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Ethnobotany of spring waters based on species toponymy on the east slope of Mount Ijen, Banyuwangi District, Indonesia

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Abstract. *Najih RR, Batoro J, Hakim L. 2023. Ethnobotany of spring waters based on species toponymy on the east slope of Mount Ijen, Banyuwangi District, Indonesia. Biodiversitas 24: 3860-3871.* Some spring waters in Banyuwangi are unique in terms of toponymy (place name), where local communities give names to springs based on plant species around the springs. This research aimed to (i) understand the names of the plants used as the design names for the springs, (ii) understand the plants in the offerings of the springs and (iii) explain the use of plants around the springs on the East Ijen Slopes, Banyuwangi District, Indonesia. A field study was conducted on the slopes of Mount Ijen. Research data were obtained from 50 informants through semi-structured interviews. This study used descriptive analysis and Relative Frequency of Citations (RFC). There were five toponymy species of springs, namely *Pangium edule* Reinw, *Planchonia valida* (Blume) Blume, *Terminalia* sp., *Ganophyllum falcatum* Blume, and *Garcinia tetranda* Pierre. Offerings dishes of springs were *Pecel Pitik, Tajin Suro, Tajin Jenang Limo,* and *Tumpeng Serakat*. There are 43 species of plants around the springs within 21 families. Plants with the highest RFC values were *Gigantochloa apus* (Schult. f.) Kurz ex Munro (0.62), followed by *Ficus benjamina* L. (0.4) and *S. mahagoni* (L.) Jacq (0.32). In terms of utilization, the toponymy species did not have the highest RFC value. Species with low RFC values have a greater possibility of extinction than other species.

Keywords: Conservation, cultural landscape, ecosystem, local knowledge, offerings

INTRODUCTION

The cultural landscape-based conservation movement has now developed rapidly. Cultural landscape-based conservation is important for identifying and assessing natural resources as one of the bio-cultural aspects (Hakim 2017). The springs on the slopes of Mount Ijen Banyuwangi, Indonesia are part of the cultural landscape of the Blambangan Biosphere Reserve. Geographically Banyuwangi has many geological sites (Hakim 2017; Hakim et al. 2022). Especially many hydrogeological sites are identified as supporting the life of the local community for a sustainable life. The springs in Banyuwangi are named uniquely by the local community after certain types of plants around the springs.

Toponymy studies (place names) such as naming forest areas, villages, cities, and important places can be based on the biodiversity elements of plants and animals (Atasoy and Yeginbayeva 2017; Hearn 2021; Zhao et al. 2021). Regional toponymy relates to human knowledge and ideas that use language symbols to describe concepts, processes and objects (Triana et al. 2022). Regional toponymy in Indonesia also involves the region's available natural resources and cultural diversity. Toponymy studies in the city of Mojokerto, related to the Sapir-Whorf Hypothesis and Toponomic Studies, have found a link between culture, language, and inner ideas to influence the process of naming places using Javanese (Setyo et al. 2022). Local people's perspectives and knowledge about the living space around them are reflections of toponymy (Bulatović and Rajović 2022).

Banyuwangi District has abundant springs ecosystems. The springs ecosystems are an essential area to be conserved. Springs carry out important reserve functions for natural resources outside the forest area, such as to save essential species (Biggs 2017; Cumming and Allen 2017). This ecosystem stores a diversity of flora and fauna with an important contribution to maintaining ecological and hydrological cycles. Threats from deteriorated changes, such as the decline of natural ecosystems into tree plantation, make it urgent to protect the diversity and utilization of plant species (Wassie 2020). Increased environmental degradation caused by anthropological factors is a threat faced together on Earth (Moran 2022). Ecosystems should be maintained in their natural form by considering harmonization in the form of reciprocal interactions between living things and the environment (Díaz et al. 2015; Calzadilla and Kotzé 2018). At present, there have been significant changes in quality and carrying capacity. The types of plants that exist in springs can be an important material for the younger generation to learn about the types of tropical forests. It is urgent to carry out a comprehensive study following academic procedures to protect the ancestors' cultural heritage.

Conservation challenges in the current era raise questions for present and future generations about whether the preservation of plants and culture in areas based on toponymy species is still being carried on from previous

generations or has been abandoned. Re-informing toponymy species is one of the biggest challenges of area conservation. Conveying community-based information through shared awareness of culture and available natural resources is considered useful in toponymy research. Perceptions of stakeholders are needed to assess the potential of biodiversity landscapes in conservation and development planning (Hakim et al. 2022). The toponymic wealth of community-based springs is important for documenting the existence and interaction of the relationship between humans and plants. Ethnobotany studies the relationship between humans and plants, not only their uses but also their ecological, economic, social, and cultural aspects (Balick and Cox 2020; Mulu et al. 2020). The purpose of this study was to find out the names of the plants that became the design for the names of the springs, (ii) to find out the plants in the offerings of the springs, and (iii) to explain the use of plants around the springs on the East Ijen Slope, Banyuwangi District, Indonesia.

MATERIALS AND METHODS

Study area

This study was conducted in Kalipuro Sub-district, consisting of nine villages: Bulusari, Bulusan, Gombengsari, Kalipuro, Kelir, Ketapang, Klatak, Pesucen, and Telemung. Kalipuro Sub-district is administratively included in the East Slope of Mount Ijen, Banyuwangi District, East Java, Indonesia. Geographically, Mount Ijen is located at an altitude of 2,386 m with slopes consisting of lowlands and highlands (Putra et al. 2022). The lowlands consist of agricultural areas, while the highlands consist of plantation areas. The areas on the slopes of Ijen are traversed by streams and water sources. Banyuwangi District has abundant potential for water resources (Setyaningrum et al. 2022), coming from springs on the slopes of Ijen, managed by regional drinking water companies and local communities. The slopes of Mt. East Ijen have local floral wisdom, which then is used as the toponymy of the area to facilitate the delivery of information related to springs at the local community level. The location of the springs based on the toponymy of the species on the slopes of East Ijen can be seen in (Figure 1).

Selection of the informants

Purposive sampling was used in this study by choosing people around the east Ijen slope springs as informants. Some people living around the springs who take advantage of the springs and the springs' water plants were selected as informants, including the elderly, spring land owners, regional administrators, cooks, and religious leaders. A total of 50 informants (10 informants from each spring) were interviewed.

Plant toponymy

The springs' toponymy was selected from plant species with tree habitus. The selection was carried out using only key informants (regional stakeholders and religious leaders), who are natives to the slopes of Mount Ijen Banyuwangi and who can explain the characteristics of plant species and the presence of springs. Springs named after the toponymy species of tree habitus were chosen, while springs named after the toponymy species of herbaceous and grass habitus are not observed in this study.

Botanical identifications

Data collection of the utilized toponymic species and plants around the springs by the East Ijen slope community was done with the consent of the informant. Informants were notified in advance about Prior Informed Consent (PCI) orally (Ellena et al. 2012; Hapsari et al. 2017). The data collection of the local communities followed the International Society of Ethnobiology Code of Ethics (ISE 2006).

