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LIFE17 NAT/IT/00619 GREENCHANGE
Green infrastructures for increasing biodiversity in Agro Pontino and Maltese rural areas

DELIVERABLE C1.

GUIDELINES FOR THE ECOLOGIC MANAGEMENT OF RUBBLE WALLS AND TREE BELTS

Action C1 – The Biodiversity Pact: increasing the functionality and ecological connectivity of rural areas

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ABSTRACT ITA

I muri a secco sono un importante elemento del paesaggio rurale Maltese, protetti dalla Legal Notice 160-1997 "Rubble walls and rural structures (conservation and management) regulations". La costruzione e il restauro funzionale dei muri a secco deve essere effettuato seguendo dei criteri specifici (vedi Deliverable A2 "*Technical document for rubble walls restoration in Maltese pilot areas*"). I muri a secco possono essere un importante bacino di biodiversità e quindi di servizi ecosistemici ad essa connessi, se la gestione non si limita al solo mantenimento strutturale del muro a secco. In questo documento tecnico verranno delineate delle azioni di gestione finalizzate a mantenere la funzionalità del muro a secco e aumentarne il ruolo di ecotono nella matrice agricola per promuovere biodiversità e i servizi ecosistemici ad essa connessi.

ABSTRACT EN

Rubble walls are an important element in the Maltese agricultural landscape, protected by the Legal Notice 160-1997 "Rubble walls and rural structures (conservation and management) regulations". The construction and functional restoration of rubble walls must be carried out following specific criteria (see Deliverable A2 "Technical document for rubble walls restoration in Maltese pilot areas"). Rubble walls can be an important source of biodiversity and, therefore, of biodiversity-related ecosystem services, if the management is not limited to mere structural maintenance. In this technical document, management actions will be outlined aimed at maintaining the functionality of the rubble wall and increasing its role as an ecotone in the agricultural matrix.

INTRODUCTION AND STRUCTURE OF THE DOCUMENT

The building of rubble walls – dry-stone walls built in loose unhewn or rough-dressed stones, which stand by gravity and friction without the use of mortar - as either border walls or retaining walls, is one of the most widespread countryside traditional building techniques all around the world. Indeed, all the great cultures of the past used this technique – from Greeks, to Romans, to other Mediterranean populations, up to continental Europe, Latin America (especially Peru) and China.

Dry-stone walls have been traditional landscape elements for centuries: they have not only an historical value, but also give an important contribution to biodiversity protection in the rural environment. The interstices in these walls provide microhabitats to various plant communities, insects, reptiles and amphibians – due to the contextual presence of warm, cool, damp, dry, sunny and shady areas - as well as breeding sites for birds. They represent valuable stepping stones and insular biotopes in the agricultural landscape and, due to their linear structure, act as ecological connections. They also have a filtering function (rainwater flowing from a plot to another passes through the walls' interstices capturing organic matter and leaving at the bottom of the wall a useful humus for soil regeneration) and allow excess rainwater to drain from the fields, benefiting agriculture production and minimising soil erosion.

Recently, the UNESCO Convention Intergovernmental Committee for the Safeguarding of Intangible Cultural Heritage has inscribed the art of dry-stone walling in the Representative List of the Intangible Cultural Heritage of Humanity, upon the presentation of a transnational candidacy by Italy, Cyprus, Croatia, France, Greece, Slovenia, Spain and Switzerland. The Committee agreed that the candidacy met the criteria of intangible cultural heritage; in particular, because the technique is a 'living' one, and plays a fundamental role in maintaining the environment and landscape.

Though Malta was not involved in the abovementioned candidacy, rubble walls are found everywhere in the Maltese islands – where they mainly serve as borders between fields and farms – and the Government issued a dedicated regulation (Legal Notice 160 of 1997 'Rubble walls and rural structures (conservation and management) regulations') to protect them. This regulation declares rubble walls as *'protected, in view of their historical and architectural importance, their exceptional beauty, their affording a habitat for flora and fauna, and their vital importance in the conservation of the soil and of water'*. It also identifies the characteristics of 'sensitively executed repairs' to existing rubble walls, which: *'(a) are carried out exclusively using the same type of drystone rubble walling that composes the existing wall; (b) satisfy all the protective conditions and safeguards contained in these regulations and*

in the Development Notification Order; and (c) do not increase the height or extent of the existing wall or significantly modify the general site topography or the overall profile or character of the wall'.

The reason behind this document lies in the need of re-defining the role and function of the rubble walls network in the Maltese rural areas in the face of the deep changes that have occurred since its establishment and of the changed expectations of a society that demands from green areas more and more complex services concerning ecosystem and environmental protection.

This document consists of:

i. A *general part*, presenting the historical and social reasons that determined the creation of the rubble walls network and describing this network's current state, based on studies performed by research centres, public authorities and single researchers. This part also addresses the topic of the rubble walls management by private farm holdings and farmers, through "land stewardship agreements" based on the objectives of the LIFE GREENCHANGE project related to the multifunctional, ecosystem-based use of green infrastructure.

ii. A *special part*, describing how to manage rubble walls when ordinary and extraordinary maintenance is required, and how to restore the functionality of wildflower strips and buffer zones using autochthonous species, with the purpose to create ecological corridors.

GENERAL PART

Reference framework for the management of rubble walls

The Pact for Agro-biodiversity is meant as a territorial governance tool that defines a reference framework to harmonize priorities, actions, interventions and funding tools for the rural environment, orienting them towards environmental conservation and agro-ecosystems rehabilitation goals.

The Pact is conceived as a permanent open discussion and negotiation table, aimed at sharing with relevant local stakeholders (both public and private) the modalities of managing rural spaces so as to increase their level of ecological protection, functionality and connectivity. Therefore, active participants in the Pact will be the institutions in charge of programming and territorial management, as well as farm holdings and their representatives, as 'land stewards' and potential beneficiaries of the Common Agricultural Policy.

Linear vegetation structures such as hedges and tree rows, when formed by autochthonous species, increase the ecosystem's complexity, enrich and diversify the rural landscape, reinforce ecological networks and create shelter and reproduction spots for wild animals moving through the territory. Therefore, they play an important role in the preservation of biodiversity.

