Chapter 4
The Sundanese Traditional Ecological Calendar and Socio-cultural Changes: Case Study from Rancakalong of West Java, Indonesia

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Abstract In the past, the Sundanese farmers of West Java, Indonesia, managed wet-rice (*sawah*) farming using *pranata mangsa*, the traditional ecological calendar. They cultivated rice varieties that were adapted to local environmental conditions. The *pranata mangsa* helped in determining the appropriate time to undertake rice farming activities, including preparation of land, planting, and harvesting. All these activities were accompanied by traditional ceremonies. Various natural indicators, such as the constellations of stars, leaf fall of certain plant species, sprouting of tubers, and call of insects, were used to determine the months (*mangsa*) of the ecological calendar. In addition, the calendar and the embedded traditional knowledge also helped in managing rice pests, prudent utilisation of water in irrigation, and effective utilisation of the social capital of villagers, through communal activities. However, after the Green Revolution, traditional rice cultivation practices changed, leading to the neglect of the *pranata mangsa.* Revitalising the *pranata mangsa* with inputs from formal scientific knowledge would help the community practise ecologically sound and economically viable agriculture that is adapted to the local environment and culture.

Keywords *Pranata mangsa* · *Sawah* farming · Traditional ecological knowledge · Rituals

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4.1 Introduction

Small scale farmers in the various agroclimatic zones of the world have made use of traditional ecological calendars to decide the timing of agricultural activities, including when to conduct rituals, prepare land and plant crops, and harvest (Adimihardja 1992; Ave and King 1986; Franco 2015; Iskandar 1998; Iskandar and Iskandar 2011; Orlove et al. 2010; Prober et al. 2011; Xu et al. 2009). Before the commencement of the Green Revolution in Indonesia, in the late 1970s, the Sundanese people of West Java and Banten managed the *sawah* farming system (wetland) using their traditional calendar or *pranata mangsa* (cf. Adimihardja 1992; Berkes 1999; Iskandar 2012; Mustapa 1996; Toledo 2002; Wiramihardja 2013). The Green Revolution refers to the breakthrough in the development and subsequent release of High Yielding Varieties (HYVs) of wheat and rice in the mid-1960s (Evenson and Gollin 2003). These high-yielding varieties were developed by scientists at the International Centre for Wheat and Maize Improvement in Mexico (CIM-MYT) and the International Rice Research Institute in the Philippines (IRRI). In Indonesia, the origins of the Green Revolution can be traced back to 1965/1966 when the BIMAS (*bimbingan massal*) programme was adopted to increase rice production. At the core of BIMAS was the ideology of *panca usaha* (five endeavours): proper soil preparation; improvement of wetland irrigation; introduction of new HYVs; use of synthetic fertilizer; and use of synthetic pesticides (Iskandar 2017; Rieffel 1969). The subsequent signing of contracts between the Indonesian government and foreign firms from Japan, Switzerland, and West Germany in 1968–1969 to cultivate improved IR5 and IR8 seeds using industrial pesticides and fertilizers was a major milestone. This massive campaign aimed to realise a Green Revolution by 1973 (see Hansen 1972).

Unlike the farming of tuber crops such as taro and sweet potato, cultivation of rice in wet fields and uplands (*ladang*) requires specific knowledge on soil, seasons, rainfall, drought, wind, diurnal variations and temperature, and suitable farming practices that include the selection of appropriate crops. Any errors in determining the appropriate time of planting and other agricultural activities would affect the harvest (cf. Dove 1999). Hence, the Sundanese farmers relied on the Traditional Ecological Knowledge (TEK) encoded in the *pranata mangsa* to determine appropriate timings for undertaking agricultural activities (cf. Berkes 1999; Gelpke 1986; Iskandar and Iskandar 2016; Lovelace 1984; Toledo 2002; Wessing 1978; Wiramihardja 2013: 26). The *pranata mangsa* is a temporal indexing mechanism that divides the year into months (*mangsa*). It serves as a framework for undertaking various agricultural activities connected to rice cultivation (cf. Ammarell and Tsing 2015; Arsana et al. 2003; Daldjoeni 1984; Hidayat 2011; Iskandar and Iskandar 2016; Shindunata 2011; Wiramihardja 2013; Wisnubroto 1999). Although the *pranata mangsa* is known to be prevalent in Javanese farming communities even before the arrival of the Hindus, it was formally recorded in 1555 *Saka* or 1633 Gregorian (Wisnubroto 1999: 13). It has been transmitted from generation to generation in the Javanese communities, including the Sundanese communities of West Java. Traditional ecological calendars in Indonesia are known by various local terms such as *kerta masa* in Bali, *lontara*

in Sulawesi (Kasryno et al. 2003), *kala mangsa* in Sundanese Kuta community, Ciamis (West Java) (Kadarisno 2019), and *pananggalan Baduy* or *kikandayan tani* in Baduy, Banten Sundanese (Iskandar 1998). Yet, the nature of the calendars and their application in guiding agricultural and ecosystem management activities are similar (Iskandar and Iskandar 2016; Wiramihardja 2013).

For the Sundanese people, there are specific rituals accompanying each stage of wet-rice farming, including preparing the land, sowing rice in seedbeds, planting, harvesting, and storing rice in rice barns. These rituals are a manifestation of the cosmology of the Sundanese people (Iskandar 2017: 182; Wessing 1978). Hence, traditional rice farming is not a mere set of agricultural activities, but a way of life. The Sundanese rural people, especially in the past, believed in various spirits, including dead spirit, place spirit, God (*dewa*), and Goddess (*dewi*). The rice goddess, locally named Nyi Pohaci (called Dewi Sri by Javanese People), played a prominent role in the beliefs related to agriculture (Iskandar 2017: 182; Wessing 1978: 76). Before cultivating the land, people performed rituals in sacred places, including in the sacred forest (*hutan keramat*), the water spring (*mata air*), and the node where river water enters the paddy field (*hulu wotan* (Mustapa 1999; Prawirasuganda 1964). The time for preparing the paddy field and planting rice was chosen using the *pranata mangsa.* Various natural indicators, such as the appearance and disappearance of certain stars, shedding of plant leaves, and calls of certain insects, have normally been used as local seasonal indicators (Iskandar 2014).

