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## Water resources of the island of Korčula (Croatia): availability and agricultural requirement

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### Abstract

The island of Korčula is located along the eastern coast of the Adriatic Sea. It has Mediterranean climate with mild and wet winters and hot and dry summers. The island's water supply has been managed in two ways: through a pipeline from the mainland and by drawing groundwater. The island's water is mainly used for drinking and for sanitary needs of the population and tourists, and only a small part is used in industrial production. Tourism causes high seasonal water needs which can hardly be met with the existing water supply system. Agriculture has long tradition on the island. Today, 3 500 ha are cultivated which is about 12.7% of island area, while only 20 ha are irrigated. Therefore total agricultural production is variable and mainly depends on climate. Due to more often and stronger droughts, yields are decreased which causes high economical losses. This paper deals with island's natural features, water needs especially for agriculture, water resources management and finally it suggests measures and activities to improve existing water use.

**Key words:** *groundwater, island, irrigation, Korčula, water supply*

### INTRODUCTION

Water is a unique and irreplaceable natural resource indispensable for life on Earth. Because of its limited amounts and uneven temporal and spatial distribution, drinking water is a main existential and economic resource. Consequently, a need arises to research water resources intensively and to determine guidelines and models for optimum exploitation. This specially refers to areas with striking water deficits such as the Mediterranean, the islands in particular.

For successful water resources management it is necessary to determine available amounts of water and the needs of all users. The methodology of balancing water supplies in insular conditions has been described by SOKOLOV and CHAPMAN [1974] and VERHOOG [1987]. According to VERHOOG [1987] groundwater is the most important water reserve on islands, but not the most appropriate form for «keep-

ing». He suggests constructing surface reservoirs on islands.

VENEZIAN SCARASCIA *et al.* [2006] gave quantity overview on available water resources at Italian national and regional levels using annual climate data of the time series 1971–2000. They defined renewable water resources as a part of water resources generated from precipitation and computed on the basis of water balance. This approach is also acceptable for insular conditions, too. SALVATI *et al.* [2008] estimated the quantity of Italy's renewable water resources using monthly meteorological data from the same period 1971–2000. Authors pointed that amount of renewable water resources of Italy dramatically decreasing, so it will be reflected on national planning purposes and water protection strategies. To prevent this prediction, integrated water management must be achieved, especially in view of the future scenarios and climate change.

Many authors emphasize the need to use unconventional sources especially in insular conditions as much as possible: desalinization of sea and/or brackish water and recycling waste water as economically and ecologically more acceptable solutions [CHARALAMBOUS 2001; GIKAS, TCHOBANOGLIOUS 2009; TSAGARAKIS *et al.* 2004; ZACHARIAS, KOUSSOURIS 2000]. CHARTZOULAKIS *et al.* [2001] presented that agriculture is the major water user in Crete with share of 84.5% of the total consumption. Rational water management is necessary to satisfy growing water requirements with sustainable development and environment protection. They emphasized that integrated water resources management should include purely technical measures (improvement of distribution system, irrigation scheduling, recycling etc.) and socio-economic measures (pricing, rationalization, education, training, etc.).

Some Croatian islands such as Korčula were supplied with water by long pipelines from the mainland in the second part of the 20th century. These solutions required high initially investments but also they have produced high exploitation costs. The main water users on Croatian islands are local inhabitants and tourists, while agriculture has negligible role. From contemporary point of view, external water resources have to be included after using proper potentials. LJUBENKOV [2011] pointed that Adriatic islands are among the rainiest islands on the Mediterranean, so they have high hydrological potential. TERZIĆ [2006] elaborated on the hydrogeological characteristics of Adriatic islands and groundwater exploitation as a form of water supply.

Korčula's water supply has been managed in two ways: through a pipeline from the mainland and by drawing groundwater. TERZIĆ *et al.* [2008] identified that there are two main pollution sources for the Korčula's Blato aquifer: sea-water intrusion which is expressed during summer period and nitrates and other humanly caused pollution indicators from the soil and epikarst belt during rainy season, which generally make problems in water supply.

