Food traditions and biodiversity conservation of the Javanese Community in Gunungkidul Karst, Yogyakarta Province, Indonesia

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Abstract. Sulistiyowati E, Setiadi, Haryono E. 2022. Food traditions and biodiversity conservation of the Javanese Community in Gunungkidul Karst, Yogyakarta Province, Indonesia. Biodiversitas 23: 2080-2092. Local traditions manifested through foods and rituals may have contributed to the conservation of plants. In this study, we explore how the Javanese community living in the dryland Karst Gunungkidul, Yogyakarta Province, Indonesia, uses food traditions and rituals to conserve plant diversity and, to some extent, conserve the ecosystem. The primary method was free listing interviews with 109 respondents, followed by in-depth interviews with 19 people of senior community members, local leaders (sesepuh), and customary leaders (juru kuncu). The study found that local people use 43 species of 19 families to produce ten culinary varieties as the local food tradition. This concept reflects the local ecological knowledge to support biodiversity and ecosystem conservation in the area.

Keywords: Biodiversity conservation, food tradition, Java, plant-based food, rituals, slaman

INTRODUCTION

As an essential element of the culture, foods have become a shared value that shapes social practice in an ethnic group (Dean 2019; Reddy and van Dam 2020). From the cultural perspective, food has two meanings; material meaning and the symbolical meaning of respecting the spiritual beings (Nasir 2019). Local people may use rituals to symbolize a repayment for nature (Geng et al. 2017). This concept reflects the local ecological knowledge of conservation. In addition, local people tend to maintain plants diversity in their culinary traditions and rituals because a particular species may refer to a cultural symbol that can not be replaced by another (Sutrisno et al. 2020). The beliefs and rituals build an intimate relationship between people and their environment, which leads to awareness of participating in conservation efforts (Kealilikanaokaeohaiillilani et al. 2021).

The connection between foods, culture, and biodiversity has been studied in ethnobiology. Among the studies, for example, the use of palms in ceremonies (Gruca et al. 2014; Campos et al. 2019); bananas in traditional ceremonies in Northern India (Sarma et al. 2020), and plant rituals in China (Geng et al. 2017). In Indonesia, there are similar examples of research, such as foods served during Ramadan in Aceh (Manan et al. 2022); foods of Riau People in Sumatra (Mardatillah et al. 2019); the genealogy of cassava-based culinary in Java (Hermingrum 2019); ethnic food of Sasek Tribe (Sukenti et al. 2016); and plant rituals in Aceh (Sutrisno et al. 2020). Indonesia is a multicultural country with 15 major ethnic groups and approximately 1,300 sub-ethnic groups (Ananta et al. 2015; Auwalin 2020). Therefore, the study of plants, food traditions, and rituals is fundamental. Such a study will help preserve culture and allow biodiversity conservation in the long term.

This research explores the food traditions, rituals, and plant conservation in one of the major ethnicities in Indonesia, the Javanese. The Javanese people constitute about 40.06% of the total population of Indonesia (Suhamono and Syahruraman 2018). As a case study, this research focused on Javanese people who live in Karst Gunungkidul in Yogyakarta Province, Indonesia. Gunungkidul was chosen for this study because most live in rural areas and maintain a traditional way of living (Rahmadi 2018). Moreover, Gunungkidul's economy has recently been opened to tourism that offers ecotourism and the protection of nature (Isdarmanto et al. 2018; Saputro et al. 2020; Kusumayudha et al. 2021) and culinary tourism (Marwanti et al. 2020).

This paper explores food traditions and rituals and discusses their importance in biodiversity (plants) conservation efforts. By doing this kind of study, we seek to contribute to biodiversity conservation based on local knowledge and culture. The novelty of this article is in its approach to linking food traditions, rituals, and biodiversity conservation. It is different from other research that discusses the aspect of ethnobiology of wild plants for maintaining food security (Abdullah et al. 2021; Kidane and Kejela 2021). This paper does not solely discuss plants...
and rituals (Bamin and Gajurel 2015; Geng et al. 2017; Sarma et al. 2020). Although several authors have conducted ethnobotanical studies of medicinal plants in Gunungkidul (Nahdi and Kurniawan 2019), the use of plants for food and rituals in the area has not yet been documented.

**MATERIALS AND METHODS**

**The community and the context**

One of the widely recognized Javanese communities that still hold on to traditional systems and values is living in the Karst Gunungkidul (also called Karst Gunungsewu), Yogyakarta Province, Indonesia. The research on this landscape was first delivered by Junghunn in 1845 and was continued by Herbert Lehmann in 1936. The total length of the karst is 85 km, and the maximum width is 30 km (Tjia 2013). The karst consists of approximately 40,000 conical hills spread over Java Island, from Pacitan in East Java Province to Gunungkidul in Yogyakarta Special Province, Indonesia (Tjia 2013; Khotimah 2019).

Gunungkidul experienced severe environmental degradation in the past, with most of its land converted into agricultural land (Khotimah 2019; Puspanti et al. 2021). As a result, Gunungkidul is a distinct community characterized by agriculture and traditional living practices; approximately 45% of the total workforce depends on agricultural and natural resources sectors (Central Statistics Agency 2020). Although the land is dry and infertile, Gunungkidul is inhabited by 768,523 people, with a population density of about 245 people/km² (Central Statistics Agency 2020). Hindus and Buddhists influenced the early culture of the Gunungkidul people (Ahmadi et al. 2021). However, the percentage of Hindus and Buddhists is less than 1% of the total population, at about 0.053% and 0.001%, respectively. Overall, 95% of the population is Moslems (Central Statistics Agency 2020). People believed that their ancestors originated from the Great Hindu Kingdom Majapahit (1293-1527) in East Java-based on local folktales. However, the archaeological proofs of the folktales were not yet found. The remnants of Majapahit’s influence could only be found in terms of folktales (Panji of Majapahit) in a wayang beber performance (Ahmadi et al. 2021) and mask art (Subiyantoro et al. 2021).

