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GEOGRAPHIC-PHYSICAL CONDITIONS OF RUNOFF AND HYDROGEOLOGICAL CHARACTERISTICS OF THE PLITVICE LAKES

JOSIP RIĐANOVIĆ and SREĆKO BOŽIČEVIĆ

Abstract:
Geographic-physical conditions of runoff start from the topographical location and the geographical position in processing of the main hydro-parameters to determine the integral hydrological regime of the Plitvice Lakes landscape.
The hydrogeological characteristics are the consequence of the hydrogeological function of the rocks, and their considerable influence on the travertine process as a fundamental phenomenon of the Plitvice Lakes.
Key words:
Geographic-physical conditions of runoff, water stage recorder, hydrological regime, hydrogeological characteristics, hydrogeological function of rocks, the travertine process.

GEOGRAFSKO-FIZIČKI UVJETI OTJECANJA I HIDROGEOLOŠKE SPECIFIČNOSTI PLITVIČKIH JEZERA

Izvadak:
Geografsko-fizički uvjeti otjecanja polaze od topografskog smještaja i geografskog položaja u obradu glavnih hidro-veličina za određivanje cjelovitog hidrološkog režima plitvičkog krajolika. Hidrogeološke specifičnosti proistječu iz različite hidrogeološke funkcije stijena i značajno utječu na sedrotvorni proces temeljnog fenomena Plitvičkih jezera.
Ključne riječi:
Geografsko-fizički uvjeti otjecanja, limnigraf, hidrološki režim, hidrogeološke specifičnosti, hidrogeološka funkcija stijena, sedrotvorni proces.

I) GEOGRAPHIC-PHYSICAL CONDITION OF RUNOFF

The more important investigations

The systematic hydrological surveys on the lakes started in the period 1951-1954 conducted by PETRIK (1958). Geomorphological by ROGLIĆ (1951), geological by POLŠAK (1957), than hydrometeorological by MAKJANIĆ (1958), hydrobiological by EMILI (1958), biodynamical by PEVALEK (1958), than the basic classical hydrochemical by IVEKOVIĆ (1958), hydromorphological by ROGLIĆ (1958), geotectonical by HERAK (1962), climatological by MAKJANIĆ (1972), hydrogeographical by RIĐANOVIĆ (1976), microbiological by STILINOVIĆ, FUTAČ and

HADŽIĆ (1990), STILINOVIĆ (1994) and the current hydrochemical and complex researches by the team of researchers SRDOČ, HORVATINČIĆ, OBELIĆ, KRAJCAR and SLIEPČEVIĆ (1985), hydrogeological by BOŽIČEVIĆ (1990 and 1994), geographical by RIĐANOVIĆ (1994) and other researches.

Introduction

The location of the Plitvice Lakes is determined by geographic co-ordinates, according to the maps at the scale of 1:25,000, sheets Plitvička jezera and Plitvički Ljeskovac. The lakes extend from the mouth of the Matica river, the beginning of Prošće, the southernmost part of the Plitvice Lakes between 44°51'10" N and 44°54'05" N, to the end of the Lower Lakes near the elevation of 483 m a.s.l., the northernmost part of the Plitvice hydrocomplex, and from westernmost part of Prošćansko Lake (Limun, or Liman draga), 15°35'37"E, to the easternmost part of the Kozjak Lake (Glibovita or Vodena draga), at 15°37'24" E (Fig. 1).

According to the geographic location, the Plitvice Lakes are the integral part of the Korana river, in calcareous rocks.

The geographic position of the Plitvice Lakes was subject to changes over time in a wide range from a desolate "devil's garden" to a "geotraffic junction" (PEJNOVIĆ, 1993) at the crossroad of tourist trends in Croatia, and the important "geoecological core" in Europe and in the World.

The Plitvice Lakes are, first of all, as a part of the Lika region, a magnificent landscape of Croatia, a specific biodynamic system, and ecological rarity of worldwide importance. The geographic position of the Plitvice Lakes has been considered in this context (Fig. 2).

Plitvice Lakes are predominant hydrographic phenomenon in the central part of the National park. The lakes are provided with water from direct streams, numerous springs and underground water.

The systematic hydrological surveys on the lakes and on the main gravitating streams and springs started in the period 1951-1954 conducted by PETRIK (1958).

According to the hydrological surveys on the Gavanovac Lake the bankfull discharge is around 600 litres per second.

The daily and seasonal fluctuations of the water stage on the lakes were found. The maximum daily water increase on the Prošćansko Lake is much larger (75,000 m^3) than downstream on the larger lake Kozjak (41,000 m^3). The biggest fluctuations of water are peculiar for the Ciginovac Lake, up to 5 m! Such a big difference appears as a result of the water inflow disconnection from Prošćansko Lake. The periodic water stage fluctuation on the Upper Lakes are bigger than 50 cm. The maximum water stage of the lakes is caused by rapid snow thaw or by the long lasting abundant rainfall. The maximum water stage of the lakes does not correspond with the maximum capacity of water in the main springs which supply the lakes with water. The high water levels appear most frequent with the certain retardation. In the spring of 1953 the average retention of all the lakes was 400,000 m^3, which responds to the 8 days discharge, if the daily discharge of water is 600 litres per second. Consequently, the retention character of the lakes is obvious.

The daily and periodical fluctuations of water stage is reflected in the constantly rising of the lakes level. These appearance provoke the other changes which are reflected in shape, area, volume, depth, and the other characteristics of the lakes. They are the hydrographic indicators which can help to explain the physiognomy and have the influence on the importance of the lakes. ***The shape, width and drainage areas of the lakes, or the drainage basins of the rivers, the sloping of the terrain, the***

