Low Density Urbanism in Medieval Sri Lanka: Exploring the hinterland of Polonnaruva

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Abstract

A hinterland survey at Polonnaruva has revealed that a planned pluralistic landscape developed during the latter part of the Early Medieval period (A.D. 600-1200). This represents a significant shift in settlement pattern from the organically derived model of *Buddhist Temporalities* found at the antecedent capital, Anuradhapura. In comparison, settlements around Polonnaruva were larger, longer-lived and evenly distributed. This

coincided with a major island-wide shift towards centralization thought to be associated with experimentation with a new model of royal control. Yet, both systems can be described as instances of low density urbanism, suggesting that there was greater variation within this settlement genre than previously anticipated.

<HEADING LEVEL 1> Introduction

Capital of Sri Lanka from A.D. 1017-1215, Polonnaruva remained the political center of the island for over two hundred years (Figure 1). New research focusing on the city and its hinterland has demonstrated the development of a formalized settlement pattern in which multiple communities and religious traditions were integrated. Settlements within the hinterland of the city were large and evenly distributed across the landscape, indicating a degree of pre-planning. This represents a significant divergence from the patterns identified around Anuradhapura, which had been capital for most of the period from the early first millennium B.C. to A.D. 1017, and denotes a distinct shift from the Early Historic period into the Early Medieval world.

A recent hinterland survey around the medieval city of Polonnaruva in Sri Lanka has demonstrated the imposition of what this research interprets as a distinctive planned settlement pattern. Reflecting the strikingly cosmopolitan nature of the city, the landscape was pluralistic in nature, containing centers of Buddhist and Hindu ritual. Polonnaruva's model of increasing centralization and order is interpreted as a conscious attempt to avoid the weakened role of royal power that characterized the final phases of the island's first capital, Anuradhapura. Yet, this centralization did not come at the expense of the kingdom's diverse communities. Furthermore, it appears to conform to a different model from that

witnessed around Anuradhapura, indicating the development of an alternative trajectory for low density urbanism. On the island of Sri Lanka, therefore, low density urbanism appears to have operated with high levels of state control at Polonnaruva but limited state control at Anuradhapura.

Low density urbanism is a relatively new concept in archaeological discourse, derived predominantly from the work of Roland Fletcher and colleagues at Angkor in Cambodia (Evans et al. 2007; Evans and Fletcher 2015; Fletcher 2012), before being exported to Mesoamerica (Isendahl and Smith 2013; Scarborough, Chase and Chase 2012), South Asia (Lucero, Fletcher and Coningham 2015) and more recently realized at Great Zimbabwe, Chaco Canyon and Iron Age European oppida (Fletcher 2019). Low density urbanism, in an archaeological sense, is term used to describe a dispersed network of communities and settlements often distributed around a ritual or political core and integrated through infrastructure such as hydraulic systems, as at Angkor (Evans et al. 2007) and in Sri Lanka (Gilliland 2013a, 2013b). It is derived from more recent geographical discourse into the agglomeration of cities and conurbations establishing almost contiguous tracts of occupation or urban sprawl, such as the Boston-Washington corridor in the USA and desakota such as Jakarta or Bangkok in southeast Asia (Fletcher 2019).

Previous proponents of low density urbanism have argued that populations were economically agricultural, but simultaneously integrated into the urban realm (Lucero, Fletcher and Coningham 2015: 1140). However, what is often missing from discussions of low density urbanism is the mechanics of how this was actually achieved, politically, economically and socially (Fletcher 2009, 2019). This relationship between core and

periphery, or city and hinterland, is perhaps one of the least developed aspects of the model, as many of the examples of low density urbanism are derived from satellite or lidar data rather than surface settlement survey. Indeed, the terminologies used within discussions of low density urbanism to refer to these different elements can sometimes be problematic. Within this paper we use the terms city and hinterland to refer to the more densely settled urban core of Polonnaruva and the lower density agrarian settlements within the surrounding landscape respectively. Exactly where this boundary is situated is inherently problematic. We have used the outer boundary wall of the city as the division between "city" and "hinterland" but recognize that this is a somewhat arbitrary division within an integrated network. It could equally be argued that the urban core of Polonnaruva should extend to cover the Parakrama Samudra (a large water tank created by constructing a bund or dam across a river) to the east as well as other temples, religious compounds and hydraulic features within its vicinity. However, this present artificial division does allow an ease of discussion of the urban core of the city and its wider landscape within what we might refer to as 'Greater Polonnaruva' (Figure 2).

<HEADING LEVEL 1> Polonnaruva: an Early Medieval capital of Sri Lanka

According to the Pali chronicle Culavamsa (Geiger 1973), Polonnaruva became *de facto* capital of Sri Lanka in A.D. 1017 following an expansion by South India's nominally Tamil Chola Empire. Taking advantage of weakened royal control of the island under Mahinda V (r. A.D. 982-1029), Rajaraja invaded in A.D. 993, capturing both Anuradhapura and Polonnaruva (Spencer 1976). The Cholas ruled over the northern part of the island for about 70 years, fending off several invasions from the southern Sri Lankan kingdom of Ruhuna. Vijayabahu I (r. A.D. 1055-1110) recaptured Anuradhapura and laid siege to Polonnaruva, eventually

retaking the city. As the Cholas retreated, Vijayabahu was crowned in A.D. 1073 and maintained Polonnaruva as his new capital. He is recorded as having ushered in a new era of religious freedom and provided support to Tamils for religious performances (de Silva 1981).

The new capital at Polonnaruva had a pre-planned urban layout and was home to numerous Hindu and Buddhist monasteries. It was enclosed by a wall measuring 5.6 kilometers in length, and divided into a citadel area at the south, and an inner city and outer city covering areas of at least 65 hectares and 400 hectares respectively, although the full extent of the outer city is still unknown (Figure 2). Polonnaruva's period as capital of the island is best remembered through the activities of two kings, Parakramabahu I (r. A.D. 1153-1186) and Nissankamalla (r. A.D. 1187-1196), who were credited with the construction and embellishment of monuments. The former is noted for the construction of the Parakrama Samudra, a huge reservoir or tank to the east of Polonnaruva covering 2500 hectares, with a carrying capacity of 134 million cubic metres (Seneviratne 1998: 95), and the Demala Maha Seya, a partially completed stupa (a large mound, often covered in brick built over a relic of the Buddha or in a location connected to his life) which measured 183 meters in height (Seneviratne 1998: 188). Nissankamalla is attributed with the construction of the Rankot Vihara complex visible in Figure 3, including a brick stupa measuring 61 meters high with a diameter of 57 meters (Seneviratne 1998: 159). These represent significant campaigns of monumental construction that characterize this period.