**Data collection**

We collected data through interviews and field visits. Key persons were chosen by a purposive sampling method. Open questions were administered to explore the knowledge, practice, and belief on the food traditions, plants, rituals, and conservation. Observation and field diaries were generated during 21 field visits to the respondents’ hamlets. Key persons in this research originated from seven hamlets in three districts (Semanu, Panggang, and Girisubo). The seven hamlets include: Bulu, Plebengan, Turunan, Pejaten, Kandri, Tileng, and Teken (Figure 1).

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**Figure 1.** Map of the research location in the Karst Gunungkidul, Yogyakarta, Indonesia. Hamlets are indicated in number, from 1 to 7.
The first part of this research will seek to understand people’s knowledge of plants around them and the species’ use in culinary traditions according to their experiences. In eight months (October 2020–June 2021), we conducted a free-listing study to collect information about food traditions and local culinary recipes in the studied area (see Quinland 2018; May and Lewis 2020). There are 109 respondents involved in the free-listing study. The respondents were chosen purposefully based on their age and experiences in practicing rituals and food traditions. All the background information regarding the respondents was obtained from the head of the hamlet (dukuh) (Table 1).

After conducting a free listing, we asked 19 key respondents to explore in-depth knowledge about plants, food traditions, and rituals. Finally, we conducted a semi-structured interview following the method by May and Lewis (2020). The respondents were categorized as the elderly (sesepuh) or the village’s customary leader (juru kunci or kaum). There could be several sesepuhs, depending on the hamlets. Sesepuh could also mean a senior community member or the village’s formal leader.

Each interview with key respondents lasted for about one to two hours at the respondent's home. We conducted home visits and face-to-face meetings because online communication and by-phone interviews were challenging due to the village's remoteness.

We asked questions about the following: 1) list of the plants used in the traditional culinary, 2) name of the foods, 3) the significance of the plant to the cuisine, 4) the practice and beliefs of local people concerning the customs and rituals involved in the cuisine.

**Data analysis**

From the free listing data, we calculated the Use Value (UV) using as follows by Hoffman and Gallaher (2007):

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\text{Use Value (UV)} = \frac{\text{Number of citations per species (C)}}{\text{Number of informants (N)}}
\]

The qualitative data analysis started with transcribing the interview recording and generating insights from field notes. To help with the transcription, we use InqScribe software. Then, data coding and data categorization were conducted using Microsoft Excel. After generating codes and categories, we developed the descriptions and narratives of the findings using the theme and subthemes. Overall, we follow the qualitative research steps by Creswell (2012) and Albuquerque et al. (2014).

**RESULTS AND DISCUSSION**

**Food traditions in Gunungkidul**

Based on the free listing study, the respondents listed 43 wild and cultivated species used in their food traditions and daily menu. The plants are used as staples, side dishes, and vegetables. The UV value varies from 0.01 to 0.80. Rice (*Oryza sativa*) and cassava (*Manihot esculenta*) have the highest UV values. They are 1 and 0.56, respectively. Other species that have a high UV are *kecipir* (*Psophocarpus tetragonolobus*), *bayam* (*Amaranthus* sp.), and *banana* (*Musa paradisiaca*).

People in Gunungkidul have developed local food traditions using local plants as ingredients. The respondents mentioned three main staples and ten side dishes (Table 2; Figure 2). The species used for making the cuisine come from several families, namely Poaceae, Euphorbiaceae, Caricaceae, Fabaceae, Rubiaceae, Moraceae, Pedaliaceae, Gnetaceae, Amaranthaceae, Musaceae, Cucurbitaceae, Solanaceae, Convolvulaceae, Asteraceae, Sapindaceae, Moringaceae, Lamiaceae, and Areceae.

Many plants that compose the traditional food of Gunungkidul are mostly planted species as a part of the agrobiodiversity that forms the agroecosystem. In many ways, the protection of agrobiodiversity contributes to conservation in general (Bennett et al. 2017), as many conservation efforts occur in the agricultural setting (Santos et al. 2021). In addition, the knowledge of species as ingredients to make local cuisine is a part of local ecological knowledge that contributes to conservation.

In terms of staple food, unlike any other Indonesian region that relies on rice (Davidson 2018), the people of Gunungkidul develop local staple traditions in the form of cassava rice and maize rice. The use of cassava as the main staple of Gunungkidul people could not be separated from the famine incident called the *gaber* catastrophe in 1962-1963. *Gaber* was a name given to a severe food crisis occurring in Gunungkidul Regency. Our respondents, who were all above 60 years old and had been a toddler or a teenager in that year, recalled that *gaber* was the most challenging time among people of Gunungkidul. Pujo from Semanu District (male, 74 years) described that *gaber* as a solid cake made of rotten cassava flour. Although it was very unappealing, Pujo could not afford other foods because rats had eaten most food and even plants in the field. Our respondents recalled that after *gaber*, people saved and made use of everything that could be eaten in their village, including papaya’s stems and leaves (*Carica papaya*), bananas’ stems (*M. paradisiaca*), and wild vegetables. Unfortunately, there was not much literature discussing the gaber catastrophe in Gunungkidul. A classic work by Nibbering (1993) associated the threat to food security with the prevalence of rats that destroyed agriculture. Nevertheless, a more recent article described that food security in Gunungkidul has been achieved by implementing rice subsidies and the culture to uphold the consumption of local staples (Utami et al. 2018).

