FINAL REPORT

of activities

THRIVING LAND

Supporting Agri-food Education

Trans Adriatic Pipeline

BODOSSAKI FOUNDATION

AMERICAN FARM SCHOOL
Thessaloniki · Greece

INAB
INSTITUTE OF APPLIED BIOSCIENCES

FINAL REPORT

of activities

THRIVING LAND
Supporting Agri-food Education

Trans Adriatic Pipeline

A Trans Adriatic Pipeline
initiative to support agri-food education in Northern Greece

Grant manager:

BODOSSAKI FOUNDATION

Implementation partners:

AMERICAN FARM SCHOOL
Thessaloniki · Greece

INAB

CONTENTS

Messages from the project partners

Jonathan Collingwood

Director of Corporate Services and Greece Country Office
Trans Adriatic Pipeline (TAP) AG

TAP crosses about 550k of Greek soil and in order to construct the pipeline temporary access to more than 10,000 land parcels was needed. During these past 4 years of construction, TAP's teams supported the owners and users of these parcels and respected the land that hosts the pipeline. Especially so, the agricultural lands that TAP mainly traverses – from Kipoi in Evros to Ieropigi in Kastoria.

That is why we opted to implement, via TAP's Social and Environmental Investments Programme, this particular project that we named **THRIVING LAND | Supporting Agri-food education**, paying tribute to the fertile soil of Northern Greece.

The goal of **THRIVING LAND** was, and remains to this day, to showcase distinct Greek agricultural products with growth potential and prospects, by investing in their strategic advantages – such as diversification, distinct identity, unique quality, and the high added value of local products. **THRIVING LAND** is a project indicative of the legacy that we, as TAP, wish to leave to the people and the land of Northern Greece.

To develop **THRIVING LAND**, TAP joined forces with the Bodossaki Foundation, which contributed its valuable experience in the role of project manager and collaborated with the project's implementation partners: the American Farm School of Thessaloniki and the Institute of Applied Life Sciences of the National Centre for Research and Technological Development (CERTH). Together, we listened to the needs of the local communities and agreed to support and feature "quality champions," i.e. recognised local products with the potential to create added value.

We also sought out participants who would not only benefit individually from the project's activities, but would also act as "champions" themselves, inspiring their respective communities and mobilising further capacity for growth.

As **THRIVING LAND** concludes, we feel that its results and benefits will extend beyond the project's 18-month implementation period. We also hope that the project's contribution in the effort to modernise the Greek agricultural sector –a sector with a long tradition and significant input to the national economy– was a notable one; because, as such, **THRIVING LAND** featured new ways to generate income, using specialised methods and tools that address contemporary challenges of both the domestic and international market.

The construction of TAP has now been concluded and the pipeline enters its operation phase, which entails transporting natural gas from the Caspian Sea to the European markets. Our vision was, and remains, to establish a cost-effective, safe and sustainable energy route, while also bringing tangible benefits to the local communities and the wider areas along the pipeline. In order to achieve that, we are looking forward to continuing our collaboration with these communities; with the landowners and land users of Northern Greece, maintaining our neighbourly relations, built on mutual respect.

Athina Dessypri

General Secretary, Bodossaki Foundation

"At Bodossaki Foundation, we strongly believe in partnerships and in joining forces for the greater common good. Thus, in tandem with steadily continuing our nearly 50-year long history of uninterrupted public benefit activity funded by the Foundation's own resources, today we are also acting as a catalyst for fostering a broader culture of social contribution in the Greek society. Recognising the enormous social needs in our country, we work with businesses that are firmly committed to social contribution and we create programmes of significant social impact.

Bodossaki Foundation recognises that supporting the agri-food sector in Greece is of major social significance, as by providing people in the Greek countryside with opportunities enabling them to remain in their native land and put their creativity to use locally, the agri-food sector can give new life to the Greek periphery. In supporting this sector, we considered that the promotion of the special quality features of Greek products, coupled with investments in products of high nutritional value, are valuable allies.

With this in mind, Bodossaki Foundation contacted the American Farm School (AFS) and the Centre for Research and Technology Hellas (CERTH), two leading organisations active in agricultural research and production, with the intention to jointly develop a comprehensive, innovative and integrated programme of interventions in the agri-food sector, which could create the conditions for healthy growth of Greek peripheral regions.

Our plans fully coincided with TAP's intention to carry out extensive social and environmental investments in Northern Greece, focusing on the areas crossed by the pipeline. The result of this partnership was the **THRIVING LAND** Programme, whose implementation was made possible thanks to a grant of 1 million euros from TAP.

The project is part of the broader cooperation between Bodossaki Foundation and TAP on the identification, preparation, implementation and monitoring of social and environmental actions in the three regions of Northern Greece through which the pipeline passes.

The **THRIVING LAND** programme was designed to meet the needs of local communities, placing emphasis on local products with special characteristics, which can create high added value not only for the programme's direct beneficiaries but also, more broadly, for all producers active in the areas covered. Bodossaki Foundation, as manager of the **THRIVING LAND** programme, undertook the design of the programme in collaboration with the two implementation partners –AFS and CERTH–, and was also responsible for systematically monitoring its progress.

For our part, our expectation through this partnership was for **THRIVING LAND** to become one of the most successful Corporate Social Responsibility programmes implemented in Greece, showcasing the importance of partnerships, integrated planning and focused target-setting, as well as of the systematic and consistent investments by grantors in actions that not only offer temporary relief to pressing social problems but have also multiplier potential, creating added value for our society. The results presented in the pages that follow prove us right in our expectations of this particular programme and motivate us to implement similar initiatives in the future."

Panagiotis Kanellis, Ph.D.

President
American Farm School and Perrotis College

THRIVING LAND project, sponsored by TAP, coordinated by Bodossaki Foundation and implemented by the American Farm School of Thessaloniki and the Institute of Applied Biosciences of the "Centre for Research and Technology Hellas" (CERTH), has greatly contributed to the further development of the Greek primary sector and to the sustainment of the rural population in the countryside.

Many challenges still exist, however. Future trends worldwide indicate an increased need for food. At the same time, climate change, the shortage of water resources and the new Common Agricultural Policy, set stricter standards for sustainable agriculture and require the implementation of new technologies and practices for the production of quality food products.

With the help of a dedicated team of AFS expert staff and trainers we created a contemporary vocational and mentoring training that rises to the challenges and meets the ever-increasing needs of farmers and livestock breeders in the Greek countryside; thus, staying true to the long and unique history of the American Farm School in Greece and in the wider region.

THRIVING LAND project has also bequeathed the legacy of a permanent digital infrastructure along the pipeline route, which allows farmers to easily and almost inexpensively join the Smart Farming network.

Kostas Stamatopoulos

Director, Institute of Applied Biosciences (INAB),
Centre for Research and Technology Hellas (CERTH)

"The agri-food sector can only be strengthened through the collaboration of all the members that comprise its structure, contributing to its proper function. In this respect, actions that bring the research and academic sector close to the primary production can offer great benefits, especially for those involved in the initial stages of the food production chain – i.e. farmers and livestock breeders.

It was with this in mind that the **THRIVING LAND** project was launched. In the context of the project, the Institute of Applied Biosciences of the Centre for Research and Technology Hellas, in collaboration with the American Farm School and under the coordination of Bodossaki Foundation, took advantage of the support offered by TAP to improve production traits and generate an added value to significant products of Northern Greece of high dynamics.

The **THRIVING LAND** project succeeded in creating the conditions that enable the genetic and biochemical analysis of products, targeting to establish an integrated product identity needed by the producers, both as a means of promoting the quality and uniqueness, as well as a tool that can be used for traceability and certification of their products.

The Institute of Applied Biosciences contributed to the project by using cutting-edge technologies to highlight local agri-food products across a wide geographical area of Greece. This contribution proves our commitment for innovative applications and services that meet the needs of society and increase our country's competitiveness."

01 The initiative

The Trans Adriatic Pipeline (TAP) AG aims at supporting agri-food education in Greece, as part of the €32 mil. Social and Environmental Investment programme that TAP has committed to implement across all three Regions of Northern Greece traversed by the pipeline (Eastern Macedonia and Thrace, Central Macedonia, Western Macedonia).

The main objective of these investments is to support the local communities affected by TAP – especially farmers and livestock breeders. To that effect, we listened to the needs of the local population, competent authorities and other relevant entities, and we collaborated with them, to ensure that each initiative would significantly contribute and support sustainability.

TAP selected the **THRIVING LAND** project for implementation, specifically because it combines (a) providing support to agriculture and livestock farming –two sectors of key significance for the Greek economy and particularly so in Northern Greece– with (b) the application of:

- modern approaches to cultivation;
- scientific methods of genetic identification;
- marketing techniques for products with distinct characteristics and/or potential.

The latter category includes local products of the areas traversed by the pipeline, such as:

- honey and bee products,
- olives and olive oil,
- medicinal and aromatic plants (MAPs),
- beans,
- fruit,
- "petimezi" (sugar cane molasses),
- peppers, and
- livestock products (from goats, sheep and cows).

THRIVING LAND was implemented thanks to a €1 mil. grant from TAP, in partnership with the Bodossaki Foundation. The American Farm School (AFS) and the Institute of Applied Biosciences of the Centre for Research and Technology Hellas (CERTH) also participated in the project as implementation partners.

02 THRIVING LAND project

The **THRIVING LAND** project was designed and implemented on two levels –the educational and the biotechnological one– offering tangible support to the Greek primary sector and Greek producers, with the following objectives:

- support improved quality of life and enhance the livelihoods of people along the pipeline's route;
- cultivate skills and competences via education and training;
- improve environmental management.

Thus, farmers have since equipped with the necessary cognitive tools and technological means that will help them stay in their native land and unlock new opportunities for the Greek agri-food sector.

Educational training & personalised consulting

Access to formal vocational agricultural education in Greece is still limited, thus creating great differences in knowledge levels among farmers. This need for uniform and systematic agricultural education is met by the American Farm School (AFS), which is actively engaged in this field and develops educational programmes that address actual needs of farmers. The programmes are designed to empower them and inform their decision-making process, concerning agricultural production.

With regard to the educational aspect of the **THRIVING LAND** project, the AFS held training seminars and personalised educational activities targeted at the local population – producers, small businesses and collaborative business ventures, interested in expanding their technical knowledge and promoting their products. The educational activities that took place combined theory with practice, seeking to provide participants with a comprehensive approach to, and training in, topics related to the cultivation, processing, and marketing of products. The content of the training was tailored to the particular characteristics of the products and geographical areas covered.