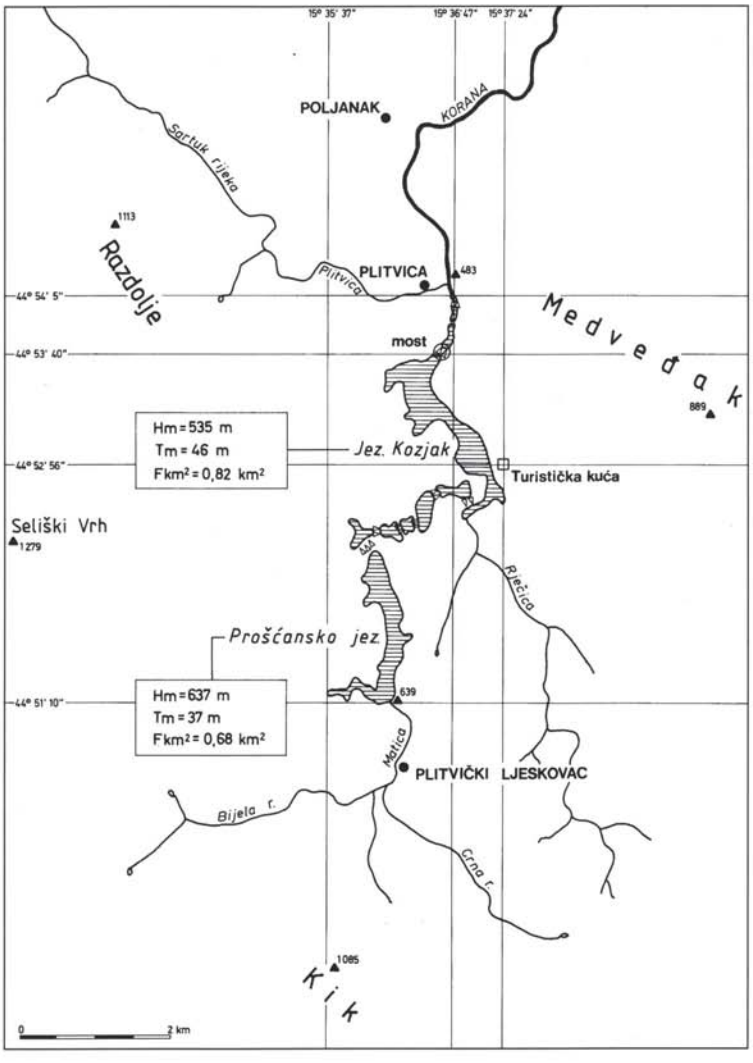


Fig. 1. Geographical location of the Plitvice Lakes
Sl. 1. Geografski smještaj Plitvičkih jezera

longitudinal and cross sections, the stream networks, the stream order, including the other coefficients, for example the variation coefficient, asymmetry and others, are very important geographical parameters which have the immediate and constant influence on the mechanism of the streamflow regime of the rivers, and generally of water flow.

In all these researches the importance of the water flow has been pointed out. The question is what and how much do we really know about the runoff processes

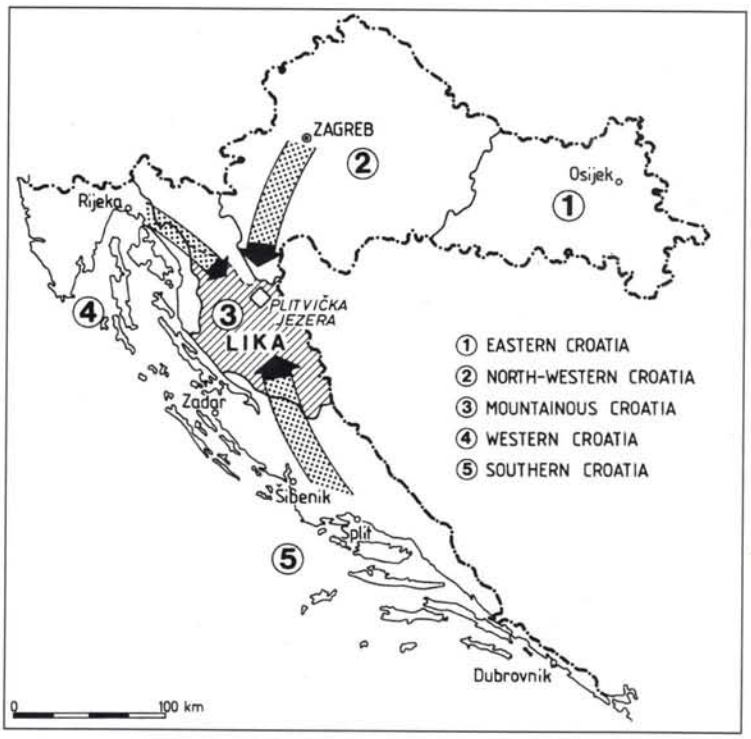


Fig. 2. Geographical position of the Plitvice Lakes

Sl. 2. Geografski položaj Plitvičkih jezera

in the Plitvice drainage basin, beginning with the regime of the precipitation, through the regime of the lakes, streamflows, springs and the underground water as well. The existing hydrological documentation is rich, but the results are of varied importance. There are a lot of data on the basis of which one can reckon up the volume of water in the lakes. Nevertheless, for the quantitative determination of the hydrological parameters, for example, water discharge (Q), the existing observations have not been sufficiently numerous and complete.

Method of investigation

In the period 1975-1980 the periodical researches were carried out as a part of hydrogeographical practicum (students and professors of Department of Geography, Faculty of Science, University of Zagreb), during which the installation of contemporary and more functional instruments was proposed. At the same time the locations of the water stage recorders were proposed (Riđanović, 1976).

The contemporary hydrological recording

In the meantime the water stage recorders, limnographs were installed (Fig. 3) thus enabling a direct monitoring of all the water stages. In the Plitvice drainage area there are seven active limnographs on typical cross-sectional areas: gauging station Plitvički Ljeskovac on Bijela river (Br_1) from 1980, gauging station Plitvički

