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# Observing Stars, Knowledge in Disaster Response: Learning from the Guidelines of the Ancestors at Sinar Resmi Sukabumi

Mengamati Bintang, Pengetahuan Merespon Bencana: Belajar dari Tuntunan Para Leluhur di Sinar Resmi Sukabumi

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#### **ABSTRACT**

Agricultural practices must consider seasonal variations and natural conditions. Astronomy, which involves studying celestial movements, plays a crucial role in this regard. Individuals who possess the knowledge to decipher celestial motions have historically contributed to the advancement of civilizations worldwide. Consequently, the presence of astronomers specializing in astrology is essential. The global agricultural civilization experienced rapid growth before the emergence of the industrial civilization. In the current era of globalization, traditional agricultural systems based on astronomical observations are being abandoned. The adoption of foreign planting techniques has led to a neglect of the indigenous wisdom and knowledge passed down through generations. Over time, our ancestors' local knowledge has gradually faded away. However, the indigenous people of Sinar Resmi, Sukabumi, continue to rely on star observations in their rice farming practices, particularly as a response to natural disasters. This study aims to demonstrate that rice farmers can effectively respond to natural disasters by observing the stars. It employs an oral tradition approach to describe the role of star observations in rice farming, focusing on case studies from the Sinar Resmi community in Sukabumi and other indigenous populations. The findings suggest that star observations in rice farming remain relevant for mitigating the risk of crop failure during natural disasters. The significance of astronomical observations and their inherent value lies in their ability to maintain order and stability in agrarian societies.

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#### **ABSTRAK**

Pertanian yang baik harus mempertimbangkan musim dan keadaan alam. Relasi yang kuat terkait hal itu adalah astronomi, mengamati pergerakan bintang. Peradaban tiap wilayah di dunia menjadi berkembang dengan bantuan orang-orang yang mampu memahami dan memaknai setiap pergerakan benda-benda langit. Hal ini berarti keberadaan astronom, orang yang menguasai perbintangan menjadi sangat penting. Peradaban agraris di seluruh dunia menjadi tumbuh pesat sebelum tergantikan oleh peradaban industri. Kini, di era globalisasi, sistem pertanian dengan cara mengamati bintang mulai ditinggalkan. Sistem tanam pun mulai mengadopsi dari negara asing.

Petani mulai mengesampingkan indegeneous knowledge. Kearifan lokal dari leluhur sudah tergerus zaman. Namun, masyarakat adat Sinar Resmi, Sukabumi sampai saat ini masih berpatokan pada peredaran bintang dalam pertanian padi terutama untuk merespons bencana. Tujuan penelitian ini adalah mengamati bintang dalam pertanian padi yang mampu merespons bencana. Penelitian ini menggunakan pendekatan tradisi lisan. Studi ini menguraikan pengamatan bintang dalam pertanian padi berbasis tradisi lisan dalam menghadapi bencana. Hasil studi kasus yang diangkat masyarakat adat Sinar Resmi, Sukabumi dapat disimpulkan mengamati bintang dalam pertanian padi dipandang masih relevan untuk merespons bencana, sehingga risiko gagal panen dapat diminimalisasi. Pengamatan dan perbendaharaan astronomi pun menjadi penting karena dapat mendukung tatanan masyarakat agraris.

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#### Introduction

The life of the ancient Sundanese agricultural society was inextricably linked to the interpretation of nature, including celestial bodies. Observing the sky is a daily activity for their farmers. The reality of human interactions with nature is represented by agricultural activities associated with celestial bodies. From the observation of celestial bodies, the *pranatamangsa* calendar is created. They use the traditional calendar, or *pranatamangsa*, to determine the timing of agricultural activities, rituals, and the harvesting season (Iskandar, 2022; Wiramihardja, 2011; Adimihardja, 1992). According to a review of the literature on the management of rice cultivation using the traditional calendar, or pranatamangsa, it declined and was abandoned by some. There are various factors that contribute to this phenomenon. The Green Revolution, declared by the government in the 1970s and governing rice farming management, came first. The Green Revolution began in 1965–1966, when the Bimas (mass guidance) program was adopted to increase rice production. Bimas is founded on the philosophy of Panca Usaha (the five efforts): soil preparation, improvement of wetland irrigation, introduction of new seeds, use of synthetic fertilizers, and use of synthetic pesticides (J. Iskandar, 2017; Rieffel, 1969). Due to the increasing population density, the available land for rice farming is diminishing. In the modern era, the *pranatamangsa* system is deemed irrelevant. Fourth, pranatamangsa was abandoned because the season is unpredictable due to global warming (Ardianto, 2022; J. Iskandar, 2017; Wiramihardja, 2011).

