

## METIC Agriculture: A résumé of identified themes for collaboration

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### Summary :

In the last one hundred years, Maltese agriculture genetic resources were dispersed throughout the Mediterranean basin. The introduction of modern varieties of livestock and plants has led to the complete disregard of all local populations in favour of these imported new exotic hybrids. The end result is that our local genotypes have already been lost or are in danger of becoming extinct. Most are well suited for extensive production systems and also well suited for integration into organic or free range type of production. Projects focusing on the rehabilitation of Mediterranean Woodlands and the use of Treated Sewage Effluent were also discussed.

The team of experts from the Faculty of Agriculture at the University of Palermo can be a great asset for the implementation of these initiatives. The development of certified products, compliment the efforts to develop an agro-tourist industry.

### Introduction

The Mediterranean basin, whose coastline includes 48 UNESCO world heritage sites, is considered by many as being the cradle of European Civilisation. Presently, this region is home to an estimated 430 million people. The abundance of cultural heritage present in the region is a magnet that attracts an estimated 300 million tourists per year. This attractive tourist destination is “swallowing” extensive prime soils especially in the coastal zones for the sake of urban development. Furthermore, agricultural activities focused at meeting the needs of the tourist industry generally dictate uniformity. To achieve such standards, synthetic genetic lines and hybrids are rapidly replacing the local animal breeds and plant species resulting in a potential loss of local genetic pools and biodiversity.

The Mediterranean coastline length is estimated at 46,000km, of which 19,000km is island coastline. The Mediterranean basin has 162 islands larger than 10km<sup>2</sup>. Whilst, the majority of the population and tourist activities are concentrated in these coastal zones, an estimated 10 million people live on islands.

The history of human intervention in land resource management shows both excellent examples of sustainable land use as well man-made catastrophic

events. Land degradation coupled with complications as a result of climate changes are a threat to natural resources with direct consequences on food security, environmental and political stability. Many North African and Middle Eastern countries drain considerable amounts of their financial resources to fulfil their food needs.

The population trend in Southern Mediterranean is still rising and is expected to reach as much as 300 million people by 2030. Unfortunately, the same cannot be said for the land and water resources in the region. Only 13 percent of the land around the Mediterranean is considered suitable for cultivation. This figure drops to 5 percent when referring to North Africa and the Middle East. All the countries in North Africa and much of those in the Middle East are water stressed. The steady increase in population growth is slowly but steadily eroding the amount of water availability per capita. Of all the natural renewable resources, fresh water is maybe the most unforgiving. Difficult to purify, expensive to transport, and impossible to substitute. Water is essential to food production, economic development, and to life itself.

The Institute of Agriculture (IOA) at the University of Malta was an active participant within the Mediterranean Trading and Innovation Centre (METIC) initiative, a project funded by the European Commission under the EU Public Initiative Programme Interreg IIIA. METIC provided an opportunity for IOA to acquaint itself with other partners from Sicily that have similar realities to those in Malta. Very often issues discussed were of mutual interest and had the potential of having financial and commercial spin offs for small and medium enterprises in both regions. Following the kick off meeting held in Malta in May 2006, the IOA was quick to respond and soon established a mixed working group made up of its members of staff and members from the Faculty of Agriculture from the University of Palermo. Various brainstorming sessions held in Malta and in Sicily ending up with the formation of a network of experts from both Universities who have identified a number of areas of collaboration and sharing of technologies. These themes are presently being elaborated and expanded so as to compile research proposals that are feasible and eligible for submission and funding. The various areas identified include: aspects of genetic recuperation and definition of local farm animals, plant stock, use of non potable water for agriculture, and stabilization of island rural landscapes.

The objective of this article is to highlight the themes of mutual interest.

#### Animal Genetic Pools:

The Maltese islands have a long tradition in rearing livestock. Archaeological findings dating back to Neolithic times have revealed remains of prehistoric art depicting various species of domesticated animals, including oxen, sheep, goats and pig. Skeletal remains excavated from various sites confirm the presence of

these animals along with other domesticated animals including the horse, cat, dog, hedgehog, tortoise, and rabbit.