In A.D. 1215 the chronicles record that the island was again invaded, this time by the north Indian kingdom of Kalinga (*Culavamsa* 80.58-80.80 [Geiger 1973: 132-134]). The capital shifted to Dambedeniya, and whilst Polonnaruva was recaptured in A.D. 1255, the city never

quite returned to its elite political status. Between A.D. 1232 and 1293, the capital shifted between Dambedeniya, Polonnaruva and Yapahuwa, before being established at Kurunegala under Bhuvanekabahu II (r. A.D. 1293-1302) (Table 1).

Polonnaruva itself was "rediscovered" in the mid-nineteenth century by British colonial officers as part of a wider mission to resettle the north central part of the island. Early archaeological interest in the site was focused on the clearance and restoration of monuments (Bell 1910). Over 100 years of work at the site has defined its urban landscape and the function of the city's major monuments, quarters and monasteries are reasonably well understood (Basnayake 1990). In the 1980s, excavations were undertaken by the Archaeological Department and Cultural Triangle (now the Central Cultural Fund). The excavations at the Alihana Parivena monastic complex (Prematilleke 1988) formed the basis of the site's recognition of UNESCO World Heritage Status in 1982.

<HEADING LEVEL 1> Temporalities and Low Density Urbanism at Anuradhapura

In 2007 a paper on the city and hinterland of Anuradhapura advanced a working hypothesis for a shift from a simplistic top-down, tiered settlement hierarchy to an organic system in which local monastic centers played the role of towns acting as foci of economic, political and spiritual power (Coningham et al. 2007). Further refinement of chronologies (Bailiff et al. 2013), along with an understanding of the changing environmental and hydrological development of the hinterland (Gilliland et al. 2013a; Gilliland et al. 2013b), and input from discussions at the *Royal Asiatic Society of Sri Lanka* (Goonatilake 2011) saw the development of this model with the full publication of six seasons of work (Coningham and Gunawardhana 2013). This new model, termed "Buddhist Temporalities", presented a fluid

and flexible system of landscape administration in which "the city's surrounding landscape of villages and rural communities was not centrally regulated by the state through higher-order settlements and royal officials but through a network of viharas (temples), closely linked to the great monasteries of the city rather than the throne" (Coningham 2011: 940). These monasteries performed functions of territorial expansion, the colonization and appropriation of new areas, and incorporation beyond royal or state prerogatives (Coningham et al. 2013b). The landscape was not as static and monolithic as originally presented, but instead was highly contested. It was home to different sects of Buddhism, whilst localized traditions existed alongside more orthodox religious norms (*ibid.*), such as non-monastic and non-urban terracotta figurines at a number of sites, belonging to the 'Tabbova-Maradanmaduva Culture' (Coningham et al. 2012). This recognition of such complexities within the landscape led to the Buddhist Temporalities model in which interdependent and competing heterarchies were active within the hinterland (Coningham et al. 2013b). This shifted the narrative of the archaeology of Sri Lanka away from normative, top-down and often textually-derived, Early Historic South Asian models, and into the wider realm of tropical forest civilizations and low density urbanism, and parallels drawn with Southeast Asia and Mesoamerica (Bronson 1978; Coe 1961; Dunning et al. 1999; Fletcher 2009; Inomata 2006; Lucero, Fletcher and Coningham 2015) rather than to the cities of the Gangetic basin (Coningham et al. 2013b). As such, rather than smaller settlements representing subordinated communities in a hierarchical model akin to those presented within the Arthasastra (see Coningham et al. 2007), within a low density urbanism scenario these hinterland settlements are now presented as part of an integrated and heterarchical network linked through key nodes.

<HEADING LEVEL 1> Exploring the wider hinterland of Polonnaruva

Polonnaruva sits within the semi-arid landscape of North Central Sri Lanka, at the junction of upland areas to the west and lower lying alluvial plains to the east, some 50 km from the coast. The region receives c.1700 mm of rain per year, mostly during October-January with near drought conditions from May to September, whilst the temperature is consistent at 26-30^{o}C throughout the year (Green 1986: 237). The landscape was drastically altered during the city's occupation with the establishment and embellishment of several large tanks and canals to capture monsoon rains to be used year-round for agriculture (Brohier 1931).

Due to the previous focus on the monumental monastic heritage, there is limited literature regarding the pattern of religious and secular communities in the city's hinterland or the archaeological sequence of the city itself. A new joint venture between the Central Cultural Fund, Postgraduate Institute of Archaeological Research, Maharaja Sayajirao University of Baroda and Durham University has begun at Polonnaruva (Manuel et al. 2018). The project aims to model the networks linking the urban core and hinterland communities through a combination of archaeological field survey, small targeted excavations and geoarchaeological analysis. Within the city of Polonnaruva itself, excavation has focused on the area surrounding Siva Devale No.2, a Hindu monument located in the northeast corner of the inner city and dated from an inscription to the early eleventh century A.D. (Pathmanathan 1987: 53). Research has demonstrated the presence of a vibrant temple economy, including metal, glass and lapidary working and the presence of terracotta token molds (Manuel et al. 2018). Siva Devale No.2 functioned as a miniature version of the South Indian temple towns that developed during the Chola period (Heitzman 1987). In South India, the Chola heartland, these temples were the central focus of the city. At Polonnaruva,

Siva Devale No. 2 is situated at the edge of the final iteration of the inner city, although as yet we do not know where the original core of the Chola city was situated. This situation reflects Polonnaruva's niche, chronologically nestled between the organically developed and Buddhism-focused Early Historic period on the island, and the wider ranging, cosmopolitan medieval developments of South Asia.

The hinterland survey at Polonnaruva follows the methodology utilized at Anuradhapura (see Coningham et al. 2013c for a more detailed methodological discussion) for two key reasons. First, it has proven to be very successful in identifying and interpreting archaeological sites within the semi-arid landscape of Sri Lanka. Second, retaining the methodology ensures that the two datasets can be systematically compared and contrasted in order to build our knowledge base. It also addresses a period in South Asia's past which has often been neglected archaeologically, with methodologies drawn from history, epigraphy and architecture to draw conclusions (Hawkes 2014a). Whilst this work represents a new emergent dataset, there are few comparable projects against which to test the results from Polonnaruva. Perhaps the closest parallels include research conducted at the later south Indian capital city of Vijayanagara (Sinopoli and Morrison 1995), or the landscape surveys at Sanchi (Shaw 2007) and Bharhut (Hawkes 2014b), both of which are much earlier in date and focus on stupas rather than cities. In contrast, many of the inferences and discussions regarding Polonnavura in this paper are drawn from how the landscape has changed from the preceding period and how it represents a new form of low density urbanism.