On many Adriatic islands including Korčula, tourism causes very high seasonal water needs which can hardly be met with existing water supply systems. Almost, there is no irrigation so due to more often and stronger droughts, yields are decreased which causes high economical losses. It must be stressed that agriculture is the main water-use sector on majority Mediterranean islands, even with worse hydrological conditions than Korčula. Obviously, it is achieved with wisely water management. BONACCI *et al.* [2012] applied linear programming method to get optimal water distribution for the Korčula. They took even the agriculture into account, but they did not elaborate actual agricultural requirements.

The main objective of this paper is to identify agricultural water requirements and island's hydro-

logical potential and finally to suggest measures and activities for better water management.

## STUDY AREA

There are 1 246 islands, ridges and reefs along the eastern coast of the Adriatic Sea, including the island of Korčula too [DUPLANČIĆ-LEDER *et al.* 2004]. Adriatic Sea is the arm of Mediterranean Sea, with area of 131 000 km<sup>2</sup> lies between Italy and Balkan peninsulas (Fig. 1b).

Korčula belongs to Dalmatia, a coastal region of the Republic of Croatia (Fig. 1a). The island is located between 42°53' and 42°59' N and 16°38' and 17°12' E. With an area of 276 km<sup>2</sup>, Korčula is the sixth largest Adriatic island, far about 1 270 m from the Pelješac peninsula. It is a typical elongated Dalmatian island stretching in the E–W direction, with a length of about 45 km and an average width of 6 km. The island of Korčula is a gently rolling area. The highest peak is Klupca with the elevation of 568 m a.s.l. The coast is about 182 km long and well-indented with numerous bays and coves.

The present name «Korčula» derives from the Greek name Korkyra melaina, which referred to the island's dense pine and holm oak woods. The island has been populated for almost 3000 years. Nowadays, it has about 16 000 inhabitants. The annual number of tourists is about 150 000, with about 750 000 tourist days, mainly in the summer season.

According to a definition accepted by UNESCO [BONACCI, ROJE-BONACCI 2003; DIAZ ARENAS, FEBRILLET HUERTAS 1986], small islands in hydrological terms are those whose water resources are very scarce. These islands have areas of less than 1 000 km<sup>2</sup>. This category also includes islands with more than 1 000 km<sup>2</sup>, if their width is less than 10 km. The very small islands are those with areas of less than 100 km<sup>2</sup>. According to this categorization, the island of Korčula is a small island.

## CLIMATOLOGICAL CHARACTERISTICS

Insular and coastal parts of Dalmatia, including the island of Korčula, are regions of Mediterranean climate with mild winters and hot, dry summers. Climate elements have been measured since 1948 at two weather stations on the eastern and western coasts of the island – Korčula and Vela Luka (Fig. 1c). Besides these two weather stations, two rain gauges operate in the villages of Čara (C in Fig. 2) and Blato (B in Fig. 2) in the central part of the island (Fig. 2).

Minimum and maximum measured instantaneous temperature in the period 1948–2008 vary between –4.5 to 37.0°C on the island's eastern coast (Korčula) and –7.8 to 39.0°C on the western coast (Vela Luka). According to monthly temperature averages, the coldest month of the year is January, with

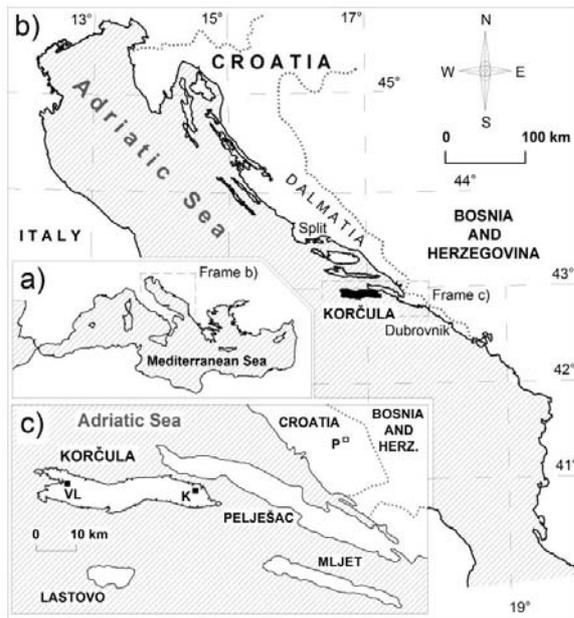


Fig. 1. Location map of the study area (VL – Vela Luka, K – Korčula)

the mean temperature of 7.1°C in the western part and fluctuating from 5.0 to 9.7°. The warmest month is