**Table 1. The profile of respondents**

| Criteria       | Semanu | Panggang | Girisubo |
|----------------|--------|----------|----------|
| Number of respondents | 37     | 30       | 42       |
| **Gender**     |        |          |          |
| Male           | 21     | 16       | 28       |
| Female         | 16     | 14       | 14       |
| **Education**  |        |          |          |
| No formal education | 12    | 3        | 7        |
| Elementary School | 16    | 21       | 30       |
| Junior High School | 7     | 5        | 1        |
| Senior High School | 2     | 1        | 4        |
| **Age (average)** | 67.2  | 63.2     | 63.1     |
| Food traditions | Description | Local name | Common name | Species as the main ingredient | Family | Part used | UV |
|-----------------|-------------|------------|-------------|-------------------------------|--------|-----------|----|
| Main staple (Grains) | Main staples as the source of carbohydrate | Beras | Rice | Oryza sativa | Poaceae | Seed | 1.00 |
| | | Tiwal | Cassava rice | Manihot esculenta | Euphorbiaceae | Tuber | 0.56 |
| Pecel and Urap | Pecel: A type of salad with mixed vegetables and peanut sauce. Urap: the salad is mixed with shredded coconut in a paste made of chili, palm sugar, and galangal | Jagung | Maize rice | Zea mays | Poaceae | Seed | 0.27 |
| | | Pepaya | Papaya | Carica papaya | Caricaceae | Flower, leaf, young stem | 0.09 |
| | | Turi | Vegetable hummingbird | Sesbania grandiflora | Fabaceae | Flower, leaf, young seed | 0.09 |
| | | Pace | Noni | Morinda citrifolia | Rubiaceae | Young leaf | 0.05 |
| | | Daqlek/daun kupu-kupu | Bauhinia | Bauhinia purpurea | Fabaceae | Young leaf | 0.14 |
| | | Ipek | Ficus | Ficus sp | Moraceae | Leaf | 0.03 |
| | | Dadap | December tree | Erythrina subumbrans | Fabaceae | Leaf | 0.03 |
| Sambal | A thick paste made of chili, onion, and the intended ingredients | Wijen | Sesame | Sesamum indicum | Pedaliaceae | Seed | 0.04 |
| | | Kacang tanah Benguk | Velvet bean | Mucuna pruriens | Fabaceae | Seed | 0.15 |
| | | Lentoro | White popinac | Leucaena leucocephala | Fabaceae | Seed | 0.17 |
| | | Kedelai | Soy bean | Glycine max | Fabaceae | Seed | 0.26 |
| | | Koro | Jack bean | Canavalia sp | Fabaceae | Seed | 0.30 |
| | | So | Gnemon/ Melinjo | Gnetum gnemon | Gnetaceae | Young leaf, flower, and fruit peel | 0.28 |
| Jangan asem-asem | A type of sour soup with mixed vegetables, spiced with onion, shallot, bay leaves, galangal, and shrimp paste | Asem | Sour Tamarind | Tamarindus indica | Fabaceae | Young leaf, fruit | 0.11 |
| | | Bayam | Spinach | Amaranthus sp | Amaranthaceae | Young leaf | 0.44 |
| Jangan gabrus | A type of soup made of shredded coconut, spiced with crushed onion, shallot, bay leaves, and galangal | Kecipir | Winged beans | Psophocarpus tetragonolobus | Fabaceae | Young fruit | 0.49 |
| | | Kacang potro | Cowpea | Vigna unguiculata subsp. Unguiculata | Fabaceae | Seed, young fruit, young leaf | 0.18 |
| | | Kacang gede Gedang | Pigeon pea | Cajanus cajan | Fabaceae | Young seed | 0.21 |
| Jangan gurah | a type of soup made of shredded coconut, spiced with crushed onion, shallot, bay leaves, and galangal | Walaah | winter squash | Musa paradisiaca | Musaceae | Flower, stem | 0.32 |
| | | Bligo | Wax gourd | Cucurbita pepo | Cucurbitaceae | Fruit | 0.16 |
| | | Kelawih | Breadfruit | Benincasa hispida | Cucurbitaceae | Fruit | 0.05 |
| Jangan lombok | a type of soup made of shredded coconut, spiced with crushed onion, shallot, bay leaves, and galangal | Lombok | Chilli | Capsicum frutescens/ Capsicum annum | Solanaceae | Fruit | 0.72 |
| | | Petai | stink bean | Parkia speciosa | Fabaceae | Seed | 0.09 |
**Oseng-oseng** sauteed vegetables, usually mixed with tempeh and chili pepper and seasoned with onion and soy sauce.

**Koro pedang** Pig bean *Canavalia ensiformis* Fabaceae Young seed 0.03

**Koro uceng** Jack Bean *Canavalia sp* Fabaceae Young seed 0.13

**Pare** Bitter melon *Momordica charantia* Cucurbitaceae Young fruit 0.19

**Lalab (fresh)** Fresh vegetables, usually eaten as condiments, accompanied with *sambal bawang* (crushed garlic and chili), or *sambal terasi* (crushed onion, chili, and shrimp paste).

