Project ALPTER Terraced landscapes of the alpine arc

REGIONE VENETO · Direzione Urbanistica · CO-FUNDED BY THE EUROPEAN UNION · INTERREG IIIB PROGRAMME 'ALPINE SPACE'

INTERREG IIIB ALPINE SPACE SUMMIT
STRESA, CONGRESS PALACE, 19-20 JUNE 2006

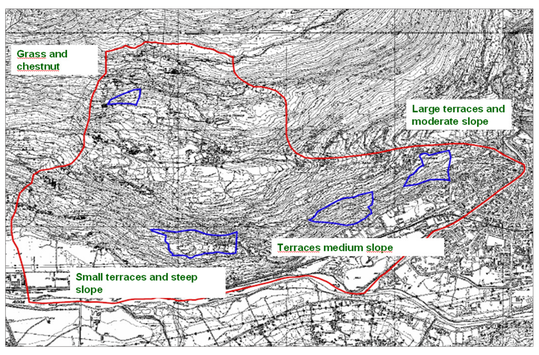
ALPTER: MAPPING TERRACED AREAS IN THE ALPS

ALPTER AND MAPPING

The agricultural terraced areas in the Alps often are not taken enough into account in the perspective of land management. Uncomplete or even missing information about the distribution and features of terraced landscapes within a certain region implies a very poor overall acknowledgement of such a valuable resource.

On the other hand, carrying out a detailed and precise mapping is of fundamental importance for any subsequent step, such as the conception of intervention strategies targeting terraced areas, with particular regard to funding availability for recovery plans.

The ALPTER project aims at developing and testing a methodology able to provide regional maps reporting extension, distribution and density of terraced sites. When focusing on a more detailed scale, costly and time consuming surveys on the ground are required, in order to integrate the lacks in cartographical data, in particular by identifying abandoned terraces hidden by shrubs and tree cover resulting from spontaneous reafforestation.



Study area of I.R.E.A.L.P.: the Italian province of Sondrio

Terraced landscapes often represent an underestimated natural and cultural heritage, both in quantitative and qualitative terms. This is partly due to the difficulties in identifying and evaluating their real extent and state of conservation.

In order to gain a deeper knowledge of terraced landscapes, four main steps have been identified:

1. Simple mapping - Localization of terraced sites in the study area;

2 - Monitoring and analysis - Elaboration of data-sheets to be filled in by means of detailed field surveys and gathering of historical and current data;

3. GIS mapping - Implementation of a GIS structure of terraced landscapes within the study area;

4. Classification - Classification of terraced landscape units.

Currently, while the two last steps are still at an early stage, the first two stages have been implemented in most of the project pilot areas.

The final output of the mapping work will be the editing of an 'Atlas of terraced landscapes in the alpine arc' and the development of a protocol for the survey and analysis of terraced sites, including standard procedures, common guidelines and data-sheets.

THE ALPTER PROJECT

Project ALPTER was conceived to counteract the abandonment of terraced farmland in the alpine region: loss of productive land, increase of natural hazards and decline of cultural heritage are all consequences of the decay of terraced structures.
Project activities include gathering data, organizing information, developing specific technologies and realizing examples of productive recovery, with the final goal of promoting large scale land transformation.

PARTNERS AND STUDY AREAS

The ALPTER project involve eight partners, acting in an equal number of study areas:

1. **Regione Veneto**: Brenta River Valley (I)
2. **Regione Liguria**: Genoa Apennines (I)
3. **I.R.E.A.L.P.**: Province of Sondrio (I)
4. **BOKU University of Vienna**: Ulrichsberg (A)
5. **University of Ljubljana**: Goriska Brda (SLO)
6. **A.D.I.**: Roquebilliere, Maritime Alps (F)
7. **Regione Val d'Aosta**: Lower Aosta Valley (I)
8. **Regione Bregaglia**: Bregaglia Valley (CH)

1 - MAPPING AND CALCULATING EXTENSION

The first step towards improving the overall territorial knowledge of terraced landscapes is developing a proper map, containing exact references to the existing terraced structures. Yet, at present detailed data concerning terraced sites are hardly available. This is one of the reasons why there are no standard methodologies for mapping and quantifying terraced systems. The following possible methods have been developed and applied in the course of the project, mainly based on the extent of terraces and the length of their retaining dry stone walls.

