

MORPHOMETRY OF DRY WALLS IN TERRACED OLIVE GROVES IN
ŠIBENIK-KNIN COUNTY

**Morfometrija suhozida u terasastim maslinicima na području šibensko-
kninske županije**

Boris Dorbi ¹, Elma Temim²

Abstract

During 20th century, more and more people went from traditional to conventional or integral agriculture. This state, among other things, significantly endangered old dry walls in terraced olive groves typical for rural landscape in Dalmatia. This paper presents gathered information of inventarisation of dry walls in terraced olive groves in 9 localities with different way of managing in Šibenik-Knin County. The basic goal of this research was collecting basic material for establishment of integral cadaster of dry walls for the purpose of their protection. The results show negative impact of intensive agriculture on dry walls.

Key words: *inventarisation, dry walls, terraced olive groves, research, rural landscape, Šibenik-Knin County*

INTRODUCTION – Uvod

A range of dry wall makings can be found throughout the whole area of Šibenik-Knin County, which represents the typical landscape scene with their forms and shapes made by masterly fitting of anthropogenic elements into natural surroundings. That is how typical cultural and historical monuments were made in rural areas, which are a mixture of traditional building and agriculture. During 20th century more and more people went from traditional to conventional or integral agriculture, and the traditional form of agriculture with sense of care for the environment was neglected, and with that all the elements that occur in typical rural landscape. This state endangered significantly old dry walls in terraced olive groves, which made the renewal of dry walls according to their primary typical look essential. Olive growing was the second most important branch of agriculture during the first half of 20th century in Šibenik area (BLAfiEVI, 2007). Failures in servicing just one part of dry walls endanger the whole system as a result of a domino effect

¹Mr.sc. Boris Dorbi, Department for karst agronomy, University of Applied Sciences šMarko Maruli 6, Knin.

²Prof.dr.sc.Elma Temim, Agromeditereanean Faculty, University of Džemal Bijedić, Mostar.

(BRANCUCCI, 2008). The complexity of the problem of dry wall protection is significantly attributing to endangerment of specific olive groves and dry walls.

The dry wall is a wall made of stone which is built without connection material (dead wall) or with connective material (live wall). The biggest differences are in size of the stones used, and if the stones are sharp edged, flattened or rounded (FREUENREICH, 1962). The agrarian reform in the second half of 19th century can be considered as the beginning of a new way of forming dry wall terraces. Although it is known that dry building was the only way of building outside city fortresses all up to 18th century. There is a period of stagnation of building after appearance of phylloxera in this area. By sudden improvement of standards of Adriatic region which is expressed in fast, megalomania building, the need for stone is settled from old dry buildings, especially during the last decades. The usage of technical gadgets while building has reached into the most distant localities of mild acclivities and entered deeply into the karst along the traffic roads, thus disposing in this manner the stone walls and contents of distant and lonely habitats and fences. Because of that it is not unusual that preserved forms of dry walls have been found in isolated and inaccessible places.

Dry building has a defensive character and it was raised for protection from erosion. The application of dry building has created a wide range of characteristic forms and ways of building which are more adjusted to the specific conditions of the natural environment and purpose. There are many examples of various forms that confirm the frequency of some shapes and certain rules that appear in different variations, and especially in inapproachable hidden localities (KULUŽIĆ, 1999). The diversity and uniqueness imposed the need of systematization. Bearing in mind the specific characteristics of dry walls (without the usage of connective material) 18 basic typological categories were determined in the representative area. During field research, data was collected using the method of interview with farmers (WERDER & MICHAEL, 2008.) that are connected with the way of managing olive groves that were taken as examples. Since dry walls are not protected as a part of cultural heritage, we need to systematically protect them, which will reflect in following preparation activities which were elaborated and suggested by dr. sc. Jadran Kale: inventory implies cataloguing shapes, typologisation implies sorting into morphological classes according to shape and structural classes according to characteristics of structure and interaction with site, cross section, etc. Categorization implies sorting attribution of pre-existing condition. A typologically put together inventory can represent a catalogue of selected lists used for different purposes.

For the purpose of protection, except first registrations of ethnographic zones for dry walls as basic phenomena, it can be stated that their preservation in appropriate landscape boundaries has been dependent of the fact if they are situated on land that has a primary archeological importance (e.g. Hvar, Vodnjan) or under protection of nature (e.g. NP Kornati, Modrava in NP Vransko lake). When summarizing the

observed actions it could be said that preservation of dry wall scenery in sufficient landscape accounts was not a consequence of expert stability, but individual practice. Georeferenced inventory of these landscape forms would obtain from their cadaster. The completion of cadaster with archeological and historical data would attribute to knowledge of anthropogenic scenery (KALE, 2010). So the paper will contain the inventarisation of morphometry of dry walls (width, height and length measurement) and dry wall parcels in Šibenik-Knin County for the purpose of their protection.

