Natural resources in Malta

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1. Climate change

The climate of the Maltese Islands is typically Mediterranean with characteristic mild, wet winters and hot, dry summers. The average annual precipitation is 530 mm (mean for period 1951-1990). Rainfall is highly variable from year to year; some years are excessively wet while others are extremely dry (extreme minimum for period 1854-1990, 191.3 mm, extreme maximum for period, 1031.2 mm). The seasonal distribution of rainfall defines a wet period (October to March with around 8 5 percent of the total annual rainfall) and a dry period (April to September).

The data used to analyse recent climatic trends concerned rainfall recorded at Valletta (1842–2000), Rabat (1852–2000) and Luqa (1947–2000), temperature at Valletta and Luqa (1927–2000), and atmospheric pressure, number of days with thunderstorms, hail, gusts, mean daily cloud cover and mean daily hours of bright sunshine at Luqa (1947–2000). The longest records are those of rainfall and temperature, spanning over 150 years. Records of other parameters cover a period of about 50 years. Climate data show temporal variations or oscillations due to changing environmental conditions and random processes.

Air temperatures are moderate (mean annual temperature for period 1951-1990 is 18.6°C), whilst mean monthly range is 12.3°C-26.3°C and never fall too low for adequate plant growth. Grass temperatures may fall below zero during the period December to April. During the summer months, grass temperatures may reach values in the upper forties. Relative humidity is consistently high throughout the year, being mostly in the range of 65-80 percent. The islands are windy, only some 8 percent of the days of the year are calm. The predominant wind is the north-westerly, which on average blows on 18 percent of windy days. The other winds are all nearly equal in occurrence.

In the Maltese Islands rainfall is the only direct natural source of water and is in scarce supply due to the dry climate. Despite a fluctuating trend the data indicates that precipitation over the past 50 years has tended to decrease. Records indicate that the effect of climate change is evident on the Maltese islands. For the periods 1950-1975 and 1975-2000 extrapolation of this trend suggests a 50 percent probability of a 17 percent decrease in annual total precipitation in Malta by 2100 from 549 mm to 453 mm. Over the same period, air temperatures increased from an average of 18.68oC between 1950-1960 to 19.38oC between 1990 and 2000. The highest temperature recorded for the period under review was in August 1999 when the temperature reached 43.7°C. Statistical analysis of meteorological data over the past 77 years, indicates that the local mean annual air temperature has risen by 0.5oC. Over the past 100 years, mean temperature has increased by 0.7 °C globally, and by 0.95°C in Europe. The Intergovernmental Panel on Climate Change (IPCC) predicts an increase in global mean temperature of 1.4 to 5.8°C by 2100, and European temperatures are projected to rise by a further 2.0°C to 6.3°C by 2100. European sea levels are also on the rise, by about 0.1 m to 0.2m over the past century, and projections indicate a sea level rise of 0.5 m by 2050 and of 1 m by 2100 would affect seawater characteristics and fish stocks, and give rise to coastal erosion and inundation, which would affect coastal development and infrastructure.

The average daily number of sunshine hours in Malta ranges from 5.1 in December and January to 11.8 in July. The minimum temperature has decreased by 0.8oC over the same period. The sea surface temperature around Malta has been taken into account to detect climatic changes. Temperature measurements at 1 m below the surface have been made at sea since 1978, which indicate an increase in mean sea surface temperature of 1.25oC. Observed extremes in the maximum and minimum temperatures are typical of desert regions. Trends towards these conditions in Malta lead one to conclude that a process of desertification is already occurring. The present trends suggest that the area of atmospheric subsidence is shifting northwards from the Sahara, thereby enhancing a desert type microclimate.

There are no perennial surface streams in Malta and rain water only flows along the bed of major valleys for a few days after heavy downpours, with about 6 percent of the total precipitation finding its way directly into the sea via this surface runoff. Rainfall patterns show a relatively high spatial variability over the Maltese territory and no definite trend in the observed precipitation. Since 1923, there has been little change in rainfall during winter and summer, whereas there has been a decrease of 0.14 mm per year during spring and an increase of 0.8 mm per year during autumn. During the rainy season, the number of days per year with thunderstorms has increased by nine since 1950. The existence of convective rainfall is corroborated by the positive trend in the daily maximum rainfall between 1923 and 2000, since this type of rainfall is of short duration and often heavy. An increase in the daily maximum rainfall is observed notwithstanding the fact that, over a full year, the absolute number of days with rainfall in the range 1–50 mm is decreasing. Annually averaged observations indicate an overall positive trend in atmospheric pressure implying a reduced frontal activity on a yearly basis and more frequent anti-cyclonic situations which often enhance subsidence, thereby restricting convection, cloud formation and hence rainfall.

The recorded decrease in the mean annual cloud cover amounts to 0.3 oktas since 1965. The duration of bright sunshine has decreased by an average of 0.6 hours per day since 1923. This decrease is attributed to changes in atmospheric composition, predominantly due to the higher atmospheric loading by suspended particles. The trapping of pollutants and dust in the lower atmosphere is favoured by anti-cyclonic situations that are accompanied by lower level inversions and slack pressure gradients, thereby lacking sufficiently strong air currents that could disperse particles. This would necessarily increase the incidence of haze, especially at low elevations of the sun.

The Maltese islands are expected to experience a decrease in the natural water resources due to climate change. The most likely changes in natural processes are an increased evapotranspiration rate due to an increase in ambient temperature, leading to perturbations in the soil water balance, alterations in subsurface water movements and sea level rise. Changes in potential evapotranspiration were estimated using the Penman–Monteith model, The peak rates expected on the basis of the local rise in temperature by 2100 were estimated to reach values about 7 mm per day. This will impact the soil water balance and ultimately the total water demand for crop irrigation.

The crop water requirement was computed using the FAO crop coefficient approach (Allen et al., 1998) and uses data published in the 1991 agricultural census (CSO, 1991). The model results confirm that temperature changes will accentuate the soil moisture deficit due to the increased evapotranspiration. This is accompanied by alterations in the subsurface water movements through the different soil layers. An accentuated soil water deficit can only be combated by a more conspicuous irrigation demand, thereby putting further pressure on the potable groundwater supplies and thus forcing a shift towards a higher dependence on water production by desalination.