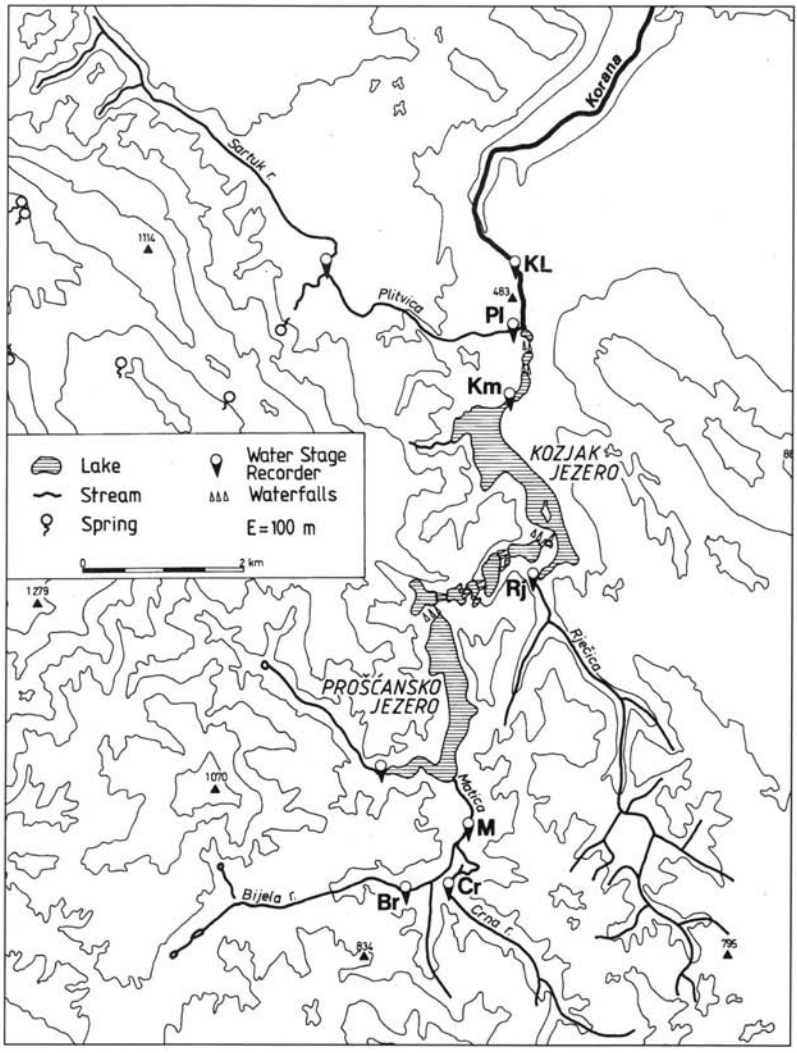


Fig. 3. Water stage recorders in the Plitvice drainage area
Sl. 3. Razmještaj limnigrafa na plitvičkom hidrokompleksu

Ljeskovac on Crna river (Cr_2) from 1980, gauging station Plitvički Ljeskovac on Matica river (M_3) from 1980, gauging station Plitvica Lakes on the mouth of Rječica (Rj_4) from 1980, gauging station Kozjak - bridge (Km_5) from 1979, gauging station Plitvice on Plitvica river (Pl_6) upstream of the big waterfall from 1980, and gauging station Korana - Luketići (Kl_7) on Korana river from 1978.

The modern monitoring of the water stage, which is the basic hydrological parameter, started mainly from 1980, and for the competent conclusions 20 year period is needed.

Table 1. The spatial distribution of the high (maximum) /HQ/, and low (minimum) /NQ/ annual water discharge (m^3s^{-1}) in the Plitvice drainage area - period 1980 - 1985.
Tab. 1. Prvi rezultati mjerenja s limnigrafima na Plitvičkim jezerima. Raspodjela maksimalnih (HQ) i minimalnih (NQ) protoka u m^3s^{-1}

Gauging station	Stream/lake	Year	HQ	Month	NQ	Month
Plitvički Ljeskovac	Bijela river (Br_1)					
		1980	1,95	V	0,098	X
		1981	1,92	XII	0,185	II-III
		1982	1,60	I	0,061	IX-X
		1983	1,64	III	0,018	XI
		1984	1,88	IV	0,033	I
		1985	1,60	IV	0,018	XI
Plitvički Ljeskovac	Crna river (Cr_2)					
		1980	6,45	V	0,529	X
		1981	9,42	XII	0,703	IX
		1982	6,21	XII	0,479	IX
		1983	7,71	III	0,361	XI
		1984	9,12	IV	0,516	I
		1985	7,71	IV	0,299	X
Plitvički Ljeskovac	Matica river (M_3)					
		1980	6,66	V	0,776	IX-X
		1981	12,20	III	1,150	VIII-IX
		1982	0,93	I	0,877	IX
		1983	10,20	III	0,612	XI
		1984	12,50	IV	0,836	I
		1985	9,77	IV	0,637	IX-X
Plitvička jezera	Rječica river (Rj_4)					
		1980	2,03	V	0,208	IX-X
		1981	2,44	III	0,228	VIII
		1982	1,59	I	0,200	IX-X
		1983	1,46	III	0,154	VIII
		1984	2,31	IV	0,188	IX
		1985	1,69	IV	0,144	VIII-IX-X
Kozjak most	Kozjak (Km_5)					
		1980	17,30	V	0,982	X
		1981	20,00	III	1,230	VIII-IX
		1982	14,60	I	1,000	IX-X
		1983	12,70	III	0,516	XI
		1984	17,20	IV	0,376	VI
		1985	13,90	IV	0,729	X
Plitvice	Plitvice river (Pl_6)					
		1980	14,20	V	0,077	X
		1981	16,40	VI	0,172	VIII-I
		1982	6,55	III	0,056	VIII
		1983	8,89	III	0,057	VIII-VII
		1984	13,30	IV	0,028	VIII
		1985	6,55	IV	0,041	VIII-I
Korana - Luketići	Korana river (Kl_7)					
		1980	26,00	V	0,275	X
		1981	30,70	XII	0,726	VIII-IX
		1982	15,20	I	0,225	IX-X
		1983	16,90	III	0,000	X-XI
		1984	31,60	IV	0,220	I-IX
		1985	16,10	IV	0,036	X

Data processing

The six year period of the modern water stage monitoring on seven characteristic cross-sections in the Plitvice drainage basin enabled the calculation of the discharge (Q) as well as the composing of Tab. 1

Preliminary results

From Tab. 1 (The spatial distribution of the high (maximum) /HQ/, and low (minimum) /NQ/ annual water discharge (m^3s^{-1}) in the Plitvice drainage area - period 1980-1985) we can make the next preliminary conclusions:

1. The (high) maximum water discharge (HQ) on all of the gauging stations of Plitvice drainage basin appear mostly in April (33,3%), than in March (26,2%), and in May (16,6%). It is caused by the thaw of snow in the spring.

2. The (low) minimum water discharge (NQ) are characteristic in the autumn, in October and November (52%), but also in the summer, in August and September (36%). Such disposition of the low water discharge is a result of the specific hydrometeorological conditions during the considered period.

3. On cross-section Korana - Luketići (Kl_7) the extreme water year was 1983-1984. On the end of 1983 in the bed of Korana river in the transversal profile Luketići the water stage "0" was registered. The river bed was without water and dry during October and November! The reason for that was an expressive drought period caused by shortage of precipitation. During April 1984 the biggest discharge in six year period of 31,6 m^3s^{-1} was recorded. Such a great water flow was caused by quick thaw of snow.

