

Landscape Archaeology of Palipbothana Mortuary Complex

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Introduction

“Without place there would be neither language, nor action nor being as they have come to consciousness through time. There would be no “where” within which history could take place. “Where” is never a there, a region over against us, isolated and objective. “Where” is always part of us and we part of it”

(Grange, 1985).

The archaeology of landscape has come to signify many things in archaeological methods and practices. In some practices, it indicates an interest for regional analysis and assessment of land-use features and artifact distribution that spatially extend beyond narrow definitions of archaeological ‘sites’ or settlements. Further, it represents a concern for the social and political production of space, in which social relationships are understood to be inherently spatial phenomena. According to Kluiving and Guttmann-Bond (2012) Landscape archaeology is the science of material traces of past peoples within the context of their interactions with the wider natural and social environment they inhabited. It is a result of the interdisciplinary development in archaeology, historical and physical geography disciplines.

Palipbothana is an ancient megalithic mortuary complex situated near Rathmalgaha weva in Kahatagasdigiliya, Sri Lanka. Ancient megalithic burial sites in Sri Lanka appeared from the Protohistoric Early Iron Age, as indicated by its radiocarbon dates of 500-400 BCE (750 – 400 BCE) at Ibbankatuwa. It continued into the Mid-Early Historic period, as evidenced by the radiocarbon dates at Galsohon Kanatta (ca. 112 BCE) and Kalotuvava (ca. 130 BCE) (Deraniyagala, 2007). The protohistoric period in Sri Lanka is identified by the appearance of developed subsistence strategies such as herding and farming, but which is antecedent to the appearance of writing. The protohistoric Early Iron Age is characterized by primitive iron technology, rice cultivation, domesticated horses, and pottery technology (Deraniyagala, 2007). The earliest dates for the period in peninsular India falls into the 1200 BCE. In the Sri Lankan context, Anuradhapura Citadel and Aligala shelter in Sigiriya radiocarbon dated to ca. 1000-900 BCE (Deraniyagala, 1992).

Megalithic mortuary complexes were a prominent feature in the Protohistoric Early Iron Age culture in Sri Lanka (Seneviratne, 1984). It was studied by different scholars during the last decades, primarily referring to the location, chronology, burial types, and social aspects. A variety of burial types has been identified within the Protohistoric Iron Age,

Including cist burials, cairn circles, clay canoe, cairn mound, alignment, urn, and dolman (Manamendra-Arachchi and Adikari, 2014). These sites are located all around the island, especially in the dry zone and intermediate zone. Different chronological sequences are available for the Iron Age mortuary complexes in Sri Lanka due to several excavations conducted on burials. The earliest dates are recorded from the Beragala Kalupahana watta, as indicated by its radiocarbon dates of ca. 2300 BCE (Manamendra-Arachchi and Adikari, 2014). Clay canoe burials excavated in Haldummulla dated back to ca. 1750 BCE (Manamendra-Arachchi and Adikari, 2014) and Ranchamadama to ca. 1359 BCE (De Silva and Somadeva, 2006). Thusitha Mendis excavated Kok Ebe in Yan Oya basin (ca. 790 BCE) and Andarawewa in Galgamuwa (ca. 500 BCE) (Mendis and Withanachchi, 2017). Mid-Early Historic dates are recorded from Galsohon Kanatta (ca. 112 BCE) and Kalotuvava (ca. 130 BCE) (Deraniyagala, 2007) sites.

Some scholars recognize a Megalithic culture in Sri Lanka and peninsular India (Seneviratne, 1984). However, there are uncertainties on megalithic mortuary practices in Sri Lanka. Siran Deraniyagala highlighted the fewer linkages between Protohistoric Early Iron Age settlements and mortuary complexes (Deraniyagala, 2007). For instance, burials at Ibbankatuwa dated about two centuries before the settlement (Karunaratne, 1994). Further, the Protohistoric Iron Age settlement in Anuradhapura does not associate with a megalithic mortuary complex. Deraniyagala (2007) associate these mortuary complexes with a particular group of people, such as pastoralists. In contrast, some other authors represent different perspectives. Accordingly, the Anuradhapura Early Iron age settlement did have a mortuary complex and relocated to the periphery with the city development, influenced by Buddhist town planning concepts (Manamendra-Arachchi and Adikari, 2014).

The majority of early research tried to study the Megalithic mortuary complex concerning the Protohistoric Early Iron Age culture and mortuary practices. Current research aims to analyze the complex human-environment relationship in (pre-) historical time: in terms of interdependencies between settlement patterns, land use, and economic system as well as the surrounding natural environment. Understanding theoretical concepts about spatial structures and processes in terms of the development of natural and cultural landscapes and settlement development is concerned.

Research area

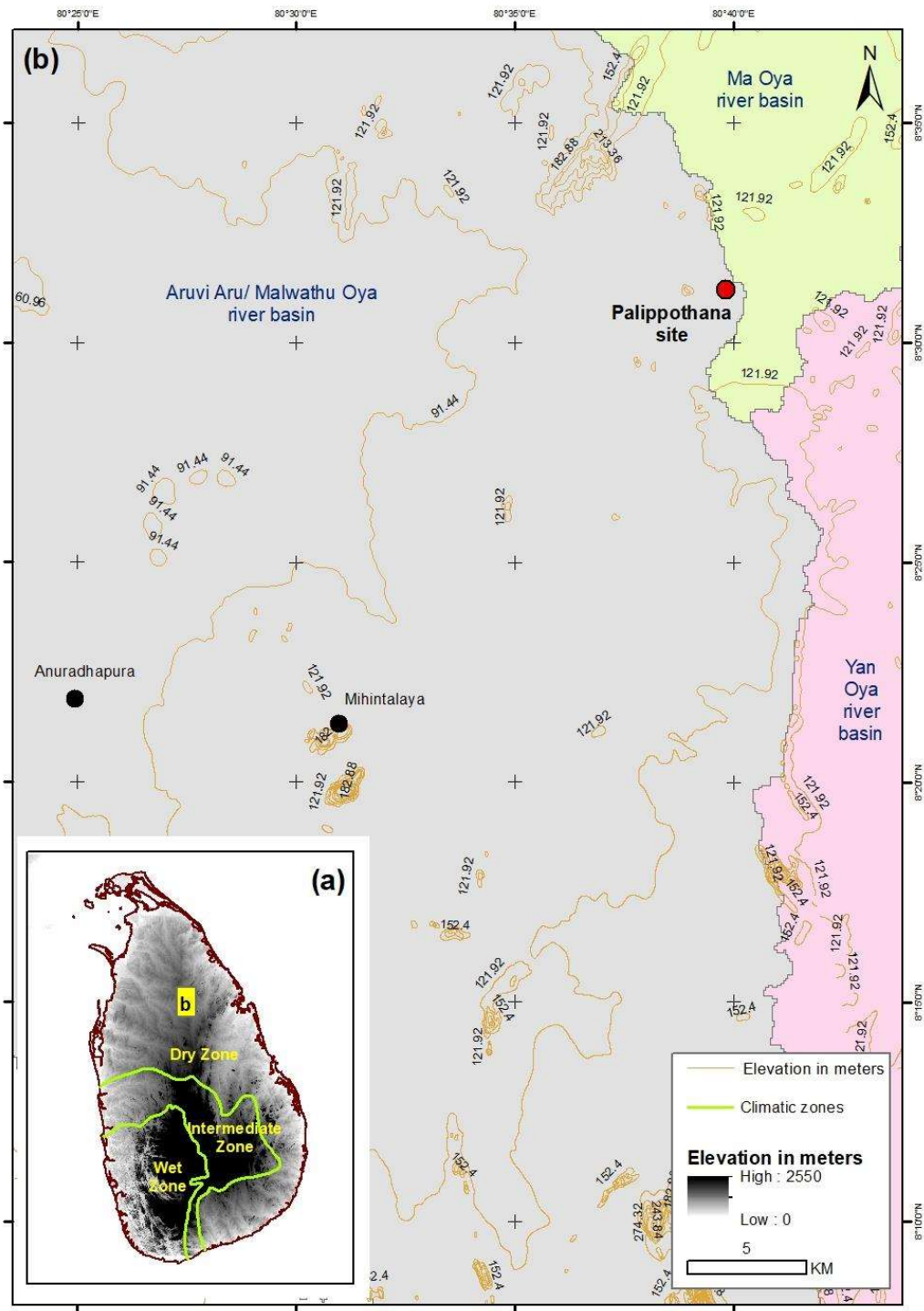
Environmental characteristics of the Dry Zone Sri Lanka and Anuradhapura hinterland

According to Cooray, (1984) "...the physiography of Sri Lanka can be best described as consisting of a central mountain mass, the Central Highlands, rising in a series of tiers or ramparts from a low, gently undulating plain surrounding it in all sides and extending to the sea...". He goes on to explain that there are 3 plains of erosion or peneplains which make up the principle physiographic regions of the island as follows:

- Lowest peneplain – 0-125m
- Middle peneplain – 125-750m
- Highest peneplain – 750-2500m

The study area for this research is located in the lowest peneplain, mainly in the North Central lowlands. The micro study area, Palipbothana, is located in the north central lowlands, 123 meters above sea level. The relief is gently undulating (Cooray, 1984; Panabokke, 1996) and corresponds to a planation surface that is characterized by the occurrence of a large number of small inland valleys (Panabokke, 2002, 1996).