Assuming a sea level rise of one metre and that the majority of galleries will consequently no longer be suitable as a natural water source, groundwater production potential will reduce by about 40 percent. Even a moderate sea level rise will lead to the deterioration of the groundwater quality due to increased seawater intrusion. Moreover, the expected shift of precipitation patterns towards more frequent events of heavy rainfall, coupled with a consequent increased runoff, will cause deterioration of the aquifer recharge process.

A reduction in soil water availability due to the expected increased temperature will lead to problems of increased soil salinity and alkalinity, to aridity and an accelerated desertification process. Changes in global and local agricultural patterns are thus expected, resulting in the abandonment of agricultural land and further soil erosion. This situation is exacerbated by the likely increased frequency of extreme events with heavy spells of rainfall. Higher temperatures will also favour the growth of thermophilic (tolerant of hot conditions) and xerophilic (tolerant of dry conditions) plant species, and the decline of hydrophilic (tolerant of wet conditions) species.

In conclusion a general shift of flora to a more desert-type assemblage is to be expected. There is still uncertainty on the effects of increased atmospheric CO2 concentrations and global warming, on plant growth and the response of plant metabolic processes. Some recent studies actually suggest that there could be a shift in the opposite direction, with a greening of the Mediterranean and an extension of the Mediterranean woodland further south and east.

The most obvious effect of sea level rise is the inundation of low-lying coastal areas. Such areas include all sandy beaches and the gently sloping rocky coasts mostly along the northeastern shoreline. Apart from the actual loss of land area, these locations also support rare and localised habitats containing highly specialised organisms. Inundation will thus result in a landward shift of shore zone patterns and the conversion of littoral to sublittoral habitats. As long as the inundation is a slow process, enough sediment is available and if an ecological corridor is accessible, these threatened habitats may shift inwards. However, constructions built recently along shorelines, which may help to reduce inundation, could inhibit this inward migration. Loss of these habitats will result in reduced biodiversity.

Climate change is one of the most serious environmental threats facing the world today. Indeed it is a key priority of the EU 6th Environmental Action Programme, the EU Sustainable Development Strategy and the Lisbon Strategy. The United Nations Framework Convention on Climate Change (UNFCCC) is the principal policy instrument governing international action on climate change. Malta ratified the Convention in 1994 and the Kyoto Protocol in 2001. Under the principle of common but differentiated responsibilities and the specific national and regional development priorities, objectives and circumstances', in 2005, Malta's formal position was that of a 'developing country' within the context of the Convention. To date it remains a non-Annex 1 party without any quantified greenhouse gas emission limitations and reduction targets. Under these international instruments, Malta's obligations are principally limited to reporting of emissions and preparation of periodic national communications. However, the EU has ratified the Kyoto Protocol as an Annex I signatory, and has committed to reducing its emissions to 8 percent below 1990 levels by the commitment period from 2008 to 2012. As an EU member state, Malta is obliged to abide by EU legislative instruments that address climate change.

Greenhouse gases are the major contributors to climate change. Malta's greenhouse gas emissions increased by 44 percent between 1990 and 2003, with CO2 being by far the most significant contributor and derive largely from the energy and transport sectors. Co2 emissions in the energy and transport sectors have increased by 41 percent and 53 percent respectively since 1990. Together, they currently contribute 95 percent of Malta's Co2 emissions Indeed, these overall emissions rose almost in parallel with the net rise in CO2 emissions (almost 44 percent over the same period).EU15 GHG emissions were 3.3 percent below 1990 levels in 2000, however, in 2003 emissions rose to 1.4 percent below 1990 levels. EU25 emissions were 5.5 percent below the 1990 level in 2003. Despite its rising emissions, in 2000 Malta had one of the lowest GHG emission rates per capita in the EU, 7 tonnes compared to the EU average of 11 tonnes. Nevertheless, it had a relatively high rate of GHG emissions per unit GDP, at 910 tonnes equivalent per million Euro, as against the EU average of 605 tonnes in 2000, possibly due to inefficient energy production and consumption. However local GHG discharges constitute only a tiny portion of global emission; in 2003, Malta's emissions accounted for only 0.055 percent of EU GHG emissions.

The main greenhouse gas in Malta is carbon dioxide with emissions in 2000 reaching 2,444 Gg, and mainly arising from the burning of fossil fuel in electricity generation 73.0 percent and transport 20.3 percent. Substantial emissions of other greenhouse gases include methane (CH4), with an overall production of around 20.2Gg in 2003 mainly from the waste sector (16Gg), and including agricultural wastes from animal husbandry (4.2Gg).

In 2003, the energy sector contributed to approximately 63 percent of Malta's total GHG emissions of 3,116.62 ktoe of CO2, and was largely responsible for the steep rise in emissions in 2003. CO2 emissions from this sector stood at 1,400 kilotonnes in 1990, rising to 1,973 kilotonnes in 2003, an increase of 41 percent. Energy consumption continues to rise, with a growth of 61 percent between 1990 and 2002. The domestic and commercial sectors have contributed most significantly to the increase in demand. This trend is expected to continue. Malta's GDP also continues to rise, albeit slowly, and the total energy generated per unit GDP has begun to rise again after falling during the 1990's. This trend is a matter of concern since it indicates that Malta is moving away from 'cleaner' economic growth. There is an urgent need to decouple economic growth from energy consumption and limit CO2 emissions from power plants to levels stipulated in Malta's National Allocation Plan. Through its National Energy Plan, Malta aims to map out, based on coordination between the principal sectors involved, a sustainable development path for the energy sector in line with EU energy scenarios, the EU post-Kyoto climate regime, and EU renewable energy targets.

Transport is the second highest but fastest growing contributor to national GHG emissions. Emissions from this sector increased steadily between 1990 (342 ktoes) and 2003 (525 ktoes), 65 in step with rising vehicle numbers. This sector has increased its share of emissions by 53 percent over the period under consideration and now stands at 20 percent of total CO2 emissions. Transport is also the major emitter of carbon monoxide. In the EU, transport energy consumption and the resulting emissions of greenhouse gases are increasing due to a rise in transport volumes that outweigh increases in efficiency. In 2002 the transport sector's emissions in EU15 rose to 22 percent higher than 1990 levels. It is evident that Malta is following this international trend; how easy it will be to decouple the growth in Malta's transport volumes from economic growth remains to be seen.

Agriculture only contributed 96.37ktoe of CO2 equivalents or 3 percent of Malta's GHG emissions in 2003 mainly arising from methane emissions due to enteric fermentation (ruminant digestion) and current organic manure management practices. Current available information indicates that nitrous oxide (N2O) emissions through agriculture are insignificant. Estimated ammonia emissions from animal husbandry operations amounted to 0.88Gg in 2003 or 95 percent of the total national emissions.

