# Terraced vineyard in Alpine environment (Vallée d'Aoste – NW Italy): an anthropogenic landscape

Regione Autonoma Valle d'Aosta
Région Autonome Vallée d'Aoste
Assessorato Agricoltura e Risorse Naturali

LNSA
Università di Torino
DIVAPRA - Chimica Agraria
Laboratorio Neve Suoli Alpini

DEIAFA
Dipartimento di Economia ed Ingegneria Agraria, Forestale ed Ambientale
Sezione Topografia e Costruzioni

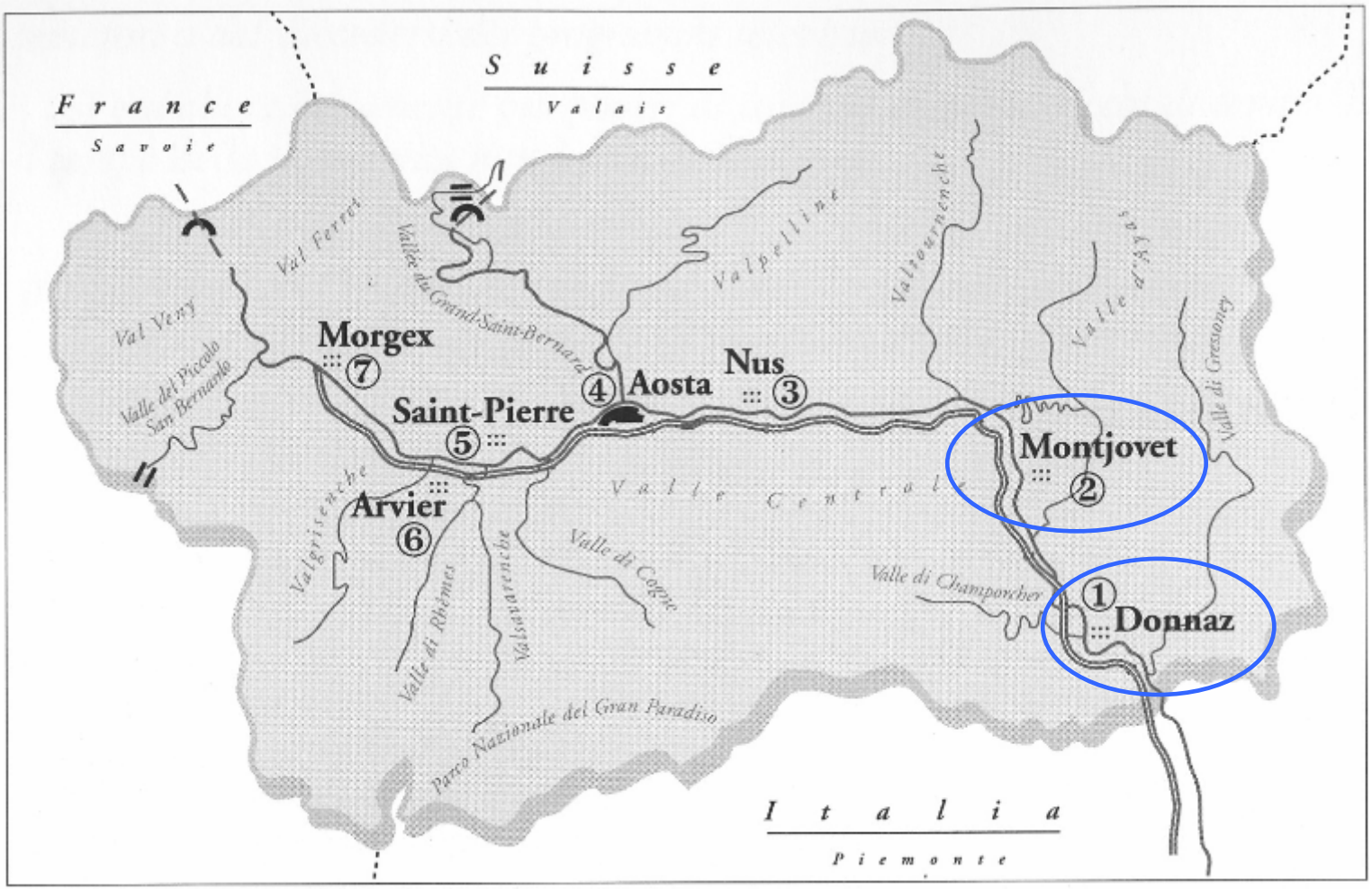

- **Surface area:**
  326000 ha

- **Surface below 1500 m asl:**
  65200 ha (1/5)

