M I K A S - 9 Months Progress Report

Project on selection, labeling and protecting the world's most important karst springs

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Project on selection, labeling and protecting the world's most important karst springs

Karst Commission

Reporting Topics for the KC Annual Meeting (29/03/2023; Florida)

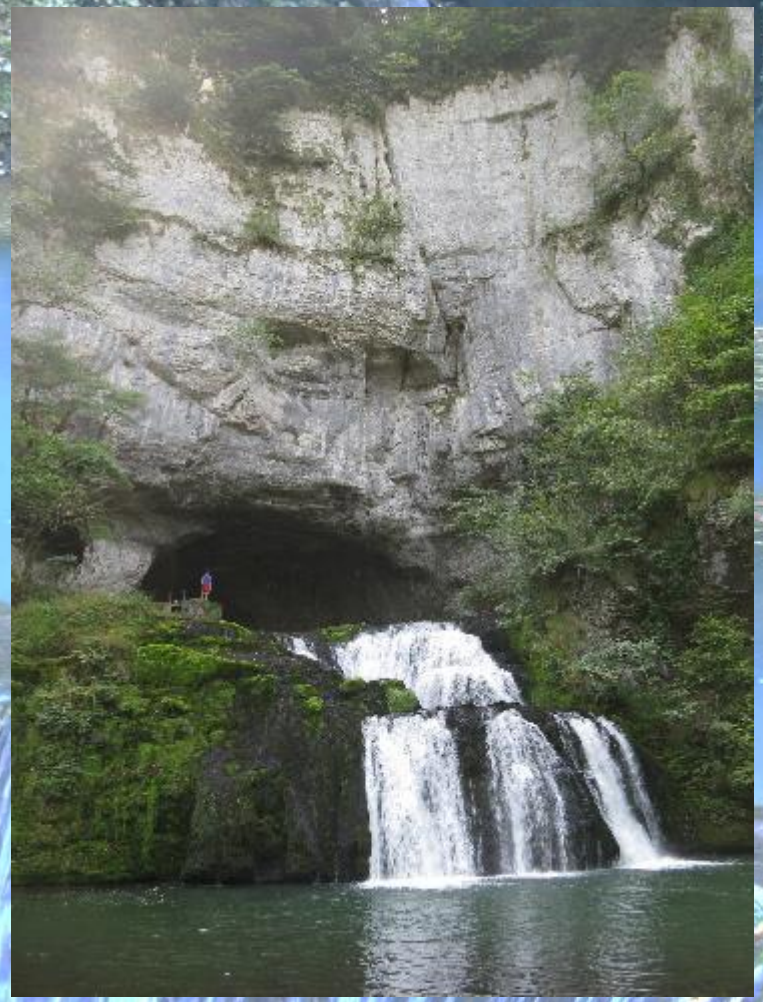
1. Aim of project and organizational chart
2. Selection criteria
3. Spring survey – Inquiry list
4. List of National experts - bottlenecks and solutions
5. Further steps

Project MIKAS – Structure & Strategy

Most Important Karst Aquifer's Springs - MIKAS

Taking advantage of the opportunity provided by the 50th anniversary of the IAH Karst Commission (KC) and the involvement of UNESCO in our karst research, this initiative (project) aims to bring together both the KC members and many national experts to work, on a voluntary basis, to:

1. develop criteria for the selection of most important karst springs, which inter alia should include historic, aesthetic, economic and scientific values;
2. establish the list of springs;
3. create the Code of Practice for these springs' utilisation and protection; and
4. promote these springs by their *in situ* labelling and internet publicising.



AB works on voluntary basis, possible fund to be used for the meetings, publications, web...
Project duration – not less than 3 years
Outputs: List of globally important springs, database, interactive map linked to WOKAM, labeling *in situ*, web site, promotion via Youtube movie (video clips, photos...), monograph.

Activities	VII-VIII 2022	IX-X 2022	XI-XII 2022	I-II 2023	III-IV 2023	V-VI 2023	VII-VIII 2023	IX-X 2023	XI-XII 2023	I-II 2024	III-IV 2024	V-VI 2024	VII-VIII 2024	IX-X 2024	XI-XII 2024
Proposal, Approval of the KC, Info to the UNESCO															
Establishment of the Advisory Board, constitutional meeting															
National experts selection and completion of the team															
AB - Development of selection criteria, guidance and inquiry forms, web site KC					X										
NEs – Data collection, preliminary proposal of the springs															
AB – First evaluation of obtained data, analyses and preliminary selection															
AB – Development of Code of Practice															
AB – Statistics, Mapping, Database creation, website															
AB and NEs - Promotional activities: photo albums, movies, design of Informative Plates															
AB and NEs - Final list of MIKAS, labelling *in situ*, reporting, preparation of common articles															
End of project, AB - preparation of common Monograph															

Organizational setup

Project and AB *approved by the KC IAH* in Malaga, 24.06.2022

AB members – Regional Coordinators:

- **Western Europe, Australia and Oceania, John Gunn**
- **Southeastern and Eastern Europe, Zoran Stevanović**
- **Asia, Junbing Pu**
- **Africa, Seifu Kebede**
- **North America, Neven Kresic**
- **South America, Augusto Auler +**
- **Project Coordinator (Team Leader) Zoran Stevanović**
- **Actual Chairman of the KC IAH Avi Burg**
- **Co-Chairs of the KC IAH, Peter Malik and Ben Tobin**
- **Chair of the UNESCO IHP** (if UNESCO accept invitation and support action) **Alice Aureli (Aurelien Dumont)**

…

Selection, data provision and implementation (communication with local administration) via invited national experts – primary members of the KC IAH, friends of the KC, local hydrogeologists, WOKAM experience.

Work mostly online, in person during some karst events.

Consultations - E-mails exchange // CC: to ZS.

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Agreement of AB (after the two online meetings held):

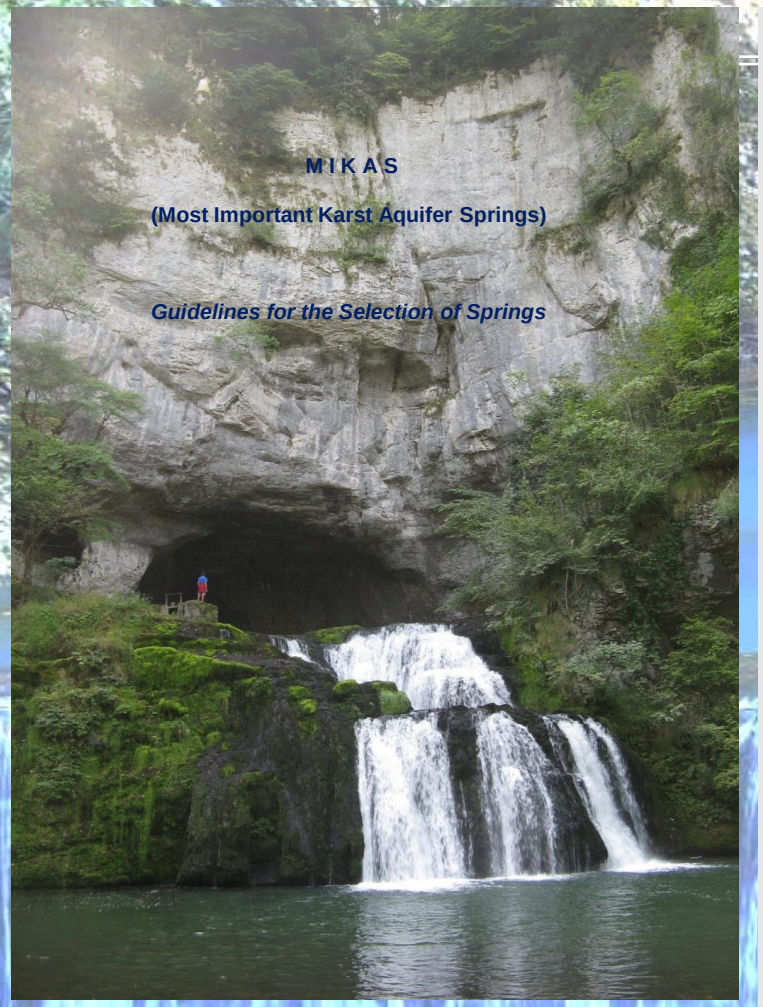
1. Number of springs per country must be restricted and proportional to their GLOBAL importance. ***Number of MIKAS to be limited on 200 springs.***