MATERIAL AND METHODS – *Materijali i metode*

Expansion of production and further technological development of olive growing in Dalmatia appeared with Roman government at the end of old era and establishment of the Province of Illiria., and subsequently Dalmatia (KRN EVI et al. 2011). Immigrants from Italy did not base their farms just in the fields, but also on terraces of karst land where the land was appropriate for olive growing and viticulture. The Slavs continued to grow olives and vine which can be seen in their documents and their latter annual taxes, which amounted one tenth of olive yield (TAMBA A, 1998). In 1412 Šibenik fell under the government of Republic of Venice and remained so until it collapsed in 1797. According to information from literature during that period vineyards were in Donje Polje, Grebac and Srima, and the hill above Šibenik where the fortress of At. John is located, also known today as Tanaja, was full of olives in such measure that it looked like Mount of Olives in Jerusalem (KRN EVI et al. 2011).

The period of French government lasted from February 1806 to November 1812. Unlike the Austrian government in Dalmatia, the French undertook a whole series of actions for improvement of agriculture.

In 1813, after the French left, Dalmatia enters into Habsbourg Monarchy and remains a part of it for a whole century. The Austrian government was leaning more toward viticulture. During second Austrian government the clearing of karst terrains happened mostly through the first half of 19th century. According to statistics from 1843 were the size of areas of vineyards and olive groves were expressed cumulative: vineyards without olive trees dominated in Dalmatia except in Šibenik. Where we have the most vineyards with olive trees (74%) (TAMBA A, 1998).

From 1918 to 1921 Šibenik was under Italian occupation, and entered into Kingdom of Serbs, Croats and Slovenes on 12th June 1921. Viticulture was main branch during this period, too, and olive growing was the second important agricultural branch in Šibenik area. The statistics for 1921 records 508.000 trees, while the statistics for 1933 records 6.000 trees (BLAŽEVI , 2007).

Nine landscape interesting localities were determined in Šibenik-Knin County by field research conducted during 2010 and the first half of 2011. They include

coastal and hinterland areas were the research was done. All nine localities have approximately fifty parcels. While choosing the localities only the number of parcels on the locality was considered regardless of their size. Five different parcels were chosen on each locality random sample method, altogether 45 parcels in sample, with different systems of agricultural management in the observed olive groves, as shown in Table 1.

Table 1. Chosen landscape localities

Tabela 1. Odabrani lokaliteti

No	Locality	Number of parcels	Current state of the parcel
1	Zaton-Blagdanovo, coastal area	5 parcels	integral management
2	DonjePolje-Edge area, hinterland area	5 parcels	integral management
3	Greba-tica-Kalina, coastal area	5 parcels	integral management
4	Murter-Hramina, coastal area	5 parcels	ecological management
5	Danilo-Eraci, hinterland area	5 parcels	ecological management
6	Primo-ten ó Entrance, coastal area	5 parcels	ecological management
7	Srima-Dobri Dolac, coastal area	5 parcels	neglected area
8	fiabori -Entrance, coastal area	5 parcels	neglected area
9	Perkovi -Crljeni, hinterland area	5 parcels	neglected area

During field research information for mapping the area of research were gathered, i.e. inventarisation, then for making of ortho-photo and photo documentation of dry walls. By using different scientific methods: analysis and synthesis, induction and deduction, method of interview, statistic methods, a conclusion about the current state on specific parcels, about the state of dry wall terraces: shape, length, size, typological classification, typisation of dry wall structures, etc. Method of interview of local residents gave information about the way of olive production in chosen localities.

RESULTS AND DISCUSSION – *Rezultati i diskusija*

Missing parts of dry walls in different breeding groups - *Nedostajući dijelovi suhozidova u različitim uzgojnim skupinama*

Comparative analysis of the state of dry walls in different breeding groups was inducted according to information gathered on field and by using ANOVA method. In this way a statistically significant difference in state of the dry walls structures in different types of managing is being pointed out.