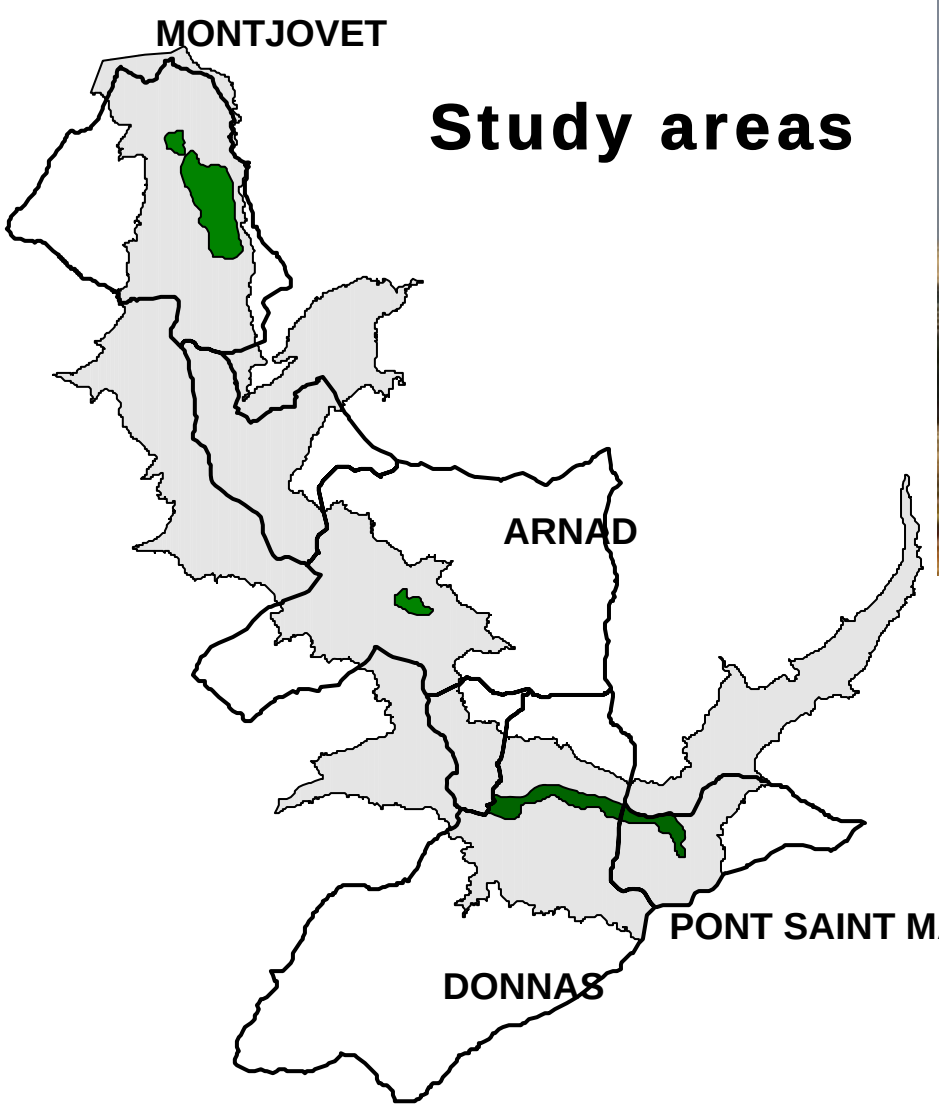
- **Surface area devoted to vineyard:**
  500 ha (DOC 200 ha)

