Chapter 8

The intensification of the agricultural landscape of the Maltese Archipelago

Jeremy Bennett

In this harsh environment man created the land on which he could live.

Bowen-Jones, Dewdney & Fisher (1961, 350)

8.1. Introduction

Bowen-Jones *et al*. (1961) in *Malta: Background for Development* furnish the reader with a prophetic edict which carries the threat of environmental catastrophe unless there is continual human investment.

> *Everything one sees in Malta* [the Maltese Archipelago], *other than major topographical features, is man-made and man-maintained in existence. For this reason, there is an unstable equilibrium that eternally threatens to collapse* (1961, 349).

This book provides an unparalleled geographic assessment of the Maltese agricultural economy, in the years prior to independence, and still serves as a compendium of knowledge and terminology nearly sixty years later. The authors' opening gambit recognizes the swell in national identity and the resulting desire to exert more control over the nation's socio-economic direction. However, their opening tonality also expresses an awareness of the influence of development and its potential threat moving into the future, thus directing the authors to the formation of a study that facilitated a greater understanding of the interplay between socio-economics and the landscapes of the Maltese Islands.

Reflecting upon their edict, a modern reader could be forgiven for agreeing with this assertion. A cursory overview of the islands reveals a marginal, alkaline environment with thin and heavily worked soils, overlain by rampant development and inhabited by 1505 people per sq. km (National Statistics Office 2019). However, at a deeper level, the environmentally deterministic and modernist view of Bowen-Jones *et al*. (1961) should be eschewed. Writing in the 1950s, these authors continued by stating 'the collapse foreseen is an increasing reality, the unstable equilibrium no longer being maintained.' Yet, in 2020, 'the collapse' has not arrived. What the authors failed to predict was that the future of the islands lay in connectivity: tourism, financial services, light skilled industry and casinos. A deeper historical perspective would have noted a critical threshold at the beginning of the first millennium BC when external investment first became crucial, adding external input to the island system, and reducing direct dependence on the land. At a more theoretical level, what the authors failed to consider was the delicate equilibrium of fragility and sustainability – the core themes of the *FRAGSUS Project*. Where Bowen-Jones *et al.* (1961) lacked a chronological framework, this project has re-asserted the importance of understanding human, rather than simply physical environments, through the full length of time. This leads to a greater comprehension of how humans live in, adapt and manage their environment, forging dynamic landscapes that have deep-seated histories.

A landscape represents an idea greater than the sum total of its constituent parts. Indeed, a concept such as the Maltese (or Gozitan) landscape contains within itself a nested hierarchy of landscape units, which are responses to lower and higher order processes. Although the spatial elements of landscapes are usually in flux, it is the palimpsest-like nature of landscapes through time that should be recognized as the key to understanding the inter-connected relationships between humans and their environments. This can be viewed as the central philosophical difference between Bowen-Jones *et al*. (1961) and the present project.

The *FRAGSUS Project* has focused on the successful reinvestigation and development of the complexities of the prehistoric Maltese Archipelago. However, in recognition of how landscapes develop through time, elements of the project stretched beyond the prehistoric world to include the classical, medieval and early modern periods. Building on the temporal nature of landscapes, an *Annales* school framework could be adopted to aid the observation of how people have managed the agrarian environment through time, especially in association with the establishment of the Anthropocene epoch. *FRAGSUS* offers detail on three major agricultural phases available for study – prehistory (encompassing the early Neolithic through to the end of the Temple Period and into the Bronze Age), the 1800s (via Alberti *et al*.'s quantitative analysis in Chapter 9) and the contemporary Maltese landscape (see Chapter 10). This chapter will therefore provide a union between these strands of the *FRAGSUS Project* by providing a synthesis of the population change and the linked agricultural intensification within the region. This will link together a synthesis of the *longue durée* of the Maltese landscapes, applying a *quellenkritik* to various phases of evidence. In doing so, the central lines of inquiry will focus on what the available agricultural resource is on the islands and how people have successfully intensified the use of the landscape to balance environmental fragility with population sustainability. This study forms part of a larger doctoral project (Bennett 2020), and many of its implications are further wrapped into the discussion in the concluding Chapter 11.

8.2. The *Annales* School and the Anthropocene

Braudel (1966), the historian, introduced the concept of structuring the understanding of human activity through time, through the medium of three scales of history and change: événements, *conjonctures* and *longue durée*. Bintliff (1992) provides a valuable archaeological application of these concepts, describing this paradigm as a series of interdependent wavelengths, which is a useful analogy especially when considering the nature of how waves combine. The shortest of these wavelengths is the history of events or événements, which can be described as the staccato record of activities on the shortest timescale. This is framed by the more structuralist account of medium- and long-term markers of time – *conjonctures* and *longue durée* respectively, each of increasing duration and of apparently lower frequency to the observer. Knapp describes the *Annales* direction as having a 'fundamental ambivalence' and the propensity to 'adapt and grow with the demands of an always-shifting method and theory' (Knapp 1992, 16). In sum, it enables the understanding of how long-term processes relate to shorter term events. The increasing acceptance of the Anthropocene as a distinct geological epoch (Waters *et al.* 2016) raises the implication that intensely applied événements can impinge on *longue durée* geological scales.

