Bronte have been exported, while the remaining 60% has been absorbed by the domestic market. At the national level, the retailing sector has represented the principal market outlet for the bulk of the firms, followed by the large-supermarket chains which have gained almost equal weight, and to a minor extent by the confectionary and the bagged meat industry. At the international level and with regard to the product value, Japan alone has purchased in 2004-2005 half of the Sicilian pistachio exported value, followed by France which stood at 20% and USA at 11%. A similar scenario opens up when taking into account the quantities exported over the same biennium instead of the value. Japan confirms itself as the major importer, followed by France, the USA, and Spain (Putrino, 2007).

Tab.9 Italian Pistachio Export Quantity (tons) and Overall Production (tons).

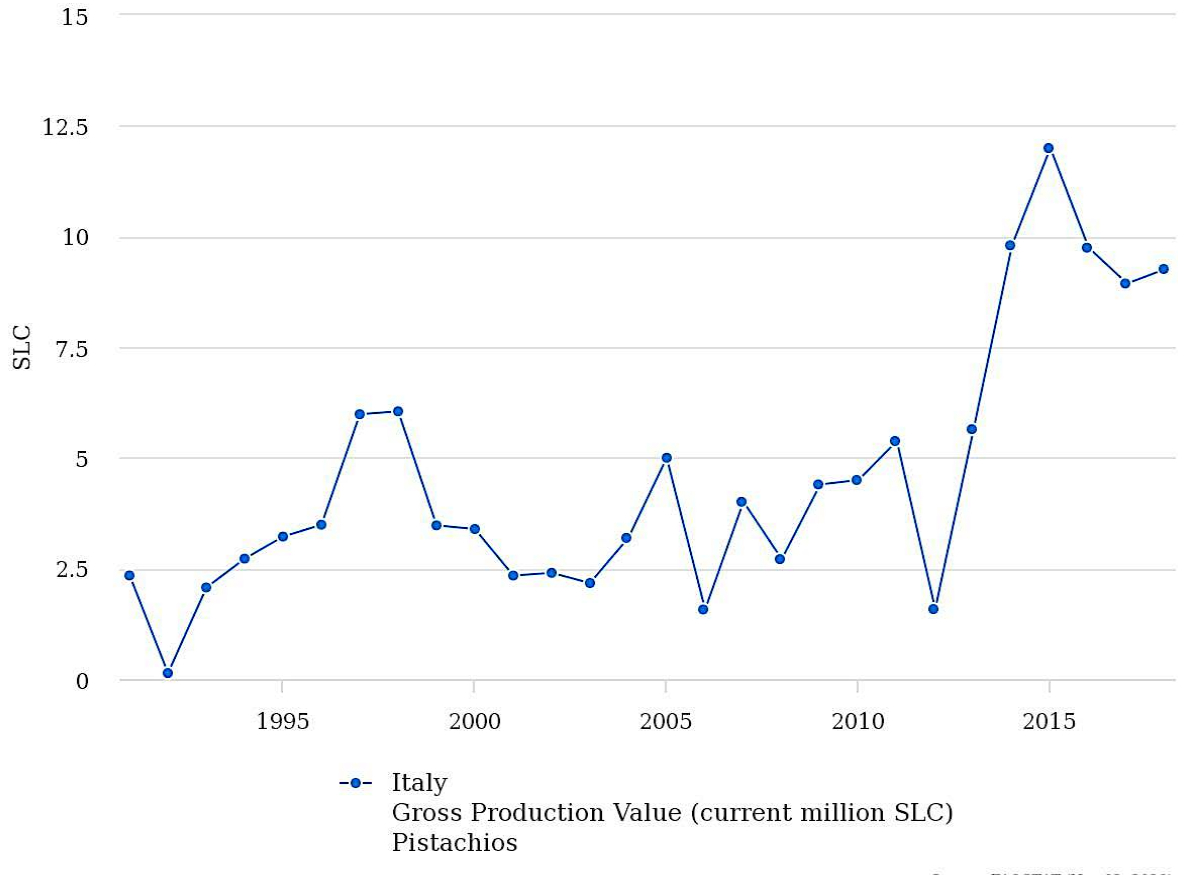


Source: My own elaboration of FAOSTAT data.

Turning to the analysis of the economic value of the Italian pistachio production, tab.10 paints a quite clear picture of the developments occurred during the last three decades. The value of gross production has been compiled by multiplying gross production in physical terms by output prices at farm gate, in other words it measures production in

monetary terms of farm goods delivered directly by the producer. The results show an unequivocally positive trend which could be interpreted as the proper recognition of the –

Tab.10: Italian Pistachio Gross Production Value (current million SLC – Standard Local Currency).



Source: FAOSTAT.

-superior quality of the Italian pistachio production, which corresponds to a very high degree to the production of the pistachio of Bronte. The graphic points out that the industry under scrutiny has managed to endure the impact of severe economic crises, to remain a growing and dynamic sector, and to reward the hard work put in especially by farmers.

In 2006, the average price paid for "tignosella" (in-shell pistachio) was 5,10 €/Kg, while "sgusciato" reached 16,35 €/Kg; over the same period, the imported "sgusciato" was purchased at 11.50 €/Kg (Putrino, 2007). The pistachio of Bronte has tended to attain double the average prices of its international competitors on the global market by virtue of the reputation it enjoys and of its exceptional organoleptic qualities. The

beneficial economic effects stemming from the sale of pistachio have further improved since 2009, when the pistachio of Bronte was officially certified as a PDO good. In 2019, "tignosella" was sold on average for 13.20 €/Kg, above the 8-9 €/Kg paid for non-Sicilian "tignosella" on the market (Marino and Marra, 2019). However, it is the increasing demand for "sgusciato" that allowed pistachio to achieve record prices. It has, indeed, risen to 30-32 €/Kg at the farm gate level and it can reach up to 100 €/Kg in the retailing sector (Manuelli, 2019). Tab.11-12 suggest that the economic boost experienced by the industry has also been propelled by the capacity of this qualitatively unparalleled product to draw the attention of buyers from all around the world who are willing to pay far more than the price of other foreign pistachios.

Tab.11: Average prices of exported Sicilian Pistachio (€/Kg)

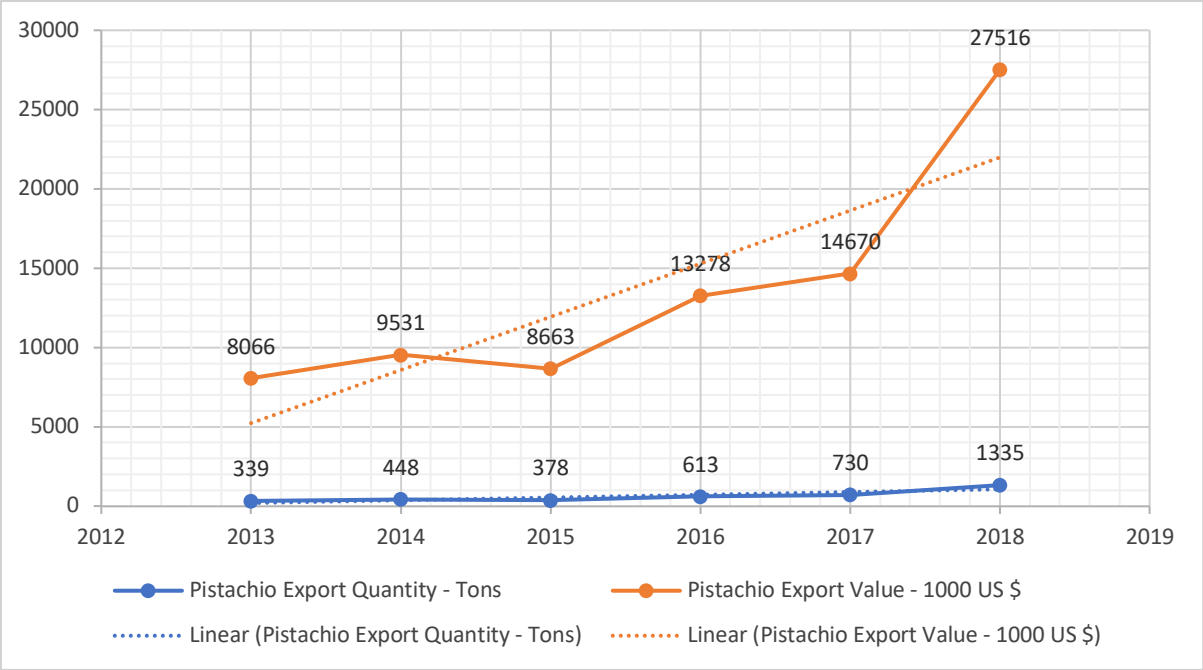
	2000	2001	2002	2003	2004	2005
Price of Imported Goods (€/kg)	4.06	5.3	7.74	5.68	4.05	4.93
Price of Exported Goods (€/kg)	13.18	15.38	17.4	20.49	10.57	14.8

Source: My own elaboration of data provided by Petino, 2010.

In conclusion, it is worth shedding light on some further economic factors informing the cultivation of the pistachio of Bronte and concerning the livelihoods of the local population. The most widespread form of farm management is the semi-capitalist or capitalist. Farmers largely resort to the family labor force to carry out weeding and phytosanitary operations. Workers coming from outside the household are often

employed to help with the pruning and harvesting procedures, even though the contribution of the family labor force remains vital and at times exceeds the former.

Tab.12: Italian Pistachio export quantities and value (1000 US$).



Source: My own elaboration of FAOSTAT data.

Although the production and sale of pistachio represents the backbone of the economic life in Bronte, there are also other economic activities the local population has traditionally been committed to and which have progressively expanded. First of all, the economic weight of handicraft activities has increased following the booming of the pistachio industry since artisans have worked side by side with farmers and local businesses to build specific equipment and machineries, such as hulling and shelling machines. The tourism and the agrotourism sector have also grown thanks especially to the curiosity and excitement that Mt. Etna arouses in visitors coming from both Europe and abroad (CORERAS, 2005; Petino, 2010).

4. Agrobiodiversity

The genus Pistacia encompasses a large variety of species which share some particular traits, such as dioecism and the presence of resins. In addition, the male trees can be easily spotted and differentiated from female ones because of their inflorescence, greater robustness, and the considerable size of their leaves. The flowers are without petals and merged in panicle axillar inflorescences in the female plants, while they are united in cymose inflorescences in the male ones. Both of them give birth to around 100-400 flowers, even though just 15-20% turn into fruits. The embryo consists of two cotyledons that, depending on the cultivar, can present a color ranging from green to yellow. (Barilaro, 2011; Marino, 2012).

The only species that flowered and multiplied in Italy are the following ones: Pistacia Vera L., P. Terebinthus L., and P. Lentiscus L.