A. Surface ratio: terraced surface (ha)/total surface of a given geographical unit (ha or sq km)

Example: Cinque Terre (Liguria) = 2,000 ha/ 38 sq km = 53%

This method is particularly important from the agronomic-productive point of view. Although quite easily obtainable from cadastral or aerophotogrammetric data, it does not provide detailed information about density and distribution of terraces.

B. Length of walls: length of retaining walls (km)/total surface of a given geographical unit (ha or sq km)

Example: Cinque Terre = 6,000 km/38 sq km = 158 km/sq km

Such a method is significant as regards the landscape value, by suggesting the impact of terraced structures on the landscape and the extent of the heritage to be safeguarded. It can be calculated through GIS elaboration of cartographical data.

C. Relative density: length of retaining walls (km)/terraced surface within a given geographical unit (ha or sq km)

Example: Cinque Terre = 6,000 km/2,000 ha = 300 km/sq km

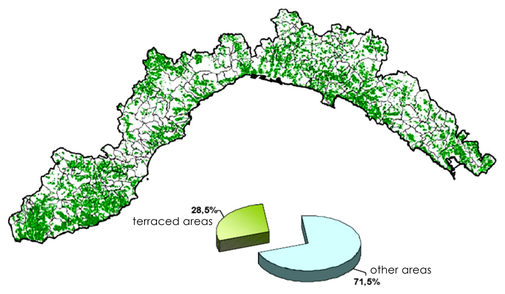
Such a method provides information about the density of dry stone walls, thus enabling to infer a fragmentation index of farming estate out of it.

D. Absolute density index = length of retaining walls (km) or extension of terraced surface per square kilometre.

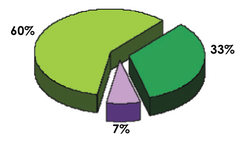
This index, which can only be obtained by using ArcGIS Spatial Analyst, is proposed by ALPTER project in order to enable an absolute comparison among different contexts. This method actually allows the identification of threshold values for the definition of landscapes at a low, medium or high level of terraced structuring, which in turn represents a useful indicator for identifying proper management strategies and tools.

LARGE SCALE MAPPING IN LIGURIA

Liguria: percentage of terraced areas



Distribution of Ligurian terraced areas according to their land use and land cover category



Large scale mapping of Ligurian terraced landscapes already started in 1999, on the basis of the then available data in possession of the Liguria Region, covering the whole territory. According to such a study, as much as 30% of the territory appears to be covered by terraced areas. Yet, even this datum is very likely to be underestimated, since most of the terraces are not recognised as such, for a number of reasons. For instance, aerial photos do not enable to identify those abandoned terraced structures which are nowadays hidden by shrubs and trees: such a critical issue applies to the Veneto case study as well (see below).
Past researches thus need to be widened, in order to get more detailed figures describing the real state of terraced sites in Liguria. Such a deeper analysis is going to be carried out within the ALPTER project.

Above: Cinque Terre (Liguria)

Below: Mono-rail through the terraces

LEVELS OF MAPPING IN VENETO

Mapping from official cartography often is not sufficient to identify all the terraces, and a series of surveys is necessary to achieve a proper map of the area. This is well exemplified by one of the study areas, namely the Brenta River Valley in Veneto (Italy). Three levels of analysis have been carried out:

A. Regional mapping: identification of terraced sites based on the Regional topographic map (C.T.R.N.) 1: 5,000. Terraced sites can be identified only through their retaining dry-stone walls. Yet, walls retaining agricultural terraces cannot be distinguished from other kinds of dry-stone walls (except road walls).

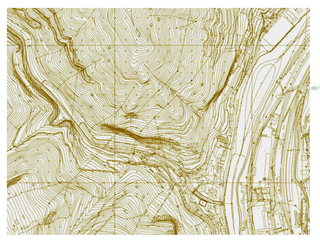
B. Pilot area: in order to find out those terraced structures which are not discernible through the previous step, aerial photos have been analysed in a pilot area.