The calendar through its rituals regulates the collective actions of local communities (Franco 2015). On the temporal scale, it influences the timings of festivals, rituals, and agricultural and ecosystem management activities. On the spatial scale, it influences the geographical area over which an activity is carried out, and access to ecosystems and species through taboos (Franco 2015). The *pranata mangsa* and the various rituals ensure that the planting and harvesting of rice are simultaneously undertaken by all farmers in the community, and the land is followed for a while before the next agricultural cycle. This cuts off the food supply to the agricultural pests and truncates their life cycle (cf. Lansing 1991). In addition, the traditional system of irrigating wet-rice fields is a prudent system, designed to pre-empt any possible deficit of water during the dry season (cf. DGIS 1982 cited by Iskandar 2007; Lansing 1991; Soemarwoto 1988). Since the rituals for planting and harvesting rice performed for Nyi Pohaci are a communal affair, they promote communal bonding (cf. Iskandar 2017; Khattri 2003; Lovelace 1984). Calendric knowledge thus contributes to contemporary natural resource management and enhanced resilience of socio-ecological systems (Prober et al. 2011).

In recent years, there have been changes in the socio-economic conditions of the Sundanese community, and the environment. Increasing human population, intensive penetration of market economy, unpredictable weather and climatic conditions due to climatic anomaly, and modernisation of the wet-rice farming systems are the factors driving this. Intensive use of HYVs, inorganic fertilizers and pesticides introduced by the Green Revolution in the early 1970s have brought drastic changes in Sundanese traditional wet-rice farming. High External Input Agriculture (HEIA) depends on external inputs such as hybrid seeds, synthetic fertilizers,

pesticides and fossil energy, which have to be purchased (cf. Reijntjes et al. 1992). HEIA focuses on maximising the output, as a result of which the rice fields have been under rice cultivation throughout the year, contradicting the season-specific farming facilitated by the *pranata mangsa.* Thus, for farmers practising HEIA, the calendric information disbursed by the *pranata mangsa* is no longer relevant. However, the older generations of *sawah* farmers of West Java, including Rancakalong village of Sumedang, West Java, Indonesia, have retained knowledge on the *pranata mangsa*. This paper elucidates the Sundanese *pranata mangsa* and ecological and socio-economic changes, based on a case study in the Rancakalong village of West Java.

4.2 Materials and Methods

4.2.1 Sampling and Interviews

We use a combination of qualitative and quantitative methods to collect and analyse data (Albuquerque et al. 2014; Creswell 2009; Newing et al. 2011). Data was gathered through participant observation, semi-structured interviews and structured interviews. General environmental conditions of the agroecosystems, including rice fields, mixed-garden, and garden, activities of informants in rice farming, and rituals of the community were observed by the authors and noted down. Researchers accompanied informants during their daily activities related to the wet-rice farming system and during rituals. Semi-structured interviews were conducted with competent informants who are purposively selected. The informants consist of the village's formal leaders (3 individuals), agricultural extension officers (3 individuals), informal leaders (3 individuals), elder male farmers (15 individuals), and elder female farmers (3 individuals). Structured interviews were undertaken with randomly selected respondents. A field survey conducted in 2008 showed that out of the 1,100-household population of farmers in Rancakalong village, 783 households farmed paddy in the wetlands (Rancakalong Village Statistical Data 2014). Only 194 households planted both high-yielding rice varieties (HYVs) and local rice varieties (LRVs) in their village. Most of these 194 households were still involved in the cultivation of local rice varieties and followed traditional rituals associated with planting, harvesting, and post-harvesting of rice (Malia 2007; Tiani 2007; Warsiti 2009). From this pool of 194 households, we randomly selected 65 farmers for the structured interviews.

4.2.2 Rancakalong Village

Rancakalong is a village in the Rancakalong sub-district of West Java, Indonesia. It lies 14.5 km away from West Sumedang, the capital of the district, and 45 km

away from Bandung, the capital of West Java (Fig. 4.1). Geographically, Rancakalong village is located 6° 49′ 27.2″ South and 107° 48′ 34.7″ East, at an altitude of 700–1,250 m above sea level. The daily average atmospheric temperature is 23 °C. Rancakalong has two major seasons: the wet season occurring between September and February, and the dry season between March and August. The total area of Rancakalong village was 207.9 ha in 2013. The agricultural land in Rancakalong can be divided into two categories: dry land and wet land. The dry land comprises the home garden (*pekarangan*), garden (*kebun*) and mixed-garden (*kebun campuran* or *talun*), while the wet land consists of the rice field (*sawah*). The wet-rice field can be further divided into two categories: the irrigated rice field and the non-irrigated rice field. The general landscape of the wet-rice farming of Rancakalong is shown in Figs. 4.2 and 4.3. The total population of Rancakalong village in 2008 was recorded as 4,100 people consisting of 2,024 males and 2,076 females from 1,514 households. Five years later in 2013, the total population was 4,082 people comprising of 2,016 males and 2.066 females from 1,538 households. The population further increased to 4,911 people (2,435 males and 2,476 females from 1,861 households) in 2017. Farming is the chief occupation (68%), followed by employment as petty traders, labourers/employees and civil servants/soldiers (Rancakalong Village Statistical Data 2014).

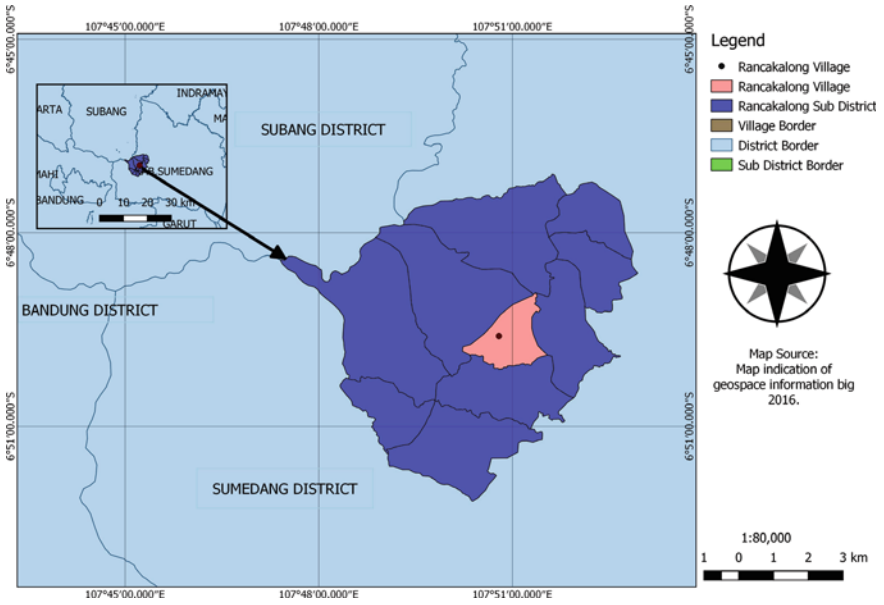

Fig. 4.1 Map showing the location of Rancakalong in West Java, Indonesia

Fig. 4.2 A wet-rice field (*sawah*) of Rancakalong being prepared for cultivation. *Photo* Johan Iskandar (2018)