2. **To establish the second list – NIKAS (Nationally Important Karst Springs).** ***To be also published at MIKAS website (country by country).***

3. **Guidelines – Inquiry list not to be very complicated to fill in.** ***Very clear instructions how to identify and classify springs in the two categories.***

4. **Selection of national experts in parallel to development and provision of Guidelines.** ***Work on Guidelines completed in January 2023, but selection is still on going.***

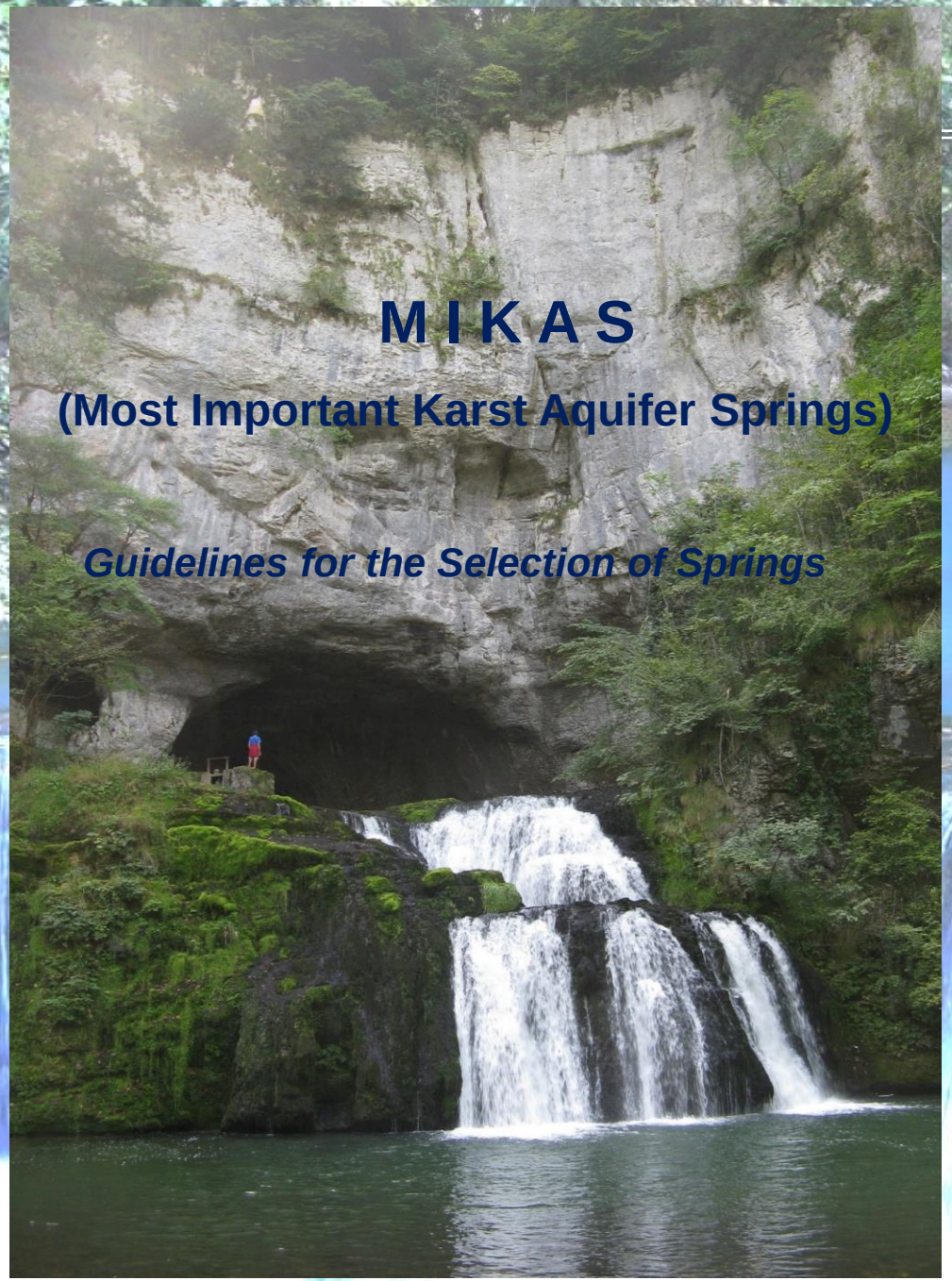
MIKAS project – Guidelines



Criteria for the selection of most important karst springs:

- Historic, **H**
- Aesthetic, **A**
- Economic, **E**
- Scientific. **S**
- Ecological **Ec**

H - Numerous springs in the world have historic and/or cultural significance for local nations or community development.
A - The aesthetic criterion is problematic, as *de gustibus non est disputandum*. E.g waterfall, a spring under a huge cliff, or large cave behind a spring, nice landscape.
E - The economic-management value should consider a spring's active use (potable water supply, irrigation, local industry). Even if not tapped, water from karst springs can sustain ecosystems, maintain the baseflow of rivers or fill large reservoirs.
S - Specific discharge mechanisms of the springs (maximal yield, intermittent flowing, gas bubbling, changing water quality in coastal areas (fresh, brackish and saline),
Ec - specific depending eco system, endangered species, Ramsar site, or some other properties in interest of the biology, ecology, hydrogeology and science in general.