Goudie and Viles (2016) adopt an approach which blends the often conflicting accounts of various scholars, demonstrating the entwined nature of human activities and geomorphology; avoiding the application of the term 'golden spike', which is common in the Anthropocene literature. Their synthesis negates the marking of the Anthropocene as événement and accounts for the ebb and flow of human activities through time, beginning with the *Palaeoanthropocene* (*c*. 5050 BC–AD 1750), followed by the *Industrial Era* (AD 1750–1945), the *Great Acceleration* (AD 1945–2000) and culminating in the proposed era of *Earth Systems Stewardship* (AD 2000 onwards). Although the authors openly concur with the escalating pulse of change from the Industrial Era onwards, their timeline is designed to account for the 'many examples of the potent impact of humans in previous millennia' (Goudie & Viles 2016, 13). The rationale accords with the *time-transgressive* synthesis, called for by Brown *et al*. (2013) and Butzer (1996, 2015), which promotes a less alarmist response to the changing world. In particular, Butzer stresses the need for a non-anthropocentric view as 'the dynamic menu of ongoing changes … are by no means ready to be synthesised' (2015, 1540). This agrees with the commonly held view that geological epochs can only be viewed at a distance, from a suitable perspective. Caution must therefore be taken, as the study of the Anthropocene is a complex affair which must account for the 'natural' process of the Holocene and the subsequent layering of human activity (Butzer 2015, 1541). Bauer and Bhan (2018) recognize the tendency for earth systems scientists to observe the Anthropocene in terms of broad geophysical effects, therefore masking the nuanced impact of regional human activities. Human impacts with such locational specificity could necessitate the use of different terminologies, such as *Anthropoeurocene*, that reflect the prominence of particular regions in particular periods (Edgeworth *et al*. 2016); the net effect of human activity is generated from 'place-based actors through a number of differentiated activities that have long been documented by both archaeologists and cultural anthropologists alike' (Bauer & Bhan 2018, 13). However, it should also be noted that significant disparities exist when considering the variation in anthropic effects worldwide (Malm & Hornborg 2014); influenced by long-term social, political and economic factors. Understandably, many islands lie at the least impactful end of this scale, as they are attenuated by their geomorphological size. Despite this, an island such as Malta is by no means devoid of the evidence of the Anthropocene. Where the earth systems approach to the Anthropocene may overlook the specificity of human activities, it serves to remind us of a core commonality shared by humanity. Gibson and Venkateswar (2015) dwell on this unifying nature of *Anthropos* and build upon the idea that the concept of Anthropocene is not yet fact, instead existing as a product of thought. To take this a step further, I would propose that thought – human cognition – is central to the Anthropocene's physical origin as opposed to its conceptual origin. The epoch's genesis is rooted in the net effect of human cognitive traits which value species needs over environmental stability. The Goudie and Viles (2016) approach, perhaps inadvertently, encapsulates the interplay between the *longue durée* and *conjonctures* by emphasizing the role of long and medium term factors with the onset of the Anthropocene. Laparidou *et al*. (2015), emphasize that humans have always had a role in modifying their environments, 'as we employ flexible and novel solutions for the survival and well-being of our societies'. Captured within this is the sense of événements, or the history of events, since niche construction (Smith 2011) can be viewed as a short-term series of events, as well as a longer-term paradigm of human activity. In short, the three temporal categories of the Annales School of thought bleed together, as time progresses. Niche construction can be an event and a cultural pattern; cultural patterns can be viewed geographically and demographically; geography and demography are influenced by the permanence of societies and other natural factors – all of which can influence the creation of one's niche. This cyclicality is a potential antithesis for Butzer's (2015) need for analysis of the Anthropocene at a distance. In summary, the *longue durée* of the Anthropocene involves the creation of a complex feedback loop, where early human activities remain layered in the environment and act as an influence for subsequent people.

8.3. The Maltese Archipelago and the *longue durée* of the Anthropocene

While keeping these thoughts in mind, we can turn to the islands of Malta. At present, visitors to the islands are met with a rich palimpsest of overlapping cultural history which has been carved into, and layered above, the natural limestone. Explicitly, much of the islands' history is visible as built heritage, yet an almost intangible time-depth can be seen within the implicit traditions of the rural world. Neolithic monuments, flanked by terraced slopes, are surrounded by buildings of the nineteenth and twentieth centuries. Each of these features is representative of short-term traditions which are intertwined through time as people act in relation to elements of the past that remain present in their contemporary landscapes.

The central resource is, in essence, the islands themselves – with limestone the primary building material used across time. It is rare to encounter a structure that is not comprised of limestone blocks, especially those which are quarried from the Globigerina Limestone strata. This encapsulates the *longue durée* of the Anthropocene, at least locally, as the layers of human development are constructed using materials which were initially deposited during the Miocene Epoch (*c*. 5.3 mya – 23 mya). Perhaps ironically, the voids left from this resource extraction have become refilled with the less dense waste of human activity. This has continued to such an extent that new landforms have been generated by the deposition of this anthropic layer, as can be seen at the Magħtab landfill. Fittingly, this site is now undergoing environmental management, including a landscaping programme which has constructed a striking set of terraces on this anthropic landform (Fig. 8.1). In many ways, Magħtab is a microcosm for the Anthropocene within the Maltese Archipelago, with its anachronistic terraces carved to disguise the artificial nature of the location, appearing to mimic the local landscape. Yet, this approach is likely to be ignorant of the ancient and essentially human origin of terracing practices. This is indicative of an engrained *mentalité* where current landscape traits are perceived as the norm, irrespective of what the true natural state may have been.

Focusing on the issue of terracing, there are many similar *longue durée* traits worth considering. Primarily, the archipelago's topography is dominated by the construction of terraces across all geological zones, through time. Thompson (2006) conveys how the shifting practices in wall construction evidence the gradual change in the cultural makeup of the islands, yet the walls still display a commonality that is millennia old. While the scientific analyses of the terraces may alter the understanding of some terracing practices, particularly where the geological variability is concerned, Thompson's anthropological study still provides value in the form of the engagement with lived experiences. 'The contrasting modes of wall, ancient and modern, are reflections of the values supported by the people of the times… No wall is created strictly favouring one ideal set of values over another. Rather, each wall is a complex of these contrasting values and their designs' (Thompson 2006, 34). Thus, the terraces are as much a cultural palimpsest as the wider landscape is. On a superficial level, they are the anthropic reshaping of the environment, with the creation of each terrace wall as an événement which involves a juxtaposed set of *longue durée* processes (quarried geology and subsequent soil erosion). Equally so, on a deeper level, these walls also represent their own palimpsest of fluctuating *mentalités*.