The greater part of the island consists of Precambrian metamorphic rocks (Dissanayake and Weerasooriya, 1985; Panabokke, 1959). The Precambrian basement of Sri Lanka is subdivided into three major complexes as Highland, Wannu and Vijayan (Cooray and Cooray, 1967; Cooray, 1984). Anuradhapura and its hinterland belong to the Wannu complex and predominantly consist of granitic, migmatitic, charnockitic gneiss and metasediments. The prominent soil group of the area is the Reddish Brown Earths and Low Humic Gley Soils-Undulating Terrain formed under the "mantled plain Undulating" landform. A narrow strip of alluvial soils is visible in this vicinity, along the natural drainage systems such as the river Malwathu Oya (Panabokke, 1996).



Map 4-1 Study area

Sources: DEM (USGS 2017); agro-climatic boundaries are taken from the National Atlas of Sri Lanka (Somasekaram, 1988); river basins are taken from the Water Information System for Sri Lanka (WISSL) (International Water Management Institute); contours are from Survey Department 1:50,000 digital topo sheets.

Climatically the study area belongs to the seasonally dry tropics (Panabokke, 1996). The mean annual rainfall is less than 1750 mm (Eriyagama et al., 2010). The northeast monsoon (winter monsoon) is from December to February and is considered as the main source of precipitation for the area. Lowland areas record about 27.5 °C mean annual temperature and in 2013, Anuradhapura recorded an annual average temperature of about 28.3 °C (Department of Census and Statistics-Sri Lanka, 2014).

Nine main river basins have a share of the present-day Anuradhapura district. These are the basins of the rivers Kala Oya, Modaragam Ara, Aruvi Aru/ Malwathu Oya, Parangi Ara, Ma Oya, Mee Oya, Yan Oya, Koddikkaddi Ara and Pankulam Ara (Panabokke, 2001). Palipothana is located in the basin of the River Malwathu Oya, adjacent to the Ma Oya basin (Map 4-1).

Settlement History

Palipothana is situated in the hinterland of the ancient Anuradhapura Kingdom. Two different chronological sequences are available for the country and ancient Anuradhapura based on a series of archaeological researches conducted during last century (Table 4-1). The first appearance of human settlements in Anuradhapura dates back to the Prehistoric Mesolithic period. Stratified excavations conducted at the Anuradhapura citadel – Gedige revealed mid-Holocene artifacts, comprised of geometric microliths, which have been radiometrically dated to around 5850 *cal* BP (S. Deraniyagala, 1972; Deraniyagala, 1992). Besides, a few other sites, such as Jethavana monastery and Vessagiriya, situated in the study area, give evidence on Mesolithic hunter-gathers (Mendis, 2008).

Protohistoric Early Iron Age culture was well established in the Indian subcontinent by 1,200 BCE (Deraniyagala, 2007; Possehl, 1990). Use of iron technology allowed early migrants from India to explore varied environmental conditions. They gradually established permanent settlements in the Dry Zone of Sri Lanka from at least 950 BCE in Anuradhapura (Deraniyagala, 2007). A ceramic sphere comprising the contemporary and related ceramic complexes including the Black and Red Ware (BRW) prove this. The Prehistoric settlement in Anuradhapura is assumed to have been superimposed by the Early Iron Age settlements in 950 BCE as is evident from the absence of any prehistoric stone artefacts within the Protohistoric Early Iron Age horizons of the Citadel of Anuradhapura. There is clear evidence of the use of iron, horses, pottery and small-scale agriculture in this context (Deraniyagala, 1992). Initial Early Iron Age settlement in the Anuradhapura Citadel area have been

estimated to be up to 10 hectares in 900 to 800 BCE and extended to at least 50 hectares by 700 to 600 BCE, and it coincided with the second urbanization in the Gangetic Valley in India (Deraniyagala, 1992).

Phase by Deraniyagala (1992)	Period	Phase by Coningham (2013)	Period
Mesolithic	c.3900 BCE	Prehistoric	Before c.800 BCE
Protohistoric Age	Early Iron c.950 – 600 BCE	Protohistoric	c.800 – 340 BCE
Basal Early Historic	c.600 – 500 BCE	Early Historic	c.340 BCE – 200 CE
Lower Early Historic	c.500 – 250 BCE	Late Historic	c.200 – 600 CE
Middle Early Historic	c.250 BCE – 100 CE	Early Medieval	c.600 – 1200 CE
Upper Early Historic	c.100 – 300 CE	Late Medieval	c.1200 – 1500 CE
Middle Historic	c.300 – 1250 CE	Kandyan	1500 – 1656 CE
		Colonial	1656 – 1948 CE
		Modern	1948 CE onwards

Table 4-1 Chronological sequences of ancient Anuradhapura

There is evidence of early Brahmi writing on pottery shards and imported pottery wares in the Basal Early Historic period from (600 to 500 BCE) (Deraniyagala, 2007). Archaeological excavations revealed postholes, and structures exhibit a rural architectural tradition with circular houses made using organic materials (Coningham, 1999). Furthermore, material evidence indicates the use of domesticated animals and wet rice cultivation (Deraniyagala, 2007).

The Lower Early Historic period (500 - 250 BCE) is a significant period of the landscape development in the area, as it corresponds with the period of the foundation of the city of Anuradhapura (Mahavamsa VII/73-76). From the latter part of the Lower Early Historic period, historical records are based on the Early Brahmin inscriptions found in the landscape (Paranavithana, 1970).

During the Middle Early Historic (250 BCE - 100 CE) period Anuradhapura was considered as one of the ten largest cities in the South Asia (Allchin and Allchin, 1999). Ancient Anuradhapura landscape consists of an inner city, several rings of monasteries and a ring of irrigation networks. The city was characterized by a fortification, gateways set in the cardinal directions and roads connected to the entrances (Mahavamsa X/73-102). The inner

city and the outer areas were zoned according to the functional needs of the city. Different quarters were assigned for the royal palaces, shrines for the gods, the ascetic settlements, traders (*yona*), city workers (*chandala*), cemeteries, agricultural and hunting settlements (Mahavamsa X/73-102). Furthermore, an official post had been established, called *Nagara Guththika* (Guardian of the city) for the administration of the city (Mahavamsa X/81).

Buddhism was introduced to the area in the latter part of the Lower Early Historic period (Mahavamsa XIII, XIV, XV) and well established in Anuradhapura during the Middle Early Historic period and thereafter, the landscape was directly influenced by the North Indian architectural and town planning concepts (Silva, 2000). In Middle Historic times, with the introduction of Buddhism (Mahavamsa XIII, XIV, XV) an inner ring of major monasteries encircled the inner city and several monasteries were added to the hinterland. Soon Anuradhapura developed into the complete city status with a centralized administration and the power to control outside resource areas, (Carswell et al., 2013). Furthermore, the Dry Zone civilization began to flourish in a structured society with industries, and irrigation agriculture, as well as the infrastructure for its development

During the Upper Early Historic period (100 - 300 CE) Anuradhapura and hinterland developed rapidly as the main cultural and economic hub of the ancient Sri Lanka. Material evidence reveals strong trade networks and cultural associations with the outside World (S. Deraniyagala, 1972; Ray, 1960). In the Middle Historic times (300 – 1200 CE), the second ring of monasteries added to the outer periphery of the suburbs of Anuradhapura, adjacent to the forest. During 7th and 8th century, CE a distinct monastery type was added to the western extremities to the city, completing the monastic developments in the area. The most prominent archaeological features visible in the present landscape such as the great stupas and monumental architectural features were added during this last phase of the Anuradhapura (Bandaranayake, 1974).

In the 10th century CE, Anuradhapura was abandoned due to the South Indian invasions. Furthermore, it is believed that the deterioration of the city was the result of malaria and other epidemics, damaged irrigation networks and unsecure conditions within Anuradhapura (Jayasundara, 2011). At the beginning of the Middle Historic times, rulers attracted it to the Polonnaruwa area because of the favorable geomorphic conditions for large-scale irrigation schemes. In addition, the economic importance of *Gokanna* port, situated in the Eastern coast (present Trincomalee), for international trade with the East Asian civilization, attract rulers to the Eastern side of the country, which encouraged the building of

a capital in Polonnaruwa (Ray, 1960). The irrigation landscape came to its maximum extent during the Polonnaruwa kingdom (Gunawardana, 1971). In the mid 13th century CE Polonnaruwa collapsed due to the South Indian invasions and the Kingdom was moved to the intermediate and wet zones of the country and the irrigation civilization was abandoned (Ray, 1960).