- **Wine production:**
  9000 hl DOC

- **22 DOC wines**




**Wine production sub areas** (Fregoni et al., 1974)

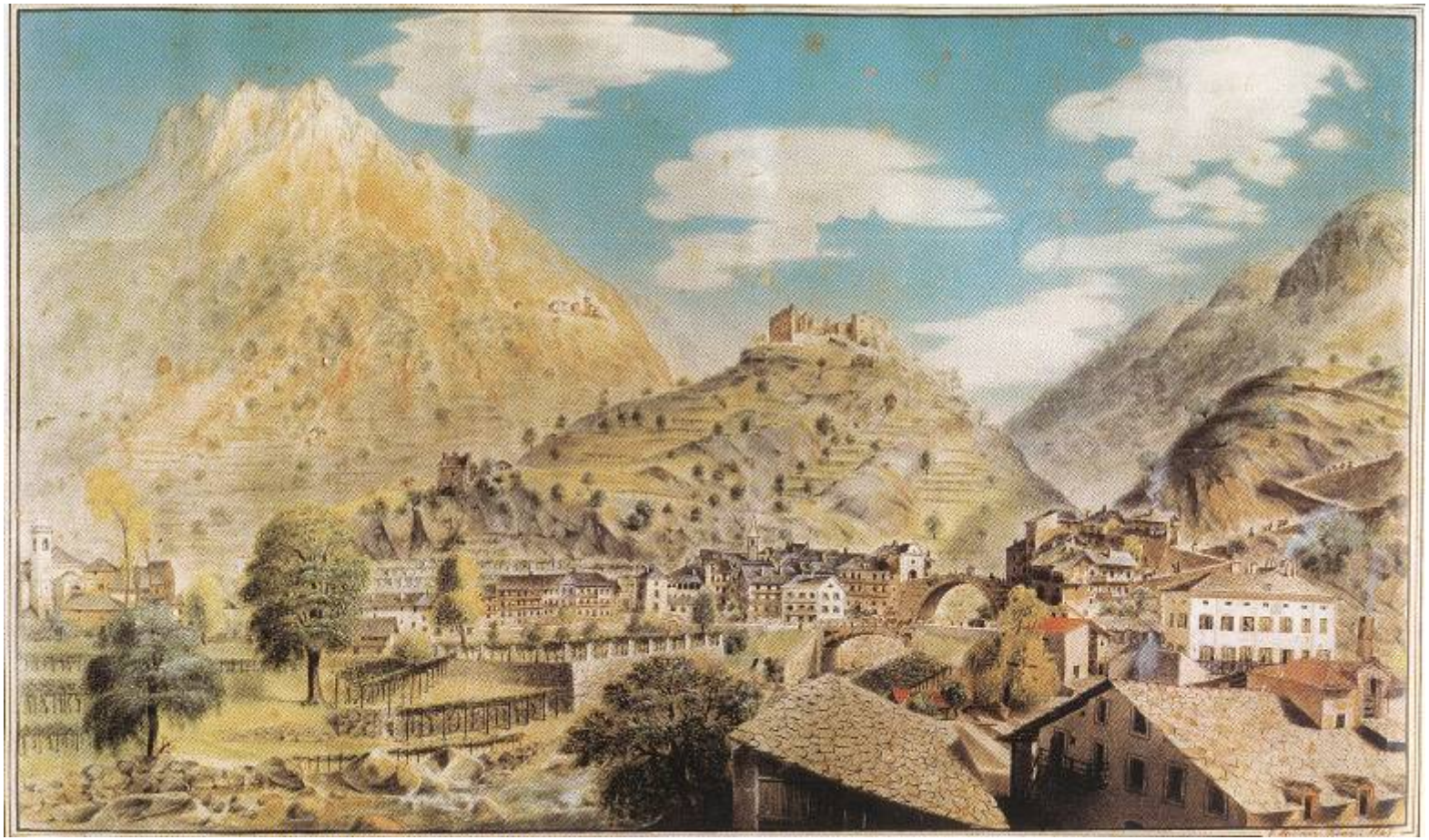



Administrative borders

Vineyards

Study areas

# PONT SAINT MARTIN - DONNAS VINEYARD HISTORICAL TERRACED LANDSCAPE



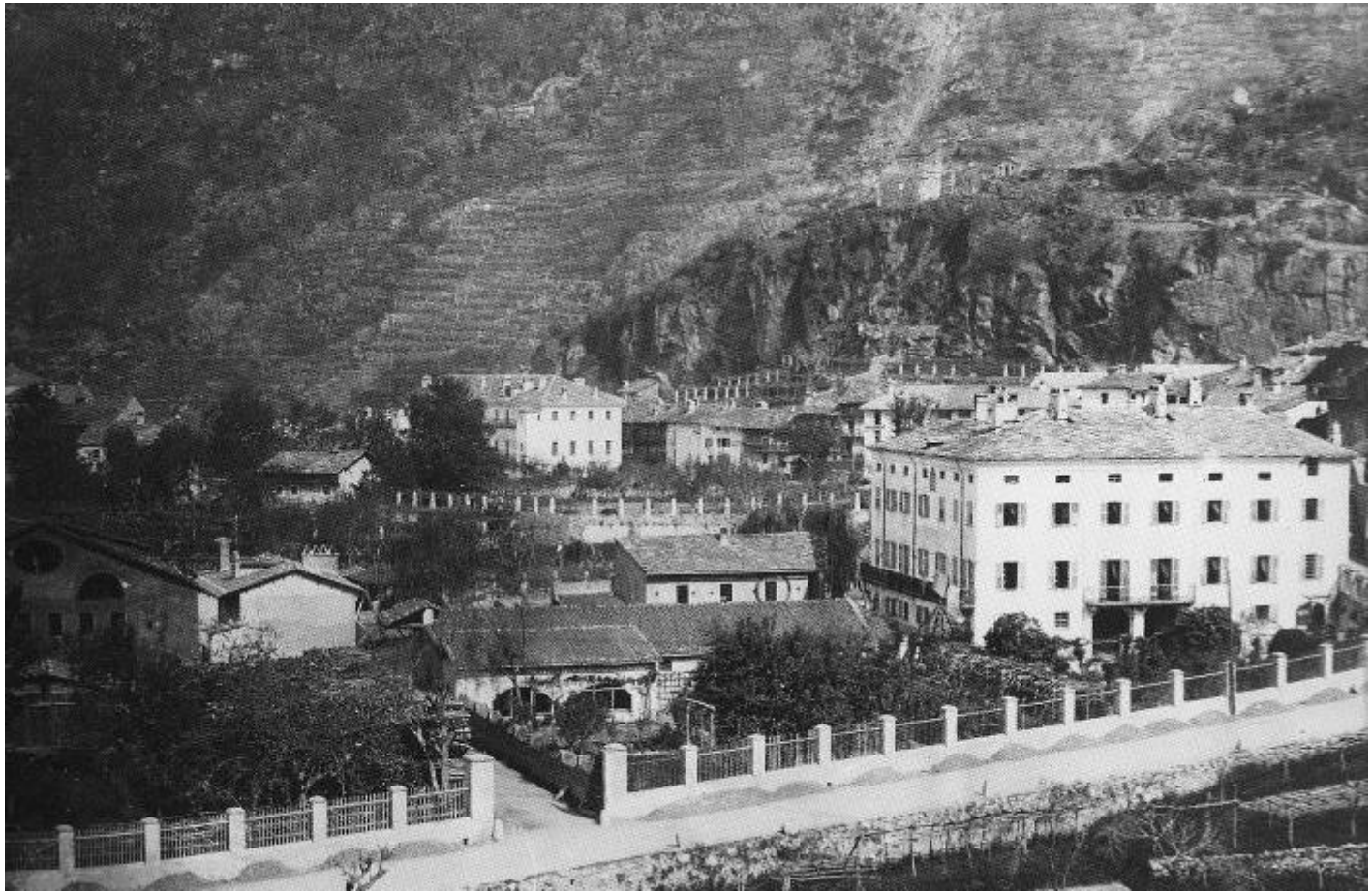
**Late 19 th century**

# DIFFERENT TYPOLOGIES OF TERRACE WALLS

**THE STUDY AREAS ARE CHARACTERIZED BY STEEP SLOPES (UP TO 100%) AND THE CONSTRUCTION OF TERRACES HAS REDUCED THE RISKS RELATED TO EROSION AND LANDSLIDES, PRESERVING THE SAFETY OF THE HUMAN SETTLEMENTS IN THE VALLEY.**