More specifically, narrow linear vegetation structures mainly host species that are typical of open spaces or edge areas, while thicker ones can host species that are more linked to shady environments, and, in general, a richer and more complex living community. Such structures also serve to slow down wind speed, stabilize soil, and produce fruits; they are useful for bees, represent a source of energy and a carbon reservoir, and allow for moderate wood production.

Therefore, rubble walls can be integrated with a linear system of vegetation that enhances the presence of biodiversity.

The rubble walls network in the Maltese islands: current state and biodiversity

Status of Maltese rubble walls

Rubble Walls, known in Malta as 'Ħitan tas-Sejjieħ', have been a predominant and integral feature of the Maltese rural landscape for centuries. Indeed, since remote times, local farmers have re-shaped the land surface, creating terraces that enabled them to maximize the agricultural exploitation of an arable land characterized by a limited surface area, a hilly topography, water scarcity and meagre soils. Early examples of 'dry' stonewalls can be seen close to the pre-historic Megalithic Temples, dating back as far as 5000 BC, and also at the Bronze Age village of Borg in-Nadur. It was however, during the Arab occupation (870-1127 A.D.) that the construction of rubble walls became a widespread agricultural

practice, not only to delineate the field boundaries, but also as a measure against soil erosion in terraced fields. Ever since, rubble walls have dominated the Maltese rural landscape (Vella and Garrido, 2010).

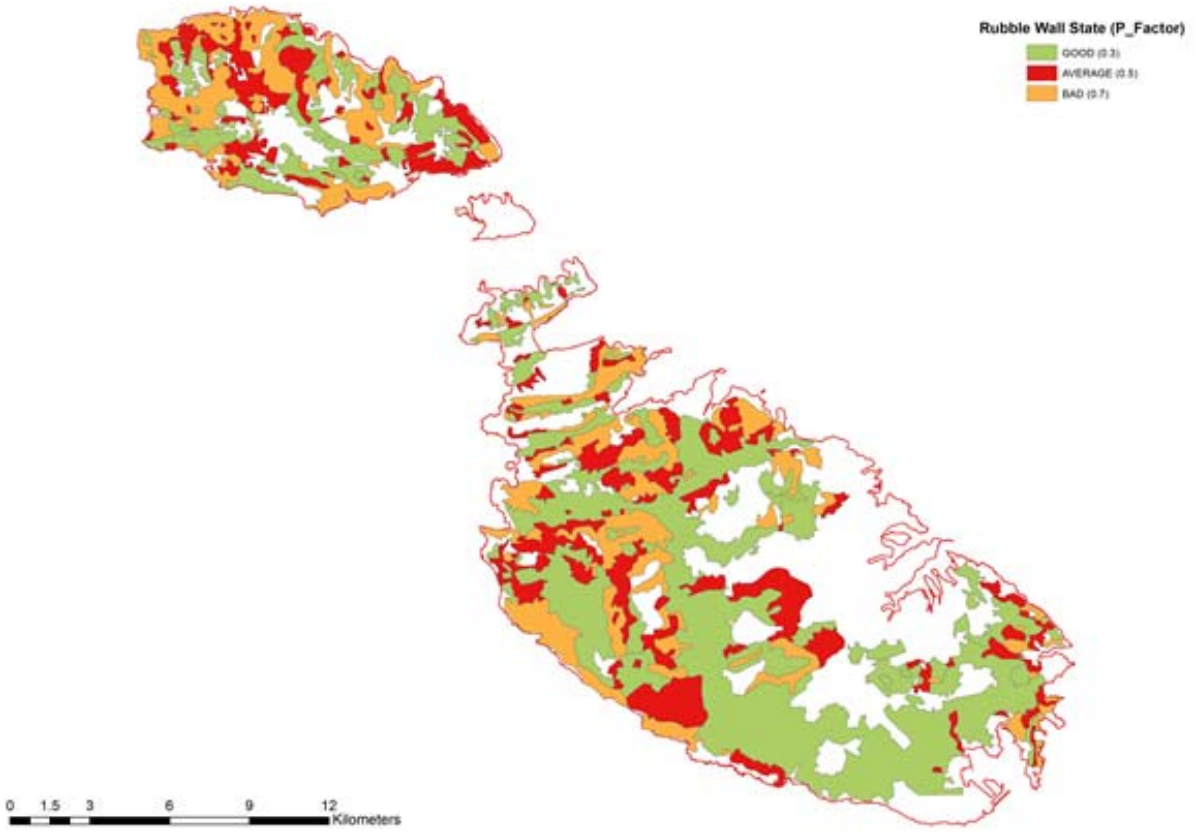
In recent decades, there has been a steady loss of rubble walls, mostly because of the loss of land due to development, and of a loss of traditional knowledge associated with the decline in the local farming community.

Quantifying the extension of Maltese rubble walls system is not a simple task, however according to surveys conducted within the framework of the EU funded project ResManMed - Assessing and validating natural resource interdependencies, in Gozo terraced fields supported by rubble walls cover a surface area of 20 km^2, corresponding to nearly half of the island's arable land. Reasonably enough, the majority of these rubble walls can be found along the steepest slopes.

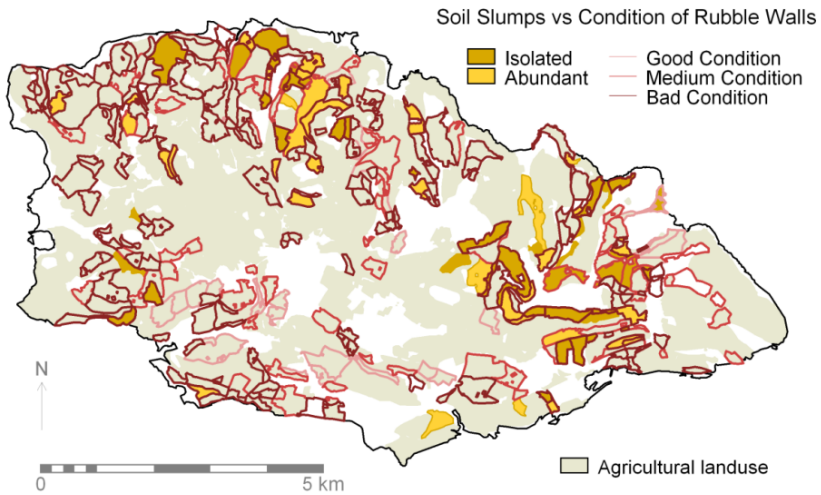
Nonetheless, existing rubble walls are often in poor conservation state. This was reported by several surveys, conducted both by national bodies, and within the framework of international projects (such as the already mentioned ResManMed, and the UNEP-sponsored project MAP CAMP - Coastal Area Management Programme). The Rural Strategy Topic Paper (MEPA, 2003) acknowledges that bad practices in wall maintenance (such as the addition of new materials or the application of inappropriate building techniques) have resulted in the loss or damage to the traditional structures.[1] The 2018 Maltese State of the Environment Report, in which the national Environment and Resources Authority (ERA) assesses land use and rubble wall state from 2009 to 2015, concludes that the majority of agricultural terraces on inclined surfaces are disused and retaining rubble walls in a derelict state. This situation is mainly considered as a consequence of the abandonment of fields (mostly of limited size and low accessibility, and requiring high maintenance) due to changes in the socio-economic dynamics[2].