During the 1800-early 1900, Malta had strong economic links with the North African coast spanning from Egypt to Morocco, and also with the other larger islands namely: Cyprus, Sardinia, Gibraltar and Sicily. It was commonly known that the many Maltese stationed in these regions took along livestock. The Maltese Goat is most probably the best known example, but the Maltese sheep, Maltese Mule, Maltese turkey and Maltese pigeon as having also experience the same fate, resulting in the widespread popularity of these breeds. Very often the "Maltese" type is recognised as a well adapted breed possessing hardy characteristics coupled with high productivity.

Changes in the Maltese production systems and in the Maltese consumer lifestyle have resulted in the setting aside of these local breeds to make way for the introduction of modern and imported hybrids and/or synthetic line type of animals. Some of these Maltese breeds can today only be found outside of Malta, The Animal Production Department within the Faculty of Agriculture at the University of Palermo houses a group of experts specialising in the genetic recovery of endangered domestic livestock populations.

### Maltese Goat

Reliefs on two stone slabs at Tarxien Temples dating to the Late Neolithic times depicts 26 images of goats with horns which curve backwards in an arc similar to those found in the Ibex (*Capra ibex*) or the Persian Wild Goat (*Capra aegagrus*). The modern breed of Maltese goat belongs to the group *Capra hircus hircus*. The origin of this breed is thought to have Italian and North African roots having striking resemblance to the Theban or Egyptian goat. It is renowned all over the Mediterranean basin as being docile, having hardy rustic characters with high milk yields. The Maltese goat has been intensively selected for: high milk production (high protein and fat content), high prolificacy and a resistance and adaptation to heat stress.

The Maltese goat is renowned for being a heavy milker. In the reunion held for the colonial exposure of London in 1886, the Maltese goat is recorded to have produced 3 litres of milk per day. The Maltese goat is described as having the potential for an average milk yield per lactation of 450kg with an average milk fat content of 4.5 percent and lactation period of 200 days (in milk) on average. The average adult live weight for bucks is 50kg and 40kg for does. The average wither height for males is 80cm and 75cm for females. The main phenotypical characteristics are white hairy body with black head, generally beardless, large drooping ears, lack of horns, straight facial profiles and have very often a pair of lappets on the throat. Birth weight for males is 3kg and 2kg for females. The average litter size is of 1.5 kids per doe per year. It is generally beardless and frequently hornless, has spreading and slightly pendulous ears, though shorter

and narrower, has a convex profile, has very often a pair of lappets on the throat, and is often of a reddish colour, with long hair and very large udders.

Following the Second World War, goat husbandry showed a marked decline. Goat population increased in the years immediately after the war (from the 40,000 heads of 1943 and 1944 increased steadily to reach 60,730 in 1946). This peak was followed by a gradual decrease in numbers reaching a minimum of approximately 2000 during the late 1980's.

The causes for this decline of the goat breeding are several. The obligation to sell all the milk for fresh consumption to the central milk dairy plant (constructed in 1938) resulted in a decline in the number of goats since all milking goats had to be registered and controlled. Licensing of the herds carried the burden of paying tax. Herdsmen that kept goats on a part time basis or as a secondary activity stopped operating. The sale of fresh milk door to door was also prohibited. With the gradual change in people perception and habits coupled with advances in medicine, the general public conceded and observed the recommendation issued by the ministry of Health to "consume milk that was pasteurized or at least boiled". In 1956 an exchange of goats with cows was initiated, probably in order to diminish the number of infected goats: the exchange was of 11 sick goats for 1 cow. This policy was suspended in 1959, but at the same time other factors contributed to the continuous decline in the goat industry. In 1965, incentive schemes were created in an effort to stop the shrinking population: data indicates that such measures were not effective. In recent years, another factor that has had a significant contribution to the decrease in goat numbers is the export to Libya. Generally preference was for goats showing red coat and selected from high producing herds resulting in the expiration of the elite stock.

This indigenous breed, highly regarded in the Mediterranean (Sardinians bought their goats from Maltese farmers) up to the close of the eighteenth century has now almost entirely been replaced with crosses with introduced goat breeds. Records made available by the Food and Veterinary Regulation Division show that as per June 2003 the goat herds in the Maltese Islands stood at 5,163 goats (3,901 in Malta & 1,262 in Gozo), consisting mainly of hybrids containing a cocktail of typical Maltese, Saanen and Alpine blood lines. Even though no pure-breed Maltese goats remain, one cannot exclude the possibility that some of the goats in Malta may be closely related genetically to the pure Maltese breed.