Materials and methods

A detailed survey was conducted within the Palipbothana site to map cultural and environmental features. Field observation and mapping were conducted to identify the main landscape elements within the area. Furthermore, the Geographical Information System (GIS) and Global Positioning Systems (GPS) were applied in mapping and spatial analysis. Random spot leveling survey was conducted in micro level to identify the topological features. Hydrological analysis under spatial analysis in GIS were implemented to study the water management landscape. USGS 2017 DEM was analyzed to create water basins and flow accumulations. Besides, primary and secondary literature were analyzed to derive information on landscape evolution. Two separate written and epigraphic sources report on the historical past of Sri Lanka (Ray, 1960). The lithic inscriptions originating from the 3rd century BCE onwards were systematically analyzed to derive information on irrigation landscape.

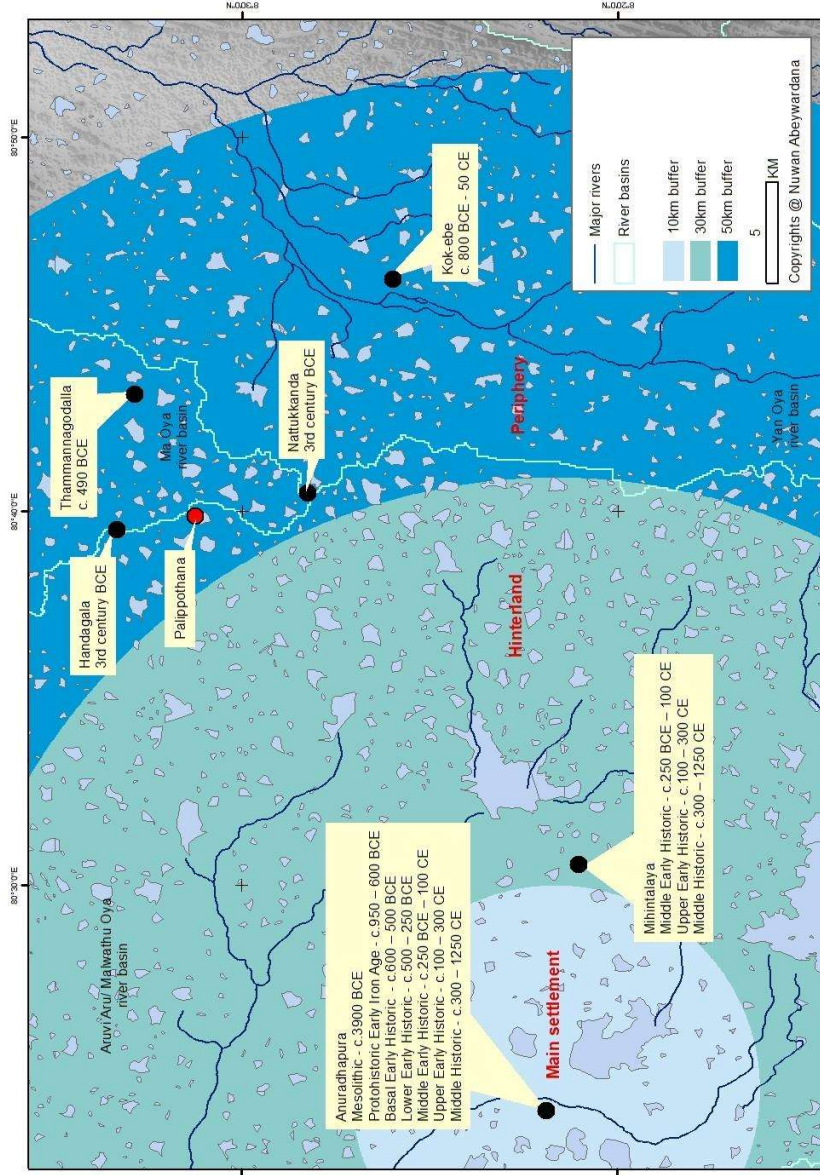
Results and Discussion

Archaeological landscape

Palipbothana is an ancient mortuary complex situated on the edge of Malwathu Oya river basin (Map 4-2). The first appearance of human settlement in Anuradhapura and hinterland dates back to the Prehistoric Mesolithic age (Map 4-2). According to Deraniyagala (2007), three different deposits reveal prehistoric evidence: Rathnapura beds, coastal alluvial gravel, and reddish-brown earth in the dry zone and cave deposits. The basal gravel of Anuradhapura consists of microlith stone tools. Stratified excavations conducted at the Anuradhapura citadel – Gedige revealed mid-Holocene artifacts, comprised of geometric microliths, radiometrically dated to around 5850 *cal* BP (Deraniyagala, 1992; S. U. Deraniyagala, 1972). A few other sites, such as Jethavana monastery and Vessagiriya, situated in the study area, give evidence on Mesolithic hunter-gathers (Mendis, 2008).

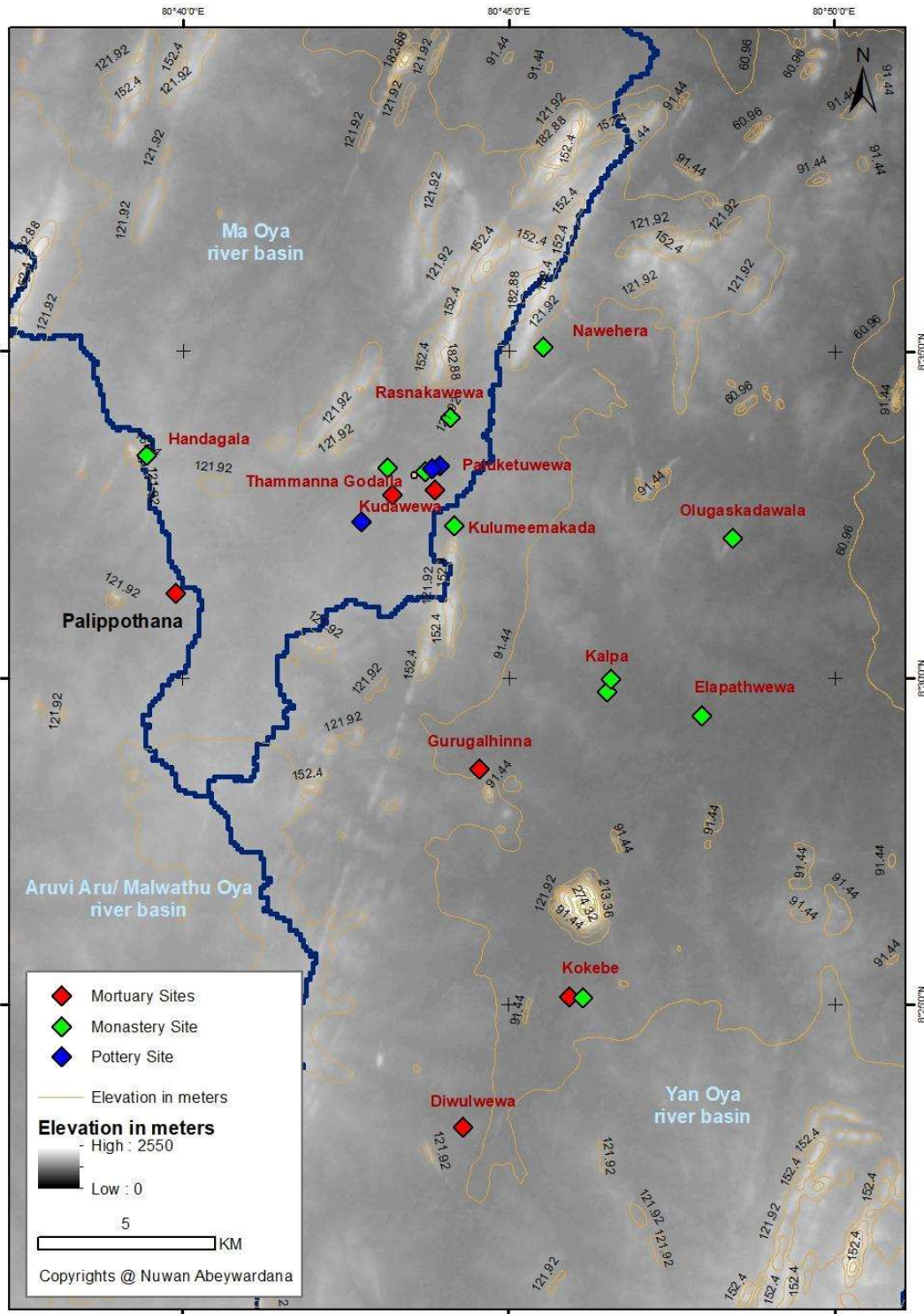
There is no direct evidence of prehistoric settlements from the micro study area. However, favorable environmental conditions of the area positively support the prehistoric

settlements. The site is located on the edge of the river Malwathu Oya basin adjacent to the Ma Oya basin. However, the terrain's gently undulating nature highly supports the natural water holes that encourage human settlements. Prehistoric hunter-gathers had a nomadic lifestyle within the area (Manamendra-Arachchi and Adikari, 2014). The high density of mammals increases the carrying capacity. Reddish-brown earth and quartzite bands provide raw materials for the tool industry. Further, several natural caves are visible in the adjacent valleys, such as Kok-ebe, Rasnakawewa, and Kalpa, which could be used as prehistoric dwelling places. Moreover, the mean annual rainfall is less than 1750 mm (Eriyagama et al., 2010). The northeast monsoon (winter monsoon) is from December to February and is considered the primary precipitation source. These conditions were highly favorable for Prehistoric open-air settlements.