**FURTHER, TERRACES HAVE REPRESENTED NEW SURFACES AVAILABLE FOR AGRICULTURE.**

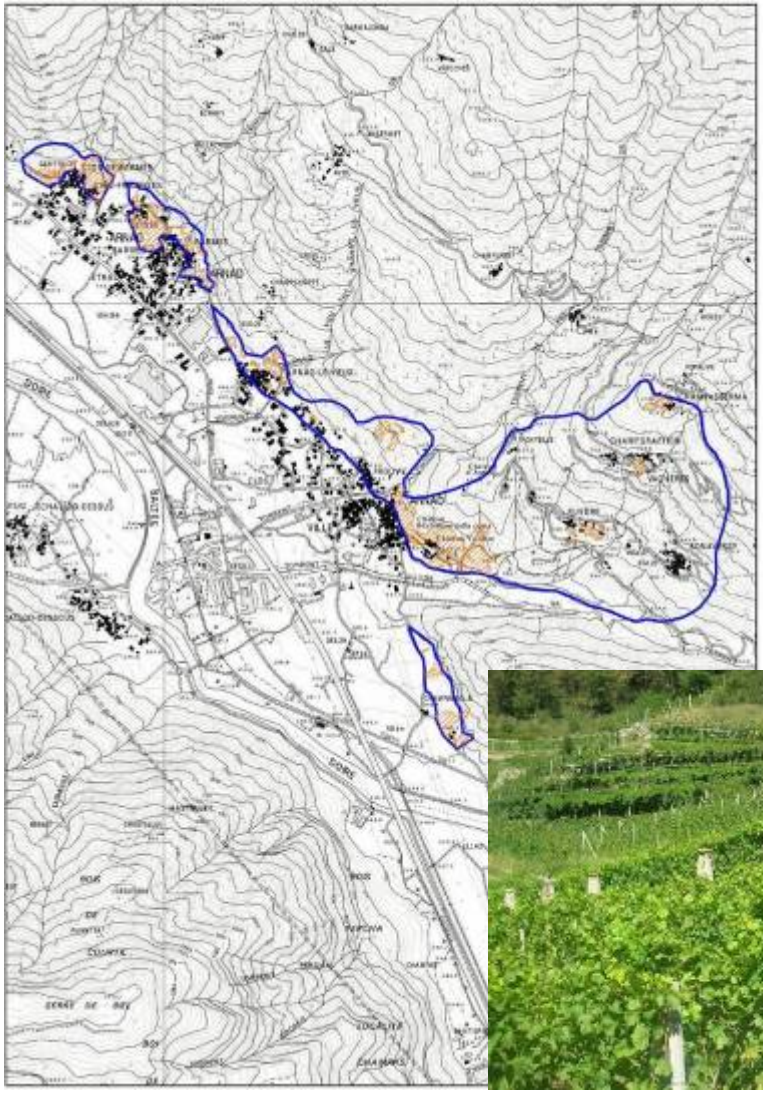
# PONT SAINT MARTIN - DONNAS VINEYARD HISTORICAL TERRACED LANDSCAPE



**Late 19 th century**

# PONT SAINT MARTIN - DONNAS VINEYARD
# CONTEMPORARY TERRACED LANDSCAPE

# ARNAD VINEYARD TERRACED LANDSCAPE

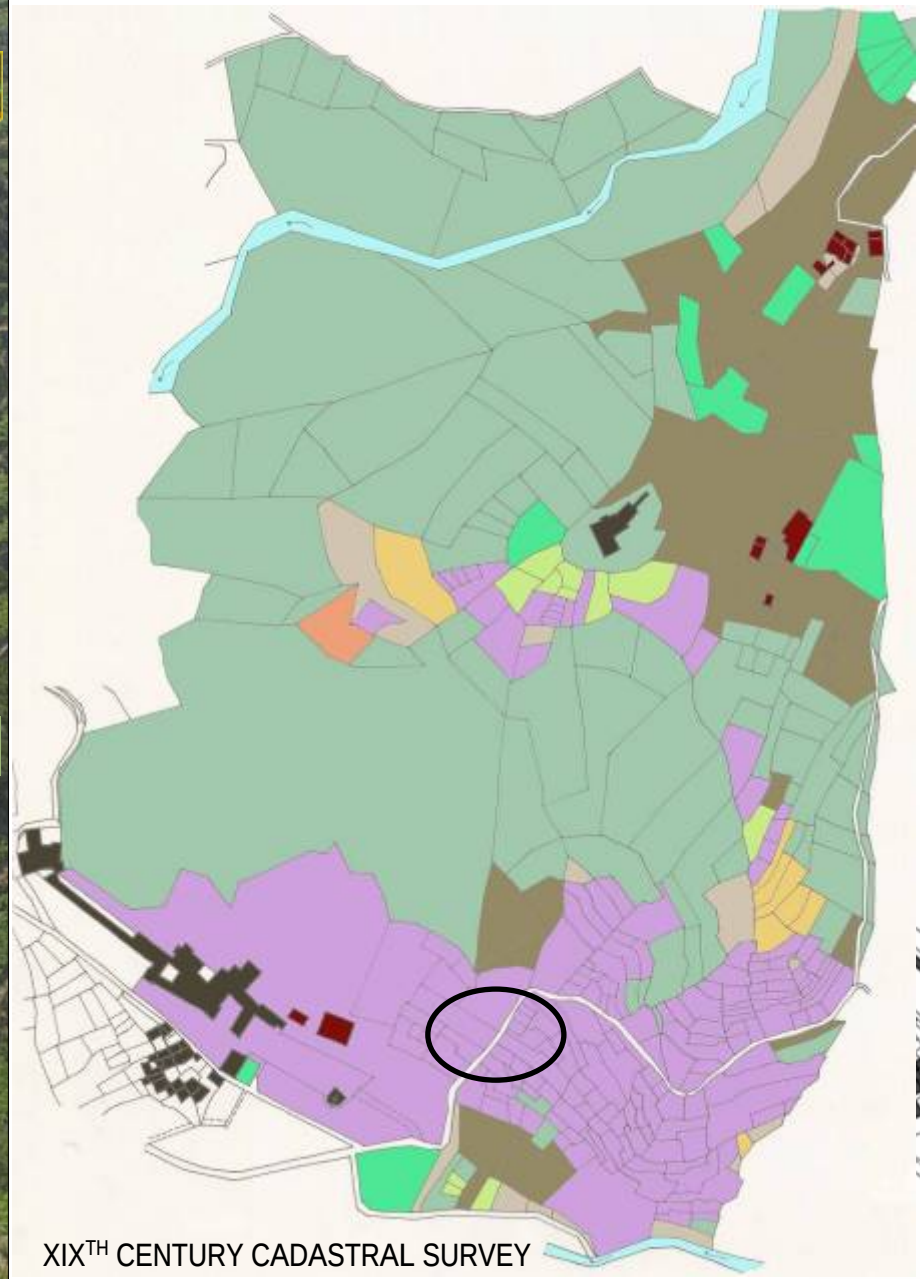


# ARNAD STUDY AREA

- GEOMORPHOLOGY CONNOTED BY QUATERNARY MORENIC DEPOSITS
- VINEYARD TERRACES STILL CULTIVATED AND GENERALLY IN GOOD CONSERVATIVE CONDITIONS
- ESPALIER-SHAPED AND PERGOLA VINEYARD LANDSCAPES