While currently there are no 100 percent pure-breed Maltese goats in Malta, one can still find them as a registered pure breed in Italy and maybe unregistered elsewhere in the Mediterranean region (Maghreb region). In Italy, the Maltese goat spread first to the island of Sardinia and Sicily. During recent years it spread also in the continental "*Mezzogiorno*". It is the Italian dairy goat par excellence and is the favourite breed of new entrepreneurs or of those who want to replace their breeds with more productive ones. While flocks of 2-6 make up the core

nucleus of the small ruminant herd of Malta, in Sicily, it is raised in small flocks (40-60 goats) in permanent systems which also use native pastures, cereal crops and horticulture by-products. On the continent it can be found in quite big flocks, 200-400 head, milking is often mechanical, feeding is based on meadows, grazing hay and concentrate. This breed accounts for about 50,000 head but only 2,000 of them are registered in the Italian herd book.

### The Maltese Sheep

A relief on a stone slab at Tarxien Temples depicts an image of a ram. A similar depiction of a ram was found in the form of a utensil handle at Mgarr Temple. Another model from Tarxien Temples interpreted as depicting a sheep does not carry horns. Skeletal remains from Xemxija were attributed to an animal approximating the modern Mediterranean sheep.

The origin of the Maltese breed is from the Awassi breed. The Maltese sheep was the original seedstock used in the development of the Comisana breed found in Sicily. They are reared for milk, meat and wool production, but they are renowned for the fineness of its fleece. The breed is described as having the potential for an average milk yield per lactation of 380kg with an average milk fat content of 6 percent and lactation period of 200 days (in milk) on average. The average adult live weight for ram is 60kg and 50kg for ewes. The average wither height for males is 1m and 0.90m for females. The main phenotypical characteristics are white coat colour with black or red-brown marking on the face with long neck and semi lop ears, rams' head is slightly broader. Long slim body with long silky coat mostly white fleece having random patches with the same colour of the head may also be present. The fleece does not extend over the head, feet and scrotal areas, but extends to cover the long tail. Both males and females have no horns. Birth weight for males and females is 2kg, and the average litter size is of 1.5 lambs per doe per year. Sheep occupy the same ecological niche as goats. Sheep and goats used to utilise most of the great extent of waste and uncultivated land as browse and natural pasture. These areas unsuitable for cultivation provided the basic forage ration and contributed significantly to meeting the nutritional requirements. Such a practice is the only activity that can contribute to a yield from such areas.

A small population of typical Maltese sheep still exists in parts of the country. In the early 1980's Malta experienced an influx of tourists from the North African countries, mainly Libya. These tourists were willing to pay more money for their local North-African sheep with a typically fleshy long tail, leading to a situation where Maltese farmers started to import North-African sheep as they had become more economically viable. This resulted in a decline in the local sheep population. Although a small population still exists, it is important to analyse and monitor the remaining population to investigate if the species is in danger of extinction.

Traditionally, the most numerous dairy animals in Malta were the Maltese goat followed by the sheep. They were important since they could utilise a great extent of wasteland and the rocky hills so typical of the Maltese islands as natural pasture. Unsuitable for cultivation, these rugged landscapes provided a yield in the form of milk, cheese, meat and fleece. The scheme introduced in 1956 whereby farmers were offered one pregnant Dutch Friesen heifer for either 5 healthy goats or 12 diseased goats resulted in the fact that today, fresh milk is almost exclusively produced by dairy cows that number approximately 9000. To sustain their normal physiology of rumen function and to attain their genetic capacity of milk yields, these cows have a dietary need for high quality roughage supplemented with a balanced mixture of concentrates. Roughage has to be cultivated, harvested and stored, while concentrates are all imported.

Although sheep and goats grazing have been identified as having contributed to a considerable damage to the local flora in the past, they are more suitable for Malta than cows which are adapted to graze on pastures, rather than the rocky hills that are more typical of the Maltese islands. Wasteland that was utilised by sheep and goats is not suitable for cattle grazing. Although goats and sheep are theoretically poor converters of fodder into milk, they cannot be displaced by dairy cattle. The traditional Maltese cheeselets '*gbejniet*' are made from milk salt and rennet and are similar in appearance to the French crottin de chevre. True *gbejniet* can only be made from sheep and goat's milk without offending the tastes of most Maltese due to their distinctive taste. Traditionally, these cheeselets come in three common versions, fresh, dry and peppered. The name *Gbejniet* indicates that these might have been introduced to Malta during or before the Arab period. The re-establishment of the pure breeds will result in having Maltese goat and sheep cheese made from the Maltese breeds. The animal factor is an integral component within the link of typical product and the territory.