However, the local people of Sinaresmi, Sukabumi, and the indigenous people of Banten (Baduy) continue to manage rice farming in huma according to their ancestral teachings by observing the stars or the traditional calendar. Unlike the cultivation of woody plants or other crops like vegetables and tubers, the management of rice fields and highlands requires specific expertise in soil, seasons, rainfall, drought, wind, fluctuations, temperature, and the implementation of suitable agricultural practices. Methods that include the selection of appropriate plants. Miscalculations in determining the correct planting time and other agricultural activities can influence crop yields and may even cause catastrophes (Permana, Eka, & Nasution, 2005; Satriadi, 2015; Hermawan, 2012). Hence, the local communities of Sinar Resmi and Banten depend on traditional wisdom, guided by the *pranatamangsa* calendar system, to participate in agricultural endeavors.

During ancient times, knowledge about the night sky and star constellations was widespread, not just among ancient Indonesians but throughout the world. Numerous works have been written and published on astronomy's cultural facets. Astronomy is said to be the oldest of the sciences. Approximately 7,000 years ago, a group of African Savannah nomads was the first to record the movement of the stars at the Nabta Playa site. These African Nomadic Humans are a group of livestock hunters and gatherers who also use these animals for ritual worship. The oldest stone circle on his site was built by them to mark the North Solstice and other seasonal markers, which were used to ensure the availability of water and food within the community. These observations marked the beginning of the discipline of astronomy, which is now well-established.

In addition to astronomy, other scientific fields require thousands of years of observation to develop into what they are today (Pangerang, 2021:1). Since then, numerous scientists have investigated the movement of stars for various reasons. There are at least four studies related to star movements that can be recorded here. First, The observation of star movements is traditionally known for agriculture, and it is also utilized by fishermen for catching fish. They go out to sea while reading nature by observing the stars in the sky. They go to the sea while reading about nature and gazing at the stars (Wiriadiwangsa, 2005:3; Partosuwiryo, 2013:1). Second, in Sundanese culture, stargazing was regarded as a measure of time before the invention of clocks. The Sundanese give names and characteristics to the day and night based on natural phenomena, events they experience, or their surroundings. To describe the time of night, they used what they felt or heard, such as "wanci tumorek" around 02:30 (deep sleep time), "wanci janari leutik" after midnight (approximately 01:30), and so on (Sastraamidjaja, 1990; Wiramihardja, 2011:3). Third, celestial body observation is done from a globalization perspective. Many have questioned whether the local wisdom of observing stars is still relevant in the contemporary global era (Ardianto, 2022; Harini et al., 2019). Fourth, observe the stars when cultivating rice, particularly huma rice. This knowledge is essential for farmers, as improper timing of farming can result in crop failure and other catastrophes (Permana, Eka, & Nasution, 2005; Hermawan, 2012; Iskandar, 2022). This previous research did not investigate stargazing as a local science in the traditional rice farming of the Sinar Resmi.

In contrast to the previous four studies, the purpose of this research is to explore the knowledge of star observation practiced by the indigenous community of Sinar Resmi Sukabumi and how it can be integrated into the living knowledge, attitudes, and behaviors of a disaster-prone community. Therefore, the main question to be addressed in this study is how the knowledge of star observation practiced by the indigenous community of Sinar Resmi Sukabumi can be utilized as a model for rice cultivation management and be collaboratively integrated with modern rice farming systems.

The argument developed in this study is that scientific research on *pranatamangsa* by various experts will greatly contribute to rural community development. Furthermore, it is mentioned that *pranatamangsa*, as a cultural heritage from ancestors that has gradually been forgotten and even influenced by ribbon, needs to be cultivated in accordance with the modernization context.

According to previous research, most of the celestial body and star observations were for agricultural purposes. Numerous modern studies have abandoned it for a variety of reasons. However, the indigenous Sinar Resmi people were able to defend it, and they continued to use it as a guide for rice farming. In this literature review, there are two issues that will be discussed, namely *pranatamangsa* and the local communities (Sinar Resmi, Sukabumi).