# ARNAD STUDY AREA

- WOOD OR CONCRETE PILE SUPPORTING STRUCTURES
- DRY-STONE AND CLEFT-STONE TERRACE WALLS
- LANDSCAPE QUALITY NOT YET COMPRIMISED BY DISFIGURING ELEMENTS

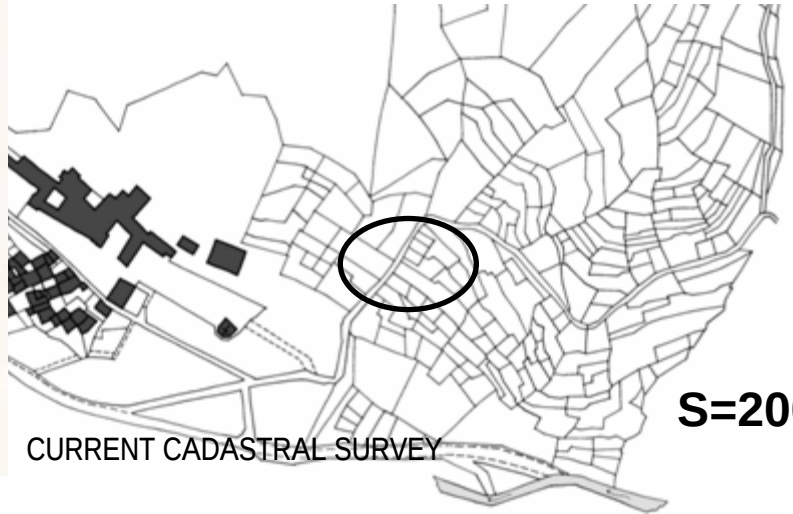


ARNAD MUNICIPALITY – LAND USE DATING 1896
historical cadastral survey – paper XXXI
(original graphical scale 1:1.000)

- ARABLE LAND
- ARABLE LAND WITH TREES
- COPPICE
- FRUIT CHESTNUT WOOD
- PRODUCTIVE WASTE LAND
- GRAZING
- IRRIGATED MEADOW
- VINEYARD
- RURAL BUILDING
- BUILDING

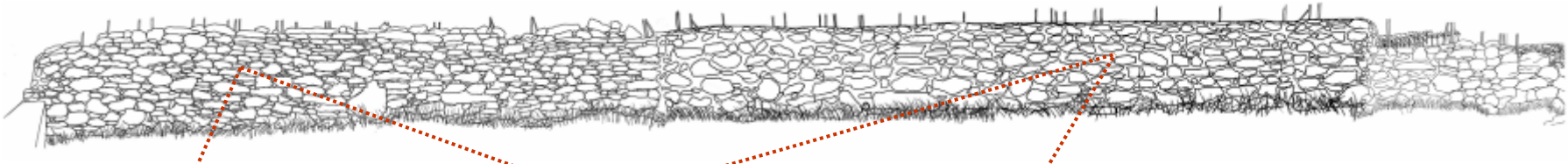
**Vineyard landscape still maintains its original shape (historical land fragmentation - same owners)**