Educational training

Education focused on both plant and animal production. As regards the former, educational activities pertained to basic cultivation principles, propagating material, soil management, climate and environmental conditions, machinery, plant protection, production systems, and energy management. They also addressed topics such as irrigation, fertilisation, and environmental and personnel safety. Finally, the beneficiaries were trained in making the most of their area's particular soil and climate conditions, in order to create a value chain and improve their gross income and livelihoods.

Similarly, the educational activities pertaining to livestock production addressed the topics of animal nutrition, breeding, basic principles in precision livestock farming, financial analysis, and the drafting of business plans.

Both livestock farmers and crop growers attended seminars on food processing, which focused on quality assurance systems (ISO), food hygiene and safety (HACCP), legislation, basic economic principles, establishing a business plan, pricing, processing meat and dairy products, processing technologies for new products, and packaging.

Finally, with regard to the promotion of the products, educational activities focused on sales, marketing and branding, networking, export legislation, distribution channels, evaluation of new products, as well as the basic principles of organoleptic control and tasting.

Theoretical knowledge was complemented by practical personalised training at the fields and livestock farms, an approach that strongly enhanced the effectiveness of the overall training.

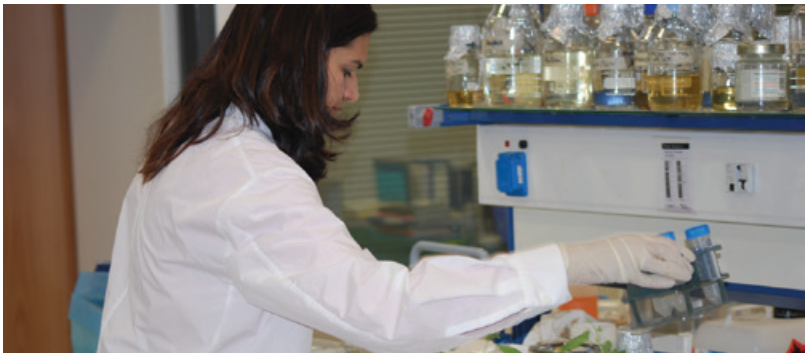
In addition, steps were taken for the technological modernisation of agricultural and livestock practices. Specifically, an additional technological intervention was added to the implementation of the project. This pertained to the installation of an "intelligent agriculture" telecommunications network in areas along the pipeline's route; an area covering a large part of the agricultural land of Northern Greece. This network has the capacity to interconnect more than 30,000 remote devices, such as field, plant and vehicle sensors, representing another step in the transition of Greek farmers to "Agriculture 4.0," more commonly known as "intelligent agriculture". The network can receive and transfer sensor measurements to the cloud server and be easily expanded with the addition of new sensors.

Biotechnology

The second level of the **THRIVING LAND** project regarded biotechnological research, undertaken by the scientific experts of the Centre for Research and Technology Hellas (CERTH). Their objective was to identify the specific characteristics and properties of the selected agri-food products, in order to create the "genetic identity" of these products and feature their added value, with a view to promote them in both domestic and international markets.

CERTH's Institute of Applied Biosciences, which provided assistance in the field of Agro-Biotechnology and Genetics, applied innovative techniques and methods sourced from the fields of genetics, biochemistry and molecular biology, to assess, evaluate, and effectively apply the genetic biodiversity.

Characterisation of the various products was conducted at genetic level, with the use of cutting-edge technology. The object was to identify the appropriate molecular markers that would fully characterise the variety and its identity. In addition, all necessary biochemical analyses were carried out on the products in order to highlight the organoleptic properties, which would inform their subsequent use in processed products of high added value.



The use of a combined genetic and biochemical approach in each sample, created a value chain that leads from the raw material to the final fresh or packaged product, enhancing local brand names and each product's added value, while offering protection from adulteration. Furthermore, agricultural and livestock production is facilitated, as product variety or breed can, respectively, be determined at an early stage, thus allowing for the selection of appropriate propagating material. This ensures continuous production with stable product quality that enhances the competitiveness of local farmers/livestock breeders, and consequently increases their income.

In collaboration with the other project partners, the Institute's efforts can contribute to achieving sustainable rural development of fully certified Greek brands, from seed to final product.

03 Project beneficiaries

The project's direct beneficiaries were farmers and livestock breeders, small businesses and collaborative business ventures, active in the production, processing and export sectors in the areas traversed by the TAP pipeline.

The beneficiaries were selected by the project partners, namely the American Farm School, CERTH and TAP's local Community Liaison Officers (CLOs), on the basis of specific criteria set for the optimal implementation, response to, and success of the initiative. These included the professional and socio-economic status of the interested applicants, knowledge and experience in their respective field, and intention to introduce innovative solutions in their crops and livestock farms. Also, certificates held by the applicants, such as their registration in the national register of professional farmers, were taken into consideration.

In total, the project's direct beneficiaries were 709 producers of the selected crops and products. Yet, the potential of **THRIVING LAND** as an initiative, exceeds this number, as it is expected to bring multiple benefits for the people along TAP's entire route, as well as for the local economy. This is because the project has created a bridge of communication and exchange of knowledge between producers and scientists, highlighting the unique characteristics of products and connecting agricultural production to tourism.

Local products are thus transformed from simple foodstuff to a gastronomic and cultural resource, capable of attracting visitors who seek out authenticity and genuine tourist experiences.

The project's goal and key objection of all collaborating partners was for local products and their uniqueness to function as "ambassadors" of their respective areas, thus, in turn, rendering the TAP project an innovative example of regional development and of ways of improving the future of the agricultural sector in Greece.

04 Project results

LIVESTOCK FARMING

Livestock farming plays an important socio-economic role in Greece, contributing to the agricultural income and to the development of other relevant sectors. At the same time, it creates jobs and assists in retaining population in remote rural communities.

Supporting the livestock sector is both a necessity and a priority – not only for strengthening agricultural income and supporting remote areas, but also for the consumers themselves, since livestock farming contributes several products comprising the Greek diet.

Sheep farming

Amyntaio-Kozani, Serres

Greece's geomorphology and climate conditions favour sheep breeding and give special attributes to their products. Approx. 9 million sheep are currently reared in Greece (2009 Census, Hellenic Statistical Authority – ELSTAT,). In recent years, however, breeding of small ruminants has become unprofitable, which has necessitated changes in the breeding process (*Statistics on low milk prices*, Greek Milk and Meat Organisation – ELOGAK, 2018, 2019).

Western Macedonia ranks sixth in the list of Greek Regions with the highest milk production from sheep and goats, annually producing 35,018 tonnes and 8,476 tonnes – respectively. Nearly 44% of the entire region's sheep/goat milk production comes from the Kozani Regional Unit (ELOGAK, 2019), around mountainous areas. And the largest part of the milk production is procured by local dairy industries.

Sheep-and-goats farming has changed a lot in the past couple of decades. The number of animals imported from non-indigenous breeds, in particular sheep, has increased. At the same time, the yield of Greek sheep-and-goats breeds is still lagging behind countries with more advanced breeding systems. Most farms only have rudimentary facilities, without special equipment or infrastructure for mechanical milking, while also lacking in terms of livestock management practices. This means that the milk production of small family farms is still relying on traditional methods, which in turn renders imperative the adoption of innovations and best practices to enhance competitiveness and sustainability. Therefore, acquainting livestock farmers with these modern methods was a key aspect of the **THRIVING LAND** project.

Serres is another area with significant sheep-and-goats production. Indeed, Serres is the Regional Unit with the highest production of lamb in Central Macedonia, accounting for 18.54% of the Region's total output. The "Serrai sheep" breed, which is reared here, is a unique animal that can adapt to difficult climates, suitable for both intensive (stabled animals) and extensive (free-range) livestock farming. It is a breed yielding excellent meat production.

SHEEP FARMING

Amyntaio-Kozani

- 25 EDUCATIONAL TRAININGS
- 6 PERSONALISED CONSULTATIONS

33 BENEFICIARIES

11 BENEFICIARIES

Serres

- 27 EDUCATIONAL TRAININGS
- 9 PERSONALISED CONSULTATIONS

41 BENEFICIARIES

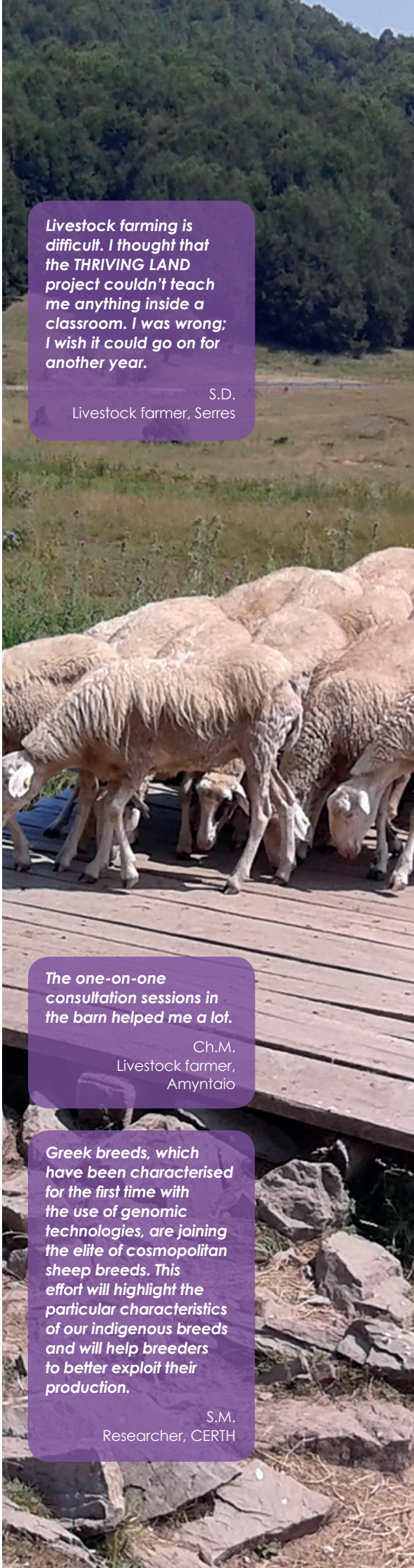
25 BENEFICIARIES

According to the Agricultural Cooperative of Serres Livestock Farmers (2011), there are currently 32 local farmers rearing 5,400 "Serrai sheep." Their meat is sold to local butchers and restaurants at the average market price for sheep's meat, without any other added value on account of its origin from a special local breed.