4. The biggest mean water discharge (MQ) /3,920 m^3s^{-1}/ is characteristic for the cross-section of Korana - Luketići in 1981.

5. ***The cross-section of Korana - Luketići (Kl_7) is representative for the hydrological characteristics of Plitvice Lakes, because here the bankfull discharge is measured.***

The main streams, such as Crna and Bijela river, Rječica and Plitvica river are the important regulators of the water stage of the Plitvice Lakes. The research of the geographicophysical conditions of the water flow in those streams is just going on. According to the newest results of the geological and hydrogeological researches the fear for the existence of Upper Lakes has been abandoned thanks to the fact that the tectonic core of broader area is build by dolomite, where the loss of water in underground is excluded (Polšak, 1957). The Lower Lakes are, on the contrary, formed in the impressive canyon of Korana river built of massive thick layers of Cretaceous limestone. According to geotectonical characteristics of terrain, there exist the conditions for the underground water discharge, but about that kind of water circulation we don't have enough information's yet. The very instructive example is from Brezovačko polje, where deep ploughing caused the water pollution on the spring of Bijela river (Roglić, 1977).

The numerous springs, both perennial and periodic are the basic water suppliers in the Plitvice drainage area. This fact demands a research of the water balance and the (regime) storage capacity of springs, respectively, each spring individually, and their rigorous protection as well.

II) HYDROGEOLOGICAL CHARACTERISTICS

The lakes in the middle of waterless karst

Driving to Plitvice Lakes from Udbine or Korenica from one side, or from Vrhovine on the other, or from the third

side Slunj, we see rocky highs on the horizon or vast lands with more or less expressed limestone-dolomite ridges. Waterflows are not visible, and only here and there a spring is a sign of water accumulation. All of this is - we would say - normal landscape for this region, because we are passing through the classical Dinaric karst where it is impossible to find a bigger accumulation of water in the world of rocks. Nevertheless, near the village Jezerce or Plitvički Ljeskovac hills are more distant, slopes more gentle, and forests more common. View over the large Prošćansko Lake and panorama of Kozjak will surprise by its contrasts and unexpected features.

Is it possible to have such vast water accumulations, or barriers in the heart of rocky substrate? It is possible - because of the particular basement rock types, association with different rock types, and because of the climatic conditions which dominate in this area. The geological framework of this part of Lika - between the Velika Kapela and Lička Plješivica mountains, as a consequence of the Mesozoic and Cenozoic geological events, conditioned this natural phenomenon.

The final period of deposition and consolidation of the deposited sediments was followed by the process of translation of individual blocks along regional, as well as local faults, and their brittle fracturation or unconsolidation due to tectonic movements as a part of events related to a part of Dinaric macrorelief in this area. The new differences in lithilogical relationships resulted both in specific permeability and impermeability, but one of the resulting processes was also tectonical movement of rock masses. Therefore, the present relief within the National park Plitvice Lakes should be considered as a result of geological framework of the deposited rocks and all other egsogenic processes that affected the surface since times when first sedimentary rocks occurred on Earth, in other words since erosional and corosional processes started to take affect. All the processes took place under specific climatic conditions, very different from the present. Location of lakes was preconditioned by specific longitudinal and transversal faults and related tectonical activity from the Cretaceous to Neogene. Specific hydrogeological conditions with occurrence of periodical surface flows, occurrence of sinkholes and springs and relationship between permeable collector areas and impermeable sediments related to tectonical fractures and faults.

Dolomite base-rock of Triassic age from Mesozoic era, enabled accumulation of lake water from Prošće to Kozjak. It is constantly filled by waters from Bijela and Crna rivers and Rječica river with quite many temporary tributaries in the drainage basin of Upper lakes. Dolomite is the reason that underground water appeared through "veins" filled with tectonical debris of Jurassic and Cretaceous limestone's that have the role of collector for rain waters from the surrounding mountains. As a result of this "symbiosis" of karstified limestone's, which drain rain waters as a sponge, and dolomites which do not allow underground drainage - but keep the water on the surface - occurs phenomenon of the Plitvice Lakes - unique feature of national and international importance defined by category of "national park" and world natural heritage.

The process of travertine formation

Thanks to the chemistry of water, permanent flows and formed natural barriers at this latitude with, obviously, favourable climate in the geological past and present time, plants and mosses helped the aesthetic shaping of this natural phenomenon. From travertine building plants to algae in the water oversaturated with calcium

carbonate and with minimum concentration of organic matter in places of torrents and waterfalls, CO_2 is extracted and $CaCO_3$ is deposited wrapping living plants and lifeless matter in the water. The process of travertine formation at this place is the fundamental phenomenon of Plitvice Lakes, as *"the resultant of strictly defined interactions of physical, chemical and biological features of the unique aquatic territory in karst"* (STILINOVIĆ, 1994). Travertine is a "living" organism that grows from an initial, soft, millimetre-thick layer up to a solid, meters-thick "organism" which gradually becomes the solid rock named travertine, "bigar" or "lehnjak" - porous limestone or solid stone with porous framework - good for cutting, shaping, constructing houses and bridges because of its hardness (BOŽIĆEVIĆ, 1994).

The process of travertine formation is a biodynamic process with initial and final phases very much influenced by mankind, regularly with negative and destructive consequences upon natural processes. Uncontrolled influence on travertine barriers and careless approach to the conservation of nature within this fundamental phenomenon, are the causes of particular mistakes made without obeying the rules of natural processes. The beauty of the cascades and bizarre waterfalls do not require any additional action to make them more beautiful, like the appearance of inadequate constructions, but it is necessary to control growth of low vegetation and trees in places where they endanger the travertine barriers.

Occupation of lakes and period of no care

Since the "bloody" Easter in 1991 till the fall of 1995, the territory of Plitvice Lakes was without needed care and control of natural processes within the local ecosystem due to Serbo-četnik's occupation. Besides total devastation of human goods in the Park, devastation of forests was also registered, especially around lakes. Besides uncontrolled and forbidden fishing of sort-fish by explosives, mines and other weapons caused many deaths of wild animals and inhabitants of the Park. Trails along the lakes were covered by vegetation which does not naturally fit the area of the Park. Wooden bridges and artificial wooden trails for touring the Park phenomena are almost completely rotten, and thus instead of being an attraction they are very dangerous for visitors today.