**Koro pedang** Pig bean *Canavalia ensiformis* Fabaceae Young seed 0.03

**Koro UCeng** Jack Bean *Canavalia sp* Fabaceae Young seed 0.13

**Pare** Bitter melon *Momordica charantia* Cucurbitaceae Young fruit 0.19

**Lalab (boiled/stewed)** Boiled/stewed leaves, usually eaten as condiments.

**Lantas** Indian camphorweed *Pluca indica* Asteraceae Leaf 0.09

**Lang** Sweet potato *Ipomoea batatas* Convolvulaceae Leaf 0.15

**Kenikir** Cosmos *Cosmos caudatus* Asteraceae Leaf 0.12

**Sambi** Lac tree *Schleichera oleosa* Sapindaceae Leaf 0.01

**Kelor** Moringa *Moringa oleifera* Moringaceae Leaf 0.03

**Legetan** Panicle spot flower *Acmeila paniculata* Asteraceae Leaf 0.02

**Gudeg** A type of dish made with coconut milk spiced with turmeric, galangal, bay leaves, and kemiri.

**Kelapa** Coconut *Cocos nucifera* Areaceae Young flower, milk 0.80

**Keluwih** Breadfruit *Artocarpus camansi* Moraceae Young fruit 0.05

**Gori** Jack fruit *Artocarpus heterophyllus* Moraceae Young fruit 0.17

**Figure 2.** Several plants are used for making traditional foods in dryland Karst Gunungkidul (pictured in their natural habitat): A. Papaya (*Carica papaya*), B. Tayuman (*Bauhinia purpurea*), C. Lombok *inert* local chili with the variety called *inert* (*Capsicum annuum*), D. So/mlinjo (*Gnetum gnemon*), E. Turi (*Sesbania grandiflora*), F. Lang (*Ipomoea batatas*), G. Terong lalab (*Solanum torvum*), H. Kecipir (*Psophocarpus tetragonolobus*).

The irrigation network does not support Gunungkidul’s agricultural land. Hence, agricultural produce is governed by the season. The primary carbohydrate source -rice and cassava- are planted in the terraced lands. Although cassava is now considered the primary commodity of Gunungkidul and hence influences the staple and culinary...
traditions of Gunungkidul, cassava itself is not a native plant of Java. The tuber was native to South America and brought to Asia in the 1800s (Malik et al. 2020).

Tiwal and giatot are two kinds of traditional foods popular in Gunungkidul. Varieties of recipes were made to increase the flavor of cassava. The recipes range from staple food to crisps fried in palm oil. We generated an illustration of several types of commonly cassava-based food on the daily menu of local people (Figure 3). The varieties of local cassava-based culinary in Gunungkidul are relatively similar to the study reported by Herminingrum (2019).

Rituals in Gunungkidul

The most commonly used term for a traditional ceremony in the Javanese culture is slametan. Slametan is conducted to protect human beings from evil spirits, in which Javanese people pray for the state of slanet, which means "nothing is going to happen (to anyone)" (Geertz 1976). The word slametan derives from salam's Arabic word based on its terminology. At slametan, people serve food offerings for the spirit and invisible beings and meals for the guests who attend the ceremony. The food is for eating and serving a spiritual duty to repay nature. However, it could also be translated as an indirect strategy for conservations. Before creating the offerings, local people are fully aware of protecting, planting, and maintaining the plants.

Throughout the year, local people conduct many rituals or slametan. The respondents cited that there are 29 rituals performed for various purposes. The rituals could be categorized chronologically based on a person's agricultural cycle and life cycle. For example, based on the agricultural cycle, there are rituals to mark the beginning of the planting season (5 practices), the maintaining of agricultural plants (4 practices), and the harvesting season (8 practices) (Table 3). Meanwhile, life cycle rituals from the wedding to the death of a person (10 practices) will be discussed in a separate section.

The respondents cited that not all village members perform all rituals. However, there are several rituals considered compulsory. They are rasulan, gumregan, and life cycles rituals. In this paper, we delved into the three main ceremonies aforementioned. The rituals require foods made from local plants as the main ingredients. The composition of food and plant ingredients is ruled by unwritten traditional customary principles passed from one generation to another.

Rasulan, the post harvesting ceremony

Rasulan ceremony is described as a ritual to offer God gratitude that the agricultural harvest has been abundant (Rahayu 2019). Another author described that peasants often perform it once a year, especially after a harvest season (Adriyanto and Kusdarini 2020). In general, the ceremony begins with the head of the indigenous custom (Juru Kunci) bringing an offering arranged in a basket made of young coconut leaves (janur). This basket is called panjang ilang. These panjang ilangs contain specific food offerings and adornments (uborampe). The most complicated panjang ilang is in Bulu Hamlet, consisting of 14 types, whereas the most modest is in the Turunan Hamlet, with only one panjang ilang.

The origin of food traditions during rasulan in the dry karst of Gunungkidul is not yet known. However, it is often linked to the history of the Gunungkidul people. Locals believe that their ancestor was King Brawijaya of the ancient Majapahit Kingdom (1201-1550) in East Java, although archaeological artifacts hardly prove it. Nonetheless, the similarity of food traditions in Gunungkidul with Hindu origin is observed. For example, panjang ilang, sajen, and tumpeng could be observed in the Hindu religion (Geertz 1976). This culture is also linked to Javanese's animistic beliefs long before the Hindu religion. Moreover, the resemblance of tumpeng - the cone-shaped rice- to Mount Meru strengthens the claim (Woodward 2011). For the local people, tumpeng symbolizes ecology and the ideal concept of conservation (Figure 4).