XIX$^{TH}$ CENTURY CADASTRAL SURVEY



CURRENT CADASTRAL SURVEY

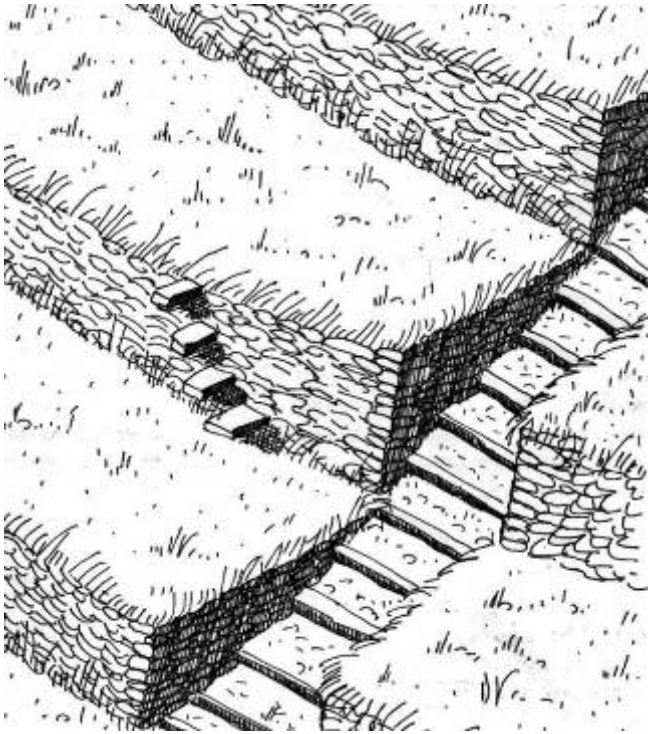
**S=200 mq**

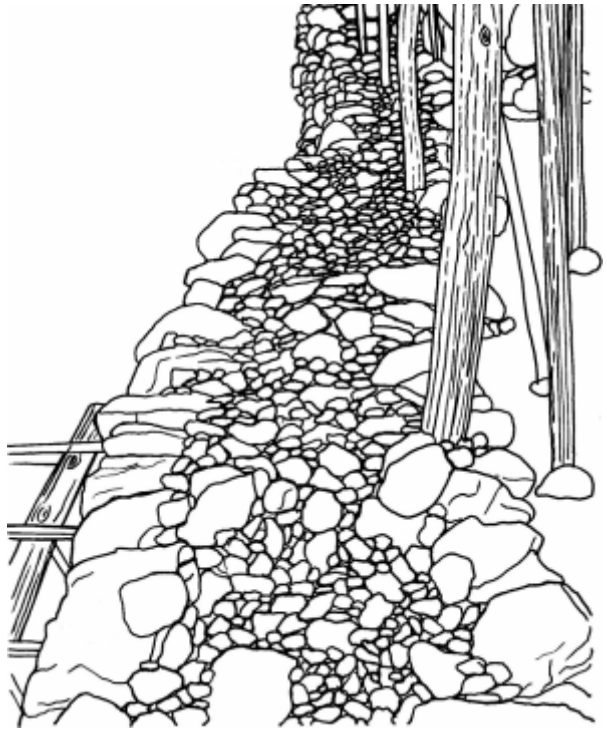


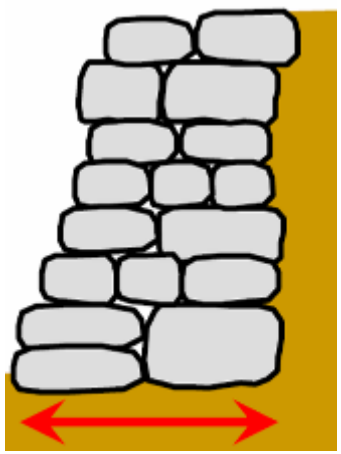
DRY-STONE MASONRY

GROUTED MASONRY

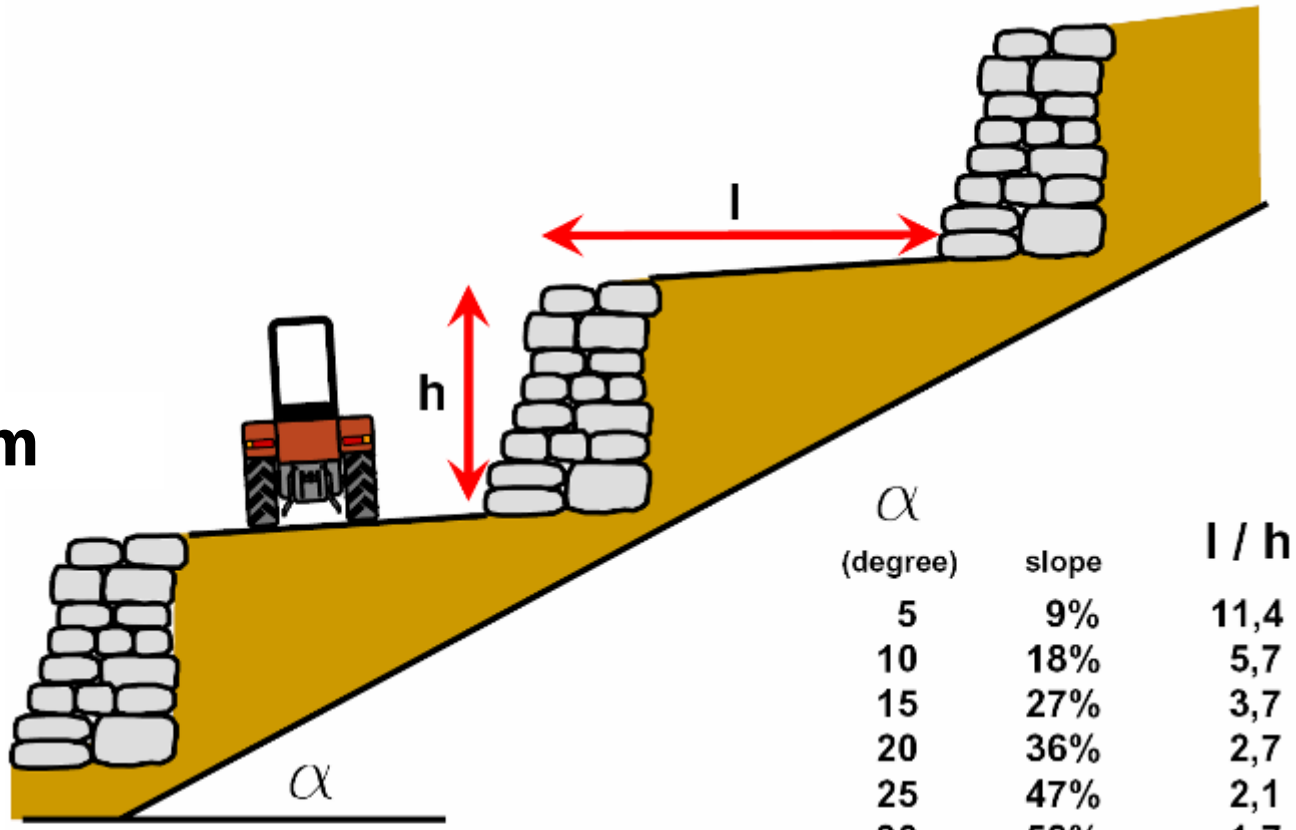
**"*opus incertum*" stone frame (a well known building technology since the Roman age)**







**0.4 ÷ 2.0 m**




**l = 1,6 ÷ 12 m**

**h = 1,5 ÷ 3 m**

| α (degree) | slope | l / h |
|---|---|---|
| 5 | 9% | 11,4 |
| 10 | 18% | 5,7 |
| 15 | 27% | 3,7 |
| 20 | 36% | 2,7 |
| 25 | 47% | 2,1 |
| 30 | 58% | 1,7 |
| 35 | 70% | 1,4 |
| 40 | 84% | 1,2 |
| 45 | 100% | 1,0 |
| 50 | 119% | 0,8 |
| 55 | 143% | 0,7 |