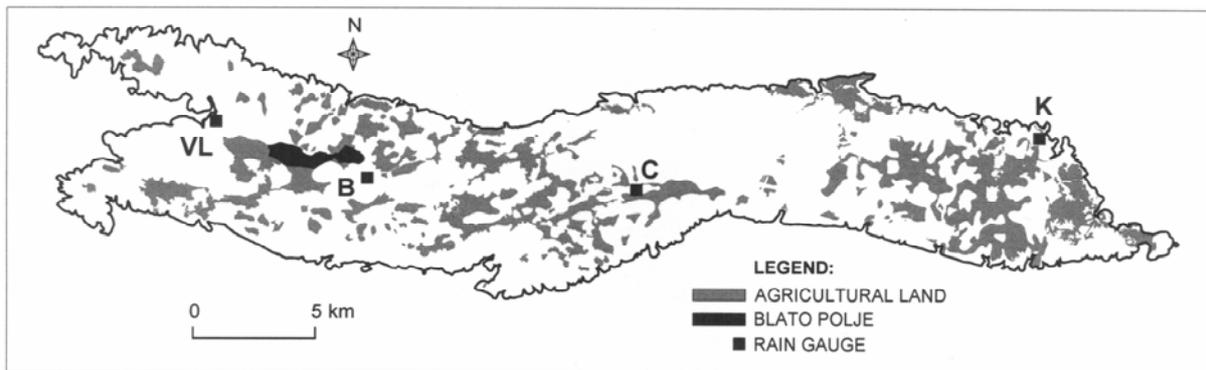


Fig. 2. Agricultural land on the island of Korčula

island of Lastovo, the annual average is 2 791 sun hours, or 7.6 sun hours per day. The maximum number of sun hours is 371 in July (about 12 hours per day) and the minimum about 123 in December (about 4 hours per day).

There is significant trend of annual precipitation in the island's longitudinal direction with minimum (around 800 mm) on the eastern coast and maximum (around 1 000 mm) on the western coast. In the period from 1948 to 2008, average precipitation on the island was about 924 mm, which is the average value of registered amounts at the four mentioned weather and rain-gauging stations. Precipitation is unequally distributed throughout the year. Most precipitation falls during the colder part of the year between October and March, with the average of two-thirds of total precipitation. The least amount of precipitation falls

July, with average monthly temperatures from 23.5 to 28.1°C in the eastern part and the mean of 25.7°C.

Relative humidity changes very little during the year due to the proximity of the sea. Monthly averages are about 71%. It is lowest in the summer period from July to August (about 65%) and highest in the autumn and winter periods between October and January (about 75%).

There are several kinds of winds of different frequency and strength blowing in Dalmatia, and the most important ones are bura, jugo and maestral. Bura is a very cold and dry north-eastern wind which usually blows in strong gushes from the mainland towards the sea and lasts for several days. The most frequent wind is the south-eastern jugo. It carries warm humid air from the Mediterranean. Maestral often blows in the warmer part of the year. It is a constant north-western wind of moderate force and velocity.

Insolation has not been measured on the island of Korčula. According to data from the neighboring

between June and August, when water is the most necessary for tourism and agricultural production. In some years, rainfall is absent during these summer months.

Annual precipitation and temperature fluctuations are presented in the form of Walter's diagram [WALTER *et al.* 1975]. The diagrams for Korčula and Vela Luka point to very high humidity in the autumn-winter period and aridity in the vegetation period (Fig. 3).

Besides space trend, island's precipitation has trend in time domain too. In the analysed period 1948–2008 annual precipitation had the decrease of approximately 20% for all gauging stations. So in the middle of the 20th century average annual precipitation was around 1 030 mm, while it was about 830 mm at the beginning of 21 century. At the same time,

temperature has upward trend with increase of about  $1.0^{\circ}\text{C}$  in 60 years. The trend of precipitation and tem-

perature for the station Korčula in the period 1948–2008 is presented in Fig. 4.