An assessment of the conditions of rubble walls in the Maltese Islands is summarized in the following maps, which also highlight the link between these structures' state of conservation and the stability of soil.

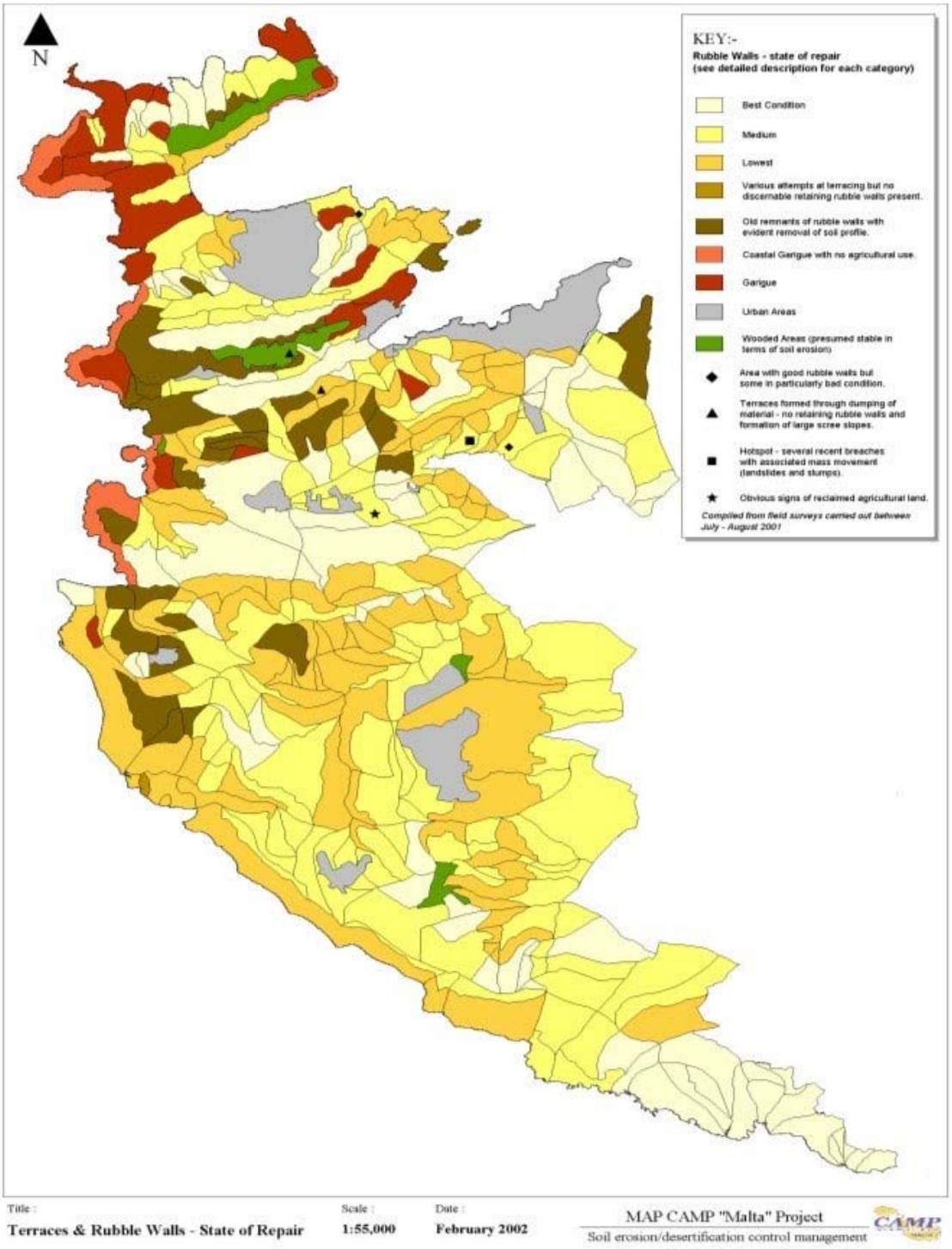
[1] Vella, J. and Garrido, J. (2010), "Our Ancestral Country Allies: The Rubble Walls".
[2] Sultana, D. (2015), "Numerical Modelling of Soil Erosion Susceptibility in the Maltese Islands using Geographic Information Systems and the Revised Universal Soil Loss Equation (RUSLE)", Xjenza Online, 3:41-50.



State of rubble walls in the Maltese Islands
(Source: Sultana 2015)



Occurrence of soil slumps in relation to the condition of rubble walls in Gozo
(Source: IRMCo)



State of repair of terraces and rubble walls in northwestern Malta in 2002
(Source: MAP CAMP - Coastal Area Management Programme)

Rubble walls and biodiversity

In the Maltese area, rubble walls can be considered as infrastructures of great importance for wild flora and fauna. Though they are not natural elements, rubble walls are perfectly integrated in the agricultural context, preserving habitats and species, and forming – combined with the adjoining vegetation – ecotones in the rural landscape. Moreover, as already mentioned, the rubble walls network is one of the most significant structural elements in the eco-mosaic of Malta and Gozo, and for this reasons it has been protected by law since 1997.