Pranatamangsa is a mechanism for indexing time that divides the year into months. It provides a framework for executing diverse agricultural activities associated with rice cultivation (Ammarell, Gene, and Tsing, 2015; Norken & Suputra, 2016; Daldjoeni, 1984; Sindhunata, 2011; Wiramihardja, 2011; Wisnubroto, 1995). Before the arrival of Hindus, which was officially recorded in 1555 Saka or 1633 A.D., *Pranatamangsa* is known to have been prevalent in Javanese agricultural society. In Javanese society, including the Sundanese of West Java, this has been passed down from generation to generation. The traditional ecological calendar in Indonesia is known by several local names, including kerta masa in Bali, lontara in Sulawesi (Kasryono E. Pasandaran & Achmad M. Fagi, 2003), kala mangsa in the Sundanese Kuta, Ciamis (West Java) (Iqbal, 2020), and the Baduy calendar, or kikandayan tani in Baduy, Banten Sunda. (J. Iskandar, 1992). The NTB understands that wariga is a collection of favorable and unfavorable agricultural days determined by the movement of the stars around the earth. The Dayak people of West Kalimantan are familiar with katika boards and farming regulations. The Batak tribe acknowledges parhalaan waktu for seed dispersal. The Javanese and Sundanese communities are familiar with P ranatamangsa, a set of rules for timing and seasons used by farmers for agriculture. The rule in Pranatamangsa is to plant and harvest rice only once a year. (Indradewa, 2021:93; Hermawan, 2012; Hanggoro, 2019:1).

Indigenous societies have a long history of rice farming using farmland (huma) and rice fields. Huma is agricultural land in the form of abandoned rice fields (left uncultivated so the soil becomes humus) while the cultivator searches for new land or tends to long-abandoned fields (Satriadi, 2015:561). Meanwhile, rice fields are former agricultural lands that have been plowed and irrigated with groundwater or river water for cultivating rice using an irrigation system. Therefore, rice fields are a type of agriculture that places emphasis on irrigation systems. Rainfed rice fields (gogoranca), whose irrigation depends on rainfall, can be distinguished from *oncoran or sorotan* rice fields, whose irrigation depends on river flow. Kasepuhan Sinar Resmi is located in Sirna Resmi Village, Cisolok District, Sukabumi Regency, at the base of Mount Halimun-Salak. The village is 23 kilometers from the subdistrict and 33 kilometers from the district. Due to the paved road, Sinar Resmi Village can be reached from Pelabuhan Ratu within two hours. When entering the Kasepuhan location, a row of houses on stilts with bamboo booths and thatched roofs is visible. The houses of the Kasepuhan are constructed from natural materials and adhere to natural laws. Kasepuhan housing models with thatched or tepee roofs utilize indigenous, naturally occurring materials. Kasepuhan culture is familiar with houses built on stilts, bamboo, and coconut trees. In addition to being resistant to earthquakes and comfortable, their stilt houses are rich with meaning. The traditional Sukabumi indigenous community's involvement in rice farming represents a living knowledge that encompasses the vulnerable disaster-prone society's attitudes and behaviors. Therefore, this research presents an innovative approach, proposing the integration of ancient wisdom into modern knowledge for the purpose of conservation.

Kasepuhan Sinar Resmi people currently engage in acculturative, home-based, rice-field farming. Rice is the primary source of sustenance for the Kasepuhan community (Kusdiwanggo & Sumardjo, 2016:310; J. Iskandar, 2017:4; Van der Meer, 1979:32–33). With the expression "farming once a year based on the stars", they observe the sun's movement throughout the year and the appearance of constellations in the sky to determine annual agricultural activities (*ngahuma sataun sakali nyokot anggeran ka bentang*). This idiom refers to the maintenance of life's harmony following the yearly cycle of natural changes. The Kasepuhan community utilizes the Orion constellation and the Pleiades asterism in their agricultural activities. The Orion constellation and Pleiades asterism, as determinants of agricultural timing, have their own specific names within the Kasepuhan community. *Kidang* (*wuluku*) is the name of the constellation Orion, and *Kerti* is the name of the Pleiades asterism.