P Vera L. is the only species that yields eatable fruits. It belongs to the class of Terebinthales. The majority of the other known species, both in Italy and abroad, have been used as a rootstock in support of P Vera L. The tree can be described as follows. It grows slowly and it is particularly long living as testified by the presence of centuries-old trees. The cortex of the stem and of the branches is ash colored. The leaves are caduceus, odd-pinnate, composed by 3-5 oval leaflets, and they become glabrous and coriaceous after they complete their development. Finally, below every leaf there is an auxiliary bud (Marino, 2012).

P. Terebinthus has found very good conditions to grow and to spread out in the southern Italian regions. This nettle tree is a heliophilous, thermophile, and frugal species. As a result, it stands out for its sui generis ability to adjust and conform to a very broad range of pedoclimatic and soil conditions, even though it tends to favor calcareous grounds. It generally assumes the shape of a shrub rather than a tree as it hardly exceeds a height of 5m. It is also renowned for possessing a strikingly hard wood and for developing imposing root systems that enable it to exploit and endure even the poorest lava soils. Its cortex takes a brownish-red color and it grows a vast crown.

P. Lentiscus is scattered in several Italian regions where it springs up spontaneously. However, it prefers mild areas at an altitude comprised between 400-600 meters above sea level. It is a heliophilous, thermophile, xerophilous, and resilient tree that weathers long-lasting droughts and nutrient deficient soil conditions, albeit extreme colds might impair its development. Despite its good adaptability, fertile and healthy lands allow the wild mastic tree to grow faster and more robust. Similarly to the P.Terebinthus, the plant usually takes the aspect of a shrub, but it can also outgrow the other Pistacia species by turning into a tall tree (Avanzato and Vassallo, 2008).

The range of Italian varieties is quite limited. The Sicilian germplasm includes the following cultivars: Napoletana (commonly known as "Bianca"), Agostana, Natarola, Femminella, Cerasola, Insolia, Olivarola, and Silvana. (Avanzato and Raparelli, 2000).

The Sicilian pistachio production is notably tied to and centered on the use of the cultivar "Napoletana", which makes up about 95% of the total harvest (MIPAAF, 2012). The remaining cultivars play, consequently, a very marginal role in terms of surface extension and production quantities. In 2009, with the OJEU 2009/C 130/09, the "Green Pistachio of Bronte" has been granted with the Protected Designation of Origin (PDO). The disciplinary of production that was subsequently published aims at promoting and safeguarding the cultivar "Napoletana", as it reads:

The 'Pistacchio Verde di Bronte' PDO is reserved for the fruit, in shell, shelled or peeled, of plants of the botanical species Pistacia vera, cultivar Napoletana, also known as Bianca or Nostrale, grafted on to Pistacia terebinthus. Up to 5 % of plants of varieties and/or of rootstock other than P. terebinthus are allowed. That percentage refers to all the plants present in the grove. In any case, products from plants of other varieties not belonging to the Napoletana cultivar will not be certified. (…) must have the following physical and organoleptic qualities: colour of the cotyledons: intense green; ratio of chlorophyll a to chlorophyll b: between 1,3 and 1,5; strong, aromatic taste, with no hint of mould or foreign tastes; moisture content: between 4 % and 6 %; ratio of length to breadth of the kernel: between 1,5 and 1,9; the nut contains a high level of monounsaturated fats (predominantly oleic acid (72 %), followed by linoleic acid (15 %) and palmitic acid (10 %).

(Council Regulation, 2009).

Around 80% of the harvest is marketed as a PDO product, and this is an additional reason why “Napoletana” represents farmers’ favorite choice (Manuelli, 2019). The cultivar under analysis has been farmed both in natural and regular plantations.

The Bianca tree shows a low-intermediate vigor. The growth habit is spreading, whereas the branching habit is intermediate. After it gets planted, it exhibits a long unproductive period, about 6-7 years. The blooming occurs from the second week of April and lasts more than two weeks. The ripening phase is accomplished by the plant relatively early and it concludes over the first half of September. The length of the terminal leaflet is 10.1 cm, whereas the width is 7.7cm, and the ration between the former and the latter is 1.3cm. The fruits are indehiscent and feature a regular elongated shape with a keeled and rounded apical part. The average weight of the dry kernel and of the nut is 0.48g and 0.91g, respectively. The nut length is 21.6mm, the width is 11.6mm, and the thickness is 9.9mm. The cotyledons are identified by a bright green color and by a length of 15,3 mm, a width of 7.5mm, and a thickness of 6.8mm. The dehiscent fruits usually account for less than 25% and the split is tight (Barone et al., 1997; Avanzato and Raparelli, 2000). Compared to other Sicilian and foreign cultivars, the “Napoletana” cultivated in Bronte displays a markedly higher content of chlorophyll stemming mostly from “chlorophyll a” (Avanzato and Vassallo, 2008). Delving a bit deeper into the topic, it has been determined that the pistachio of Bronte can be distinguished from the same produce farmed in other countries because of its exceptional qualities stand out when researched in laboratory tests that use very specific and technical scientific instruments, such as nuclear magnetic resonance, chemometric classification, and infrared spectroscopy (Scrubba et al., 2004; Vitale et al., 2013; Bellomo and Fallico, 2007).

As already hinted above, there is a restricted number of cultivars aside from “Bianca” which can be found in Bronte, and they represent less than 5% of the total production. Femminella gives birth to fruits small in size but qualitatively good.

Agostara’s fruits are also tiny in size in comparison to Bianca and it carries through the blooming and ripening before the other cultivars.

On the contrary, Natalora tends to complete the same maturation stages later than the rest, and that is likely the cause of the significant blank production rates; in other words, the blossoming occurs at a different time with respect to pollination (Barone and Marra, 2004).

The pistachio groves in Bronte perform also a noteworthy ecological and landscape function thanks to the plant's capacity to endure droughts and to adapt to shallow and skeleton-rich soils. They have conquered and colonized every small piece of volcanic land available, forming the only natural resource able to valorize and exploit rocky and rugged terrains otherwise not usable for agricultural purposes and unfit for other rural species.

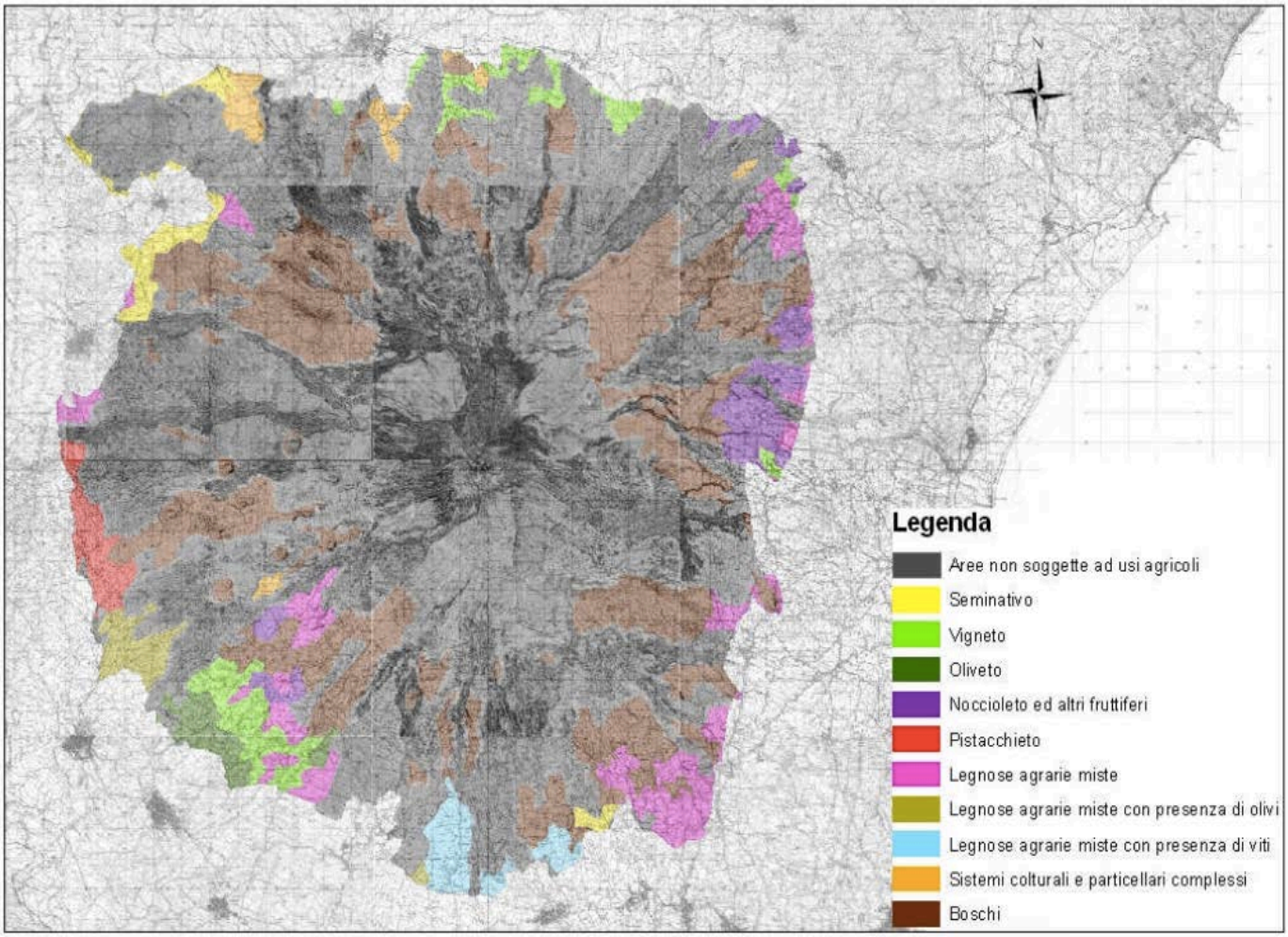
The uniformity and consistency of the pistachio groves is interrupted only at the edge of the district of Bronte. However, it is possible to admire spectacular polychrome landscapes in the areas where olives, prickly pears, and almonds find suitable conditions to grow and intercrop with pistachio (Petino, 2010). To further enrich this scenario is the sporadic co-presence of woodlands, shrubs, and lava originated from volcanic eruptions.