| 60 | 173% | 0,6 |


**PEDOLOGICAL SURVEYS**

**SOIL CHEMICAL ANALYSIS**

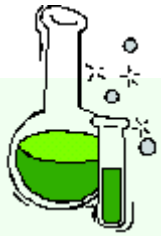
**PEDOLOGICAL AND CHEMICAL SOIL PROPERTIES**

**EVALUATION OF SOIL PRODUCTIVE VOCATION**

## Soil pedological and chemical evaluation comprises the following steps:

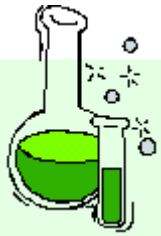
- DESCRIPTION OF THE SITE
- OPENING OF PROFILES
- SOIL DESCRIPTION, ACCORDING TO THE PROCEDURES RECOMMENDED BY SOIL SURVEY STAFF, U.S.D.A
- SAMPLING (ONE SAMPLE (2-4 KG) FOR EACH RECOGNIZED SOIL HORIZON)
- SAMPLES PREPARATION

## Soil analysis (1):



- ROCK FRAGMENTS (> 2 mm) CONTENT
- PARTICLE SIZE ANALYSIS (TEXTURE) WITH/WITHOUT CEMENT DISSOLUTION
- MINERALOGY BY X-RAY DIFFRACTION