# Method

Based on a case study of the Kasepuhan indigenous people of Sinar Resmi, Sukabumi, this study introduces the Sundanese people's star-observing activities for rice planting and disaster response. The observation of the stars is used in rice farming to respond to current challenges.

This study uses an oral tradition approach to collect the necessary data (Dananjaya, 2008). The oral tradition method was used to learn how the Sinar Resmi native people used star observations in their agricultural tradition. This study relied on data from interviews and direct field observations. The information gathered is relevant to society.

The collection of data occurred in two phases. The first consists of tracking data in documents, such as records relating to star observations that are part of a series of rice farms. Second, collect data regarding the indigenous people of Sinar Resmi's astronomical observations through interviews with key informants.

The data analysis was conducted in stages. The initial step involves classifying the data to facilitate analysis. Furthermore, the interpretation and understanding of data are related to the cultural background and environment that exist around them. Thus, the understanding of stargazing and existing traditions becomes unified.

#### **Result and Discussion**

The community of Kasepuhan Sinar Resmi organizes rice farming to prioritize *huma*, which they call "ngahuma". Since the 18th century, Ngahuma has been a cultural inheritance that must be maintained and preserved because it has become their defining characteristic. Ngahuma is viewed as an expression of gratitude and reverence for ancestors. As a community that cultivates rice, rice is revered, praised, and crowned as the goddess of fertility. There are at least 32 rice rituals performed by the Kasepuhan community within one rice planting cycle. Their ancestors and their descendants planted rice in Huma because Huma is one of their inherited agricultural systems. Cultivating huma is equivalent to opening new fields because the previously cultivated huma has been abandoned for a considerable period, resulting in the growth of tall grass and large trees. Huma is synonymous with production space. Therefore, huma is considered "sacred land," which prohibits its cultivation at will. The process must adhere to the rules established by ancestors and passed down from generation to generation. If violated, the penalty is bebendon. The ngahuma activity, at each stage, is always accompanied by rituals as a form of respect for the "sacred field" that will be inhabited by Nyi Pohaci. The first consideration is the method of stargazing. Second, there is the factor of stargazing. Finally, the implications of stargazing are discussed.

#### **Methods of Star Observation**

The observation of stars by the agrarian community of Kasepuhan Sinar Resmi is the practice of ancestral teachings and traditions rooted in rice farming culture. In order to avoid unanticipated catastrophes, these locals must adhere to several crucial rituals during the rice-planting process. This type of ritual can be divided into three categories: *First*, observe the stars. *Second*, the ritual invokes Dwi Sri as the goddess who bestows good fortune on earthly marriages. *Third*, the *mipit* ceremony (permission to pick crops). This article addresses only the first step, which is observing the stars.

# **Determining the Stars' Location**

Observing the position of the Orion star (béntang wuluku/kidang) is the only way to determine the beginning of the agricultural cycle and the timing of the associated activities. From the perspective of Kasepuhan, if they do not engage in this activity, there is a high possibility that they will experience crop failure and face a food crisis. Farmers implement agricultural phases following the estimation of time derived from observations of the movement of the stars. As shown in the table, knowledge of the revolving of the stars is closely related to the natural cycles of the seasons.

**Table I Star Position Meanings for Rice Cultivation** 

Position of the Star	Season	The Phases of Rice Cultivation
Tanggal kerti kana beusi/ tanggal kerti turun wesi (This indicates the appearance of the constellation Kerti on the horizon. When the star Kerti appears, get ready to use iron.)	Dry	Prepare iron-based tools for rice cultivation, such as machetes, hoes, gobangs, and sickles.
Timbul kidang turun kujang/tanggal kidang turun kujang (When the kidang rises, the cleaver is utilized.)	Dry	Start preparing the soil for rice planting by cultivating the land.
Kidang rumangsang/kidang ngarangsang ti wetan, Kerti ngarangsang ti Kulon atau Kidang-Kerti pahareup-hareup. (If you see the kidang star (wuluku) in the position of the morning sun)	Dry	Ngahuru signifies the time to burn the remnants of field prunings. Ngahuru has a connection to forest fire disaster mitigation.
Kidang nyunanan (the kidang star begins to rise in the sky)	Dry	Appropriate time to clear the land