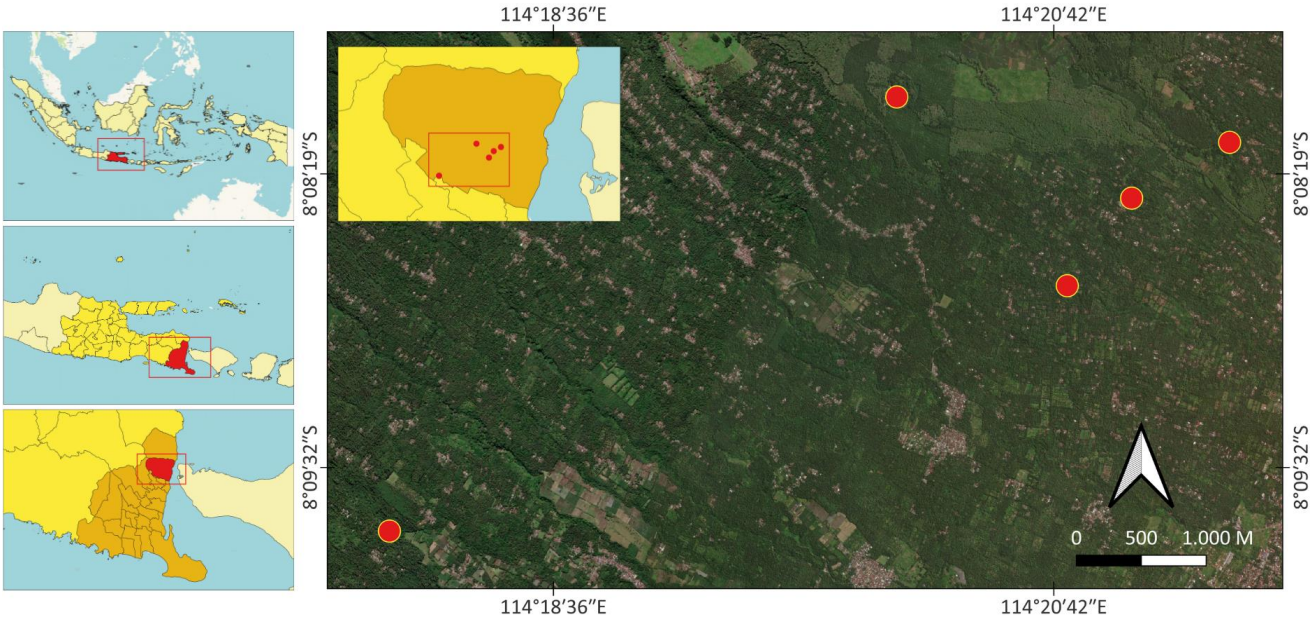

Figure 1. Location of springs on the slopes of East Ijen, Kalipuro Sub-district, Banyuwangi District, Indonesia

The first identification of plants was based on local people knowledge on plant local names. From the local names, scientific verification was made through morphological examination and literature confirmation. A standard book, i.e., Flora of Java, was used in identification methods. Plants whose scientific names could not be determined were collected and sent to the Purwodadi Botanical Garden for further expert identification. Furthermore, the plants which have been recorded were arranged based on the correct nomenclature from online databases: integrated taxonomic information system online resources (https://www.itis.gov/), the plant list (http://www.theplantlist.org/), and the royal botanic gardens plants of the world online (https://powo.science.kew.org/).

Data collection

The ethnobotanical survey was carried out in August - December 2022. The data collection technique used the purposive sampling method with a combination of semi-structured interviews which were designed like ordinary conversations based on a list of questions that had been prepared beforehand.

The list of questions were the presence of toponymic species, the use of plants around the springs and the types of plants in the springs area. The choice of language in the interview process was determined based on the local language to comfort the informants. The languages used are Javanese *Krama Inggil* (the level of Javanese that is considered the politest), Madurese, Osing and Indonesian.

Data analysis

Relative Frequency of Citation (RFC)

Relative Frequency of Citation (RFC) is a quantitative index that provides citation information on the importance of the species investigated based on local knowledge, calculated using the formula described by Tardiõ and Pardo-de-Santayana (2008) as follows:

$$RFC = \frac{FC}{N}$$

Where: FC is the frequency of species citation and N is the total number of respondents in the study. The range of RFC values is 0 to 1 (where the higher RFC value in plants indicates that the plant is of high use in society).

RESULTS AND DISCUSSION

Informant's demography

Informant's data were categorized based on job categories, gender, age, ethnicity, and level of education. The demographic characteristics are important to obtain population dynamics data (Table 1). The majority of informants (66%) were male. The data collection was primarily directed towards men, especially caretakers of sources considered experts in the history and the use of the springs since activities in the spring community are conducted mainly by men, and men take an important role in decision-making related to the springs. Nevertheless, the role of women is also important in the communities around the springs, especially regarding the knowledge of recipes for ritual dishes.

Data shows that 50% of the people around the springs have graduated from elementary school, and 32% have not accessed formal education at all. The people said that it was mostly due to the limited number of schools in the nearest village, the inaccessibility of schools, and the high cost of education.

Information from residents explained that in-depth knowledge of the plants around the springs is owned by the elderly, from ages ranging from 46-60 by 38% and ages ranging from 30-45 by 30%. The knowledge of the use of the springs was obtained from experience gained from daily activities in the area around the springs. The Madurese dominates the water source area by up to 66%. The Mangir, Pakem, Putat, and Wadung springs are dominated by Madurese. On the other hand, the Klumpit spring is dominated by the Osing Tribe. While Madurese culture and speech can be found in almost all areas of East Java, the Osing Tribe is a native Banyuwangi tribal community that occupies Banyuwangi and the surrounding area (Rachmah et al. 2022).

Toponymy species on springs

The local springs' community believed that the naming of a spring was based on the charismatic plant species with large tree habitus at the first time of discovery, so the plant was agreed upon as a marker. We recorded the presence of toponymy species in five springs (Table 2), namely Sumber Klumpit (*Terminalia* sp.), Sumber Mangir (*Ganophyllum falcatum* Blume), Sumber Pakem (*Pangium edule* Reinw), Sumber Putat (*Planchonia valida* (Blume) Blume), and Sumber Wadung (*Garcinia tetranda* Pierre).

Local cultural wisdom

Human interactions with nature evolve from time to time to form local wisdom based on cultural landscapes (Omoding et al. 2020). The collaboration of humans and nature creates a work that forms local wisdom which influences various kinds of landscapes that represent various cultures in different regions around the world. Continuous development can reveal a long and intimate relationship between humans and their natural environment (Bridgewater and Rotherham 2019).