Map 4-2 Relative and absolute datings of the river basins are taken from the Water Information System for Sri Lanka

Relative and absolute datings of the river basins are taken from the Water Information System for Sri Lanka (WISSL) (International Water Management Institute); rivers and tanks are from Survey Department 1:250,000 digital topo sheets. (Deraniyagala, 1992; Mendis and Wiihanachchi, 2017)



Map 4-3 Major sites of the area

Sources: DEM (USGS 2017); river basins are taken from the Water Information System for Sri Lanka (WISSL) (International Water Management Institute); contours are from Survey Department 1:50,000 digital topo sheets.

The next important interchange in landscape development of the area is Protohistoric Early Iron Age (Map 4-2). Protohistoric Early Iron Age culture was well established in the Indian subcontinent by 1,200 BCE (Deraniyagala, 2007; Possehl, 1990). The Early Iron Age's trustworthy earliest dates in Sri Lanka are determined from the Anuradhapura Citadel horizons, dated back to 950 BCE. (Deraniyagala, 2007). The Prehistoric settlement in Anuradhapura is assumed to have been superimposed by the Early Iron Age settlements in 950 BCE, as it is evident from the absence of any prehistoric stone artifacts within the Protohistoric Early Iron Age horizons of the Citadel of Anuradhapura. Sooner Anuradhapura developed as a central place and developed into city status by 6th, 5th century BCE (Deraniyagala, 2007). According to Deraniyagala (2007) the settlement at Anuradhapura exceeded 10ha in extent by ca. 900 BCE, and it was at least 50ha by ca. 700-600 BCE and thus already a 'town'. Simultaneously settlements in peripheral regions developed as semi-urban areas providing the agricultural and economic resources to the central area. Further, the study area is rich with natural resources such as reddish-brown earth and favorable irrigation agriculture conditions.

A ceramic sphere called Black and Red ware (BRW) distinguishes the protohistoric Early Iron Age. Further, the Megalithic, Protohistoric mortuary complexes are a distinguishing feature in the era (Deraniyagala, 2007; Seneviratne, 1984). Anuradhapura demarcates as the major BRW complex within the landscape. It does not include a Megalithic mortuary complex. However, many mortuary complexes are located within the hinterland and peripheral regions and mostly in the study area, namely Kok-ebe, Gurugalhinna, Rambewa, Walahaviddawewa, Diwulwewa, and Thammannagodalla (Map 4-3). Gurugalhinna was the earliest study site studied by R.W. Levers in 1885 and Raja De Silva in 1970 (Seneviratne and Jayaratne, 2006). Few other sites in the region were studied recently and radiometrically dated. The earliest dates comes from the Kok-ebe site (ca. 800 BCE to 50 CE), and Thammannagodalla was dated to ca. 490 BCE. Palipbothana is another Megalithic mortuary complex that could probably date to Protohistoric Early Iron Age.

Continuous improvement occurred in the landscape in the Early Historic periods. With the inception of Buddhism in Anuradhapura urban areas, hinterland and periphery also influenced by Buddhist concepts. As a result, a lithic inscription tradition was introduced to the landscape from the 3rd century BCE onwards. From the 3rd century BCE to the 7th century CE, these inscriptions were written in Brahmi script and are categorized into cave, rock, pillar, and slab inscriptions (Dias, 2001). From the 8th century CE onwards, most rock

inscriptions were written in early Sinhalese script. The inscriptions predominantly address common acts such as grants of cave-dwellings, monasteries, land, tanks, and villages, as well as revenues from the tanks and lands (Dias, 2001). Additionally, they contain details on bureaucracy, as they were used to publish rules and regulations to manage the landscape (Dias, 2001). The study area comprised several sites with Early Brahmin inscriptions from 3rd century BCE onwards. Few examples are; Handagala, Nattukkanda, Rasnakawewa and Berawagama (Map 4-3). Early Brahmin inscriptions located in the area indicate social stratification, different professions, and resource use within the period. They often mention local chieftaincies and leaders such as *Parumaka*, *Gamika*, *Batha* and *Gapathi*. For instance Handagala inscription mentioned;

“*Parumaka-Naga-puta-Tisaha lene ságaśa*”

(The cave of *Tissa*, son of the chief *Nāga*, [is granted] to the Sangha.) (IC - I, 120)

Another inscription in Rasnakawewa mentioned;

“*Gamika-Anudi-jhaya-upaśika-Sonaya lene*”

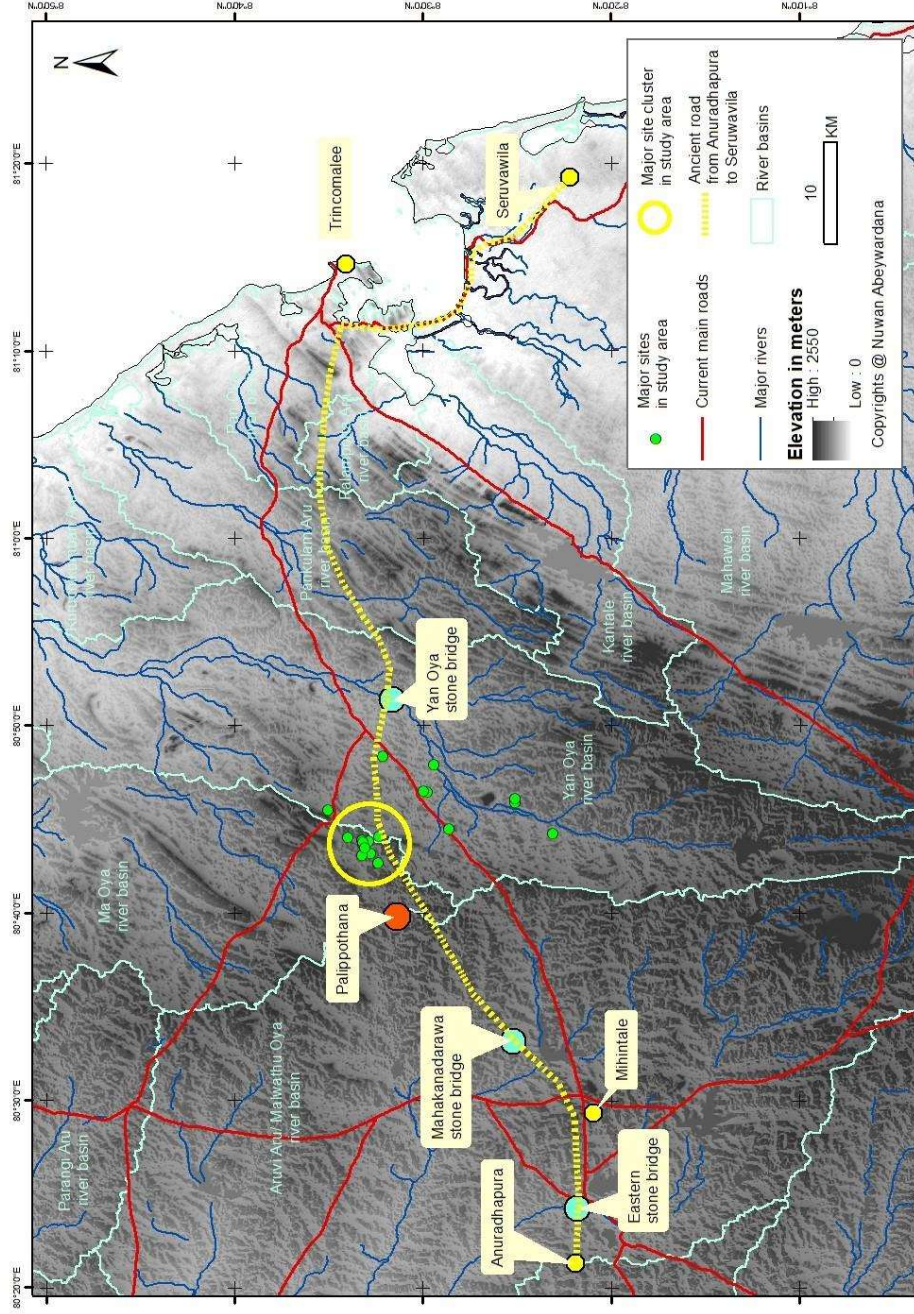
(The cave of female lay-devotee *Sonā*, the wife of the village-councilor *Anudi*) (IC, I, 115).

According to Paranavitana (1970) these *parumakas* were the descendants of the Indo-Aryan pioneers who established village settlements in different parts of the island during the early days of colonization by the immigrants from India. They should probably link with the Early Iron Age Protohistoric culture of Sri Lanka. In many occurrences, *parumakas* are mentioned by name without giving any details about their parentage or office. However, some inscriptions said their responsibilities and office. For instance, an inscription located in Brahmanayagama, closer to the study site, mentioned on a *parumaka* who is a minister (IC, I, 161), *Gamika* is another high-rank title similar to *parumaka*. Paranavithana rendered the word as a village-counselor (IC, I). Meanwhile, *gapathi* referenced to the head of the household. Inscription evidence scattered in the area from Early Historic times reveals the continuing settlements and structured society within the region. Further, they referenced the different industries and professions during the period. Early Brahmin inscription in Brahmanayagama mentioned a donation by an ironsmith named *Phussa* (IC, I, 161d).