Figure 8.1. *An oblique aerial image of the northern slopes of the Magħtab land-fill site, depicting landscaping efforts including 'artificial' terracing (image © 2020 CNES / Airbus).*

The blurring of *mentalité* and *conjoncture* can be seen within the system of land tenure in the islands, as demonstrated by Bugeja (2018) who outlines the division between established landlords/church land and peasant landowners. The entrenched stagnation of ownership made it difficult for less economically viable farmers to acquire the land in which they worked. However, the availability of long-term perpetual leasing, *emphyteusis*, 'elevated the tenant into a position of *quasi*-ownership' (Bugeja 2018, 26). While this form of lease represented balance between the landlord and the tenant, the short-term leasing that was available represented greater gains for the landlord, especially considering the fluctuating value of the land based on its perceived quality. More developed private land would usually be subject to higher taxation, which would be reflected in the leasing costs. In contrast, long-term leasing was commonly found with Government and Church land, which came with lower taxation and 'very often characterised by feudal practices' (Bugeja 2018, 26). Although the annual rent, *qbiela*, relieved the farmer from tithe, they were obliged to repair field walls and to not sub-let land. Where extensive repairs were required, it was not uncommon for the landowner to intervene, assumedly as a matter of responsibility for maintaining an element of control. Where farmers invested in improving the land, at their own expense, it was common for landlords to increase the rent after the end of tenancies. Accordingly, tenant farmers were disinclined to move on from land they had heavily invested in, especially since no system of compensation existed to account for their improvements. Where landowners 'were largely characterised by a strong sense of elitism' (Bugeja 2018, 27), it is understandable that tenant farmers would opt for long-term leasing in order to regain a sense of control over their destinies.

From the 1850s, there was a considerable effort to encourage the expansion of agricultural practices to the barren, *xagħra* lands (Bugeja 2018). This served to increase governmental revenue and thus offset the cost of repairs elsewhere. Although this land was rarely productive, competitions were held to reward the most successful farmers, and the prizes became a valuable income source. In the period surrounding World War II, when the need for agricultural productivity was heightened, farmers enjoyed legislative changes that promoted their positive input, protecting them from excessive rent increase and harsh changes in lease conditions. Equally so, the landowner retained the right to reassess tenancy if the farmer was not operating the land adequately. Finally, in the post-war period, the accumulation of wealth and the rise of pensions resulted in the redevelopment of the land tenure system. With farmers retiring earlier and sub-letting their land, the overall amount of cultivated land increased while freeholding was in decline.

In essence the rise of the tenant-farmer class, as described by Bugeja (2018), is an artefact of long-standing tenancy practices. Although aspects of these practices have transformed through time, the process still maintained the architecture of the medieval traditions. This reflects the process of 'Agricultural Involution' (Geertz 1963), as increasing complexity can be found within a seemingly static system. Tied to these practices, the personal experience of the farmer, as presented by Thompson (2006), is effectively encoded in the walls they build and repair; they are indicative of the *conjonctures* that exist. Ultimately, these *conjonctures*, such as the expansion of land in the post-war era, are physically embedded in the *longue durée* as altered and abandoned land, now subject to unimpeded ecological processes. These 'Anthroscapes' ultimately reflect how short and medium term histories can directly influence the flow of the *longue durée*, therefore reinforcing how, at least in Malta, the Anthropocene has been present for a considerable period of time.

During the early twenty-first century, continual population growth and rampant development have placed renewed pressure on the landscapes of the archipelago. The traditional and historical rural locations are increasingly threatened by the advance of urban areas. A variety of public interest groups, utilizing social media, have formed to raise awareness of the risk to the local heritage. When observing much of this development, it is noticeable that many sites remain abandoned. Not wishing to comment further on the specific causes of this, all that remains to be said is that modern development and expansionism are mimicking the drive to incorporate new land, as described above. Ultimately, both cases involve the inscribing of the Anthropocene, with the cyclical nature of the expansion beyond need perhaps forming part of a medium-term *mentalité*.

8.4. Intensification

The concept of intensification is fundamental to the understanding of a number of *longue durée* environments. In this instance, the term specifically refers to the aspects of human activity which drive increased productivity from managed landscapes. Although this discussion refers to agricultural intensification, it is prudent to remain cognizant of the subsequent forms of intensification that are facilitated by increased agricultural output. Boserup's (1965) model is a fitting point of departure. A basic interpretation suggests that population increase is supported by an advancing technological framework available to that population, with the carrying capacity of the land constantly improved by greater investment of labour and/or the investment in infrastructure. Boserup (1975) pursued this further by emphasizing the importance of the ratio between people and land as the central factor in determining productivity within the context of a rural socio-economic system. Morrison (1994) stresses that archaeologists should exercise caution when using Boserup's (1965) model as a means of understanding intensification, since the approach acts more like a typology of societies rather than a mode of analysis. Morrison notes that Boserup's model cannot account for the myriad of strategies employed by societies through time and space. The restriction of Boserup's model is its linearity and lack of clarity on the specific nature of what intensification involves; instead, research should focus on 'delineating the actual paths of intensification' (Morrison 1994, 145). A more cautious approach should be adopted, especially considering the risk of dichotomous interpretations of intensification/disintensification, with emergent complexity serving as a broad concept that encompasses the intersection between population and production – specifically, the genesis of a complex and self-organizing system comprised of a variety of actors (Marcus & Stanish 2006). Further to this, Miller (2006) stresses the nuances of intensification, noting the concepts of *extensification* and Fuller's (2001) *diversification* as alternate routes to producing an end result similar to Boserupian intensification.

In effect, there is an element of Annales school thinking that needs to be considered here – that production and intensification strategies are part of the cyclical process discussed earlier. Boserup (1975) could be interpreted as observing the concept of production as a string of événements, framed by the *conjonctures* of investment methods. The central caveats to draw from Boserup are that investment in pre-mechanized societies is often seen with an increase of labour using pre-existing tools and methods; productivity can be achieved through greater use of status quo techniques. Interestingly, it is worth drawing comparison with Geertz (1963), where the process of 'Agricultural Involution' was defined. In this instance, agriculture develops into a system of increasing complexity, with ever increasing land divisions dominating the outward appearance of the agricultural system. Comparison between both models suggests that each population continues to a point of maximal indigenous carrying capacity, from which new management strategies must be employed. Boserup (1975) posits the greater investment of labour/technology, followed by economic migrations, while Geertz (1963) observes increasingly complex social management. Crucially, only Geertz (1963) is referring to an island context. Boserup's consideration of economic migration is attenuated by an island setting. Despite this, a fitting proxy would be the factors surrounding the socio-political setting of an island and how these influence the agrarian world. Boserup (1975) suggests that a population has little incentive to produce surplus beyond subsistence, unless external factors provide enough influence to generate a need. This is a vital idea to consider in the framework of the complex history of the Maltese archipelago.