<HEADING LEVEL 1> Results

The new survey in Polonnaruva's hinterland has now completed 280 kilometers of transects (30% of the area covered at Anuradhapura) along with 12 kilometers of the Kalinga Ela canal bund, and 8.5 kilometers of the Ambang Oya (Figure 4). As at Anuradhapura (Coningham et al. 2013c), transects were traversed by a team of between five to eight archaeologists spaced five meters apart recording archaeological and ethnographic sites. Archaeological sites were similarly defined by architectural or sculptural remains, lithics or a scatter of more than five ceramic sherds per square meter. Sites were mapped with GPS, photographed and diagnostic material collected. At present, transect survey has specifically focused on areas which are accessible, but geographically representative of the region. A major challenge of working around Polonnaruva is the prevalence of strict nature reserves and dense forest (58% of the survey area), which are home to a large proportion of the island's wild elephant (and other wildlife) population. Future work in these areas will require a modified survey technique, as well as close co-operation with forestry personnel. Despite these restrictions, we remain confident that the results gathered to date provide both a representative and non-probabilistic sample of hinterland sites.

In total, 183 new archaeological sites and 42 hydraulic features have been recorded. The 183 archaeological sites can be further subdivided into 51 ceramic scatters, 51 ceramic scatters with metal-working residues, 39 religious sites, 20 undiagnostic sites, six slag scatters, six possible megalithic burials, four examples of ancient quarrying, three lithic scatters, one conical hole site, one colonial period bridge and evidence of a large moated enclosure (Figure 5). The 42 hydraulic features can be divided into 26 tanks or bunds, 11 canal bunds and five sluices or annicuts (structures built within river channels used to divert and control water flow).

<HEADING LEVEL 2> Ceramic Scatters

Ceramic scatters were the most commonly recorded site type in the hinterland, and were found in association with brick, tile, metalworking residues and occasionally other artefacts, such as glass beads (Figure 6). They typically have no evidence of religious activity or structural remains such as pillars. The scatters ranged in size from 0.0025 to six hectares, with an average of roughly 0.25 hectares. Where metal-working residues were found, the smallest site encountered measured 0.12 hectares, with an average closer to 1 hectare. This is in stark contrast to the 478 scatters found around Anuradhapura, which were small and ephemeral – less than 0.0025 ha (Manuel et al. 2013: 50-52). Eight auger cores collected at two ceramic scatters with metal-working residues – S018 and S022 –consistently demonstrated cultural material ranging between 0.5 and 1.5 meters in depth. Again, this contrasts with the shallow scatters around Anuradhapura, which were only 0.2 meters deep.

On the basis of diagnostic sherds recovered from surface collection, these sites were predominantly dated to the Early Medieval period (A.D. 600-1200) based on excavations from trench ASW2 located in the citadel at Anuradhapura (Coningham et al. 2013a). Although a large number of sherds belong to long-lived variants dating from the Early Historic (c. 340 B.C.) right through to modern periods making phasing difficult, the sherds were more typical of those found in the final phases of occupation in the Anuradhapura hinterland. As such, we currently postulate that the ceramic scatters are predominantly, but not exclusively, dated to the Pollonaruva period. Finer chronological clarity can only be derived from further excavations of sites in Greater Polonnaruva, and within the city itself.

Problems of dating aside, the quantity and density of ceramics was much greater around Polonnaruva than was found around Anuradhapura.

This suggests that a very different settlement pattern was present at Polonnaruva. Indeed, the smaller ceramic scatters at Polonnaruva tended to be located within erosion gullies and washes, rather than *in situ* deposits of material, suggesting that hinterland communities were agglomerated and permanent at Polonnaruva, in contrast to the ephemeral and short-term chena (slash-and-burn) villages at Anuradhapura. In terms of distribution, the ceramic scatters were evenly distributed throughout the landscape, with some of the larger sites found along the Ambang Oya (River). There was also a distinct cluster of scatters with metal-working residues found to the west and southwest of the Parakrama Samudra, closer to the hills, providing possibly easier access to raw materials.

<HEADING LEVEL 2> Religious Sites

A total of 39 religious sites were recorded and ranged from modern temple complexes that incorporated ancient architectural elements into new buildings, to large complexes consisting of multiple elements such as lenas (caves), stupas, image houses and other monastic elements. In terms of chronological development, the five caves or lenas would represent evidence of Early Historic monastic occupation and are found all across the island at this point (Coningham 1995). However, four of these five sites are incorporated into later monastic complexes including three Pabbata Viharas, traditionally dated to between A.D. 700 and 1200 (Bandaranayake 1974: 81). Many of the other monastic sites are difficult to date due to the level of preservation or lack of chronologically secure materials. Ten of the remaining 34 religious sites can be securely dated to the period A.D. 600-1200 based on

architectural features (Coningham et al. 2013a). A further two sites can be assigned a late date based on the presence of Pollonaruva period inscriptions.

What is immediately noticeable is that the religious sites around Polonnaruva are larger and more formalized than those at Anuradhapura. At present, the religious sites are predominantly Buddhist in appearance. However, this may be an artificial construct of our current identification and classification of sites. We know from Anuradhapura how Buddhist monastic sites appear in the archaeological record from the many examples recorded, although we have few examples of Hindu sites in both the Anuradhapura or Pollonaruva hinterland from which to build our understanding. The presence of a Hindu Siva Devale temple alongside Buddha statues at the well-known religious complex of Nagalakanda (S125) suggests that the hinterland accommodated multiple traditions and communities.

This is confirmed through the identification of yoni (depiction of the womb or female sexual organs common within Shivite worship) stones from two sites (one of which was not in situ) (Figure 7). These two sites were situated 25km southeast of Polonnaruva, in an area where there was a cluster of five religious sites recorded, but only two ceramic scatters. Two *lenas* (caves or rock shelters) were recorded at Siripa Lena Temple (S202), and were the only new examples recorded on survey, complementing the known examples at Dimbalagala, Pulligoda and Kandakaaku. Neither of them contained Early Brahmi inscriptions, suggesting that early monastic architecture was scarce in the area to the southeast of Pollonaruva. Ceramic sherds with applique trisula (a trident commonly associated with Shivite worship) recovered from two sites to the southeast (Figure 8) also indicate greater religious pluralism in the landscape, although this also reflects the inherent issue in South Asian archaeology of

distinguishing between different religious practices (Coningham et al. 2017: 41f). Assigning religious denomination to inanimate objects is problematic, and there are many examples, including within Sri Lanka of the same object or site being used by multiple religious (and lay) communities for different purposes (Coningham et al. 2017)

An Early Brahmi slab inscription was recorded at Weheragodalla (S206) that dates the site to 187 B.C., and an eleventh and twelfth century A.D. inscription was recorded at Keththarama Aramaya (S234). Further work on the translation and history of these inscriptions is required. Also of note was the identification of a stone-cut cistern at Maliga Thanna (S235) that had been subjected to looting (Figure 9). The cistern measured 1.8 by 1.8 meters in size and about two meters deep. It had been partially dug out by looters and was part of a wider complex of walls and structures covering an area at least 9ha in size. However, as it was buried deep inside an area of the jungle, it was difficult to ascertain its overall form. As for the other religious sites, they are variable in size, with the largest complexes such as Medirigiriya, Nagalakanda, Weheragodella, and Galkanda all measuring over 25 hectares and comprising several structures including stupas, image houses and even a hospital in the case of Medirigiriya.