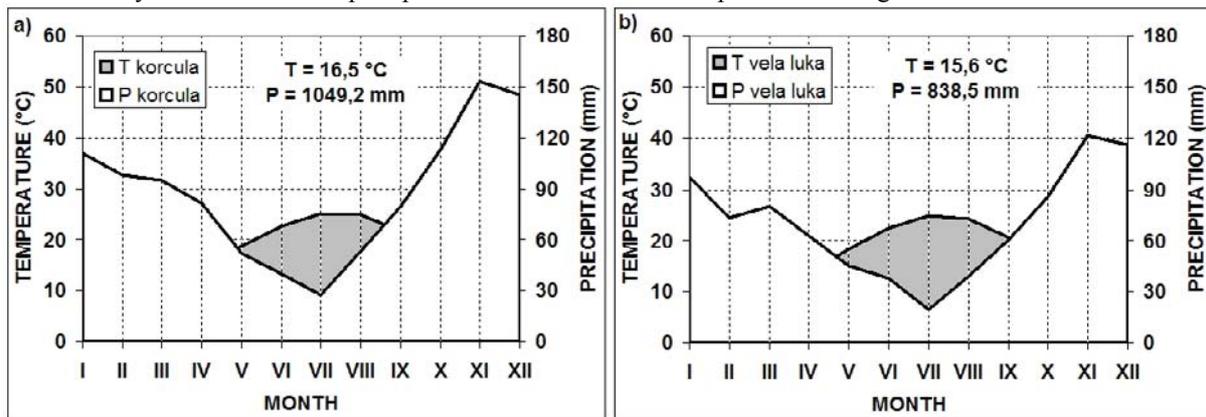


Fig. 3. Arid period for Korčula and Vela Luka according to Walter's diagram

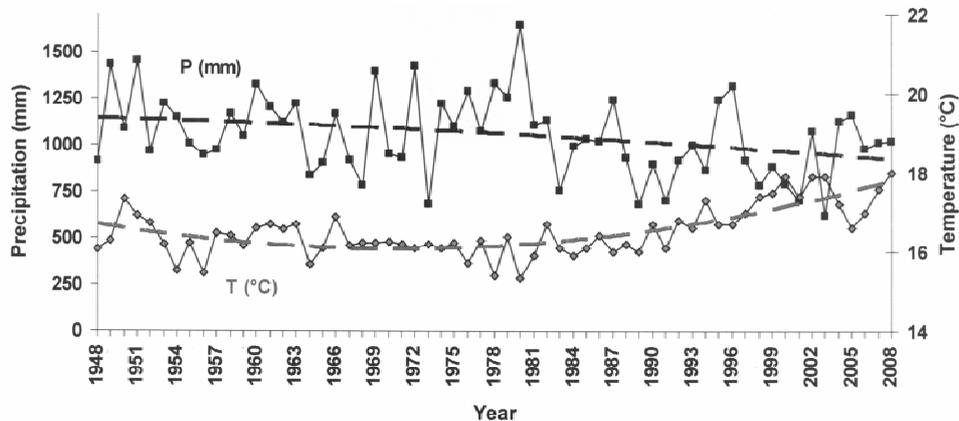


Fig. 4. Trend of annual precipitation and average temperature for Korčula in the period 1948–2008

## ISLAND GEOLOGY AND WATER RESOURCES

The island of Korčula is the part of the vast area of the Outer Dinaric ranges. It is built of limestone and dolomites accumulated between the Lower and Upper Cretaceous periods (a period from about 145 to 70 million years ago), sporadically covered with terra rossa and Quaternary sands. The characteristics of these carbonate sediments (limestone and dolomites) point to a sediment accumulation in a relatively shallow-sea, turbulent environment, with changing flow strengths and salt concentrations as well as water temperatures and depths.

Tectonically, the area belongs to the tectonic unit of South Dalmatian islands. The island of Korčula is an anticline with asymmetrical wings. The stretching of layers in the western part matches the so-called Hvar direction (E–W), assuming the so-called Dinaric direction (NW–SE) towards the east.

The whole area is tectonically very disturbed, which is the result of wrinkling processes in its Mesozoic and Tertiary layers. Tectonic activity in this area

occurred during the Upper Jurassic and Lower Cretaceous periods; in the transitional period between the Upper Cretaceous and Tertiary (when basic tectonic units were formed) and during the Upper Eocene (maximum) [TERZIĆ 2006].

During the Tertiary and Quaternary periods, structures formed in the Upper Eocene finally acquired their present form.