We must be aware of the fact that four years lasting carelessness can not be restored in few months, not even in one year, but systematically according to a programme of restoration and revitalisation. The false belief that a number of visitors can be endlessly increased only for commercial purposes, is not acceptable from the point of ecological balance in the Park and is not compatible with postulates about monuments of natural heritage. These facts should be carefully evaluated and accepted within the Programme accepted by the Government in September 1993.

Danger of eutrophication of lakes

According to investigations, systematically carried out by expert-teams under lead of STILINOVIĆ (1994), follow the statements:

"Plitvice lakes are today exposed to destructive processes of anthropogenic eutrophication and protection of the fundamental phenomenon depends primarily on prevention of further destruction of the local ecosystem. That is possible only very strictly on scientific basis, and not any activity nor construction on the territory of the Park should be carried out without ecological expertise. Increase in concentration of dissolved organic matter in the water of the

Lakes inhibits the processes of calcite sedimentation, and above concentration of 10 mg/l sedimentation is disabled although the other abiotic and biotic factors are satisfactory.

On the Plitvice Lakes, attention should be primarily given to water plants which during vegetational season behave as "biofilters", especially in smaller lakes. Besides enriching water with oxygen, aqueous macrophyta build in biogenic elements in their corpuses much faster than phytoplankton, so in those parts of lakes overgrown by reed, planktonic biomass is significantly lower than in open parts (specifically cyanobacteria). When macrophyta die in the fall, their remains must be without exception collected and removed, because if they stay and start to rotten in water, they represent a significant source of biogenic elements and organic compounds (secondary pollution). Today, methods to prevent eutrophication by method of macrophyta as biofilter, are still not clear, but it will be of great importance to keep removing remains of reed and other water plants in parts of overgrown Lakes by the end of vegetational season, according to instructions of expert-team. removal of organic deposit (mud) is also a very efficient method; regularly decreases primary production of phytoplankton and influences on composition and improves the quality of water."

Conclusion

The life of the Plitvice Lakes is very intensive and is demonstrated in constant changes. Evolutionary viewed the lakes are disappearing because the deposit transport obviously increases the amount of filling. That confirm the remains of the former lake depressions which are now filled up, and walled by the travertine dams in the valley of Bijela river and Crna river. Bijela river and Crna river, through Matica river, constantly bring the sedimentary material to Prošćansko lake. But beside the process of accumulation and some other processes, for instance the extraction of the amorphous limestone (Iveković, 1971), one has to take into account the biodynamic processes which considerably influence upon farther grow and spreading of travertine dams. Those facts suggest that Plitvice Lakes are in the constant development and disappearing. The relation between these processes of the opposite effect is not quantitatively founded yet, but according to the research experience on the Plitvice Lakes there are conditions not only for the existence, but also for the enlargement of number of the lakes in the National park (Brnek-Kostić, 1976)!

The hydrogeographic features of the lake stress the importance of investigation of:

1) ***geographic and physical conditions of water runoff (Riđanović, 1976),*** and

2) ***quantitative determination of hydrographic values by water level recorders.***

The installing of the water stage recorders in the Plitvice drainage area has provided objective measurement from which one can exactly follow the fluctuation of the water stage, and from the scientific point of view direction of total activity on the lakes of the National park to the broader area of National park. Also, water stage recorders measurement provides a more realistic image about the water appearance on the surface as well as in underground. Before the war in Croatia, in the Plitvice hydrocomplex there were nine installed water level recorders. In this paper, data from seven hydrometric profiles have been used.

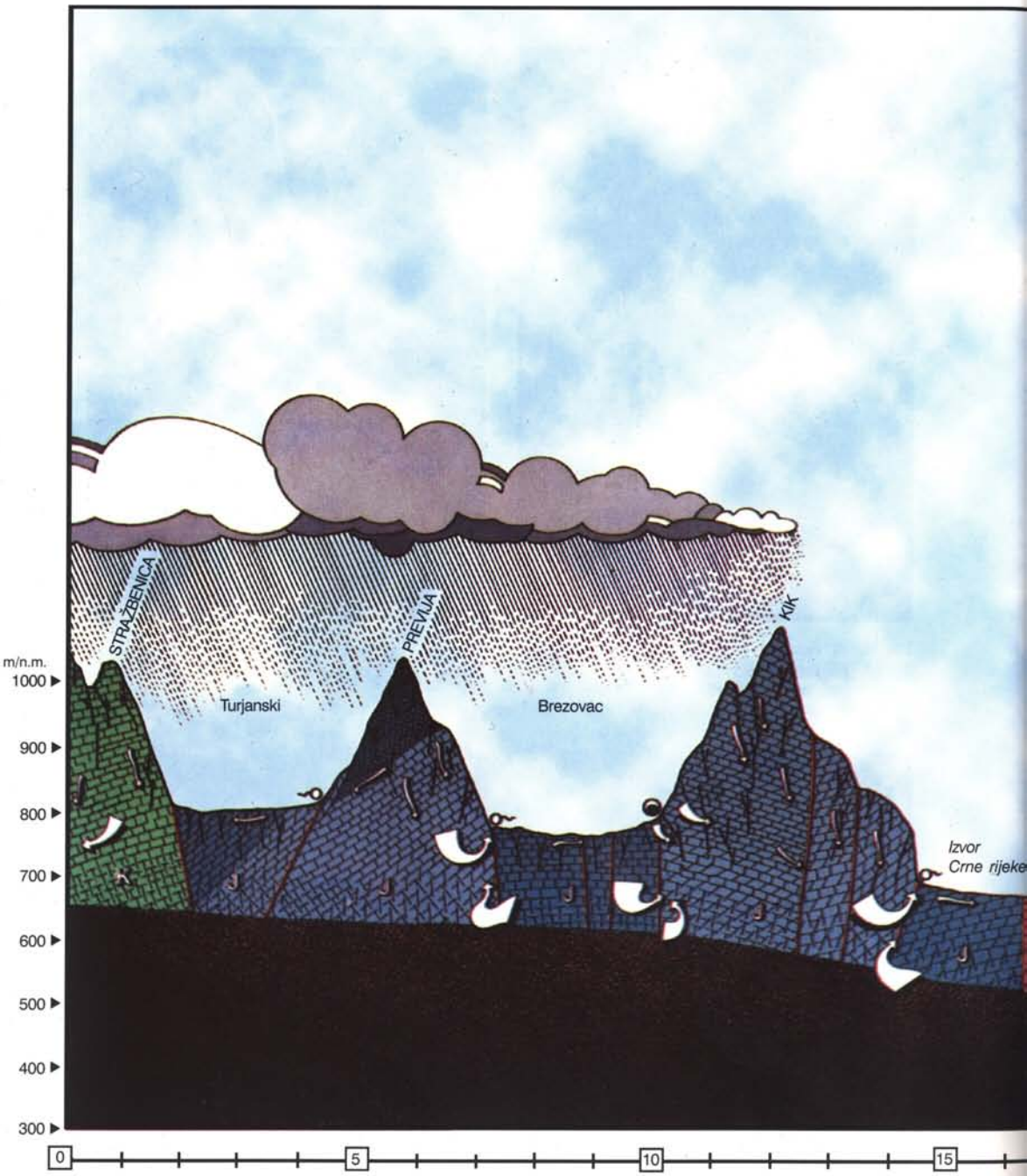
The results of measurements taken so far, although the period was rather short, have indicated the necessity to expand the area and territory of the Plitvice National park from the present 19,172 to 30,000 hectares. According of the newest "Act about the proclamation of the law about