It is clear that many of these sites are at risk from encroachment, looting and rededication despite Sri Lanka's strong legislation protecting archaeological sites and materials (Antiquity Ordinance No 9 1940; Central Cultural Fund Act No 57 1980). Twenty of the sites showed evidence of looting or deliberate destruction through quarrying, agriculture or other construction. At the same time, 14 of the sites were identified through the presence of archaeological material being reused within modern temples or as new temples built at the

site. This suggests a high degree of rededication of monuments in the area – reopening the debate between looting and rededication and the fuzzy boundaries that exist between illegal activity derived from colonial era legislation and modern religious practice on the island (Coningham and Gunawardhana 2012).

<HEADING LEVEL 2>Undiagnostic Sites

At Anuradhapura this category encompassed sites that contained stone blocks and pillars but with no obvious signs of being monastic or religious. Whilst worked stone pillars indicated a degree of specialization and were usually present at monastic sites, their presence was not an absolute indication of monasticism. They were often found in isolation and may represent secondary use. At Polonnaruva, the twenty undiagnostic sites were predominantly isolated pillars representing small structures. They are difficult to date from architectural features due to the longevity of the material.

<HEADING LEVEL 2>Inscriptions

There have been 44 inscriptions recorded within the city of Polonnaruva and a further 272 within a 50km radius of the city (see Davis et al. 2013 for detailed information on methodology). The vast majority of these inscriptions date to the Early Historic period (340BC-AD200), and the overall pattern of inscriptions at Polonnaruva and its hinterland followed that at Anuradhapura: donation > construction > elaboration > immunity (Davis et al. 2013) (Table 2). Donation typically refers to the gifting of land to monastic communities, whilst construction and elaboration reflects the building and expansion of monuments and structures within those monastic compounds. Immunity refers to the removal of state or

kingly power and jurisdiction over parts of the landscape, handing complete control of agricultural land, water resources and taxation to monastic groups (Davis et al. 2013)

The documented inscriptions indicate widespread monastic activity in the hinterland during the Early Historic period, with 238 recorded inscriptions. Many of these were focused in the area to the west of Polonnaruva in the Sigiriya-Dambulla-Ritigala triangle, while fourteen inscriptions were found at, or to the east of, Polonnaruva indicating that the wider landscape was also populated during this period. However, whilst the more numerous earlier inscriptions were spread over the wider landscape, by the tenth century A.D. inscriptions were focused within the city of Polonnaruva rather than surrounding hinterland, reflecting a growing consolidation and centralization of power.

<HEADING LEVEL 2> Discussion of survey data

The emerging data from Polonnaruva presents us with an alternative model of social and political organization from that evident at Anuradhapura. Sites at Polonnaruva, both secular and religious, were much larger in size, contained a wider variety of material and ceramic scatters, and appear to have been longer-lived. Whilst the maximum size of ceramic scatter remained the same, only six sites around Anuradhapura were one hectare or larger, compared to 25 sites around Polonnaruva, as already discussed (Figure 10). This is even more surprising given the much longer timespan of hinterland investment and occupation at Anuradhapura. These large settlements around Polonnaruva were found evenly distributed at a distance of five to 30 kilometers from the center. At Anuradhapura, they were clustered at 22 to 28 kilometers from the citadel, identified as broadly one day's travel by ox-cart.

However, it is not only the contrasting size, location and longevity of sites, but their relationship to each other that is different as well. At Polonnaruva, the larger ceramic scatters and religious sites were often found in proximity, especially closer to the city. This suggests that the rigorously planned city is reflected in its planned hinterland. This is corroborated in the Culavamsa (73.55-73.164 [Geiger 1973]), which states that Parakramabahu I transformed Polonnaruva from royal residence to urban center. In doing so, he moved away from the system of multiple monasteries and tanks that surrounded Anuradhapura, to a single major city, tank (Parakrama Samudra) and monastic ensemble (Alihana Parivena). As such, the long-term trend of settlement and construction on the island saw a significant shift in trajectory during this period, with a greater focus on centralized and monumental construction.

The system of settlement around Polonnaruva differed significantly from that of Anuradhapura, where the model of Buddhist Temporalities evolved organically over a millennium. It raises the question as to how and why the new settlement pattern around the new capital was so drastically different. Was this a top-down attempt to create a more efficient system for political or economic reasons to avoid the inflexibility evident at Anuradhapura, or an adoption of new models of social and political organization loaned from the Chola Empire? By the time Polonnaruva rose to prominence, the island of Sri Lanka had already been exposed to the more diverse, cosmopolitan medieval world of South and Southeast Asia. Whilst there was a degree of cosmopolitanism in the earlier Anuradhapura period (Coningham et al. 2017), it had always occurred alongside the Buddhist majority. As Polonnaruva emerged and grew, it placed order and both religious and secular plurality at the center of its structure.

<HEADING LEVEL 1> Discussion: The Broader Context of Low Density Urbanism

Few contemporary comparisons for Polonnaruva's hinterland exist in the archaeological literature. At eleventh century Bagan (Myanmar), communities who lived in the immediate hinterland of the city did so in unwalled, agricultural villages of around three ha – the only archaeological signature of which were ceramic and brick scatters with occasional remnants of religious monuments. Auger-cores at these sites showed occupation depths of around 1.5 meters (Hudson, Lwin and Maung 2001), similar to the sites around Polonnaruva. In the Phimai region of northeast Thailand, Welch notes that small temples were often present within alluvial planned villages during the Khmer period (1000-1300AD) (1998: 211-213). Welch initially postulated that most of the population lived in clustered villages between 1 and 15 hectares in size (Welch 1997: 71), however this model of individual villages has been largely replaced by an integrated model of low density urbanism. The use of lidar technology at Angkor has uncovered a vast low-density settlement landscape integrated by an elaborate water management network extending over 100,000 hectares (Evans et al. 2007). Within this, the team have identified the presence of an urban core and agricultural hinterland measuring some 35,000 hectares and consisting of an orthogonal and cardinally oriented grid plan (Evans et al. 2013) of far greater regularity than seen at Polonnaruva. The team investigating Angkor see this as a single integrated landscape, with little distinction between urban core and agricultural landscape. This differs somewhat from the way in which we visualize the Polonnaruva landscape, where there is some distinction between the two, even if the boundaries are somewhat fuzzy. However, the Angkor landscape was linked together through water networks, both natural and artificially created, in a fashion similar to that seen at Polonnaruva and Anuradhapura before it (Gilliland et al. 2013b). Carter et al.

(2018) argue that the massive hydraulic networks of Angkor integrate the urban, suburban and non-urban communities of the region even though they exhibit very different settlement characteristics. At Angkor, the center plays the key role as the integrating force for communities across the landscape.