Surface flows do not appear on the island due to porosity of the terrain. Most rainfall water sinks through the porous terrain and flows underground. This is proven by numerous vruļjas, especially along the island's southern coast. Only sporadically, strong and short-term torrents during heavy rains are of relative importance. There are some small temporary springs on the island and also 20 small ponds. Some ponds permanent, while others run dry in summer.

Permanent groundwater measurements are organized only in the "polje" (small depression) of Blato due to its fundamental role in the island's water supply. Since the Blato has low altitudes, the groundwater levels varies from surface (6–7 m a.s.l.) in the winter to almost seal level in the summer, during

maximal extraction. When hydrological conditions and extractions are extremely unfavourable, there is significant salinity increase in the pumped water which can reach 3 000–4 000 mg·l<sup>-1</sup>.

## AGRICULTURE

Agriculture has long tradition on the island of Korčula. It takes place in many karst poljes and valleys [BONACCI 2004] (Fig. 2). Today, 3 500 ha are cultivated which is about 12.7% of the island area. Only 20 ha are irrigated in the polje of Blato which is 0.6% of the island's cultivated area. Karst polje Blato is drained by network of canals that end in the "estavelle" (crack in the rock) in the east side of polje and continues toward tunnel. During rainy season estavelle acts as spring. Polje has been used for an extensive agriculture for a long time therefore drainage tunnel was dug in the year 1912 for flood protection. Before that, polje of Blato had been flooded almost every year which was adversely for agriculture. Since, almost negligible irrigation on the island, total agricultural production depends on climate. Due to more often and stronger droughts, yields are decreased. The most important agricultural cultures are olive trees and wine which occupy 2 600 ha and 400 ha respectively. Remaining 500 ha are mainly covered by fruit trees (citrus, cherry, almond etc.) and less by vegetable (potato, cabbage, tomato etc.).

Agricultural land on the island has area of 6 500 ha and 54% are cultivated (Fig. 2). The island's agricultural development is possible in two ways: to cultivate careless areas and to develop irrigation systems.

There are a few soil types on the island of Korčula which are results of geological features and various climatic and tectonic actions. The dominant soil type on the island is a brown soil developed on limestone and dolomite followed by rendzina. But these soils are mainly shallow and/or inclined so they are unfavourable for agriculture. The most important agricultural activity is placed in karst poljes and valleys and surrounding terraces, where soils are deeper and constituted mainly by terra rossa and brown soil. Terraced slopes are typical Mediterranean landscape and they are the results of human response to arable land scarcity.

Calculation procedure of crop water requirements is explained in literature DOORENBOS and PRUITT [1977]. The total amount of water required for specific crops on the island of Korčula are presented in Tab. 1. They are calculated by CropWat software (Version 4.3). Calculation is based on climate data and FAO Penman-Monteith methodology. Results are presented for different climate conditions: dry, average and wet year. Average year refers to mean climate data from period 1981–2008. Dry year has 25% of statistical appearance, while wet year has 75% of statistical appearance. For average precipitation of 850

mm (1981–2008), 284 mm fall in vegetation period from April to September. Dry year assumes total annual precipitation of 431 mm and 123 mm in vegetation period. For the wet year, total precipitation is 1 273 mm with 446 mm in vegetation period.

**Table 1.** Crop water requirements (m<sup>3</sup>·ha<sup>-1</sup>·year<sup>-1</sup>) for wet, average and dry year and irrigation period

Crop	Wet	Average	Dry	Irrigation period
<b>Fruit trees</b>				
Deciduous orchard	3 630	4 490	5 730	V–VIII
Citrus	1 850	2 690	4 030	V–VIII
Olives	2 100	2 960	4 330	V–IX
<b>Grapes</b>				
Wine	1 790	2 630	3 650	V–VIII
Table	2 520	3 360	4 380	V–VIII
<b>Vegetables</b>				
Tomato	3 660	4 500	5 410	V–VIII
Sweet peppers	2 620	3 180	3 770	V–VII
Water melon	2 340	2 900	3 490	V–VII
Carrots	3 080	3 660	4 440	IV–VII
<b>Roots</b>				
Potato	3 970	4 810	5 720	V–VIII

Crop water need could be dismembered in two components: the part of precipitation which can be used from the crop i.e. the effective rainfall and amount of water that need to be remunerated by irrigation i.e. irrigation water need [DOORENBOS, PRUITT 1977].