8.5. Population

Dwelling on population as the motivator behind increased production, we must observe the complex demography of Malta through time. Undoubtedly, the complexity of demography is deeply interrelated to the growth of population and social networks. During the Neolithic and Temple Periods, these networks were primarily local-regional/Malta-Sicily, as evidenced by ceramic styles (Malone 1985; Bonanno 1986a) (see Chapter 6) and chert procurement for lithic tools (Chatzimpaloglou *et al*. 2020). Moving through the Bronze and Phoenician periods, the islands enter a wider maritime network (Stoddart 1999) (see Chapter 7), where the archipelago's natural harbours served to increase the external perception of the archipelago's value. These periods represent the islands on the cusp of broad connectivity with the wider Mediterranean, something which would be achieved from the Punic period onwards. Later historical records provide insight to the islands' relationship to the political powers of Sicily and the interplay between the needs of the inhabitants and the structure of wider regional politics. Thus, the phasing of population can be divided into two categories, sub-carrying capacity and post-carrying capacity. Since the islands have finite resources, it is logical to observe the periods that are drawing on insular means of production as distinct from those which rely on the outside world. Not surprisingly, the latter periods involve a marked shift in Malta's inclusion within the extra-regional political world.

8.5.1. Sub-carrying capacity periods

Understandably, the measurement of population in this period carries the most uncertainty, regardless of chronology and technology. There have been attempts by Renfrew (1973; Renfrew & Level 1979) to estimate the Temple Period population, and from several authors to relate this to death rates from the cultural patterns of burials (Bocquet-Appel 2002; Stoddart & Malone 2015; Thompson *et al.* 2020). From the perspective of this discussion, a prehistoric population estimate could act as an initial representation of the carrying capacity, assuming limited trade and population mobility. Renfrew's estimates for the archipelago reached *c*. 11,000 individuals, based on territories defined by the positions of pairs of megalithic sites and the population required to build such structures. Perhaps more reasonably, Clark (2004) estimated a population of 1407 for the Late Neolithic of Gozo, based on 60 per cent land utilization and 2 ha of land per person. If we extrapolate this to include Malta, the total number becomes 8787. Grima (2008b) presents a systematic analyses of estimated carrying capacity based on areas of low slope (<5 per cent gradient) and a minimum of 1.5 ha per person, which reveals pockets of low lying land totalling 7071 ha and supporting 4713 individuals. Usefully, the Clark (2004) and Grima (2008b) estimations do not exceed records of the medieval population which was not reliant on imports as a means of sustenance. During the fourteenth century, Malta exported grain to Sicily, although this is likely to have been an uncommon practice (Aloisio 2007). During the fifteenth century, the islands suffered from grain shortages every 2–3 years (Wettinger 1982) which drove increased demand of Sicilian grain imports (Aloisio 2007). Referring to Table 8.1, below, the population is likely to have been between 8000 and 10,000 individuals during this century. In contrast, Sagona (2015) presents a brief analysis of the potential carrying capacity of land with recorded archaeological field scars, although this is an unconvincing interpretation which is reliant on poorly applied, northern latitude, ethnography. In brief, the suggested land utilization, based on Gregg (1988), is 0.62 ha to 0.73 ha per person and therefore would suggest a considerable difference in carrying capacity in comparison with the Clark extrapolation.

Table 8.1. *Carrying capacity estimates for the Neolithic/Temple Period of the Maltese Archipelago. Figures are based on areas of low slope and calculations of low soil loss, with figures from Grima (2008b) provided for comparison. The figures classed as RUSLE 0–10 t/ha/yr represent a conservative estimate of population based on areas of stable soils. The RUSLE 0–25 t/ha/yr is an expanded area which includes slightly less stable soils as well as those which fall within the RUSLE 0–10 t/ha/yr.*

	RUSLE 0–10 t/ha/yr	**RUSLE 0–25 t/ha/yr**	**Grima (2008b)**
Area (ha)	3843.81	13997.61	7071
Population (1.5 ha/person)	2562.54	9931.74	4713

Although this may initially conjure the idea of populations ranging towards the Renfrew computation, it is worth considering the highly undefined nature of the prehistoric agricultural environment. *FRAGSUS* has highlighted the potential role of the hilltop plateaux for early agriculture, and emphasized the relative inaccessibility of the clay slopes (see Chapter 5). It is entirely possible that the prehistoric agrarian world, envisaged by each of these models, was far more restricted in reality, and was a landscape of fragmented tamed pockets (see Chapter 6). Finally, while observing the physical remains of the Temple Period, Malone *et al*. (2009a) caution that the current record only offers a limited synthesis of prehistoric populations, with isolated sites providing an uncertain cross-section of ancient communities.

The use of RUSLE (Revised universal soil loss equation) provides a direct measure of soil stability and erosion (Wischmeier & Smith 1978) (Fig. 8.2; Table 8.1; see Chapter 2), whereas the Grima (2008b) model was based on the presumption of soil stability from low lying areas. These new estimations help extrapolate