In these two areas with strong activity in the sector, Kozani and Serres, a focused training programme on sheep and goat farming was implemented in the context of the **THRIVING LAND** project, comprising educational seminars and individual consultation/ mentoring sessions. Group seminars offered beneficiaries the opportunity to improve their breeding practices and promote the genetic potential of Greek breeds and their products. Participants were trained in safety, traceability, and quality assurance systems; learned the basic principles of animal husbandry management (feeding, breeding, health and well-being, precision livestock farming); and were also tutored in food processing, marketing techniques and branding.

The conclusion of the theoretical educational aspect (i.e. seminars), was followed by the consultation meetings with certain beneficiaries, selected on the basis of their interest in further personalised training, attendance record and participation, as well as the level of their productive activity. During these personalised consultations, on-site visits to the facilities of the selected beneficiaries were carried out, to advise them on effectively managing their livestock farms, meat and milk processing, as well as the market, to help ensure their financial sustainability.

During the educational trainings, it became apparent that participants would greatly benefit from a handy guide with useful advice for livestock farming. Subsequently, the guide "Basic principles for managing sheep-and-goats farms" was created, a significant initiative and useful tool, available only in Greek here: https://www.afs.edu.gr/dyn/userfiles/files/book_aigoprovata_FINAL.pdf



Livestock farming is difficult. I thought that the THRIVING LAND project couldn't teach me anything inside a classroom. I was wrong; I wish it could go on for another year.

S.D.
Livestock farmer, Serres

The one-on-one consultation sessions in the barn helped me a lot.

Ch.M.
Livestock farmer, Amyntaio

Greek breeds, which have been characterised for the first time with the use of genomic technologies, are joining the elite of cosmopolitan sheep breeds. This effort will highlight the particular characteristics of our indigenous breeds and will help breeders to better exploit their production.

S.M.
Researcher, CERTH

In the context of the **THRIVING LAND** project, CERTH's Institute of Applied Biosciences draw on its expertise and combined information from different scientific fields to study (a) the genetics of Greek sheep breeds and (b) the composition of their milk. The objective was to assist in optimally utilising and capitalising on these breeds.

A total of 216 sheep samples were analysed, gathered from different farms in Northern Greece. The indigenous breeds studied were those of "Serrai", Florina (Pelagonia), Mytilene (Lesbos), and Thrace sheep. The Assaf and Kalarrytiko breeds, on the other hand, were used as reference breeds to investigate genetic differences between breeds and the level of admixture among populations.

The study was conducted with the use of methods based on animal genetic material (DNA) – namely, the simultaneous analysis of thousands of genes that may characterise the origin of each animal and detect possible crossbreeds (admixed populations).

The results of this study revealed that Greek sheep breeds maintain high levels of genetic richness, serving as an important genetic reservoir which can be exploited in genetic improvement breeding schemes so as to upgrade performances of autochthonous populations.

Moreover, with the aim to create new tools to assign animals to their origin and the traceability of their products, a set of molecular markers was identified that can be used for breed identification.

The results of the **THRIVING LAND** project can be applied, in conjunction with the phenotype of the animals (i.e. the observable characteristics of the breed), in the reproductive management of flocks, targeting the improved performances.

In conclusion:

After the completion of the educational and consulting activities, it is estimated that the application of new systems and technologies will lead to more manageable production costs for farming units. In addition, environmental impacts are also expected to decrease thanks to the more effective energy use and optimal waste management.

Moreover, by applying modern food traceability protocols and introducing new, DNA-based technologies in husbandry management, it is possible to create high value-added products. Products carrying a strong brand identity that will protect and benefit farmers and producers, as well as food processors and the overall food industries, while also protecting consumers from possible adulterations.

Cow Farming

Pentalofos (Thessaloniki Regional Unit)

Although in the last few years cow farming has been facing difficulties due to the large increase in production costs, it remains one of the most important sectors of the Greek livestock economy.

Almost half (48.6%) of the cattle population in Greece (*2013 Census*, ELSTAT) is bred in Eastern, Central and Western Macedonia. Among them, Central Macedonia is the Region with the largest number of dairy cattle, 25.7% (*2013 Census*, ELSTAT). Of these, 43.5% are located in the Thessaloniki Regional Unit, which also produces 41.6% of beef meat and accommodates 85.9% of the Greek buffalo population.

Providing support to dairy cattle farming can contribute to the financial sustainability of the farmers active in the sector.

In the context of a holistic action plan implemented in the selected areas, beneficiaries of the cow farming sub-project of **THRIVING LAND** participated in educational trainings and received personalised consultations in key aspects of cattle farming and food processing. Targeted educational seminars addressing these key sectors of primary production were complimented with lessons on marketing and branding techniques. More specifically, the trainings covered the following topics:

- sales, marketing and networking;
- exports legislation;
- global and European distribution channels;
- branding;
- introduction to the assessment of new products;
- basic principles of organoleptic control and tasting.

The conclusion of the theoretical educational aspect (i.e. seminars), was followed by the consultation meetings with certain beneficiaries, selected on the basis of their interest in further personalised training, attendance record and participation, as well as the level of their productive activity. During these personalised consultations, on-site visits to the facilities of the selected beneficiaries were carried out, to advise them on effectively managing their livestock farms, meat and milk processing, as well as the market, to help ensure their financial sustainability.

The project gave me the opportunity to get to know and apply digital applications that are useful for my farm.

S.A.
Livestock farmer,
Pentalofos

Pentalofos

27 EDUCATIONAL TRAININGS

3 PERSONALISED CONSULTATIONS

23

5

BENEFICIARIES

Beneficiaries also had the opportunity to learn the art of dairy farming and cheese making. Lack, however, of practical guides on these subjects led to the creation of the textbook "Cheesemaking," which is available only in Greek here:
https://www.afs.edu.gr/dyn/userfiles/files/book_TYROKOMIA_final.pdf

The purpose of this book was to instruct amateurs how to make quality cheese or yogurt in a small family farm or even a larger dairy farm. Individual chapters contain information about the basics of milk production; techniques in making various cheeses and yoghurts currently produced in Greece; a guide to best hygiene practices in cheesemaking; as well as basic guidelines on pricing.

In conclusion:

Increasing competition in the cow farming sector requires the establishment of modern and well-organised dairy farms with high-yielding cows. Specialised feed, genetic selection and modern breeding techniques, coupled with the application and use of new technologies, can contribute to the development and sustainability of farms.

BEEKEEPING

Drama, Pella, and Kastoria Regional Units

Greece is one of the world leaders in beekeeping. In fact, it has the highest density of beehives amongst all European countries, annually producing 16,000-17,000 tonnes of honey. Greek honey is of excellent quality with distinct characteristics and flavour, mainly due to the country's climate, as well as the rich and varied beekeeping flora.

In addition, honey is considered an agricultural product with great potential on the European market, given that the EU's self-sufficiency in honey production stands at 55.1%. In Greece, the sector employs almost 25,000 beekeepers, who collectively own ca. 1,800,000 hives. The average number of colonies per farm is small, indicating the prevalence of many small holdings, while only about 20% of all beekeepers are considered professionals (meaning they own 150+ beehives per holding).

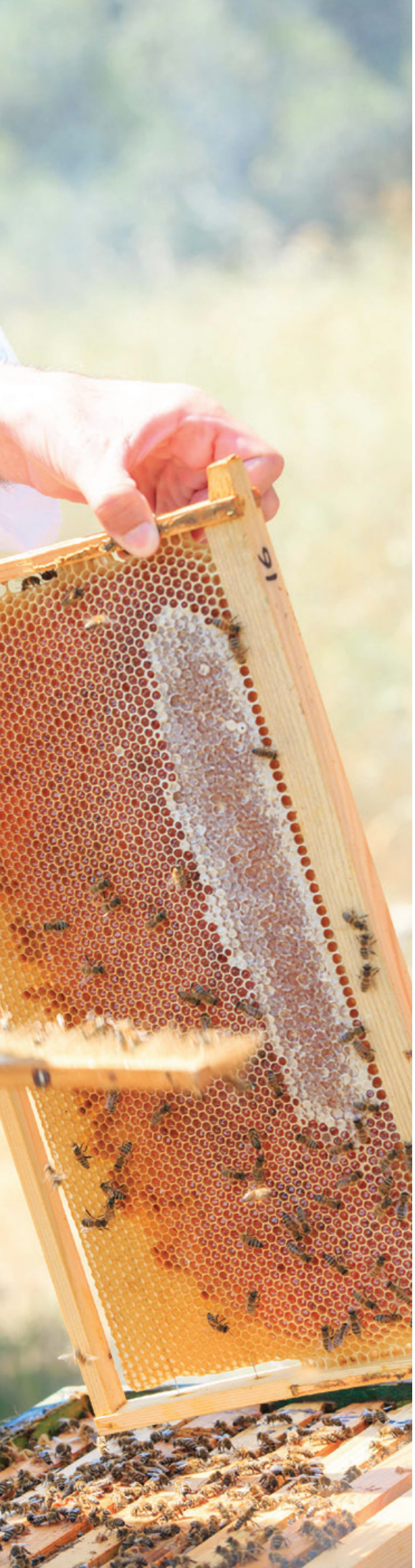
Beekeeping is a primary industry in which one can embark with a small initial capital and without necessarily possessing farmland. For these reasons, engaging in beekeeping in Greece is an alternative way to supplement agricultural income.

The areas for the implementation of this particular sub-project were selected on the basis of attributes that support the further development of beekeeping:

- **Drama:** The area's forest environment offers unique quality "food" for the production of polyfloral forest honey varieties. According to data from the Ministry of Rural Development and Food, about 530 beekeepers are established in the area, 30% of whom are below 40 years of age, while 10-15% are female (Ministry of Rural Development and Food – YPAT, 2019).
- **Pella:** An area with extensive woodland and a growing interest in beekeeping. Native flora includes "Jerusalem thorn" (paliurus spina-christi), a great apiculture plant that blossoms in spring and produces a lot of honey, with a light colour and a strong flavour.
- **Kastoria:** The area offers favourable conditions for organic beekeeping, thanks to the wide variety of wildflowers, trees, herbs and aromatic plants.