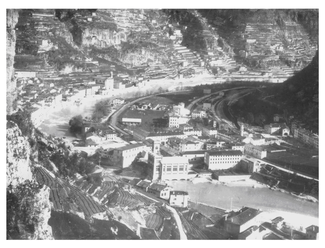
C. Detailed scale: abandoned terraces can hardly be identified from above because of the shrub and tree cover hiding them. For this reason field surveys are required. Such a deeper analysis is only applicable to a limited zone.

Source: Regional Topomap
Year: 1999/2000
Mapped: **22% of the total**
52 km of walls

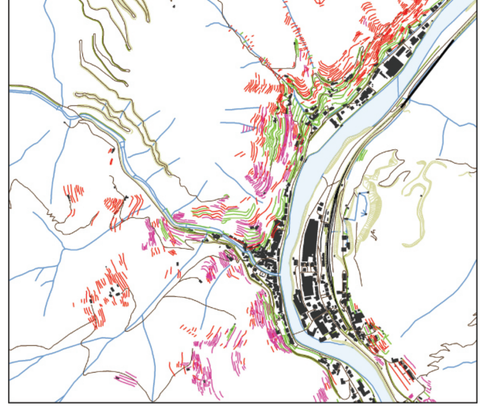
Source: Aero-photographs
Year: 1967
Mapped: **83% of the total**
190 km of walls

Source: field survey
Year: 2006
Mapped: **presumably 100%**
230 km of walls





Regional topographic map 1: 5,000 (left) and aerial photographs (centre and right) of the study area in Veneto



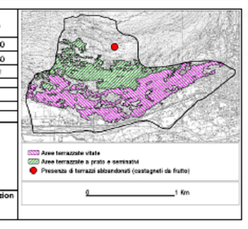
Comparison among the three mapping levels

2 - MONITORING AND ANALYSIS

A – Identificazione e ubicazione

Stato:	Regione:	Comuni:
Italia	LOMBARDIA	SONDRIO – CASTIONE ANDEVENNO
Area campione:		PENDICI RETICHE A NORD OVEST DI SONDRIO

Coordinate Geografiche centro dell'area, Gauss-Boaga O (o UTM WGS 84)	
Longitudine (x):	1.564.400
Latitudine (y):	5.113.360
Estensione area (Km²)	7,5 km²
Quota media:	750 m
Riferimento cartografico	
Tipo di carta (C.T.R., I.G.M., ecc.): Carta Tecnica Regionale CTR formato digitale raster	Scala: 1:10.000
Foglio N.: C3c2 e C3d2	Denominazione:



All of the ALPTER project partners agreed on a common data-sheet for survey and analysis of terraced areas (above).
The form consists of two parts: one at a larger scale (1: 25,000) for the identification of the overall territorial setting, and one at a more detailed scale (1: 10,000) for analysis of typical terraced sites.

3 - GIS MAPPING

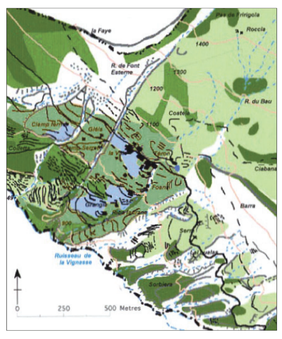
GIS (Geographical Information System) is a computer application used for storage and mapping of geographic data. Spatial features are geographically referenced and integrated with other data in tabular form (attributes).

Beyond simple mapping and monitoring, the analysis of terraced sites might thus be significantly improved by creating a GIS structure. Basic indications for the GIS structure on terraced sites should include the following themes:

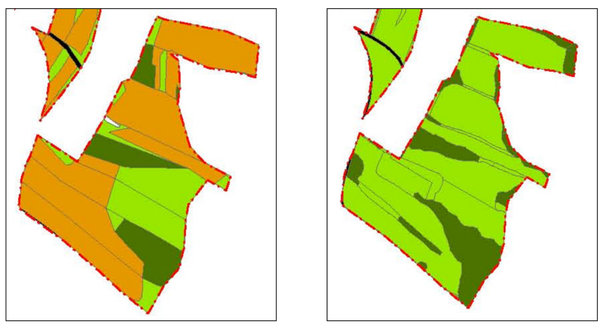
- Altitude, slope steepness, solar exposition, geologic substratum, pedologic characters, land use (*from existing cartography*);

- Height of the walls, width of the stripes, constructive characters, age and historical use (*mainly from field surveys*);

- Index of risk, index of accessibility, index of landscape interest (*obtained through calculations*).