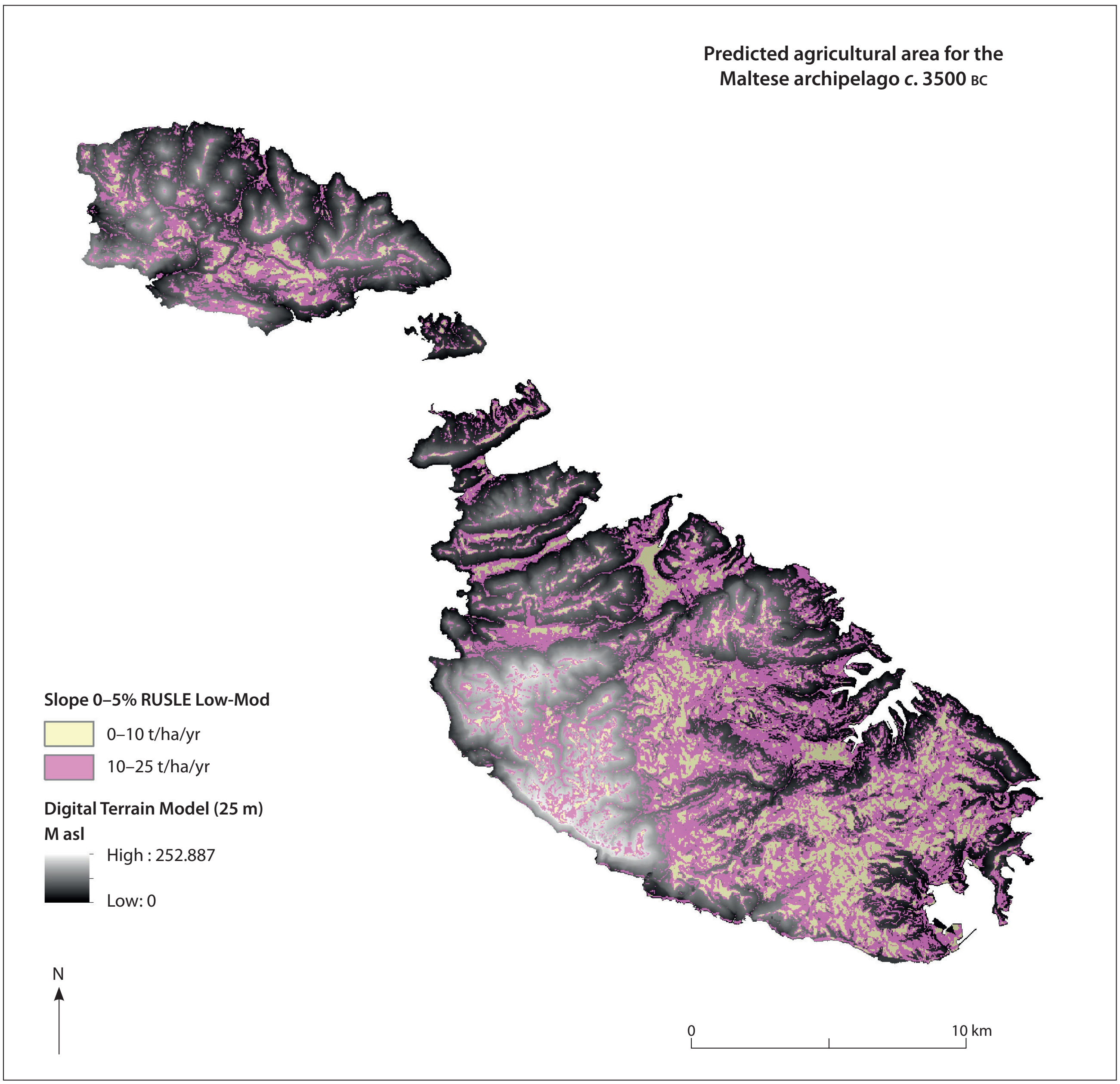

Figure 8.2. *RUSLE estimates of areas of low and moderate erosion for Gozo and Malta (J.M. Bennett).*

some of the recent environmental findings discussed in this volume and enrich the understanding of the lived experience of these islands during prehistory. Importantly, Grima's (2008b) approach should be recognized as meritorious as it sets the agenda for quantifying the past landscapes of the archipelago. Undoubtedly, future data and refinement of this GIS investigation will further delineate the parameters of early population in these islands.

Moving forward in time, the Bronze Age has had comparatively less research on population structure. Recchia and Fiorentino (2015) suggest that the Maltese archipelago was still within carrying capacity at the end of the Temple period, with the Early Bronze Age population co-habiting with the indigenous in a manner that suggests the islands could support a subsistence based economy. The evidence from the Cambridge Gozo survey (see Chapter 7) suggests an expansion of domestic territory, with site clustering similar to what was seen during the Early Neolithic, and an intensity of activity at re-used sites from earlier periods which is interpreted as a 'recommencement of a cycle of domestic activity that was played out of the earlier Neolithic and Temple Period phases' (Boyle 2013, 287). Boyle also indicates the value of focal locations as loci of trade and communication, given their position on the best routes to natural harbours. However, this perhaps contradicts the assertion that the Bronze Age was marked by a socio-ideological transformation, rather than a significant demographic change. Adding to this, a marked hiatus in cereal agriculture occurred in tandem with an increase in livestock grazing indicated by the palynological data (see Chapter 3). This could be indicative of a net reduction in human activity on the islands. It could be speculated that this reduction is tied to a form of Boserupian economic migration where a proportion of the population left the archipelago because of their inability to intensify production effectively.

Progressing through the Late Bronze Age/Borġ in-Nadur phase, the accumulated data suggest a return to greater levels of productivity along with the establishment of defended hilltop settlements (see Chapter 7). The climatic fluctuations between arid and humid periods is reflected in the variation between adopted cereals, which is indicative of local strategies to support population. The crucial difference that Recchia and Fiorentino (2015) highlight is the advantage of wider cultural contacts, which perhaps enabled the used of climate adapted crops more readily than would be found with a less connected island community. This reflects the fact that the Maltese Islands were beginning to enter the increasingly complex Mediterranean classical world which was already urbanized in the east (Malone & Stoddart 2009, 379). Phoenician activity in the archipelago is well documented, however the generation of a population estimate remains difficult because of the nature of contact and colonization. The account from Herodotus (Book IV, 196) tells of a building of trust through indirect trade at new locations. The Maltese Islands, with poor natural resources other than rock and crops, would appear to have little to offer Phoenician colonizers (Bowen-Jones *et al*. 1961; Blouet 1963; Vella & Anastasi 2019). However, such an assertion ignores the value of the archipelago's sheltered harbours and strategic position between the North African littoral and the Near Eastern heartland of Phoenicia (Recchia & Fiorentino 2015). Considering this, there is an accepted model (Bondì 2014; Sagona 2015) of overlap between the Phoenician traders and the indigenous population, which ultimately gave way to a more permanent form of Phoenician settlement, a feature which is highly evident from the rock-cut burial tombs (Said-Zammit 1997; Sagona 2002). At this stage, the issue of carrying capacity becomes a little more tenuous since the presence of a trade network would suggest that the operation of supply and demand may have existed within the Phoenician period. The subsequent population development, and the transition of Phoenician (trading outposts) to Punic (hinterland management) (Vella 2014), brought the Maltese archipelago into the period of post-carrying capacity populations, or post-insular reliance, where the islands were reliant on external contact as a means of supporting local production capabilities.