Rubble walls are semi-natural ecosystems able to allow for those functions that are necessary in the maintenance of the vitality of populations belonging to sensitive species, of communities, habitats and ecological processes. Their role is framed within the concept of conservation of a physical and functional continuity between natural and semi-natural environments, conceived as a strategy aimed at mitigating the effects of environmental fragmentation on populations and communities. In general, rubble walls form linear systems able to: provide resources and shelter areas, ease the movements of species that are sensitive to fragmentation, maintain the vitality of meta-populations of sensitive species, indirectly control those invertebrate species characterized by population outbursts, reduce the local disappearance rate of species in fragmented landscapes.

The rubble wall ecosystem is not limited to the built elements. Rubble walls can belong to two main typologies: retaining rubble walls, which are terracing structures with a higher and a lower part, and two-sided boundary rubble walls. Therefore, according to the typology, a vegetation edge hosting flora and fauna species can be found either on both sides of the wall, or below/above it. This is how rubble walls achieve their maximum expression as ecological corridors, performing a connectivity role besides sheltering functions. Their suitability to host biocenosis depends on the biological complexity and characteristics of the vegetation adjoining the wall. In particular, it is linked to the specific composition and diversity of flora, to its maturity and structure (in terms of height, width and length), to the distance from sources of anthropogenic disturbance.

The ecotone adjoining the rubble wall can provide the right habitat for the survival of species typical of the garrigue habitats – especially important at local level, since these habitats are very rare in the Maltese islands. Additionally, garrigues and thermo-Mediterranean scrubs, dominated by *Anthyllis hermanniae subsp. Melitensis* and *Euphorbia melitensis,* are habitats of European interest (habitat 5330 – Thermo-Mediterranean and pre-desert scrub) and host rare species such as *Periploca angustifolia,* and the orchids *Himantoglossum robertianum, Anacamptis pyramidalis* subsp. *urvilleana* and *Ophrys melitensis*. However, the most important feature of garrigues is represented by herpetofauna, including numerous species listed in Annex II of the Habitat Directive (*Chamaeleo chamaeleon, Telescopus fallax fallax, Elaphe situla*). More specifically, rubble walls provide shelter to *Crocidura sicula calypso*, an endemic shrew (Habitats Directive, Annex IV) and various reptiles including *Coluber viridiflavus carbonarius*, *Chalcides ocellatus tiligugu*, *Tarentola mauritanica*, *Hemidactylus turcicus turcicus* and

Podarcis filfolensis maltensis. Finally, garrigue areas provide ideal sites for many bird species, as well as for the reproduction of *Calandrella brachydactyla*. The sites included in the Maltese Natura 2000 network, as well as the intervention areas, host numerous species of micro-mammals (*Suncus etruscus*) and chiropters (*Pipistrellus pipistrellus, P. kuhlii, P. pygmaeus, Plecotus austriacus, Tadarida kenioti, Eptesicus serotinus*), among which the presence of *Myotis blythii* (Annex II species) has been reported.

The interventions aimed at reinforcing the role of rubble walls as ecological corridors will contribute to increase the suitability and the environmental availability for various reptile species that frequent scrub areas, traditional rural ecosystems and rocky formations, and are threatened by the loss and fragmentation of habitats and by intensive conversion of agricultural areas:

- *Zamenis situla* (included in Annex II of the Bern Convention, in Annex IV of Habitat Directive, and classified as LC in the IUCN Red List), quite rare in Malta and especially threatened by intensification of agricultural practices;
- *Podarcis filfolensis maltensis* (included in Annex II of the Bern Convention, in Annex IV of Habitat Directive, and classified as LC in the IUCN Red List), more widespread in Gozo and Comino than in Malta and with a population that is considered as stable;
- *Chamaeleo chamaeleon* (included in Annex II of the Bern Convention, in Appendix II of CITES, and classified as LC in the IUCN Red List), distributed in the whole Maltese territory with a stable population;
- *Tarentola mauritanica* (classified as LC in the IUCN Red List), characterized by stable populations and more frequent in Malta than in Gozo;
- *Hemidactylus turcicus* (included in Annex III of the Bern Convention and classified as LC in the IUCN Red List), present both in Malta and in Gozo;
- *Hierophis viridiflavus* (included in Annex II of the Bern Convention, in Annex IV of Habitat Directive, and classified as LC in the IUCN Red List), characterized by stable populations both in Malta and in Gozo;
- *Hemorrhois algirus* (classified as LC in the IUCN Red List), quite frequent in Malta.

This will happen because – besides the shelter provided by the wall – these species will find on both sides of the wall a one-meter-wide vegetation strip formed by species such as *Anthyllis hermanniae subsp. Melitensis***,** *Euphorbia melitensis, Periploca angustifolia, Thymbra capitata, Erica multiflora, Euphorbia melitensis, Periploca angustifolia* ssp. *laevigata, Anthyllis hermanniae* ssp. *melitensis, Teucrium fruticans, Phlomis fruticosa, Prasium majus, Chiliadenus bocconei, Urginea pancration,* as well as species attracting pollinators (*Borago officinalis*, *Cerinthe majus, Coronilla valentina* and *Hedysarum coronarium*). It is worth stressing that these vegetation species, and especially shrubs, are typical of habitat 5330; therefore, the planned interventions will also recover and restore this habitat.

Thus structured, rubble walls will become the backbone of the landscape of the HNVF - High Nature Value Farmland, according to the definition applied by EEA and UNEP, e.g. "*Those areas in Europe where*

agriculture is a major (usually the dominant) land use and where that agriculture supports, or is associated with, either a high species and habitat diversity or the presence of species of European conservation concern, or both".

Rubble walls and the LIFE GREENCHANGE goals

As described in the previous chapter, the management of rubble walls in Maltese rural areas herein proposed is in line with the key objective of the LIFE GREENCHANGE project of maintaining and increasing biodiversity in the Maltese Islands. Consistently with the EU Biodiversity Strategy up to 2020 and with the Communication of the Commission on Green Infrastructures COM(2013) 249 final, GREENCHANGE intends to test and develop a territorial governance model able to increase the contribution of agricultural areas to the protection of biodiversity and the improvement of ecosystem services. Moreover, it aims at mitigating anthropogenic disturbance on high-naturalness zones still existing in target areas, strengthening their ecological quality, and increasing the connectivity of the whole territory through the reconstruction of linear, areal and polygonal green infrastructures with different roles (corridors, stepping stones, buffer zones).