Fot. 1. A view to part of the Lower Lakes
Fot. 1. Pogled na dio Donjih jezera

Fot. 2. Plitvice Lakes - abundance of water
Fot. 2. Plitvička jezera, obilje i raskoš vode

Fot. 3. Sastavci - the procession of lakes ends here and the River Korana begins
Fot. 3. Sastavci - gdje jezera završavaju, tu počinje rijeka Korana

HIDROGEOL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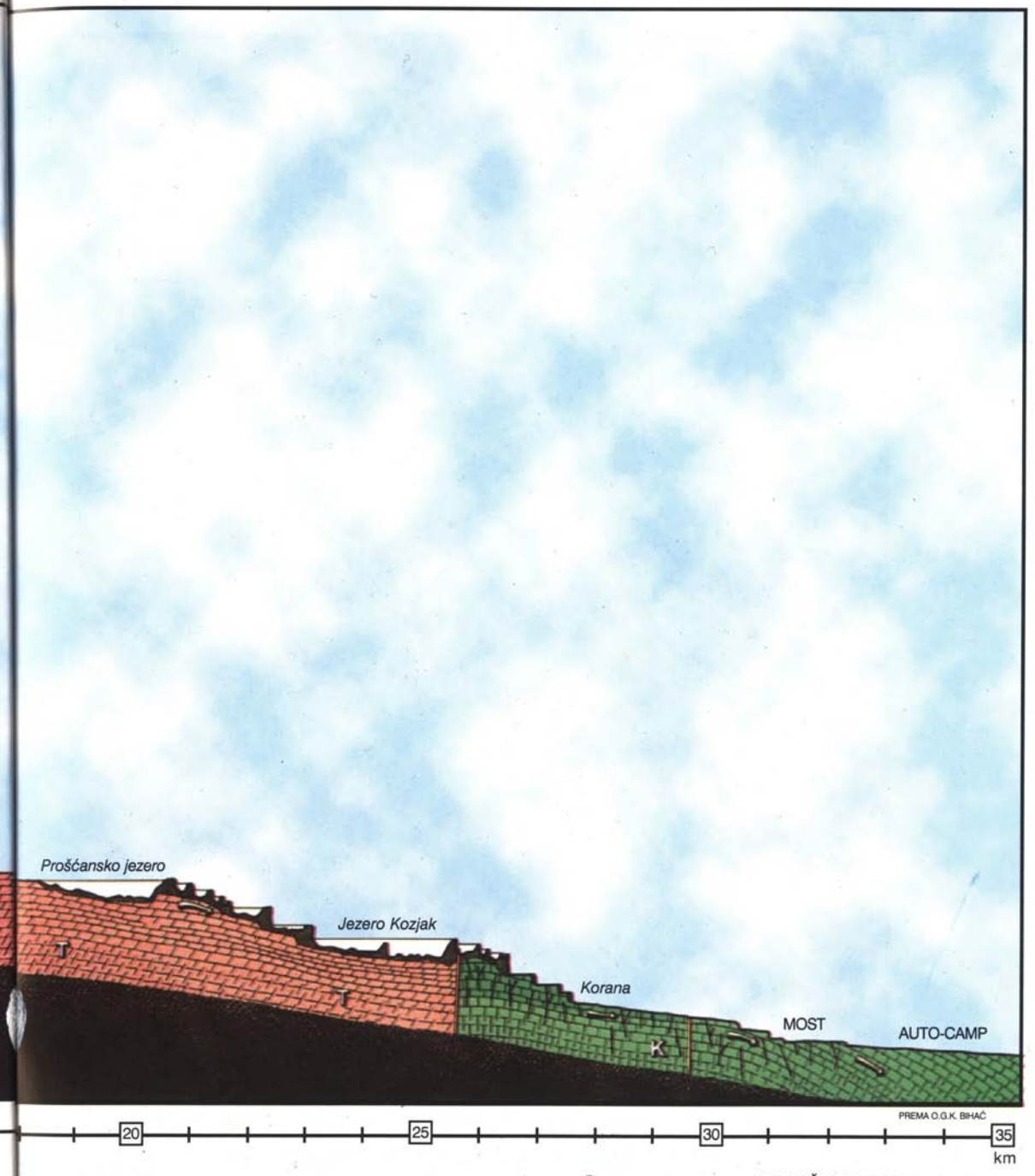
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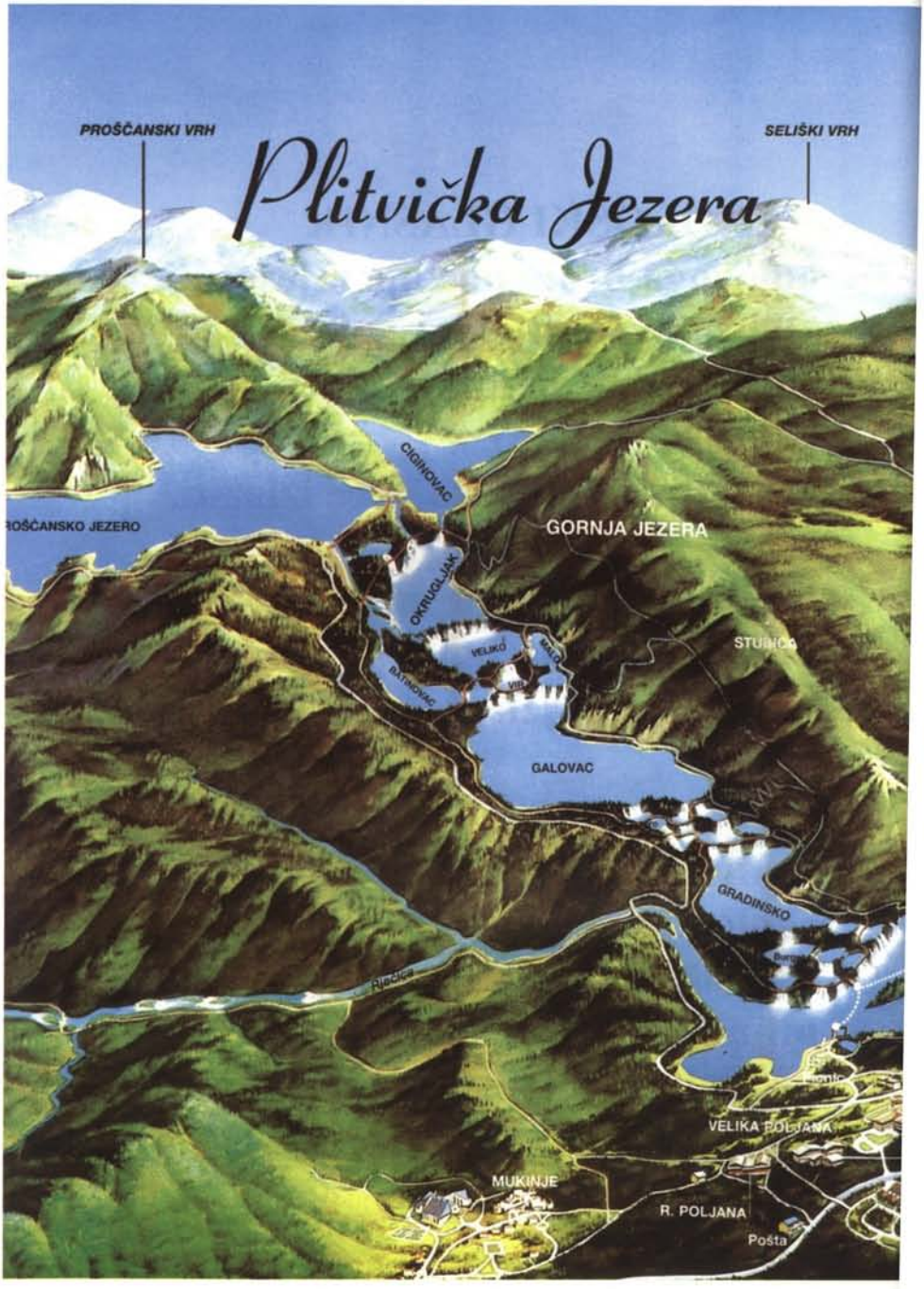