The ecological relevance of this agricultural system is confirmed by the fact that 700 ha covered in pistachio fall within the Etna Park and are, to a certain extent, included in the naturalistic reserves created by and belonging to the Natura 2000 network. The Etna Park has been the first Regional Nature Park to be set up in Sicily by decree of the president of the Sicilian Regional Authority in March 1987 (Putrino, 2006). It extends on a surface of about 59000 ha and it encompasses also the Municipalities of Bronte and Adrano among the others. The environmental importance of the park is, instead, testified by the fact that it has been registered on the World Heritage List as a "Natural Site" (19237 ha) and that it comprises thirteen protected natural areas as envisaged by the BIOITALY project, of which 9 Sites of Community Interest (SICs) and 4 Sites of Community Importance/ Special Protection Areas (SPAs). The UNESCO site, thus, includes a portion of the park, comprising the zone defined as an integral reserve. Furthermore, 9 Natura 2000 sites overlap the property to various degrees, providing

additional protection for 77% of the area under European legislation (Sturiale et al., 2020). The following description, Decision: 37 COM 8B.15, accounts for the inscription of Mount Etna on the World Heritage List under criterion (viii):

Mount Etna World Heritage Site (19,237 ha) comprises the most strictly protected and scientifically important area of Mount Etna, and forms part of the Parco dell' Etna Regional Nature Park. Mount Etna is renowned for its exceptional level of volcanic activity, and the documentation of its activity cover at least 2700 years. Its notoriety, scientific importance, and cultural and educational value are of global significance. (Ente Parco dell'Etna e MATTM, 2013)

Pics Source: Ente Parco dell'Etna and MATTM, 2013.

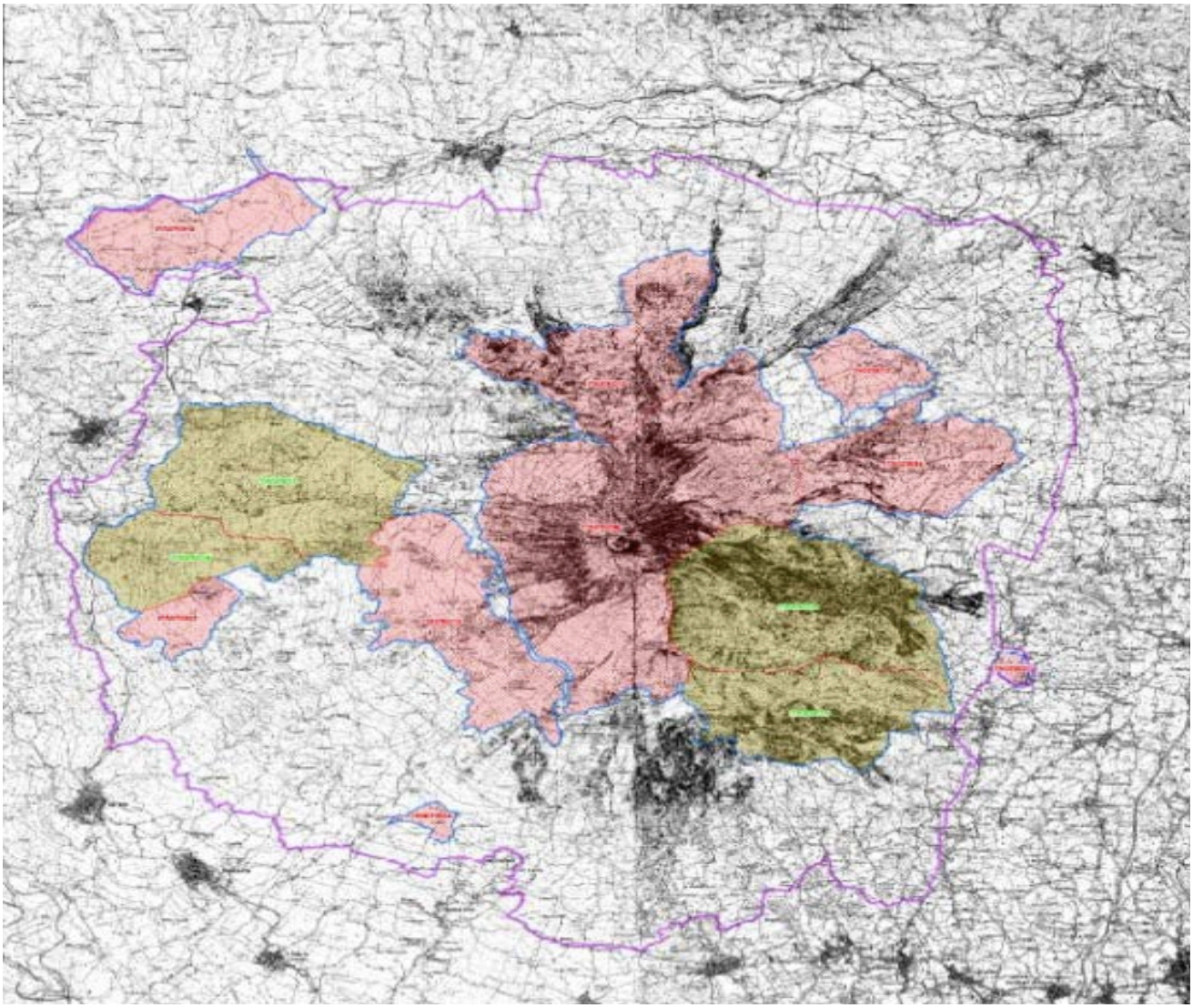


Source: Putrino, 2006. Crops distribution within the Etna Park.

The Natura 2000 network was established with the European Directive 43/92/CEE, commonly known as "Habitat Directive", which aims at safeguarding the biodiversity of specific regions without undermining the right of the local populations to pursue their socio-economic and cultural interests (Comune di Paternò, 2018).

The pistachio groves border on and appear in two specific SCI/SPAs, and these are "Piano dei Grilli" (ITA 070018) and "Sciare di Roccazzo della Bandiera" (070017). Their surface fall within the district of Bronte at the following rates: 100% and 96.3%, respectively.

The sites are, therefore, situated on the western slope of Mt Etna between 700 and 1600 metres above sea level. They consist, from a geological perspective, of ancient lava beds that are currently covered with woods of oaks and holm oaks. Small shrubs with a discontinuous cover and dominated by *Helichrysum italicum, Centranthus* -



Source: Ente Parco Dell'Etna, 2009. Location of the Natura 2000 sites. The two green polygons on the left represent the SCI/SPAs "Sciare di Roccazzo Della Bandiera" (above) and "Piano dei Grilli" (below).

- *ruber*, *Euphorbia rigida, and Senecio ambigus* can be identified in the area. The *Genista aetnensis* has also established itself between lava fields and buildups of sand. The area is also ecologically relevant for the presence of extensive deciduous and ever green forest formation, including *Quercus ilex* and *Quercus congesta.* Finally, they are characterized by meso-Mediterranean and supra-Mediterranean bioclimatic conditions (Ente Parco dell'Etna, 2009).

Next page source: Vegetation Map of the "Sicilian Department of Cultural Heritage and Sicilian Identity". Printing Scale: 1: 50.000.

Piano Paesaggistico

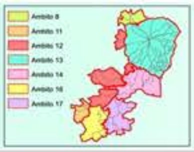
Ambiti 8-11-12-13-14-16-17 Catania

Regione Siciliana

Assessorato dei Beni Culturali e dell'Identità Siciliana
Dipartimento dei Beni Culturali e dell'Identità Siciliana

Soprintendenza per i Beni Culturali ed Ambientali di Catania

Progetto finanziato con P.O.R. Sicilia 2000-2006 Misura 2.02 Azione C



Piano Paesaggistico

Ambiti 8-11-12-13-14-16-17 Catania

tavola **3.1**

Scala di stampa 1:50.000

Ambiti regionali 8, 11, 12, 13, 14, 16 e 17 ricadenti nella provincia di Catania

Tavole di Analisi
Sistema naturale

Vegetazione

DIPARTIMENTO DEI BENI CULTURALI E DELL'IDENTITA' SICILIANA
Il Dirigente Generale
SERVIZIO PIANIFICAZIONE PAESAGGISTICA
Il Dirigente Responsabile
SOPRINTENDENZA PER I BENI CULTURALI ED AMBIENTALI DI CATANIA
COORDINAMENTO TECNICO-SCIENTIFICO
CONTRIBUTI TECNICO SCIENTIFICI
COLLABORATORI
CONSULENZA SCIENTIFICA
UNIVERSITÀ DI CATANIA
Dipartimento di Architettura e Urbanistica
Il Responsabile Unità Operativa IV
Il Soprintendente

Legenda

FORMAZIONI BOSCHIVE NATURALI

- Boschi a querce caducifolie (Quercus virgiliana, Q. amplifolia, Q. dalechampii, Q. congesta), talora con presenza di castagno (Castanea sativa)
- Boschi a querce caducifolie (Quercus virgiliana, Q. dalechampii, Q. congesta) e Leccio (Quercus ilex)
- Boschi a querce caducifolie (Quercus virgiliana, Q. dalechampii, Q. congesta) e Leccio (Quercus ilex) diradati
- Boschi e boscaglie a querce caducifolie (Quercus congesta, Q. dalechampii) con Pino laricio (Pinus nigra ssp. calabrica)
- Boschi misti a Cerro (Quercus cerris) e Pino laricio (Pinus nigra ssp. calabrica)
- Boschi a Pino laricio (Pinus nigra ssp. calabrica)
- Formazioni rade a Pino laricio, talora con ginestra dell'Etna (Genista aetnensis)
- Boschi misti a Pino laricio (Pinus nigra ssp. calabrica) e Faggio (Fagus sylvatica)
- Boschi misti a Pino laricio (Pinus nigra ssp. calabrica) e Faggio (Fagus sylvatica) diradati
- Boschi di Betulla (Betula aetnensis)
- Formazioni aperte a betulla (Betula aetnensis)
- Boschi di Castagno (Castanea sativa)
- Boschi a quercia castagnara (Quercus virgiliana) degradati
- Boschi di leccio (Quercus ilex) degradati
- Boschi di quercia congesta (Quercus congesta) degradati
- Boschi di quercia congesta (Festuco heterophyllae-Quercetum congestae)
- Boschi di cerro (Arrhenathero-Quercetum cerridis) degradati
- Boschi di cerro (Arrhenathero-Quercetum cerridis)
- Boschi misti di faggio (Fagus sylvatica) e cerro (Quercus cerris)
- Boschi di faggio (Fagus sylvatica) frammisti ad arbusteti e pascoli
- Boschi di Faggio (Anemono apenninae-Fagetum sylvaticae)
- Boschi di faggio (Fagus sylvatica) diradati
- Boschi a quercia castagnara (Quercus virgiliana)
- Boschi a quercia da sughero (Quercus suber)
- Boschi a quercia da sughero (Quercus suber) degradati
- Boschi di leccio (Quercus ilex)
- Boschi di Leccio (Quercus ilex) diradati
- Formazioni a pioppo tremulo (Populs tremula)

FORMAZIONI BOSCHIVE DA IMPIANTO

- Rimboschimenti a conifere (Pinus sp. pl.)
- Rimboschimenti di caducifolglie (Quercus sp. pl.)
- Rimboschimenti misti di conifere (Pinus sp. pl.) e caducifoglie (Quercus sp. pl.)
- Rimboschimenti ad eucalipti (Eucalyptus sp. pl.)
- Rimboschimenti misti di conifere (Pinus sp. pl.) e eucalipti (Eucalyptus sp. pl.)