The main non-hydraulic and non-urban features identified at Angkor through the lidar survey were temple compounds, the most common of which was a central east-facing temple surrounded by a horseshoe-shaped moat with a small land bridge on the eastern approach, although there are several variations on this theme (Evans et al. 2013:; Klassen 2018). Of the 1400 temples that have been identified, only 105 have been dated by conventional methods, i.e. inscriptions, artefacts or architectural features. Using data gleaned from this subset, the remaining temples have been chronologically arranged through semi-supervised machine learning (Klassen 2018). Within the Khmer world, scholars have argued that temples played political, administrative and economic roles within society (Welch 1998: 210) and represented an extension of kingly power. It is also worth noting that Khmer society was one in which both Buddhist and Hindu worship were promoted and tolerated at different times, and where both religions shared ritual practice and space (Sharrock 2007: 39-41, 2009; Nietpuski 2019: 54). Temple construction and endowment was a means of developing marginal, unexploited land using capital and labor donated to the temple (Welch 1997: 73). This mirrors the pattern of temple construction seen from inscription data at Polonnaruva, as well as Anuradhapura, where undeveloped land was donated by kings and other elites to religious communities to establish monasteries and generate agricultural potential, in particular rice farming (Davis et al. 2013).

Such newly developed agricultural land at Angkor has been extensively mapped from the lidar data by Hawken (2013), who has pointed out that relic rice-paddy fields cluster around and emanate from temples. He identified a dual system of field organization – cardinally aligned systems located close to formal settlements and more irregular coaxial systems further afield and situated near to smaller local temples. Hawken argues that the more irregular patterning reflects systems that were in place before the establishment of state mega infrastructure (2013: 365), although it is also possible that multiple systems or heterarchies operated within the same landscape, as evidenced in the Buddhist Temporalities system at Anuradhapura (Coningham et al. 2013b). Other types of archaeological site are less well documented at Angkor, due to the reliance on remote sensing techniques as opposed to terrestrial settlement survey approaches. As such, Angkor provides an excellent model of a more centralized or top down model of low density urbanism than we see at Pollonaruva, which in turn appears to be more centralized than Anuradhapura. Conversely, Isendahl and Smith (2013: 134) present a model for low density urbanism in the Maya world that is far more community driven, with "strong forms of bottom-up community organization" that promoted resilience and sustainability. In their model, low density urbanism is an organic development to environmental pressures and existing social structures. This latter model mirrors that seen around Anuradhapura, where there existed a reciprocal relationship between the religious and secular core of the city, and the dispersed communities of its hinterland. Nominally, the bond was maintained through Buddhist practices, which were encouraged and supported through royal patronage, but also through political and economic links, in particular the intricate irrigation networks (Coningham et al. 2013b). However, this is not to say that all Maya cities were organically derived, as demonstrated by the planned city of Nixtun-Ch'ich' in Guatemala, the

creation of which was “top-down, [and] imbued the landscape with power… Its creation was not simply a display of power, but the implementation of governing strategies affecting all occupants from the most humble to the highest elite” (Pugh and Rice 2017: 593). Again, this points to there being no single model of low density urbanism, in terms of social and political organization, in either a global or local setting.

7.Conclusion: Polonnaruva as a New Model of Low Density Urbanism in Sri Lanka

Based on the results of the first two seasons of hinterland survey, we can now add Polonnaruva to the growing archaeological corpus of low density urban landscapes (Fletcher 2019). At Anuradhapura, hinterland communities were largely independent of the urban, royal core but exhibited low density traits (Fletcher 2019). Polonnaruva is different in that such communities appear to be far more integrated into the core, despite sharing similar subsistence strategies and environmental conditions, and displaying continuity in artefact and architectural styles. At Polonnaruva, the evidence from hinterland survey suggests a degree of spatial organization and pre-planning not evident in earlier Sri Lankan landscapes and is perhaps more closely aligned with examples from Angkor. As such, in a Sri Lankan context, Polonnaruva represents a much more ‘top-down’ system of low-density urbanism with a more rigidly tiered system of settlement hierarchy. However, neither the city nor the hinterland match the hyper regularity or order seen within the Angkor world, or even briefly at Nixtun-Ch’ich’. Instead, Polonnaruva appears to sit somewhere between the organically developed systems at Anuradhapura and the regulated systems of Angkor. This raises the question as to whether this reflects the implementation of new approaches adopted from the wider Medieval world of South and Southeast Asia, or was a natural development of

social and political control on the island as rulers learnt from their actions at the previous capital.

We can confirm that there is significant variation among low density urban structures within Sri Lanka as well as communities across the ancient world. It is entirely possible for low density urban communities to operate with high levels of centralized control as at Polonnaruva, or almost none at all as seen at Anuradhapura. Indeed, Anuradhapura likely acted as a precursor for the later patterns we see at Polonnaruva and more widely across the subtropical world, although such a system was ultimately weakened through the overuse of immunity grants (Coningham et al. 2013b; Davis et al. 2013). Thus, the new rulers at Polonnaruva ensured that communities remained much more firmly under their control. Their patronage of multiple faiths and practices reflects not only the island's position in a more globalized world, but perhaps also a deliberate attempt to both restrict the power of any one particular community and appease them all. Whether this was a more successful approach than at Anuradhapura remains debatable. Certainly, Polonnaruva was relatively short-lived as a capital, although it did succeed in promoting and sustaining a pluralistic society on the island of Sri Lanka.

Further research is needed at Polonnaruva, both inside and outside the city, to build on our initial pilot work. There is a significant change in settlement pattern with the shift in capital from Anuradhapura to Polonnaruva, which some have viewed this as a period of collapse at the former (see Strickland 2017 for broader discussion of this). However, the results of the Anuradhapura survey demonstrate continued occupation beyond the abandonment of the city (Manuel et al. 2013) and the period of the eleventh century AD can be viewed as a

transition from Early Historic Anuradhapura to Medieval Polonnaruva. The challenge moving forward is to identify and interpret the archaeological signature of this shift in the social, political, economic and religious structure of Polonnaruva and the wider landscape of Sri Lanka, while also situating it within the wider context of medieval South and Southeast Asia.