M I K A S

(Most Important Karst Aquifer Springs)

Guidelines for the Selection of Springs

MIKAS project – Guidelines

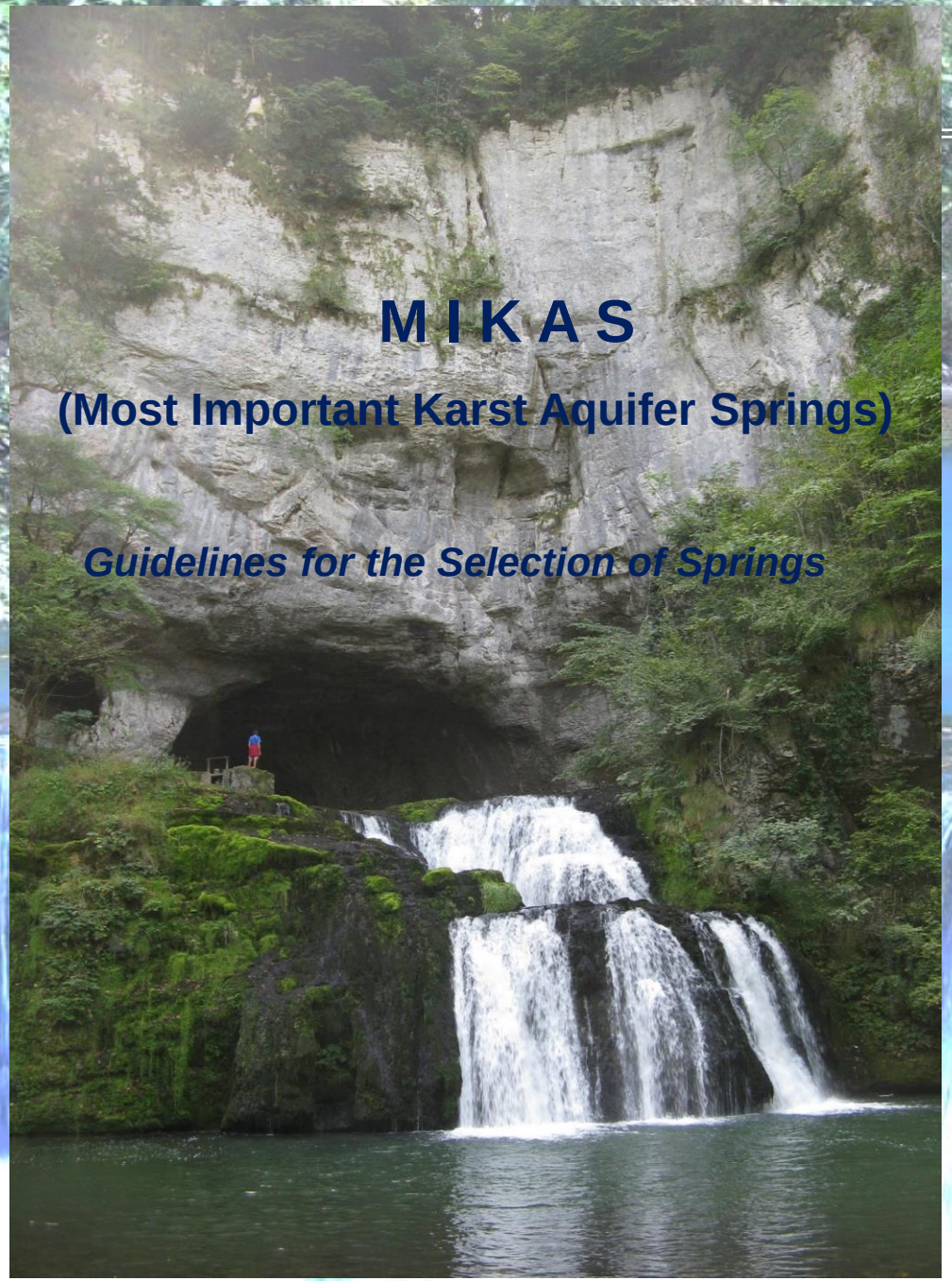
Karst Commission

In the initial stage of the project a proposal was made to establish an algorithm which would somehow enable their more objective selection and ranking (e.g. T = (4H x 5A x 5E x 3S x 3Ec) = 100)

However, to facilitate the work of the NEs, it was decided at the AB meeting to apply a simpler procedure, i.e. “Expert’s Opinion”, instead of assigning numerical value, which still remains an optional solution.

Along with a Survey for each of the springs, the NE should propose the list for which the spring would be a candidate (MIKAS and/or NIKAS) and provide justification for such a potential decision.

Justification should be more detailed, as well as illustrated, for springs that are proposed for the MIKAS list.



MIKAS

(Most Important Karst Aquifer Springs)

Guidelines for the Selection of Springs

MIKAS project – Guidelines

Karst Commission

Groups of information

Location and Hydrogeological Setting

Spring Importance / Criteria

References and Information Sources

Graphics

Optional Data

The grading of springs (by used 1-5 for each criteria);

Approximated size of the catchment (km^2);

Groundwater chemistry and threats to spring water quality;

Additional graphics (maps, preferably hydrogeological or geological);

In case of tapped (captured) springs:

Water distribution system

Purpose(s) for which water is used

Number and types of beneficiaries

Water treatment applied

MIKAS project

Inquiry list for the spring

Spring Survey
Instructions for filling

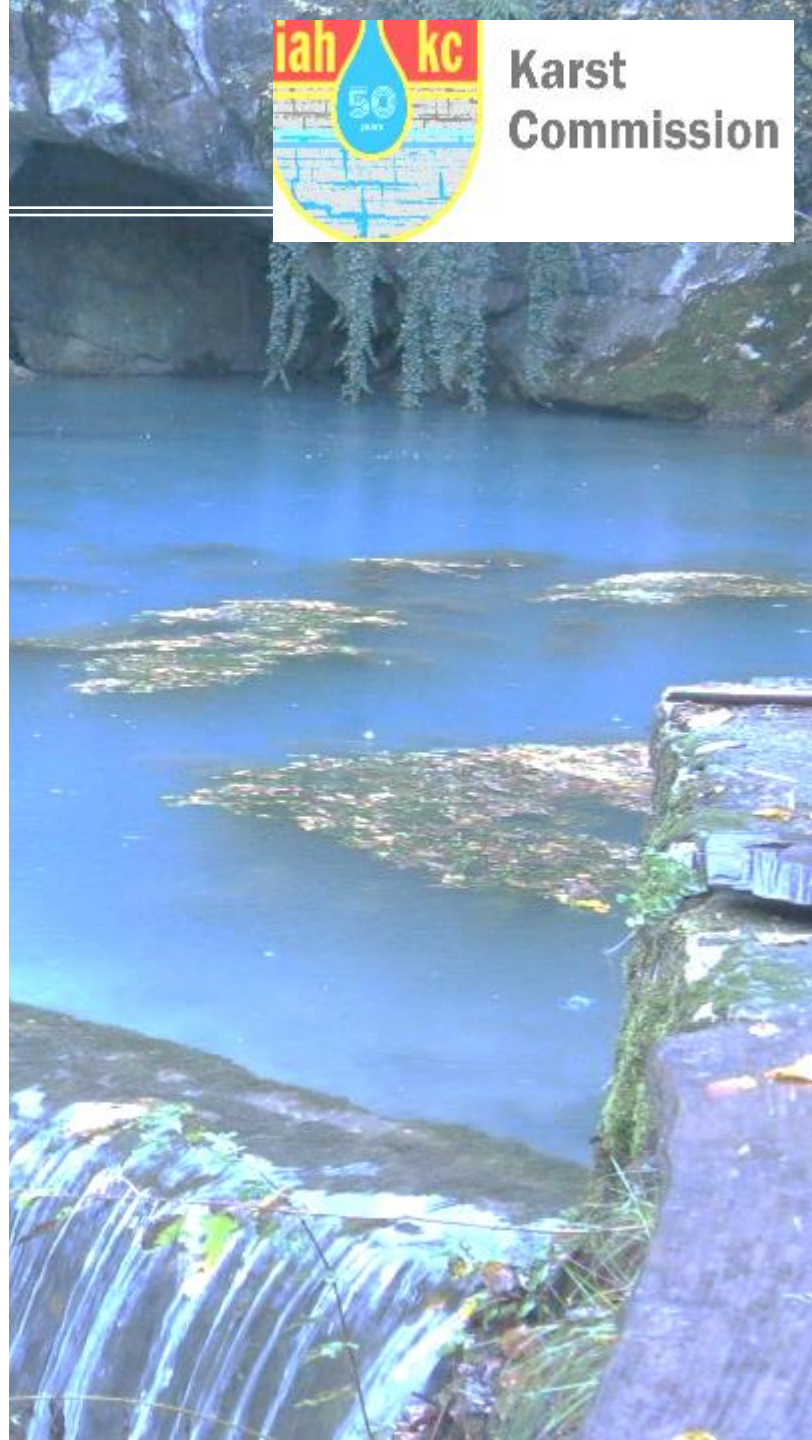
1) Spring Location and Hydrogeological Information