ARBUSTETI, MACCHIE E GARIGHE

- Arbusteti a prevalenza di rosacee (Rhamno-Prunetea)
- Arbusteti a prevalenza di rosacee (Rhamno-Prunetea) e pascoli
- Arbusteti subtermofili a sparzio infestante (Calicotome infesta) e/o ginestra comune (Spartium junceum)
- Arbusteti subtermofili a sparzio infestante (Calicotome infesta) e/o ginestra comune (Spartium junceum) e vegetazione prativa
- Arbusteti a Ginestra dell'Etna (Genista aetnensis)
- Arbusteti a Ginestra dell'Etna (Genista aetnensis) diradati
- Cespuglieti subtermofili ed aspetti di macchia
- Macchia a lentisco (Pistacia lentiscus)
- Macchia a lentisco (Pistacia lentiscus) frammista a garighe a timo arbustivo (Thymus capitatus)
- Arbusteti subalofili (Pegano-Salsoletea) talora frammisti a specie di macchia o gariga
- Garighe a timo arbustivo (Thymus capitatus)
- Garighe a timo arbustivo (Thymus capitatus) frammiste ad ampelodesmeti e aspetti di macchia o bosco diradato

PRATERIE

- Praterie steppiche a barboncino mediterraneo (Hyparrhenia hirta)
- Praterie steppiche a graminacee perenni (Lygeo-Stipetea)
- Praterie steppiche ad ampelodesma (Ampelodesmos mauritanicus)
- Praterie steppiche dei calanchi a sparto pungente (Lygeum spartum)
- Praterie steppiche caratterizzate da varie specie perenni, con alberi e arbusti sparsi
- Praterie mesofile (Cynosuro Leontodontetum siculi)
- Praterie mesofile (Cynosuro-Leontodontetum siculi) con cespugli e alberi sparsi
- Praterie mesofile umide (Holoschoenetalia)

VEGETAZIONE IGROFILA DEI CORSI D'ACQUA E AREE UMIDE

- Vegetazione ripale
- Pantani salmastri
- Vegetazione degli ambienti paludosi
- Vegetazione retrodunale
- Vegetazione alofila del litorale
- Vegetazione dei greti ciottolosi (Scrophulario-Helichrysetalia)
- Vegetazione dei corsi d'acqua a dominanza di Cannuccia di palude (Phragmites australis)

VEGETAZIONE ALTOMONTANA

- Vegetazione erbacea a Festuca (Festuca circummediterranea)
- Vegetazione a Spino santo (Astragalus siculus)
- Deserto vulcanico

VEGETAZIONE PIONIERA

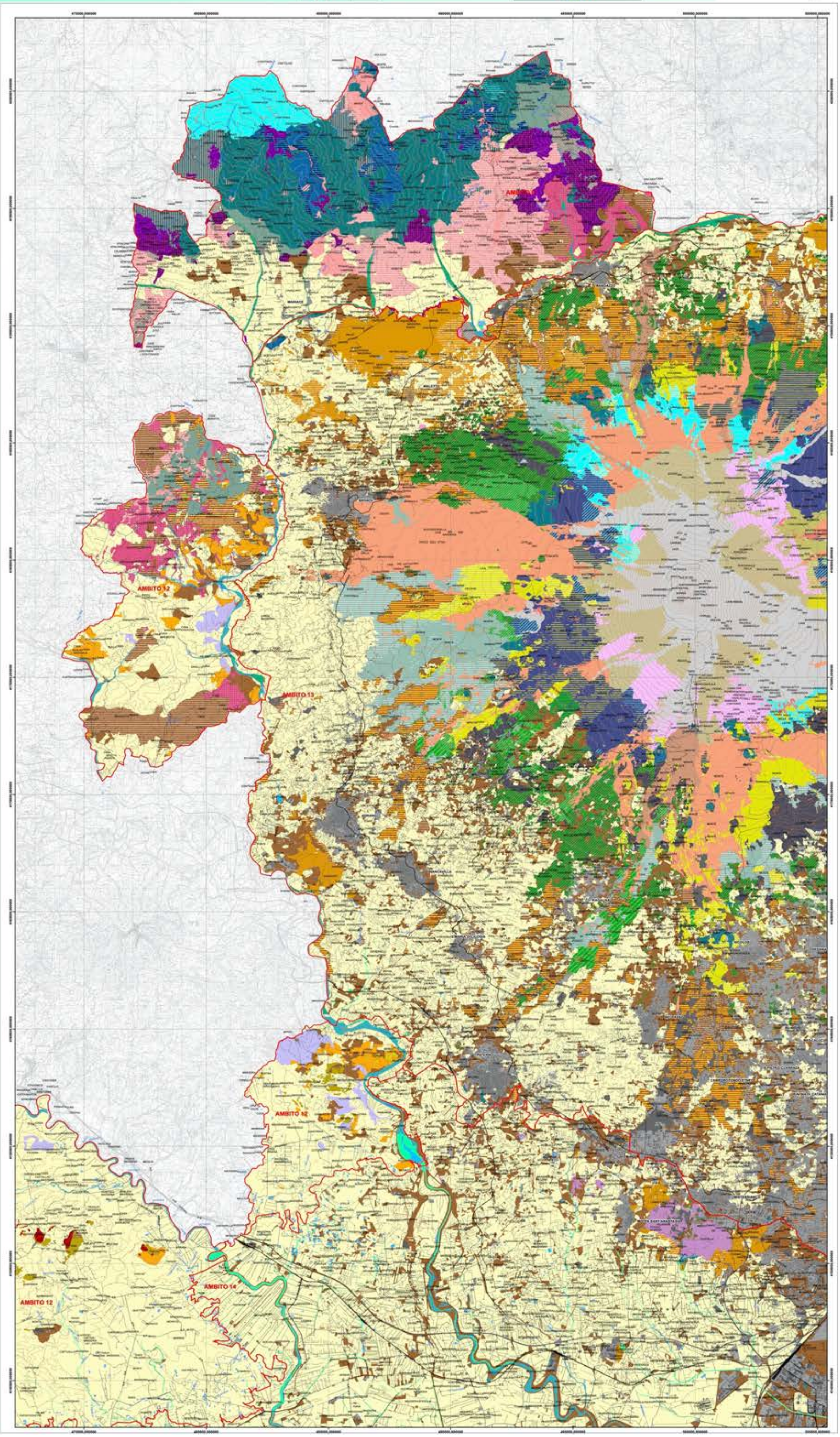
- Vegetazione pioniera delle colate laviche a crittogame, con prevalenza di Stereocaulon vesuvianum
- Vegetazione pioniera delle colate laviche con specie erbacee e sparsi individui di ginestra dell'Etna (Genista aetnensis) e Pino laricio (Pinus laricio ssp. calabrica)
- Vegetazione pioniera altomontana su sabbie vulcaniche (Rumex scutatus e Anthemis aetnensis)

VEGETAZIONE DEI COLTIVI E INCOLTI RECENTI

- Vegetazione nitrofilo-ruderale dei campi a riposo e incolti (Echio-Galactition)
- Vegetazione nitrofilo-ruderale dei campi a riposo e incolti (Echio-Galactition) con arbusti e alberi sparsi
- Vegetazione nitrofilo-ruderale dei campi a riposo e incolti (Echio-Galactition) colonizzata da alberi e arbusti
- Coltivi

AREE PRIVE DI VEGETAZIONE

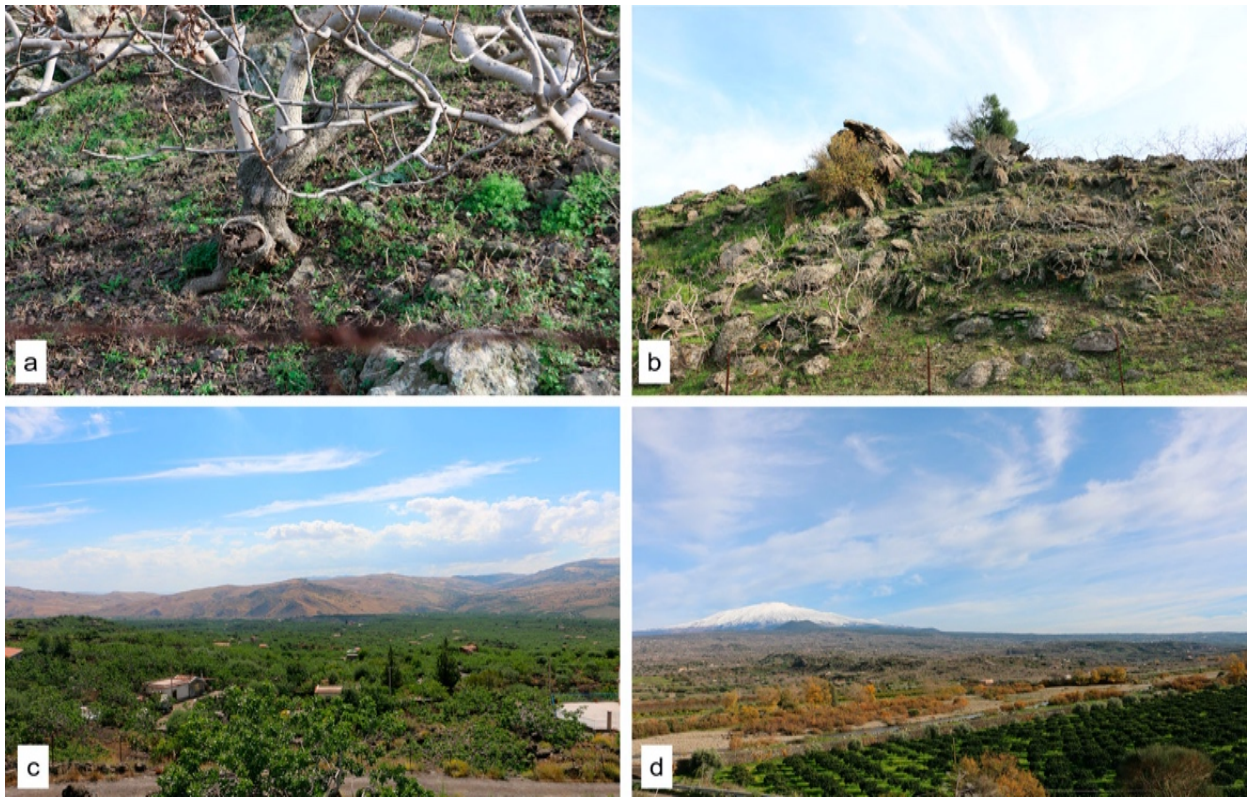
- Aree urbanizzate
- Cave



5. Local and traditional knowledge systems

The vast majority of pistachio orchards in Bronte are referred to as “natural pistachio plantations” because they consist in young buds of Pistacia Vera L. grafted on P. Terebinthus trees spontaneously sprouting in situ and irregularly scattered over the rocky slopes of volcanic origin. Transplanting operations have been traditionally carried out directly in the field (MIPAAF, 2012). Farmers have recently started to resort to seed and horticultural production techniques in spite of the high upfront financial costs and the slow response of the plants. They have committed themselves to perfect the interplanting of P.Terebinthus on potted seedlings grown in the nursery in the attempt to shorten waiting times and/or to increase planting density (Marino, 2012). In this regard, a few nurseries have opened in Bronte to provide farmers with the necessary plant materials. In addition, as set and specified by the PDO disciplinary of production “alongside the free-standing forms of plant cultivation (‘ceppaia’ (stump), ‘vaso libero’ (goblet-trained)), single-stem training systems are also allowed to facilitate harvesting and cultural operations.” (Council Regulation, 2009). Pistachio groves can be generally defined as “specialized”, meaning that they are not mixed with other crops. “Napoletana”, accounting for more than 95% in the traditional planting systems, is the most relevant cultivar and Terabinth is the only rootstock, together they constitute the backbone of the agricultural system (Barone and Marra, 2004).