The next essential landscape changes in the area happened in the Middle Historical period (300 CE - 1250 CE). Buddhist monastic complexes, founded in Early Historical periods, were well developed in Middle Historic times. Sites like Kalpa, Rasnakawewa,

Kiralagala, Nawehera, Kuda Dambulla, and Kulumeemakada represent Middle historical developments (Map 4-3). These sites were developed parallel to the developments that happened in Anuradhapura main settlement and showing distinct architectural traditions similar to Anuradhapura.

The ancient road network has been reconstructed using several ruined stone bridges which relatively dated to Middle Historical times (Map 4-4). The ancient road from Anuradhapura to Trincomalee (*Gokanna*) starts from the city's eastern gates and reaches through the stone bridges at Malwathu Oya, Mahakanadarawa, and Yan Oya. The route is hypothesized here considering the area's geographical conditions, locations of the stone bridges, and archaeological sites' density. Palipbothana is closer to a main archaeological complex in the area, and an ancient road could flow through this complex (Map 4-4). The ancient road could have been started a few centuries before, even though stone bridges fall into the Middle Historic period. It has been mentioned in several ancient sources. According to Seneviratne (1985), the road is named "*mahacharika magga*" in *Dathuwamsa*. Thusitha Mendis compared this road with the ancient road to Seruwavila and linked with the ancient resource utilization systems, especially copper magnetite (Mendis and Withanachchi, 2017).



Map 4-4 Ancient road network

Sources: DEM (USGS 2017); river basins are taken from the Water Information System for Sri Lanka (WISSL) (International Water Management Institute); current road network is from Survey Department 1:250,000 digital topo sheets

Irrigation landscape

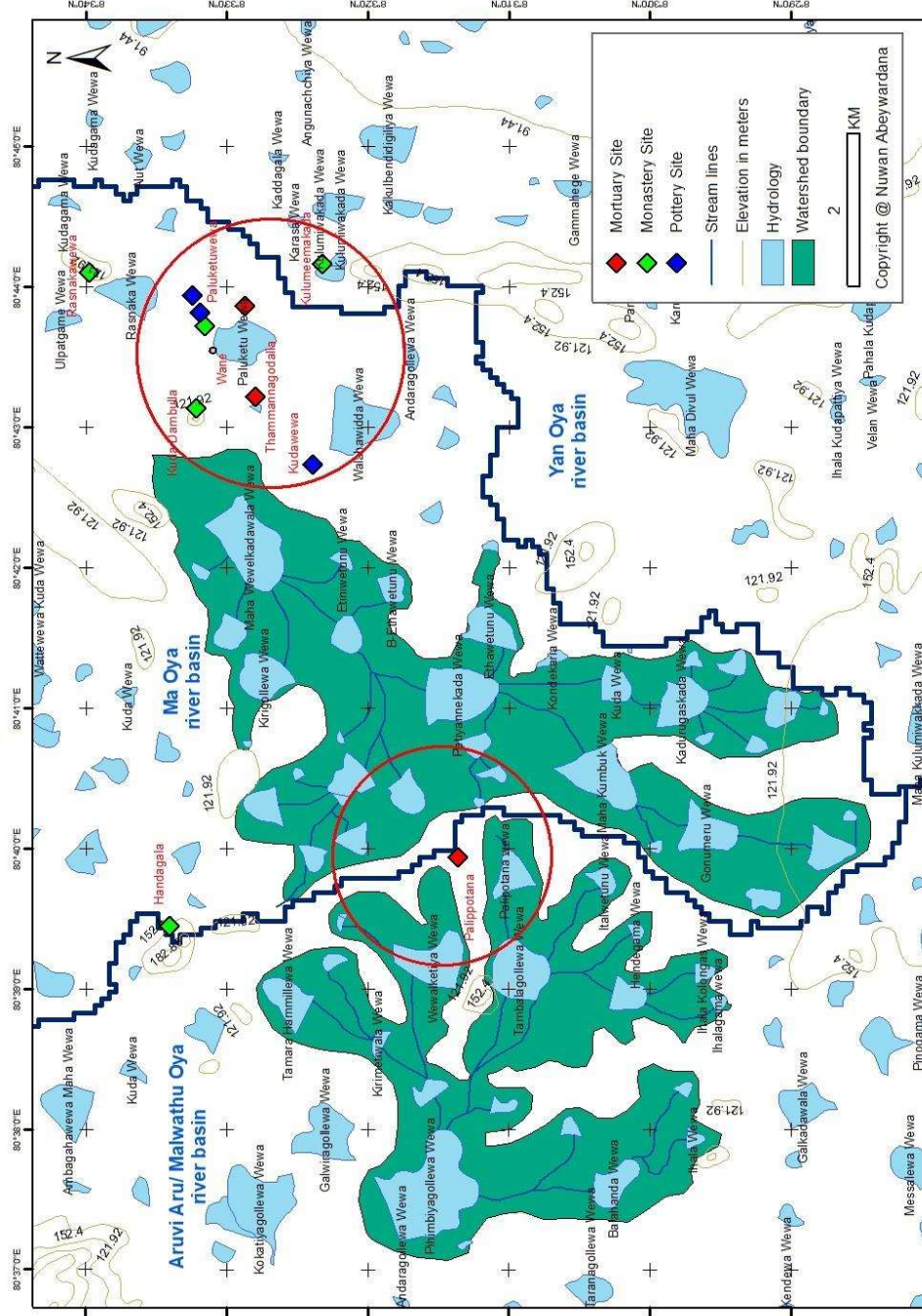
Irrigation agriculture is regarded as a precondition for developing the island's first urbanization in the surrounding of present-day Anuradhapura (Deraniyagala, 2007; Panabokke and others, 2009). Very little is known about the origin and evolution of this sophisticated system. However, many scholars believe the tank system originated from the 3rd century BC and developed throughout the Early Historic periods (Abeywardana et al., 2019, 2018). In the Early Iron Age and Basal Early Historic period, the availability of primitive iron technology (Deraniyagala, 1992) enables the early migrants for primitive earthen works, resulting in the landscape's rudimentary ponds. Anuradhapura has a high density of inland valleys, allowing to build rudimentary ponds (Panabokke and others, 2009) with underlying iron technology. Therefore, it is positive to believe the Basal and Lower Early Historic people practice this technology for centuries for their domestic water needs and small-scale wet rice cultivation.

The numerous drip ledge caves and lithic inscriptions from about the 3rd century BCE in the study area are important in two aspects. The first point is those inscriptions referenced irrigation activities often. Further, it shows the iron technology was superior enough to carve the hard rock surface to engrave inscriptions and drip ledges. Similarly, the developed iron technology enabled them to dig below the decomposed rock to enhance the rudimentary ponds into tanks or reservoirs (Panabokke, 2010). Geomorphology of the study area positively supports such rudimentary ponds and natural water holes. Palipbothana, situated on the edge of the river Malwathu basin, could be linked with such a rudimentary pond in the Early Iron Age periods.

From the 3rd century BCE, lithic inscriptions and the Chronicles referenced numerous canals and professions link with the channels (Abeywardana et al., 2019). Therefore, it is confident that diverting water through the canals was well known to irrigation engineers in Anuradhapura, at least from the 3rd century BCE. By the time, chains of small tanks constructed along numerous inland valleys were connected through the canals. It could be the initial stage of developing the so-called tank cascade system (Madduma Bandara, 1985) in the lowland dry zone area. In most circumstances, the ancient literature referenced the numerous tanks and the canals separately (Abeywardana et al., 2019). Consequently, it shows these irrigation schemes developed independently and randomly located along the area's inland valleys. However, by centuries of experiments and practices and with the gained