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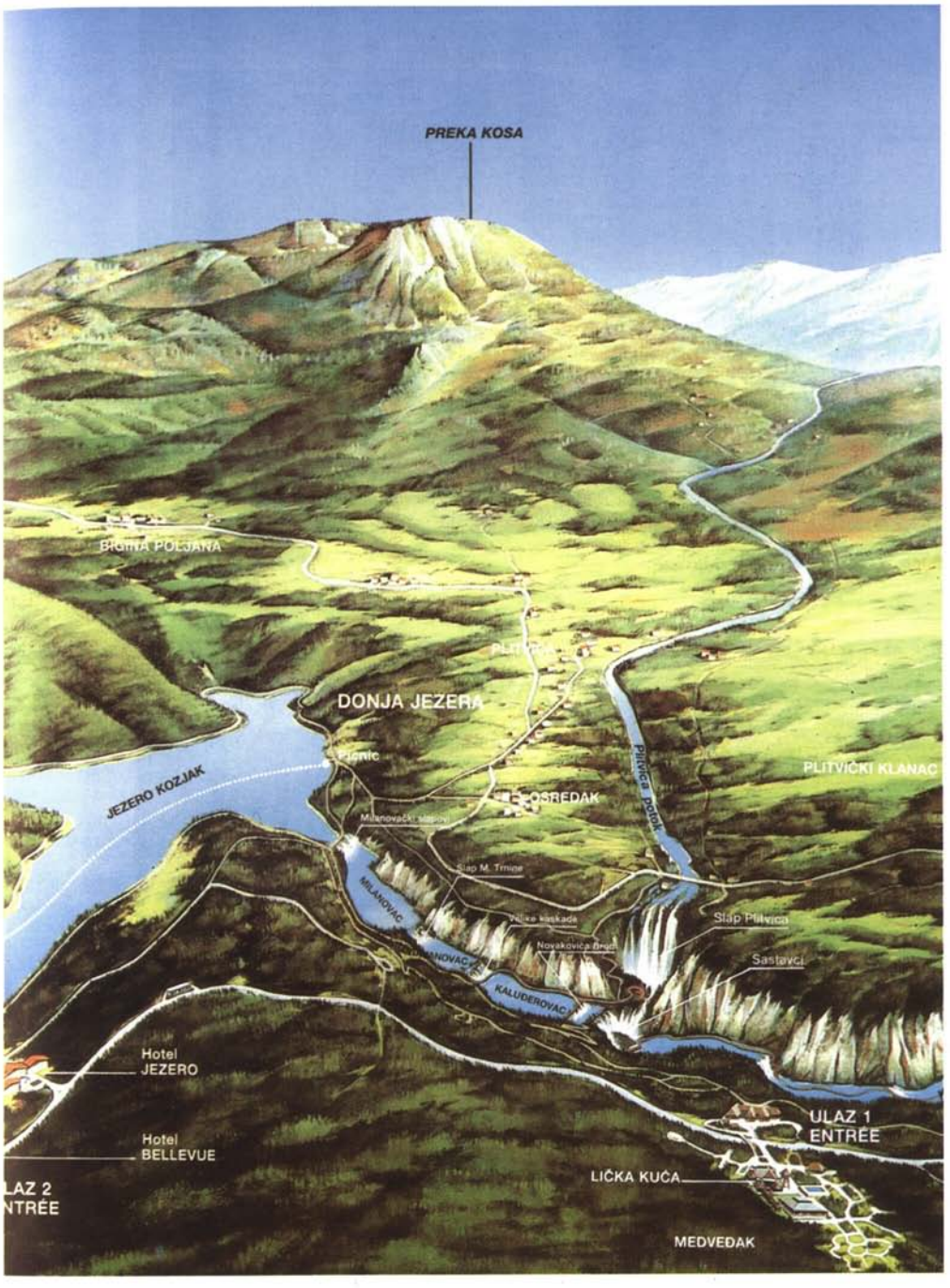
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Fot. 4. Water stage recorder on Matica river
Fot. 4. Limnigraf na rijeci Matici

Fot. 5. Water stage recorder "Korana - Luketići"
Fot. 5. Limnigraf "Korana - Luketići"

the change of the law on the proclamation of National park Plitvice Lakes" (N.N. 13 of February 6th, 1997) the area of the National park Plitvice Lakes has been enlarged from 191,72 sq km to 295 sq km.