Natural Pistachio Plantations.



Source of pictures and description: Wilson et al., 2018.

Pics: (a) Pistacia vera L. grafted on P. terebinthus rootstock. (b) Typical rugged landscape on which Bronte pistachios are cultivated. (c) June 2016 photo (37.758380N, 14.815963E) showing green pistachio groves on volcanic soils in the foreground contrasting with the dry vegetation on sandstone and clay hills west of the Simeto River in the background. Photo looks west from a location about three kilometers south of Bronte. (d) December 2016 photo (37.729207N, 14.782497E) looking east towards Mt Etna with citrus groves and the Simeto River in the foreground. The pistachio groves (without leaves at this time of year) on the lower slopes of the volcano appear in brownish tones below the dark green forests on Etna's upper slopes and the snowcapped summit.

The natural pollination of the pistachio orchards is ensured by the influence of the subtropical Mediterranean climate in combination with the wind frequently blowing from west and the orographic lift resulting from the topography of the mountain (Wilson et al., 2018). Pollination has been traditionally entrusted to the performances of the wild P. Terabinthus males dispersed around the land. The use of some P. Vera genotypes for pollination purposes is still going through a trial stage since it represents a newly adopted practice for a limited number of farmers, even though it could deliver positive outcomes due to its slightly higher germinability rate (Marino and Marra, 2019). Two specific issues arise and must be highlighted when dealing with natural pollination. First of all, on the one hand, according to the Ministry of Agricultural, Food,

and Forestry Policies (2012) male trees within pistachio plantings account for approximately 1%, on the other hand, Barone and Marra (2004) point out that the female/male ratio generally observed in Bronte is around 1/20. In both cases, the number of male plants present on the territory in proportion to the female ones is dangerously low. Several studies indicate that 1/8 is the ratio suggested to achieve more efficient and productive results and to guarantee a safe survival and propagation of the species (Mipaaf, 2012). Secondly, the blooming periods of P. Vera and P. Terebinthus do not fully overlap because the latter has a tendency to germinate somewhat earlier than the former, setting up an obstacle for the fructification and productivity of the agricultural system in question.

The cultivar Napoletana begins to sprout in the first two weeks of April and the flowering takes about ten days. The development of the nuts occurs two months afterwards. Finally, the ripening phase comes to an end between August and September (Barone et al., 1997; Martelli and Longhitano, 1987).

Timetable of pistachio development.

The alternate bearing is a typical pistachio habit induced by its natural life cycle which has urged farmers to adopt some peculiar agronomic and management practices. First and foremost, keeping also in mind that the area is defined by harsh pedoclimatic and soil conditions, the harvest is carried out every two years.

The scarce water and nutrients availability has not allowed to produce on an annual basis and, at the same time, to guarantee a sustainable use of the plant that would not end up harming it. From an agronomic perspective, bearing fruits is an extremely energy consuming activity for the plant. The latter has, indeed, to uptake, absorb and digest water and nutrients in order to promote and increase its vegetative and reproductive biomass, in other words to grow branches, roots, leaves and to give birth to flowers and fruits. Therefore, considering that building up biomass is a demanding task for the pistachio plants situated on the western slopes of Mt. Etna and that agricultural activities eventually curtail it, farmers have decided to reap the fruits of this nut tree in odd-numbered years. During the non-harvest/off years, farmers eliminate the flower buds so as to let the plant direct its efforts towards the formation of vegetative biomass and gather sufficient nutritional resources for the following year. This management practice is performed primarily with the aim to enhance production from a quantitative and qualitative point of view in the harvest/on years, but also to reduce agricultural expenses and to assist the plant to complete its life cycle in a sustainable way. In addition, the total removal of inflorescences in “off” years is intended to exercise a biological control of the main pests by disrupting their life cycle (Barone and Marra, 2004; Wilson et al., 2018). *Hylesinus vestitus,* popularly known as *Chaetoptelius vestitus,* is the most noteworthy pest whose survival is negatively and purposefully affected by the procedures laid out above (Greco and Nucifora, 1999). An additional method used to cope with *Chaetoptelius vestitus* consists in leaving the twigs and leaves that were pruned under the trees to then burn them in the following spring (Petino, 2010). *Megastigmus pistaciae* is another infamous *pest attacking pistachio* trees, whereas *Cytospora terebinthi* and *Septoria pistaciae* are deemed the most hazardous diseases. The phytosanitary treatments needed to contrast them are

implemented between April and May with cupric and a-cupric compounds blended together with phosphate esters (Martelli and Longhitano, 1987).

Source: Greco and Nucifora, 1999.
Hylesinus vestitus: Pistacia Vera branches with holes caused by the perforation near where the buds sprout.

Further land management practices adopted by farmers concern the use of fertilizers and the control of weeds. Fertilizers are not an essential factor for the cultivation of pistachio as testified by the fact that they are seldom applied. However, since the rugged terrain makes the introduction of machines almost impossible and the weather/soil conditions demand the adoption of dryland farming techniques, farmers have from time to time made use of foliar fertilizers. Weeds control operations are regularly executed every year to prevent plants from competing between each other for the uptake of water and other important nutritional factors and to facilitate harvesting procedures given that the productive branches of the pistachio tree often end up reaching the ground.

The very volcanic nature of the soil hinders also the possibility to carry out hoeing tasks or makes it extremely costly. As a result, some farmers have resorted to the use of chemical herbicides at the end of the winter and at the beginning of the spring; in each of the two treatments 2 l/ha of glyphosate (round up) are administered with sprayers (MIPAAF, 2012; Martelli and Longhitano, 1987).

The traditional know-how behind harvest and post-harvest procedures is now worth being examined. The fruits after being picked from the trees are de-hulled and dried by the farmer him/herself. The in-shell pistachio is then sold to the local processing industries or to the cooperatives which transform the raw material supplied by farmers and whose activities can be distinguished in three different stages: shelling, peeling, and creation of pistachio by-products.

The biennial harvest is primarily done manually. The household's labor force together with employed workers hand pick the ripe in-hull pistachios from fruits-bearing branches. They are often equipped with long poles with hooks in order to approach the furthest fruits, even though they often end up climbing onto the trees to pursue the same goal but trying not to unintentionally damage the tree or make the drupes fall down. The "paniere" is the basket used for harvesting, it contains about 9-10 kg of produce and can be carried on the back. In regular plantations where farmers have easier access to, the harvesting is done with a traditional method known as "bacchiatura", in other words the pistachio branches are shaken with poles or simple vibration after placing a net under the plant in order to avoid the dispersal of the fruits when they fall and to prevent them from touching the ground. Once gathered inside the nets, the fallen fruits are manually poured into baskets that can contain up to 50 kg. However, the rocky lava soils render this practice virtually unfeasible and compel workers to arduously hand-pick the product from the bumpy ground as well. Farmers know when the harvest time has come when they notice that the hull has taken a rose/white color and the shell has become translucent/matt, and this period usually lasts from the last week of August to the last of September (MIPAAF, 2012).

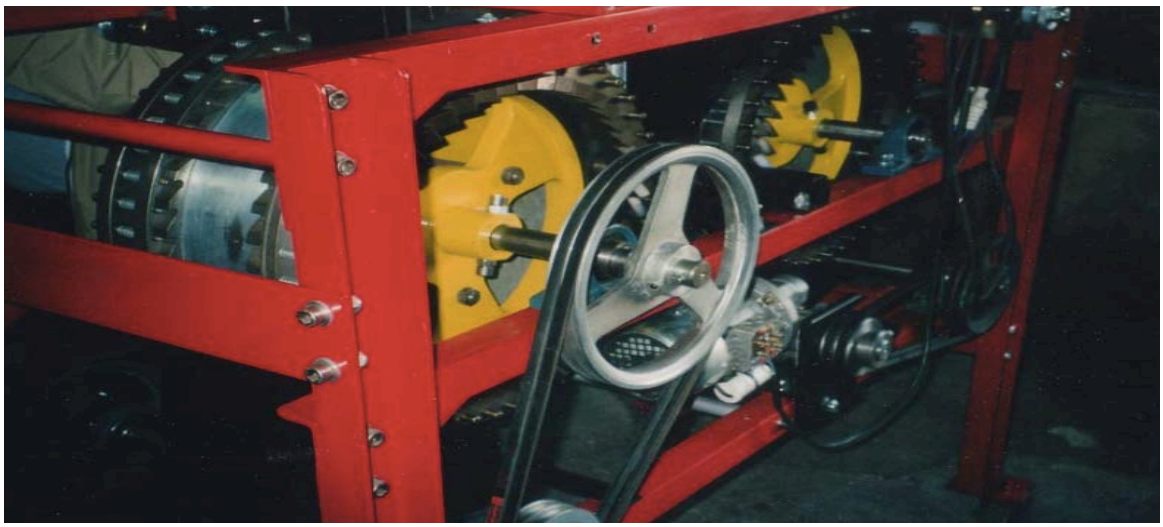
The drupes are in turn "sgrullati" (hulled) by means of electrical and pound hulling machines. To dry the "tignosella" (in-shell), farmers lay the nuts on the so called "stindituri" (tarps) under the sun for 4-5 days. Professional drying machines have recently made their way in the pistachio processing line, they bring the fruits at a temperature of about 40-50 °C without altering the chlorophyl content (Marino and Marra, 2019; Barilaro, 2011).