Spring name		**Dominated aquifer's lithology and stratigraphy**	*limestones, dolostones, chalk, marbles, evaporites, complex lithology*
Country / Region			*karst aquifer (water bearing rocks) age (use Intern. stratigraphic chart)*
Nearest settlement		**Important or unique karst features in the catchment**	*e.g. caves, other springs, swallow holes, gorges, numerous sinkholes, etc.*
River/Hydrogeological basin		**Type of Spring**	*permanent or temporary; gravity or ascending; fresh or thermal; or use some of literature source for classification*
Coordinates	*Use World Geodetic System WGS84 standard – for N, E in degrees, minutes and seconds (check by pinned spring on Google Earth Map)*	**Regime of spring discharge (Q in l/s, min/av/max)**	*discharges according to available data*
Z(altitude)m asl		**Specific characteristics**	*if belongs to Natural reservation area or parks? Is it transboundary aquifer? It has special discharge mechanism (provide a representative hydrograph)?*
Intake structure*	*Tapped or not, if yes type of intake and construction*	*List of annexes and figures with authorship (to be attached or placed in document after this table). Annexes should include but not be limited on: - Location map (Geographical of a whole country and local topography map); - Extract of Google Earth map with pinned spring; - Sketch geological or hydrogeological map; - Cross-section. Fig. 1 Fig. 2 Fig. 3 Fig. 4 (after ...., 2017) Photo 1 ... (photo by....) Photo 2 ...*	
Amount of used water* and ecological flow*	*Average pumping hours (h/day) and rate (l/s). Average overflow - non-tapped yield as an ecological flow (l/s)*		
Water physical and chemical characteristics	*Average values of Temp (^{0}C); TDS (g/l) or EC (µS/cm); pH ( ) Hardness (^{0}dH)*		
Groundwater protection	*Established sanitary protection zones of the catchment (yes/no) or only protected spring site (fenced?), or free access to site (explain shortly)*		
Remarks (web pages)	*Information sources, web pages (preferably in English)*		

*/ in case of spring tapped

2) Spring Importance / Criteria

Criterion	Justification / Facts	Criteria order
Historic, H Aesthetic, A Economic, E Scientific, S Ecological, Ec	*Provide justification following principal or all of selection criteria.* **H:** *Numerous springs in the world have historic and cultural or spiritual significance for local nations or community development. Many cities were also built nearby large springs. Explain in few words, if applicable.* **A:** *The aesthetic criterion is always problematic. However, something like a waterfall, a huge cliff or a cave behind a spring should commonly be judged as a natural wonder or nice feature acceptable for the list.* **E:** *The economic-management value should primarily consider a spring's use. Spring water can be used for potable water supply, irrigation, or for supplying the local industry. Even if not utilized spring can be still of great importance at regional or national level as representative water point with prospect for utilization.* **S:** *The scientific value may consider specific discharge mechanisms of the springs such as large maximal yield, intermittent flowing, gas bubbling, changing water quality in*	*List criteria according to their relevancy / importance for spring in question. e.g:* **H** **S** **E** **A** **Ec**



Karst Commission

MIKAS project

Inquiry list for the spring

	coastal areas (fresh, brackish and saline) or some other properties that could be of scientific interest. **Ec:** *Water of karst springs and ecological flow sustains ecosystems, maintain the baseflow of rivers or fill large reservoirs. Presence of protected and endangered species in already protected area, Ramsar site, or some other properties in interest of the biology, ecology, hydrogeology could also be evaluated.*	
Current status of spring	*Statement if the spring is already recognised by the authorities as a nature reserve and/or deserves protection due to its importance for the nation*	
Final proposal for list MIKAS or NIKAS	*Write your proposal hereto*	

3) References and source

References, which validate spring importance	*Provide not more than 10 main references, which include historical facts, some older references (first appearance in literature), main technical references, which provide insight to the spring and catchment characteristics (geomorphology, hydrology, geology, hydrogeology), popular literature about spring (fairy tales, legends, travelogues, guidebooks…)* *If possible follow this style:* *Jacobsen T., Lloyd S. (1935) Sennacherib's aqueduct in Jerwan. The University of Chicago, Oriental Institute Publ. (Breadost J.H., ed.), vol XXIV, Chicago, 140 p.* *Reade J. (1978) Studies in Assyrian geography, Part 1: Sennacherib and the waters of Ninveh.- Revue D'Assyriologie Orientale, 72:157-175*
Data collected by:	
Assisted by (collaborators):	
Remarks	*Every remark, suggestion, not presented above that may strength proposal and support MIKAS project. Please use additional sheet for explanation, if needed.*

4) Optional data

Grading criteria for proposing the spring	*Optionally, you may grade each of criteria (grades from 1 lowest grade to 5 "first class"; e.g. H = 4;S = 4;E = 3;A = 3;Ec = 3*
Surface of catchment area (km^2)	
Water distribution system*	*If spring is captured and data is available provide technical information about pump (if any), its capacity, or gravity pipeline; local using – tap; any other tapping structure close to spring or in same aquifer (e.g. wells), all briefly described.*
Purpose of water used*	*Human consumption, animal watering, irrigation, small industry, water for nature.*
Sort and number of beneficiaries*	*Approx.no of people, livestock (big/small), orchards (type & ha), agriculture land (crop & ha), number of industrial objects connected, energy produced*
Groundwater chemistry	*Low mineralized, brackish, saline, mineral, etc. Dominant and specific ions for spring in question and their content (e.g: Ca, HCO_3, Cl in mg/l). If possible, attach typical analysis.*
Water treatment*	*All processes applied and capacity of water treatment plant (if any)*
Threats to spring water quality	*Main kind of pollutants, (type and distance to sewage discharge points, landfills, pesticides used in area…).*