The management model for rubble walls is one of the tools to achieve these objectives, since it intends not only to support the restoration, integration, maintenance and conservation of the walls, but to transform their network in a real green infrastructure (a complex system where man-made elements are associated with autochthonous vegetation strips, both shrubby and herbaceous) with multiple functionalities. The rubble wall not only maintains its role as traditional agricultural and land management technique (for land delimitation, soil and plants protection, and water management), but increases its function as habitat and ecological corridor for animal and vegetation species (also of conservation interest).

At the same time, the rubble walls management model is framed within those GREENCHANGE actions aimed at defining and sharing – with a multi-stakeholder approach – tools and guidelines for a sustainable management of rural territories, able to improve the regulation and maintenance of ecosystem services.

More specifically, such actions intend to test methods and techniques able to contextually optimize the quality of agricultural production, the biodiversity preservation, and the provision of ecosystem services by agro-ecosystems. The involvement of the agricultural sector is crucial to achieve these goals.

For this reason, the model will be implemented through the direct involvement of Maltese farmers and farm holdings: the aim is to mobilize farmers and make them aware of their land stewardship role, as well as of their key responsibility in the development of multi-functional agriculture, able to provide the community with more and more extended ecosystem services, whilst allowing for the maintenance,

increase and protection of local biodiversity, for the diversification of farm holdings, and for an increased quality of agricultural production.

A rubble walls system structured according to the GREENCHANGE management model is, indeed, able to provide multiple ecosystem services (as further specified in the next chapter). GREENCHANGE intends to integrate their assessment into public and private decision-making processes, therefore the foreseen actions (A1, C3, C4, C5, C6, C7, C8, C9) envisage the active involvement of local actors in the acknowledgement, evaluation and monitoring of the services provided by agro-ecosystems.

Green infrastructure, rubble walls and ecosystem services

According to the EU definition, green infrastructure is "*a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services*". The interest towards these territorial elements (also at EU level) depends on the recognized importance of planning and implementing connection between natural and semi-natural areas to ensure and develop specific ecosystem services.

Within this framework, rubble walls could represent the most significant green infrastructure of the Maltese rural territory. In the Maltese islands, around half of farm holdings own less than 0.5 ha of agricultural area, and these land plots are usually delimited by such structures (Rural Development Programme for Malta 2007 – 2013).

Besides covering the already mentioned role of ecological corridors, rubble walls provide numerous ecosystem services, namely:

- **Cultural services**. As previously described, rubble walls are an essential feature of the Maltese rural landscape, and strictly connected with its basic characteristics (hilly morphology, water scarcity, etc.) and with the traditional land management techniques of local farmers. The construction of rubble walls has been practiced for centuries in various countries, however the techniques and materials used in Malta are typical of the local tradition, and are therefore an integral part of the Maltese identity and heritage.
- **Contrast to soil erosion**. The predominantly hilly morphology of the Maltese islands increases rainwater run-off and hence soil erosion, impoverishing agricultural soils and complicating land management. This phenomenon is recognised as the main threat to soil resources in the Country. For these reasons, national policies have aimed at minimizing soil erosion. This has often been interconnected with the protection of rubble walls.

- **Support to pedogenesis**. Soil productivity depends on specific characteristics, strictly interconnected to soil features. The formation of soil depends on various processes and requires a

very long time – rubble walls contribute to create and maintain the necessary conditions (slope and retention of water and sediments) for soil formation.

- **Maintenance of biodiversity**. Rubble walls form an important habitat for local fauna and flora. During draught periods, the inner part of these structures remains damp, providing an environment with different humidity levels, where humidity decreases from bottom to top. This allows for the development and growth of various plant species in the interstices, including *Adiantum capillus-veneris*, *Lobularia maritime*, *Asparagus aphyllus*, etc. Small cavities inside the walls also shelter various species of small vertebrates and invertebrates, including *Tarentola mauritanica*, *Podarcis filfolensis*, *Chalcides ocellatus*, *Coluber viridiflavus*, etc. Maintenance of biodiversity is also linked to the already mentioned concept of HNVF - High Nature Value Farmland, introduced in the 1990es, when the strict interconnection between biodiversity conservation in Europe and the persistence of low-intensity agricultural systems was acknowledged. According to the current scientific definition, HNVFs are areas where agriculture represents the main land use and is associated with the presence of a high number of species and habitats, and/or of species of Community interest. This definition shows the strong connection between agriculture and biodiversity, as well as the potential contribution of certain types of agricultural activities to the natural value of rural systems. In agriculture, land management and agronomic techniques that allow for higher biodiversity levels are usually associated to low-impact cultivation practices, with lower input of phytosanitary products, less processing, cover crops use, etc. Preliminary surveys conducted in Malta showed that the extension and distribution of HNVF is mainly based on the density of linear structures such as the rubble walls (Vella and Garrido, 2010).

Moreover, the already mentioned combination of rubble walls with shrubs and wildflower strips further strengthens the supply of ecosystem services. Thanks to this kind of intervention, an increase of the pollinators' species and of carbon storage is expected, as well as a limitation of invasive species.

In conclusion, the restoration of rubble walls foreseen within the GREENCHANGE project in Malta will reinforce at least five ecosystem services, selected according to CICES classification Ver. 5.1 through a preliminary analysis that allowed identifying the more relevant ones, namely:

- Pollination - Code 2.2.2.1;
- Maintaining nursery populations and habitats - Code 2.2.2.3 (corresponding to the maintenance of biodiversity);
- Regulation of chemical composition of atmosphere and oceans (Carbon Storage) - Code 2.2.6.1;
- Natural, abiotic characteristics of nature that enable spiritual, symbolic and other interactions - Code 6.2.1.1 (corresponding to cultural services);
- Cultivated terrestrial plants grown for nutritional purposes - Code 1.1.1.1 (corresponding to crop production).