Manure management practices which give rise to excess methane production concern mainly the inappropriate storage and application of manure which favours anaerobic digestion and production of methane.

In general terms, the ecosystems spread over the Maltese islands will be affected in a number of ways. Most of the bays and the north eastern shores are expected to experience submergence, shifting zone patterns landward. Specialised and rare habitats such as wetlands will be mostly under threat, some of which will be facing complete obliteration. Existing infrastructure may serve to reduce the extent of inundation, but can also restrain the inland transfer of the threatened habitats. Malta is more likely than larger countries to suffer the consequences of climate change but, as with other small states, cannot be considered a main culprit of the change. The seriousness of these consequences will in part depend on the extent to which adaptation measures will be implemented in time. Averting the worst effects requires a strong will for immediate action to control emissions of greenhouse gases, as well as to prepare for adaptation to the impending impacts. Acting now means avoiding future excessive burdens and averting irreversible situations.

2. Fishing resources

Maltese fisheries are typically Mediterranean, they are not species selective and are frequently described as multi-species and multi-gear fisheries, with fishermen switching from one gear to another several times throughout the year. The social and cultural importance of the Maltese fishing industry far outweighs its negligible economic contribution, which is equivalent to about 0.1 percent of the national Gross Domestic Product (GDP). The livelihood of most of the local fishermen depends on the sale of highly prized species made available to the consumer as fresh fish of highest quality caught by traditional methods during very short fishing trips. The variety and quality of the catch also contributes significantly to the important tourism industry, since local restaurants are proud of their high quality local seafood.

The main fishing port in Malta is Marsaxlokk Harbour, in the southeast of the island. About 40 percent of the vessels registered in Malta operate from the fishing villages of Marsaxlokk and the neighbouring Birzebbugia, which lie either side of the harbour, separated by the promontory on which lies the historic Fort San Lucjan, which now houses the Malta Centre for Fisheries Sciences (MCFS). The most important fishing port on the island of Gozo is Mgarr Harbour, where over 70 percent of the island's fleet berth. This port is also the second largest in terms of number of fishing boats for the whole of the Maltese Islands. The other main ports are distributed around Malta. In order of importance they are: St. Paul's Bay in the north; Marsascala and Msida on the east coast; and the landing place of Gnejna, located conveniently amidst the cliffs of the western coast, caters for the fishers from Mgarr (Malta) and Rabat.

The average Maltese fishing vessel (of which there were 2 252 registered in 2004) is well under 10m LOA, with the exception of the trawlers, which exclusively use bottom otter trawls and average 22.5m LOA. Most of vessels are traditional, i.e. *luzzu* and *kajjik*, with the latter being more common. Multi-Purpose Vessels (MPV) are a relatively recent addition to the fleet, but form more than 35 percent of the fleet. Unlike the *luzzu*, which is an "antique" traditional vessel made largely out of wood. MPV generally have fibre glass hulls. Fibreglass has also become the preferred material for construction of *kajjiks*, which until a couple of decades ago used to be made of wood.

The main engine power of the traditional vessel classes and their derivatives is generally very low, but MPV have a higher average power rating, reflecting their larger size and different hull structure. Trawlers, as might be expected, have much more powerful main engines, although still comparatively small for their kind of fishing operations (e.g. trawling for prawns at 800m depth).

The main equipment used by the Maltese fishing fleet are various forms of hook-and-line (over 60 percent). Different types of gillnets and entangling nets 20 percent, whilst traps form over ten percent of the registered main gear.

The most prevalent method of fishing is set bottom long-lining, which is seasonally operated by over half of the operational vessels, especially those in the <6m and 6–12m categories. The next most frequent method of fishing is trammel netting, which is practiced by 27 percent of the fishermen, principally those operating smaller craft.

A quarter of the fishermen use the hand trolling line locally known as rixa, which consists of a line and artificial lure, mainly made of hackle and neck feathers, covering different sizes of hooks. The main species targeted by the rixa are dolphin fish (*Coryphaena hippurus*), frigate mackerel (*Auxis hazard*) and amberjack (*Seriola dumerili*). These fishermen, the majority of whom are part-timers or recreational fishermen owning vessels <6m LOA, frequently also use bogue traps. Octopus traps are used by only 4.5 percent, operating vessels of up to 12m LOA. Bogue traps are made of strips of cane and are baited with balls of bean flour laced with essence of salted herring, whilst octopus traps are made of metal wire and are baited mainly with mackerel and pieces of larger fish.

Drifting longlines are used by ten percent of fishermen. In this case, the vessels are larger, with lengths between 6 and 24m. This is necessary because the target species are tuna and swordfish, which are caught from around 20 miles offshore and beyond.

Apart from their registered normal fishing activity, up to 130 vessels (>6m LOA) also participate in the traditional dolphin fish or *lampuki* fishery (August–December), whereby a fishing site or *rimja* is assigned to each vessel after lots are drawn for each national district. Each licensee must lay at least 35 Fish Aggregating Devices (FAD–known locally as *kannizzati*), which are anchored small floating rafts onto which a few palm fronds are attached, in a straight line along a given direction. Fishing sites are distributed all around the Maltese Islands, apart from in the "swordfish corridor", which is kept free from lampuki FAD so that swordfish fishing can proceed unhindered. The sites start from 7 miles offshore and FADs are laid at intervals of one-half to three-quarters of a mile, depending on the district. Aggregated dolphin fish and other species, such as pilot fish (*Naucrates ductor*) and amberjack (*Seriola dumerili*) are caught by a surrounding net similar to a purse seine.

Between April and July, the market is dominated by landings of bluefin tuna, with the second most plentiful species being the swordfish. Both these species are targeted in the same way, with pelagic drifting long-lines, but differ in the thickness of the snood and the size of the hook, with the tuna long-lines double the strength of swordfish long-lines. This is because tuna are stronger than swordfish and before such differentiation there was considerable (up to 70 percent) loss of fish through the breaking of both lines and hooks by tuna.

On an annual basis, swordfish is the third most landed species in terms of weight, and it is the only species with landings of more than 1t in every month of the year. It is targeted throughout the year, albeit to varying degrees and for different reasons. During the winter months (December–April), most boats target lucrative demersal species, before reverting to tuna long-lining, which catches swordfish and albacore as secondary species. The peak fishing period for swordfish is between May and August.