Fig. 4.3 A *sawah* field before harvest. *Photo* Johan Iskandar (2018)

4.3 Findings

4.3.1 Traditional Rice Cultivation in Rancakalong

Most local cultures of Indonesia can be referred to as rice-based cultures (cf. Beets 1990; Brush 1992; Sastrapradja and Widjaja 2010). Before the onset of the Green Revolution, Indonesia had at least 8,000 local rice varieties, mostly planted in Java (Bernsten et al. 1982; Fox 1991; Whitten et al. 1999). This high diversity of local rice varieties mirrors the diversity of ecosystems, as traditional rice varieties were developed to suit the local cultural needs and environmental conditions. Thus, the diversity of agroecosystems, rice varieties, and cultural practices go hand in hand. Prior to the Green Revolution, there were at least 60 local rice varieties (landraces) cultivated by the Rancakalong farmers. Post-Green Revolution, this number had come down to 35, as local rice varieties were replaced by new rice varieties (Malia 2007; Warsiti 2009). Farmers who farm local rice varieties (*paré buhun*) cite maintaining heritage, adaptability to local rice field environments (altitude, humidity, water availability, soil fertility), resistance to pests, requirement for traditional rituals and making of traditional cakes, and higher economic value as reasons for their practice.

4.3.2 Folk Classification

4.3.2.1 Folk Classification of Land

Rice cultivable land is classified into swidden (*ladang*) and wetland (*sawah*). Rancakalong people classify wetland rice field (*sawah*) into several types, based on water availability, location, size, and soil fertility (Iskandar 2012; Warsiti 2009). Based on water availability, the *sawah* is divided into *sawah ranca* with abundant water, and the *sawah guludug* or *sawah tadah hujan* that is rainfed. *Sawah ranca* can be cultivated throughout the year, with the traditional rice varieties that can be cultivated twice a year, or the modern rice varieties that can be cultivated thrice a year. Based on location, *sawah* is classified into *sawah landeuh* located in lowlands and *sawah pegunungan* in the upland areas. The plots of *sawah landeuh* are larger in size, while the *sawah pegunungan* is smaller and usually terraced to avoid soil erosion. On the basis of soil fertility, the *sawah* may be divided into *sawah subur* or *sawah ledok* that has fertile, muddy soil and *sawah cengkar* with soil considered non-fertile (*tidak subur*).

4.3.2.2 Folk Classification of Rice Varieties

Paré is the Sundanese term used by the people of Rancakalong to refer to rice. Traditional or local rice varieties are named as *paré buhun* or *paré ranggeuyan* and

modern ones are named as *paré énggal*. The local rice varieties are classified into several types based on the hairy and non-hairy nature of seeds, the colour of hulled rice, the colour of the stem, and rate of maturation (cf. Iskandar and Ellen 1999; Iskandar and Iskandar 2018; Malia 2007; Soemarwoto 2007; Warsiti 2009). Based on the hairy and non-hairy nature of grains, rice can be classified into two: *paré bulu* (hairy), and *paré gundil* (non-hairy). Based on morphology, it is classified using size, shape, and colour into big (*gabah gedé*), slightly smaller (*gabah sedengan*), small (*gabah leutik*), roundish (*buleud*), oval (*lonyod*), thick (*gendu*t), flat (*gépéng*), white hulled rice (*béas bodas*), bright hulled rice (*béas bodas hérang*), milk white hulled rice (*béas bodas susu*), red hulled rice (*béas beureum*), and black hulled rice (*béas hideung*). Rice plants with black stem are known as *tangkal paré hideung* or *jarami hideung* and brownish ones as *jarami coklat*. Based on culinary properties, rice is divided into two main groups, namely, glutinous (*paré ketan*) also known as sticky rice (fragrant and delicious) and non-glutinous rice (*paré biasa* atau *paré lain ketan*) that can further be divided into two sub-categories, namely, sticky and fragrant (*sangu pulen*) and non-sticky and not fragrant (*sangu béar*). Based on the harvesting time, the local rice varieties can be divided into three categories: *paré biasa* or *normal*, *paré hawara*, and *paré leuir* that are normally harvested approximately in 5–6 months, 4–5 months, and 6–7 months, respectively (Malia 2007; Warsiti 2009).

4.3.2.3 Classification of Rice Pests

Pests of *sawah* are grouped into six on the basis of damaged plant organs, as destroyers of grain, leaves, stem, roots, a combination of root and stem, and a combination of stem, leaves, and grain. Pests of the rice grain, including grain-eating birds, are *manuk peking* (*Lonchura punctulata* Linn.), *manuk piit* (*Lonchura leucogastroides* Horsf and Moore), and the insect *kungkang* (*Leptocorisa acuta* Thunb.). Pests destroying leaves include insects of *hama bodas* (*Nymphula depunctalis* Gn.), *hileud paré* (*Scriphoga innonata* Wlk.), *lembing* (*Nezara viridula* L.), *simeut* (*Locusta* spp.), and *wereng coklat* (*Nilarvarpata lugens* Stal.). Pests destroying stem; root; root and stem; and stem, leaves, and grain are *hama beureum* (*Tryporzia incerulans* Walker), *keuyeup* (*Parathelpusa/Potamon* sp.), *gaang* (*Gryllotalpa africana* Pal. B), and *beurit* or *tikus sawah* (*Rattus argeventer* Robinson & Kloss), respectively (Iskandar et al. 2016).

4.3.3 Management of Rice Pests

Although most farmers of Rancakalong village use synthetic pesticides to eradicate rice pests, some farmers use traditional botanical pesticides (biopesticides). At least 18 plant species from 14 families were found to be used: *bratawali* (*Tinospora tuberculata* Beumee), *beungbeureuman* (*Vitis discolor* Dalz.), *cabe rawit/céngék* (*Capsicum frutescens* L.), *comrang* (*Nicolaia speciosa* Horan), *gadung* (*Diocorea*

hispida Bl.), *hanjuang beureum* (*Cordyline fruticosa* L.), *jengkol* (*Archidendron pauciflorum* (Benth.) I.C. Nielsen), *kacang babi* (*Tephrosia vogelii* Hook), *kahitutan* (*Paederia foetida* L.), *konéng gedé* (*Curcuma xanthorrhiza* Roxb.), *laja* (*Alpinia galanga* (L.) Willd.), *pandan* (*Pandanus amarylifolius* Roxb.), *panglay* (*Zingiber cassumunar* Roxb.), picung (*Pangium edule* Reinw.), *sereh wangi* (*Cymbopogon nardus* (L.), *suren* (*Toona sureni* (Bl.) Merr.), *tembakau* (*Nicotiana tabacum* L.), and *teureup* (*Nicotiana tabacum* L.) (Iskandar et al. 2016).