Table 2. Testing of missing pieces of dry walls for three breeding groups (ANOVA)
 Tabela 3. Testiranje nedostajućih dijelova suhozidova za tri uzgojne skupine (ANOVA)

GROUPS	NUMBER	SUM	AVERAGE	VARIANCE		
Integral olive groves	15,000	638,170	42,545	3004,787		
Ecological olive groves	15,000	264,500	17,633	359,874		
Neglected olive groves	15,000	121,140	8,076	105,396		
SOURCE OF VARIATIONS	SS	Df	MS	F	P-Value	F crit
Between groups	9500,031	2,000	4750,015	4,107	0,024	3,220
in groups	48580,795	42,000	1156,686			
Total:	58080,825	44,000				

By method of analysis of variance (ANOVA) an equality of missing parts of dry walls in three breeding groups of olive groves: integral, ecological and neglected (Table 1). Null-hypothesis is: "It is possible that missing parts of dry walls equal for all three breeding groups". The resulting p-value equals 0,024, so that on the level of significance from 100% we can conclude that there is a significant difference in missing parts of dry wall in these three breeding groups. The biggest percentage of missing parts have the integral olive groves 42,52%, then 17,63% and at the end neglected for olive groves 8,076%.

Weedy parts of dry walls in different breeding groups - Zakorovljeni dijelovi suhozidova u različitim uzgojnim skupinama

Table 3. Testing of weedy parts of dry walls for all three breeding groups
 Tablica 3. Testiranje zakorovljenih dijelova suhozidova za tri uzgojne skupine (ANOVA)

GROUPS	NUMBER	SUM	AVERAGE	VARIANCE		
Integral olive groves	15,000	643,710	42,914	2591,962		
Ecological olive groves	15,000	234,180	15,612	386,802		
Neglected for olive groves	15,000	252,580	16,839	236,301		
SOURCE OF VARIATIONS	SS	Df	MS	F	P-Value	F crit
Between groups	7134,135	2,000	3567,067	3,328	0,046	3,220
in groups	45010,907	42,000	1071,688			
Total:	52145,041	44,000				

By method of analysis of variance (ANOVA) equality of weedy parts of dry walls in all three breeding groups is tested: integral, ecological, neglected for (Table 2). Null hypothesis is: "It is possible that the weedy parts of dry walls are equal for all three breeding groups." The resulting p-value equals 0,046, so that the level of significance from 10% we can conclude that there is a significant difference in the weedy part of dry wall in these breeding groups. The integral olive groves have the biggest percentage of weedy parts 42,91% , then neglected for 16,84%, and the smallest percentage occurs in ecological olive groves 15,61%.

Bearing in mind the data gained by testing which shows in the first and second case that the statistically most significant percentage occurs at integral olive groves it can be concluded that this way of managing is not the most appropriate for dry wall terraces. Intensive agriculture with its aggressive agrotechnical methods, like ploughing makes the ground dither which makes the dry wall structure unstable. By intensive acting of mechanization (eg. agriculture tractor) dry walls collapse or are removed for the purpose of cohesion of parcels. With the intensive use of mineral fertilizers instead of organic ones the increased erosion activity is enabled as well as drift pressure from erosion to dry walls, and drainage of ground into lower layers etc. Also, next to the mentioned factors the pride of horticultural manufacturers also counts, where individuals influence negatively on the structure, do not remove weed of the dry wall. Destroy abutment, use top rocks for building etc.

Based on the results following measures are recommended for the improvement of dry wall state in integral olive groves:

- Importance of informing appropriate authorities local population about the significance of dry wall heritage
- Renewal of dry walls with following methods: preservation, revitalization, restoration, reconstruction, recomposition, especially localities Zaton and DonjePolje
- Reducing usage of agricultural mechanization
- Reducing the use of agrichemicals and pesticides
- Destruction of annual and perennial weeds

Ecological agriculture wouldbesides breeding acceptable environment care, as well as already developed self-consciousness, have a smaller impact on dry wall elements of rural landscape.

Suggested measures for improvement of dry walls in ecological olive groves imply:

- Renewal of dry walls with following methods: preservation, revitalization, restoration, reconstruction, recomposition, especially localities Murter and Danilo
- Greater awareness from agricultural advising service about ecological production

Neglected for area imply weediness and missing parts of dry walls which are smaller than at intensive managing. Dry wall degradation was caused by neglected, humans, animals (wild boars or similar) or natural hazards (fire, erosion). Together with their renewal, we suggest the development of ecotourism.

Knowledge of morphology of complete, partially missing and weedy dry walls determine the methods of protection. Methods of preservation and revitalization are possible combined with other methods depending on the grade of damage of dry walls. Suggestion of method of restoration and reconstruction is functional for renewal methodology, and all with the purpose of rehabilitation of missing parts of dry walls. Measures for successful improvement of dry wall condition in uncared for olive groves are:

- Importance of informing appropriate authorities of local population about the significance of dry wall heritage
- Renewal of dry walls with following methods: preservation, revitalization, restoration, reconstruction, recomposition, especially localities Murter and Danilo
- Development of ecotourism

* Work is an excerpt from a science master s thesis Boris Dorbi : *Prilog istraflivanju i za-titi suhozida u terasastim maslinicima na podru ju Tšbensko-kninske flupanije*.