Landings of dolphin fish occur mainly between August and December, mostly from the FAD fishery, but if weather conditions remain favourable, the season can extend into January.

Landings of small gregarious pelagic and demersal species are generally not seasonal except for mackerel; species in these groups are landed in quantities of less than 5t per month. Bogue is the most landed small pelagic species, caught mostly by traditional traps made out of cane strips, followed by mackerel. Prawns originate exclusively from trawling, which takes place throughout the year, with quantities reducing in winter months due to unfavourable weather. Landings of other demersal species originate from trawling, long-lining and fixed netting operations.

During the third quarter of 2006, 500,191 kilograms of fresh fish were landed at the local fish market. When compared to the same period last year, fresh fish landings at the local fish market declined by 11.8 per cent. The wholesale value of fresh fish landings, declined by 1.8 percent, to Lm 779,911 (€1,890,000) in the third quarter of 2006. Dolphin fish and Swordfish were the dominant species caught in the reference period.

Dolphin fish landings by weight at the fresh fish market declined by 3.3 per cent over the comparative period whilst the wholesale value declined by 13.6 per cent. Meteorological conditions that resulted in early catches brought the average price per kilogram down by 10.3 per cent in the third quarter of 2006, in spite of the decline in overall landings for the period.

Swordfish landings declined by 31.8 per cent over the comparable period of last year. The decline in Swordfish landings resulted in an increase in the average price per kilogram of 25.7 per cent in the third quarter this year. As a result, the wholesale value of fresh swordfish landings declined by 6.1 per cent.

Boats owned by persons resident in Malta landed 60 per cent of fish at the local market during this period. The rest was landed by boats owned by persons residing in Gozo, save for 0.8 per cent of catches which involved foreign-owned vessels.

The fresh fish price index of September 2006 stood at 112.72, up by 5.7 percent in September 2005. The fresh fish volume index also rose by 5.7 per cent during the comparative period.

The Fisheries Conservation and Control Division (FCCD) regulates and manages both the capture fisheries and the aquaculture industries, together with all other related activities. The FCCD is also involved in scientific monitoring, research and development through the Malta Centre for Fisheries Sciences (MCFS) and offers technical advice to the industry. The main goal of the FCCD is to implement sound fisheries management, ensuring the sustainability of living marine resources. In particular, the management of the unique Maltese 25 mile Fisheries Management Zone is of highest priority for the effective conservation of local and sub-regional fisheries resources.

Malta's accession to the EU in May 2004 required extensive changes in national fisheries legislation to ensure compliance with regulations related to the Common Fisheries Policy (CFP). The results of the Malta-EC negotiations on the 25 mile Fisheries Management Zone have also been transposed into a new Council Regulation (EC 813/2004) which lays down detailed conservation measures in connection with the zone's management regime. Essentially, it limits the number, size and power of fishing vessels allowed in the zone, depending on the type of fishing activities in which they are engaged. Apart from the main Maltese Legal Act (ActII/2001, Ch425) dealing with the conservation and management of fisheries, a number of subsidiary regulations have been drawn up, including one on the registration and operations of fishing vessels (LN:407/2004). The fishing fleet register was closed on 15 September 2003 through a notice in the Government Gazette (10 September 2003) in order to prevent any increase in fishing capacity and effort, in line with the management policy reflected in EC:813/2004.

Malta has adopted management measures compliant with the EU CFP and is currently participating in discussions in connection with the revision of EC legislation on management measures for the conservation and sustainable exploitation of fisheries resources in the Mediterranean. Through MCFS, Malta has a scientific data collection programme, in line with Commission Regulation EC:1581/2004, the results of which are essential for the national and regional fisheries management processes.

United Nations fisheries agreements and the FAO Code of Conduct for Responsible Fisheries are thoroughly reflected in Maltese fisheries policy, and a Maltese version of the Code has recently been published. Malta is complying with the various International Plans of Actions in support of the Code of Conduct and is addressing the issues contained in the FAO Strategy to improve the status and trends in capture fisheries, as well as those of the Reykjavik Declaration on responsible fisheries in the marine ecosystem. Malta became a member of the General Fisheries Commission for the Mediterranean on 29 April 1965 and ratified the amendments to the Agreement on 23 December 1999. It has always been an active member of this Commission, but since 1998 has intensified its participation at scientific level, attending all GFCM Scientific Advisory Committee meetings and taking a key role in the scientific activities of the FAO sub-regional projects COPEMED, MedSudMed and MedFiSIS. Malta also became a member of the International Commission for the Conservation of Atlantic Tunas on 7 August 2003.

There are two fishers' cooperatives in Malta and all professional fishermen are affiliated to one or the other. Ghaqda Koperattiva tas-Sajd Ltd. and Koperattiva Nazzjonali tas-Sajd offer various services between them to all professional and part-time fishers, including fish purchasing and sales (including exports and imports); supply of ice, fishing tackle and other inputs; cold storage facilities; insurance coverage; and facilities for packing and processing of fish.

Annual aquiculture production increased dramatically during the 1990's, from 60t in 1991 to a peak of 1800t in 1998, from six commercial farms, when output consisted of 1200t of sea bream and 600t of sea bass. However, due to decreased prices for these two species throughout the Mediterranean region, production dropped to 1300t in 2001, to around 1000t in 2004 (US$ 6 million). The market for these species is currently re-expanding and production is expected to increase once again. There are no hatcheries in Malta and all fingerlings are imported from European countries for growing on in offshore cages.

The production of Bluefin tuna (*Thunnus thynnus*) through penning has been increasing over the past few years. The fattening of this species around the Maltese islands started in 2000, with one farm producing 300t/year. During 2001, two farms produced 1150t and production reached a peak of 3550t in 2003. The live tuna are exclusively imported from foreign purse seiners fishing in the central Mediterranean, and are re-exported to Asian markets after harvesting the fattened fish.

The main Seabream and Seabass growing-on units use offshore floating cage technology in the form of Dunlop and Farmocean cages. Floatex and Kames type cages are used for the more protected, inshore units. All cages are moored on concrete mooring blocks. For bluefin tuna fattening, 50m diameter plastic double-collar offshore cages, manufactured in line with the latest offshore technology, are used. About 95 percent of Maltese mariculture finfish products are exported to European markets.

The fish processing industry in Malta is practically non-existent and there is no utilisation of fish-derived byproducts. A few tonnes of locally caught small pelagic fish species, such as mackerel, are utilized as feed in the tuna farming industry, although most of the fish feed (pelleted or whole fish) is imported.