At this point, the in-shell pistachios pass from the farmers' hands to the local cooperatives or processing industries. On the one hand, the use of shelling machines makes this first step quite straightforward and it does not normally bring about problems. On the other hand, the peeling, that is to say the removal of the endocarp, is appraised as one of the most critical phases pistachios might undergo during their -

Workers harvesting in-hull pistachios by hand and placing them in the “paniere”.

-transformation as it involves the use of highly technological machines. The fruits get steamed in an almost boiling water (90C°) for a few minutes to allow the endocarp to separate itself. The film constituting the endocarp is finally cleared away when the fruits go through rolling rubbers rotating at different speeds. Subsequently, the nuts are exsiccated and placed inside fiber-optic machines which discard the fruits that have not been adequately peeled or that do not meet the standards (Materazzo et al., 2015). The final product is subjected to a further meticulous analysis performed by specialized personnel that manually checks its quality.

Pistachio drying under the sun.



Source: Barone and Marra, 2004. Pistachio shelling machine.

Pistachio hulling machine.

In conclusion, winter pruning is done on an annual basis with the help of ladders and scissors which have two sharp blades to avoid cracking the soft wood. Short blade saws are used to make major cuts. The branches of the tree come close to the soil surface reducing to a bare minimum the use of ladders and, as a consequence, the risk of being damaged. The crown of the tree is maintained low to allow for smooth pruning and harvesting procedures (MIPAAF, 2012).

Source: MIPAAF, 2012. Pruning tools on the left and pruning of the higher branches below.

Natural pistachio trees.

6. Cultures, value systems and social organizations

The case study under examination perfectly reveals how a unique and qualitatively exceptional good can evolve into a symbol representing much more than a commodity highly valued in international markets and, consequently, profitable for farmers. The pistachio of Bronte enshrines agricultural, landscape, environmental, and, above all else, cultural values. It is a typical product that has tremendously contributed to reinforcing the local sense of place and cultural identity by narrating the history and the traditions of an entire community. The cultivation of this specialty food product stands for an agricultural activity charged with meanings and symbolic values that have come to identify a specific territorial framework. On the one hand, the traditions that have emerged from the use of this natural resource have nurtured and influenced every sphere of social life, while, on the other hand, the latter has found its roots in them.

An event that testifies its undiminished cultural relevance is the festival entirely dedicated to it that is held in Bronte every fall. The “sagra del pistachio di Bronte” has proven to be a successful initiative since it has been able to attract a rising number of tourists over the years, exceeding one-hundred thousand in a few occasions. These figures are encouraging and stir the enthusiasm of the local population who considers the festival the greatest showcase of the green pistachio of Bronte and of its producers. The event represents also the perfect occasion to discover and get to know the different uses that have been traditionally made of pistachio. It forms a fundamental ingredient in countless recipes and, despite it has become largely famous within the confectionary, pastry and ice cream industries, the culinary offer also boasts a wide range of bagged meats and the pasta made with the delicious pistachio flour. Finally, to let the reader better understand the contemporary cultural significance of the agricultural system here under analysis, it might suffice to indicate the official tagline that has been adopted by the municipality of Bronte, that is to say, “City of Pistachio”.

"Welcome to the City of Pistachio" reads the sign, the official tagline adopted in Bronte.

Stands selling pistachio at the annual festival.

Mortadella (typical Italian bagged meat) with pistachio kernels.

Pasta made with pistachio flour.

The case of the pistachio of Bronte demonstrates how food productions can enhance the local sense of place with the same effectiveness of historical-artistic heritage sites. In the city there is no bar or restaurant not offering nougats, cakes, ice-cream, and pastes whose main ingredient is the famous green gem. Moreover, the appeal of Bronte stems also from the broad and traditional social engagement also at the upstream end of the value chain. In the period that goes from the end of August to mid-September, women, men, children, and even the elders partake in the harvesting operations and the streets of the city look empty. The harvest is such a meaningful and vital event for the local population that the myth has it that once in Bronte marriages and baptisms were celebrated exclusively during that year, which occurs on a biennial basis (Lombardo, 2015).

Different institutions have been set up in the last twenty years with the aim to recognize the intrinsic values associated with such an agricultural system and to promote land use development and planning compliant with local socio-cultural norms.

The “consorzio di tutela” (consortium for the protection) was founded in 2004. It includes farmers producing the green pistachio of Bronte within the boundaries established by the disciplinary of production, associations, cooperatives, producer

organizations, and packagers and distributors; in other words, it consists of all producing and processing undertakings abiding by the rules set out by the consortium. This institution was created for and serves multiple purposes. First and foremost, the safeguard, support, and valorization of the product, together with the traditions and customs passed down from generation to generation, constitute the main goals pursued by the organization. Notwithstanding the important role it plays in this regard, the existence of the consortium was a condition sine qua non for any group of farmers seeking to obtain the PDO certification from the European Union. Therefore, this organization was also primarily meant to pave the way towards the achievement of this objective.

It took several years of technical and bureaucratic work before the farmers of Bronte could boast and rely on this certification to protect their product within the global market against lower quality and cheaper pistachios. The designation arrived, indeed, only in 2009 with the OJEU 2009/C 130/09. As far the criteria for awarding this noteworthy certification are concerned, the traditional production processes and the singular socio-cultural factors distinguishing the local population are not less appreciated than the climatic, geologic, and agronomic features of the area (Petino, 2009).

Protected Designation of Origin (PDO) official label of the Green Pistachio of Bronte.

Yet the pistachio of Bronte won another important recognition in 2000 when it officially became a Slow Food Presidium. The presidiums are designed to acknowledge and reward those sites where farmers have come to play the role of guardians of the biodiversity of the territory and defenders of the traditional values and landscapes, and where all the relevant stakeholders have committed themselves to contribute to a further transition towards the adoption of agroecological practices. Such a remarkable accomplishment will likely lead to a greater safeguard both of the agricultural system and of the product within international markets (Petino, 2010).

The Green Pistachio of Bronte with the PDO and Slow Food Presidium labels.

In conclusion, there three additional local organizations that deserve to be introduced and briefly analyzed, and they are: “Pistacchio Smeraldo Bronte”, “Pro Loco Bronte”, and “Bioregione Etnea”.

The “Pistacchio Smeraldo Bronte” is a cooperative of producers that was instituted in 1971. It comprises thirty farms all located on the western slopes of Mt Etna and certified with the PDO “Pistacchio Verde di Bronte”. They account for approximately 15% of the entire production. The objectives of the cooperative are to improve and

valorize the production of pistachio from a socio-economic point of view and to do it holding very high landscape and environmental values.

The “Pro Loco Bronte” is an association founded in 1960. It has stood out for its capacity to revive and carry on traditional events and celebrations of all sorts, such as carnival allegorical floats and art exhibitions, and to lead tourists to the discovery of the most charming treasures of the municipality. In addition, since the 1970’s, this organization has been dedicated to support local agricultural products, especially pistachio, to the point that it has been able to project and pull of the first famous “Sagra del Pistacchio di Bronte” (pistachio festival) in 1981.

Finally, the “Bioregione Etnea” is a project created to champion and increase the biological agricultural production. It provides services of technical assistance to help farmers adopt and implement biological methods in order to defend the territory and add value to what they produce (Petino, 2010).

7. Landscape Features

The disciplinary of production of the PDO "Green Pistachio of Bronte" commends the sound, sustainable, and sui generis integration between environmental and human factors which brought about the right conditions for the cultivation of the famous pistachio, it reads as follows:

The production area has volcanic soils and enjoys a semi-arid, subtropical Mediterranean climate, with long, dry summers, rains concentrated in the autumn and winter and significant changes in temperature between the day and night. These pedological and climatic factors, together with the use of terebinth (Pistacia terebinthus), introduced by man, give the fruit particular qualities (…) that are hard to achieve in other production areas or elsewhere in the Etna massif. This particular combination of pedological, climatic and human factors gives 'Pistacchio Verde di Bronte' PDO specific qualities that make this a unique product.

(Council Regulation, 2009)

The description of the site set out in the disciplinary of production well summarizes and highlights some pivotal characteristics of the agricultural landscape under analysis and, therefore, constitutes a good starting point for the scope of this last section. What has begun to emerge are, indeed, the beneficial and constructive synergies that have arisen between anthropic activities and the climatic, morphological, and orographic elements of the area.

The municipality of Bronte (760 meters asl) extends over the western natural slopes of Mt. Etna and, from there, it is possible to enjoy the view of the Simeto valley. The first attempts to colonize the Mountain and to create more extensive human settlements trace back to the XI-XIII centuries. Since then, Bronte, as many other municipalities developed around the Mountain, has repeatedly suffered from the powerful and destructive eruptions of the volcano. The lava flowed through or near

the city in 1651, 1832, and in 1843, causing several damages and provoking the death of some of its citizens.

From a geomorphological point of view, each volcano's blast has piled more and more pyroclastic materials onto the surface of the slopes and has superimposed over the outcome of the previous explosions. As a consequence, the topographic features of the area have been constantly reshaped and transformed.

The rugged areas covered with pistachio groves are characterized by rocky volcanic soils. It is worth reiterating that this crop has embodied an invaluable resource because it has driven the local population towards a new holistic vision of the land use and has spurred the development of an agricultural system that harmoniously integrates with the environment. The cultivation of pistachio, in concert with the anthropic activities it has necessarily implied, has added terrific landscape value to an area that many reckoned not fit for agricultural purposes and doomed to be a bare volcanic land. Most of the terraces which had been ingeniously built by farmers to cope with the often-steep slopes, and which demonstrated the tenacious commitment to settle and conquer unfavorable lands, have been abandoned (Ente Parco dell'Etna, 2009). On the southern end of the pistachio orchards, it is possible to observe lavas originating from ancient volcanic cones (100-200 thousand years ago).

More recent sedimentary soils and magma flows, which date back from the XII-XVII centuries A.D., distinguish the territory in the proximity of Bronte. Monte Barca is the most notorious volcanic cone of ancient formation that stands close to the graveyard of the city.

The historic city center is the primary and most considerable anthropic element that belongs to the socio-cultural landscape and that, together with a limited number of holdings spread around the farmed fields, sets apart from the vast natural panorama of the Mountain (Petino, 2010).

Next page source: Geological Map of the "Sicilian Department of Cultural Heritage and Sicilian Identity". Printing Scale: 1: 50.000.