Plants used as biopesticides have been widely studied by researchers (cf. Djunaedy 2009; Reijntjes et al. 1992; Santoso et al. 2005). According to Utami and Haneda (2010), *brotowali* (*Tinospora tuberculata* Beumee) and *jéngkol* (*Archidendron pauciflorum* (Benth.) I.C. Nielsen) have the potential to repel rats (*tikus*), while *gadung* (*Diocorea hispida* Bl.) has been used to poison animals. The tobacco/*bako* (*Nicotiana tabacum* L.) has been used as biopesticide not only in Indonesia, but also in other countries including North Africa (Nyirenda et al. 2011). The farmers of Luzon in the Philippines use hot chilli/*céngék* (*Capsicum frutescens* L.) as a biopesticide to eradicate rice pests (Nicolas and Cabagorias 2015).

Unlike chemical synthetic pesticides that kill insects, the biopesticides used by farmers of Rancakalong village are intended to repel them (cf. Reijntjes et al. 1992). Hence, the use of biopesticides does not eradicate the natural enemy of pests and is perceived safe for the environment and human health. They are also cheap as the source plants are plenty in the rural ecosystems (cf. Majumder et al. 2013). Similarly, since Baduy people have completely rejected the Green Revolution, synthetic pesticides are not allowed in their swidden farming. Additionally, the fallowed time employed in the Baduy swidden farming ensures that the life cycle of pest insects, including brown plant hopper (*wereng*) may be broken. As a result, unlike wet-rice farming that experiences annual attacks by *wereng* (cf. Winarto 2016), the Baduy swidden is rarely attacked by *wereng* (Iskandar and Iskandar 2015).

4.3.4 Pranata Mangsa

The origin of *pranata mangsa* as a calendar can be traced back to the decree of the King of Mataram, Pakubuwono VII, on 22 June 1855. The calendar makes use of the position of the sun, constellations (Orion/*bintang wuluku*), and local seasonal indicators to detect the change of seasons (Partohardjono 2003: 177). Time reckoning is achieved by triangulating the celestial data with various seasonal indicators such as shedding of leaves of certain plant species, calls of insects, and migration of birds. This is similar to the calendar of the Baduy community called *panaggalan* or *kalender Baduy* (Iskandar and Iskandar 2016). The first day of a new year (*tindak tahun*) is determined using calculations based on a wooden device called a *kolényér*, and celestial indicators such as the position of the belt of Orion (*béntang kidang*) and the Pleiades (*béntang kartika*), and flowering of plant species such as *jampang kidang* (*Centhoteca lappacea* (L) Desvauk), *jampang kerti* (*Centhoteca* sp.), and *kanyéré*

tree (*Bridelia monoica* (Lour.) Merr). However, the most important factor determining New Year (*tindak tahun)* is harvesting the *huma sérang*, the sacred swidden, the default scheduling of which is three months before *tindak tahun* (Iskandar 2007).

Farmers of Sulawesi have a traditional ecological calendar called *lontara* (Arsana et al. 2003; Kasryno et al. 2003). It is determined in a community meeting called *tudang sipulung*. The meeting is attended by various stakeholders, including the farmer community, informal leaders, formal leaders, experts in traditional calendric knowledge (*palontara*), and agricultural extension officers. The calendar is divided into twelve months and eight years (*tasipariamae*) or *windu. The tasipariamae* consists of *tahun alif*, *tahun ha*, *tahun jiem*, *tahun zaey*, *tahun daalem*, *tahun bea*, *tahun wau*, and *tahun dalem.* The position of some stars (*bintang*) in the sky, namely, *bintang bakua*, *bintang mangiweng*, *bintang ikan pari*, *bintang pakjeko*, *bintang gadis*, and *bintang raja* is predominantly used for the prediction of the seasonal changes and the wet-rice farming activity times (Saenong et al. 2003).

The *pranata mangsa* of Rancakalong divides the year into 12 months, namely, *kasa/kahiji*, *karo/kadua*, *katiga/katilu*, *kapat/kaopat*, *kalima*, *kanem/kagenep*, *kapitu/katujuh*, *kawolu/kadalapan*, *kasongo/kasalapan*, *kadasa/kasapuluh*, *desta/kasabelas* (*hapit lemah* in Baduy community), and *sada/kaduabelas* (Table 4.1). The first month of the *pranata mangsa* is named *kasa* which coincides with June–July, while the end of the year is called *sada* or *kaduabelas* that corresponds to May–June. The *pranata mangsa* of Rancakalong is similar to the *pananggalan* of Baduy community in having 12 months; there are also certain month names common to both calendars, but the months do not correspond to the same. For instance, *kalima* (May–June) is the second month of the Baduy calendar, whereas *kalima* in Rancakalong is the fifth month (12 October–7 November). The first month of the year (*tunggul tahun*) of the Baduy calendar is named *sapar* (June–July), whereas in Rancakalong, it is the *kasa/kahiji* (June–July) (Table 4.1).

Nowadays, the traditional ecological calendars in different regions of Java have been rarely practised, except in the Baduy community and Kasepuhan community (*sawah*) (Adimihardja 1992; Iskandar 2007; Iskandar and Iskandar 2016). Both the Baduy community and Kasepuhan community are known to maintain and cultivate their traditional rice varieties that are adapted to the local environmental conditions. In Rancakalong village, the *pranata mangsa* has rarely been used by the *sawah* farmers; the farmers who still use the *pranata mangsa* are the ones who cultivate traditional varieties of rice.