Local wisdom from various tribes is part of the cultural heritage given by the previous generation, which is important to be maintained and passed on to the next generation. The determination of community activities was based on the information from spring holders (Figure 2; Table 2). Community activities were carried out during certain months in the area around the springs. The *Slametan* tradition was performed according to the Javanese, Hijri and Anno domini calendars. The month of Suro (Muharram) and Ruwah (Sya'ban) were believed to be special months based on ancestral heritage. Local people celebrate those months to continue the tradition from generation to generation. On the other hand, the Javanese people believed that the month of Suro is considered the

right time to do self-introspection during a year of life's journey, while the month of Ruwah is considered a month to purify the soul and body to prepare better for the month of Ramadan. The choice of day is also considered important; Legi Friday is a sacred day to carry out community activities because it is considered a sacred night and has a lot of power. The Javanese calendar inherited from previous ancestral usually chose Legi Friday to determine good days and daily activities (Prahmana et al. 2021).

Based on the Anno Domini calendar, Pakem Spring carries out community activities in August. Other than praying for the safety of the body, blessings of sustenance and asking for an abundance of water, the local community confirmed that the reason behind choosing August was also for the commemoration of Indonesia's Independence Month. The community activities were centered in the area around the spring. Pakem Spring was centered under a banyan tree, and the Putat Spring was centered in a place of worship for Muslims (*musholla*, a small mosque). Community activities were usually carried out in the morning by involving all the people around the spring. However, some community activities were also held at night, such as Srakalan at Putat Spring, which were carried out once a month. On the other hand, Barong was also an important performance for the Pakem Spring community, usually performed by the Osing people of Banyuwangi.

Spring offerings

The local wisdom of offering dishes is part of the cultural heritage obtained from the previous generation and needs to be maintained well to be passed on to the next generation. The plants recorded in the offerings recipes are listed in (Figure 3, Table 3). The dish offered in the springs on the Ijen slopes comes from the acculturation of Madura, Java and Osing cultures. The local people of the springs adhere to an agrarian culture; for example, historical records explain that the adherence of Javanese people to an agrarian culture is written on ancient temple buildings in the form of reliefs that describe groups of people in the past taking natural (plants) materials to be utilized (Anggorojati et al. 2023). Various recipes for dishes using plants in traditional ceremonies were recorded to be described further. Plants are obtained from the communities' gardens and traditional markets.

Table 1. Informant's demography

Informant category		Total	Percentage (%)
Sex			
	Male	33	66%
	Female	17	34%
Education			
	No formal education	16	32%
	Elementary School	25	50%
	Junior High School	3	6%
	Senior High School	2	4%
	Undergraduate	4	8%
Age			
	30-45	15	30%
	46-60	19	38%
	61-75	9	18%
	76-91	7	14%
Tribe			
	Javanese	6	12%
	Madura	33	66%
	Osing	9	18%
	Others	2	4%
Occupation			
	Farmer	39	78%
	Trader	5	10%
	Civil Servant	3	6%
	Others	3	6%

Figure 2. Community activities around the spring A. *Jaranan*, B. *Barong*, and C. *Selametan*

Banyuwangi people often use food as an important part of the offering ritual ceremony. Banyuwangi cuisine is diverse due to its exotic ingredients, aromas, tastes, and textures. Traditional dishes can usually only be found in certain months or rituals. Traditional dishes during the month of Suro include *Tajin Suro*, while traditional dishes found at certain ritual moments include *Pecel Pitik*, *Tajin Jenang*, and *Tumpeng Serakat*. *Pecel Pitik* is the most common dish found on every Banyuwangi people's ritual occasion as it is found in all offerings at springs. There are philosophical meanings behind each spring's ritual offerings. *Tajin Suro* shows proof of gratitude to the God Almighty and request for blessings, health, and safety for the following year. *Pecel Pitik* means:

"*Mugo-mugo barang hang diucel-ucel dadio barang hang apik*"

which translate:

"Hopefully, every effort that has been made yielded good results" (Indiarti and Nunuk 2019).

Tajin Jenang Limo contains different meanings for each color and location. *Jenang Putih* (a white dish) is made to exalt brothers and sisters in the east and a symbol for a father, *Jenang Merah* (a red dish) is made to exalt brother and sisters in the south and a symbol for a mother, *Jenang Kuning* (a yellow dish) is made to exalt the brothers and sisters in the west, while *Jenang Hitam* (a black dish) are made to exalt the brothers and sisters in the north, while *Jenang Hijau* (a green dish) are known by locals to symbolize *Pancer* (oneself). *Tumpeng Serakat* is a tradition of the Osing people to glorify the mountain that was considered as a place of ancestral spirits' residence.

Table 2. Species toponymy dan community activities

Name of springs	Species toponymy	Community activities	Center of activities	Calender		
				Java	Hijriah	Anno Domini
Klumpit	*Terminalia* sp.	*Selametan*	Around springs	Suro	Muharram	-
Mangir	*Ganophyllum falcatum* Blume	*Selametan*	Around springs	Jum'at Legi (Suro)	Muharram	-
Pakem	*Pangium edule* Reinw	*Selametan, Jaranan, Barong*	Under *F. benjamina* around the springs	-	-	August
Putat	*Planchonia valida* (Blume) Blume	*Selametan, Srakalan*	In the *musholla* around springs	Jum'at Legi (Ruwah)	Sya'ban	-
Wadung	*Garcinia tetranda* Pierre	*Selametan*	Around springs	Jum'at Legi (Ruwah)	Sya'ban	-

Note: *Selamatan*: A ritual traditions aimed to ask for safety and as a form of gratitude to God. *Jaranan*: A traditional Javanese dance depicting a group of horsemen (dancers riding horses). *Barong*: A ritual of Banyuwangi folk performing arts using barong attributes to maintain harmony. *Srakalan*: A tradition of recitation in the birthday of the Prophet Muhammad SAW to obtain blessings and safety from Allah Swt. *Hijriah*: Lunar Calender