Capture fishery products are mainly sold through the wholesale fish market in Valletta. Fish are sold by public auction carried out by intermediaries (belonging to five limited companies) under the supervision of fisheries protection officers. Sales are usually made on credit and FCCD collects the monies due to the fishers. The fish are bought wholesale and are marketed by about 150 registered fish vendors, each of which has an exclusive marketing zone. Fish products originating from small-scale fisheries are also frequently sold direct to catering outlets. The number of modern fish shops is increasing throughout the country.

The vulnerability of the fishing industry in Malta can be gauged by its low productivity. The average value of annual catches per employee is slightly over Lm800 (€2,000), merely one-fifth of the EU average. This reflects the predominantly non-industrial, part-time nature of fishing activities in Malta, based on traditional methods. The small size and lack of resources of the Maltese economy have resulted in underinvestment in the fishing industry. Moreover, the small size of the industry has been an obstacle to the accumulation of significant amounts of capital for investment in technology, which could reap economies of scale. The main constraint for the aquaculture sector is the limited coastal sea areas suitable for farm site installations, which greatly restricts the expansion of the industry and its viability.

The fishing industry in Malta is small and vulnerable. The proportion of the working population depending, to varying extents, on this industry for its livelihood, is around 1.3 percent. The average value of catches is around 0.16 percent of national GDP, with the industry's direct contribution to GDP estimated at around two-thirds of this figure when adjusted for the cost of imported inputs, most notably fuel. From an international perspective, the value of the annual fish catch in Malta is around 0.07 percent that of the EU, while total employment, including full-time, part-time and seasonal employment, is around 0.4 percent of the EU total for the sector. The per capita consumption of fish products (excluding canned and other processed products) is estimated at 6.58 kg/year.

Malta provides very little state aid to the fisheries sector. The aid is granted for the modification of fishing vessels and for the improvement of port facilities. Aid is also granted in the form of a refund to co-operatives for their marketing expenses under the fish-marketing scheme. Storage facilities are provided although no storage aid is given.

3. Land available for farming

The land area of the various islands is: Malta: 245.7 km2, Gozo: 67.1 km2 and Comino 2.8 km2. Agricultural land accounts for almost half of Malta's land area (49 percent) while forests make up only 0.9 percent. Natural vegetation accounts for 22 percent of land, most of which is in coastal areas. The major land cover change over the past few decades has been the conversion from arable land to urban areas, although with the coming into force of the Structure Plan, the rate of loss of arable land has decreased significantly. Malta is relatively urbanised, with a soil sealing figure of 23 percent. It results that Malta's built-up land area within the 1988 development boundary increased from 15.4 percent to 16.9 percent in 2004. The 2000 figure was 16.5 percent. This estimate does not take into account development outside the development zone, such as in rural settlements. Within the urban areas, exists "urban farms" (farms located in areas defined as being urban). It is the intention of the Malta Environment and Planning Authority that such farms are relocated to rural areas and the space vacated be utilised for urban development (rather than permitting further urban spread).

Part of the reason for this relatively high level of urban land is its high population density (approximately1,274 persons/km2 in 2005). This high population density suggests intensive use of land, and increasing land and property values are pushing up development densities. Malta's limited land area and the increasing land and property values indicate that competition over the use of land in the Islands is substantial. There is strong potential for improving the overall efficiency of land use. An in-depth investigation into this, is urgently required.

The main strategic factors affecting land use change in Malta are urbanisation, quarrying, agriculture and recreation. Urbanisation is one of the most significant pressures on the Maltese countryside. Some traditional rural settlements have also become characterised by new dwellings with an urban-type design and layout. In addition, only a small proportion of approved new rural dwellings were for farmers. This is significant because it is only essential dwellings for farmers that are permitted forms of residential development in the open countryside, suggesting that a significant proportion of new rural dwellings that have been granted planning permission may not have been strictly in line with policy. If this trend continues into the medium or longer term, the impact on the openness and rural feeling of the countryside could become significant. This issue is exacerbated by the fact that urban areas are now visible from 90 percent of the Maltese territory.

The most critical land-related agro-environmental issues relate to the abandonment of agricultural land, farm intensification and fragmentation of land ownership. Between 1994 and 2000 the principal factors that brought about loss of arable land were the development of quarries (19 ha); hotels and hospitals (11 ha); schools (10 ha) and animal breeding farms (8 ha).

The Structure Plan for the Maltese Islands adopts a relatively restrictive approach to developments in the countryside specifying that those categories of non-urban development, which will be permitted outside existing and committed built-up areas, are those that are considered normal and legitimate inclusions in the non-urban scene:
Farmhouses and other genuine agricultural buildings, reservoirs, picnic area toilets and car parks, control buildings and walls/fences at archaeological and ecological sites.

The Agricultural land in Malta or the total land declared by farmers, is classified into three categories as follows:

- Dry-farmed land (Raba' baghli), that is land that depends exclusively on rainwater for irrigation of crops, but may be watered on a few occasions.
- Irrigated land (Raba' saqwi), that is land that has a continuous supply of water all year round and is irrigated by water from sources other than rainwater.
- Unutilised/garigue land (Raba' Moxa), which is a term, used to describe all non- productive registered agricultural land.

The sum of the first two categories represents the total agricultural land area that is further subdivided into uncultivated land and Utilised Agricultural Area (UAA) that includes arable land, vineyards and orchards.

There are three major types of agriculture activity on the Maltese islands, mainly associated with irrigated land and intensive cultivation of fruits and vegetables, dry land farming and livestock farming. The latter is based mainly on the intensive production of swine, rabbit, poultry and eggs for which Malta is self sufficient, as well as cattle mainly for dairy production and beef products whose supply remains insufficient to meet local demand.

The majority of farming in agriculture in Malta is based on the growing of some types of crops. Utilised agricultural area can be split into three categories:

- Arable area: land which is cultivated under a system of crop rotation;
- Kitchen gardens: small plots of land cultivated on a semi-subsistence basis, in which most of the products are intended for consumption by the farmer and not for market;
- Land under permanent crops – area of land where the crop occupies the same land for a period of time normally 5 years or more.

State of the Environment Report 2005, states that the role of agriculture in Malta is however far more important than its economic contribution indicates, primarily because it is the largest single land user with 47.8 percent which compares well with the 46.7 percent of the EU25 average. However in contrast to the other EU member states, the amount of forest and natural areas amount to only 23.6 percent against the 47 percent of the EU25 average; whilst the artificial areas are a staggering 28.6 percent against the average 4 percent of the EU25. Recent estimates of built up land indicate that during 2005, the proportion of built up land reached 27.7 percent.