Honey aside, there are also other beekeeping products, the production of which is of particular financial interest. These include royal jelly, pollen, propolis and beeswax, i.e. by-products that can be utilised in pharmaceuticals and cosmetics, as well as foodstuff. Moreover, beekeeping can also serve act as a leisure activity for visitors to beekeeping areas in search of alternative experiences.

For all the above reasons, honey and beekeeping products were selected to be supported in the context of **THRIVING LAND**. Moreover, as specialised and continuous training is a key prerequisite for actively engaging in beekeeping and becoming professional in the sector, the beekeeping educational sub-project was designed to offer local residents the opportunity to acquire the necessary knowledge.



BEEKEEPING

Drama

- 22 EDUCATIONAL TRAININGS
- 4 PERSONALISED CONSULTATIONS

66 BENEFICIARIES

9 BENEFICIARIES

Pella

- 31 EDUCATIONAL TRAININGS
- 3 PERSONALISED CONSULTATIONS

123 BENEFICIARIES

5 BENEFICIARIES

Kastoria

- 40 EDUCATIONAL TRAININGS
- 8 PERSONALISED CONSULTATIONS

125 BENEFICIARIES

22 BENEFICIARIES

BEEKEEPING AND TOURISM

Drama

- 6 EDUCATIONAL TRAININGS

19 BENEFICIARIES

Pella

- 6 EDUCATIONAL TRAININGS

22 BENEFICIARIES

Kastoria

- 6 EDUCATIONAL TRAININGS

24 BENEFICIARIES

The courses were designed to meet the needs of three different groups:

- beginner/amateur beekeepers;
- professional beekeepers;
- professionals interested in honey-related tourist activities.

The first group attended courses on bee biology and feed, the handling of bees during the year, as well as how to deal with bee diseases and other challenges.

Active beekeepers were able to enrich their knowledge by attending theoretical and practical courses on bee diseases, their feeding system, production methods for queen bees and royal jelly, quality assurance systems, basic marketing principles, and the development of beekeeping-based products.

In parallel, representatives of tourism enterprises were informed about how to integrate beekeeping-related activities into their services. They also received training in the new trends in alternative and sustainable tourism, creating exciting visitor experiences (culinary tourism, ecotourism), developing new products within the tourism sector, networking skills, and funding opportunities.

As part of the educational training, two guides were created:

"A beekeeper's first steps," available only in Greek here:
https://issuu.com/afs12/docs/book_____low

"Honey in the local economy from antiquity to the present day," available only in Greek here:
https://www.afs.edu.gr/dyn/userfiles/files/book_ΜΕΛΙΣΣΟΚΟΜΙΑ_FINAL.pdf

The first guide was addressed to for beginner beekeepers, containing information about a fully operational apiary, relevant legislation, number of hive members, and the division of work within the hive. Having attended the beekeeping seminars and using this guide, novice beekeepers should be able to further seek advice and solutions on swarming, what kind of apiculture products they can produce, necessary activities that should be performed during the year, information on Greece's main apiculture plants and, finally, familiarise themselves with the rich photo annex. The second book discusses the history and tradition of honey, its role in human diet, and concludes with the presentation of 32 recipes for desserts and main courses.

Results:

By putting into practice the knowledge acquired during the educational trainings, project beneficiaries –both beginner and professional beekeepers–, managed to increase the number of their hives and/or their production. Furthermore, in Kastoria the beekeepers established their own cooperative, while entrepreneurs of the tourism sector introduced honey-based recipes and initiatives to promote local products.

With the help of our instructor, I learned to identify the qualities that local plants can bring to my honey.

P.G.
Beekeeper, Kastoria

The consultation I received from the project kick-started a new endeavour of making new honey-based products.

E.H.
Beekeeper, Pella

All of this has been a great motive for me to approach more professionally my occupation with beekeeping.

M.G.
Beekeeper, Pella

OLIVES AND OLIVE OIL

Makri, Maroneia (Evros and Rodopi Regional Units)

Greece is the world's third largest producer of olive oil and the fifth largest producer of table olives (International Olive Council, FAO). However, cases of olive oil adulteration are frequently being recorded. In order to address adulteration, it is required for both olives and olive oil to be fully characterised, at both the genetic and biochemical level. Also important is to be able to issue certificates of Protected Designation of Origin (PDO) for different varieties (Agrimonti and Marmiroli, 2019).

The geographical extent of the **THRIVING LAND** project made it possible to characterise a special variety of olives cultivated in the Evros and Rodopi Regional Units. This is the Makri Olive, which produces olive oil of excellent quality. However, because of the small scale of olive cultivations in the wider area, and the significant distance from large and well-known olive production zones, this particular agricultural activity has not yet grown to fulfil its potential. Hence, the innovation of this particular sub-project lies in the characterisation of the particular variety as a product of high added value, which will strengthen the identity of the local olive oil.

Olive trees are widely cultivated in Greece, in the mainland and the islands, in mountainous and lowland areas, producing many different varieties. The variety growing in Thrace (in the Makri and Maroneia areas, of the Evros and Rodopi Regional Units respectively), is 100% native and exhibits excellent quality characteristics, in both its forms – table olives and olive oil. Recently, the reputation of the Makri/ Maroneia olive oil has been spread abroad, as they have won many medals and awards at international competitions.

The olive growers of Makri and Maroneia believe that olive trees cultivated in the area belong to two distinct varieties:

- Trees cultivated in Makri, between the communities of Chili and Dikella, are thought to belong to the Makri olive variety, which is a native Greek variety producing medium-sized fruit, round and green, that blacken during ripening. The olive oil produced from these trees is of medium intensity, with delicate and fruity aromas. Local producers are in the process of obtaining a PDO certificate for their native Makri olive variety.
- Trees cultivated in Maroneia, to the west of Makri, belong – according to local olive growers– to the Maroneia (or "Maronitiki") olive variety, which is listed in the Greek national catalogue of varieties. The "Maronitiki" olive is related to the Thassos olive and is particularly resilient to cold weather. The fruit of the "Maronitiki" and Makri olive trees are morphologically similar, while the qualitative characteristics of the olive oil from them are also comparable.

Seeking to further highlight these qualitative characteristics, CERTH –as part of its contribution to the **THRIVING LAND** project– collected samples and compared olive trees from the areas of Makri and Maroneia, at the genetic and biochemical level of the extracted olive oil. The "Koroneïki" and "Chondrolia" (from Chalkidiki) olives were used as reference varieties and the genetic analysis was conducted as per established protocols in the distinction between olive varieties.

Results demonstrated that the "Koroneïki" and "Chondrolia" reference varieties are clearly distinct to the olive samples collected

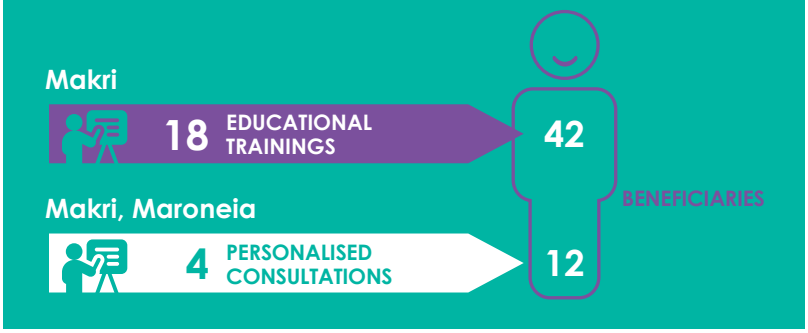
Such an initiative was necessary, because many farmers are neither appropriately trained nor properly counselled. Thanks to this seminar, myself and other people from my village organised an initiative of our own, focusing on our specific needs.

V.A.
Farmer,
Nea Petra, Rodopi

For the first time, olive trees of the area were genetically identified, helping produce olive oil with higher quality characteristics, while highlighting the beneficial properties of olive oil

N.M.
Researcher, CERTH

OLIVES AND OLIVE OIL



from the Evros and Rodopi Regional Units, which were classified as a single variety. Therefore, contrary to collective beliefs among olive growers in the two areas, the DNA analysis showed no difference between the local olive trees. On the contrary, certain samples from Makri and Maroneia had identical genetic profiles, while entire fields from the two areas were very similar.

Moreover, the biochemical analysis of olive oil extracted in the areas of Makri and Maroneia found that locally produced olive oil is rich in phenols and unsaturated fatty acids, i.e. rich in antioxidants and beneficial fats, with the Maroneia olive oil identified as having a higher total polyphenols content.

The biochemical analysis of fatty acids and phenolic compounds did not reveal any significant differences between olive oil produced in the two areas. In conclusion, the genetic background of the olive trees from Makri and Maroneia was found to be identical, while the differences observed in the olive oil are not systematic and largely attributed to the different method of extraction employed by each producer.

During the implementation of the **THRIVING LAND** project and in collaboration with the olive growers of the area, educational trainings were carried out covering all kinds of practices regarding olive cultivation, as well as the post-harvest handling of olive fruit and the production of olive oil itself. More specifically, primary production seminars focused on soil management, fertilisation, irrigation, plant protection and harvest management, environmental protection and safety, personnel safety, and basic economic principles. Also discussed were topics related to the standardisation and/or processing of table olives and olive oil, the legislation applying to said standardisation, and to food safety.

Given the great value of local olives and the requirements supporting the sustainability of producers, the American Farm School drafted a dedicated textbook for olive growers, containing instructions on best practices regarding olive cultivation. This textbook, entitled "Olive," is available only in Greek here:
https://www.afs.edu.gr/dyn/userfiles/files/book_ελιά_low.pdf

In conclusion:

Olives and olive oil from Makri and Maroneia in Evros are award-winning products of excellent quality. They present potential for export as products bearing a strong identity and contribute to the prosperity of the local rural population. It's certain that the knowledge acquired by producers during both the theoretical courses and individual trainings will enhance the olive production sector in the area.

BEANS

Argos Orestiko (Kastoria Regional Unit)

The cultivation of beans in Greece ranks second, only surpassed by grain. Beans are a foodstuff of high nutritional value because of their ingredients – mainly protein, which can represent up to 25% of their total weight. They are also rich in fibres, have a very low content in fats, low glycaemic index, and are rich in trace elements and iron, as well as in B vitamins.