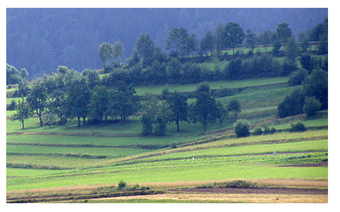


EXAMPLE OF GIS ELABORATION: HISTORICAL ANALYSES IN ULRICHSBERG (UPPER AUSTRIA)



Detail from the Austrian study area map (Ulrichsberg, Upper Austria). Comparison between the historical land use in 1828 (left) and the current land use system (right).

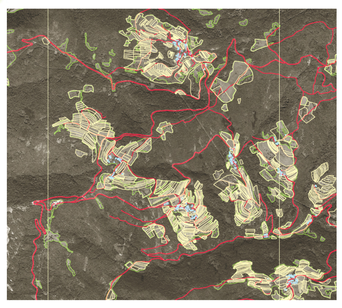
A significant historical analysis has been undertaken as regards the Austrian study area (below), where land use changes occurred since 1828 were recorded (right). GIS-based digital map of the study area has then been obtained (left), enabling a comparison between the historical and the current land use system. While the main transformation is from cultivated fields to grassland (meadows and pastures), the share of area shifted from farmland to wood is not as important as in other alpine regions. Finally, large areas remained unchanged, especially those plots of land which were already used as meadows.

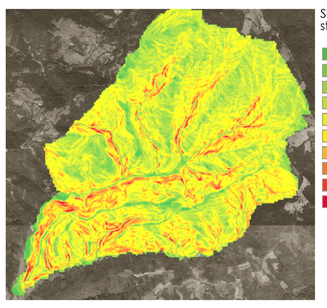


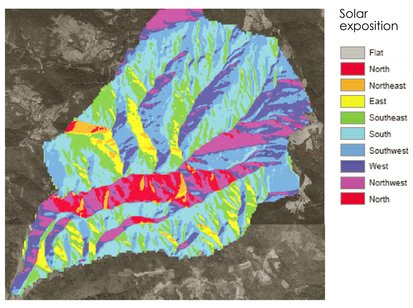
	1828	2005	CHANGE
Meadows and pastures	29.0%	74.2%	+ 45.2%
Agricultural fields	67.2%	13.6%	- 53.6%
Woods	2.0%	11.7%	+ 9.7%
Streets and settlements	1.8%	0.5%	- 1.3%
Total	100.0%	100.0%	

LAND USE CHANGE	AREA (m²)	PROPORTION
Fields → Meadows	267,731	50.1%
Fields → Woods	26,194	4.9%
Meadows → Woods	26,028	4.9%
Meadows → Fields	12,105	2.3%
Area of land use change	332,058	62.1%
Total surface	534,753	100.0%

A COMPLETE STRUCTURE OF GIS DATA: SEVERNA BRDA IN SLOVENIA





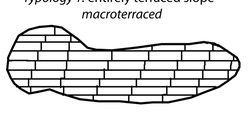


GIS maps referring to the area of Severna Brda (Slovenia): terraced sites, streets and buildings location layers (left); slope steepness (centre); solar exposition (right).

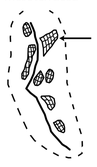
4 - CLASSIFICATION OF TERRACED AREAS

The last work to be carried out is the identification of standard criteria for the classification of terraced areas (i.e. extension or density, vulnerability to natural hazards, construction typology, state of conservation and so on). Tables proposing different possible classification criteria may represent a final project output.

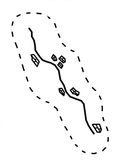
Typology 1: entirely terraced slope
macroterraced



Typology 2: partly terraced slope
mesoterraced



Typology 3: sparsely terraced slope
microterraced



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