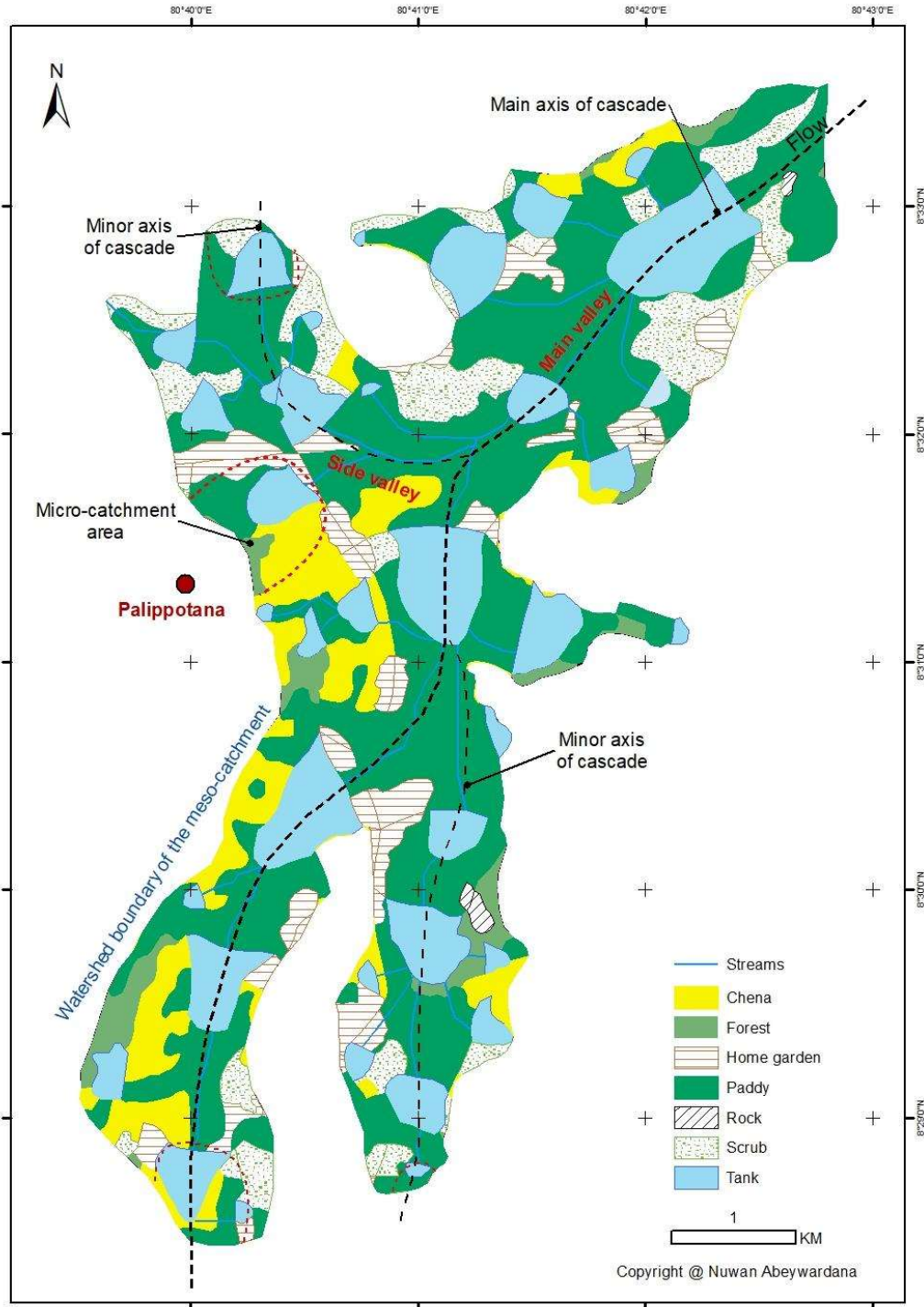
knowledge of rainfall and run-off, they gradually interconnect tanks with canals into a cascade, forming an integrated watershed management system in dry zone Sri Lanka.

Principle landscape management system in the ancient hydraulic civilization in the dry zone is identified as “Tank Cascade System”. It assures the most critical water resource available throughout the year for cultivation and other uses, especially in critical periods of drought. This technology establishes a water-conveying system consisting of a series of tanks interconnected by canals, with surplus water coming from the upstream reservoirs and return flow from the upstream service to the next downstream reservoir (Jayasundara, 2011). Tank cascade system is defined as a connected series of tanks organized within a micro-catchment of the dry zone landscape, storing, conveying and utilizing water from an ephemeral rivulet” (Madduma Bandara, 1985).



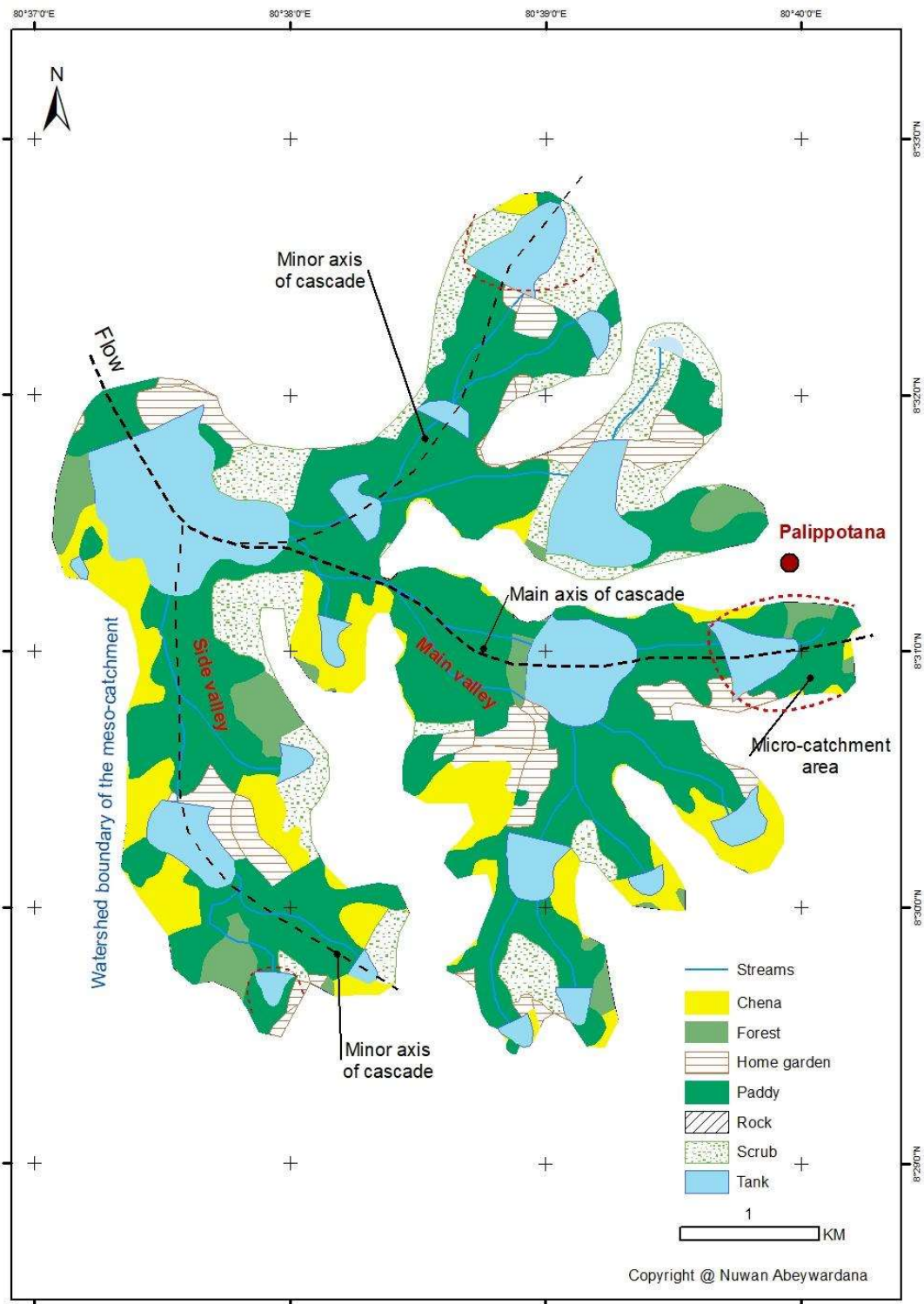
Map 4-5 Irrigation landscape in Palippothana

Sources: river basins are taken from the Water Information System for Sri Lanka (WISSL) (International Water Management Institute); tanks and contours are from Survey Department 1:50,000 digital topo sheets; stream lines were calculated from flow accumulation for USGS 2017 DEM; archaeological sites are from field observations.



Map 4-6 Maha Wewelkadawala cascade

Sources: tanks and landuse are from Survey Department 1:50,000 digital topo sheets; stream lines were calculated from flow accumulation for USGS 2017 DEM; archaeological sites are from field observations



Map 4-7 Pihimbiyagollewa cascade

Sources: tanks and landuse are from Survey Department 1:50,000 digital topo sheets; stream lines were calculated from flow accumulation for USGS 2017 DEM; archaeological sites are from field observations

Palipbothana is situated between upper catchments of two major tank cascades within the area Map 4-5, Map 4-6, Map 4-7. Cascade number 1 is a large cascade, Maha Wewelkadawala, situated east of the site. Palipbothana is located on a micro catchment in the side valley of the cascade (Map 4-6). Further, a core settlement area is visible closer to the cascade's main command area comprising sites like Kuda Dambulla, Thammannagodalla, Kudawewa, wana, and Paluketuwewa (Map 4-5). Pihimbiyagollewa is the second cascade which is located west of the site. Palipbothana is linked with a micro catchment situated along the central axis of the cascade (Map 4-7). Interestingly, the site is located between the two cascades' watershed boundaries and possibly flooding during the rainy season. It is hypothesized here that the site was originally located closer to a rudimentary pond in the landscape, and those ponds were later developed into tanks and connected along the shallow valleys into a cascade.