As the biggest harvest festival, all village members usually celebrate the rasulan. The ceremony begins with purifying the village from spiritual impurities. People go to the nearest shrine, called resan. In our respondents' villages, the resan usually is a big tree near water sources. In Bulu Hamlet, the resan is the bubu tree (Ficus annulata) and in Pejaten is the banyan tree (Ficus benjaminia). A customary local leader (juru kunci) cited prayers in the resan, sometimes accompanied by an arrangement of offerings called sajen. The sajen contains white and red rose petals (Rosa sp.), kenanga (Cananga odorata), kantil (Michelia campaca), suruh leaves (Piper betle), tobacco (Nicotiana tabacum), menyam (incense), melati (Jasminum sp.), and gambir (Uncaria sp.).

Several important foods, mostly from agricultural produce, must be present during rasulan. A basket of tubers, called the rak-rak, symbolizes the welfare of the village. The rak-rak consists of boiled cassava (M. esculenta), uwi (Dioscorea alata), gembili (Dioscorea esculenta), kimput (Xanthosoma sp.), and kentang klevi (Plectranthus rotundifolius). A bamboo basket (tampah) is filled with rice, dish, and snack. The dishes' compositions are ingkang (chicken in coconut milk), jangan lombok (chili cooked with onion and shallot and sometimes stinky beans/Parkia speciosa), boiled eggs, and fried noodles. In some hamlets such as Plebengan Hamlet in Semanu District, as described by Pak Kas (male, 59 years), the rasulan always requires a particular snack made of traditional cereals of jawat (Setaria italica), cantel (Sorghum bicolor), and ketan (Oryza sativa var glutinosa). The grains are made into rice cakes called jadah. Jadah is made by stewing the cereals, mixing the ingredients with coconut shreds, and grounding the cake until soft and chewy.

The sticky rice cake jadah symbolizes togetherness among villagers, hoping that they, their families, and friends could "stick" together (Jiyo, male, 62 years). At the rasulan, each household cooks abundant foods. Then, they invite people to eat with the family. The family food usually consists of rice, fried noodle, chicken in coconut milk, sweetened fried tempeh and tofu, and jangan lombok (chili in coconut milk).
Slametan: Ceremonies marking the birth, wedding, and death

A particular slametan marks a special event in a person's life cycle. Each slametan involves an elaborate ceremony and requires multiple food arrangements and offerings (uborampe). Here, we compiled the use of food arrangements in slametan, described by the juru kunci (the customary leader) (Table 4).

Figure 3. Cassava-based food in dryland karst Gunungkidul. A. Cassava tuber (Manihot esculenta); B. Dried cassava, called gaplek; C. Cassava flour; D. Manggleng, dried cassava and fried in palm oil; E. Lempeng, the cassava crisps; F. Gatot, the greyish and brownish dried cassava soaked in water for three days and then is steamed with shredded coconut; G. Tiwul or the cassava rice; H. Lemet, sweet cassava cake wrapped in banana leaves.

Figure 4. Food and its adornment (uborampe) in the traditional slametan. A. A tumpeng consists of cone-shaped rice, vegetable salad in shredded coconut, and boiled eggs; B. Kembang boreh, consisting of 1. Red and white rose petals, 2. Dlingo (Acorus calamus) and bengle (Zingiber cassumunar), 3. Kenanga (Canangium odoratum); C. Sajen rasulan (the offerings for rasulan) consists of 1. Mbako (tobacco), 2. Sirih (Piper betle), 3. Red and white rose petals (Rosa sp.), 4. Cempaka (Michelia champaca), 5. Menyan (incense), 6. Gambir (Uncaria sp.), 7. Injet (limestone paste), 8. Melati (Jasminum sp.).