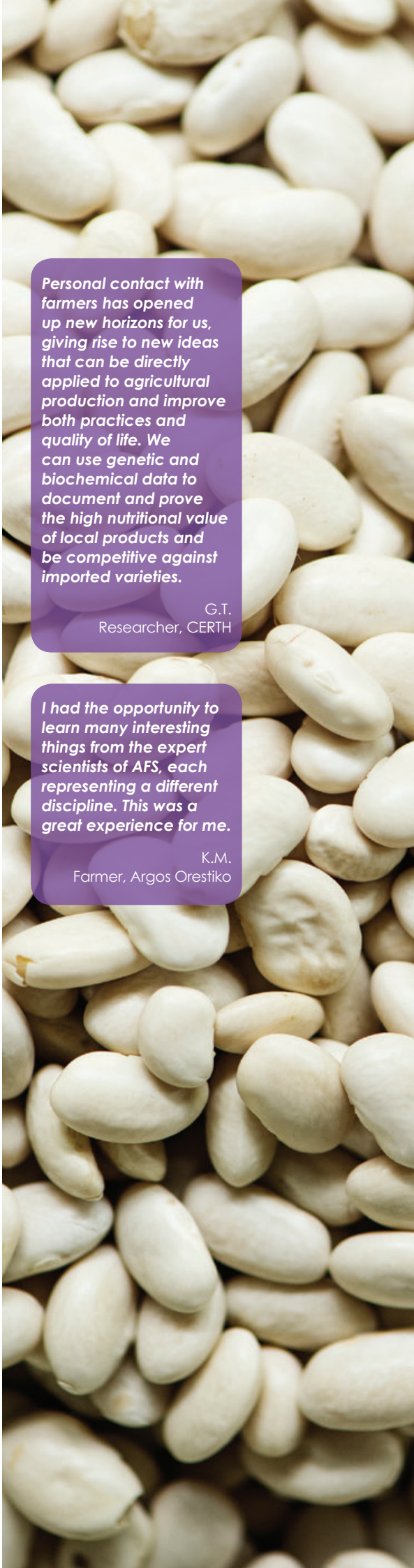
The Western Macedonia Region is a major producer of high-quality dry beans, thanks to its excellent continental climate and suitable soil conditions. Western Macedonia produces approximately 50% of Greek beans, while the Kastoria Regional Unit alone accounts for 22% of Greece's total acreage of bean cultivations. Kastoria beans are very popular and highly appreciated in Greek cuisine, thanks to their unique organoleptic characteristics.

Although Kastoria beans have been classified as Protected Geographical Indication (PGI) products, bean growers are facing problems with the quality of genetic material (seed quality and plant yield), as well as product adulteration. This is because imported beans of inferior quality are often fraudulently sold as "Kastoria beans" to cash in the added value of the product's PGI designation. In other words, both "giant" and "flat" Kastoria beans are targeted by those in the pulses market, as just a mere reference to Kastoria as place of production serves as a guarantee of quality and credential for dry beans.

A total of 134 samples of beans from 21 different cultivations in the area of Kastoria were studied. Of these samples, 72 were of the "giant" beans variety and taken from 12 crops, while 62 belonged to the "flat" beans variety and originated from 9 crops. Their genetic analysis was performed using the ISSR (Inter Simple Sequence Repeats) molecular markers, while proteins, dietary fibre and sugars were measured in a 100 gr beans/crop mixture.

Genetic analysis highlighted the diversity of the "giant" and "flat" varieties, as well as the genetic variety of each area. More specifically, the "flat" bean samples were more homogeneous and were grouped according to their crop of origin. The only exception regraded certain samples from the area of Melissotopos, in which genetic homogeneity was even higher. This demonstrates that the same product may be cultivated in the same area, yet there may be genetic differences – even from crop to crop. The same pattern was even more evident in the case of the "giant" variety, as this variety of beans showed greater genetic diversity and was segregated by crop. The findings of genetic analysis further highlight the need to create a genetic identity for these varieties of beans, as this distinct identity will protect the designation of origin and can enhance local varieties' brand name.

Biochemical analysis showed that "giant" beans were slightly richer in dietary fibre and richer in protein than "flat" ones. In addition, they also contained fewer sugars, which renders them ideal for low glycaemic diets.

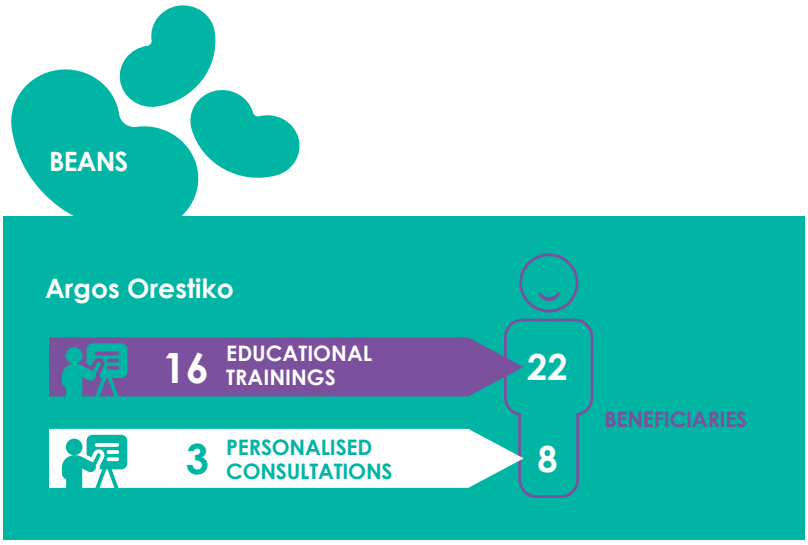


Personal contact with farmers has opened up new horizons for us, giving rise to new ideas that can be directly applied to agricultural production and improve both practices and quality of life. We can use genetic and biochemical data to document and prove the high nutritional value of local products and be competitive against imported varieties.

G.T.
Researcher, CERTH

I had the opportunity to learn many interesting things from the expert scientists of AFS, each representing a different discipline. This was a great experience for me.

K.M.
Farmer, Argos Orestiko



The scientific analyses performed are expected to create a protective shield around the very unique, Kastoria dry bean. A shield that will allow bean growers to produce a certified product that is protected from adulteration, thus further establishing the brand name of the Greek Kastoria bean varieties.

As regards the educational aspect of the project, the seminars covered bean cultivation, as well as soil management, climate and environmental conditions, machinery, plant protection, organic production and integrated management, energy management, irrigation and fertilisation, environmental and personnel safety. Topics related to marketing, basic economics, legislation, certification standards (HACCP, ISO), and packaging were thoroughly discussed.

In the context of the project, the American Farm School drafted the relevant textbook "Pulses", available only in Greek here: https://www.afs.edu.gr/dyn/userfiles/files/book_όσπρια_low.pdf

In conclusion:

Beans are a key product for the Kastoria area and greatly affect the prosperity and income of the local rural population. Hence, preserving their quality and equipping local growers with knowledge and expertise, could guarantee their future success and achievement of greater added value. Which in turn would contribute to the sustainability of their holdings and enhance the local agricultural economy in its entirety. By applying the new knowledge and skills acquired in the trainings and by combining them with the use of modern technologies and innovative applications, producers increase their own prospects of viability and progress.

MEDICINAL AND AROMATIC PLANTS (MAPS)

Komotini (Rodopi Regional Unit), Thessaloniki Regional Unit, Ptolemaïda (Kozani Regional Unit)

Medicinal and aromatic plants (MAPs) have been used in Greece since the antiquity and in recent years have aroused the interest of both the scientific and commercial world. Their properties render them unique, which is why they have multiple uses and applications as beverages, spices, pharmaceuticals, cosmetics, etc. These plants do not require any particular conditions for their growth and can be used to maximise the yield of small and relevantly infertile land, with very good financial results.

Greece is one of the world's richest countries when it comes to the biodiversity of native aromatic plants, some of which thrive exclusively on Greek soil. The cultivation of aromatic plants represents 4.5% of overall agriculture in Eastern Macedonia and Thrace, 22.4% of Central Macedonia and 22.5% of the total cultivated land in Western Macedonia. In each of the aforementioned Regions a group of **THRIVING LAND** beneficiaries was established, as all three of them account for about half (49.4%) of the country's total acreage dedicated to the cultivation of MAPs (Greek Payment Authority of Common Agricultural Policy Aid Schemes – OPEKEPE, 2019).

The MAPs sector presents increased export potential and can contribute to the growth of the local economies of mountainous, poor areas, increasing the prospects of both the primary and manufacturing sector. The genus *Sideritis* or mountain tea, for example, is known from the antiquity and traditionally used as a fortifying beverage to fight common cold and gastrointestinal discomfort. Its particular chemical composition has graced *Sideritis* with a wide range of medicinal qualities: antioxidant, antimicrobial, anti-inflammatory, anti-neurodegenerative, etc.

The genus *Sideritis* grows in the Mediterranean basin and ca. 150 species have thus far been recorded, of which 17 are native to Greece. The most prevalent amongst these 17 varieties are *S. perfoliata subsp. athoa* (known as Vlach tea), *S. clandestine* (known as Mt. Taygetus tea), *S. scardica* (known as Mt. Olympus tea), *S. raeseri* (known as Mt. Parnassus tea), *S. syriaca* (known as "malotira"), and *S. euboea* (known as Euboea –or Evia– tea). Sideritis plants grow wild in the mountains and only certain species may be cultivated.

In the context of the **THRIVING LAND** project, CERTH's scientists studied the native Sideritis species. Their first goal was to biochemically and genetically characterise them, with the ultimate objective being to select strains with superior characteristics, in order to produce tea with the desired medicinal properties.

A total of 44 samples of Sideritis from the wider area of Rodopi were studied. These belonged to the *S. perfoliata sub athoa, S. scardica, S. raeseri, S. syriaca and S. athoa* varieties. Their genetic analysis was performed using the ISSR (Inter Simple Sequence Repeats) molecular markers, while total polyphenols and flavonoids, antioxidant capacity, amino acids, terpenes, phenolic acids and trace elements were also measured.

The genetic analysis of the Sideritis plants yielded valuable information on the genetic origin of the species, as well as on the genetic identity of each individual species. Biochemical analysis showed that the native and cultivated species of Sideritis in Greece are rich

[This was] An integrated educational project. During the personalised training, I became aware of my problems and discovered my own opportunities for growth.