4.3.4.1 Celestial Information

Both the Rancakalong community and Baduy community have traditionally used various local seasonal markers such as flowering, fruiting and leaf shedding of plants, and animal behaviour besides information on the position of the sun and constellation for time reckoning. Rancakalong calendar is similar to Baduy in using positions of the Orion Belt (*béntang wuluku* in Rancakalong and *béntang kidang* in Baduy) to decide the beginning of the farming cycle, and timing of various activities connected to the

Table 4.1 Comparison of the *pranata mangsa* of Rancakalong, and the *pananggalan* of the Baduy, South Banten

Baduy of South Banten[a]			Rancakalong, Sumedang, West Java[b]		
Name of month	Indicators and characteristic	Swidden activities and rituals	Name of month	Indicators and characteristics	Wet-rice farming activities and rituals
Sapar as New Year/ *tunggul taun* of Baduy calendar (April–May)		*Huma sérang* (communal sacred swidden): clearing; *huma puun* (swidden owned by Baduy traditional priest): fallowed; *huma masyarakat* (swidden of ordinary Baduy household): fallowed. Ritual of *Séba*	*Kasa/Kahiji* (21 June–31 July)	Arrival of wind from the northeast. Some plant species, including *randu/kapok* (*Ceiba petandra* (L) Gaertn) and *karet* (*Hevea brasiliensis* Willd ex A. Juss) Mull. Arg) shed leaves. Eggs of small animals, and insects such as crickets hatch. The *wuluku* (the belt of Orion) is on the eastern horizon. Extreme atmospheric temperatures: hot during the day and cold at night. Traditionally, the months were perceived as inappropriate for rice cultivation	Planting rice of the dry season. Ritual of *nitipkeun*, and *ngalaksa*
Kalima (May–June)		*Huma sérang*: felling; *huma puun*: clearing; *huma masyarakat*: fallowed. Ritual of *ziarah* at the sacred place in Inner Baduy	*Karo/Kadua* (1 August–25 August)	Flow of wind from north and south to west. Temperature is hot during the day and cold during the night. *Wuluku* (the belt of Orion) is in the east. Lack of water in wells and rivers. Certain plant species, including carrot, sprout. Fruiting season	
Kanem (June–July)	*Kidang* (the belt of Orion) appears on the eastern horizon; flowering/ fruiting of *kanyere* (*Bridelia monoica*), *jampang kidang* (*Centhoteca lappacea*) and *jampang kerti* (*Centhoteca* sp)	*Huma sérang*: burning; *huma puun*: felling; *huma masyarakat*: fallowed	*Katiga/Katilu* (24 August–16 September)	Wind flows from the north; temperature gets optimal. Trees exhibit good leaves. Traditionally, the annual non-rice crops (*palawija*) are harvested	

(continued)

Table 4.1 (continued)

Baduy of South Banten[a]			Rancakalong, Sumedang, West Java[b]		
Name of month	Indicators and characteristic	Swidden activities and rituals	Name of month	Indicators and characteristics	Wet-rice farming activities and rituals
Kapitu (July–August)	*Kidang* (the belt of Orion) appears on the eastern horizon; Trees of *kanyere* (*Bridelia monoica*) and grasses of *jampang kidang* (*Centhoteca lappacea*) and *jampang kerti* (*Centhoteca* sp) flowering and fruiting	*Huma sérang:* re-burning and planting rice (*ngaseuk*); *huma puun*: burning; *huma masyarakat*: clearing. Ritual of *ngaseuk huma serang*	*Kapat* (17 September–11 October)	Wind blows from the west and start of rainy season. Breeding season of birds. Fish of rivers and lakes emerge from their holes. *Randu/Kapok* (*Ceiba pentandra* (L) Gaertn) trees fruit. Traditionally, harvesting of *palawija*	Land preparation for planting rice
Kadalapan (August–September)		*Huma sérang*: first weeding; *huma puun*: Reburning and planting rice; *huma masyarakat*: felling. Ritual *narawas* and *nukuh* of *huma masyarakat*	*Kalima* (12 October–7 November)	Wind blows from the northwest. Rainy season. Winged termites emerge from nests; snakes move out from their holes. *Wuluku* (the belt of Orion) appears earlier	Traditionally, appropriate time for planting rice in the wet-rice field
Kasalapan (September–October)	*Kidang* (the belt of Orion) appears overhead or sideways to the west. *Lancah kidang* (grass spider) prepares its nest on grasses and her web has a hole in the middle; the spider is seen mostly on the edge of the nest	*Huma sérang*: second weeding; *huma puun*: first weeding; *huma masyarakat*: burning, re-burning, planting rice. Ritual of *ngaseuk* of *huma masyarakat*	*Kanem/ Kagenep* (8 November–20 December)	Strong wind blows from the west, and high rainfall. Maturing of fruit plants, including *rambutan*, *duku*, *durian*	Planting rice of the wet season, ritual of *nitipkeun*; Commencement of the first weeding of the wetland fields
Kasapuluh (October–November)		*Huma sérang*: second weeding; *huma puun*: first weeding; *huma masyarakat*: first weeding and conducting the ritual of *ngirab sawan*	*Kapitu/ Katujuh* (21 December–1 February)	Wind blowing from the west and cold temperature. Heavy rains with occasional flooding	

(continued)

Table 4.1 (continued)

Baduy of South Banten[a]			Rancakalong, Sumedang, West Java[b]		
Name of month	Indicators and characteristic	Swidden activities and rituals	Name of month	Indicators and characteristics	Wet-rice farming activities and rituals
Hapit lemah (November–December)		*Huma masyarakat*: second weeding	*Kawalu/Kadalapan* (2 February–28 February)	Wind blows from the west and rotates. Reduction in rainfall. Breeding season of cats. Rice plants of swidden fields start to grow panicles	
Hapit kayu (December–January)		*Huma sérang*: harvesting ritual of mipit pare in *huma serang* of Cibeo on day 24, harvesting rice strats on day 28	*Kasanga/ Kasalapan* (1 March–25 March)	Wind blows from the south. Insects, including *tongérét* (*Dundubia mannifera* Linnaeus), and *turaés* (*Cryptotympana acuta* (Signoret) give out loud shrill. *Tongérét* predominantly shrill in the morning, while *turaés* shrill in the afternoon	Panicles of rice are ripe and yellow in colour, before harvesting time
Kasa (January–February)		*Huma sérang*: harvesting rice; *huma puun*: –; *huma masyarakat*: ready to harvest–. Ritual of *kawalu kahiji* in Inner Baduy	*Kadasa/Kasapuluh* (29 March–17 April)	Wind blows from the southeast. Breeding season of animals, nesting of birds	Rice panicles are homogenously ripe. After 2 days, rice is ready to be harvested
Karo (February–March)		*Huma sérang*: fallowed; *huma puun*: harvesting rice; *huma masyarakat ready to harvest*: –. Ritual of *kawalu tengah* in Inner Baduy	*Desta/Kasabelas* (18 April–10 May)	Wind arrives from the southeast. Air and soil temperature is hot. The pests of *kungkang* insect (*Leptocrisa acuta* (Thunberg) appear and destroy rice. Traditionally, planting of rice or non-rice crops, including tobacco, corn, and sweet potato	Harvesting of rice. Ritual of *nyalin, ngampihkeun paré*
Katiga (March–April)		*Huma sérang*: fallowed; *huma puun*: fallowed; *huma masyarakat*: harvesting rice. Ritual of *kawalu tutug* in Inner Baduy, and *ngalaksa* in Inner Baduy and Outer Baduy	*Sada/Kaduabelas* (11 May–20 June)	Wind coming from the east. Air temperature is hot during the day, and is very cold at night. Planting time for non-rice crops (*palawija*)	