In 2001, the total agricultural land area declared by farmers in the Maltese islands was established at 11,619.9 ha of which 1,471 ha or 12.7percent were classified as garigue and the remaining 87.3 percent or 10,148 ha as agricultural land. An average of 4.8 percent of the agricultural area is unutilised or abandoned. While the Island of Malta has 255.8 ha, Gozo has 236.3 ha of unutilised land area, representing 3.1 percent and 12.1 percent of the total agricultural land area, respectively.

From the agricultural census of 1983 a decrease of 1,342 ha or 11.7 percent in agricultural land has been recorded from 11,491.0 ha declared in 1983 against a total of 10,148.6 ha recorded in the last Census of 2001. This decline continues to accentuate the trend of loss of agricultural land established over the past years. There was a significant shift in the type of agricultural land from 'dry' land to 'irrigated' land. A 260 percent increase from 580 ha to 1,508.8 ha was recorded in the 'irrigated' classification, which means a shift of 928.8 ha of 'dry' land to 'irrigated' land in these last 18 years. A total of 960 ha, representing 63.4 percent of the 'irrigated' land is found in the Western and Northern districts with predominance in the locality of St. Paul's Bay area, which accounts for 13.9 percent of the total for the Maltese Islands.

A total of 11,959 holdings were registered during the last census with 943 or 7.9 percent of the holdings not having any land area, being holdings engaged in other agricultural activity such as herdsmen, pig breeders and poultry farms. A holding is defined as a single unit which has a single management and which may have agricultural land in different localities. A total of 8143 holdings or 73.9 percent of all agricultural land holdings have less than 1 ha of agricultural land in the Maltese islands. This percentage is somewhat higher in Gozo where nearly 82 percent of the numbers of holdings have less than 1 ha of land. The average size of the holdings is of only 0.876 ha that considerably limits the range of farming methodologies, which can be adopted, and investments made in the sector. Many farms are losing their economic viability contributing to a general shift towards part-time work.

It can be generally said that land is now owned 2/3 by the state and the remaining 1/3 by the private sector, however only a low percentage of agricultural land is farmer owned. The 2001 Census of Agriculture indicates that only 19.5 percent of holdings are operated on a freehold basis. However, no record exists as the Land Registry is only in a pilot phase. The only way of determining what land is privately owned is by elimination (assuming all non-state land is privately owned). However, records of government-owned immovable property (land and buildings), which are maintained by the Government Property Division at the Land Department, are not computerised nor are records of tenancy agreements. Government recently offered an amnesty for those illegally farming government land and received 12,000 applications to have a land parcel's illegal occupancy made legal.

Both the state and private landowners tend to hold on to their property and sales are mostly evident only when the property is to be developed for building. 80.4 percent of the agricultural land area cultivated is rented, with only 19.5 percent being owner occupied or under a freehold basis. This percentage is somewhat higher in Gozo where 25.3 percent of the land is under freehold. Government has retained ownership of agricultural land to ensure that it is not utilised for other purposes. Privatisation of agricultural land would be an attractive option, as farmers would tend to invest more in their private property rather than in land held on tenure. Government leases agricultural land on an annual basis for a very low rental (Euro2.43/tumolo) while the Private sector agricultural land is let for around (Euro4.80-9.72/tumolo). Land is normally automatically re-let to the existing tenant or his descendants (in accordance with the Agricultural Leases (Reletting Act). However, in the event that an agricultural holding becomes vacant then Government is obliged to tender the tenancy. Rates of up to Euro 39/tumolo have been given for such land (which almost certainly represents its value for illegal sub-letting purposes rather than its agricultural value).

As a result of customary inheritance practices on Malta, which dictate that farmland is divided amongst offspring, farms are increasingly fragmented, and characterised by an increasing number of smaller fields. Specific problems associated with this include: increasingly complicated access arrangements (with their legal implications, as well as environmental impacts due to multiple access routes), lowered long-term tenement viability, and limitations on the range of farming methodologies that can be adopted (e.g. restrictions on mechanisation, even where topography is not a major limiting factor). Although no statistics are available, these problems are known to be significant. Consequently, many farms are losing their economic viability and abandonment is on the increase. New employment opportunities in other sectors compound the problem and contribute to a general shift towards part-time work in agricultural activity.

Of the total physical land area worked by the farmer of 8,388.2 ha, 84.7 percent or 7,471.0 ha is dedicated to arable land of which nearly 60 percent cultivated with fodder. The remainder is under vineyards, 490.1 ha or 5.6 percent of the total area worked and under orchards, 427.1 ha or 4.8 percent of the total land worked. Just over half of the total arable land area is found in the Western and Northern districts where these account for 51.3 percent of the total arable land in the Maltese Islands. Gozo accounts for 20.1 percent of the total arable land.

The area under field crops has decreased from 3,397 ha in 2003 to 2,507 ha in 2005 which amounts to 30.6 percent of arable land, with potatoes being the major crop. Beans, tomatoes and onions follow the potato crop in importance. Melons (including winter, summer melons and water melons) are also an important crop, with marrows and cauliflowers following.

The area under permanent crops has increased in recent years from 917 ha in 2001, to 1081 ha in 2003 and 1090 ha in 2005, mainly due to an increase of land under vines (mainly for quality wine production) and under olive trees. In 2005, the area under vines increased considerably to 840 ha from the 490 ha of 2001. Likewise the area under olives has grown substantially in the last few years from a few hectares in 2001 to 87 ha in 2005.

Greenhouses have also increased significantly in recent years particularly since accession in part due to the support provided under the Investments in Agricultural holdings measure. According to the Farm Structure Survey 2005, estimates are for 70 ha of land under greenhouses, which represents a substantial increase from the 50 ha found during the last 2001 Agri Census. During the previous census of 1983, the number of greenhouses was of 275 and covered only an area of 20,520 square metres.

There is no forestry activity in Malta given the limited woodland area amounting to about 200 ha which translates into a wooded land cover of only 0.9 percent of the total areas which is minute in comparison to the 31 percent EU 25 average. Of these the largest areas are those of Mizieb and Buskett with 50 and 30.6ha respectively and are protected by legislation, thus none of these woodland areas are utilised for logging.