SPECIAL PART

Maltese regulations on "Rubble walls": involved public bodies, permitting procedures, timing and modalities of the execution of works

The main legislative references for the construction and maintenance of rubble walls in Malta are:

- L.N. 211 of 2016, Development Planning Act (Cap. 552), Development Notification Order, 2016
- Rural Policy Design Guidance 2014
- Rural Policy Design Guidance 2020 (Draft)
- Rubble Walls and Rural Structures (Conservation and Maintenance) Regulations (S.L.552.01)

In particular, the 2014 Rural Policy And Design Guidance (issued by the MEPA - Maltese Environment and Planning Authority, currently split into Planning Authority and Environment and Resources Authority), allows for the construction of new rubble walls using the same traditional construction methodology of rubble walling, within legally-established arable land, provided the following criteria are satisfied:

(1) as a retaining wall, provided there are visible differences in site levels, in which case the wall shall not exceed a height of 1.2 metres from the higher soil level; and/or

(2) as a boundary wall along an existing country lane or road, in which case the wall may be constructed up to the height of the adjacent legally-established rubble walls, even if such height exceeds 1.2 metres.

(3) where there are no differences in site levels (flat land) either a narrow footpath of not more than 0.9m in compacted soil, or a rubble wall not more than 0.6m high, or a hedge shall serve as field demarcation;

(4) no new retaining/boundary walls or demarcation, shall result in land parcels of less than one tumolo; and

(5) the next review of the Development Notification Order shall favourably consider the maintenance (repair) of walls, according to established Legal Notice(s).

Gates shall have a maximum width of 4.5 metres, shall be clad in timber and not exceed a height of 1.2m or the legal height of the boundary wall, including supporting pillars.

The Planning Authority confirmed these provisions also in a proposal for the update of the document (Rural Policy and Design Guidance 2020) that is currently under discussion. The Authority will therefore continue to support the construction of new rubble walls where these will serve as traditional barriers against soil erosion, namely along country lanes or roads and where there are differences in site levels.

Authorities involved at permitting stage

The Planning Authority (PA) is the body responsible for the assessment of proposals that require a development permit, and for the issuing of permits for works. The PA carries out consultations within

its internal structure and with relevant external stakeholders, depending on the nature and location of the proposed works. These may include the Environment and Resources Authority (ERA), Superintendence of Cultural Heritage (SCH), the Agricultural Advisory Committee (AAC), and Transport Malta (TM), among others.

Proposals that require a permit

All works on rubble walls, including maintenance, construction, modification, or removal, require some form of notification/permitting from the Planning Authority.

A Development Notification Order is necessary for works under Class 2 - Minor Works, part (iv), namely the construction, alteration, or maintenance, of random dry-stone rubble walls on existing agricultural land, or along a legally existing street, in accordance with the Rubble Walls and Rural Structures (Conservation and Maintenance) Regulations (S.L.552.01), subject to the following conditions:

(a) the wall shall not be higher than 1.20 metres above soil level on both sides;
(b) in case of different levels between terraced land, the wall shall not be higher than 1.20 metres above the higher soil level, and 2.40 metres above the lower soil level;
(c) the total demolition and reconstruction of existing random dry-stone rubble walls is not permitted and, in the case of partial demolition and reconstruction, the area to be replaced should be declared as unsafe by the perit;
(d) for the construction of new walls, a single access opening of not more than 1.20 metres wide, with a gate constructed in timber and not exceeding the height of the wall, is permitted;
(e) new access openings on existing walls are not permitted;
(f) The construction of new walls shall not entail the sub-division of agriculture land.

Works excluded above would require a Full Development Permit, and are to follow the mentioned regulations above, as well as the Rural Policy Design Guidance 2014 (or the Rural Policy Design Guidance 2020 as soon as it comes into force).

Subsidiary Legislation 552.01 ‘Rubble Walls and Rural Structures (Conservation and Management) Regulations’ states that no permit is required for sensitively executed repairs to existing rubble walls, provided that such repairs:

(a) are carried out exclusively using the same type of dry stone rubble walling that composes the existing wall;
(b) satisfy all the protective conditions and safeguards contained in these regulations and in the Development Notification Order; and
(c) do not increase the height or extent of the existing wall or otherwise significantly modify the general site topography or the overall profile or character of the wall.

In reconstructing or building rubble walls, the beneficiary must adhere to all requirements and regulations of the Planning Authority and the Environment and Resources Authority (ERA).

Documentation to be submitted

Applications are to be submitted by a warranted Perit through the Planning Authority's online system (e-applications). The following documents would be necessary for a Development Notification Order:

- Filled in and signed application form
- Ownership declaration, and notification to owner/s where relevant
- Marked site plan with photo references (scale 1:2500)
- Photos cross-referenced to site plan/plans
- Plans as existing and as proposed, in conventional colours

In some specific cases (depending on the sensitivity of site and on the proposal), and also in the case of a full development application, the following will also be required apart from the above:

- Section drawings as existing and as proposed
- Elevation drawings as existing and as proposed
- Method Statement
- Proof of farmer registration (if relevant to the proposal)
- Proof of active farming activity

Other documentation such as aerial photography, survey sheets, specialist reports, or specific declarations, may be requested during the assessment process at the discretion of the Planning Authority.

Timeframes to obtain authorisation

- Development Notification Order: a response from the Planning Authority is to be expected within 30 days from the validation of the notification
- Full Permission Summary (Schedule 2): a response from the Planning Authority is to be expected within 42 working days from the validation of the application. No works may be carried out until 30 days following the publication of the decision, since this would be open for any appeals by interested parties.
- Full Permission Non Schedule 1: A response from the Planning Authority is to be expected within 100 working days from the validation of the application. No works may be carried out until 30 days following the publication of the decision, since this would be open for any appeals by interested parties. This kind of permission may be necessary for more complex proposals, implemented in areas of high archaeological or ecological sensitivity.

A valid commencement notice is to be submitted to the Planning Authority prior to the commencement of works, and any other permit conditions are to be observed if applicable.

Management procedures in relation to the LIFE GREENCHANGE objectives

Ecological conversion of rubble walls

As previously detailed, rubble walls can become *green infrastructure* if the restoration of the wall is associated to the planting of vegetation species able to provide ecosystem services and at the same time to represent shelter areas for animal and plants species. To fulfil these purposes, it is important to re-create a complex structure, where the rubble wall is combined with an herbaceous strip and a shrubs/wildflowers strip. The characteristics of this structure vary according to the two possible typologies of rubble walls (boundary walls and retaining walls). The following paragraphs describe this kind of intervention types and define its management guidelines.