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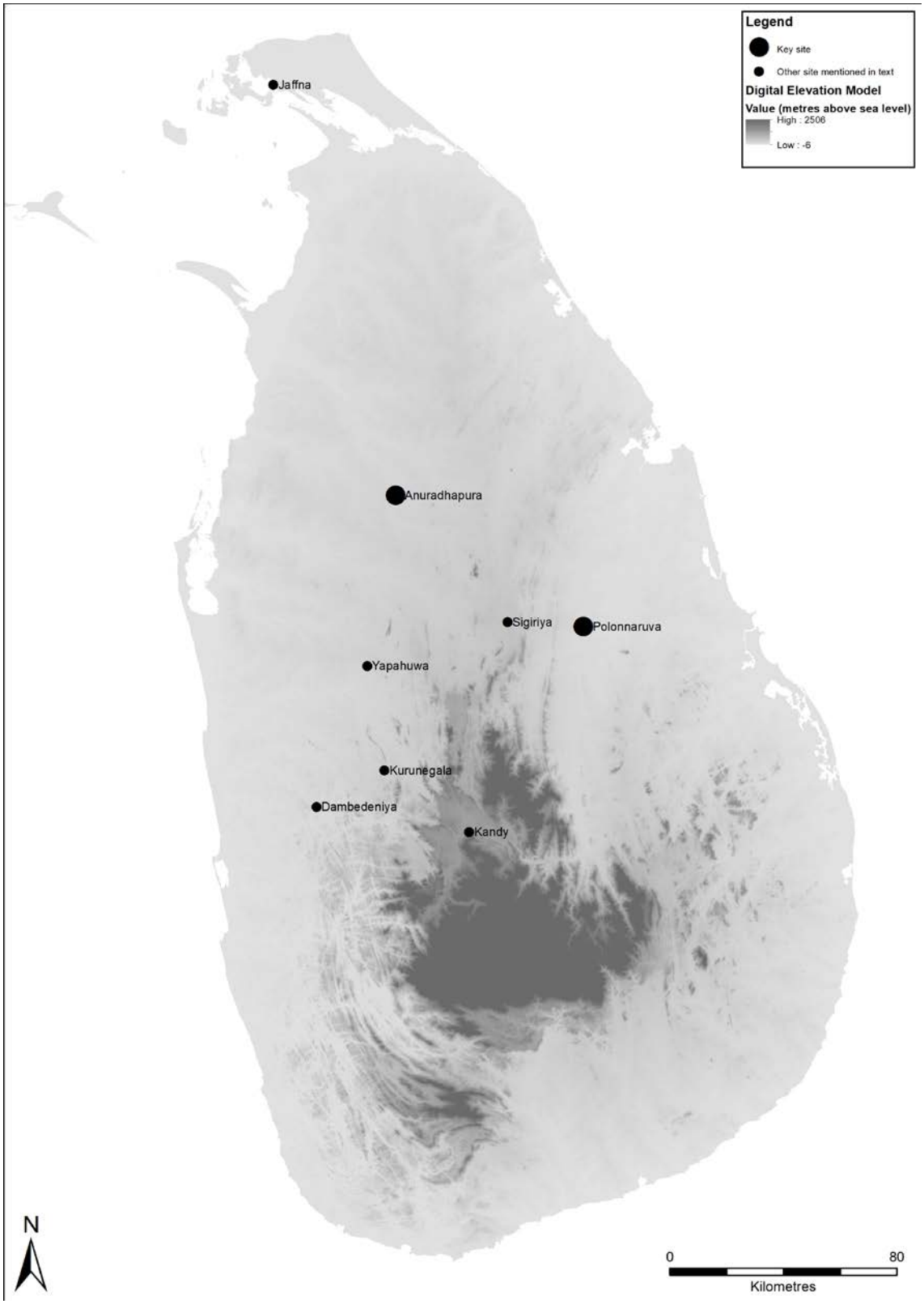

Figure 1: Map of Sri Lanka showing location of Polonnaruva, Anuradhapura and other key sites mentioned in the text including the later capital cities. Digital Elevation Model is adapted from NASA Shuttle Radar Topography Mission (NASA 2016).

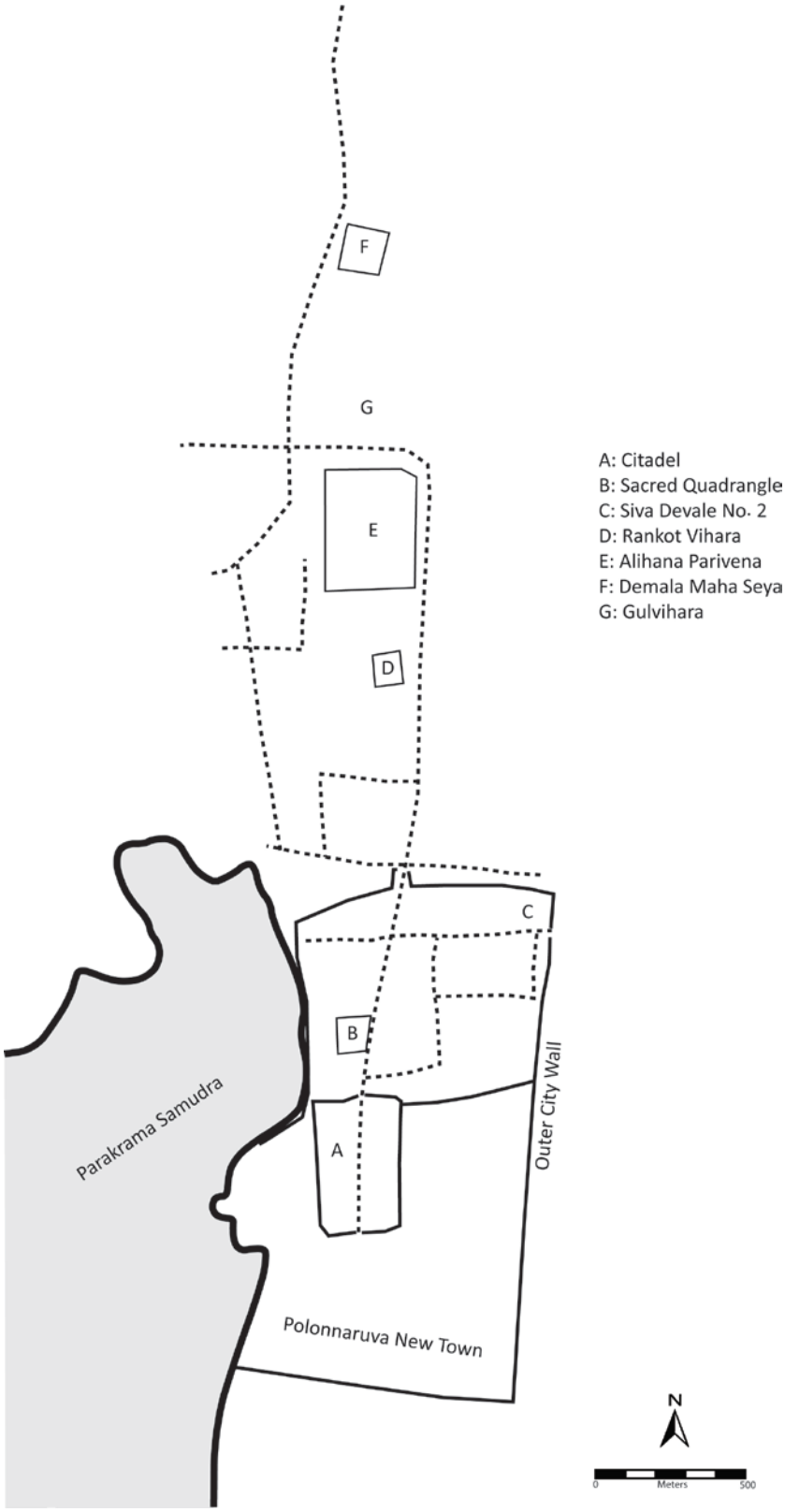

Figure 2: Schematic plan of Polonnaruva showing key areas discussed (adapted from Seneviratne 1998)

Figure 3. Aerial view of Polonnaruva, looking south towards Rankot Vihara (photo: Manuel/POLAARP).