Bentang kidang manceran jeung ngagileuk ka kulon (the position of the kidang star visible above the head or beginning to incline westward)	Change from the dry to the rainy season	At that time, planting rice was considered to be optimal.
Tilem kidang turun kungkang (When the kidang star sinks below the time horizon, plant pests and insects emerge, and it is the right time for a stealth attack.)	When the rainy season arrives	During this time, the locals performed a ceremony to safeguard the rice from pests.
Kidang dan kerti ka kulon' (When the kidang star and kerti depart for the west)	Rainy	The people must harvest immediately

The table illustrates the importance of the position of the stars in determining the type of labor required to plant rice based on the season. The position of the stars in the sky, which serves as a guide for traditional leaders and the Kasepuhan people, contains the philosophy of "Mother Earth, Father of Heaven, and Guru Mangsa," which translates to "learn from the universe whether or not people can practice rice farming". In other words, the position of the stars is interpreted as preparation for an impending disaster that threatens the rice crop. First, when the Kerti star appears on the horizon, it serves as a sign for farmers to prepare their agricultural tools and equipment. Second, when the Kidang star rises, farmers cultivate and prepare the land immediately. Third, if the kidang star is directly on the horizon, similar to the position of the morning sun, farmers perform ngahuru, which entails burning forest-felled wood, branches, twigs, and leaves. Ngahuru is carried out in relation to forest fire disaster mitigation. Fourth, when the Kidang star is seen rising, it is the right time to clear the fields. Fifth, when the kidang star is directly above the head, rice or ngaseuk should be planted. Ngaseuk is the act of planting rice seeds with aseuk, 'tugal'. During that time, a ceremony was performed to invite Nyi Pohaci Sangyang Sri to the planet. This ritual is regarded as a sign of reverence for the rice goddess. This ceremony is accompanied by angklung beans and dogdog lojor, which, according to the Kasepuhan people, is the music that Nyi Pohaci enjoys. Sixth, when the kidang star sinks below the horizon, it is time for rice pests to attack. Additionally, the community and farmers perform *beberes mager* rituals to protect rice from pest attacks. Seventh, when the kidang star and kerti move to the west, indicating that the rainy season is approaching, farmers must immediately harvest rice while performing the *mipit* rice harvesting ritual.

The indigenous people of Sinar Resmi have used the position of the *kidang* star from the first to the seventh to determine the correct time for the various stages of shifting or swidden agriculture. *Pranatamangsa* Sinar Resmi can also determine the dry season based on the Kidang star on the eastern horizon during the first dawn, typically between June, July, and August. During these months, rice cultivation is not suitable, according to their beliefs. The optimal time is on the fifth day between October and November, when the wind blows from the northwest, indicating rain. However, this does not mean that the rainy season has begun. Rice pests will emerge as the rainy season approaches and begins. In order to circumvent this, they perform a *beberes mager* ritual, a ritual designed to protect rice from pests.

#### **Factors Observed in the Occurrence of Stars**

The existence of enforceable customary laws between tradition and its people, geographical conditions, and ecological knowledge are the driving forces behind stargazing. In their daily lives, the Kasepuhan Sinar Resmi community is bound by custom and culture. The teachings and traditions based on rice culture are executed under all applicable regulations, without addition, subtraction, or omission. Belief in tradition must be congruent, concordant, and not in conflict with itself. If there is a disagreement, *kabendon* will occur. *Kabendon* can manifest as incurable diseases or other catastrophes, such as becoming lost in the woods. The influence of this rule is reflected in their behavior and way of thinking when participating in rice culture rituals, such as stargazing.

The geographical conditions surrounding the Kasepuhan Sinar Resmi community have become the foundation for the emergence of life-saving ritual traditions. Due to the steep slope of the land, the altitude

of 630 ASL, and the high monthly precipitation, the natural and geographical conditions of Kasepuhan have the potential to cause landslides. To prevent landslides, they use a zoning system that creates zones with all the rules: (1) Leuweung Kolot (Leuweung Tutupan), forest areas that cannot be disturbed for any reason. This area is believed to be guarded by spirits, and anyone who violates it will suffer misfortune (kabendon); (2) Leuweung Titipan, a forest area entrusted to posterity (incu putu) by the Kasepuhan ancestors to be protected and not disturbed. Those who enter this territory without permission from the elders will suffer dire consequences (kabendon). The government must also participate in preserving this area until it can be opened with the consent of the ancestors; (3) Leuweung Sampalan, a cleared forest area that can be used for public housing, rice fields, and gardens. This zoning system gave rise to local traditions for responding to disasters that have existed for a very long time—roughly 400 years. This tradition is still in effect today.