The highest irrigation water needs are in dry year with values that are 20 to 50% higher than in average year. On the other hand, the lowest needs are during the wet year. In the last column, usual irrigation periods are specified for each crop separately.

The highest needs have potato, tomato and deciduous orchard which are 4 810, 4 500 and 4 490 m<sup>3</sup>·ha<sup>-1</sup> in the average year, respectively. The lowest needs have wine and citrus which are 2 630 and 2 690 m<sup>3</sup>·ha<sup>-1</sup> in average year. The most present culture – olive tree, needs 2 960 m<sup>3</sup>·ha<sup>-1</sup> for irrigation in the average year, while it is 2 100 m<sup>3</sup>·ha<sup>-1</sup> in wet year and 4 330 m<sup>3</sup>·ha<sup>-1</sup> in dry year. Besides irrigation needs, as defined before, crops receive significant amount of water by effective precipitation which are 1 170 m<sup>3</sup>·ha<sup>-1</sup>, 2 590 m<sup>3</sup>·ha<sup>-1</sup> and 3 380 m<sup>3</sup>·ha<sup>-1</sup> in dry, average and wet year, respectively.

## WATER SUPPLY

Since the 1980s, water supply in the eastern part of the island (place Korčula) has been managed by bringing water from the mainland spring Prud (P in Fig. 1c) and across Pelješac peninsula through a 58 km long pipeline. Along the way, water «rises» several times to elevations of about 350 m because of the configuration of the terrain. This route has two submarine sections: mainland – Pelješac and Pelješac –

Korčula. About  $2.5 \cdot 10^6 \text{ m}^3$  per year is captured in the mainland spring area. An extension of the system toward the neighboring islands of Mljet and Lastovo has been planned.

As a form of water supply in the western part of the island (places Blato and Vela Luka) since the middle of the 20th century, groundwater has been drawn from the polje of Blato. It is located in the central-west part of the island near the village of Blato (Fig. 2). Besides four municipal wells, with total capacity of  $65 \text{ l} \cdot \text{s}^{-1}$ , the polje of Blato has numerous private wells used for irrigation.

Blato is a typical karst polje with an area of  $2.19 \text{ km}^2$  and a few temporary springs and estavelle. Its central part is at about  $7 \text{ m a.s.l.}$  The topographic catchment of the polje covers about  $10.8 \text{ km}^2$ . During summer months, the exploitation capacity of the underground aquifer is often reached. About  $1.0 \cdot 10^6 \text{ m}^3$  per year is drawn from the Blato aquifer for public water supply and about  $0.08 \cdot 10^6 \text{ m}^3$  per year for irrigation.

The construction of the main pipeline is currently under way with the aim of connecting the island's eastern and western parts into an integral water supply system. Unfortunately, the total losses of the existing water supply system are about 65%, which is  $2.3 \cdot 10^6 \text{ m}^3$ , while annual consumption reaches about  $1.2 \cdot 10^6 \text{ m}^3$  (Tab. 2).

**Table 2.** Extraction and consumption of water for present and future (desirable) state

Specification	Present state	Future state
	volume ( $10^6 \text{ m}^3 \cdot \text{year}^{-1}$ )	
Extraction	3.5	2.6
Consumption	1.2	2.2
Population & Tourism	1.1	1.1
Industry	0.1	0.1
Irrigation	0.08	1.0*
Losses	2.3	0.4

\*Area of 650 ha and average hydrological conditions.

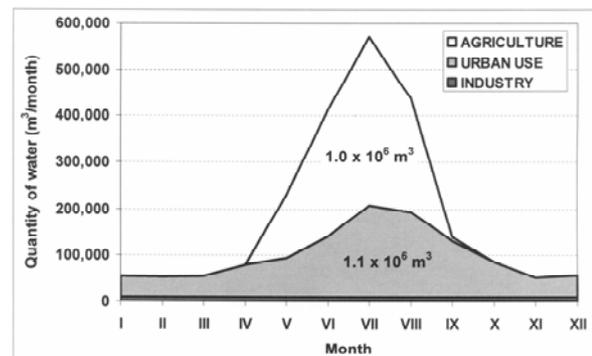
Today, water supply system reaches its capacity in the summer period due to tourist season and it is not possible to use its water for irrigation. This situation is not rational in two ways. First, losses in the water supply system are too high so they increase distribution costs. Another disadvantage is that bad water resource management does not allow using water for agriculture. This is a typical situation of water resources management for many Croatian Adriatic islands.