iah kc 50 years

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MIKAS project

Inquiry list for the spring - An example

Project MIKAS – Most Important Karst Aquifers' Springs

Spring Survey

Instructions for filling

1) Spring Location and Hydrogeological Information

Spring name	**Vrelo Mlave**	**Dominated aquifer's lithology and stratigraphy**	Limestones
Country / Region	Serbia, Eastern Serbia, Homolje, Carpathians Mts.		Upper Jurassic - Lower Cretaceous (strata from Oxfordian to Aptian age)
Nearest settlement	Žagubica	**Important or unique karst features in the catchment**	It is the largest among group of springs in contact of karst aquifer and lacustrine basin' sediments. A few swallow holes, numerous sinkholes and one sinking stream in the catchment
River/Hydrogeological basin	Mlava River basin, Beljanica Mt.	**Type of Spring**	Permanent, ascending – vauclusian type, freshwater spring
Coordinates	N 44° 11' 29.63" E 21° 47' 1.98"	**Regime of spring discharge (Q in l/s, min/av/max)**	270 / 1900 / 16500
Z(altitude)m asl	321	**Specific characteristics**	Spring is inside Kučaj – Beljanica National Park (est. in January 2022). Rare short discharge interruptions due to knee type drainage siphon
Intake structure*	Not tapped, N/A		
Amount of used water* and ecological flow*	N/A		
Water physical and chemical characteristics	T 9.2 °C; 0.1-5 NTU; TDS 0.28 g/l; pH 7.7; 11.8 °dH		
Groundwater protection	No sanitary protection zones established		
Remarks (web pages)	https://sr.m.wikipedia.org/sr-el/%D0%92%D1%80%D0%B5%D0%BB%D0%BE_%D0%9C%D0%BB%D0%B0%D0%B2%D0%B5 https://www.srbijaplus.net/zagubica-vrelo-mlave.htm https://beljanicatrail.org/?page_id=414		

Fig. 1 Location Map of Vrelo Mlave spring in Serbia
Fig. 2 Google Earth map with pinned spring
Fig. 3 Sketch HG Map (after Marinović, 2022)
Fig. 4 Schematic cross section (after Vasić, 2017)
Fig. 5 Vrelo Mlave, siphon section (Milanović, 2010)
Fig. 6 Vrelo Mlave typical spring hydrograph (y.1980)
Fig. 7 Vrelo Mlave spring (summer)
Fig. 8 Vrelo Mlave spring (winter)
Fig. 9 Vrelo Mlave, panoramic view

All photos of the spring by Z. Stevanović

*/ in case of spring tapped

2) Spring Importance / Criteria

Criterion	Justification / Facts	Criteria order
Historic, H **Aesthetic, A** **Economic, E** **Scientific, S** **Ecological, Ec**	*Vrelo Mlave, the main source of river Mlava, is the largest karst spring in Carpathian karst of eastern Serbia. This is typical vauclusian spring issuing from lake of 30m in diameter. It is most studied spring with 60 years of systematic discharge measurements, which is the longest period for one karst spring observation in the country. Jovan Cvijić, the founder of karstology, conducted here his first explorations (1889-1896), including measuring of lake and siphon depths by cannon ball, and observing spring's reaction on an earthquake whose epicentre was some 50 km away. Spring was further studied in detail since 1980s and its characteristics explained in several studies and dissertations (see list of references). Mlava karst aquifer contains large static reserves stored in deeper aquifer sections and was proposed for detail research and possible engineering interventions to regulate minimal flows and in case of positive results to be used for regional water supply including suburb area of the capital city Belgrade which is located at the distance of some 120 km.*	S H E A Ec
Current status	*Vrelo Mlave spring belongs to natural reserve area – National Park Kučaj-Beljanica established in 2022 (comprises c. 45,000 ha). Vrelo Mlave is also inscribed in the national list of the Natural Monuments since the beginning of 2000s.*	
Final proposal for list MIKAS or NIKAS	**MIKAS**	

3) References and source

References, which validate spring importance	*Cvijić J. (1895) Caves and underground hydrography in eastern Serbia (Serb. original: Pećine i podzemna hidrografija u istočnoj Srbiji), Glas SKA, XLVI, Belgrade, 101 p.* *Cvijić J. (1896) Springs, peat bogs and waterfalls in eastern Serbia (Serb. original: Izvori, tresave i vodopadi u istočnoj Srbiji), Glas SKA, LI 18, Belgrade, 122 p.* *Milanović S. (2010) Creation of physical model of karst aquifers on example of Beljanica Mt. (Eastern Serbia) (in Serbian) Doct. Dissert., Hydrogeol. Dpt., Fac. Min. & Geol, Univ. Belgrade* *Ristić V. (2007) Development of simulation model for daily discharges of the karst springs (in Serbian) Doct. Dissert., Hydrogeol. Dpt., Fac. Min. & Geol, Univ. Belgrade* *Stevanović Z. (1982) Hidrogeology and water budget of karst groundwater of Vrelo Mlave catchment area (in Serbian), "Naš krš", vol. 6, no. 12, 13, Sarajevo, pp. 67-78* *Stevanović Z., Filipović B., Stevanović I. (1986) Prospects for groundwater capturing in the upper basin of the Mlava River for water supply of Belgrade or other users (in Serbian). Voda i sanitarna tehnika, vol. VI, pp. 17-26* *Stevanović Z. (1991) Karst hidrogeology of the Carpathian-Balkandies of eastern Serbia and water supply opportunities (in Serbian) Spec. ed. Fac. Min. & Geol, Univ. Belgrade, 245 p.* *Stevanović Z., Milanović S., Benderev A. (2015) Specific discharge mechanism of some karstic springs in the Carpathian – Balkanides. Recueil des Traveaux de la Acad. Serb. Sci et Arts, Belgrade, vol.10, pp. 163-186* *Vasić Lj. (2017) Genesis and water circulation conditions of the complex karst systems of Kučaj-Beljanica massif (in Serbian) Doct. Dissert., Hydrogeol. Dpt., Fac. Min. & Geol, Univ. Belgrade*
Data collected by:	Zoran Stevanović
Assisted by (collaborators):	
Remarks	*Spring siphon was explored by divers on several occasions. The narrow knee has been found at the depth of about 30m.The total reached depth is 73m, but gallery is further expanded and extended to the inner part of the karst aquifer. The two tracer tests confirmed connection of Vrelo Mlave spring with sinking stream Crna Reka (apparent velocities in low water period were 0.013-0.019 m/s). Spring hydrograph is characterized by several discharge peaks (snowmelt, after heavy rains in springtime and summer) and about two months recession period usually in August-September). During recessions in late 1970s the two coefficients of laminar drainage are indicated: a_1 = 0,0530; a_2 = 0,0145. Based on isotopic analyses of ^3H and $^3H/^3He$ karst system is „relatively fast", groundwater age is around 6 years. The spring is a known touristic place, well-advertised and labelled at the spot, there is also a motel downstream of spring site, on left riverbank.*

4) Optional data

Grading criteria for proposing the spring	S = 4; H = 4; E = 3; A = 3; Ec = 3
Surface of catchment area (km²)	120
Water distribution system*	N/A
Purpose of water used*	*Main water source of river Mlava, ensures its baseflow. A few km downstream from spring site water is used for big trout fishpond.*
Sort and number of beneficiaries*	N/A
Groundwater chemistry	*Dominant ions Ca and HCO_3 are witnessing prevailing presence of limestones in the catchment area. Content of other ions are significantly lesser, while micro constituents are often below detectable limit.*
Water treatment*	N/A
Threats to spring water quality	*Local solid waste dump is around 1 km away, and cemetery 0.5 km, but both aren't in direct connection with the karst aquifer. Catchment is not permanently populated, farming to a low extent and livestock grazing, take place mostly during summer months.*