## Soil analysis (2):



- pH
- ORGANIC C
- TOTAL C AND N CONTENT
- AVAILABLE P
- EFFECTIVE CATION EXCHANGE CAPACITY

**Soil classification according to WRB (FAO, 2006)**

# ARNAD STUDY SITE

**ARNAD I: 13 years old vineyards (espalier shaped)**

**ARNAD II: 12 years old vineyards (pergola shaped)**

**ARNAD III: abandoned (30-35 years)**

**ESPALIER-SHAPED**

# ARNAD I

## 13 years old vineyards

**Technic Escalic Cambisol**

## SOIL DESCRIPTION

**Oi**: 2.5-2 cm
**A**: 0-2.5 cm
Colour: 10YR4/4 (moist and crushed)
Skeleton: 2-3%, dimension of the clasts < 2 cm
Roots: abundant herbaceous roots.
Weak developed fine granular structure.
Consistence: weak, no sticky and slightly plastic.
Boundary: clear and smooth.
**EB**: 2.5-3.5 cm.
Colour: 10YR6/3 (moist and crushed)
Shallow and discontinuous, with patches of 20-25 cm of diameter mostly located near the trunks of the vines (around 25 cm). The upper part of this horizon, rich of pruning residues, is colonized by fungal mycelium.
**Bw1**: 3.5-27.5 cm
Colour: 10YR 3/3 (moist and crushed)
Skeleton 40%, dimension of the clasts: 1-3 cm.
Roots: abundant very fine, fine and medium.
Moderately developed fine sub-angular blocky structure breaking into finecrumbs.
Consistence: friable, no sticky and no plastic.
Boundary: clear and wavy.
Thickness: 24-12 cm.

**PERGOLA-SHAPED**

# ARNAD II

## 12 years old vineyards

**Technic Escalic Cambisol**

# ARNAD III

## Abandoned 30-35 years

### Technic Escalic Cambisol

| Percentage of skeleton (fraction larger than 2 mm), pH, available P, total C and total N of the vineyard soil | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Site** | **Horizons** | **Depth** | **Skeleton** | **pH** | **Available P** | **C tot** | **N tot** |
| **ARNAD I** | | **cm** | **% by weight** | | **mg kg$^{-1}$** | **g kg$^{-1}$** | **g kg$^{-1}$** |
| | **Ap** | **0-3** | **9.4** | **5.8** | **24** | **123.3** | **7.7** |
| | **EB** | **3-4** | **19.4** | **6.5** | **44** | **51.3** | **2.8** |
| | **Bw1** | **4-27** | **49.3** | **7.0** | **27** | **19.8** | **1.6** |
| | **Bw2** | **27-37** | **53.4** | **7.5** | **17** | **12.8** | **0.9** |
| | **BC1** | **37-60** | **53.7** | **7.9** | **16** | **7.2** | **0.5** |
| | **BC2** | **60-79** | **30.8** | **8.2** | **9** | **5.5** | **0.1** |
| | **BC3** | **79-91+** | **72.3** | **8.3** | **11** | **4.3** | **0.1** |

| Percentage of skeleton (fraction larger than 2 mm), pH, available P, total C and total N of the vineyard soil | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Site** | **Horizons** | **Depth** | **Skeleton** | **pH** | **Available P** | **C tot** | **N tot** |
| **ARNAD II** | | **cm** | **% by weight** | | **mg $kg^{-1}$** | **g $kg^{-1}$** | **g $kg^{-1}$** |
| | **Ap** | **0-2** | **21.4** | **7.1** | **25** | **20.1** | **1.5** |
| | **Bw1** | **2-17** | **23.6** | **7.2** | **26** | **9.4** | **0.7** |
| | **Bw2** | **17-33** | **23.6** | **7.4** | **23** | **10.5** | **0.9** |
| | **Bw3** | **33-51** | **15.3** | **7.8** | **15** | **8.0** | **0.8** |
| | **Bw4** | **51-81** | **6.3** | **8.3** | **14** | **6.6** | **0.6** |
| | **Bw5** | **81-100** | **8.3** | **8.4** | **13** | **4.8** | **1.1** |
| | **BC** | **100-110+** | **20.3** | **8.1** | **7** | **5.0** | **2.1** |

| Percentage of skeleton (fraction larger than 2 mm), pH, available P, total C and total N of the vineyard soil | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Site** | **Horizons** | **Depth** | **Skeleton** | **pH** | **Available P** | **C tot** | **N tot** |
| **ARNAD III** | | **cm** | **% by weight** | | **mg kg$^{-1}$** | **g kg$^{-1}$** | **g kg$^{-1}$** |
| | **A** | **0-2** | **13.6** | **7.3** | **40** | **42.8** | **4.1** |
| | **AB** | **2-9** | **14.9** | **7.2** | **37** | **15.4** | **3.2** |
| | **Bw1** | **9-17** | **34.9** | **6.4** | **7** | **14.5** | **2.2** |
| | **Bw2** | **17-28** | **30.9** | **6.6** | **0** | **9.0** | **1.1** |
| | **Bw3** | **28-42** | **22.4** | **7.2** | **7** | **19.0** | **0.8** |
| | **Bw4** | **42-57** | **18.7** | **7.5** | **2** | **20.4** | **1.3** |
| | **BC** | **57-68+** | **47.4** | **7.8** | **3** | **19.9** | **0.6** |

## Conclusions:

1. Soils did not display significant differences between managed and unmanaged plots, probably because abandonment has lasted only few decades, maximum 30-40 years


# Conclusions:

2. The dry-stone walls and the slope drainage system often showed an almost immediate decay after being abandoned, indicating that their maintenance is a fundamental issue not only for landscape conservation, but also for slope stability and soil maintenance


V[th] International Congress of the European Society for Soil Conservation
*"Changing Soils in a Changing World: the Soils of Tomorrow"*
Palermo, 25-30 July 2007

# Terraced vineyard in Alpine environment (Vallée d'Aoste – NW Italy): an anthropogenic landscape

**Freppaz M., Agnelli A., Drusi B., Stanchi S., Galliani C., Revel Chion V., Zanini E.**

michele.freppaz@unito.it
**www.lnsa.unito.it**