So in the future, rational water resource management must be set. It is evident that existing supply system has reserves that must be directed into agriculture, too. It is shown in Tab. 2 for the future desirable situation that total extraction of water for the island can be decreased from 3.5 to 2.6 million  $\text{m}^3$  per year.

That quantity of water will be adequate for domestic use, industry and even for new consumer – agriculture. In this case water losses must be reduced on the acceptable level.

In this work it is estimated that surface acceptable for irrigation covers 650 ha which is about 20% of cultivated area and it includes: 520 ha olive trees, 100 ha fruit trees, 20 ha vine and 10 ha vegetable. This agricultural production should take 1.0 million  $\text{m}^3$  water per average hydrologic year. Irrigation water amount is 1.4 million  $\text{m}^3$  during a dry year and 0.7 million  $\text{m}^3$  during a wet year.

Due to tourism in the summer time, there are high seasonal needs for potable water (Fig. 5). At the same time the need for the agricultural purposes reaches its maximum too, but natural water resources are at the minimum. Therefore, rational and wisely water management is necessary.



**Fig. 5.** Water needs for different sectors on the island of Korčula

## PROPOSALS FOR WATER RESOURCES MANAGEMENT IMPROVEMENT

The first unavoidable step in the water resources management of each island is a detailed investigation of its proper water resources. The volume of renewable water resources depends primarily on hydrological regime which is variable from year to year. In the analysed period 1948–2008, mean the island's annual precipitation varied between 620 mm registered in the year 2000 and 1 355 mm in 1972. In the period 1948–2008 average precipitation was 924 mm, but in the period 1981–2008 it was 850 mm. Average precipitation (850 mm) gives total volume of water for the island of 235 million  $\text{m}^3$ . Other components of the island's water budget are presented in Tab. 3. Real evapotranspiration for period 1981–2008 is calculated by Palmer's method [PALMER 1965] and it is 544 mm averagely, which is 150 million  $\text{m}^3$  per year and 64% of precipitation. Remaining 85 million  $\text{m}^3$  includes surface flow and infiltration which presents potentially renewable water resources. Permanent surface flow does not appear on the island due to high infiltra-

tion rates of karst terrain. Most rainfall water sinks through the porous terrain and reaches underground. In this work, it is estimated that about third of renewable resources is surface and turbulent subsurface outflow to the surrounding Adriatic Sea, while remaining two-thirds recharges underground and forms freshwater lens [BONACCI 1987]. Therefore, the most important water resource on the island is groundwater. Since the island's underground is permeable, seawater intrudes into it and encounters freshwater. The freshwater lens of the island is a dynamic water body which is fed by precipitation and emptied by flow to surrounding sea and human extraction. Groundwater reserves are variable in time and they are limited [VACHER, QUINN 1997; WHITE, FALKLAND 2009]. Interface between freshwater lens and seawater is the transition zone with brackish water which depth depends on many factors like geological features, sea level, extraction intensity etc.

**Table 3.** Components of the island's water budget for the period 1981–2008

Component	Volume, $10^6 \text{ m}^3 \cdot \text{year}^{-1}$
Precipitation	235
Real evapotranspiration	150
Renewable resources	85
Outflow to the sea	30
Groundwater recharge	55

On the island of Korčula, groundwater is exploited only on the polje of Blato, mainly for domestic use and industry and less for irrigation. With total annual extraction of about 1.0 million  $\text{m}^3$  per year and estimated retained renewable resources of 55 million  $\text{m}^3$ , water exploitation index (WEI) for the Korčula is about 1.8%. This index is defined as the quotient between total annual extraction and long-term average freshwater resources at analysed region. This index is much lower for Korčula than for many Mediterranean islands such as: Naxos, Malta, Cyprus, Sicily, etc. European Environment Agency (EEA) defines a warning WEI threshold of 20% to distinguish a non-stressed region from a stressed one. Besides the Blato polje, hydrogeological investigations have been done only in the polje of Čara, where it was found low abundance of groundwater (less than  $1.0 \text{ l} \cdot \text{s}^{-1}$ ) on the two bores. Therefore, these bores are not used for water supply.