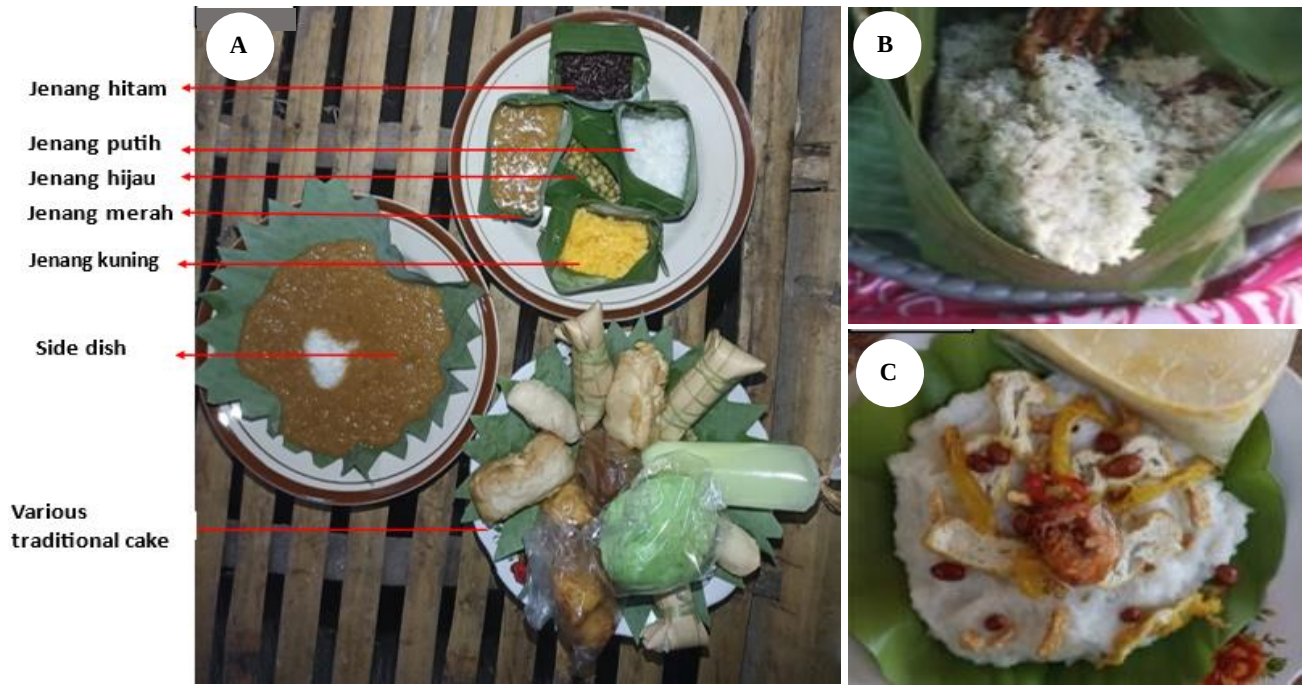

Figure 3. Spring offerings: A. *Tajin Jenang Limo*, B. *Pecel Pitik* and C. *Tajin Suro*. *Tajin Jenang Limo*: A five colored porridge (red, yellow, green, black and white), a dish to exalt *Dulur Papat Limo Pancer* (the understanding that humans have a companion within themselves in the natural world). *Pecel Pitik*: A dish made from grilled free-range chicken without giblets added with grated coconut mixture. *Tajin Suro*: A porridge with coconut milk to commemorate the month of Suro

Utilization of plants around springs

Plants around the springs (*Klumpit, Mangir, Pakem, Putat,* and *Wadung*) that had been utilized were diverse (Table 4), with a total of 43 species within 21 families, of which the most were from the family Fabaceae (7 species), followed by Malvaceae (5 species) and Moraceae (4 species). Most of the species from the Fabaceae family found were cultivated plants. The close distance between the communities' gardens and the spring area affected the diversity of the plant species found in the spring ecosystem. Species from the Fabaceae family dominating the ecosystem were *sengon* (*Albizia chinensis* (Osbeck) Merr.), *acacia* (*Acacia mangium* Willd.), *lamtoro* (*Leucaena leucocephala* (Lam.) de Wit), *petai* (*Parkia speciosa* Hassk), and *kedawung* (*Parkia timoriana* (DC.) Merr.), which were introduced to the area. Those species were cultivated plants often found in the gardens and agroforestry of local communities, functioning to support people's lives. The bark of the plants from this family was used as building material or firewood, the leaves as fodders and the fruit for personal consumption or as medicine.

The species that was used the most was coconut (*Cocos. nucifera* L.), with a total of 10 uses recorded, followed by bamboo (*Gigantochloa apus* (Schult. f.) Kurz ex Munro.), with 7 uses recorded. Coconut planted by local people on the slopes of Mount Ijen was chosen as shade tree coffee - agroforestry (Hariyati et al. 2022). Coconut is a versatile plant for the life of the local community around the springs, contributing to food security and the economic income of the farmers. For thousands of years, coconut has been considered the "tree of life" due to its various use, making it a valuable and revered tree (Nair and Nair 2021; Mat et al. 2022).

All parts of the coconut tree can be used for human needs. The flesh of the fruit can be grated and the juice (coconut milk) can be used for East Java's special soup dishes. Processed dishes using coconut flesh were widely used in traditional cake recipes, daily meals, as well as special moments such as ceremonial offerings of springs. The yellow young coconut leaves (*Janur*) are used by the Javanese people for wedding decoration (Jazeri and Susanto 2020). *Janur* symbolizes that humans must have the nature of seeking God's pleasure and mercy. On the other hand, the trunk of coconut trees around the springs was one of the most abundant and inexpensive natural resources. The trunks of the coconut trees produce strong and durable wood. The hard and fibrous texture of the wood made the wood chosen as a material for building roofs for local people's houses (Sodangi and Kazmi 2020).

The local communities' houses around the springs are made of woody and non-woody plants. The *G. apus* was a type of non-woody plant that is often used for construction materials in rural Java (Hildayanti 2023). The *G. apus* with old harvesting age has a low starch content so it is resistant to stem borers (Arinasa and Peneng 2013). People around the springs use the culm of *G. apus* to make handicraft, fences, cattle pens, house wall, stairs, and roofs.

The *G. apus* and *Schizostachyum* sp. were agreed as spring conservation plants to increase the volume of spring water. The plants were left to grow thickly around the springs and then were used wisely. Plants were important for soil and water conservation, to keep the water available and to maintain the soil so landslides did not occur (Partasasmita et al. 2017). The enormous water storage ability of the plants was supported by their fibrous roots to bind the soil and help reduce erosion so that it was considered a living aquifer (Partasasmita et al. 2017). However, the people around Wadung Spring did not utilize *Schizostachyum* sp. as an economic income due to its limited availability

The knowledge of the use of toponymy species was still maintained by the local community around the springs. All springs utilize the toponymy species unless the Klumpit spring. The local community believed that the Mangir and Wadung springs had lost toponymy species in the area around the springs, but the knowledge about the utilization of the species was still kept in the minds of the informants. On the other hand, the toponymy species of Klumpit spring was not considered a toponymy species anymore due to its absence and its lack of utilization. Some informants were even unaware of the presence of Klumpit spring's toponymy species in the past.

Mangir toponymy species (*G. falcatum*) and potat (*P. valida*) were known to be used as wood for building houses. Mangir wood was one of the important woods in the timber industry (Fujianti et al. 2021), Putat woods has a lot of tyloses, making it a hardwood and a wood which is very resistant to treatment with high pressure.

The *P. edule* was a toponymy species of Pakem spring in which the fruit has been used as food spices. The fruit was left in hot wood-burning ash for one day; then, the skin was crushed so that the flesh could be taken and utilized as a mixture for a dish called *Rawon* (East Java's black beef soup). The use of fruit flesh in a dish was familiar for the people around *Pakem* Spring, for example by crushing the skin of the fruit, then soaking it for a day in some running water, then taking the fruit flesh and processing it into a dish. Another method of processing the fruit includes soaking the fruit flesh in a tub full of water for three days while replacing the water every day to remove the intoxicating properties of the fruit.