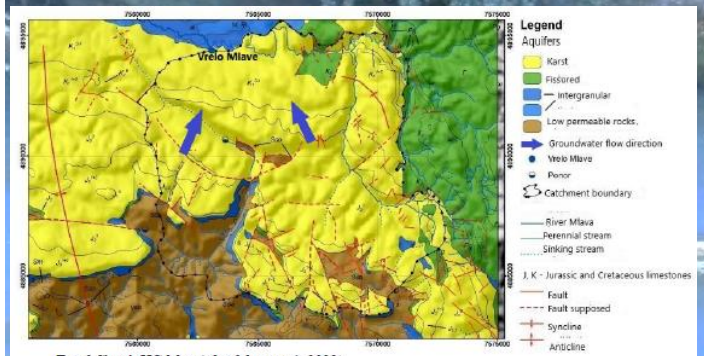
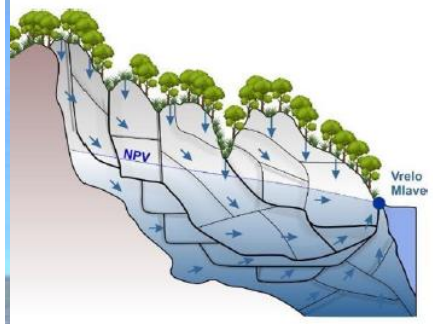
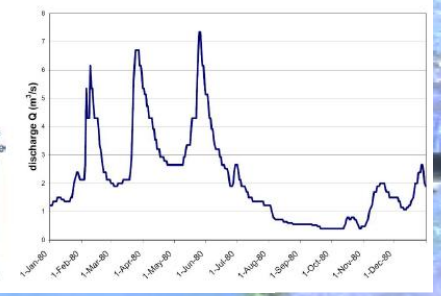
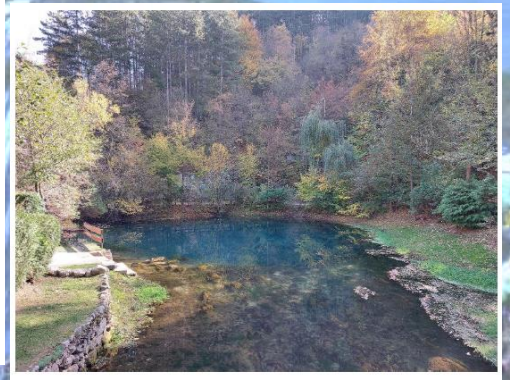
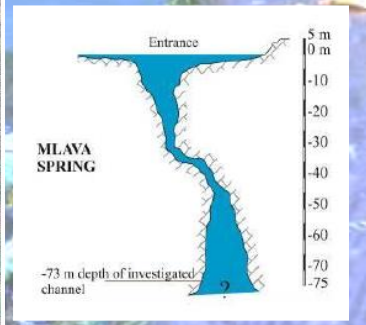


Fig. 3 Sketch HG Map (after Marinović, 2022)









Continent	Number of covered countries	Number of experts confirmed
Africa	6	7
Americas	12	11
Asia	19	21
Australia & Oceania	4	4
Europe	29	38
Total	70	81

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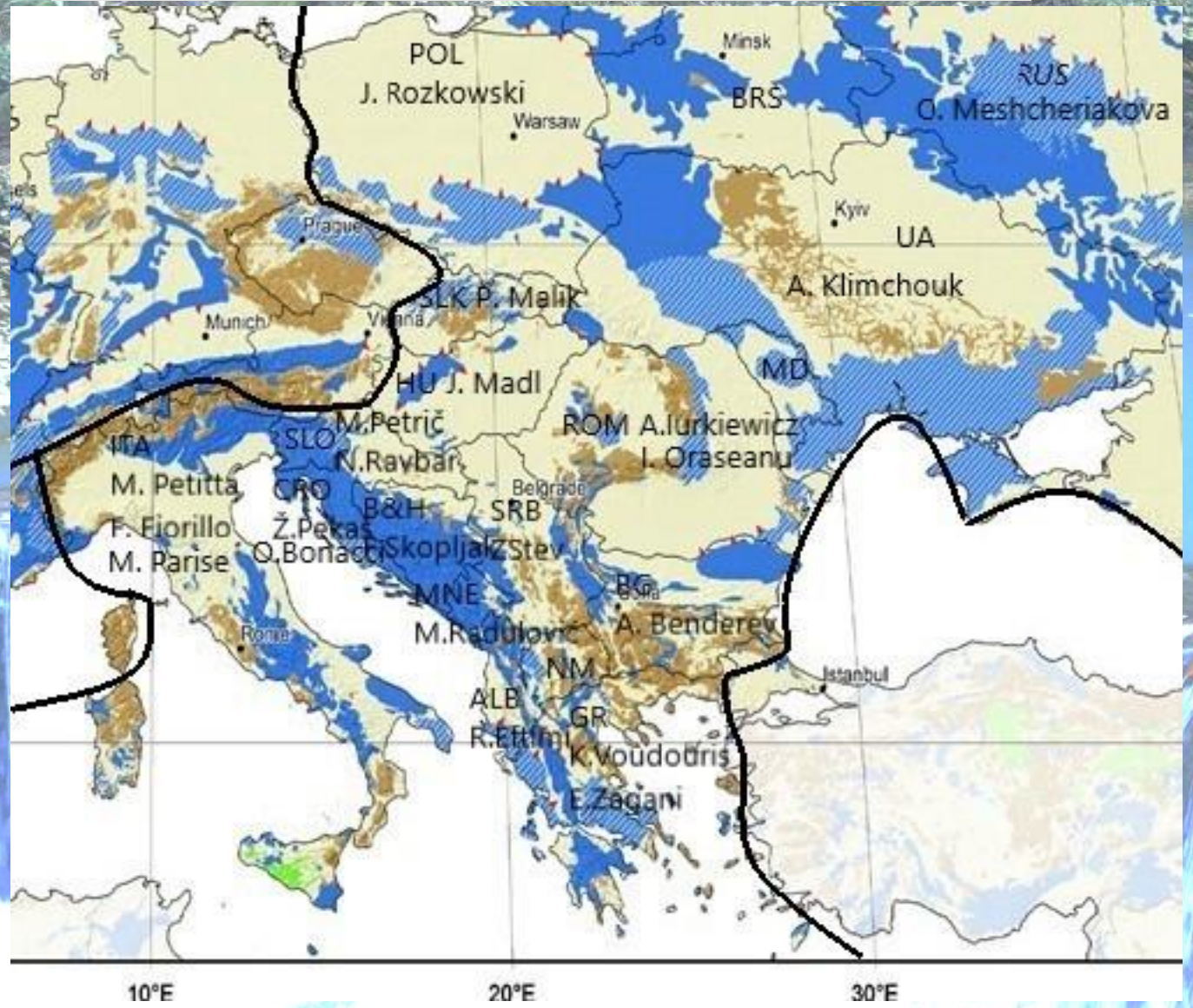
National experts – Status of SE Europe