Irrigation landscape highlights that the area is an extensive agricultural area within historical times. Irrigated paddy cultivation is the main livelihood within the landscape. Besides, some farmers do/burn *chena* cultivation (*hen*), which rain-fed agriculture that is located along the divide of the valley that hosts the tank. Based on its application's long duration, it can assume that the indigenous agricultural system was a sustainable land-use system integrating natural resources, irrigated paddy cultivation, *chena* and village life in the area. The cultural and ecological dimensions of the system were blended and interdependent.

Several lithic inscriptions in the study area, originating from the Middle Early Historical times, give evidence on irrigation landscape. They are located in Handagala, Nattukkanda, Vilewewa, Rasnakawewa, Thammannakanda, Thimbiriwewa, Kallanchiya, and Kahatagasdigiliya, closer to the Palipbothana site (Map 4-8). Inscriptions often reference to several tanks and canals existed in the region in Early Historical times (Table 4-2). For instance Nattukkanda inscription dated to 2nd century CE reports the following:

“Success! A *karisa* for the *Caitya* in *Vadamanaka*, a *karisa* in *Sadavi*, a *karisa* in *Karabavi*, a *karisa* in *Datavi*, a *karisa* in *Honagiriya*, a *karisa* in *Madaci*, a *karisa* in *Cahalabalala*; a *karisa* in *Sivalavi*, a *karisa* in *Vijitara*, a *karisa* in *Culatisavi*, a *karisa* in *Paliya* - the *karisa* for the *catiya* in all these tanks and tracts of fields are (the property) of the *Honagarika-vihara*. (Also) a *karisa* in *Baradaka* and a *karisa* in *Kabaragamikavi*.” (IC, 2, Part 2, 141 A)

Century	Reign	Reference	Location	Names of the tanks and canals
1st C BCE	N/A	IC,1, Nos. 1129, 1132	Handagal a	Naka-nakaraka, Nakodapika
1st C CE	N/A	IC,1, No. 1130	Handagal a	Anulapi
1st C CE	N/A	IC,1, No. 1132	Handagal a	Nakodapika
2nd C CE	N/A	IC , 2, Part 2, 141 B	Nattunka nda	Navavavi, jabavi, kabaragama-vavi
2nd C CE	N/A	IC , 2, Part 2, 141 A	Nattunka nda	Vadamanaka, Sadavi, Karabavi, Datavi, Honagiriya, Madaci, Cahalabalala, Sivalavi, Vijitara, Culatisavi, Paliya, Baradaka, Kabaragamikavi
2nd C CE	N/A	IC , 2, Part 2, 141 C	Nattunka nda	Pajini Honagiriya, Padi
2nd C CE	Gajabahu	IC , 2, Part 1,65	Vilevava	Kubaragama
2nd C CE	Mahallaka-Naga	IC , 2, Part 1,72	Tamman nakanda	Pajalaka,Palaaviya, Manikaragamaka,
2nd C CE	Mahallaka-Naga	IC , 2, Part 1,73	Timbiriv ava	Gagavi
2nd C CE	Mahallaka-Naga	IC , 2, Part 1,74	Kallanchi ya	Nakava
2nd C CE	Vasabha	EZ. VI. Pp 211 ff	Kahataga sdigiliya	channels of the Kabara-aviya tank
3rd C CE	Ghotabhaya	IC , 2, Part 2, 108	Thimbiri wewa	Ganga-vapi, channels of the tank (Kalaka) - vapi
3rd C CE	N/A	IC , 2, Part 2, 153	Rasnakav ewa	channels, of Vihikaviya tank, channels of Alagadaka tank

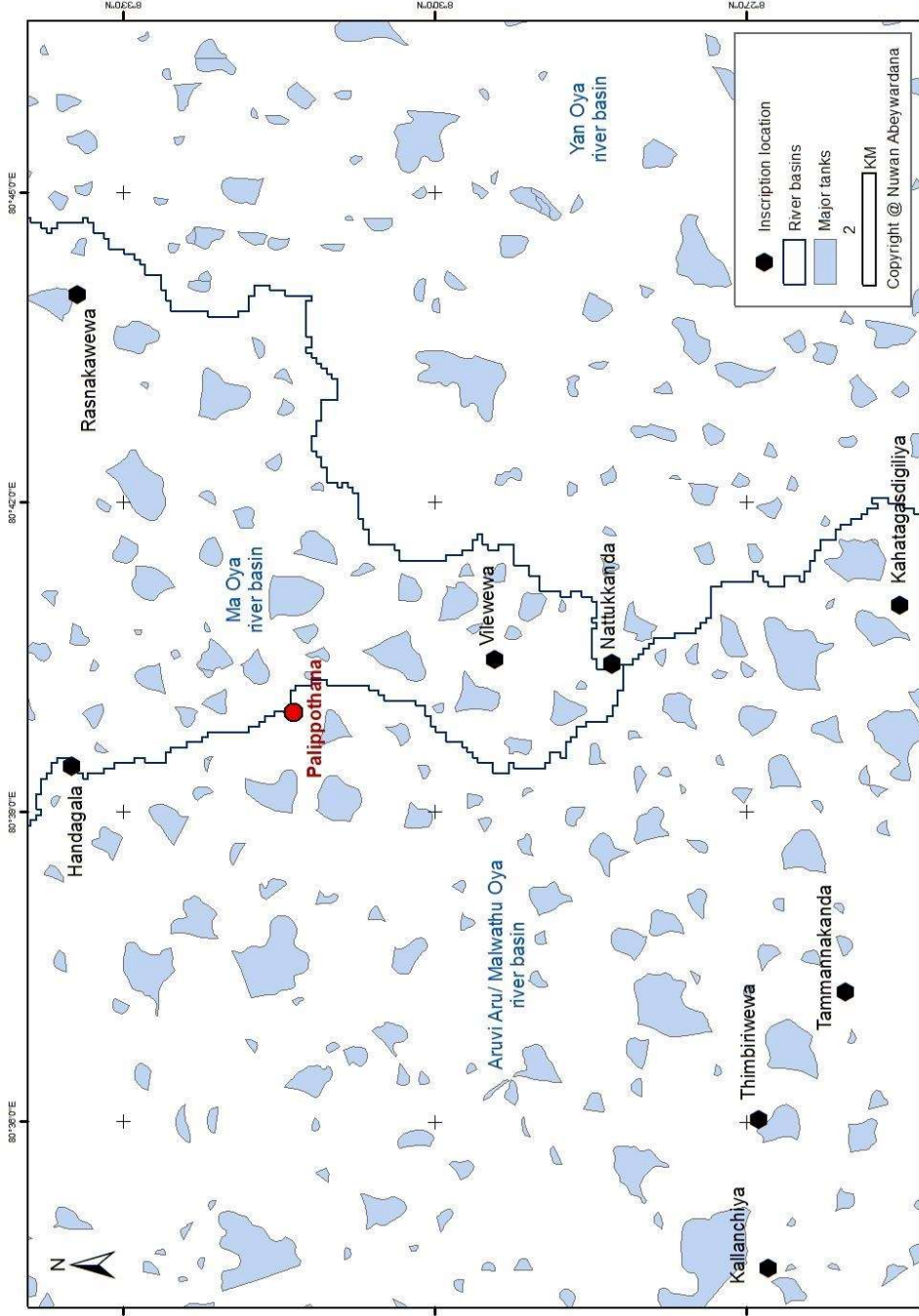
Table 4-2 Different tanks and canals existed within the region

Inscription texts often mentioned on different professions link with the tanks and other irrigation elements (IC, I, 1129, 1130, and 1132). Several inscriptions in the area

mentioned on the proprietors of the tanks (*vapi hamika*). For instance, an inscription located in Handagala said:

“The cave of the lay-devotee *Datta*, proprietor of the tank (*parumaka vapihamika*) of Nakanakaraka, and the cave also of the lay-devotee *Huma*, [is given] to the *Sangha* / The cave of the chief *Dighadatta*, son of the chief *Mahadatta*, the proprietor of the tank of *Nakodapika*, [is given] to the *Sangha*” (IC, I, 1129,1132).

According to the analyzed inscription records in the area, Buddhist temporalities played a crucial role in water management and governance in the Rajarata kingdom. Most records referred to numerous grants of irrigation and their incomes to Buddhist monastic entities. Gunawardana assumes a dual purpose behind these grants of irrigation to the temple authorities (Gunawardana, 1971). He suggests that these grants and subsequent developments turned the Buddhist monasteries into largely self-sufficient economic units to become administrative and political centers (Gunawardana, 1971) eventually. Furthermore, Gunawardana assumes that the society was multi-centered, with power devolving on the gentry and the monastic institution (Gunawardana, 1971). Comparably, Coningham suggests Anuradhapura was a theocratic landscape where monastic centers played a dual role in religious and secular administration, based on the grants of irrigation and the absence of towns and lower-order administrative centers hinterland (Coningham et al., 2007). However, as revealed by the inscription records, it is hypothesized that in the initial development stage of the water management and governance systems (1st century BCE to 3rd century CE), the temple authorities were only one layer irrigation owners among other groups. In light of the spatial distribution and the grants' purpose, it is hard to conclude that temple authorities were administrative centers. According to an inscription in the Nattukkanda archaeological reserve closer to Palipbothana site, two tanks owned by the monastery were mortgaged to a village council called *Atrajiva*, indicating the different layers of owners of irrigation in the 3rd century CE. Furthermore, the purpose of most of these grants was mentioned as religious.