Herbaceous strip – Rubble wall – Shrubs strip

Considering that rubble walls usually occupy a strip around one meter wide, and that currently the non-arable land adjoining the walls is approximately 60 cm wide, it would be appropriate to extend this latter up to at least one meter, using it to re-create wildflower strips and shrubs habitat of Community interest.

Plantation must be performed starting from late winter or spring.

To re-create Thermo-Mediterranean and pre-desert scrubs (habitat 5330), the following species shall be planted: *Anthyllis hermanniae subsp. melitensis***,** *Euphorbia melitensis, Periploca angustifolia, Euphorbia dendroides.* The planting layout should be wide, to avoid that growing shrubs cast too much shadow on the wall. In case of retaining walls, it is recommended not to plant shrubs right at the foot of the wall and never in the upper area, to avoid that roots damage the dry stone structure. Soil preparation should be limited, in order to preserve existing species, with the exception of alien species that should be completely eradicated or – in case of alien species of agricultural value such as *Opuntia ficus-indica* – reduced, to allow for the co-existence of the species'.

Typical habitat 5330 species can be planted with a 3-meters' spacing, alternating them and trying to use them in a uniform way, for at least 50 meters.

To create wildflower strips, it is recommended to use the following species: *Thymbra capitata, Erica multiflora*, *Teucrium fruticans, Phlomis fruticosa, Prasium majus, Borago officinalis*, *Cerinthe majus, Coronilla valentina* and *Hedysarum coronarium.* The planting layout can be more serried, since these species' development does not affect the wall's exposure to the sun. Also for these species, limited soil preparation is recommended (especially when already developed autochthonous species are present), as well as the eradication of alien species, when possible.

Wildflower strips can be continuous, or planted in patches at least 20 meters long.

In case of a wildflower strip associated with a retaining wall, it is recommended to plant it upstream of the wall. If, on the contrary, the strip is associated with a boundary wall on a flat land, the sunnier side of the wall shall be preferred, in order to ease the growth of the plants.

Post-planting works

These works should primarily ensure the functionality of the rubble wall as boundary (or retaining) structure, and secondarily its enhancement as green infrastructure. They can include complementary maintenance and management interventions, such as the thinning or pruning of existing shrubs or trees (in order to ease the settlement of the new plants), or the slight pruning of newly planted shrubs whose excessive growth hampers the functionality of the rubble walls (too much shade) or limits agricultural works.

Replacements

When plants die in newly planted strips, it is mandatory to replace the dead plants in the following year, in order to fully re-establish the foreseen plant density.

Shrubs management

During the first years, the management of shrubs shall consist in non-invasive interventions, with husbandry pruning aimed at ensuring their balanced growth and at avoiding competition with existing trees and herbaceous plants. Such interventions must not be performed during the fauna's reproductive period, and must respect the plants' needs. They should result in the creation and maintenance of a diversified, well-structured shrubs layer, connecting the herbaceous layer to the wall and not damaging the wall itself.

After the first year, it will be necessary to replace the plants that did not take root with new plants of the same type and number, and of the same age of the rooted ones. These thickenings shall be repeated for two years until all the plants initially foreseen fully take root.

Wildflower strips management

The presence of low unmown wildflower strips on the edge of a rubble wall is an added value for biocenosis because – besides hosting more valuable flora species – these strips are especially suitable for ensuring a stable presence of numerous *taxa* of arthropods, amphibians, reptiles, birds and mammals. More specifically, they create a suitable habitat for insects and other arthropods, soil fauna and birds, avoid walls collapse (moving back the operational line of tractors) and contribute to slow down the transmission of pollutants from the fields towards the outside.

The kind of management of such strips influences the vegetation communities that will settle therein. For instance, increasing the number of passages and cuts for the containment of vegetation strongly limits the number of species, since only the plants more adapted to disturbance actions or able to re-

form their vegetative system quickly after the cut can survive. On the other hand, the total absence of management interventions does not correspond to a greater plants biodiversity. Strips where interventions to control flora do not occur at all, show a severe reduction of the number of species, and even wide populations of alien species. In this case, perennial species are advantaged, along with plants having less natural interest because highly invasive for cultivated fields. It is therefore recommended to undertake a balanced management that favours a vegetation community with high number of species, and pays special attention to the faunal function of the strips as well. As a matter of fact, the effectiveness of herbaceous strip as habitats for numerous taxa of invertebrates and vertebrates is strictly connected to the timing of mowing. In particular, it is preferable to perform a spring mowing as late as possible, followed by a second mowing at the end of summer.

Moreover, if the floristic composition of the strip allows for it, it is also possible to postpone the first mowing until later in the summer: this allows for a prolonged flowering, useful for the reproduction and feeding of insects and other arthropods and, indirectly, for attracting numerous other species along the food chain. Anyway, cutting operations shall preserve small shrubs (such as the *Thymbria capitata*), which serve for the feeding of pollinators.

Maintenance of functionality

The maintenance of the existing rubble walls should always be carried out with the utmost respect for the original typology and constructive characteristics, not to alter the state of the places.

The main aspects to consider regard:

- Choice of materials
- Laying of the foundations
- Elevation of the wall
- Periodic maintenance

The following paragraphs provide details on each of these aspects.

Choice of materials

The reconstruction of a wall begins by obtaining the material; it is essential to use local stone, i.e. the one that can be recovered in the immediate vicinity or directly from the removal, accumulation and selection of the stones that made up the collapsed or otherwise unsafe wall. The selection of stones must be made in order of size, thickness and length, in order to avoid wall patches that are not homogeneous with the original characteristics.

Taking into account that in a rubble wall stones must behave as if they formed a single block, during construction, the stones must be placed in such a way that they are in contact with each other as much

as possible, carefully filling most of the hollow spaces with small-sized material (the so-called "flakes") placed piece by piece. By doing so, a stable balance will be obtained due to the weight of the stones themselves and to the action of the forces that stress them.