There is a model for the indigenous Kasepuhan Sinar Resmi people's ecological wisdom in protecting and preserving the environment because it is an integral part of their religion. The forest zoning systems of Leuweung Kolot, Leuweung Titipan, and Leuweung Sampalan are components of this model. The Kasepuhan people utilized the water resources, forest resources, and arable land in Mount Halimun Salak National Park, where they lived, prior to their designation as conservation areas and protected forests. This agricultural land (Leuweng Sampalan) is the basis of life for the Kasepuhan people, who cultivate rice fields, rice fields, and gardens. Existing natural resources, such as food, firewood, and medicinal plants, can be utilized by communities to meet their subsistence needs. All activities involving the utilization of natural resources are inextricably bound by existing customary regulations. During the months of Maulud and Safar, the collection and use of natural resources, such as not taking wood or other materials for house construction, are prohibited. It is forbidden for the Kasepuhan community to enter the Leuweng Tutupan and Leuweng Titipan areas without the permission of the elders or the traditional leader. In order to maintain the security of Leuweng Tutupan and Leuweng Titipan, the Kasepuhan people also exercise control, such as preventing the entry of outsiders. Only girang elders or traditional leaders may grant permission to enter the area; they will then conduct traditional rituals while carrying incense and reading prayers. Thus, the existence of two prohibited forest zones located at the highest level and protected by rules governing their use serves an ecological function for water conservation and flood and landslide prevention.

# **Implications of Astronomical Observation for Disaster Mitigation**

Even though it is not written or explicitly stated in the customary leader's regulation regarding disaster mitigation, stargazing is related to rice, geographical conditions, and ecological wisdom with its zones, all of which have significant implications for responding to and predicting disasters. The concrete implications of star observations on disaster mitigation can be classified into three aspects, as follows:

- 1. Star observations manifest *huma* rice farming as an ancestral heritage and *sawah* rice farming as a cultural assimilation of the Kasepuhan community. They are grateful for being able to utilize forest land for cultivation, unlike other indigenous communities in the West Java region that have abandoned *huma* rice farming due to the lack of forest areas.
- 2. The agrarian community in Sukabumi possesses traditional ecological knowledge of star constellations, weather, climate, and the preservation of water resources. Their knowledge of the appearances of the Kidang and Kerti star constellations serves as a guide for the Kasepuhan community to predict seasons and the optimal time for farming, ensuring a fortunate and abundant harvest while avoiding crop failure disasters.
- 3. The agrarian community in Sukabumi can maintain food security, meaning they can ensure food availability and prevent Kasepuhan residents from experiencing hunger.

In protected forest areas, the Kasepuhan community is only permitted to use natural resources for subsistence purposes; the commercialization of natural resources is prohibited. This ecological knowledge keeps the forest undamaged and undisturbed.

# **Conclusion**

An essential finding of this research is that the indigenous farmers of Sinar Resmi, Sukabumi have adopted the practice of observing the movement of the stars in the sky for rice farming in a single planting cycle. In addition to rice cultivation, *Pranatamangsa* is also used for disaster mitigation. In the Ngahuru tradition, felled trees are burned during the dry season, but there has never been a forest fire in the *Ngahuru* tradition. The Sinar Resmi community can interpret the position of the stars *Kidang* and *Kerti* in the sky, which to the uninitiated appears to be something complex due to the interconnected nature of the structure's elements, which include climate, seasons, water, ecological conditions, rice farming stages, and rituals that are crucial to the success of rice plants. Everywhere, *Pranatamangsa* has been abandoned, but the indigenous people of Sinar Resmi Sukabumi can maintain and preserve it through their annual rice farming in *Huma*. They believe in ancestrally transmitted local knowledge. As a valuable and economically viable cultural artifact, *pranatamangsa* continues to be vital to the survival of farmers.

This investigation is limited to the indigenous *pranatamangsa* of Sinar Resmi, Sukabumi. There are still significant other topics about the Kasepuhan community that need to be explored and described to prevent the erosion of Sundanese cultural heritage in Sukabumi over time.

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