National experts – Status of Asia

ASIA		
Eastern Asia		
China（Hong Kong，Macao， Taiwan）	Junbing Pu	junbingpu@163.com
Republic of Korea	Heejun Kim	hydroqueen@kangwon.ac.kr
Mongolia	Ulziiburen Burenjargal	burenjargal@must.edu.mn
Southern Asia		
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Maldives		
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Pakistan	Jerome Perrin	je.perrin@brgm.fr
Sri Lanka	Jerome Perrin	je.perrin@brgm.fr
Bhutan	Zoran Stevanović	zstev_2000@yahoo.co.uk
South-Eastern Asia		
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Philippines	Ross Dominic Darang Agot	ross.agot@gmail.com
Western Asia		
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Lebanon	Joanna Doummar	jd31@aub.edu.lb
Syrian Arab Republic	Joanna Doummar Dr Nazeer Asmael	jd31@aub.edu.lb nazeer.asmael@u-bordeaux-montaigne.fr
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Turkmenistan	Olga Meshcheriakova ?	olgam.psu@gmail.com
Uzbekistan	Olga Meshcheriakova ?	olgam.psu@gmail.com
Southern Asia		
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Bangladesh		
Iran (Islamic Republic of)	Zargham Mohammadi	zmohammadi@shirazu.ac.ir
Iraq	Zoran Stevanović	zstev_2000@yahoo.co.uk
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Lao People's Democratic Republic	Vongphachanh Sinxay	sinlu007@yahoo.com
Malaysia	OTHMAN BIN KANGSAR	othman@jmg.gov.my
Myanmar	Thida Oo	thidaoo.ms@gmail.com
Thailand	Chaiporn Siripornpibul	alekchaiporn@gmail.com
Viet Nam	Vu Thi Minh Nguyet	nguyetvuminh@yahoo.com
Western Asia		
Israel	Avihu Burg	burg@gsi.gov.il
Palestine	Amer Marei	marei.amer@gmail.com

MIKAS project promotion

БЪЛГАРСКА АКАДЕМИЯ НА НАУКИТЕ. BULGARIAN ACADEMY OF SCIENCES
ИНЖЕНЕРНА ГЕОЛОГИЯ И ХИДРОГЕОЛОГИЯ, 36
ENGINEERING GEOLOGY AND HYDROGEOLOGY, 36
София, 2022. Sofia

Project "Most Important Karst Aquifer Springs" (MIKAS) and Bulgaria's participation in it

Aleksey Benderev[1]

[1]Geological Institute, Bulgarian Academy of Sciences, 1113, Sofia, Bulgaria;
e-mail: alekseybenderev@yahoo.com

Проект „Най-важни извори от карстови водоносни хоризонти" (MIKAS) и участието на България в него

Алексей Бендерев

Benderev, A. 2022. Project "Most Important Karst Aquifer Karst Springs" (MIKAS) and Bulgaria's participation in it. *Engineering Geology and Hydrogeology*, 36, 45–57.

Abstract. Karst has a wide distribution, both throughout the world and in Bulgaria. The groundwater formed in it are important for providing water for the population and for the existence of a number of ecosystems. Considering the importance of karst springs, an international project "Most Important Karst Aquifer Springs" – MIKAS was started. The project aims to bring together the joint efforts of scientists from different countries in order to characterize and promote the most important springs in the respective countries. Its organization is carried out by an international Advisory Board, and National experts from the respective country are involved in its implementation. The main task is to prepare Global and National lists of karst springs representing world and national natural heritage for each country. Determining the importance of each source is carried out after applying historical, aesthetic, economic, scientific and ecological criteria. In order to unify the selection of representative springs by the experts from the different countries, the Advisory Board has proposed a methodology for preparing accompanying forms with complex information, including maps, photos, graphics and others. As a sample, two completed forms are attached to the adopted Methodology – for the Khanis spring, Iraq, proposed for inclusion in the Global List and for the Vrelo Mlave – for the National List of Serbia. In Bulgaria, it has been established that there are over 150 karst springs of regional and local importance on its territory. Part of the accepted general criteria is applicable to each of them with different weight. From these springs, after review and discussion of the existing information, it is planned to select a part of them for a more detailed evaluation and possibly their inclusion in an extended National list. The weighting of the various criteria will be determined and a summary assessment and ranking will be made based on it. On this basis, a National list will be prepared, which will include the most highly rated karst springs with the necessary illustrative material for each spring. This list will be presented to the Project Advisory Board and it will be discussed with them which of the springs could be included in the Global List.

Keywords: karst spring, karst, Project MIKAS, Bulgaria.

Резюме. Карстът има широко разпространение както по света, така и в България. Формираните в него подземни води имат важно значение за осигуряване вода за населението и за

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Фиг. 3. Древен каптаж при с. Мусина, област Велико Търново (https://uspelite.bg/otkriha-misteriozna-podvodna-zala-ot-rimsko-vreme-krai-musinskata-peshtera-1).
Fig. 3. Ancient tape near the village of Musina, Veliko Tarnovo Region (https://uspelite.bg/otkriha-misteriozna-podvodna-zala-ot-rimsko-vreme-krai-musinskata-peshtera-1).

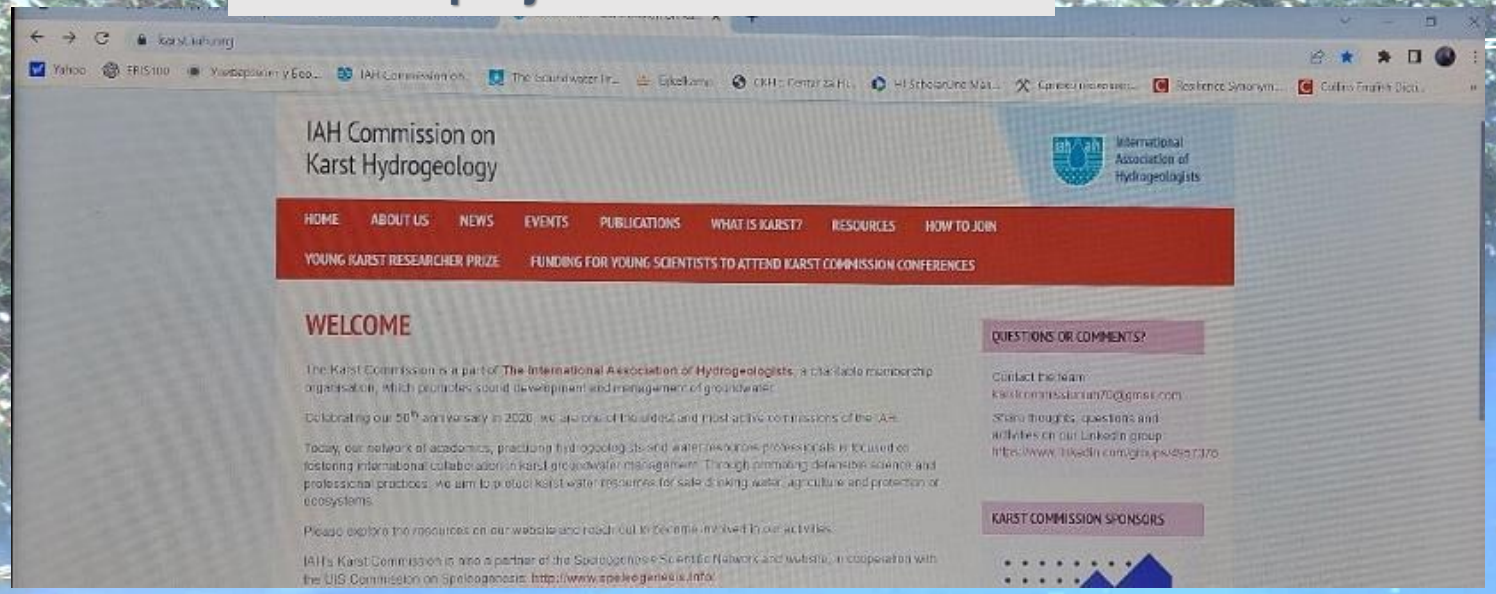
Фиг. 4. Изворът „Клептуза", Велинград.
Fig. 4. Kleptuza Spring, the town of Velingrad.