**Table 3. Rituals performed by villagers**

| Name of rituals          | Purpose                                                                 | Food traditions/ species                                                                 |
|--------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| **Beginning of the planting season** |                                                                       |                                                                                          |
| Witwit                   | Marking the beginning of the planting season                            | Rice and side dishes (bancakan) Main staple: *Oryza sativa* Side dishes: *Urap* made of *Amaranthus* sp., *Vigna sinensis*, *Vigna radiata*, *Daucus carota*, *Cocos nucifera*, *Allium cepa*, *Allium sativum* *Kaemferia galanga*, *Oryza sativa* (seeds) |
| Mendemi                  | Seeds are planted                                                       | Rice Main staple: *Oryza sativa* Side dishes: *Urap* made of *Amaranthus* sp., *Vigna sinensis*, *Vigna radiata*, *Daucus carota*, *Cocos nucifera*, *Allium cepa*, *Allium sativum* |
| Labuh                    | Rice and main staples are brought to the field                          | Rice Main staple: *Oryza sativa* Side dishes: *Urap* made of *Amaranthus* sp., *Vigna sinensis*, *Vigna radiata*, *Daucus carota*, *Cocos nucifera*, *Allium cepa*, *Allium sativum* |
| Tanam                    | Main staples are planted                                                | No offer only prayers cited on the site.                                                 |
| Nyebar                   | Rice is not planted but dispersed in the ground                         | Rice (seed), no offers, only prayers cited on the site.                                  |
| Nadah udan               | Asking for rain                                                         | Rice, food adornments, drinks made from rice jelly Main staple: *Oryza sativa* Side dishes: *tumpeng* made of *Amaranthus* sp., *Vigna sinensis*, *Vigna radiata*, *Daucus carota*, *Cocos nucifera* (milk), *Allium cepa*, *Allium sativum* *Jangan lombok* comprises *Capsicum frutescens*, *Capsicum annuum*, *Allium cepa*, *Allium sativum*, and *Alpinia galanga* Flower offering: *Rosa* sp., *Cananga odorata*, *Michelia champaca*, *Nicotiana tabacum* |
| **During the maintenance of plants** |                                                                       |                                                                                          |
| Pari dandan              | Performed when rice is bloom by giving flowers                          | A white powder was sprinkled into the rice paddy. The powder is made of *Kaemferia galanga* and *Oryza sativa* (flour) Flower offering: *Rosa* sp., *Cananga odorata* side dishes |
| Sedekah                  | Praying that the plants grow well by giving food to neighbors           | Side dishes: *urap* made of *Amaranthus* sp., *Vigna sinensis*, *Vigna radiata*, *Daucus carota*, *Cocos nucifera* (milk), *Allium cepa*, *Allium sativum* *Jangan lombok* comprises *Capsicum frutescens*, *Capsicum annuum*, *Allium cepa*, *Allium sativum*, and *Alpinia galanga*. Flower offering: *Rosa* sp., *Cananga odorata*, *Michelia champaca*, *Nicotiana tabacum*, *Musa parasitica* (fruit). |
| Bancakan                 | Praying that the plants grow well by giving food to neighbors           | rice and simple side dishes consist of rice, *urap*, boiled eggs, and fried noodle.     |
| Kirim wedak/ Kirim parem/pareman | Giving powder made of rice flour to rice planted in the field         | powder made of galangal (*Kaemferia galanga*) and rice (*Oryza sativa*)                 |
| **Wiwit panen**          | Marking the beginning of harvest by giving food to children and neighbors | Rice and side dishes, flowers as offerings *Musa parasitica*, *Capsicum annuum*, *Allium sativum*, *Allium cepa*, *Sesbania grandiflora*, *Erythrina subumbran* Flower offerings: *Rosa* sp., *Cananga odorata*, *Pandanus* sp. |
| Bancakan                 | Praying that the harvest is abundance by giving food to neighbors       | Rice and side dishes (same as above)                                                     |
| Rasulan                  | The most significant harvest ceremony performed in the village         | Rice, side dishes, food adornment, and flowers (discussed in detail in the following subtitle) |
| Kirim dowa               | Sending prayers to the ancestor                                         | Rice, side dishes (same as *sedekah*)                                                   |
| Bersih dusun             | Cleaning the village                                                    | Rice, side dishes (same as *rasulan*)                                                   |
| Bancakan beji            | Cleaning the water source                                               | Flowers (same as *rasulan*)                                                             |
| Sadranan                 | The substantial harvest ceremony performed in the village              | Flowers, food adornment (same as *rasulan*)                                             |
| Gunregan/gunreg          | Paying respect to cattle and agricultural tools                         | Rice, dishes, *ketupat* Offering: rice cooked in young coconut leaves, shaped in rhomboid, called *ketupat* Flower offering: *Rosa* sp., *Cananga odorata*, *injet* (limestone paste) |
Table 4. The foods and ceremonies accompany a person’s life cycle