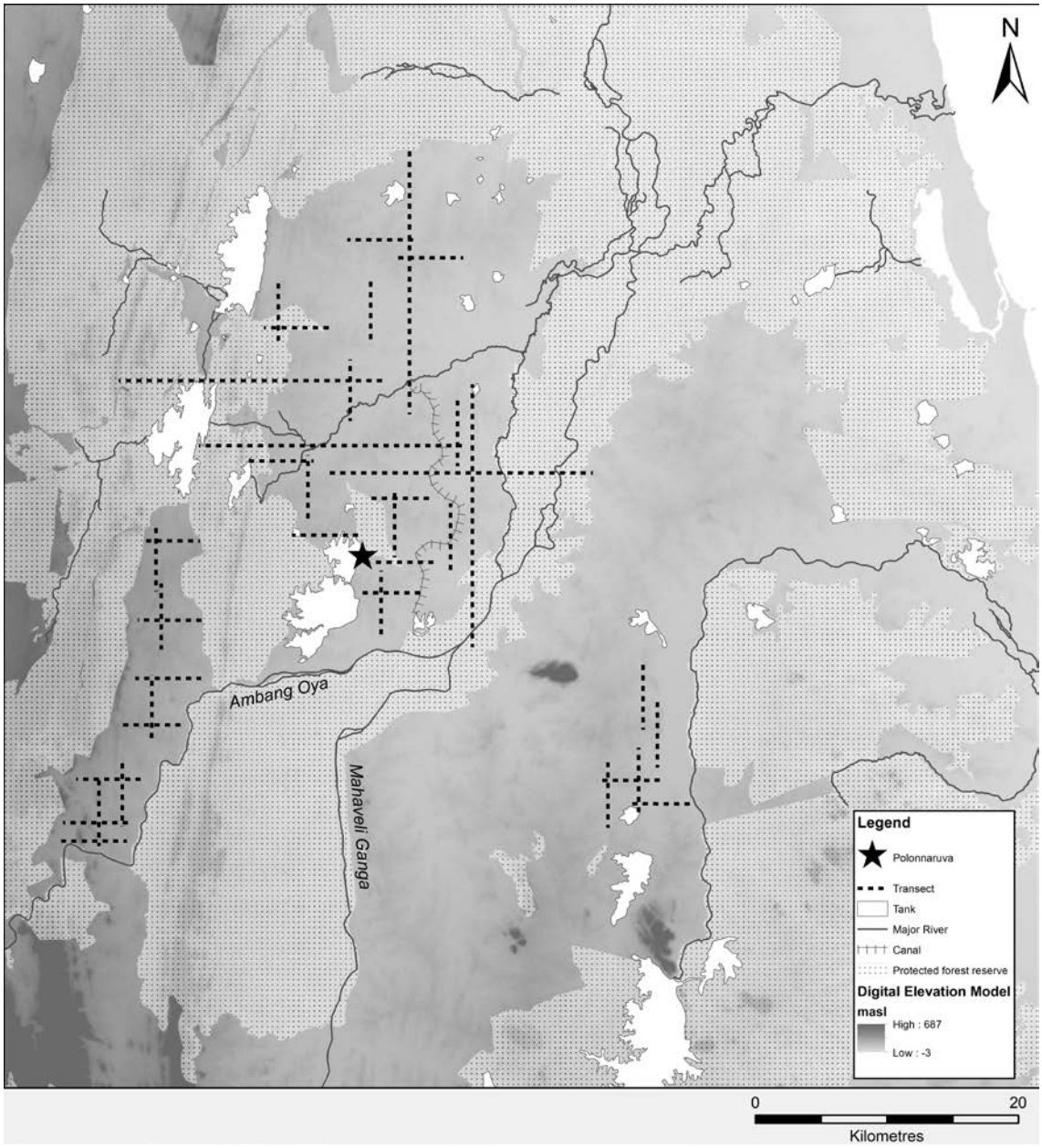

Figure 4. Map of the transects undertaken at Polonnaruva, shown against the location of the main rivers, tanks, canals and protected forest reserves around the site (modified from UNEP-WCMC 2018). Digital Elevation Model is adapted from NASA Shuttle Radar Topography Mission (NASA 2016).