In 2005, the total agricultural land area declared by farmers in the Maltese islands was established at 11,791ha which represents a slight increase of 1.5% from the 2001 Agricultural Census figure of 11,620 ha. Of this total land area declared, 87.9 percent or 10,365ha were classified as agricultural land, while the remaining 1,426 ha or 12.1 percent were classified as other areas including 'xaghri'. An average of 1 percent or 111 ha of the agricultural area is unutilised or abandoned which represents a considerable decrease from the 492 ha reported in the Census of Agriculture for 2001. The change in the total utilised agricultural area has however been minimal from the 9,656 ha of 2001 to 10,254 ha during 2005. Over the last 30 years, the loss in agricultural land was of 3,515 ha from 15,134 ha in 1971 to 11,6I9 ha in 2001, which is equivalent to an average annual loss of 117 hectares.

All agricultural land area in Malta is considered as Less Favoured Area due to specific handicaps. There was no apparent change in the holding size structures and the majority of agricultural holdings are relatively small with an average size of only 0.92 ha which contrasts sharply with the EU25 average of 15.8ha. Although the majority of agricultural holding, i.e. 8,092 or 73 percent of holdings, have less than 1 ha of Utilised Agricultural Areas (UAA), these holdings account for only 30.1 percent or 3,085 ha of the total UAA. On the other hand, whereas only 2,980 agricultural holdings, or 26.9 percent have 1 ha or more of UAA, these holdings account for the remaining or 70 percent or 7,169 ha of the total UAA. There are only 2.1 percent of holdings with 5 ha to less than 50 ha, and no holdings over this size; when the EU25 average for these categories of holdings amounts to 38.1%.

Agriculture production in the Maltese islands faces several constraints, including:

- the high opportunity cost of land, the loss of agricultural land through urbanisation plus land abandonment due to decreasing prospects for farmers from the utilisation of marginal dryland areas, are contributing factors.
- the fragmentation of farms and the increasing number of smaller fields, as a result of customary inheritance practices on Malta, constitute other factors of concern. Land fragmentation has the following negative consequences: an increase in the demand for access roads to fields, leading to a loss of agricultural land and an increase of surface water runoff; increase in the possibility of land abandonment; limiting of agricultural techniques that could be applied on field; constraining the design of proper irrigation schemes; increase in the demand for agricultural buildings; further construction of boundary walls to define property rights; and reduction in the economies of scale and economic viability of production obliging a shift towards part-time work. These factors all contribute to the degradation of the rural landscape.

4. **Water availability** (Volume and Quality)

The Maltese Islands have limited natural supplies of water. The islands' natural water resources depend entirely on rainwater percolating through the porous limestone rock and accumulating in aquifers from where it either seeps out or is pumped by man. It is estimated that between 16 percent and 25 percent of the annual rainfall infiltrates to recharge the aquifers. The largest aquifer is the Main Sea level Aquifer that consists of a lens of freshwater floating on denser saline water in limestone rock at sea level. The other aquifers of importance are the Perched Aquifers, which consist of rainwater trapped in the permeable Upper Coralline Limestone due to the underlying layer of impermeable Blue Clay.

Groundwater aquifers form the only large natural source of water, apart from desalination of seawater. Groundwater is exploited for municipal and industrial use by farmers and others for irrigation and industrial purposes. Half of the water used for municipal supply comes from the aquifer, whereas another half comes from the seawater desalination plants.

There are three potential sources of water for irrigation:

- Storm and rainwater collected in underground cisterns or surface reservoirs with capacities from 100 to 2,000 m3. Although this water collection may seem relatively insignificant, at a local level it is very important for the irrigation of large areas of vegetable production in the absence of rainfall during critical growth periods in spring and summer.
- Extraction of groundwater that has become the most common source of irrigation water at present. There is an unknown number of unregistered boreholes estimated to run into the hundreds, which present an additional and unregulated tapping of the limited freshwater resource and expose the aquifers to over-extraction, saline intrusion and pollution risks.

- Treated sewage effluent that is currently used to irrigate 280 ha of agricultural land in an area of Malta outside the groundwater protection zone. Only some 10 percent of sewage water is currently being treated and reused.

The Malta Resources Authority estimates that in 2003 sectoral water consumption attributed to 39 percent of the total domestic consumption sector, followed by arable agriculture at 37 percent. Harvesting of surface runoff and the use of treated sewage effluent have been estimated to contribute just 3 percent and 7 percent respectively of total; increasing these shares would contribute to more efficient use of Malta's water resources. The trend with regard to leakage control has been positive; between 1995 and 2003 losses to leakages of water produced by the Water Services Corporation fell by 53 percent.

In 2004, desalination plants comprise the main source of water production for Malta, nearly 18 million cubic metres in fact. Pumping stations supplied the largest volume of water from the mean sea level aquifer, an average of 681,031 cubic metres per month. Borehole production accounted for an average of just over 380,000 cubic metres monthly.

In contrast, Malta's sister island Gozo, used an average monthly supply of 167,369 cubic metres of water abstracted from boreholes as compared to 11,500 cubic metres from pumping stations. This means that, while in Malta water pumped from pumping stations accounted for 26 percent of the total water supply in 2004, this proportion stood at only 6 percent for Gozo. Gozo has no existing Reverse Osmosis plants. Boreholes are the main source of water, with over 93 percent of total production for the Island, translating to some 2 million cubic metres. A supplement of 450,355 cubic metres, concentrated especially in the summer months, was transferred from Malta throughout the year. Between them, the two islands consumed nearly 33 million cubic metres of water in 2004. Water consumption per head was 81 cubic metres with a daily average consumption in Malta of 82,681 cubic metres and in Gozo 7,157 cubic metres.

In 1995, water production exceeded 31 million cubic metres, with monthly output varying from 2.2 million cubic metres in February to 3 million cubic metres apiece in July and August. Well over half of total water output was produced by the Reverse Osmosis plants. Pumping stations were responsible for a production of 7.7 million cubic metres with another 6.3 million sourced in boreholes. Virtually no spring water was produced.

The bulk of water consumption in 2005 was billed to households, 69 percent of the total. The industrial sector was the collective recipient of water bills amounting to 5.5 percent of billed water consumption, while this percentage for the agricultural, forestry and fishing sector stood at a mere 4 percent.

In 2005, an estimated 6.7 million cubic metres of water was lost in leakages. The percentage of water production by source was 24.7 percent to pumping stations, 20.4 percent to boreholes, 54.9 percent to Reverse Osmosis plants and 0.0 to springs. In brief, total water production 31.04 million cubic metres, estimated amount lost in leakages 6.70 million cubic metres and water available for end users was 24.34 million cubic metres in 2005.