Source [a] Iskandar (2007: 117); [b] Warsiti (2009)

cultivation of wet and swidden fields. The position of the *bentang kidang* has been mainly used by the Baduy community to decide the right time for different stages of swidden farming (Iskandar 2007: 116). The *prananta mangsa* of Rancakalong determines the dry season based on the appearance of *bentang wuluku* on the eastern horizon at dawn in *kasa/kahiji* (June–July) and *karo* (August). Traditionally, planting rice is not appropriate during this month due to the dry season. The appropriate time for planting rice is *kalima* (October–November) when winds from the northwest would bring rain. Winged termites and snakes emerge from their holes during this season. Traditionally, this marks the appropriate time for planting rice in the wet-rice field. However, as mentioned earlier, since they began intensive wet-rice farming agriculture, the Rancakalong community has continuously cultivated the irrigated wet-rice field even during the dry season (*kasa/kahiji*) (Table 4.1).

4.3.4.2 Local Seasonal Indicators

As seen in Table 4.1, the *pranata mangsa* facilitates time reckoning by triangulating the celestial observatory data with various local seasonal indicators such as shedding of leaves of certain plant species, calls of insects, and migration of birds. The shedding of leaves of the *randu/kapok* tree (*Ceiba petandra* (L) Gaertn) and maturation of its fruits indicate the commencement of the dry season and coincide with *mangsa kasa/kahiji* (June–July) of the *pranata mangsa*. According to Western scientific knowledge (etic view), the shedding of leaves of *randu* coincides with the dry season to cope up with the lack of water in the soil (cf. Purseglove 1974: 36).

Calls of cicadas such as *tongérét* (*Dundubia mannifera* L.) in the morning and *turaés* (*Cryptotympana* sp.) in the afternoon indicate the change of the wet season to the dry season. The males of the *tongérét* as well *turaés* give out loud calls during the onset of dry seasons. The sound is generated from the base of the ventral abdomen to invite the female insect to mate. After mating, the eggs are laid in the crevices of tree bark (cf. Borror et al. 1979). The eggs hatch and the emerging nymphs are locally named *kuuk*. The *kuuk* fall and burrow into the soil, and feed from the plant roots until they emerge out of the soil upon maturity. The mating call of the cicadas coincides with the month of *kasongo/kasalapan* (March) (Table 4.1). This month usually coincides with the transition from wet to the dry season, as indicated by a reduction in rainfall, locally named as *musim dangdangrat* or *musim pancaroba* (Darpan et al. 2013: 55).

Migrant birds such as *manuk kapinis* or *manuk hujan* (*Hirundo rustica*) and *manuk teri* (*Glareola maldivarum*) appear in the village ecosystem between September–March and indicate the onset of the rainy season (Iskandar 2007). *G. maldivarum* is a resident bird of the Northern Hemisphere (Siberia, Mongolia, China). During winter (September–March), the species migrate to Southeast Asia, including West Java. Like *Glareola maldivarum*, species of *manuk entod leuncang* (*Motacilla alba*, *M.caspa* and *M. flava*) also appear in West Java as migrant birds from the Northern Hemisphere at the same time, and their arrival is traditionally perceived to signal the start of the rainy season. Swidden farmers of Borneo name *manuk entod leuncang* as

burung beras-beras (rice bird) because these birds appear in the swidden ecosystem of Borneo during the planting season of rice (Smythies 1960: 264).

4.3.5 Rituals Associated with Traditional Agriculture

According to the Rancakalong farmers, the planting of rice should be carried out on an auspicious day and must be accompanied by traditional rituals. The precise day for planting rice is based on the farmer's or his wife's birthday, or the day of their marriage, in relation to the past experience of the most auspicious days for planting. In addition, the direction of planting is also influenced by the date of planting the rice. For instance, on the 1st, 2nd, and 3rd days, the direction of planting rice is towards the east, south, and north, respectively. Some activities, including planting and harvesting rice, are also avoided during taboo days (*waktu larangan*). Planting and harvesting of rice are prohibited on Saturdays and Sundays in the months of *muharram*, *safar*, and *mulud*; Mondays and Tuesdays in the months of *silih mulud*, *jumadil awal*, and *jumadil akhir*; Wednesdays and Thursdays in the months of *rajab*, *rewah,* and *puasa*, and Fridays in the months of *sawal*, *hapit*, and *rayagung* (Darpan et al. 2013; Warsiti 2009). Planting and harvesting during taboo days are said to result in crop damage or poor harvest.

Besides considering auspicious days, the Rancakalong farmers perform *upacara nitipkeun* (*nitipkeun* = entrusted), a domestic calendric ritual of planting rice. This ritual seeking blessings of God for the crops is usually conducted between 10 and 15 days after harvesting rice. These domestic rituals were facilitated by the male leaders of the family in the past. As the proficiency of men in rituals declined, they sought the help of informal spiritual leaders (*sesepuh/paraji*). Various plants such as *jawér kotok* (*Coleus atropurpureus* (L.) Benth), *taleus hideung* (*Colocasia esculenta* (L.) Schott, and *tamiang* (*Schizostachyum blumei* Nees) are collected and used in these rituals. Each plant used in the ritual has a different resonance. For example, *colocasia* has two colours: green and black, with green indicating fertility and black indicating protection (Table 4.2). The Baduy swidden farmers too practise a similar ritual. One of the plants predominantly used in Baduy is *hanjuang* (*Cordyline fruticosa* L.) which has two colours: green and red that symbolise body (*lahir*) and soul (*batin*) respectively (Iskandar 1998).