The reintroduction of the Maltese sheep and goat into Malta will bring back breeds that are hardy, prolific and high milk producers under Mediterranean conditions. These breeds can have a significant contribution towards the Maltese rural development and also has the potential to contribute to the social economic aspects in the northern shores of the Mediterranean and maybe an even greater role along the southern shore: Libya and other Maghreb countries.

### The Maltese Cattle

A number of depictions found in the form of bas reliefs from Tarxien temples, together with the skeletal evidence excavated from various Neolithic sites in Malta, suggest that this *Bos* sp. was characterised by a large hump on the back over the shoulder similar to that found in the various modern breeds of zebu (*Bos indicus*) which originated in Asia. In addition, the Maltese Prehistoric Cattle breed appears to have been characterised by long horns. The combination of long bulky horns, a shoulder hump and a possible pendulous dewlap approximates

the Neolithic Maltese Breed to the Ankole-Watusi Cattle which originated in Africa. The Maltese Neolithic Cow on the other hand was apparently smaller with short horns and lacked a definite shoulder hump. Since ox skeletal remains were found in Late Pleistocene deposits in Malta, it is suggested that the Neolithic Ox was not introduced to the Islands by Neolithic man, but may have been already present in a wild state and was subsequently domesticated.

The local breed of cattle known as “gendus” is described as being of large frame. Cow and bulls are said to reach same size. These animals were used exclusively for agricultural work and were known for their gentle temperament. They are characterised by a relatively short horns and large size measuring about 152-180cm high at the withers. Prior to mechanisation, this beast was utilised exclusively as a working animal, mostly for draft. The Oxen has gradually been replaced by modern forms of mechanised traction. By the late 1980’s only three cows and one bull in the pure line were present. Unfortunately all four individuals were closely related. At that point, the Maltese Cattle Foundation was established to restore the herds by artificial selective interbreeding techniques. Presently no 100 percent pure-bred cattle remain in Malta. Some 15 “Maltese” type oxen are present, but none of them is 100 percent pure. The closest is 97.5 percent pure. There are also similar breeds in Cyprus, Crete, Egypt and Sicily.

#### The Maltese Chicken

The Maltese Black is a rustic egg-type breed that was formally widely raised in Malta under backyard conditions. This breed has “Mediterranean Characteristics”, namely it has a light body frame, non-sitting white egg-type hen. This breed is renowned for its prolific production of large white eggs and its reluctance to brood. During the 1960’s, the local poultry industry benefited from a substantial programme of incentives to modernise this sector, both the egg and broiler meat production. The role of the extensive production that was largely responsible for the production of poultry products steadily diminished to insignificant levels. The egg sector is now totally dependant on commercial units rearing synthetic poultry strains found on the global market, replacing the local variety. This greatly reduced the population of the local variety and although they are no longer used for farming, they are reared to take part as show birds in poultry shows. Nonetheless, population numbers are critically low and this breed is endangered. Trends indicate that in the near future, the European Union will only allow the production of eggs under free range conditions. In such a scenario, the Maltese Black Chicken is an ideal breed, well adapted to our environment and has high egg layer capabilities under the free range conditions. Mallia 1999, has attempted to describe the breed.

#### The Maltese Turkey

The Maltese Turkey is a rustic broad breasted breed well adapted to backyard production systems. Feathering is usually described as being black-bronze,

having mainly black plumage with a bronzing effect on the rump and tail. Some also show light markings on the wing primaries. Poults have a predominantly black plumage up to the age of 8 weeks. Turkeys tend to reach maximum weight at 24 weeks and reach a live weight of approximately 11kg. This slow growing rustic breed may have an important niche within the free range type of poultry production. There is evidence that Malta might have had an important role in the distribution of turkey throughout the Mediterranean region. So much so, that in Egypt, turkeys are known as “*Deek Malti*” meaning Maltese Rooster.

### The Maltese Rabbit

There are two recognised local breeds: the red rabbit also known as *tax Xiber* and the grey rabbit. The red rabbit may still be found in the wild in considerable numbers on the smaller island of Comino. A smaller population may also be present in the north of part of Malta in a locality known as “*Ahrax tal Mellieha*”. The fact that the red rabbit inhabited Comino may have helped safeguard its existence. The only threat to the red rabbit on Comino is the occasional outbreak of disease. Such episodes in the past almost wiped out the entire population though they seem to have recovered.