| Event       | Name of ceremony | Major food arrangements involved in the ceremony | Description of the foods/species | The meaning of the ceremony |
|-------------|------------------|---------------------------------------------------|----------------------------------|-----------------------------|
| Birth       | Lairan           | Bancakan                                          | Main staple: rice (*Oryza sativa*)<br>Main dish: Urap comprises of rice and side dishes (*bancakan*)<br>Main staple: *Oryza sativa*<br>Side dishes: Urap made of *Amaranthus sp.*, *Vigna sinensis*, *Vigna radiata*, *Daucus carota*, *Cocos nucifera*, *Allium cepa*, *Allium sativum*<br>Fruits: *Musa paradisiaca*<br>Protein source: eggs, chicken | To celebrate and give blessing to the newborn and the mother so that both are healthy |
| Puputan     | Bancakan, Jenang abang-putih | Same as the event above | Main offering: Red and white rice porridge (*Oryza sativa*). The red porridge is made of rice, coconut milk, and palm sugar that gives brownish color, and this is to represent red. Besides, white porridge is a simple rice porridge in coconut milk, without sugar | To celebrate the fell off of a baby's umbilical stump The red and white porridge represents two supernatural siblings who accompany the baby. The first sibling is the umbilical cord (red), and the second is the amniotic liquid (white). Javanese believe that the two siblings accompany a person from birth to death, and is commonly called in the phrase “kakang kawah, adi ari-ari,” which means the bigger brother is the amniotic fluids and the younger brother is the umbilical cord |
| Jajan pasar | Bancakan         | Fruits: *Salak* (*Zallaca edulis*), *rambutan* (*Nephelium lappaceum*), banana (*Musa paradisiaca*), snacks: cassava-based snacks (*Manihot esculenta*) such as gethuk or lemet and judah (sticky rice cake) made of *Oryza sativa var glutinosa* | To give a blessing to a baby so that the baby can be prosperous in the future |
| Selapan     | Bancakan         | Same as the event above | The baby is given a tassel made of *dliingo* (*Acorus calamus*) and *bengle* (*Zingiber montanum*) | Same as above, but *bancakan* in this event is more sophisticated in the main foods and dishes |
| Teen Ager   | Sunatan (circumcision) for boys only | Kendari | Main staple: Rice (*Oryza sativa*)<br>Main dishes: Urap made of *Amaranthus sp.*, *Vigna sinensis*, *Vigna radiata*, *Daucus carota*, *Cocos nucifera*, *Allium cepa*, *Allium sativum*<br>Protein source: *ingkang* (chicken in coconut milk), sweetened tempeh or mear in palm sugar (*Cocos nucifera*), *salam* (*Syzygium aromaticum*), *laos* (*Alpinia galanga*), coriander (*Coriandrum sativum*), shallot (*Allium cepa*), garlic (*Allium sativum*) | To pray for the boy’s health and mark the boy’s journey to adulthood. Foods are served to men who gathered in the boy’s house the night after circumcision. The gathering of the men is supposed to pray for the boy to enter his adulthood with a blessing and nothing harmful endangers him |
| Event            | Kenduri                                                                 | Tumpeng                                                                                     | Notes                                                                                                                                                                                                 |
|------------------|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Adult Wedding    | Main staple: Rice (*Oryza sativa*)<br>Main dishes: *Urap* made of *Amaranthus sp*, *Vigna sinensis*, *Vigna radiata*, *Daucus carota*, *Cocos nucifera*, *Allium cepa*, *Allium sativum*<br>Protein source: *ingkung* (chicken in coconut milk), sweetened tempeh or mear in palm sugar (*Cocos nucifera*), *salam* (*Syzygium aromaticum*), *laos* (*Alpinia galanga*), coriander (*Coriandrum sativum*), shallot (*Allium cepa*), garlic (*Allium sativum*)<br>To pray for the bride and groom's welfare. The varieties of food served during the kenduri represent the hope for a prosperous wedding | A tumpeng is cone-shaped rice. Several dishes are laid on the bottom of the cone, such as *ingkung*, which is chicken in coconut milk and bay leaves; *urap* or vegetables in shredded coconut; boiled eggs, tempeh, and meat | Cone-shaped rice called tumpeng represents the ecosystem where people live, resembling a mountain. The variety of dishes represents prosperity |
| Death            | **Geblag** (the first day of a person's death) and **pitung dinan** (the seventh day of a person's death) | same as the event above | Foods are served to men during the kenduri. Kenduries will be conducted seven days after a person's death. In kenduri, people recite prayers to ask forgiveness for the deceased and bless the remaining family |
|                  | **Kenduri**                                                                 | Tumpeng                                                                                     | **Tumpeng** represents the ecosystem, whereas *ingkung* means a prayer. *Ketan-kolak-apem* is a food trilogy present at a person's death or commemorating a person's passed away. Ketan is made of sticky rice as a symbol of togetherness (stick together), kolak arrives from the Arabic world *Khaliq* or God the Creator, and apem is an interpretation of the Arabic word, *afwan*, which means forgiveness |
| Patangpuluh (40 days of a person's death), nyatus (100 days), and nyewu (1000 days) | Usually the same as above, except that in nyewu (1000 days after a person's passed away), the family typically slaughtered a goat (if the deceased is a female) and two goats (if the deceased is a male)<br>Protein source: Goat meat is usually made into *kicik* or meat seasoned with pala (*Mystica fragrans*) and pepper (*Piper nigrum*). Alternatively, the goat meat is cooked in soy sauce, turmeric (*Curcuma domestica*), pepper, cabbage (*Brassica oleracea*), tomato (*Solanum lycopersicum*), coconut milk (*Cocos nucifera*), *salam* (*Syzygium aromaticum*), *laos* (*Alpinia galanga*), coriander (*Coriandrum sativum*), shallot (*Allium cepa*), and garlic (*Allium sativum*)<br>same as the event above | same as the event above | same as the event above |
| Patangpuluh (40 days of a person's death), nyatus (100 days), and nyewu (1000 days) | Tumpeng                                                                                     | same as the event above | same as the event above |
Gumregan, giving blessings to the cattle

Gumregan is a ceremony held to give blessings to cattle, especially cows and goats. It is held in the month of Gumreg (based on the Javanese calendar). The exact timing of gumreg is decided by the elderly of the village. Gumregan begins with every villager cooking ketupat, rice cooked in an envelope made of young coconut leaves. The shape of the wrapping is usually a three-dimensional rhomboid. The varieties of ketupat are ketupat pengluar, ketupat pendowo limo, and ketupat lepet. Then, Ketupats are given to the cattle, and the horns are given a white sign made of injet (limestone soaked in water). Giving ketupat means giving a blessing to the cattle; hence the animals grow big and produce healthy offspring. In Bulu Hamlet, Semanu District, Sung (male, 68 years) cited that during rasulan, besides ketupat, an offering of flowers is also given to the cattle. The flowers as the offering are called kembang boreh, a mixture between red and white rose petals and kenanga (C. odorata), and a balm made of ground dingo (Acorus calamus) and bengle (Zingiber montanum). The word dingo is an acronym for dho elingo (remember), which means that human beings must remember God, the creator of life. It also means that human beings must protect animals and nature.

The acculturation between Hindu culture and Islamic culture appears in the gumregan. The event of gumregan is often cited as commemorating Prophet Sulaiman (or Solomon in the bible) as one of the prophets in Islam. The ceremony of gumregan shows local appreciation for animals and the plants used to feed them. The gumregan shows that people in Gunungkidul respect their livelihood. Such a ritual may serve as local wisdom for conserving animals, including local plants as the main ingredients of offerings. Some plants, such as dingo (A. calamus) and bengle (Z. montanum), do not only serve for offering but also for making spices and traditional medicine (Rajput et al. 2014; Maneenoon et al. 2015; Khwairakpam et al. 2018).