The *G. tetrandra* Pierre is a toponymy species from a Wadung Spring which was no longer present in the spring ecosystem but the knowledge of its utilization was still maintained. The fruit is used as a spice to add acidity to traditional dishes, especially for fish, the *Wadung* fruit is acidic, giving a fresh taste to dishes when eaten. In addition, *G. tetrandra* Pierre was believed to be a medicine that speeds up the healing of mothers after giving birth by boiling the skin, then draining the boiled water and drinking it twice a day every morning and evening.

Table 3. The plants recorded in the offerings' recipes

Plant family and scientific name	Vernacular name	Part used	Relegions offering and citation area			
			Pecel Pitik	***Tajin Suro***	***Tajin Jenang Limo***	***Tumpeng Serakat***
			*Kl, Ma, Pa, Pu, Wa	*Kl, Ma	*Pu, Wa	*Kl
Amaryllidaceae						
Allium cepa L.	*Bawang Merah*	Bulb		√		√
Allium sativum L.	*Bawang Putih*	Bulb		√		√
Apiaceae						
Coriandrum sativum L.	*Ketumbar*	Seeds		√		√
Arecaceae						
Cocos nucifera L.	*Kelopo, Nyiur*	Fruit	√	√	√	√
Athyriaceae						
Diplazium esculentum (Retz.) Sw.	*Pakis*	Leaves				√
Brassicaceae						
Nasturtium officinale R.Br.	*Selada Air*	Leaves				√
Caricaceae						
Carica papaya L.	*Kates*	Leaves				√
Cucurbitaceae						
Cucumis sativus L.	*Timun*	Fruit				√
Sechium edule (Jacq.) Sw.	*Markisa, Labu Siam*	Fruit				√
Euphorbiaceae						
Aleurites moluccanus (L.) Willd.	*Kemiri*	Seeds	√	√		√
Manihot esculenta Crantz	*Singkong*	Leaves				√
Fabaceae						
Arachis hypogaea L.	*Kacang Tanah*	Seeds		√		√
Glycine max (L.) Merr.	*Kedelai*	Fruit				√
Phaseolus vulgaris L	*Buncis*	Fruit				√
Vigna radiata (L.) R. Wilczek	*Kacang Hijau*	Fruit			√	√
Vigna unguiculata (L.) Walp.	*Kacang Panjang*	Fruit				√
Lauraceae						
Cinnamomum burmannii (Nees & T. Nees) Blume	*Kayu Manis*	Bark		√	√	
Musaceae						
Musa x paradisiaca L.	*Pisang*	Leaves	√	√	√	√
Myristicaceae						
Myristica fragrans Houtt.	*Pala*	Seeds		√		√
Piperaceae						
Piper nigrum L.	*Merica*	Seeds		√		√
Poaceae						
Cymbopogon nardus (L.) Rendle	*Serai*	Stem		√		√
Oryza sativa L var. glutinosa	*Ketan*	Seeds			√	
Oryza sativa L.	*Padi*	Seeds	√	√	√	√
Zea mays L.	*Jagung*	Seeds			√	
Rutaceae						
Citrus hystrix DC.	*Jeruk*	Leaves		√		√
Solanaceae						
Capsicum annuum L.	*Cabai Besar*	Fruit	√	√		√
Capsicum frutescens L.	*Cabai, Lombok*	Fruit	√			√
Solanum lycopersicum L.	*Tomat*	Fruit				√
Zingiberaceae						
Curcuma longa L.	*Kunyit*	Rhizome		√		√
Zingiber officinale Roscoe	*Jahe*	Rhizome		√		√
Alpinia galanga (L.) Willd	*Lengkuas*	Rhizome		√		√
Kaempferia galanga L.	*Kencur*	Rhizome		√		√

Note: Kl: *Klumpit*, Ma: *Mangir*, Pa: *Pakem*, Pu: *Putat*, Wa: *Wadung*; *Pecel Pitik*: A dish made from grilled free-range chicken without giblets added with grated coconut mixture. *Tajin Suro*: A porridge with coconut milk to commemorate the month of Suro, *Tajin Jenang Limo*: A five colored porridge (red, yellow, green, black and white), a dish to exalt *Dulur Papat Limo Pancer* (the understanding that humans have a companion within themselves in the natural world). *Tumpeng Serakat*: A traditional ceremonial food symbolizing the mountain with various types of steamed vegetables topped with peanut *Pecel* sauce

Tabel 4. Lists of species around springs

Plant family and scientific name	Vernacular name	Part used	Use	RFC	Citation area
Achariaceae					
Pangium edule Reinw.	*Pakem*	Fruit	Spices, fruits as vegetables, drugs-like sensation	0.18	Ma, Pa
Anacardiaceae					
Dracontomelon dao (Blanco) Merr. & Rolfe	*Rawu*	Stem	House wood	0.06	Ma
Annonaceae					
Annona muricata L.	*Nongko Londo*	Fruit	Fruit to eat	0.02	Pu
Cananga odorata (Lam.) Hook.f. & Thomson	*Kembang Wongso*	Flower	Grave pilgrimage flowers	0.04	Pu
Arecaceae					
Arenga pinnata (Wurmb) Merr.	*Aren*	Fruit	Fruit to eat	0.06	Kl, Pa, Pu
Cocos nucifera L.	*Kelopo, Nyiur*	Whole part	Coconut water, coconut milk, urap-urap (spiced grated coconut), broom stick, *Janur* (young coconut leaves used in wedding traditions), coconut oil, house wood, firewood, traditional cakes, ceremonial offerings	0.18	Kl, Ma, Pa, Pu, Wa
Caricaceae					
Carica papaya L.	*Kates*	Fruit	Fruit to eat	0.02	Pu
Clusiaceae					
Garcinia × *mangostana* L.	*Mangis*	Fruit	Fruit to eat	0.1	Kl, Ma
Garcinia tetrandra Pierre	*Wadung*	Fruit	Fruit as a seasoning for fish, medicine after childbirth	0.02	Wa
Euphorbiaceae					
Aleurites moluccanus (L.) Willd.	*Kemiri*	Seeds	Spices	0.02	Pu
Fabaceae					
Acacia mangium Willd.	*Akasia*	Stem	House wood	0.02	Ma
Albizia chinensis (Osbeck) Merr.	*Sengon*	Stem	Plywood, house wood, firewood	0.14	Kl, Ma, Pa,
Leucaena leucocephala (Lam.) de Wit	*Lamtoro*	Fruit, leaves, stem	Fruit to eat, animal feed, firewood	0.04	Pa, Pu
Parkia speciosa Hassk.	*Pete*	Fruit, stem	Fruit to eat, house wood	0.22	Ma, Pa, Pu, Wa
Parkia timoriana (DC.) Merr.	*Kedawung*	Fruit	Fruit to eat, stomachache medicine	0.08	Pa, Pu
Senna siamea (Lam.) H.S.Irwin & Barneby	*Johar*	Whole plant, stem	Springs conservation tree, house wood, firewood	0.02	Pa
Tamarindus indica L.	*Asem*	Fruit	Fruit to eat	0.02	Pu
Lamiaceae					
Gmelina arborea Roxb.	*Gmelina*	Stem	House wood	0.02	Wa
Tectona grandis L.f.	*Jati*	Stem	House wood	0.04	Wa
Lauraceae					
Litsea firma (Blume) Hook.f.	*Wuru*	Stem	House wood	0.02	Kl
Persea americana Mill.	*Alpukat*	Fruit, stem	Fruit to eat, ice fruit, firewood	0.3	Kl, Ma, Pa, Pu, Wa
Lecythidaceae					
Planchonia valida (Blume) Blume	*Putat*	Stem	House wood	0.14	Pu