The ritual performance begins when an informal leader squats in front of the offerings. Incense is burned and prayer is recited (Warsiti 2009), seeking safety and success in planting rice. Like planting of rice, the time of harvesting rice must also follow an auspicious day and must be accompanied by traditional rituals. The special ritual undertaken before harvesting rice is *upacara nyalin.* A day before the harvest, a wooden platform named *rarangken*, *sawen* or *sanggar* made of wood is erected close to the farm shelter (*saung*) (Fig. 4.4).

Various plants, including leaves and fruits of *kawung* (*Arenga piñata* (Wurmb.) Merr), *sulangkar* (*Leea indica* Burm.f.) Merr.), and local rice varieties (*Oryza sativa* L) and their panicle are put in the *sanggar*. On the following day, banana, coconut,

Table 4.2 Some plants predominantly used for performing the ritual of planting rice in Rancakalong village

No	Scientific name	Family	Local name	Symbolic meaning
1	*Coleus atropurpureus* L	Lamiaceae	*Jawér kotok*	*Jawér kotok* comes from the word *jawér* (Sundanese) or *jengger* (*Indondesian*) and *kotok* (Sundanese) or *ayam* (Indonesian-chicken). *Jawer kotok* thus means chicken comb. *Kotok* is a metonym with another sense *kotokeun* meaning 'night blindness'. So, the plant is used to symbolically communicate that the activities of rice farming must be carried out carefully, unlike being *kotokeun*
2	*Colocasia esculenta* L	Araceae	*Taleus hideung*	*Taleus hideung* has two colours: green and black; green symbolises fertility and black symbolises protection
3	*Costus speciosus* L	Costaceae	*Pacing*	*Pacing* is a calendrical metonymy. *Pacing* is interpreted as *cicing* which means 'it does not move'. So, *pacing* is used to symbolically communicate that rice farming must be maintained forever
4	*Justica gendarusa* L		*Handarusa*	The name *handarusa* is derived from *diriksa* or *diraksa* which means it must be maintained; the rice crop planted in the wet-rice field must be maintained
5	*Schizostachyum iraten Widjaja*	Gramineae	*Tamiang pugur*	*Taming pugur* refers to the bamboo species *Schizostachyum iraten* Widjaja that has fallen leaves. The bamboo species are perceived to be strong. Therefore, rice farming activities must be strong or continue to be maintained throughout the period and should not stop or drop (*pugur*)

(continued)

Table 4.2 (continued)

No	Scientific name	Family	Local name	Symbolic meaning
6	*Styrax benzoin* Dryland	Styrataceae	*Menyan*	The aromatic smoke is culturally perceived as a medium of communication between farmers and mystic forces. In addition, it also repels insect pests

Fig. 4.4 A male farmer standing next to the *sanggar* in the plot of a wet-rice field before harvesting rice. *Photo* Johan Iskandar (2018)

tamarind, bread, red and white rice porridges, top of cone-shaped rice (*puncak nasi tumpeng* or *puncak manik*), coconut oil, turmeric, strand of betel leaf are left, covered by sugar palm leaves (*daun kawung* = *Arenga pinnata* (Wurmb.) Merr.) that are considered as decoration (*rarangken*). Traditional snacks such as *kupat*, *leupeut*, *bubur beureum*, *bubur bodas*, *papais bodas*, *papais beureum*, and *kueh bugis* are also left. The *sanggar* is then covered by a cotton white cloth or shroud (*kain kapan* or *boeh*). On the day of the rice harvest, a *paraji* is invited to perform the ritual *nyalin* in the *sangar* (Warsiti 2009). After the ritual, the foods in the *sanggar* can be consumed by the harvesters, particularly if the *sawah* owner comes late to deliver food for the labourers.

A traditional thanksgiving festival of post-harvesting rice, popularly known as the ritual of *ngalaksa*, is also celebrated by Rancakalong people. In the past, the *ngalaksa* festival was annually undertaken on a date determined by the *pranata mangsa*. Today, however, the festival and associated rituals are undertaken every 3 or 5 years, and more recently it has been linked to tourism promotion. Initially, the ritual *ngalaksa*

aimed to provide a tribute to the spirits of ancestors who had succeeded in finding and sustaining rice seeds and to show gratitude for the safety, blessings, and fortune afforded to the farmers. The hamlet where the ceremony is held is called *rurukan.* Today, 5 *rurukan* of sub-district Rancakalong have been determined by the local government as a centre of *ngalaksa.* The *rurukan* of Rancakalong, Cibunar, Cijere, Legok Picung, and Pasir Biru take turns to perform the ritual of *ngalaksa* in the month of the *kahiji* (July) of the *pranata mangsa.* The term *ngalaksa* is derived from *laksa,* i.e., food made from various rice flour. The *laksa* is made from local rice varieties called *paré buhun* or *paré ranggeuyan.* Three local rice varieties, namely, eldest water (*cikal cai*) from the wetland, eldest dry land (*cikal darat*) from the swidden, and youngest rice (*paré ketan*) of the sticky type are used for cooking. Plants including *congkok* (*Curculigo cavitulata* Gaertn.) and *cariang* (*Homalomena cordata* Schott.) are used for wrapping *laksa* and wrapping rice (*pangineban*), respectively. After the harvest, the traditional art of *tarangwangsa* is performed in the Rancakalong village when *kacapi* (zither) is played. Black, white, red, and yellow cloth, kris, comb, mirror, coin, grilled chicken meat, coconut oil, bamboo fan, chicken egg, grilled common carp fish, white rice, traditional cakes, fruits, flowers, incense, and *rujak* (banana, coconut, tamarind, coffee drink) also find major uses (Fig. 4.5).

Performing *tarawangsa* after harvesting rice ensures certain benefits, including the maintenance of traditional art and strengthening of communal bonding (*gotong royong*), as well as respect for rice and the local environment. In addition, *tarangangsa* has begun attracting tourists to Rancakalong village, bringing additional benefits for rural people.