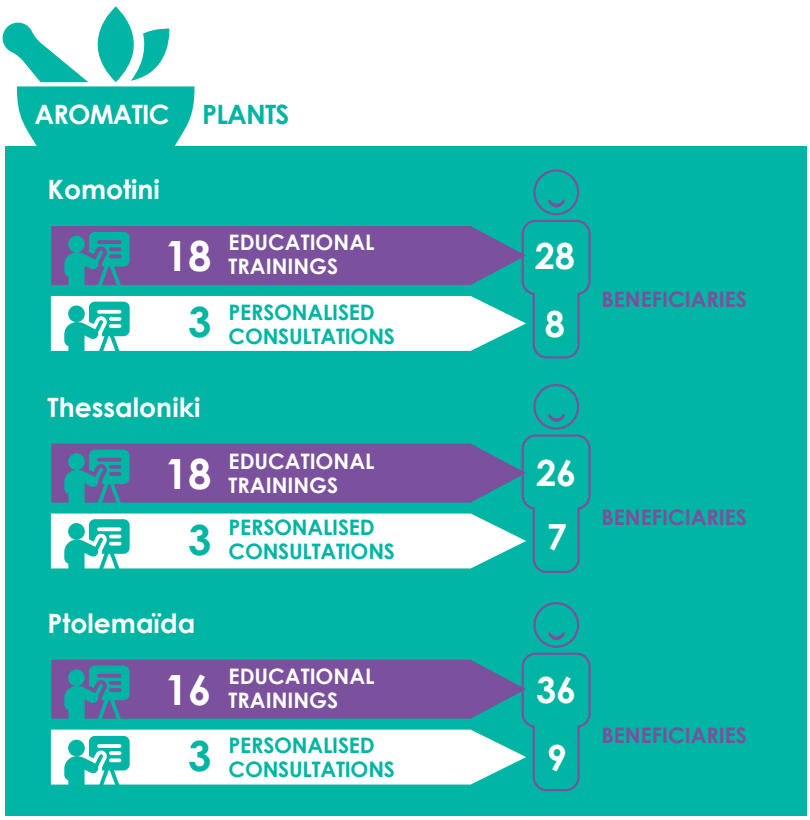
I.G.
Farmer, Ptolemaïda

[We attended] Targeted educational trainings, coupled with an awareness of the real economy.

A.S.
Processor, Kozani

The gap between primary production and research was bridged, by introducing Siderite plants with their own 'identity,' The results highlight the unique profile of the species growing in the wider area and are expected to improve cultivation and increase their commercial value.

F.T.
Researcher, CERTH



in elements with potential medicinal effects, while the profile of said elements was largely influenced by geography and location.

These scientific analyses are expected to enhance the production and business of Sideritis producers, as well as the overall local economy. By cultivating fully characterised strains of the plant, they can now market products with a strong local identity that highlights the specific characteristics of each species. Moreover, now aware of the bioactive elements released in the infusion process of plant leaves, they can create specific blends of teas/beverages for consumers, thus improving commercial targeting of their final product.

Educational trainings, in addition to the topics mentioned at the beginning of the chapter, covered subjects such as basic economic principles, creating a business plan, pricing, drying and infusion, food safety with an emphasis on standardisation and processing facilities, legislation and certification standards (HACCP, ISO), as well as the final products of MAPs cultivation.

Greece-produced medicinal and aromatic plants have an undeniable potential. As opportunities abound, a textbook describing the characteristics of the main MAPs, as well as relevant cultivation techniques, has been drafted. The textbook is available only in Greek here: https://www.afs.edu.gr/dyn/userfiles/files/book_αρωματικά%20φυτά_low.pdf

In conclusion:

MAPs constitute a branch of agricultural production that has emerged in recent years as a dynamic cultivation with many advantages in unsaturated markets. MAPs present a viable agricultural solution, especially in mountainous and less fertile areas, thus enabling farmers to make the most out of land deemed unsuitable for other kinds of cultivation. In addition, they may be marketed in various sectors – including food and other industries– and perform very well as export products. Project beneficiaries acquainted themselves with all aspects of cultivating, processing, and marketing MAPs. The integration of this knowledge into their everyday practice is expected to give them the extra push needed to successfully enter and conquer the relevant markets in both Greece and abroad.

FRUIT TREES

Pyrgoi (Kozani Regional Unit), Skydra (Pella Regional Unit)

The cultivation of fruit trees is one of Greece's most important agricultural sectors, with consistently high annual export levels and a well-developed processing activity.

Each area in Greece, depending on its microclimate, produces distinct fruit varieties of excellent quality. The Regional Units of Imathia and Pella account for 72% and 88%, respectively, of the country's total acreage used for growing table stone and clingstone fruits. More specifically, the area of Skydra is famous for peaches and other stone fruits, as well as for clingstone fruits often processed to make excellent compotes. The mountains around Eordaia are known for the cultivation of excellent quality pome fruits. Indeed, the cultivation of such fruit in the area occupies 9,060 stremma out of a total of 25,930 stremma of land cultivated in the entire Western Macedonia Region (i.e. amounting to ca. 35%). Local apples are known for their crispness and rich aromas and are therefore popular among consumers.

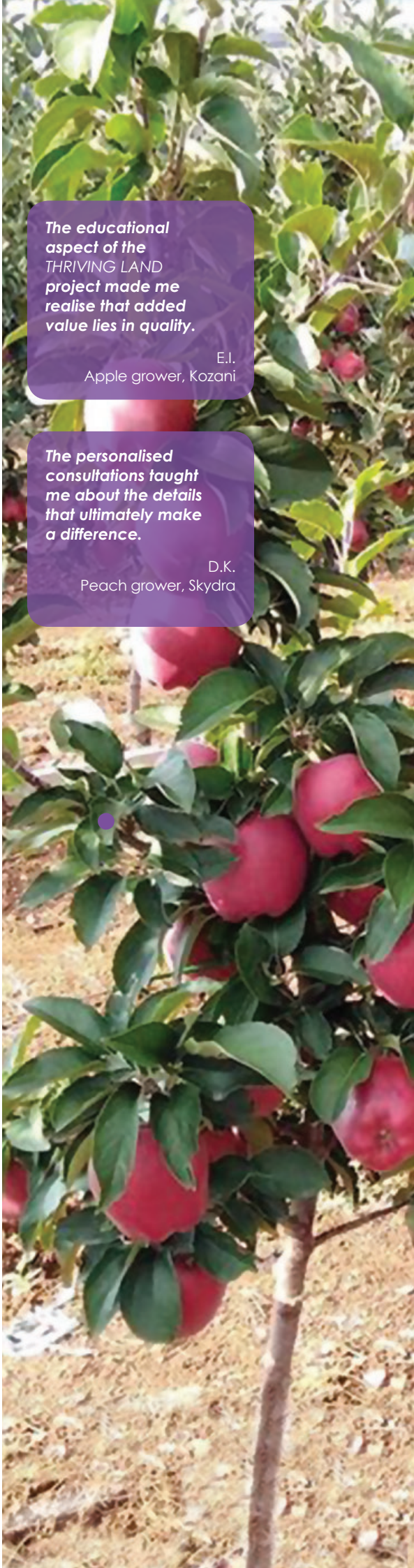
The educational trainings held in these areas covered a variety of issues, emphasising on the environmental footprint and modern management systems, creating business plans, as well as basic economic principles.

Acknowledging the needs of local producers, the American Farm School drafted a textbook on the cultivation of fruit trees, incorporating the most up-to-date and innovative methods.

The guide is available only in Greek here:
https://issuu.com/afs12/docs/book_____low

In conclusion:

Fruit growing is one of Greece's most dynamic agricultural export sectors. Supporting farmers by providing them with advanced expertise, is expected to enhance the potential of the sector, while also increasing the added value of products. By applying the knowledge learned through their participation in the project, producers are anticipated to better address the needs of their cultivations and increase productivity and performance – in both growing and selling their products.

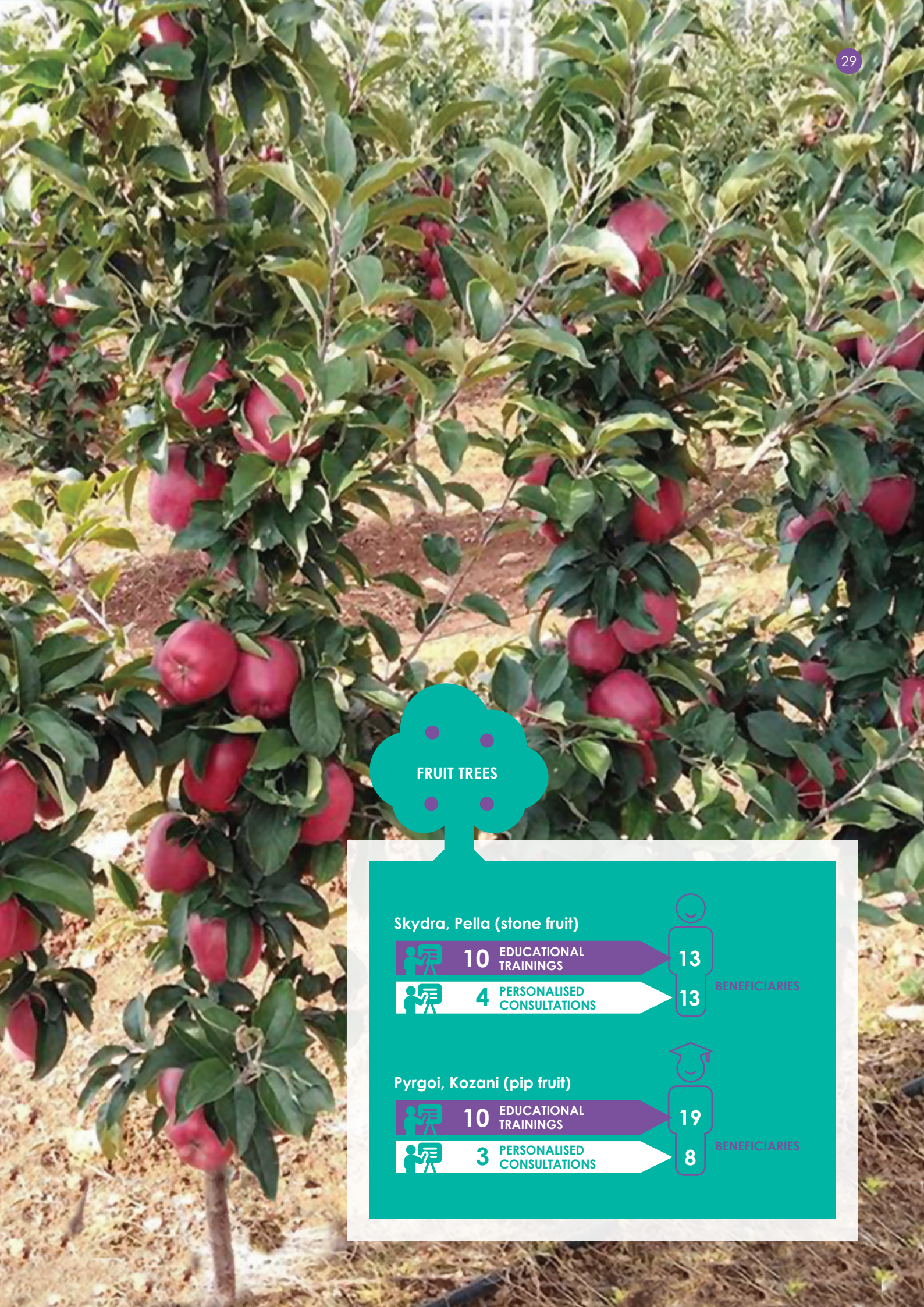


The educational aspect of the *THRIVING LAND* ***project made me realise that added value lies in quality.***

E.I.
Apple grower, Kozani

The personalised consultations taught me about the details that ultimately make a difference.