Malvaceae					
Ceiba pentandra (L.) Gaertn.	*Randu, Kapuk*	Whole plant, fruit	Springs conservation tree, bed cotton	0.12	Pa, Pu
Durio zibethinus L.	*Duren*	Fruit	Fruits for sale, fruit to eat	0.16	Kl, Ma, Pa
Pterospermum javanicum Jungh.	*Bayur*	Stem	House wood	0.04	Ma
Taliparitis simile (Blume) Fryxell	*Waru Gunung*	Whole plant, stem	Springs conservation tree, House wood	0.04	Ma, Pa
Taliparitis tiliaceum (L.) Fryxell	*Waru Doyong*	Whole plant	Fence, cattle rope	0.04	Ma
Meliaceae					
Lansium parasiticum (Osbeck) K.C.Sahni & Bennet	*Langsat*	Fruit	Fruit to eat	0.02	Kl
Swietenia mahagoni (L.) Jacq.	*Mahoni*	Whole plant, stem	Springs conservation tree, house wood	0.32	Kl, Ma, Pa, Pu, Wa
Moraceae					
Artocarpus altilis (Parkinson ex F.A.Zorn) Fosberg	*Sukun*	Fruit	Steamed fruit, chips	0.08	Pa
Artocarpus elasticus Reinw. ex Blume	*Bendo*	Whole plant, stem, sap	Springs conservation tree, house wood, Sap as a bird trap	0.1	Ma
Artocarpus heterophyllus Lam.	*Nongko*	Fruit, stem	Fruit to eat, house wood	0.1	Pa, Pu
Ficus benjamina L.	*Beringin*	Whole plant	Springs conservation tree, bird nesting place	0.4	Ma, Pa, Pu, Wa
Musaceae					
Musa x paradisiaca L.	*Gedang*	Fruit, leaves	Fruits to eat, traditional cakes, leaves as part of offerings	0.14	Pa, Pu
Myristicaceae					
Myristica fragrans Houtt.	*Pala*	Seeds	Spices, healthy drinks	0.02	Kl
Myrtaceae					
Syzygium littorale (Blume) Amshoff	*Klampok*	Stem	House wood	0.02	Pu
Syzygium polyanthum (Wight) Walp.	*Manting*	Whole plant, stem	Springs conservation tree, house wood	0.08	Pa
Poaceae					
Schizostachyum sp.	*Jajang, Pring*	Culm	Springs conservation tree	0.04	Wa
Gigantochloa apus (Schult. f.) Kurz ex Munro	*Jajang, Pring*	Whole plant, culm	Handicraft, fences, cattle pen, house wall, stairs, roofs, and springs conservation tree	0.62	Kl, Ma, Pa, Pu, Wa
Rubiaceae					
Coffea canephora Pierre ex A.Froehner	*Kopi*	Fruit	Fruits for sale, coffee drinks	0.16	Ma, Pa, Wa
Sapindaceae					
Ganophyllum falcatum Blume	*Mangir*	Stem	House wood	0.16	Ma, Wa
Schleichera oleosa (Lour.) Merr.	*Kesambi*	Fruit	Fruit to eat	0.02	Pa
Urticaceae					
Dendrocnide stimulans (L.f.) Chew	*Lateng*	Whole plant	Springs conservation tree	0.06	Pu

Note: Kl: Klumpit, Ma: Mangir, Pa: Pakem, Pu: Putat, Wa: Wadung

Relative Frequency of Citation (RFC) analysis

RFC value calculation showed that the highest value was in *G. apus* (0.62) followed by *Ficus benjamina* L. (0.4) and *Swietenia mahagoni* (L.) Jacq (0.32). The high RFC values of *G. apus* and *S. mahagoni* were obtained from species utilization from all springs, while the utilization of *F. benjamina* was reported in four springs (*Mangir, Pakem, Putat,* and *Wadung*). An ethnobotanical study of medicinal plants indigenous knowledge in Sumatra, Indonesia also reported that *G. apus* has a high RFC value of 1,11 in terms of utilization by the village community (Nisa et al. 2022).

Toponymy species in terms of utilization did not occupy the highest RFC value, with *P. edule* having RFC value of 0.18, *G. falcatum* of 0.16, *P. valida* of 0.14, and *G. tetrandra* Pierre 0.02. Species that have low RFC values are less noticed and less used by the community, so that they have greater possibility of extinction than other species (Mukhoyyaroh 2020). The lower the RFC value of toponymy species, the higher possibility of the species in the ecosystem of water sources getting threatened. Increasing the recognition of toponymy species can be carried out by introducing the importance of conserving springs to present and future generations. Re-introduction of toponymy species to the community may be one of the plant conservation efforts to increase knowledge, use and appreciation of the species in a sustainable manner.

Recommendation for introduction of species related to the name on springs

The water reservoirs' role of the springs' biodiversity has begun to receive less attention (Silcock et al. 2020). The absence of conservation activities by local communities has resulted in a decline in knowledge of the spring plants' diversity and their future uses. Undeniably, some informants tend to recommend trees mainly based on their economic value rather than their ecological value. They have applied coffee farming with an agroforestry system in their privately owned area around the springs. Their broad knowledge of coffee farming encourages them to imitate similar agricultural practices and implement them in the area around the springs. Thus, smallholder coffee plantations will change the springs vegetation if not addressed immediately. Despite the support of related parties and the government being urgent, the supply of water by the local community and the regional public drinking water company (PUDAM) in Banyuwangi still depends on the presence of the springs.

According to the community leader, making the spring area shrine can be one of the ways to conserve the toponymy species since it is considered effective to protect the plants' biodiversity and can be passed on from one generation to another. Some plants that local people usually labelled as sacred plants are *ringin* trees (*F. benjamina*), *bendo* (*Artocarpus elasticus* Reinw. ex Blume), *Glintungan* (*Bischofia javanica* Blume) and other large trees (Iskandar and Iskandar 2017; Pokharel and Adhikari 2021; Vioretha 2022). Plant sacredness has proven to be effective in maintaining the existence of plant species and areas. The existence of sacred springs can be used to protect springs and their surroundings (Khasanah et al. 2020). Meanwhile, the rituals and offerings held around the springs were a culture that was normalized and become a habit of the local people (Batoro et al. 2020).