Fig. 4.5 The performing of *tarawangsa* by playing a *kacapi* (zither) and offering various ceremonial materials as part of the traditional ritual of *ngalaksa. Photo* Johan Iskandar (2018)

4.3.6 Pranata Mangsa, *the Green Revolution, and Socio-cultural Changes*

When the Green Revolution was introduced in Indonesia in the 1970s, the aim was to increase paddy production through five approaches: introduction of HYVs, including IR5, IR8, IR22, and IR24; use of inorganic fertilizer and synthetic pesticides; improvement of rice cultivation; and improvement of irrigation. Unlike the lowlands of the Northern Coast of Java (cf. Breman and Wiradi 2002; Hart et al. 1989), the farmers of Rancakalong adopted the Green Revolution ten years later, in the 1980s. Since then, traditional wet-rice farming of Rancakalong has gradually changed. The modernisation of wet-rice farming through the Green Revolution has dramatically affected the ecological, socio-economic, and cultural aspects of the community. Post-Green Revolution, rice fields (*sawah*) are cropped with HYVs thrice every year, earning the name 'rice-rice-rice'. Dryland rice fields are mainly cropped with rice twice every year, interspersed with *cilembu* (*ubi cilembu* = *Ipomoea batatas* (L.) Lam.) crop. The system is named 'rice-*cilembu* sweet potato-rice'. The non-rice crops (*palawija*) have been replaced by *ubi cilembu*, because of the demand for *ubi cilembu* in urban markets.

In the past, all farmers cropped the traditional LRVs. However, a field survey conducted by Warsiti (2009) and our field research (2018) in Rancakalong village in 2008 documented that out of the 783 farming households, only 194 households (25%) cropped both the LRVs and HYVs, and the majority of the farmers (589 households 75%) cropped the HYVs. Respondents cultivating LRVs under the traditional system cited suitability for cropping in the highlands and good production (65%); requirement for traditional rituals, including *nitipkeun*, *nyalin*, and *ngalaksa* (20%); good taste for home consumption (10%); high price (3%); and resistance to pests (2%) as factors driving them. Before the Green Revolution, 60 local rice varieties were commonly farmed in the wetland fields of Rancakalong village. After the Green Revolution, only 20 local rice varieties are planted (Iskandar et al. 2018; Iskandar and Iskandar 2018; Warsiti 2009).

As mentioned earlier, farmers who have adopted HYVs do not follow the *pranata mangsa*, which stipulates two rice crops in a year and requires traditional LRVs to be planted. Of the 65 farmers cultivating both HYVs and LRVs, only 15 respondents (23%) recognised the traditional calendar (*pranata mangsa*), but reported applying it rarely now. Their planting season in the wetland field is just determined by the commencement of rain (*turun hujan*). The uniformity in collective actions determined by the *pranata mangsa* earlier does not exist anymore. Consequently, the planting and harvesting of rice are not synchronous across the community. Continuous cultivation of fields with the same crop has sustained the population of pests throughout the year. In the past, the *pranata mangsa* required the field to be fallowed or cultivated with non-rice crops after the rice harvest. As a result, populations of insect pests such as brown plant hopper were unable to survive continuously in the field. In addition, natural enemies of the brown hopper, including spiders and birds have been eradicated by pesticides introduced by the Green Revolution. Infestation of

pests including the brown plant hopper/*wereng coklat* (*Nilaparvata lugens* Stal) has frequently recurred since the switch over to intensive farming (cf. Fox 1991; Iskandar and Iskandar 2018; Winarto 2016). In addition, abnormal climatic patterns such as abundant rain in the dry season make situations conducive for the breeding of insect pests, and the rice crop is damaged by the brown plant hopper. The *pranata mangsa* would have predicted such outbreaks as it is refined through observation of local seasonal indicators that respond to the abnormal climatic patterns. In addition to pest disturbance, the climate change-induced drought disaster regularly hits the *sawah* farming system in the West Java region in recent decades. For example, in 2018, at least 22 districts of West Java, including 41,946 ha of Sumedang district, were hit by drought (https://regional.kompas.com/read/2018/09/05/21465611/22). Today, more frequent drought disasters and damage to the water basin are driving rice crop failure, because farmers are forced to cultivate HYVs throughout the year, regardless of the *pranata mangsa.* Therefore, the failure of rice crops due to drought and lack of water has become inevitable.

Traditional calendric rituals and ceremonies including *nitipkeun*, *nyalin*, and *ngalaksa* are rarely undertaken by the majority of farmers. According to our informants, in the past, majority of the farmers believed in the rice goddess, Nyi Pohaci. Rituals and festivals commemorating Nyi Pohaci required traditional rice varieties (LRVs) and were conducted by specialists called *rurukan.* As the belief in the rice goddess has decreased, the respect of farmers for traditional rice has also decreased. Together with the adoption of HYVs and modern irrigation, the need for consulting the *pranata mangsa* does not arise anymore. Tourism has led to the revival of festivals such as *ngalaksa.* However, the festival requires traditional rice varieties for the rituals. As a result, farmers are unable to fully participate in this festival. In addition, the timing of *ngalaksa* is not determined by the *pranata mangsa*, but by the government who has set July as the fixed month. Many *paraji* (informal spiritual leaders) who once facilitated domestic calendric rituals such as *nitipkeun* and *nyalin* have passed away, taking their knowledge with them.

Wetland rice farming based on the *pranata mangsa* and its associated beliefs foster a strong sense of group solidarity among community members irrespective of differences in demographic and socio-economic status (cf. Lovelace 1984). As the power and authority of *pranata mangsa* (Franco 2015) in directing the community's collective actions fade, the social capital declines, which in turn hampers agroecosystem management (cf. Franco 2015; Iskandar and Iskandar 2016; Khattri 2003; Lovelace 1984; Orlove et al. 2010; Prober et al. 2011; Xu et al. 2009; Yenrizal et al. 2018). Thus, the situation is complex, with changes in agricultural practices and religious beliefs leading to loss of calendric knowledge associated with the *pranata mangsa*; the loss of the *pranata mangsa* on the other hand deprives the community of an opportunity to practise climate-friendly agriculture that fosters communal bonding while maintaining agricultural productivity.

4.4 Conclusion

The traditional ecological calendar (*pranata mangsa*) is strongly embedded in the traditional beliefs of the Sundanese community. The *pranata mangsa* is complexly interrelated among factors such as climate and weather, water, rice diversity, local ecological conditions, and rituals. It had once played an important role in the management of rice farming in wetlands. However, the onset of the Green Revolution and the HYVs, together with the change in religious beliefs have weaned the people away from the *pranata mangsa.* In the context of sustainable and climate-friendly agriculture, we suggest that it would be in the interest of the community to hybridise the *pranata mangsa* with formal scientific knowledge to attain ecologically sound and economically viable agriculture that is adapted to the local environment and culture.

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Compliance with Ethical Standards In accordance with the requirements of the code of ethics, we conducted research firstly by asking for permission from the formal leader of the village, and before conducting interviews with the informants and respondents. We also received permission to ensure that the rights of individuals were not infringed upon.

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