CONCLUSIONS – *Zaključci*

By detailed analysis of metric data of measuring dry walls such as height, width and length complete and weedy parts of dry walls in parcels, and length of missing parts of dry walls in meters, it can be seen that there is a significant difference in influence of different way of agricultural management on dry walls in olive groves in Tšbenik-Knin County.

By testing the differences in missing parts of dry walls in terraced olive groves in three breeding groups (integral, ecological, uncared for), with the help of new ANOVA we observe following differences: The biggest percentage of missing parts have got the integral olive groves 42,54%, while testing of weedy dry walls of olive groves in the same breeding groups have the integral olive groves 42,91%.

Bearing in mind the obtained results we can conclude that intensive agriculture with its aggressive breeding actions makes dry wall structure unstable. Ecological agriculture wouldbesides breeding acceptable environmental care (based on Regulation on ecological production and refinement of herbal products and Regulation for conscious production) have to influence positively on the environment.

Weedy areas are characteristic because of their weediness and missing parts of dry walls from the past which are smaller than in intensive managing. As a part of their renewal it is recommended the development of ecotourism.

By further course of renewal a further formation of dry wall cadaster would take place, where the dry wall typology would be registered systematically and in details. Making priority lists of procedures according to preservation, value and state of the dry wall is just one part of defined and elaborated plan of intervention without which it is impossible to imagine systemic acting on the field of cultural heritage of farmers.

When speaking about renewal of dry walls, as well as a part of cultural-historical monuments, we can apply on the given localities the following methods: revitalization, restoration, reconstruction and recomposition.

REFERENCES - *Literatura*

BLAŽEVIĆ, M. (2007): Prilog povijesti poljoprivrede –ibenskog područja od 1921.-1941. godine. Radovi zavoda za povijesne znanosti HAZU u Zadru, No. 49-12, 2007. Zadar, 645-689.

BRANCUCCI, G. (2008): Risk assessment of terraced landscape in Liguria. Terraced landscapes of the Alps (Project). (ur. Fontanari, E., Pattasini, D). Venezia, 8-19.

DORBIĆ, B. (2011): Prilog istraffivanju i za-titi suhozida u terasastim maslinicima na području TMBensko-kninske flupanije. Agromediteranski fakultet, Univerzitet Dfemal Bijedi Mostar. Mostar.

FREUDENREICH, A. (1962): Narod gradi na ogoljenom krasu: zapaflanjanjancimci i crteffi arhitekta. Savezni zavod za za-titu spomenika kulture. Zagreb.

KALE, J. (2010): Prijedlog modela inventarizacije suhozida. *Prostor* 2(40) 18(2010). Zagreb, 452-467.

KRNJEVIĆ, M., KRNJEVIĆ, Ž., DORBIĆ, B. (2011): Prilozi za povijest dalmatinskog maslinarstva. Murterski godi-njak 7-8. Otok-Murter, 271-290.

KULUŠIĆ, S. (1999): Tipska obiljeffja gradnje u suho na kr-u hrvatskog primorja (na primjeru kornatskih otoka). *Hrvatski geografski glasnik*, No. 61. Zagreb, 53-83.

TAMBA A, A. (1998): Vinogradarstvo i vinarstvo TMBenskog kraja kroz stolje a. Matica Hrvatska-TMBenik. TMBenik.

WERDER, S., MICHAEL, M. (2008): Landscapes Bregaglia: plans and policies. Alpter project. Venezia, 109-114.

www.wikipedia.org/wiki/Mastrinka (preuzeto: 12.05.2011)

SAŽETAK

Tijekom 20. stoljeća sve je više ljudi prelazilo s tradicionalne na konvencionalnu ili integralnu poljoprivredu. Ovakvo stanje, međutim, značajno je ugrozilo i stare suhozide u terasastim maslinicima tipičnim za ruralni krajobraz na području Dalmacije. U ovom radu su prikazani prikupljeni podaci inventarizacije suhozida u terasastim maslinicima na 9 lokaliteta s različitim načinom gospodarenja na području Šibensko-kninske županije. Osnovni cilj ovog istraživanja je bio skupljanje temeljnih podataka za uspostavu integralnog suhozidnog katastra u vidu njihove daljnje zaštite. Dobiveni rezultati pokazuju negativni utjecaj intenzivne poljoprivrede na suhozidne strukture.