8.5.2. Post-carrying capacity periods

Said-Zammit (1997) has produced a population estimate for the Punic period of the archipelago, with the estimate representing the population just prior to entry into the Roman world. Based on 100 per cent utilization of cultivable land (equalling 18,960 people on 60 per cent of the total land area), Said-Zammit proposes that the total population was in the region of 17,555 individuals with population incrementally rising to this level. However, caution must be taken with the concept of complete land utilization as geological factors render areas inaccessible to agricultural practices. Although technological innovation would improve accessibility, a significant area of land will always remain unavailable e.g. littoral and steep gradient locations. This is echoed by Alberti *et al*. (2018) in a logistical regression analysis of nineteenth century land quality assessment. Although this will be discussed in more detail in Chapter 9, the central theme to consider is that the later historic landscape contained locations which spanned the gamut of agricultural viability. Notably, this includes areas of exceptionally poor agricultural viability, despite near contemporary technology. By

Table 8.2. *Summary of population changes in the Maltese Archipelago (after Bowen-Jones* et al. *1961 and Cassar 2002).*

Year (AD)	Population	Source	Comments by Bowen-Jones *et al.* (1961)	Comments by Cassar (2002)
991	21000	Emir Yusef al Futah	Excessive in comparison with Giliberto's report	
1240	5600	Giliberto Abbate		
1241	2199			Potentially the number of hearths as opposed to total population
1400	10000	Bosio	Population did not exceed this number	
1419	8335			Established figure for Malta
1480s	9829			Established figure for Malta
1528	17000	Commisioners of the Order of the Knights of St. John	Number includes 5000 Knights	
1530	25000	Chev. L. de Boisgelin, Bosio and Fra Joannus Quintinus	Multiple suggestions of local population at 20,000 (plus 5000 Knights)	
1535	22000			
1565	31000	Order of the Knights of St. John	22,000 (plus 9000 Knights) pre-Great Seige	
1565	23000	Following casualties according to Zabarella and Bosio	20,000 (plus 3000 Knights)	
1582	20000	Grand Inquisitor Visconti (Malta only)		
1590	32290	Knight de Quadra, for the Viceroy of Sicily		
1632	52900 (51750)	Enumeration under Grand Master de Pawla	48,450 (plus 4450 Knights)	Cassar presents 51,750 excluding 5000 Knights
1736/40	66364			
1741	111000	Enumeration under Grand Master de Despuiz	Conflicts with Ciantar's assessment	
1760	66800	G. A. Ciantar. 1772. *Malta Illustrata*. (Malta only, excluding members of the Order of Knights)	Excluding members of the Order of Knights	
1798	114000 (98000)	Boisgelin	Unreliable as Gozo estimate is 24,000; this conflicts with 1842 population of 14,000 as there is no known population migration to Gozo	Cassar presents 98,000
1807	115154	*Almanaco di Malta* 1807	Based on Parish registers; 93,000 'native Catholic' and 22,100 'other inhabitants and domesticated strangers'	
1813	110803	Burril, W. H. 1813. *Report on the Plague in Malta*		
1828	115945	*Historie de Malte* 1840	Little difference in comparison with the 1807 account; the plague may have limited population growth, however the enumeration process must be questioned	
1837	119878	Watson, S. B. 1838. *The Cholera at Malta in 1837*	Over-estimation is also a likely to be at fault here	
1842	113864	The First Census of the Maltese Islands		
1871	200000			
1931	245640			
1948	304991			
1990	355910			

applying this new understanding to the landscapes from the classical period onwards, it is obvious that 100 per cent utilization of the environment is simply not possible. Returning to Said-Zammit's (1997) work, it is straightforward to re-scale this estimate according to a reduction in available land. For example, at 60 per cent utilization of cultivable land (including the additional support of trade) the population would have been around 10,200. Although this is only speculation, it serves as a reminder that a more detailed analysis of the environment must take place – one which incorporates the pedological and spatial investigations of the *FRAGSUS Project*.

In her study of the Roman Imperial and the Byzantine periods, Bruno (2009) states that there is no concrete way to determine the population size. She suggests that the recorded military garrison of 2000 (all male and of military age) is consistent with what would be expected for a significant population size. However, this overlooks the role of the garrison, perhaps suggesting that it served to defend/exert control over the local population, when in fact a frontier garrison may have had other strategic purposes and whose numbers should not be used as an indicator of local demography.

With the appearance of historical records, there is a more reliable basis for understanding the output and requirements of the Maltese Islands. Bowen-Jones *et al*. (1961, 133) provide a useful summary of the population record during the historic period which is adapted in Table 8.2, incorporating their comments and those of Cassar (2002). The first official census on the islands took place *c*. AD 1241, under the jurisdiction of the Norman King Frederick II. Across both islands the local governor, Gilberto Abbate, recorded 1891 families, which equates to *c*. 7267 individuals (Bruno 2009). However, comparing this figure with Table 8.2 reveals discrepancies. This emphasizes the need for caution when scrutinizing these early population records, using them as a guide to the general trajectory rather than as absolute fact, at least until the later Medieval period.

Although Bowen-Jones *et al*. (1961) scrutinized the validity of each of these estimates, their overview presents a much clearer idea of how the population has accumulated within the archipelago. At this juncture, the concept of Boserup (1975) and intensified production meets a complex socio-political structure where the nature of external events and external investment influenced activities taking place within the Maltese Islands. To chart this, the following section will consider the environment within which agriculture takes place, and which frames the adaptations driven by either internal or external influences.