D.K.
Peach grower, Skydra



FRUIT TREES

Skydra, Pella (stone fruit)

- 10 EDUCATIONAL TRAININGS
- 4 PERSONALISED CONSULTATIONS

13 + 13 BENEFICIARIES

Pyrgoi, Kozani (pip fruit)

- 10 EDUCATIONAL TRAININGS
- 3 PERSONALISED CONSULTATIONS

19 + 8 BENEFICIARIES

PEPPERS

Karatzova (Pella Regional Unit) and Florina Regional Unit

Many varieties of pepper are cultivated in Greece – each with particular characteristics, depending on the soil and climate of the cultivation areas. Among them are the pepper varieties Florina and Karatzova, which originally grew in Florina and Aridaia, respectively. These two varieties have greatly contributed to the local economic development of these areas. In fact, Florina peppers have been classified as a PDO (Protected Designation of Origin) product, are being exported in many countries, and are particularly popular in Europe thanks to their special organoleptic characteristics. However, exactly due to this success, many pepper varieties cultivated in Greece are being labelled as "Florina-type" or "Karatzova-type," yet without possessing the requisite characteristics. This happens largely because the genetic identity of the varieties, needed to protect the designation of origin, has not been created.

In the context of the **THRIVING LAND** project, the Florina and Karatzova pepper varieties were genetically and biochemically analysed to create their unique genetic identity. A total of 127 samples were collected from 18 crops: 60 samples of Karatzova peppers from 6 crops in Aridaia and 67 samples of Florina peppers from 12 crops. Of the 67 samples of Florina peppers, 40 came from 5 crops in the area of Florina and are thus considered to represent the traditional variety, while 27 originated from Drama; because in the area of Drama, according to local producers, a special type of Florina pepper is cultivated with higher yields, larger fruit size and thicker flesh, used mainly in canning.

The genetic analysis of the samples clearly differentiated the Florina variety from the Karatzova one. In addition, the Florina samples originated from Florina were also differentiated from the Florina-type samples from Drama. Specifically, Florina peppers were identified as more polymorphic compared to the Karatzova ones. In addition, Florina-type samples from Drama demonstrated great homogeneity.

The biochemical analysis of the samples also showed differences between the two varieties. Florina peppers yielded 7 times more phenolic compounds, which contribute to the antioxidant properties of peppers, as well as higher fructose and glucose levels than all other peppers. That ranks them first in sweetness properties. They also had the highest levels of dietary fibre. Florina-type peppers from Drama also had very high phenolic compounds, indeed at higher levels than traditional Florina peppers. Their sweetness, however, was found to be lacking compared to the Florina proper peppers, similar to the sweetness levels of Karatzova peppers. The percentage of dietary fibre was marginally lower than the traditional Florina peppers. Lastly, Karatzova peppers had twice as much lycopene as the other varieties but yielded the least phenolic compounds. Their sweetness and dietary fibre levels were similar to those of Florina-type peppers.

In conclusion:

The scientific analyses conducted in the context of the **THRIVING LAND** project are expected to enhance the production of different varieties of local peppers, as well as the local economy in general; this should come as a result of the specific characteristics of each variety being identified and featured, thus creating a protection shield for PDO products.

New framework for cooperation has been established between the primary sector and the scientific community, highlighting historical pepper varieties that are coming back to our table, now with a complete genetic and biochemical profile that can help designate these varieties as PDO.

E.M.
Researcher, CERTH

They believed in us. They supported us scientifically and financed our entire processing line. And the way we work has changed dramatically.

A.A.
"Genisea" cooperative

SUGAR CANE AND ITS PRODUCTS

Genisea (Xanthi Regional Unit)

The cultivation of sugar cane is neither unfamiliar or new to Greece. On the contrary, sugar cane used to be cultivated in various areas around the country but was gradually abandoned. The women's cooperative "Genisea" revived this crop, having secured seed from Trabzon in Pontus.

Their goal was to produce traditional sugar cane molasses. Starting with the cultivation of sugar cane, the pressing and baking of the juice, packaging and standardisation, they end up with a final product called "petimezi".

"Genisea" was supported by specialised staff of the American Farm School with field visits and trainings organised for members of the cooperative. Great emphasis was placed on standardising production processes.

Two main aspects of support were defined and applied. The first one concerned the modernisation of production machinery. In the context of the **THRIVING LAND** project, the cooperative was equipped with sugar cane processing tools, as well as laboratory-grade measuring instruments. Special machinery for the post-harvest processing of sugar cane was also installed, improving the quality of the end-product and saving many man-hours of work. Thanks to precise measurements, the quality of the product could now be standardised and ensured, thus achieving product stability and an extended period of safe consumption.

The second aspect of work involved activities to enhance the level of expertise among the members of the cooperative. Topics on food technology, hygiene and safety were discussed, and necessary trainings were conducted to achieve and certify the high quality of the final products.

Staff were also trained on basic economic principles, while a study on pricing was also drafted. In parallel, the study "*Competition and Sales Organisation Survey*" was conducted and delivered for use to the cooperative. With the help of prominent chefs, 10 innovative recipes were developed for new products incorporating "petimezi." Given all the above, the cooperative has now been enabled to become more competitive in the market, while also equipped with recipes for the development and promotion of new products, thus expanding its portfolio and potentially claiming a larger market share.

A textbook on food processing, preservation and standardisation was also prepared and delivered to the members of the cooperative – a useful guide aiming to optimise the final product.

In conclusion:

Upon the conclusion of **THRIVING LAND**-related activities in Genisea, the members of the local cooperative have acquired new production possibilities, combining tradition with modern expertise. They have also developed new skills and been offered the tools to seek better prospects in the market – on the shelves of delicatessen stores in both Greece and abroad.

I sowed my cotton at the optimal time and with absolute certainty [about the results], thanks to the knowledge of soil conditions during the time of my interest.

F.A.
Farmer, Rodopi

I can now be aware of what's going on in my vineyard, any time.

D.M.
Agronomist/grower, Xanthi

LoRa (Long Range) Intelligent Agriculture System

Eastern Macedonia-Thrace, Central Macedonia and Western Macedonia

Agriculture 4.0, or "intelligent agriculture", is now a reality. Professionals of the agri-food sector perform much more efficiently in their agricultural work when timely afforded all available information, in terms of both quantity and quality. To that end, the American Farm School developed and installed a telecommunications system that covers extensive parts of the cultivated areas throughout Northern Greece, from northern Evros in the east to the Prespes area in the west.

The areas where the **THRIVING LAND** project was implemented largely constitute farmland with a high concentration of large cultivations and can significantly benefit from the technological support offered to the production process. To that effect, thirty base antennas (gateways) and sensors cover the entire length of the pipeline route, offering digital interconnection and remote monitoring of land parcels, livestock units, manufacturing facilities and vehicles.

The Long Range (LoRa) technology applied, allows for the remote interconnection of various sensors, providing free and openly accessible information on soil-related and meteorological parameters of cultivated areas, in real time, with the use of modern applications (apps) for mobile phones, tablets and computers. For example, each participating producer can access, in real time, accurate data on soil moisture, and accordingly and safely plan their irrigation activities.

With the potential to support more than 30,000 interconnected devices, this system is an important step forward and a true legacy to all those involved in the agri-food and supply chain; as it provides technological solutions to primary production needs, standardisation and processing facilities, and transport.

Thus, the THRIVING LAND project also becomes an important factor in the transition of the Greek agri-food sector to the digital era, having already built the basic infrastructure for the expansion of precision agriculture applications across a large geographical area.