The grey rabbit, once also common, is today found only in isolated pockets. Over hunting has had a drastic effect on population numbers. Furthermore the genetic pool of the grey rabbit is seriously threatened. Some imported species of rabbits have escaped to the wild and have over time established well. These newly introduced rabbit breeds interbred with the local grey rabbit populations and over the years has resulted in the loss of pure breed of grey rabbit. It is not certain if any pure breeds are to be found anywhere in the country today.

Rabbit breeding in Malta is highly oriented towards self-consumption, although it is a growing sector in terms of production. Rabbit hunting, followed by the preparation of the rabbit pie is a traditional dish that dates back to the period of the Knights. The reintroduction of the local breeds is an essential element in obtaining certification to classify the Maltese rabbit pie as a traditional product with strong links to the territory.

### The Maltese Pigeon

The Maltese pigeon was also a very popular member of the back yard animal population. It was a heavy type with limited flying capabilities. This pigeon was kept exclusively for the production of squab, that was used for pigeon pie or pigeon broth. Very little data or information is available in the literature to describe the breed, no population estimates are available. A particularly heavy pigeon is available in Egypt and is known as “*Malti*”.

### The Maltese Bees



Malta has a local variety of indigenous honey producing bees (*Apis mellifera rutneri*). It is different from any other Mediterranean bees, being slightly smaller in size, dark in colour with apparently no yellow bands. It is also incredibly resistant to diseases, viscous and highly active.

Honey production in Malta has a long history and can be considered as being a traditional product of Malta since Roman times. Cicero's oration against Caius Verres includes accusations of stealing 13 jars of honey from Juno's temple whilst governor for Malta. Some even believe that the Latin name for Malta, Melita refers to the abundance of the product during Roman times.

The most popular type of honey is the one produced by bees feeding on the nectar from the flowers of wild thyme. Other type of honey is also produced. Nowadays, one still finds prominent places, like *Wied il-Ghasel* and *Imgiebah*, which prove the abundance of bee population and honey produced on the Island. Presently some 1,100 hives, belonging to an estimated 160 beekeepers are present. The industry suffered a severe setback in 1995-96 caused by a parasitic infection. The local bee variety should be protected to complete the certification of the Maltese honey.

#### Plant Genetic Resources

Reference to the Maltese tendency to roam the Mediterranean coast during the 1800-early 1900 has already been mentioned and also the likelihood that this was a significant route of dissemination of Maltese animal breeds within the region. Literature indicates that the same can be said with regards to the dispersal of Maltese plants.

Father Lawrence E. Attard O.P. reports how in 1800 a Maltese trader Salvu Gatt and his wife Giroloma from Haz Zebbug obtained a long lease of the island of Lempedusa, then lying abandoned and uninhabited. Taking with them a number of Maltese workers, they repaired the Castle and prepared the land for farming. The couple brought with them animals, and trees from Malta and built warehouses. In 1843 The Gatt couple had to evacuate the island under the threat of two Neapolitan men-of-war. Father Attard also states "In fact the Maltese were the first amongst the settlers to recognise the possibilities of the Algerian soil. They planted large plots with orange groves and introduced the cultivation of Maltese fruits such as the "*ghambakar*" and "*baitar tad-dem*". They also imported the Maltese goat whose milk became one of their best sold products."

The identification and re-introduction of Maltese plant and crop genotypes into Malta is of great importance as they not only form part of our heritage but can also be the basis for the development of certified products.

#### Clover

A local tall stemmed drought resistant variety of clover is said to exist in small pockets around the island. A wild type of clover (*tan-nebbieta*) is also found in some areas of Malta (mainly on the clay slopes in *Mellieħa* and *Għajn Tuffieħa*). These varieties should be investigated for their nutritive value as animal fodder for sheep and goats.

### Tomatoes

There are two recognised varieties of local tomatoes. The “flat” type (*tadama catta*) has disappeared from the market and is thought to be found in small quantities grown by farmers for their own use. The other variety is known as “*zengulija*” meaning oblong. This variety has not been seen anywhere in the Maltese Islands for the past few years and is thus believed to be extinct.

### Marrows

“*Qarabali*” (baby marrows) are similar though milder in taste to courgettes. Though it can still be found in areas it is very rare and risks becoming extinct.