When dismantling deteriorated or collapsed parts of the rubble wall, the first step is to stack and select the stones, classifying them according to the following typologies:

- foundation stones, which must be large, solid, parallelepiped-shaped and not rounded, because they must bear the weight of the wall;
- building stones, to be preferred without edges and with one flat side;
- stones of small size, to be used for filling the empty spaces between the larger stones, and between the wall and the earth as a drainage layer behind the visible part;
- binding stones, which - due to their size and weight - block the underlying stones and act as a support for those above; they must be positioned both in the sense of depth and in that of length;
- roofing stones, flat, "slab", or according to the local style and shape;
- flakes or wedges, material of different sizes to fill the residual hollow spaces, also with an aesthetic function.

The stones suitable for building a rubble wall should have large and flat faces. Those that are positioned on the visible face of the wall must have at least one smooth side. For this reason, flat and angular stones should be preferred, rather than rounded and curvilinear ones. Corner stones are easier to lay and consequently provide durable support to the whole construction, but no stone or splinter should be cast aside, because even the less suitable stones can serve as filling material between the two faces of the wall.

The choice and installation of stones must be done avoiding stones with veins, whose resistance can be compromised by the cutting forces to which they will be subjected. Furthermore, when choosing the ‘face’ of the stone (that is, the side that remains visible), one must choose the more regular, well-squared, smoother side, which can be most pleasing to the eye.

Foundations

When digging or restoring the subsoil for the foundation, it will be necessary to remove the annoying vegetation and especially the plant stumps, to prevent them from making the foundations unstable. Most of the times, the foundations are already present or at most they need to be rearranged. At the base of the wall (if the intervention involves reconstruction down to the ground) one must position the most resistant and heavier stones, to create a solid base for the wall. If, on the other hand, the old foundation stones are not present, a layer of at least 10-15 cm of gravel must be laid, on which to place the larger and more regular stones, to avoid stagnation of water at the foot of the wall.

Elevation

The wall must be risen regularly and simultaneously for the entire width considered. The bond and stability of the wall will be ensured by the insertion in the layers, every 50 cm in height and every 100 cm in length, of a sufficient number of binding stones, which are longer than (or at least equal to) the thickness of the wall. To distribute the load over a larger surface, these stones must rest on as large a surface as possible with different points of contact with the stones below. It will be essential to stagger the vertical joints in such a way as to better distribute the loads, avoiding continuous joints both vertically and horizontally. It is important that the facing stones are not simply laid one on top of the other in the front part of the wall: they must be arranged in the most orderly way possible and must immediately present maximum stability, that is, avoid the slightest movement if loaded.

During installation, short stones shall be alternated, although not regularly, with long stones, to give texture to the wall. In retaining walls in terracing systems, the longer stones must be inserted into the ground behind, slightly inclined towards the mountain to counteract the pushes to bulge and overturn. The longer stones will be placed perpendicularly to the wall, the greater the clamping between the wall and the ground behind it and therefore the lower the risk of collapse and bulging.

When extending an existing rubble wall, it will be necessary to reshape the part of the wall that is still standing in the form of a ladder, by removing some of the stones, in order to have a more effective and long-lasting grip between the two parts.

When restoring a damaged section, the wall must be dismantled, on both sides, for about one meter beyond the damaged/unstable part.

A rubble wall acting as a division between two plots at the same height, shall be built as a double-headed or double-sided walls, internally filled with waste stones (small stones or splinters) and with various junctions consisting of large, flat and long stones passing from one face of the wall to another.

In the case of a terracing, the upstream space must be progressively and carefully filled, as the elevation of the wall increases, with waste stones and soil in order to favour the flow of rainwater, as well as the growth of vegetation and the creation of shelters for insects and other useful animals. Filling is essential for a good drainage, without which an excessive thrust of the ground would compromise the stability of the wall. It is also preferable that small stones for drainage are placed at the tip to facilitate the correct flow of water. An inclination of the façade of about 10% towards the mountain must be respected. For a wall about one meter high above the ground, its thickness will go from a base of about 1 meter to a head of 60-65 cm, progressively withdrawing the edge of the facade and tilting the stones towards the mountain. This will allow greater resistance to the overturning and slippage of the stones towards the outside in the presence of thrusts from the ground behind.

If it is necessary to regularize the shape of certain stones to adapt them to the intended use (i.e. by modifying their corners or edges), this must be done by hand, using only chisel and mallet and avoiding mechanical cuts.

In the construction of the wall, it is necessary to proceed by placing the stones in rows as horizontal as possible (courses), in order to constantly equalize the upper profile. The height of each course will always be determined by the largest stone used in the external facing: for each new course, raise the guide wire to the height of the guide stone and proceed by completing the row. Each layer must be made with segments of similar height, levelling it, where necessary, with stone chips, before moving on to the laying of the next course.

To obtain the alignment, two boards or indicator rods must be laid vertically at the extreme sides of the running wall, and a cord stretched between the two supports, so that it touches the outer edge of the stones laid. When building a curvilinear wall, in order to correctly maintain the profile, it will be necessary to prepare a series of guides consisting of vertical axes arranged at regular intervals and fixed upstream and downstream.

The closure of the wall consists in the laying of the so-called "cover", that is a layer of regular, flat and heavy stones, arranged flat. Above them, it will be useful to tuck the wall with the excavated earth (the finest and most fertile one) to rebuild a grassy surface and fill in the empty spaces.

Maintenance

Once the construction of the wall is completed, an annual inspection will be necessary in order to eliminate plants and weeds whose roots have excessively developed: these are the primary cause of displacement of the stones. Displacements of the "binding" blocks may also occur in the medium-short period after the reconstruction, due to the settlement of the ground; if not consolidated in time, these could cause landslides and further movements of other stones. Hence the importance of routine maintenance, certainly less onerous than an intervention required for repairing more severe damages or failures.

A final aspect to be taken into great consideration is that of ensuring adequate static safety conditions, ensuring: (a) stability to rotation (preventing the wall from overturning around the lower outer edge); (b) stability to sliding due to the thrust that tends to move the wall parallel to itself; (c) resistance to crushing due to the vertical thrust and the weight of the wall itself.

In addition, in order to reduce the loads that can cause instability, the draining of the water infiltrating the soil must be ensured, especially in terracing. Effective drainage must be pursued in the internal part of the wall, also by creating small openings (barbicans) at the level of the ground, pierced at full thickness and at regular intervals. These openings will also allow easy crossing of the wall by those animals that could hardly climb it.