Piano Paesaggistico

Ambiti 8-11-12-13-14-16-17 Catania

Regione Siciliana

Assessorato dei Beni Culturali e dell'Identità Siciliana
Dipartimento dei Beni Culturali e dell'Identità Siciliana

Soprintendenza per i Beni Culturali ed Ambientali di Catania

Progetto finanziato con P.O.R. Sicilia 2000-2006 Misura 2.02 Azione C

Piano Paesaggistico

Ambiti 8-11-12-13-14-16-17 Catania

tavola **1.1** Scala di stampa 1:50.000

Ambiti regionali 8, 11, 12, 13, 14, 16 e 17 ricadenti nella provincia di Catania

Tavole di Analisi – Sistema naturale

Geologia

DIPARTIMENTO DEI BENI CULTURALI E DELL'IDENTITA' SICILIANA

SERVIZIO PIANIFICAZIONE PAESAGGISTICA

SOPRINTENDENZA PER I BENI CULTURALI ED AMBIENTALI DI CATANIA

COORDINAMENTO TECNICO-SCIENTIFICO

CONTRIBUTI TECNICO SCIENTIFICI

COLLABORATORI

CONSULENZA SCIENTIFICA

UNIVERSITÀ DI CATANIA

Legenda

- Alluvioni attuali e recenti; depositi di spiaggia (a). Olocene.
- Alluvioni antiche (aa). Pleistocene.
- Alluvioni terrazzate continentali e marine (Qt). Pleistocene superiore - Olocene.

VULCANITI ETNEE

- Materiale piroclastico del Cratere Centrale (mpc) (ceneri, sabbie, lapilli, bombe e blocchi lavici).
- Materiale piroclastico rimaneggiato (mpr).
- Colate laviche (a) e piroclastiti (b) del XX secolo fino al 1974
- Colate laviche (a) e piroclastiti (b) del XIX e XVIII secolo
- Colate laviche (a) e piroclastiti (b) datate dal XVII al XII secolo
- Colate laviche (a) e piroclastiti (b) recenti, prevalentemente non datate (lpr)
- Lave (a) e piroclastiti (b) delimitabili a morfologia superficiale ben conservate (lpd)
- Lave (a) e piroclastiti (b) difficilmente delimitabili a morfologia superficiale degradata (lpn)
- TUFI (a) E LAHARS SUPERIORI (b) (ts). Tufi gialli a grana fine grossolanamente stratificati, talora con resti vegetali inclusi (a). Lahars rosso-bruno poco cementati (b)
- PRODOTTI DEI CENTRI ERUTTIVI DELL'ELLITTICO (ve) E DEL LEONE (vl). Piroclastiti (a). Successioni prevalentemente laviche in colate talvolta ancora delimitabili.
- CONGLOMERATI SABBIOSI ALLUVIONALI, localmente chiamati CHIANCONE (cs). Depositi alluvionali irregolarmente stratificati in banchi, costituiti da ciottoli e blocchi vulcanici eterogenei immersi in una matrice sabbiosa.
- TUFITI DEL BASSO VERSANTE SUD-ORIENTALE (tf). Depositi giallo-bruni di spessore notevole a banchi ben definiti con intercalazioni di sottili livelli di pomici.
- VULCANITI DEI CENTRI ERUTTIVI DEL TRIFOGLIETTO (vt). Alternanza di lave in colate non più delimitabili e piroclastiti di vario spessore, attraversata da numerosi dicchi (Valle del Bove).
- TUFI (a) E LAHARS INFERIORI (b) (tl). Tufi giallo-bruni stratificati a grana medio-fine talora associati a lave riferibili ai centri del Trifoglietto (a). Lahars ben cementati di color bruno ad elementi lavici generalmente di grandi dimensioni (b).
- LAVE (a), PIROCLASTITI (b), E TUFITI DEI CENTRI ERUTTIVI ALCALINI ANTICHI (ta). Lave fortemente degradate, talvolta terrazzate, spesso a megacristalli di pirosseno ed olivina (a). Piroclastiti associate (b). Depositi nerastri in banchi compatti e granulometria variabile talora a stratificazione incrociata (c)
- LAVE SUBALCALINE DI BASE (b). Espandimenti lavici subaerei terrazzati del basso versante sud-occidentale, lave a pillows, brecce ialoclastiche ed intrusioni poco profonde del versante sud-orientale. Basalti ad affinità tholeiitica.

DEPOSITI SEDIMENTARI DEL QUATERNARIO

- Sabbie gialle quarzose (a) con lenti di arenarie ben cementate e conglomerati poligenici ad elementi prevalentemente quarzarenitici (b) (Qs). Le sabbie passano verso il basso alle Argille marnose grigio-azzurre (Qa).
- Argille marnose azzurre talora siltose a stratificazione poco evidente (Qa). Macrofaune ad Arctica islandica e Chlamys septemradiata. Pleistocene inferiore.

SERIE EVAPORITICA

- GESSI. Strati gessosi varvati e banchi a grossi cristalli con struttura massiccia (Mg). Messiniano.
- CALCARE DI BASE. Calcare bianco-grigiastro a laminazione parallela, spesso vacuolare e brecciato (Mc). Messiniano.

DEPOSITI SEDIMENTARI DEL TORTONIANO

- FORMAZIONE TERRAVECCHIA. Marne argillose grigie e brune e sabbie quarzose giallastre in sottili livelli e grosse lenti (Ma). In alcune zone affiorano potenti bancate sabbiose contenenti livelli conglomeratici. Tortoniano. Nella parte alta della formazione si intercalano le argille brecciate brune (AB2). Tortoniano.

COMPLESSO ANTISICILIDE

- ARGILLE SCAGLIOSE ANTISICILIDI. Argille varicolori, scagliettate e a giacitura caotica, con intercalazioni di radiolariti e di calcari diasprigni nerastri (AAS). Cretaceo superiore.

COMPLESSO CALABRIDE

- FLYSCH DI CAPO D'ORLANDO. Alternanza di arenarie grigio-giallastre in grossi banchi e di argille marnoso-siltose (OM). Alla base sono presenti livelli conglomeratici (a). Oligocene sup. - Miocene inf.
- METAMORFITI III. Semiscisti sericitico-cloritici e grafitici con intercalazioni di quarziti e metarcose di derivazione pelitico-arenacea (m3).

Unità di S. Marco D'Alunzio

- DOLOMIE E CALCARI. Calcari algali grigi e calcari dolomitici algali passanti a calcari encrinitici (LI). Lias inferiore.

COMPLESSO SICILIDE

Flysch di Monte Soro

- Unità di Monte Pepelizzo: membro pelitico-carbonatico e raramente arenaceo.
- Unità di Monte Trearie: membro arenaceo (d); membro pelitico-arenaceo (e).
- Unità di Santa Maria del Bosco: membro arenaceo (f); membro pelitico-calcareo-arenaceo (g).

Unità Sicilidi

- ARGILLE VARICOLORI. Argille verdi e rosso-vinaccia a struttura caotica e con intercalazioni di siltiti e calcareniti (AV). Oligocene - Miocene inferiore.
- FORMAZIONE DI POLIZZI. Calcari marnosi e marne di colore bianco (Ec). Frequenti sono i livelli calcarenitici dati da brecciole gradate a macroforaminiferi. Eocene inferiore - medio.
- ARGILLE SCAGLIOSE. Argille rosso vinaccia, verdi e grigio ferro, scagliettate e a giacitura quasi sempre caotica (AS). Intercalazioni decimetriche di diaspri, siltiti carbonatiche e calcari micritici bianchi. Cretaceo sup. - Eocene inf.

FLYSCH NUMIDICO

- FLYSCH NUMIDICO (Maa). Alternanza di argille brune e di quarzareniti giallastre (a) talora in grossi banchi (b). Miocene inferiore.

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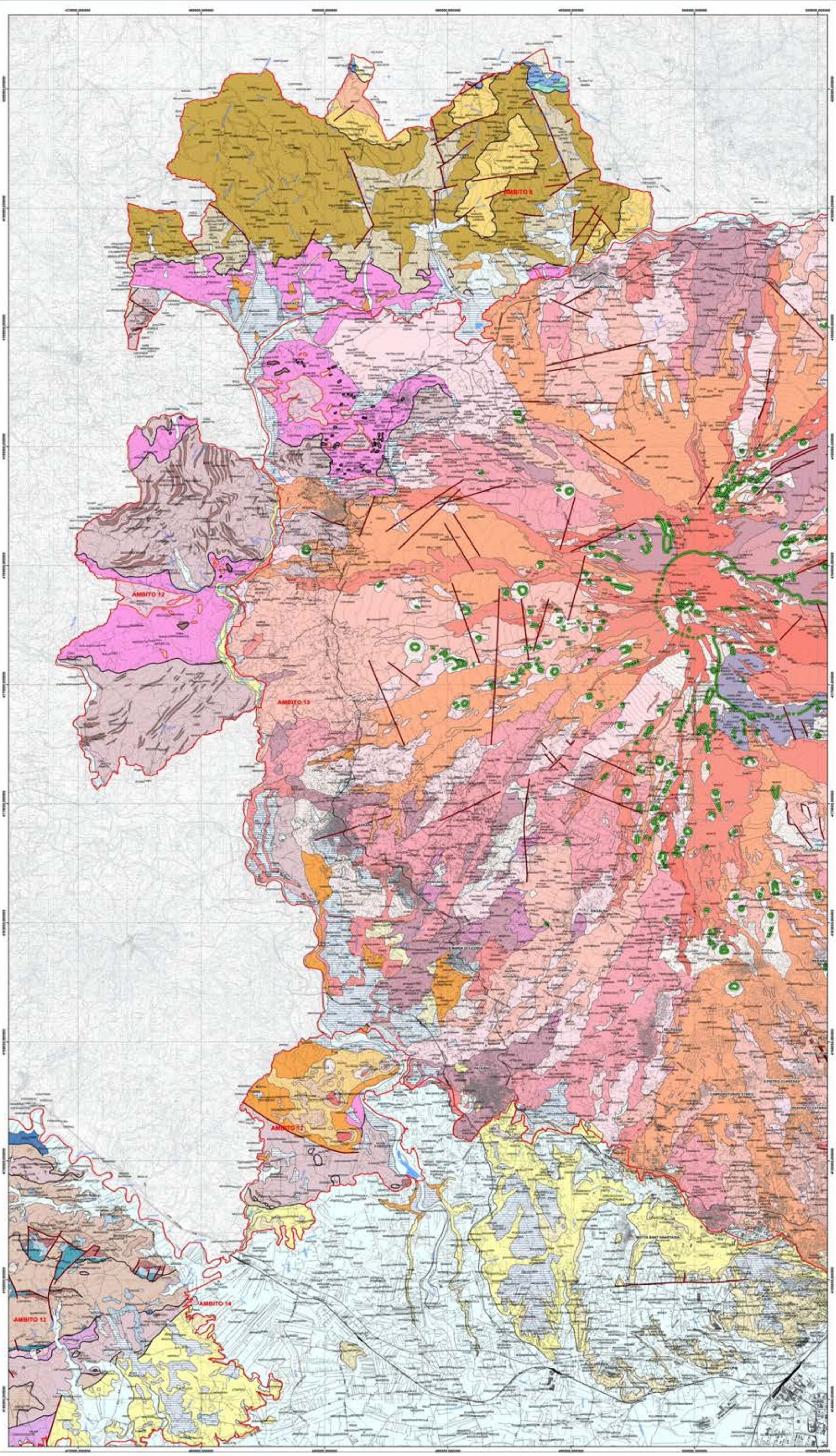
- ARGILLE MARNOSE CON LIVELLI DI ARENARIE GLAUCONITICHE (OMa). Argille marnose brune o verdastre con intercalazioni arenacee giallo-verdastre piu' frequenti nella parte apicale (a). Microfauna a Globigerina oligocenica in basso e ad Orbulina alla sommità. Oligocene superiore - Miocene medio.
- FORMAZIONE DI CALTAVUTURO. Marne e calcari marnosi rosai in facies di Scaglia (E-O). Eocene medio - Oligocene.
- RADIOLARITI. Radiolariti policrome ed argilliti silicee a fratturazione prismatica fittamente e sottilmente stratificate (GC) con corpi lenticolari di vulcaniti basiche. Giurassico - Cretaceo.
- CALCARI CON SELCE (Ts-C). Dal basso verso l'alto si riconoscono un'alternanza argilloso-calcareo-arenacea (Flysch Carnico), calcari con selce, argilliti silicee e radiolariti con intercalazioni di vulcaniti submarine. Carnico sup.-Norico-Retico (?)
- FORMAZIONE MUFARA. Argille talora marnose e siltose grigio-verdi contenenti caratteristici straterelli di calcite fibrosa (Tm). Carnico medio - superiore.