Фиг. 8. Извор „Хубча", използван за хидроенергийни цели, Централни Родопи.
Fig. 8. Hubcha Spring, used for hydropower purposes, Central Rhodopes.

Фиг. 9. Басейн върху субтермален извор „Мосомище", Южен Пирин.
Fig. 9. Pool on the subthermal spring Mosomishte, South Pirin Mountain.

Further steps

MIKAS project on Website KC



Recruitment of national experts

Central America, Caribbeans,

Central Asia, Central Africa...

UNESCO IHP sponsorship

United Nations Educational, Scientific and Cultural Organization

International Hydrological Programme

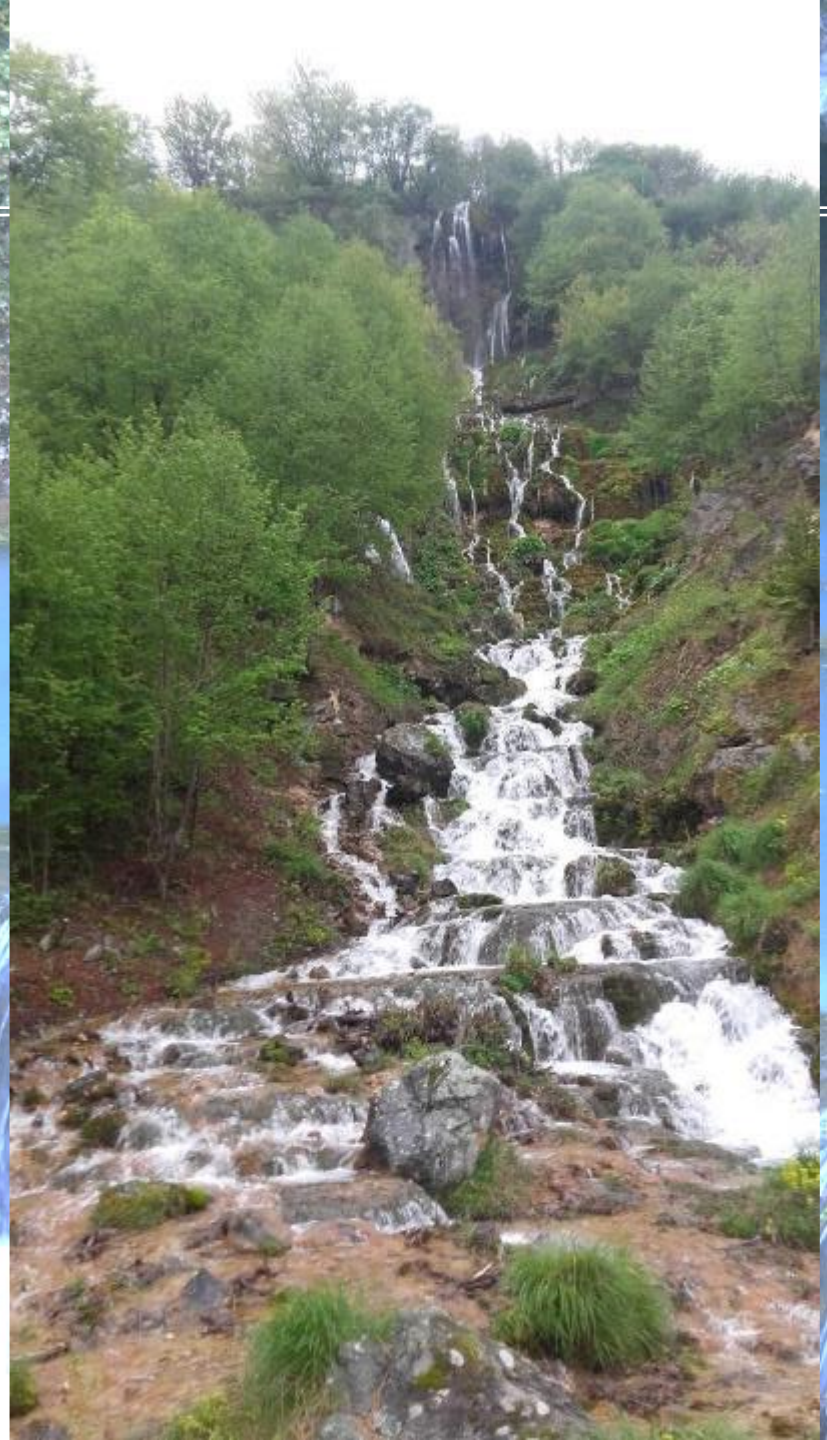
Further steps

Code of Good Practice

The idea of identifying and protecting selected springs does not imply prevention of their further use. On the contrary, the aim of the initiative is to:

- highlight their importance,
- defend them from possible devastation, and
- ensure that any further intervention takes into account their protected status.

In case a spring is actively used for water supply, which would necessitate its greater protection, there would still be space for visits of organised groups during designated time slots.



Karst Commission

Further steps

Unique Informative Plaque (Plate)

- Basic information (in local language(s) and English) about the springs,
- The history and importance,
- Morphological characteristics,
- Geology and HG settings,
- Discharge mechanisms,
- Eco-system,
- Other specific facts.

Proposal

Most Important Karst Aquifer's Springs - MIKAS

XXX Spring

United Nations Educational, Scientific and Cultural Organization

International Hydrological Programme

About Project

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Historical facts and old drawings

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Morphology and hydrology

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Geology

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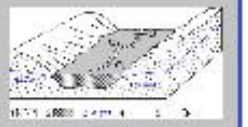

Hydrogeology Groundwater Origin

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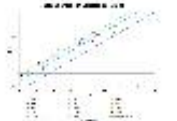
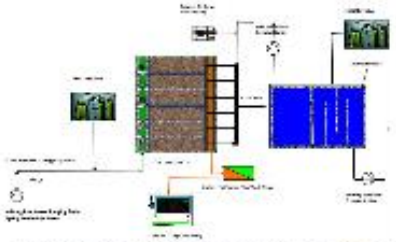
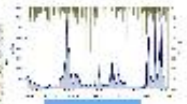
Water Use and Protection







Eco System

Project on selection, labeling and protecting the world's most important karst springs

Karst Commission

Thank you for your attention