8.6. The agrarian archipelago

To develop a synthesis of the development of intensification within the Maltese archipelago, it is essential to comment on the nature of the agricultural environment through time. This section will observe the geological and pedological constraints which provide the context within which technological and population changes occur.

8.6.1. The agricultural substrate

Lang's (1960) study has acted as the foundation for the understanding of Maltese soils and their development with three main types of soil identified: Carbonate Raw, Xerorendzinas and Terra soils. In more recent years, *MALSIS – A MALtese Soil Information System (TCY00/MT/036)*, has developed an inventory of soil for the Maltese Archipelago (Vella 2000, 2001, 2003). This has progressed from Lang's considerable work to a quantitative survey which is aligned with the FAO World Reference Base (WRB 2014) of soils. Specifically, this has reclassified the soils identified by Lang (1960) and added some more niche soils that were not previously acknowledged. Calcisols are noted as the most dominant and likely correlate with Lang's Carbonate Raw soils. Linked by the Blue Clay parent material, Vertisols are another reclassification of the carbonate raw soils, defined by deep clayey fissures during the dry summer months. Luvisols correspond to the Terra soils, which are essentially relict soils with subsequent $CaC0_3$ concentrations which are indicative of the present climatic conditions. Utilizing the WRB (2014) and working with archaeological considerations, French and Taylor (Chapter 5) have presented an extensive re-analysis of the soils and palaeosols across the Maltese Archipelago which emphasizes a shift away from developed argillic brown soils (or Luvisols) as the result of anthropic factors, leaving an environment characterized by thin xeric soils and vertisol slopes. Thus, to manage this delicate situation, soils must be constrained by agricultural terraces and improved through the use of natural and artificial fertilizers.

8.6.2. The development of agricultural technology

Sustaining the agricultural environment requires the careful management of a variety of different factors. In the case of the Maltese Archipelago, soil conservation is the key to maintaining any level of agricultural viability. Given the restricted limestone environment, as described by Chatzimpaloglou *et al*. (Chapter 1), the variety of soils available is relatively limited. This is exacerbated by the difficulties of geology, with the predominance of Blue Clay slopes, especially in Gozo. Sagona (2015) reports ethnographic accounts of 1830s soil production which tell of thin and friable soils, which have good agricultural return. However, where the landscape is denuded of soil, these accounts include the practices involved with the regeneration of a viable substrate. Generally, this relies on the breakdown of the soft limestone (usually the Globigerina), sometimes aided by manual interaction. Through weathering, and improvements such as manuring and crop rotation, the land can be 'amended' to something more viable and productive. Bugeja (2011) describes the practices of surface preparation, such as depicted in Jean Houël's late eighteenth century drawing of Borġ in-Nadur. Typically, these involved the clearance of barren rocky areas, with the levelling of protruding stone and the infilling of negative space in the bedrock. Such preparation echoes the medieval 'Red Soil Law,' latterly incorporated within the Fertile Soils (Preservation) Act of 1973, which required anyone who is erecting a building to gather and preserve the red soil present at the building site. Thus the legislative structure of the archipelago preserves an entrenched practice of bedrock preparation and redistribution of soil used to encourage better agricultural productivity.

Folk practices and accounts of pre-mechanized farming (Halstead 2014) are invaluable to the interpretation of agrarian practices through time. Observed practices provide a reference tool for how ancient landscapes may have been utilized, with varying states of technological development. The folk accounts reported by Sagona (2015) are the first 'technological' step in managing the landscape. Awareness of soil performance and the methods required for improvement were advances made during the prehistoric phases. French and Taylor (Chapter 5) describe pockets of developed Pleistocene soils which would have been readily available to prehistoric agriculturalists. Despite this likelihood, evidence from a number of 'Temple' sites suggests that much work was already taking place to improve the productivity of the soil prior to the construction of the 'Temple' buildings (see Chapter 5). Notably, soils at Ġgantija show significant levels of enrichment with settlement-derived organic waste, contained within what could only be described as a rudimentary terrace, based on the spatial setting of the soils. The related strata appear to underlie elements of the megalithic structure and represent an intentional accumulation of soil to form a viable agricultural topsoil. It could be postulated that this may be one of the earliest forms of agricultural terrace in the Mediterranean and beyond; however, further investigation would be required to confirm the veracity of this interpretation.

As Chapters 2 and 5 have revealed, the continual degradation of soils within the archipelago has led to the adoption of agricultural terracing in the traditional sense. This technology acts as an effective control mechanism for eroding soils. By physically altering the gradient of the hillslope, and creating additional surface roughness, soil can be captured and built into flat surfaces. Terracing is also advantageous as it maximizes water retention within fields – which is vital in semi-arid locations. Labour investment therefore surrounds the construction and maintenance of terraces. On limestone bedrock, Pace (2004) has demonstrated the intentional 'cutting' of the bedrock surface, prior to the creation of a terrace structure, dating to *c*. 800 BC (see Chapter 7). Although relating to a much later landscape, that practice can also be seen at the site of Tal-Istabal, Qormi, in Malta where the *FRAGSUS Project* used Optically Stimulated Luminescence dating in relation to the exposed archaeological landscape (see Chapters 2 & 5; Appendix 2). Fundamentally, this practice is not dissimilar to the soil preparation techniques described by Sagona (2015) as the limestone cut during the formation process could be crushed and used as for soil formation, if not used in wall construction. Borg (1915) reflects that fields had reached a peak of development as a result of the division of land into terraces. Ploughing was meticulous and reliant on the use of non-mechanized techniques, including the 'Maltese plough.' This device balanced the need for a strong steel ploughshare with the practicalities of maintaining a shallow depth of furrow which avoided exposing the bedrock. Borg also describes the use of the hoe, especially as a spade is not effective in the stony and stiff soils. The challenges, overcome by traditional practices and steel tools, were likely an even greater problem for ancient agriculturalists. The creation and development of soil is one achievement while the seasonal process of working the soil is another. Accounts such as those of Borg (1915) and Halstead (2014) suggest that scratch agriculture, using simple tools, may have been very long established, perhaps since the prehistoric period.