How food traditions and rituals contribute to conservation

The United Nations Convention on Biological Diversity promotes the potential of traditional and local ecological knowledge for biodiversity conservation (O’Neill et al. 2017; Tengö et al. 2017). The convention document clearly states that conservation and sustainable use of biodiversity should acknowledge indigenous knowledge and practices. Still, there is a need to study the direct link between food traditions, rituals, and conservation. Some research highlights the importance of food traditions to food security (Gras et al. 2016). On the other hand, some others pinpoint the significance of rituals in conservation (Bamin and Gajurel 2015; Sutrisno et al. 2020). Therefore, our finding adds to another dimension of conservation studies: the link between food traditions, rituals, and conservation. We highlighted five principal findings in our research.

First, we found the link between traditions and the conservation of plants and the ecosystem. Rituals in Gunungkidul could not be separated from the use of plants as ingredients of the food offerings. For example, the culture of bringing food offerings to the shrine near a water source during the bancakan beji indicates that water is essential for people living in the dry land. People protect the water materially by cleaning it during rasulan and spiritually by holding a ceremony. The primary offerings of the processions must consist of certain plants. People only use definite leaves and plants as offerings. The strict food arrangements and offerings that require certain plants show that local people have strong motivation to conserve plants through their culture. It means that species used for food traditions and rituals will be conserved because they are irreplaceable (Sutrisno et al. 2020). The concept encourages people to plant and conserve biodiversity in their home gardens.

Secondly, the needs for plants in rituals lead to sustainable agriculture. The locals’ need to perform rites and beliefs set an agricultural system that grows ritual plants. The composition of plants in the local agricultural practice is generally shaped by the needs of foods and to supply offerings during prime events such as rasulan. Modern agriculture that requires planting commodity plants such as rice and maize does not necessarily change the overall species composition grown by farmers. In addition, to preserve food traditions, people produce vegetables and spices used in their daily staples. In the terraced farmland, people conservatively plant cassava (M. esculenta), yams (Ipomoea batatas), corn (Zea mays), coconut (Cocos nucifera), groundnut (Arachis hypogaea), soybean (Glycine max), and somelinho (Gnetum gnemon). Meanwhile, in yards and home-gardens people plant coconut (C. nucifera), clove (Syzygium aromaticum), coffee (family Rubiaceae), cacao (Theobroma cacao), and woods such as sonokeling (Dalbergia latifolia), mahogany (Swietenia macrophylla), lamtoro (Leucaena leucocephala), tobacco (N. tabacum), fruits and vegetables. The varieties remain the same as they were reported by previous studies traced back decades ago (see Uhlig 1980; Simanjuntak 2001). Agriculture shapes foods in the daily menu of villagers and constitutes many important events such as rasulan and slametan.

Third, people demonstrate local ecological knowledge of their landscape ecology. Understanding the local environment as depicted by food symbols, such as tumpeng, shows local ecological knowledge belonging to the group. This type of knowledge could be advantageous to help ecosystem rehabilitation and conservation. The culture of bringing foods to a shrine called resan -which means tree in Sanskrit-near a water source indicates that water is essential for people living in the dry land. Hence people protect the shrine materially by cleaning it during rasulan and spiritually by holding a ceremony in the resan. Resan does not only represent a spiritual place, but it also portrays traditional practices of tending trees as a form of traditional agroforestry. The importance of agroforestry itself has been discussed by much literature, including Suryanto and Putra (2012), Roshetko et al. (2013), and Khasanah et al. (2015). In general, the finding confirms other several studies, reporting that local ecological knowledge aids the protection of wildlife (Turvey et al. 2014; Pereira et al. 2016; Ulicsni et al. 2016), restores ecological balance (Reyes-García et al. 2019), and assists the
community in adapting to climate change (Leonard et al. 2013).

Next, food traditions and rituals show active public participation in conservation. Community participation is crucial for a successful conservation endeavor (Geng et al. 2017). However, in many conservation programs led by the government, public participation appeared to be one of the biggest challenges (Sorice et al. 2013). Despite that, our research confirmed that food traditions and rituals reflect the indirect participation of the local community in conservation efforts. The traditional rituals, such as rasulan, gunregan, and life-cycle rituals, are embedded in the daily rhythm of the local community. The rituals build a personal relationship between people and nature; hence the approaches are considered sustainable (Kealiikanakaoelohaililani et al. 2021).

Lastly, we note that food traditions and rituals construct social identity and cohesion. The sticky rice cake (jadah) symbolizes togetherness at many ceremonies and rituals. Serving traditional meals and inviting neighbors, relatives, and passersby to have meals together during the slametan do not solely reflect the people’s hospitality. We believe that it serves as a measure to alleviate hunger and ensure that all community members can eat invaluable food during the festive. Togetherness and living harmoniously are two principal virtues of the Gunungkidul people, reflected in food and rituals. Besides, although Islam is the major religion in Gunungkidul, traditional beliefs influence people’s identity. The combination creates harmonious life, as depicted in the cone-shaped rice and vegetables that represent the land of Gunungkidul (tumpeng).

To conclude, adapting to available staples, creating culinary recipes, and preserving the culture and plant diversity using rituals are strategies for biodiversity conservation in Gunungkidul. In addition, the conservation effort reflects local people’s adaptive capabilities toward disaster and drought-prone environments. Finally, the practice and beliefs manifested in local people’s rituals are a powerful tool for conservation and more effective than the government’s regulation (Bamin and Gajurel 2015; Geng et al. 2017).

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