It seems that Korčula's proper water resources are much higher than island's needs. It should be stressed that it is evident at annual level, but seasonal variation causes problems in the summer season due to the highest water demand and the lowest water availability. On the average, Korčula has high per capita amount of renewable water, which is about  $5\,560 \text{ m}^3 \cdot \text{h}^{-1} \cdot \text{year}^{-1}$  and it is much higher than for

many Mediterranean islands and regions [CHARTZOU-LAKIS *et al.* 2001].

## CONCLUSION

Korčula's water supply is provided by the pipeline from the mainland and the extraction of proper groundwater. But, today's water supply system presents a limiting factor for the island's development, especially in agriculture which is management in a traditional way almost without irrigation. Modern and stable agricultural production is not possible without irrigation. But irrigation and generally an increasing demand for water impose a rational use of limited water resources particularly in insular conditions. This approach requires analysis crop water requirements and irrigation technology, too. It is calculated that 1 million  $\text{m}^3$  of water has to be ensured for Korčula's agriculture. Irrigation area should cover 650 ha, which includes mostly olive trees followed by fruit, vine and vegetable. Among them, deciduous orchard and tomato are crops that have the highest irrigation needs with about  $4\,500 \text{ m}^3 \cdot \text{ha}^{-1} \cdot \text{year}^{-1}$  for average hydrologic year.

There are two ways of technical improvements in water management on the island of Korčula:

- improvement of the existing water supply system,
- increasing exploitation of water resources.

Since existing water distribution losses are over 50% i.e. 2.3 million  $\text{m}^3$  per year, it is necessary to improve the water supply network and to reduce losses to an acceptable level. In that case the extraction of natural water resources and transportation costs will be reduced which is acceptable from economical and ecological point of view. Achievement water saving could be pretty high and satisfactory for the agriculture.

Each island has its own water resources that should be carefully investigated and monitored. It is estimated that manageable water resource of the Korčula is 55 million  $\text{m}^3$ , which is much higher than water needs. Today's water exploitation index is only 1.8%. It seems that water resources on the island of Korčula have not been entirely investigated yet and even adequately used. The same situation is with many other Croatian islands.

Besides mentioned technical improvements, socio-economic measures are advisable such as a water pricing, education at all levels of society, promotion of rational water use etc.

This paper presents water resources problems on the island of Korčula. It points that island water management should be primarily based on wisely using its proper water resources. That task requires multidisciplinary approach which can take economical, social and ecological aspects of water use.

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**Zasoby wodne wyspy Korčula (Chorwacja): dostępność i potrzeby rolnictwa**

STRESZCZENIE

**Słowa kluczowe:** *Korčula, wyspa, woda, woda gruntowa, nawadnianie*

Wyspa Korčula jest położona wzdłuż wschodniego wybrzeża Adriatyku. Korčula ma klimat śródziemnomorski z łagodnymi i wilgotnymi zimami i gorącymi i bezdeszczowymi okresami letnimi. Istnieją dwa źródła zasilania w wodę – rurociągiem ze stałego lądu oraz pobór wody gruntowej.

Woda na wyspie służy głównie do celów pitnych i na sanitarne potrzeby mieszkańców i turystów, a jedynie mała jej część jest używana w produkcji przemysłowej. Turystyka powoduje duże sezonowe zapotrzebowanie na wodę, które trudno pokryć z istniejącego systemu zaopatrzenia w wodę.

Rolnictwo ma długą tradycję na wyspie. Obecnie uprawia się 3 500 ha, które stanowią 12,7% obszaru wyspiarskiego, a tylko 20 ha się nawadnia. Dlatego produkcja rolna jest zależna przede wszystkim od zmiennych warunków klimatycznych. Ze względu na częste i silne susze zmniejszenie plonów powoduje duże straty ekonomiczne.

W niniejszym artykule przedstawiono naturalne cechy wyspy, w tym potrzeby wodne rolnictwa, oraz zarządzanie zasobami wodnymi. Zaproponowano przedsięwzięcia, mające na celu poprawę istniejącej sytuacji.