Water quality in Malta is based on the EU Drinking Water Quality Directive. Nearly 100 percent of the population in Malta have access to an improved water supply and improved sanitation. Malta has an average annual rainfall of only 578mm and with rain rarely falling during the summer months, one can easily understand that potable water has always been a challenge. Malta has no mountains, the highest point is at Ta' Zuta on Dingli Cliffs at 253m above sea level and in Gozo at Dbiegi (191 m). There are also no lakes, rivers or streams but only minor springs. Hence, the increased importance of boreholes and Reverse Osmosis plants. The potable water supply is already dependent on desalination for over 50 percent. A high cost to the consumer and to the national economy.

Efficient and effective management of these water resources is essential for the continued survival and development of Maltese agriculture. With rainfall insufficient and unpredictable, the irrigation of cropped land is increasing and currently estimated at 1,143 hectares (10.7 percent of agricultural area in 2001). The incentive to use irrigation is considerable - the value of production from land with access to an unlimited supply of water is 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 order to produce the necessary yields and product quality required to secure an adequate economic return for Maltese farmers – especially those full-time farmers whose livelihoods depend solely upon agriculture. 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 & organically-grown vegetables.

With regards to reservoirs and wells, a total of 9,069 were captured during the last Census and more than half were constructed before the 1975. Windmills, which were predominant earlier in the century, still grace the landscape and 301 of them still being used.

Due to the intensive nature of agricultural production and the porous geology, all of Malta's groundwater is highly vulnerable to nitrate pollution. Indeed all of Malta by virtue of L.N. 233 of 2004 has been declared a Nitrate Vulnerable Zone. Nitrate levels in groundwater have been rising since 1966 when analysis for this parameter first began.

In 2004, NO3 levels in Malta's groundwater exceeded the Nitrate Directive trigger value of 50 NO3 mg/l at two thirds of the Water Services Corporation abstraction boreholes. These excesses were most notable in the perched aquifer system, with the highest value of 132 mg/l at Mgarr. The highest nitrate level found in the sea level aquifer system was 85 mg/l at the Speranza borehole. The fresh water lens that makes up Malta's mean sea level aquifer system is particularly vulnerable to localised seawater intrusion. Chloride concentrations, indicating saltiness, in this groundwater body all exceeded the WHO drinking water standard of 250 Clmg/l, which may be used as a benchmark for groundwater but remains a very high standard in this context. Concentrations range from 1,736 mg/l at Ta' Kandja to 354 mg/l at Xewkija (Gozo). The perched aquifer system is also slightly at risk from salinity, with values ranging from 209 mg/l at Bingemma to 163 mg/l at Falka near Rabat.

A preliminary risk assessment carried out by the Malta Resource Authority indicates that with the exception of the small island of Comino, mean sea level aquifer system, all Malta's groundwater bodies are at risk or probably at risk of failing to meet the objectives of the Water Framework Directive. An initial characterisation of Malta's groundwater quantitative status in 2004 confirms that despite the data gaps that constrain accuracy, the major groundwater bodies in the Islands are being over-abstracted or are dangerously close to being over abstracted, so that their status is now in jeopardy. This is reflected in decreasing groundwater levels and spring flows. In the case of Malta's mean sea level aquifer system, which provides 66 percent of total groundwater extracted, and which is seriously threatened by localised seawater intrusion, it would mean losing a resource that under optimum conditions could store up to 1.5 billion cubic metres of water, and which once lost would be difficult to restore.

There are obviously numerous sources of the nitrate pollution in groundwater, including the urban sewage systems. However, available data does suggest a potential correlation between intensive agricultural activity and those groundwater sources with the highest nitrate levels indicating that agriculture is a key contributor to the nitrate problem. There are a number of potential sources of agricultural nitrate pollution in the Maltese Islands namely: misapplication of livestock manures and mineral fertilisers to field, nitrate loaded effluents generated from parlour washings, and rainwater running off from fouled yards, hard standings and open air manure stores common in livestock farms.

There are numerous obstacles to improve this situation namely, the continuing trends in the drilling of new boreholes, the many dam systems that are dilapidated and ineffective at trapping rainwater due to heavy sedimentation, accumulation of rubbish, overgrowth with vegetation etc. Many of the existing cisterns and reservoirs found on farms are used for the storage of extracted groundwater rather than rainfall collection. There is currently no infrastructure in place for the availability of additional large-scale reservoirs for the storage of treated effluent until the dry season. Due to land fragmentation and problems of access, the installation of appropriate irrigation networks remains problematic. Many farmers lack the appropriate technology (e.g. micro-irrigation techniques) to use the alternatives of harvested rainwater effectively. The salinity of water distributed from the Sant' Antnin Sewage Treatment Plant has increased to unacceptable levels and risks causing localised soil salinisation.

Malta is almost totally serviced by a sewerage system. In remote places, the government drains cesspits free of charge. The national microbial failure rate of the water supply system (measured against E coli) is below 1 percent. The problem of nitrate in drinking water has improved following the implementation of the EU drinking water directive. Groundwater which may have high levels of nitrates is then blended with the water coming from the Reverse Osmosis plants and the level of nitrates in the final product is well within the EU/WHO Standards. The other problem is chlorides levels, which exceed the 250 mg/l level. This is expected to occur as Malta is a small island. With the blending process, levels are being lowered to >500 mg/l but this is still higher than the 250 mg/l standard.

Water Services Corporation makes water routine check monitoring. Each month, at least one water sample is collected from each village in Malta and Gozo, as well as samples taken from each distribution reservoir and other water sources such as boreholes, pumping stations and Reverse Osmosis plants. The samples are analyzed chemically and microbiologically. Microbiological parameters analysed are total Coliforms, Faecal Coliforms, Faecal Streptococci and Total Bacterial Count. In order not to contaminate groundwater, there has been a development of engineered facilities to recover and dispose of waste. Such facilities are being designed and developed in such a manner that will avoid the release of any contaminants into the surrounding environment, including groundwater.

Lack of water resources constitutes a significant restriction on the productivity of the Maltese agriculture sector, given the long dry, hot summers, elevated evapotranspiration rates and low, unpredictable and highly variable annual rainfall. In fact only 15 percent or 1,508 ha of the total agricultural land area is irrigated, the remainder being dry land which depends almost entirely on rainfall.