The maintenance mechanism of the Plitvice Lakes is still sensitive, because it depends on balance between the steady state of today's natural conditions, modern socio-economical project, as well as of the political situation.

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N.B. Besides the cited works, some others causal, group and individual editions were used, where the results of the researches of the broader area of the National park Plitvice Lakes were discussed.

Summary

GEOGRAPHIC-PHYSICAL CONDITIONS OF RUNOFF AND HYDROGEOLOGICAL CHARACTERISTICS OF THE PLITVICE LAKES

JOSIP RIĐANOVIĆ and SREĆKO BOŽIČEVIĆ

The location of the Plitvice Lakes is determined by geographic co-ordinates, according to the maps at the scale 1:25,000 sheets Plitvička jezera and Plitvički Ljeskovac. The lakes extend between 44°51'10" N and 44°54'05" N, and from the 15°35'37" E to 15°37'24" E (Fig. 1).

According to the geographic location, the Plitvice Lakes are the integral part of the Korana river, in calcareous rocks.

The geographic position of the Plitvice Lakes was subject to changes over time in a wide range from a desolate "devil's garden" to a "geographic junction" at the crossroad of tourist trends in Croatia, and to the important "geoecological core" in Europe and in the World.

The Plitvice Lakes are, first of all, as a part of Lika region, a magnificent landscape of Croatia, a specific biodynamic system, and ecological rarity of worldwide importance. The geographic position of the Plitvice Lakes has been considered in this context (Fig. 2).

The hydrogeographic features of the Lakes stress the importance of investigation of:

1) geographic and physical conditions of water runoff, and

2) quantitative determination of hydrographic values by water level recorders.

Before the war in Croatia, in the Plitvice hydrocomplex there were 9 installed water level recorders (Fig. 3). In this paper, data from 7 hydrometric profiles have been used. The results of measurement so far, although the period was rather short, as well as other geographic - physical, hydrogeological and other, primarily ecological researches illustrate the necessity to expand the area and territory of the Plitvice National park from the present 19,172 to 30,000 hectares. According of the newest "Act about the proclamation of the law about the change of the law on the proclamation of National park Plitvice Lakes" (N.N. 13 of February 6th, 1997) the area of the National park Plitvice Lakes has been enlarged from 191,72 sq km to 295 sq km.

Sažetak

GEOGRAFSKO-FIZIČKI UVJETI OTJECANJA I HIDROGEOLOŠKE SPECIFIČNOSTI PLITVIČKIH JEZERA

JOSIP RIĐANOVIĆ i SREĆKO BOŽIČEVIĆ

Geografski smještaj Plitvičkih jezera određen je veličinama φ (širinom) i λ (duljinom) s topografskih karata u mjerilu 1:25000, točnije s listova: Plitvička jezera, 069-1-1 i Plitvički Ljeskovac, 069-1-3; izdanje Vojno-geografskog instituta, naručitelj Republička geodetska uprava Hrvatske; sadržaj dopunjen godine 1975.; tiskano 1982. godine (sl. 1).

U sklopu smještaja razmotrene su i veličine h (nadmorska visina) i d (dubina jezera) preuzete iz navedenih topografskih karata ili iz do sada najpouzdanije hidrodokumentacije za sva jezera prema mjerenjima u razdoblju 1951.-1955. godine što ih je objavio PETRIK (1958.). Postojeća dokumentacija je od kapitalne važnosti, ali život na Plitvicama je vrlo intenzivan i očituje se u stalnim i brzim promjenama.

Poželjno bi bilo izvršiti novi geodetski premjer i nastaviti s hidrološkim mjerenjima kako bi se dobili točniji, stvarni, podaci koji su preduvjet i temelj (polazište) za sva istraživanja u okviru Nacionalnog parka Plitvička Jezera.

Geografski položaj Plitvičkih jezera tijekom vremena mijenjao se ovisno od društveno-gospodarskih prilika i vojno-političkih zbivanja u širokom rasponu od zabitnog "đavolskog vrta" izoliranog od prometa u gustim i vlažnim šumama Like do "geoprometnog zgloba" i "geoekološke jezgre" (PEJNOVIĆ, 1993.). Na raskrižju suvremenih turističkih kretanja (ŽULJIĆ, 1962.) ponajprije u Hrvatskoj (sl. 2), ali i u Europi i svijetu.

Hidrogeografske značajke jezera ističu važnost istraživanja:
1) geografsko-fizičkih uvjeta otjecanja vode (RIĐANOVIĆ, 1976.) i
2) kvantitativno određivanje hidro-veličina pomoću suvremenih mjernih uređaja, limnigrafa (sl. 3).

Prije domovinskog rata na Plitvičkim jezerima bilo je postavljeno 9 limnigrafa (KRGA, 1984.); U ovom radu korišteni su podaci sa 7 hidrometrijskih profila (tab. 1).

Potrebno je nastaviti s istraživanjima geografsko-fizičkih uvjeta to jest mehanizma otjecanja vode i to počev od režima padalina (oborina) preko režima jezera, riječnih režima, režima izvora, vrela i gibanja vode u podzemlju. Dosadašnja su mjerenja (RIĐANOVIĆ, 1989.), iako kratkotrajna, ukazala na potrebu povećanja površine Nacionalnog parka Plitvička jezera od sadašnjih 19 172 ha na 30 000 ha. Prema najnovijoj "Odluci o proglašenju Zakona o izmjenama Zakona o proglašenju Plitvičkih jezera nacionalnim parkom" (N.N. broj 13 od 6. veljače 1997.) površina Nacionalnog parka Plitvička jezera povećana je od 191,72 km^2 na 295 km^2.

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