*Picture: **THRIVING LAND** LoRa coverage map*

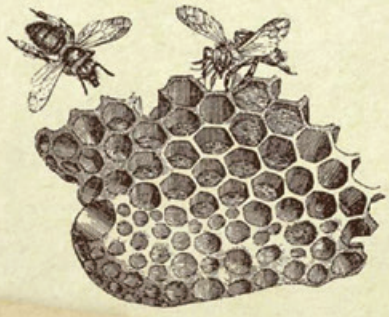
ΔΡ. ΗΛΙΑΣ ΚΑΛΦΑΣ

ΑΡΩΜΑΤΙΚΑ ΦΥΤΑ

ΑΜΕΡΙΚΑΝΙΚΗ ΓΕΩΡΓΙΚΗ ΣΧΟ

ΑΘΑΝΑΣΙΟΣ ΠΑΠΑΔΟΠΟΥΛΟΣ

ΤΑ ΠΡΩΤΑ ΒΗΜΑΤΑ ΕΝΟΣ ΜΕΛΙΣΣΟΚΟΜΟΥ



ΡΙΚΑΝΙΚΗ ΓΕΩΡΓΙΚΗ ΣΧΟΛΗ

ΔΡ. ΧΡΥΣΟΒΑΛΑΝΤΟΥ ΑΝΤΩΝΟΠΟΥΛΟΥ - ΔΡ. ΗΛΙΑΣ ΚΑΛΦΑΣ

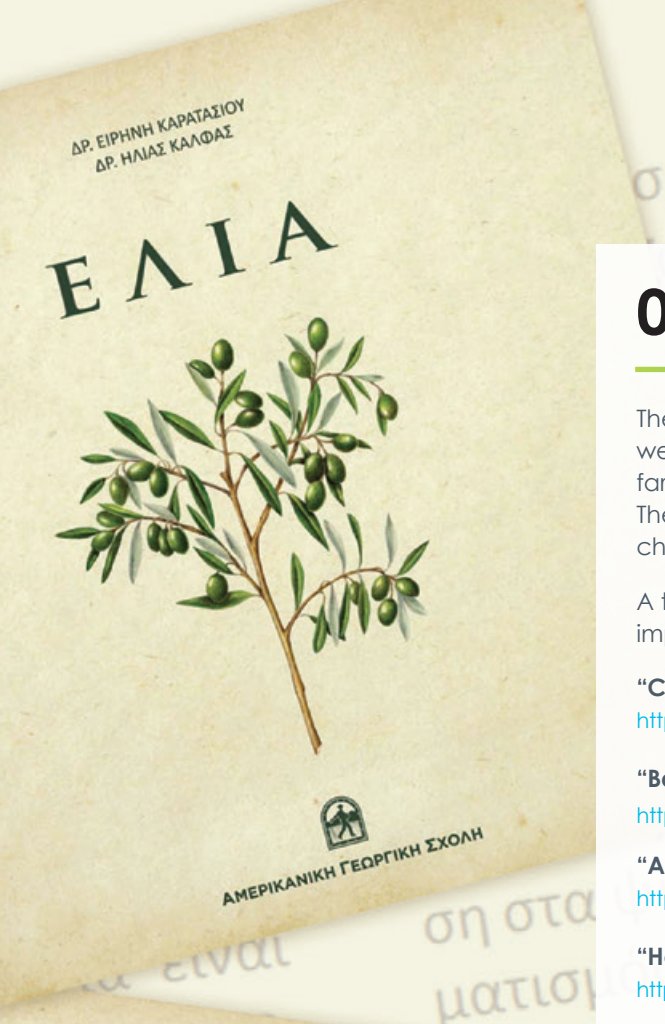
ΠΡΑΚΤΙΚΕΣ ΚΑΛΛΙΕΡΓΕΙΑΣ ΚΑΡΠΟΦΟΡΩΝ ΔΕΝΤΡΩΝ

ΑΜΕΡΙΚΑΝΙΚΗ ΓΕΩΡΓΙΚΗ ΣΧΟΛΗ

ΔΡ. ΗΛΙΑΣ ΚΑΛΦΑΣ

ΑΡΩΜΑΤΙΚΑ ΦΥΤΑ

ΑΜΕΡΙΚΑΝΙΚΗ ΓΕΩΡΓΙΚΗ ΣΧΟΛΗ



05 Textbooks

The textbooks drafted in the context of the **THRIVING LAND** project, were prepared to meet the needs of an extensive category of farmers and livestock breeders who participated in the trainings. They constitute an important legacy and are available, free of charge, to the public.

A total of eight (8) textbooks were created as part of the project's implementation, available only in Greek in the links below:

"Cheese making"
https://www.afs.edu.gr/dyn/userfiles/files/book_TYROKOMIA_final.pdf

"Basic principles for managing sheep-and-goats farms"
https://www.afs.edu.gr/dyn/userfiles/files/book_aigoprovata_FINAL.pdf

"A beekeeper's first steps"
https://issuu.com/afs12/docs/book_____low

"Honey in the local economy from antiquity to the present day"
https://www.afs.edu.gr/dyn/userfiles/files/book_ΜΕΛΙΣΣΟΚΟΜΙΑ_FINAL.pdf

"Olive"
https://www.afs.edu.gr/dyn/userfiles/files/book_ελιά_low.pdf

"Pulses"
https://www.afs.edu.gr/dyn/userfiles/files/book_όσπρια_low.pdf

"Aromatic plants"
https://www.afs.edu.gr/dyn/userfiles/files/book_αρωματικά%20φυτά_low.pdf

"Fruit Trees"
https://issuu.com/afs12/docs/book_____low

06 Looking forward

Educational opportunities – Digital agriculture

Following the completion of the LoRa telecommunications network, funded by the **THRIVING LAND** project, the agriculture of Northern Greece, and especially the areas along the route of the TAP pipeline, can take advantage of the fact that they are now amongst the most advanced European regions in terms of technological coverage. At the same time, they can design and implement activities formerly impossible due to their prohibitive cost.

The innovation of the project can be summarised in the possibility offered to producers to connect to the network and remotely receive their data of interest. This enables them to have a good overview of the conditions prevailing in their cultivations. Understanding the utility of intelligent systems and training producers in the use of these systems should, therefore, be primary objectives for both local communities and scientists.

Scientific organisations now have the capability to conduct large-scale studies through applied research. And the results can be directly assessed and utilised by the actual value chain actors in the real economy.

All of the above allow local producers to strategically plan their production and redesign their processes and goals, adapting to contemporary needs and requests. For example, they could plan the production of "green products," in order to gain a foothold in, yet demanding, but also very attractive markets.

Undoubtedly, the extensive LoRa network, which offers true coverage of hundreds of thousands of farmland acres, constitutes a comparative advantage for producers in Northern Greece and a driver for the further development of the entire agri-food and supply chain.

Benefits of CERTH research

In the context of the **THRIVING LAND** project, producers were given for the first time the opportunity to have their products fully characterised with the use of multiple scientific methods; thus, being able to highlight the uniqueness of their production throughout comparative studies.

Combining the results acquired from scientific analyses and the activities of the **THRIVING LAND** project in the studied species, economy in local communities is enhanced alongside with the entrepreneurship of breeders and producers through the promotion of the unique characteristics of their production. As an example, the genetic and biochemical identification of the Karatzova pepper variety, is anticipated to significantly contribute to its characterisation as a PDO product.

Moreover, the ability to trace the origin or constituents of products throughout the food production chain protects both producers and consumers from adulteration, while adding value to these products. Thus, the research conducted on Greek sheep breeds, in the context of the **THRIVING LAND** project, is expected to significantly contribute to the establishment of purebred populations and creation of purebred nuclei comprising of breeds that are in danger of extinction.

Thus, these populations, with the unique identity that will be accompanied by, will protect and benefit breeders, farmers, food processors and the food industries, while also protecting consumers from possible fraud.

At the same time, as the primary sector plays an important social and environmental role in areas with limited development, the activities of the **THRIVING LAND** project can help improve agricultural incomes and support the development of other sectors (e.g. manufacturing); create jobs and contribute to retaining the population in rural communities, where other agricultural activities are harder. Sideritis, or mountain tea, is a typical example of a cultivation in semi-mountainous areas, providing employment to people. The establishment of a genetic identity for three commercial varieties of Sideritis, along with the characterisation of their biochemical profile, has facilitated agricultural production in these areas.

07 Project implementation partners

TAP

The TAP pipeline will transport natural gas from the giant Shah Deniz II field in the Caspian Sea to Europe. With a total length of approximately 878 km, TAP connects with the Trans Anatolian Pipeline (TANAP) at Kipoi, on the Greek-Turkish border, and crosses Greece, Albania and the Adriatic Sea, before coming ashore in Southern Italy.

TAP's route can facilitate gas supply to several Southern European countries, while its landfall in Italy provides multiple opportunities for further transport of Caspian gas to the wider European markets.

As a key part of the Southern Gas Corridor, TAP is strategically and economically important to Europe and essential in providing reliable access to a new source of natural gas. TAP plays a significant role in boosting Europe's energy security, supply diversification, as well as decarbonisation objectives.

TAP' shareholders are BP (20%), SOCAR (20%), Snam (20%), Fluxys (19%), Enagás (16%) and Axpo (5%).

More about TAP at www.tap-ag.com

American Farm School of Thessaloniki

The American Farm School of Thessaloniki is the premier institution in southeastern Europe for education and research in agriculture, food systems, environmental studies and other life sciences related to our sustainable future. Founded in 1904 by enlightened American educators, the School continues to apply its hallmark "learn by doing" approach to educate students of all ages. Divisions include the **Elementary School of Environmental Education, Middle School, High School, Junior College** and **Perrotis College of Agriculture, Environment and Life Sciences**.

Vocational training and consulting services offered to adult students aim at developing innovative professionals and entrepreneurs in the agri-food sector.

More about the American Farm School at **www.afs.edu.gr/en**

Bodossaki Foundation

Bodossaki Foundation is a public benefit organisation established in 1972 in order to continue the charitable offering of its founder, Prodromos-Bodossakis Athanassiades, to the Greek society. Its vision is a society of equal opportunities and prospects for all.

To promote its vision, the Foundation funds, plans and implements, in full alignment with the principles of transparency, accountability and integrity, actions and programmes of relevance to its four strategic pillars: supporting education, strengthening healthcare, protecting the environment and empowering Civil Society.

Today, Bodossaki Foundation also acts as a catalyst for fostering a broader culture of social contribution in the Greek society, managing third-party resources (re-granting) on behalf of grantors wishing to fund programmes with a strong social impact.

More about Bodossaki Foundation at **www.bodossaki.gr/en**

CERTH Institute of Applied Biosciences (INAB)

The Centre for Research and Technology Hellas (CERTH) is a legal entity governed by private law with non-profit status, supervised by the General Secretariat for Research and Technology (GSRT) of the Greek Ministry of Development and Investments. CERTH has implemented important scientific and technological achievements in research areas of great interest for individuals and the society, such as: energy, environment, new functional materials, industrial processes, informatics, telematics, telecommunications, transportations, agri-biotechnology, health sciences, mechanotronics, agrotechnology, as well as various interdisciplinary approaches in scientific and technological areas resulting from the above. In 2018, CERTH was ranked 22nd in the list of the top 500 European research centers and 1st in Greece. CERTH's Institute of Applied Biosciences (INAB), one of the five thematic institutes of CERTH focusing on biosciences, is a leader in applied biotechnological research, both in Greece and internationally, focusing on bringing the agri-food sector close to human nutrition and health.

More about the Institute of Applied Biosciences at **https://www.inab.certh.gr**

THRIVING LAND
Supporting Agri-food Education