### Strawberries

The traditional local variety of the Maltese strawberry has a very sweet taste but is small in size.

### Oranges

The tree is lively, with upright branches, great size and high output. The fruit is big, ovate and seedless (0-1 seeds) with thin skin while its flesh is very juicy, aromatic and of exquisite taste. From historic records one can see that this fruit was commonly exported to France during the time of the Knights. The orange variety from Malta is commonly cultivated in the district of Messina since the beginning of the year 1900. It was imported from Malta and that is how it got its name -*Malteziko orange*. Orange groves with Maltese Oranges can also be found in Tunisia and Algeria..

### Olives

Excavation at the Tarxien Phase level (3300/3000-2500BC) at Scorba revealed carbonised remains of the tree species *Olea europaea* (Olive) [Metcalfe, 1966]. Malta was a first rate producer of olive oil as the names of some villages in Malta (Zejtun, Zebbug amongst others) indicate. Recently a local variety known as Bidnija was identified.

### Pomegranate

“The Malta pomegranate” is extinct in Malta but is said to be found in other Mediterranean countries.

## Grapes

There are on two Maltese grape varieties, the *Girgentina* and *Gellewza*. DNA testing is currently being conducted on these varieties in Malta. The white variety *Ghirgentina* produces excellent quality refreshing dry white wines with good flavour and depth of character. The red variety *Gellewza* produces medium bodied easy drinking red wines and award winning fruity rosés. The harvesting of these varieties takes place at the end of August.

## Water Resources

The limited natural supply of freshwater resources is under intense pressure from competing users. Although agriculture is the main user of water resources, its availability is a significant restriction on the productivity of the Maltese agriculture sector. The insufficient rainfall coupled with its unpredictable nature necessitates crop irrigation. The incentive reaped following irrigation is significant. Yields from land with access to an unlimited supply of water are on average at least 3.5 times that from dry land farming. In an increasingly competitive market, access to irrigation will become more and more important in producing the necessary yields and product quality required to secure an adequate economic. Furthermore, the provision of good water quality will be essential for the diversification of agriculture into higher quality products or value added crops such as cut-flowers and organically-grown vegetables. The increase in financial returns has prompted farmers to tap into the aquifers and abstract groundwater. Over abstraction is leading to a gradual deterioration of Malta’s only fresh water resource. There is desperate need to manage irrigation water resources in a more sustainable manner; discouraging the further exploitation of groundwater and encouraging the increased use of both harvested rainwater and treated sewage effluent (TSE). Harvesting of surface runoff and the use of treated sewage effluent has been estimated to contribute just 3 and 7 percent respectively of the total water consumption. Increasing these shares would contribute to more efficient use of Malta’s water resources. The availability of TSE is expected to increase in the coming years with the coming in line of the planned Waste Water Treatment plants. The efficient and effective management of available water resources is essential for the continued survival and development of Maltese agriculture.

There are however, numerous obstacles hindering developments to increase the utilisation of harvested rain water and TSE, namely:

- 1) The ease of drilling and operating new boreholes tapping into groundwater.
- 2) The silting up and clogging of many dam systems.
- 3) The deviation of storm water towards the sea.

- 4) Most of the existing cisterns and reservoirs are committed to the storage of abstracted water rather than rainfall collection;
- 5) The lack of infrastructure for the more wide scale distribution of TSE.
- 6) Land fragmentation creates problems with issues of access and the installation of appropriate irrigation networks for utilisation of both harvested rainfall and TSE.
- 7) Lack of appropriate technology at farm level to utilise harvested rainwater and TSE effectively.
- 8) Opposition to the use of the TSE due to the perceived “image” and safety both by farmers and consumers;
- 9). Salinity of water distributed from the Sant’ Antnin Sewage Treatment Plant has increased and risks causing localised soil salinisation;
- 10).Lack of established guidelines that are specifically designed to address the use of TSE under our conditions.

An integrated approach on the use of TSE is a must prior to the actual implementation. No real guidelines exist relating quality of TSE to the needs of the various crops at the different stages of maturity. No guidelines are available linking TSE with soil types and groundwater quality, season and mode of irrigation. The Maltese islands will eventually have 4 sewage treatment facilities supplying a huge quantity of usable water, yet, farmers have no experience on how to manage this potential source of water. This lack of know how applies to Malta but is also applicable to the rest of the Mediterranean countries interested in the utilisation of TSE.