It is necessary to convey knowledge about the history of springs based on toponymy species in order to increase the knowledge and appreciation of the younger generation. Mapping and describing the distribution of toponymy species will encourage public understanding of the importance of their contribution to the conservation of available natural resources, in the context of eco-cultural landscapes.

Some local people have realized the importance of self-awareness in protecting the spring area. Their understanding of the inseparable and highly dependent relationship between the community and sustainable natural resources has been cultural. The awareness of the sustainability of natural resources in ecosystems is highly dependent on the local communities as the managers around the area (Friedman et al. 2020; Berkes 2021). Spring management policies such as conflict reduction programs around spring areas by regulating spring protection areas and utilization areas, and also making water usage agreements are important to implement. The synergy between the State Forestry Public Corporation (PERUM PERHUTANI), Regional Water Company (PUDAM), local government, relevant stakeholders and the local communities needs to be forged in harmony. The same perspective and understanding of the preservation and utilization of natural resources can be an opportunity to introduce forest plants, especially the toponymy species in the spring areas. The biggest challenge might be the availability of toponymy species seeds, which are difficult to find around the springs' area. Thus, beds to grow plants are necessary for toponymy species' seed planting preparation. The introduction of toponymy species is important to bring back historical stories of naming areas related to cultural landscape conservation.

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REFERENCES

Anggorojati A, Widayat R, Budi S. 2023. Visualization of paddy in Panel 65 of the Karmawibhangga section of Borobudur Temple. Biodiversitas 24 (2): 2085-4722. DOI: 10.13057/biodiv/d240239.

Arinasa IBK, Peneng NI. 2013. Types of Bamboo in Bali and Its Potential. LIPI Press, Bogor. [Indonesian]

Atasoy E, Yeginbayeva A. 2017. Toponymic approach in scientific research of landscapes associated with the plant world. International Conference on Literature, Humanities and Social Sciences (LHSS-