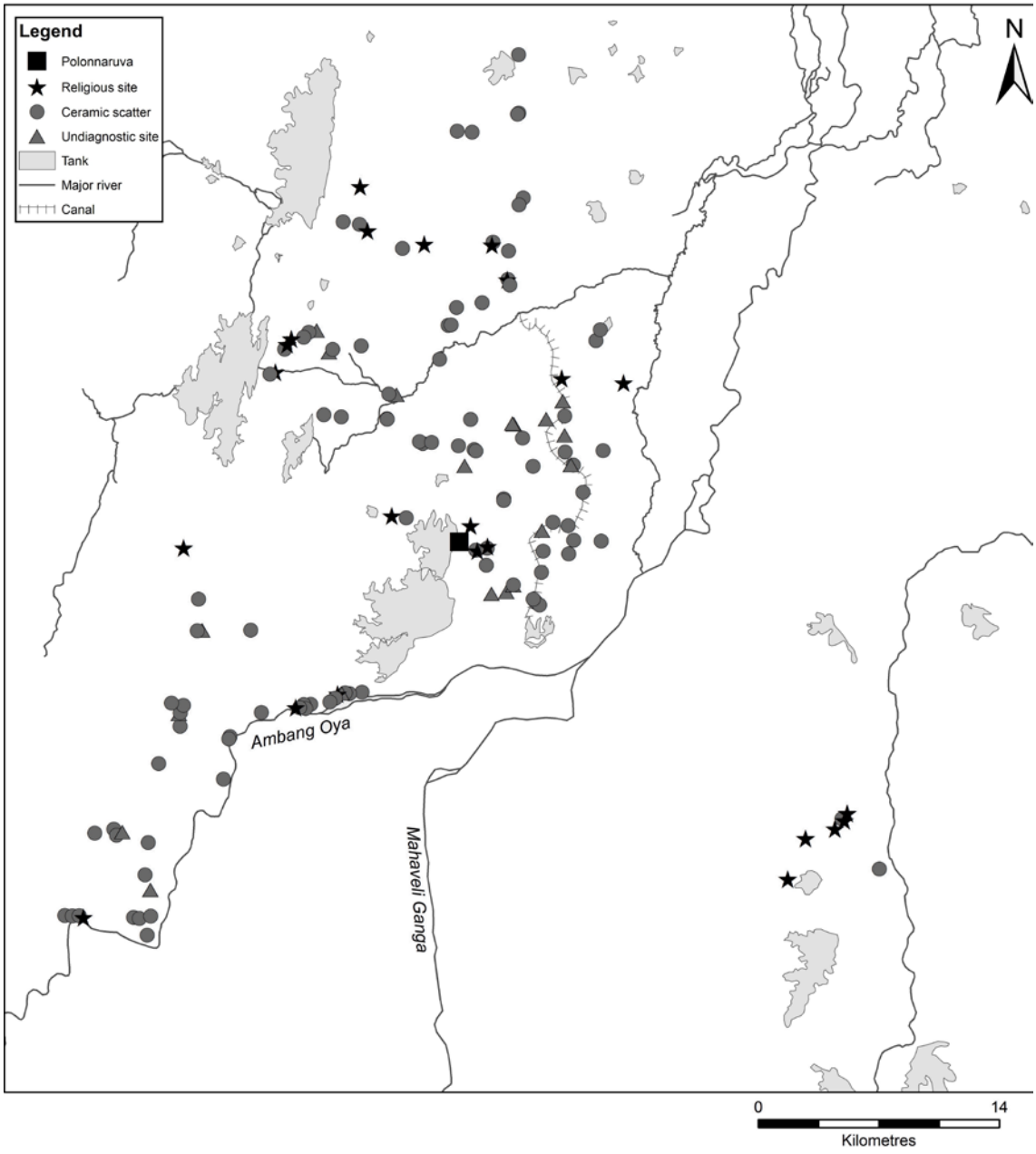

Figure 5. Map of sites identified during 2015 and 2016 hinterland surveys.

Figure 6. Dense surface scatter of ceramics at S254 (photo: Manuel/POLAARP).

Figure 7. Yoni stone resting at base of brick-built stupa at S206 (photo: Manuel/POLAARP).

Figure 8. Applique trisulas from S021 (left) and S360 (right) (photo: Manuel/POLAARP).

Figure 9. Stone cut cistern at S235 (photo: Manuel/POLAARP).

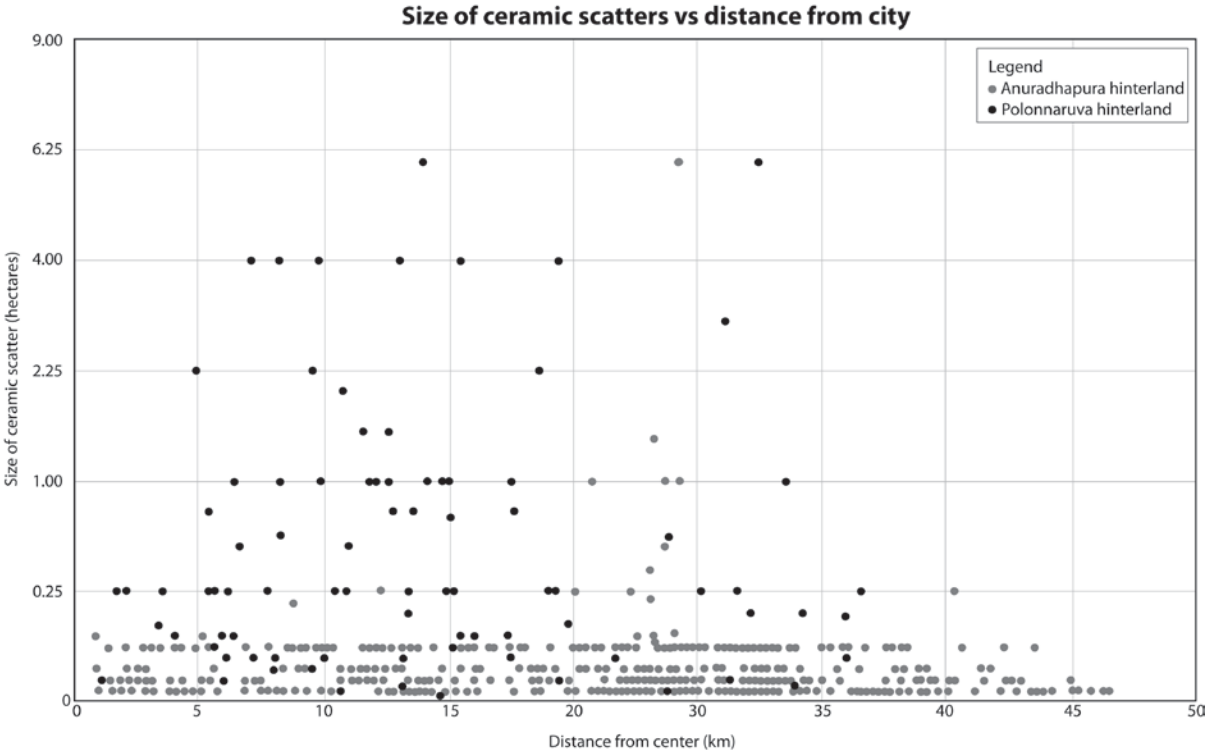

Figure 10. Scatter graph showing the size of ceramic scatters versus distance from city.

Table 1. Chronology of Sri Lanka by Period and Capital City

Period[a]	Date	Principal Capital[b]
Prehistoric	before 800 B.C.	
Protohistoric	800-340 B.C.	
Early Historic	340 B.C.- A.D. 200	Anuradhapura
Late Historic	A.D. 200-600	Anuradhapura
Early Medieval	A.D. 600-1017 A.D. 1017-1200	Anuradhapura Polonnaruva
Late Medieval	A.D. 1200-1215 A.D. 1215-1293 A.D. 1293-1500	Polonnaruva Dambedeniya[c] Polonnaruva[c] Yapahuwa[c] Kurunegala
Kandyan	A.D. 1500-1656	Kandy

[a] Table modified after Coningham and Gunwardhana 2013.

[b] Main capital city where tooth relic was held.

[c] The exact date boundaries between these capitals is unclear in textual sources

Table 2. Number and periodization of inscriptions recorded at Pollonaruva

Date	Number	Type
Up to second century A.D.	238	Predominantly cave inscriptions relating to donation of property; non-monarch donors
Third to sixth century A.D.	15	Predominantly compulsory service and elaboration of monuments
Seventh to ninth century A.D.	19	Predominantly immunity grants; across whole landscape
Tenth to eleventh century A.D.	34	Predominantly immunity grants; focussing on and around major sites
Twelfth to thirteenth century A.D.	28	Predominantly construction of new monuments in the city, repair of monuments and some land donation
Nineteenth century A.D.	1	Request for merit for British royalty (unknown donor)