#### Nursery for Sclerophyll type trees

It is thought that prior to human settling and intervention, the Maltese Islands had large areas covered with Mediterranean Sclerophyll Forest. This is the highest type of vegetation that can develop under the Mediterranean type of climate. In the Central Mediterranean this forest is characterised by Holm Oak (*Quercus ilex*) and Aleppo Pine (*Pinus halepensis*) with an undergrowth of smaller trees, shrubs and climbers. In sheltered areas such as on hillsides and in valleys, the olive (*Olea europea*), the carob (*Ceratonia siliqua*), the bay laurel (*Laurus nobilis*) and several others dominate. The sandarac gum tree (*Tetraclinis articulata*) Malta’s national tree, is now very rare, but which probably covered considerable tracts of land in the past. In the Maltese Islands, the native forest is all but extinct and only remnants remain at four localities, all on the island of Malta. These forest remnants take the form of small copses of Holm Oak where the total number of trees/copse is less than thirty. Some of these trees have been estimated to be between 500 and 900 years old.

Human settlement resulted in the falling of trees for their wood and the clearing of land for agriculture and habitation. Additionally, the grazing of sheep and goats caused damage to mature trees but more importantly prevents them from regenerating. Deforestation, especially followed by overgrazing with soil

compaction, can be considered as the principal anthropic cause of land degradation. Over time, this intense human activity has resulted in a quasi complete deforestation of the islands, exposing and subjecting the soil to the elements. As a result of these pressures, Maltese soils are vulnerable to erosion. Soil erosion by both water and wind is acknowledged as a significant problem increasing the threat of long-term land degradation.

The Mediterranean coastline is increasingly threatened from a range of human activities, particularly urbanisation, development, and intensification of agricultural systems resulting in processes of degradation, erosion or desertification. Concurrently, the Mediterranean Ecosystem is undergoing a “tropicalisation” trend due to effects of climate change. Furthermore, the long dry summers pose significant threats to woodlands due to fires. Mediterranean woodlands, especially those in arid areas, have diminished considerably and in many cases are degraded with large denuded and exposed surfaces characterised by sporadic patches of thin layers of soils alternating with outcropping rock. This means that the floristic and structural diversity of the natural vegetation, as well as the faunistic species richness and abundance, is constantly been reduced. Unfortunately, the vulnerability of Mediterranean ecosystems allow a higher negative impact from factors that lead to any form of degradation.

The regeneration and management of woodlands in the Mediterranean needs particular attention: the role of plant cover is essential for mitigating desertification. Propagation of drought-tolerant plants can be a formidable challenge as well as a powerful tool to combat desertification and enhance biodiversity. The setting up of a nursery specialising in the production and selection and multiplication of vigorous trees and plants characteristic of the Sclerophyll eco-system is an excellent example of inter regional cooperation. Seedlings could be transported throughout the Mediterranean coast and utilised in projects of reforestation, soil stabilisation and as a measure to halt and decrease soil erosion. Furthermore, such a centre could also act as a gene bank for the various tree and plant found in the region.

#### Conclusions:

Considering Malta’s small size, it may be surprising to note the high degree of agro-biodiversity. It is essential to create collaborative frameworks and initiatives with regions having similar agro-biodiversity to protect and conserve it. Although Malta has in the past ratified and signed various conventions related to biodiversity, very little is being done to safeguard it. Scientific work for the recovery and maintenance of our local agricultural plants and animals should commence immediately. Some varieties might be extinct, other are on the verge due to bastardisation with other breeds, whilst in other cases it is unclear if the local variety is still to be found. There also seems to be a good case for the re-

introduction of the Maltese goat and the preservation of the Maltese Oxen. Both animals are interesting and valuable for their different characteristics.

The European Commission (EC) has been active in our region for decades through the implementation of many projects. However, their impacts have not always been as expected as they were hampered by lack of coordination and information gaps between policy and decision makers, researchers and rural communities. The objectives of METIC were precisely focused at overcoming these hurdles. The outputs from METIC will enhance the sustainable income-generating potential in rural communities and coastal activities through projects that encourage agro-ecosystem health through sustainable practices and the preservation of our regional genetic pools. All this translates in a healthier socioeconomic environment. It goes without saying that these proposals will have to be supported by policy instruments and appropriate national/regional guidelines.

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