17). Manila, 23-24 January 2017 (Philippines). DOI: 10.17758/URUAE.ED0117313.
Balick MJ, Cox PA. 2020. Plants, People, and Culture: The Science of Ethnobotany. Garland Science, London Now York. DOI: 10.4324/9781003049074.
Batoro J, Hakim L, Rahardi B. 2020. The perception of sacred trees as proponent of water spring in Malang District East Java, Indonesia. Asian J Med Biol Res 6 (3): 425-430. DOI: 10.3329/ajmbr.v6i3.49790.
Berkes F. 2021. Advanced Introduction to Community-Based Conservation. Edward Elgar Publishing, Cheltenham.
Biggs J, Von Fumetti S, Kelly-Quinn M. 2017. The importance of small waterbodies for biodiversity and ecosystem services: Implications for policy makers. Hydrobiologia 793: 3-39. DOI: 10.1007/s10750-016-3007-0.
Bridgewater P, Rotherham ID. 2019. A critical perspective on the concept of biocultural diversity and its emerging role in nature and heritage conservation. People Nat 1 (3): 291-30. DOI: 10.1002/pan3.10040.
Bulatović J, Rajović G. 2022. Toponymy of the Rural Settlement Gnjili Potok. Eur J Econ Stud 11 (1): 3-13. DOI: 10.13187/es.2022.1.3.
Calzadilla P, Kotzé LJ. 2018. Living in harmony with nature? A critical appraisal of the rights of Mother Earth in Bolivia. Transnatl Env Law 7 (3): 397-424. DOI: 10.1017/S2047102518000201.
Cumming GS, Allen CR. 2017. Protected areas as social-ecological systems: perspectives from resilience and social-ecological systems theory. Ecol appl 27 (6): 1709-1717. DOI: 10.1002/eap.1584.
Díaz S, Demissew S, Carabias J et al. 2015. The IPBES conceptual framework—connecting nature and people. Curr Opin Environ Sustain 14: 1-16. DOI: 10.1016/j.cosust.2014.11.002.
Ellena R, Quave CL, Pieroni A. 2012. Comparative medical ethnobotany of the Senegalese community living in Turin (Northwestern Italy) and in Adeane (Southern Senegal). Evid-Based Complement Alternat Med 2012: 604363. DOI: 10.1155/2012/604363.
Friedman WR, Halpern BS et al. 2020. Research priorities for achieving healthy marine ecosystems and human communities in a changing climate. Front Mar Sci 7: 5. DOI: 10.3389/fmars.2020.00005.
Fujianti H, Lestariningsih N, Nirmalasari R. 2021. The utilization of medicinal plants for diabetes mellitus Dayak Ngaju Ethnic at Tumbang Samba in Central Kalimantan. Adv Biol Sci Res 14: 456-462. DOI: 10.2991/absr.k.210621.078.
Hakim L, Rahardi B, Guntoro DA, Mukhoyyaroh NI. 2022. Coffee landscape of Banyuwangi Geopark: Ecology, conservation, and sustainable tourism development. J Trop Life Sci 12 (1): 107-116. DOI: 10.11594/jtls.12.01.11.
Hakim L. 2017. Cultural landscape preservation and ecotourism development in Blambangan Biosphere Reserve, East Java. In: Hong S-K, Nakagoshi N (eds). Landscape Ecology for Sustainable Society. Springer International Publishing, New York. DOI: 10.1007/978-3-319-74328-8_21.
Hapsari L, Kennedy J, Lestari DA, Masrum A, Lestarini W. 2017. Ethnobotanical survey of bananas (Musaceae) in six districts of East Java, Indonesia. Biodiversitas 18: 160-174. DOI: 10.13057/biodiv/d180122.
Hariyati JR, Siswanto D et al. 2022. Diversity and estimated above ground biomass of shade trees in some coffee-based agroforestries, Banyuwangi District. Adv Biol Sci Res 22: 598-604. DOI: 10.15294/biosaintifika.v9i1.8117.
Hearn KP. 2021. Mapping the past: Using ethnography and local spatial knowledge to characterize the Duero River borderlands landscape. J Rural Stud 82: 37-53. DOI: 10.1016/j.jrurstud.2021.01.024.
Hildayanti A. 2023. Optimizing bamboo as an alternative building material to respond global architectural challenges. IOP Conf Ser Earth Environ Sci 1157: 012011. DOI 10.1088/1755-1315/1157/1/012011.
Indiarti W, Nurchayati N. 2019. Olah Rasa Ujung Timur Jawa: Makanan Ritual dalam Kebudayaan Osing. Almatera Publishing, Yogyakarta. DOI: 10.14203/press.262. [Indonesian]
International Society of Ethnobiology (ISE). 2006. International Society of Ethnobiology code of ethics. http: //ethnobiology.net/code-of-ethics/
Iskandar J, Iskandar BS. 2017. Various plants of traditional rituals: Ethnobotanical research among the Baduy community. Biosaintifika: J Biol Biol Educ 9 (1): 114-125. DOI: 10.15294/biosaintifika.v9i1.8117.
ITIS. 2023. Integrated taxonomic information system online resources. https://www.itis.gov/. (accessed 02.02.2023).
Jazeri M, Susanto S. 2020. Semiotics of Roland Barthes in symbols systems of Javanese wedding ceremony. Intl Linguist Res 3 (2): 22-31. DOI: 10.29303/iccsproceeding.v2i1.129.
Khasanah NLN, Yanuwiadi B, Batoro J. 2020. Local wisdom and its implications in plant diversity conservation in springs area (Study Case in Ngenep Village, Karangploso District, Malang District). Indones J Environ Sustain Dev 11 (1): 49-55. DOI: 10.21776/ub.jpal.2020.011.01.08.
Mat K, Kari ZA, Rusli ND et al. 2022. Coconut palm: Food, feed, and nutraceutical properties. Animals 12 (16): 2107. DOI: 10.3390/ani12162107.
Moran EF. 2022. Human Adaptability: An Introduction to Ecological Anthropology. Routledge, London.
Mukhoyyaroh NI. 2020. Ethnobotanical Study on Local Bananas (*Musa* Spp.) Utilization in Srigonco Village, Bantur District, Malang District. [Tesis]. Universitas Brawijaya, Malang. [Indonesian]
Mulu M, Ntelok ZRE, Sii P, Mulu H. 2020. Ethnobotanical knowledge and conservation practices of indigenous people of Mbeliling Forest Area, Indonesia. Biodiversitas 21 (5): 2085-4722. DOI: 10.13057/biodiv/d210512.
Nair KP. 2021. The coconut palm (*Cocos nucifera* L.). In: Nair KP (eds). Tree Crops: Harvesting Cash from the World's Important Cash Crops. Springer Cham, New York. DOI: 10.1007/978-3-030-62140-7_3.
Nisa U, Triyono A, Ardiyanto D, Novianto F, Fitriani U, Jannah WDM, Astana PRW, Zulkarnain Z. 2022. Ethnopharmacological study of medicinal plants indigenous knowledge about low back pain therapy in Sumatra, Indonesia. J Appl Pharmaceutical Sci 12 (9): 178-188. DOI: 10.7324/JAPS.2022.120921.
Omoding J, Walters G, Andama E et al. 2020. Analysing and applying stakeholder perceptions to improve protected area governance in Ugandan conservation landscapes. Land 9 (6): 207. DOI: 10.3390/land9060207.
Partasasmita R, An'amillah A, Iskandar J, Mutaqin AZ, Annisa. 2017. Traditional knowledge of bamboo and its role in Karangwangi Village Cianjur, West Java: Implications for management of cultural keystone species. Biodiversitas 18: 275-282. DOI: 10.13057/biodiv/d180135.
Pokharel N, Adhikari Pokharel B. 2021. A relationship between plants and their Hindu and Buddha Cultures: An analysis *Ficus Religiosa* (Pipal). In: Niglio O, Lee EYJ (eds). Transcultural Diplomacy and International Law in Heritage Conservation: A Dialogue between Ethics, Law, and Culture. Springer Singapore, Singapore. DOI: 10.1007/978-981-16-0309-9_10.
Powo.science.kew. 2023. The royal botanic gardens plants of the world online. https://powo.science.kew.org/. (accessed 02.02.2023).
Prahmana RCI, Yunianto W, Rosa M, Orey DC. 2021. Ethnomathematics: Pranatamangsa system and the birth-death ceremonial in Yogyakarta 12 (1): 93-112. DOI: 10.22342/jme.12.1.11745.93-112.
Putra AK, Purwanto, Islam MN, Hidayat WN, Fahmi MR. 2022. Development of mobile virtual field trips in Ijen Crater Geosites based on 3600 auto stereoscopic and geospatial technology as geography learning media. Geo J Tour Geosites 41 (2): 456-463. DOI: 10.30892/gtg.41216-850.
Rachmah H, Tsaury AM, Alhamuddin A, Gunawan R. 2022. Development of social skills based on local wisdom in the Osing Community of Kemiren Village Banyuwangi, East Java. Adv Soc Sci Educ Humanit Res 658: 211-215. DOI: 10.2991/assehr.k.220407.041.
Setyaningrum EW, Masithah ED, Yuniartik M, Nugrahani MP, Dewi ATK. 2020. Comparison of water quality and its influences on phytoplankton abundance based on water characteristics in coastal of Banyuwangi District, Jawa Timur, Indonesia. IOP Conf Ser: Earth Environ Sci 441: 012129. DOI:10.1088/1755-1315/441/1/012129.
Setyo WFN, Muryani C, Nurhadi N. 2022. Toponymic and historiography influences on place naming of villages in Klego District, Indonesia. KnE Soc Sci 7: 89-100. DOI: 10.18502/kss.v7i16.12155.
Silcock JL, Tischler MK, Fensham RJ. 2020. Oases at the gates of hell: Hydrogeology, cultural history and ecology of the Mulligan River Springs, far Western Queensland. Proce R Soc Queensland 126: 91-107. DOI: 10.3316/informit.626589576097202.
Sodangi M, Kazmi ZA. 2020. Integrated evaluation of the impediments to the adoption of coconut palm wood as a sustainable material for building construction. Sustainability 12 (18): 7676. DOI:10.3390/su12187676.
Tardiõ J, Pardo-de-Santayana M. 2008. Cultural importance indices: A comparative analysis based on the useful wild plants of Southern Cantabria (Northern Spain). Econ Bot 62: 24-39. DOI: 10.1007/s12231-007-9004-5.

Theplantlist. 2023. http://www.theplantlist.org/. (accessed 02.02.2023).
Triana HW, Kustati M, Nelmawarni, Reflinaldi. 2022. West coastal toponyms of Sumatra Island: A corpus linguistics study. OKARA: Jurnal Bahasa dan Sastra 16 (1): 90-108. DOI: 10.19105/ojbs.v16i1.6163
Vioretha N. 2022. Identifying the myth of the banyan tree circulating in the community. Semesta: J Sci Educ Teaching 5 (2): 99-103. DOI: 10.24036/semesta.v5i2.74.
Wassie SB. 2020. Natural resource degradation tendencies in Ethiopia: A review. Environ Syst Res 9: 1-29. DOI: 10.1186/s40068-020-00194-1.
Zhao F, Zhang S, Du Q, Ding J, Luan G, Xie Z. 2021. Assessment of the sustainable development of rural minority settlements based on multidimensional data and geographical detector method: A case study in Dehong, China. Soc-Econ Plan Sci 78: 101066. DOI: 10.1016/j.seps.2021.101066.