Establishing a date for the onset of agricultural terracing is difficult in practice, as soil stratigraphy and chronology pose a significant challenge to overcome. A combination of thin soils and regular ploughing ensures that cultural material has lost its stratigraphic security. As material slowly erodes into terraces, there is a small chance of dateable material entering the fill. However, to utilize this, the material would need to be found in an intact deposit, or perhaps in the lower parts to the wall. Any secure dateable material relating to the formation of the terrace may provide a *terminus post quem*, while subsequent additions during the use of the terrace would represent a *terminus ante quem*. However, finding distinction between these would be exceptionally challenging when considering the stratigraphic nature of terraces. One potential way to overcome this problem is by using Optically Stimulated Luminescence (OSL) dating, which allows the acquisition of absolute dates from the soil itself (see Chapter 2; Appendix 2). Although the uncertainties of soil accumulation would still apply to this technique, the use of relative accumulation profiling (Sanderson & Murphy 2010) would enable a controlled observation of this effect alongside the use of direct OSL dating. This could be achieved in two ways. Firstly, an attempt could be made to date individual terraces (Davidovich *et al*. 2012), which could be an arduous and expensive process that provides dates with very specific spatial dates. A second, novel method, is to consider terracing's effect on erosion into the valley basins. By searching for deep valley deposits, the use of OSL profiling could be used to date terracing relatively through the proxy of valley stratigraphy (see Chapter 2). Logically, the onset of terrace construction would constrain the amount of soil eroding into the valleys. By profiling a deep valley section, it is possible that the pre- and post-terrace erosion deposits could be identified and dated. In 2016, the *FRAGSUS Project* tested this method at a number of sites, as discussed in Chapters 2 and 5. Dates obtained from the Ramla Valley, Gozo and the site of Tal-Istabal, Malta, show much promise for the technique. In the lower Ramla Valley, AD 1880±16 is the date after which the degradation of the upper slope was constrained (Appendix 2). At the latter site, AD 1620±23 has been noted as the start of soil accumulation. Further samples were taken in the Marsalforn Valley, and suggest colluvial accumulation from at least 1560±240 BC and throughout later prehistoric times, but do not directly constrain the fixing of the period of terrace construction (see Chapter 5).

The two sites dated above represent the use of Globigerina Limestone and Blue Clay geological zones for terracing. Tal-Istabal, represents a continuation of the hard geology terrace construction methods, utilizing the easily worked limestone to prepare a flat bedrock surface upon which a terrace can be constructed. Interestingly, this site also contained a deep channel for water flow from a cistern and an interconnected wheel well. As such, this weight of archaeological evidence is indicative of the Knights period for production intensification – and this is further corroborated by the OSL date. Similarly, in the Ramla Valley, colonization and field demarcation in the mid-sixteenth century AD associated with the Knights of St John suggests that the Blue Clay slopes were not intensified through terracing until at least this period and well into the late nineteenth century. This is likely because of the difficulty encountered when working with the soils on these slopes, as the plough horizon is no more than a restructuring of the parent material – a stiff, moisture retentive argillic layer. The intensification of these slopes is therefore an artefact of a drive to increase productivity during the Knights of St John and the British periods, when a significant level of investment could be made to alter this landscape.

8.7. Discussion: balancing fragility and sustainability

The Maltese archipelago can be viewed as an allegory for the Anthropocene world. The analyses of the changing environment have shown that the influence of human actions can have consequences that remain for the *longue durée*. The flourish of agricultural activity in the later Neolithic caused resounding effects to the stability of soils on the islands. Through clearance of scrub and heavily worked soils, the processes of erosion and soil loss began. Quickly, people adapted by working to improve soils using uncomplicated enriching techniques in an attempt to sustain the viability of soil. However, the need to expand agricultural zones also arose, and is possibly visibly indicated by cart ruts (Pace 2004) which have become inscribed into the bedrock. Although much uncertainty exists regarding the function(s) of the cart-ruts (Hughes 1999; Magro Conti & Saliba 2007), a common interpretation is one of short-range commodity and communication routes, likely utilizing wheeled vehicles as indicated through geomorphological investigations (Mottershead *et al*. 2017). While the haulage may well have varied in composition, its perceived existence is indicative of more intensified landscape from the Bronze Age onwards, especially considering the ruts as markers of vectorized movement towards upland areas. Equally so, the process of terracing has been occurring throughout the historic period, and probably stretches back in some form to the Late Bronze Age.

In summary, these threads of intensification would suggest a trajectory of growth throughout the prehistoric period that would have necessitated a greater output from the land. Although soil exhaustion may only be a marker of the most commonly used land, it is likely that a continually increasing population associated with the rise of the Temple Period culture was the true driving force behind the need to intensify the prehistoric landscape. It could therefore be postulated that the notable cultural change between the Temple Period and the Bronze Age was partly influenced by the degrading agricultural landscape. Through time, the population may have dropped through lower birth rates and out-migration, although the *FRAGSUS* study has confirmed that a complete abandonment did not occur (see Chapters 6 & 11, and Volumes 2 & 3). As such, sustainability gives way to fragility. From the later Bronze Age onwards, the influx of new technologies and external interests in the archipelago allowed the population to adapt the agricultural environment once more. The adoption of agricultural terracing helped to preserve the fragile *status quo*, and is still extant in the modern era. Terraced 'anthroscapes' are an almost indelible mark on the landscape, one which states the general discontent with the natural processes of erosion. As such, they mark human intentionality to change the environment, rather than change occurring as a by-product. Crucially, in the Maltese archipelago, terracing is indicative of the *longue durée* effects of early farming practices. However, in the twenty-first century, the Maltese Islands have managed to preserve a modest level of sustainability. Nonetheless the reliance on the land for subsistence rapidly diminished through the late twentieth century, allowing the expansion of local produce and market gardening enabled by the permanence of knowledge within folk agrarian practices. In addition to development pressures growing hand-in-hand with an increasing population, the possible abandonment of marginal coastal zone agricultural land, particularly since the mid-twentieth century (Grima 2008a), may have also had an important role to play. Together these factors could lead to a catastrophe not unlike that predicted by Bowen Jones *et al.* (1961). However, continuing rampant development may lead to a much greater anthropic erasure of the agrarian landscape, well before any widespread environmental collapse takes place.