- Cupole di lava autobrecciata
- Frane
- Detriti
- Coni di deiezione

Tettonica

- Contatti Anomali
- Faglia Dirette
- Orli di Condotti
- Ricoprimenti Tettonici



In this regard, it is crucial to analyze the features of the anthropic components identifying the area and their relationship with the surrounding landscape.

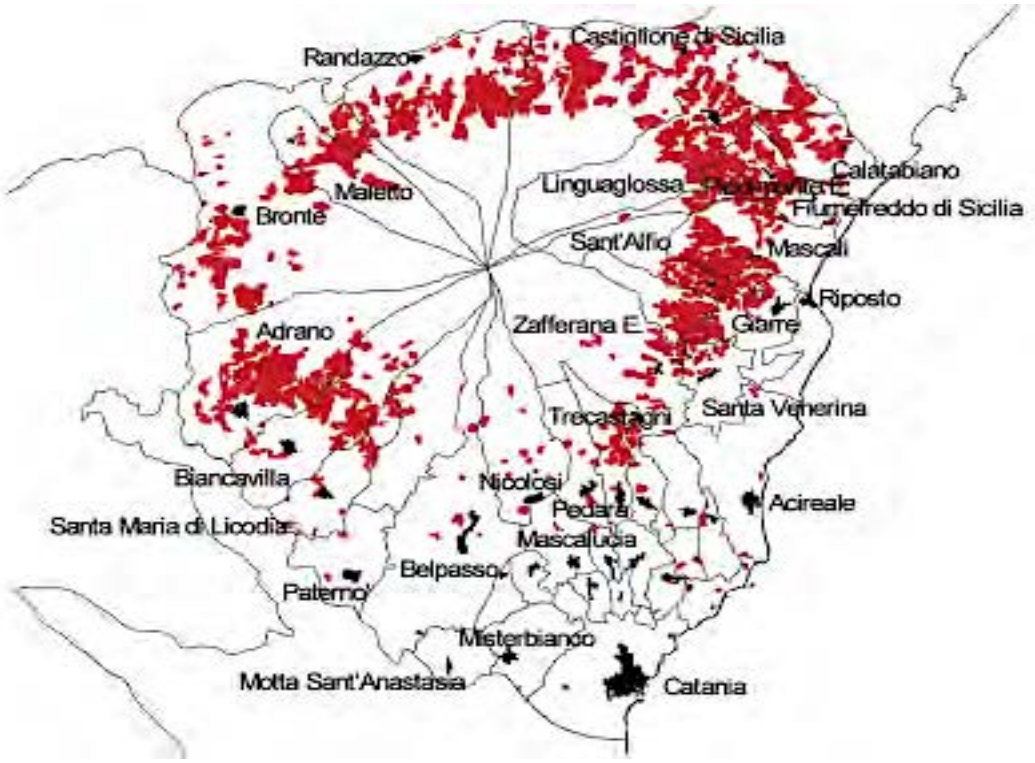
The rationale behind the structure of the settlements that were established on the Etnean western slopes was based on the physical need to take advantage of the morphological peculiarities of the land and of the materials it naturally supplied.

The largely prevalent building material is the hewn or processed lava stone which is adopted for the construction of any type of artifact: walls built with the traditional dry-stone technique to support terraces or used as fences, votive and rural artifacts, and water management and transport infrastructures are just a few examples. The wise exploitation of the lava stone has given rise to an astonishing equilibrium between the natural and the anthropic environment. In this context, the man was able to defend and valorize the landscape by making his works perfectly blend into the surroundings and camouflage among the natural vegetation.

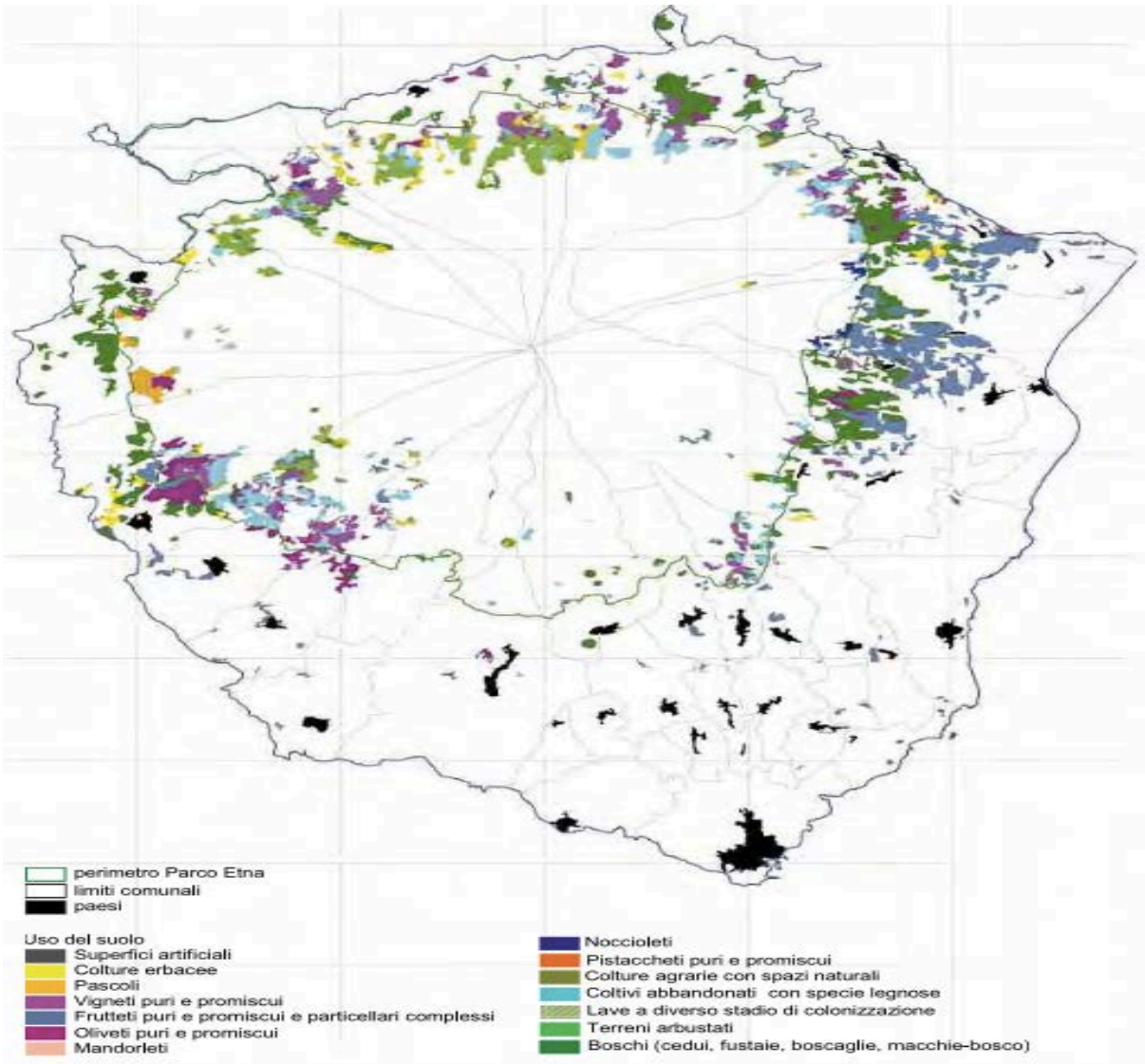
Except for some more socially relevant constructions, manor and farmhouses, and their respective outbuildings, and building materials and techniques are poor and basic. Due to the scarcity of alternative resources, the dry-stone technique is the most frequently utilized. The terraces are also built with the dry-stone technique without the use of blinding materials. Unfortunately, today, following a steady process of abandonment and/or the lack of management practices, the surface of the terraces currently used for the cultivation of pistachio amounts to only 217 ha.

Nonetheless, Bronte can boast an original manor and austere architecture which is also functional to the performance of traditional activities.

The public space, realized as well in lava stone, assumes the role of a connective tissue with its paving patterns that reach through and cut across the farmed fields. This infrastructure system covers the whole area. The city and the countryside are, indeed, inextricably intertwined and seem to have no sharp boundaries dividing them. This is the result of the slow and steady development of a community that has cleverly adjusted to, benefited from, and merged harmoniously with the morphological and lithological characteristics of the territory. (Barbera et al., 2015).



Source: Barbera et al., 2015. Map of the distribution of the terracing system and of the municipalities of Mt. Etna.



Source : Barbera et al., 2015. Aggregate land use map of the terraced areas around Mt. Etna.

Natural fences, “stenditoio” (drying space), and rural artifact made of lava stones.

Stairs built with lava stone.

Rural *building and pistachio trees.*

Terraces built with the dry-stone technique.

Source: Barbera et al., 2015. Paving realized in lava stone.


Source: Barbera et al., 2015. Front and back of a rural building used as a deposit.


Source: Barbera et al., 2015. Front and back of a rural building used as a house for the workers.

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