Map 4-8 Inscriptions referenced to irrigation landscape

Sources: river basins are taken from the Water Information System for Sri Lanka (WISSL) (International Water Management Institute); tanks are from Survey Department 1:50,000 digital topo sheets; archaeological sites are from field observations.

According to some inscription evidence from the area, the tanks and irrigation elements' ownership could be sold and transferred. An inscription in Vilevava said:

“Success! The mother of the great king Gamani Abhaya, having purchased the tank of *Kubaragama* after having spent her own wealth-having paid four thousand *kahapanas* K1000-4 gave (the same) to the Sangha in her own monastery” (IC , 2, Part 165).

Further, inscriptions from the area mentioned on different incomes and revenues from irrigation elements. According to the Thimbirivava rock inscription:

“Success! The Minister *Homiya Nakala* of *Gagavi*, being in the Abhayagiri-vihara and having beaten the drum of proclamation, gave to the *Ganapabbata* monastery the principal (lit.great) revenues (or share), belonging to him of the tank of three (categories of) revenue (or of three shares i.e., the tank of *Gagavi*). It was given to the community of *bhikkus*. The date on which this tank was granted-it was granted in the fourth year of the raising of the umbrella (of dominion) of the great king Naga. It was given on the twelfth day of the fortnight in the Moon which has completed (the year)” (IC, 2, Part 173)

References

1. Abeywardana,N., Bebermeier,W., Schütt,B., 2018. Ancient Water Management and Governance in the Dry Zone of Sri Lanka Until Abandonment, and the Influence of Colonial Politics during Reclamation. *Water* 10, 1746. <https://doi.org/10.3390/w10121746>
2. Abeywardana,N., Pitawala,H.M.T.G.A., Schütt, B., Bebermeier, W., 2019. Evolution of the dry zone water harvesting and management systems in Sri Lanka during the Anuradhapura Kingdom; a study based on ancient chronicles and lithic inscriptions. *Water Hist.* 11, 75–103. <https://doi.org/10.1007/s12685-019-00230-7>
3. Allchin,B., Allchin,R., 1999. *The Rise of Civilization of India and Pakistan (South Asia Edition)*. New Delhi: Foundation Books.
4. Bandara,C.M., 1985. Catchment Ecosystems and Village Tank Cascades in the Dry Zone of Sri Lanka A Time-Tested System of Land and Water Resource Management, in: *Strategies for River Basin Management*. Springer, pp. 99–113.
5. Bandaranayake,S.D., 1974. *Sinhalese Monastic Architecture: The Viháras of Anurádhapura*. BRILL.

6. Carswell,J., Deraniyagala,S., Graham,A., 2013. Mantai: City by the sea. Lindensoft-Verlag.
7. Coningham,R., 2013. Anuradhapura: The British-Sri Lankan Excavations at Anuradhapura Salgaha Watta. The@ Hinterland. Archaeopress.
8. Coningham,R., Gunawardhana,P., Manuel,M., Adikari,G., Katugampola,M., Young,R., Schmidt,A., Krishnan,K., Simpson,I., McDonnell,G., Batt,C., 2007. The state of theocracy: defining an early medieval hinterland in Sri Lanka. *Antiquity* 81, 699–719. <https://doi.org/10.1017/S0003598X00095673>
9. Coningham,R.A.E., 1999. Anuradhapura, Volume 1: The Site. Oxford: Archaeopress.
10. Cooray,P.G., 1967. An introduction to the geology of Ceylon. National Museums of Ceylon Colombo.
11. Cooray,P.G., 1984. The geology of Sri Lanka (Ceylon). Natl. Mus. Publ. Dep. Gov. Print. Ed Colombo Sri Lanka.
12. De Silva,N., Somadeva,R., 2006. The Galpaya Survey: Report of the First Field Season 2006. Postgraduate Institute of Archaeology [University of Kelaniya].
13. Department of Census and Statistics-Sri Lanka [WWW Document], n.d. URL <http://www.statistics.gov.lk/> (accessed 10.18.18).
14. Deraniyagala,S., 1972. The Citadel of Anuradhapura: Excavation in the Gedige area. *Anc. Ceylon* 2.
15. Deraniyagala,S.U., 2007. The prehistory and protohistory of Sri Lanka, in: *The Art and Archaeology of Sri Lanka*. Central Cultural Fund.
16. Deraniyagala,S.U., 1992. The prehistory of Sri Lanka: an ecological perspective. Department of archaeological survey, government of Sri Lanka.
17. Deraniyagala,S.U., 1972. Archaeological explorations in Ceylon, pt. 1:Horton plains. *Spolia Zeylan*. 32, 13–23.
18. Dias,M., 2001. The growth of Buddhist monastic institutions in Sri Lanka from Brahmi inscriptions. Colombo Dep. Archaeol. Surv.
19. Dissanayake,C.B., Weerasooriya,S.V.R., 1985. hydrogeochemical atlas of Sri Lanka. Natural Resources, Energy & Science Authority of Sri Lanka.

20. Eriyagama,N., Smakhtin,V., Chandrapala,L., Fernando,K., 2010. Impacts of climate change on water resources and agriculture in Sri Lanka: a review and preliminary vulnerability mapping. IWMI.
21. Geiger,W., 1908. Mahavamsa: Great Chronicle of Ceylon. H. Frowde.
22. Grange,J., 1985. Place, body and situation, in: Dwelling, Place and Environment. Springer, pp. 71–84.
23. Gunawardana,R.A.L.H., 1971. Irrigation and Hydraulic Society in Early Medieval Ceylon. Past Present 3–27.
24. International Water Management Institute, n.d. Water Information System for Sri Lanka. [WWW Document]. URL <http://slwater.iwmi.org/>
25. Jayasundara,J.M.S.B., 2011. Potentials of Reservoir Cascade Ecosystem in Adoption to Climate Change. Samodhana J. Fac. Soc. Sci. Humanit. 2.
26. Karunaratne,P., 1994. A brief report on the excavation at Ibbankatuva, a proto-and Early Historic settlement site. Furth. Stud. Settl. Archaeol. Sigiriya-Dambulla Reg. 104–9.
27. Kluiving,S.J., Guttman-Bond,E., 2012. Landscape Archaeology between Art and Science : From a Multi- to an Interdisciplinary Approach. Amsterdam University Press.
28. Manamendra-Arachchi,K, Adikari,G., 2014. Past and Present Biodiversity of Anuradhapura. Ministry of Environment and Renewable Energy, Colombo, Sri Lanka.
29. Mendis,T., 2008. A New Cultural Road Map to Anuradhapura A Material cultural at Vessagiriya, in: Heritage Achievement. Central Cultural Fund, Colombo, Sri Lanka.
30. Mendis,T., Withanachchi,C., 2017. Settlement archaeology of middle Yan Oya basin.
31. Panabokke,C.R., 2010. Evolution of the indigenous village irrigation systems of Sri Lanka.
32. Panabokke,C.R., 2002. Small Tanks in Sri Lanka: Evolution, Present Status, and Issues. IWMI.
33. Panabokke,C.R., 2001. The Small Tank Cascade Systems of the Rajarata: Their Setting, Distribution Patterns, and Hydrography.

34. Panabokke,C.R., 1996. Soils and agro-ecological environments of Sri Lanka. NARESA.
35. Panabokke,C.R., 1959. A STUDY OF SOME SOILS IN THE DRY ZONE OF CEYLON. *Soil Sci.* 87, 67–74.
36. Panabokke,C.R., others, 2009. Small Village Tank Systems of Sri Lanka: Their Evolution, Setting, Distribution, and Essential Functions. Hector Kobbekaduwa Agrarian Research and Training Institute.
37. Paranavithana,S., 1970. Inscription of Ceylon: Early Brahmi Inscriptions, vol. 1. Dep. Archaeol. Colombo.
38. Possehl,G.L., 1990. Revolution in the Urban Revolution: The Emergence of Indus Urbanization. *Annu. Rev. Anthropol.* 19, 261–282. <https://doi.org/10.1146/annurev.an.19.100190.001401>
39. Ray,H.C., 1960. History of Ceylon... Vol. 1.
40. Seneviratne,S., 1985. Iron Technology in Sri Lanka: A Preliminary Study of Resource Use and Production Technique during the Early Iron Age.
41. Seneviratne, S., 1984. The Archaeology of the Megalithic Black and Red Ware Complex in Sri Lanka. *Anc. Ceylon* 5, 7–30.
42. Seneviratne,S., Jayaratne,D.K., 2006. The Megalithic Memorials of South India and Sri Lanka. *Altern. Archaeol.J. Soc. Archaeol. Univ. Perad.* 1–14.
43. Silva,R., 2000. Development of Ancient Cities in Sri Lanka with special reference to Anuradhapura. *Reflect. Herit. Hist. Scholarsh. Pre-Mod. Sri Lanka* 49–81.
44. Somasekaram,T., 1988. The National Atlas of Sri Lanka. Sri Lanka Surv. Dep. Colombo Sri Lanka 1–141.