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Power centres and marginal landscapes: tracking pre- and post-conquest (late Iron Age and medieval) land-use in the Cēsis castle hinterland, central Latvia

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Abstract

During the late Iron Age, the eastern Baltic was inhabited by Finno-Ugric and Baltic speaking societies whose territories were conquered in the 13th century as a result of the crusades. This paper examines the degree to which indigenous landscapes were transformed as a result of the crusades, and the evidence for maintenance of indigenous land-use practices. Vegetation and land-use history are reconstructed using palynological data from Cēsis castle and its hinterland. Comparison is made with selected palynological, archaeological and documentary data across Livonia (Latvia and Estonia) and contrasted with the greater impact of the crusades in nearby Prussia. Despite the emergence of key power centres in the medieval period, including towns and castles such as Cēsis, many parts of the rural landscape remained largely unchanged by the crusades, particularly in those more marginal landscapes studied in this paper. Lower intensity land-use can be linked to poor agricultural soils but also reflect the limited colonization of rural landscapes beyond the major towns and castles. Indigenous societies and practices survived to a greater degree, with later agricultural intensification in the 14th century reflecting the increasing political stability, grown of urban centres, establishment of serfdom and the development of the manorial system.

Keywords: Palaeoecology; land-use, crusades. Iron Age, medieval period, Livonia

1. Introduction

During the late Iron Age, the lands of the eastern Baltic, roughly equating with modern-day Latvia and Estonia, were inhabited by Finno-Ugric and Baltic speaking societies. These societies, centred on strongholds, have been linked to historically documented tribal groupings and territories that begin to appear in the cultural record during the course of the Iron Age (Šnē 2005, 2006), and that in parts of the eastern Baltic saw significant demographic and economic expansion (Kihno and Valk 1999). However, these societies and their territories were utterly transformed in the early 13th century as a result of the crusades, starting in what is today Latvia in 1209 and lasting until 1290. The crusades in the eastern Baltic were followed in 1230–1280 by successful crusades in Prussia (present-day north-east Poland, Russian Kaliningrad and north-western Lithuania) that together resulted in the subjugation of pagan tribal lands and their replacement with a theocratic state run by the military orders and their episcopal allies (Figure 1). The conquered territories in the eastern Baltic, referred to as Livonia (derived from the German 'Livland', itself derived from the indigenous Livs who inhabited the Lower Daugava region), were reorganised into a series of hierarchical administrative territories run by the Livonian branch of the Teutonic Order (and their predecessors in the region the Sword Brothers) and individual bishops. The conquest was accompanied by the foundation of new urban centres and the construction of heavily fortified castles, followed by the development of trading networks and increasing exploitation of natural resources.

There has been an increasing interest in investigating the impact of cultural processes in transforming the landscapes of north-eastern Europe, traditionally understood through archaeological and historical data (Christiansen 1997; Urban 2003). However, there is a growing body of palaeoenvironmental data from the region covering the late Iron Age and medieval periods that demonstrates the high degree of chronological and spatial variation in patterns of vegetation change and land-use (e.g. Veski et al 2005; Latałowa et al 2009; Lamentowicz et al 2008; Noryśkiewicz 2013; Szal et al 2014, 2016; Wacnik et al 2014, 2016; Poska et al 2014; Pędziszewska and Latałowa, 2015; Brown et al 2015, 2019; Stivrins et al 2015, 2016), reflecting the complex and divergent patterns of pre- and post-conquest settlement and society across the new theocratic state. Livonia differs critically from Prussia in seeing lower levels of colonization following the crusades, with migrants restricted largely to towns and castles, and with a greater survival of indigenous populations.

This paper examines the ecological signals of vegetation change and land-use over the late Iron Age and medieval periods (c. 10th – 16th centuries), and in particular, the evidence for the impact of the crusades, through a comparison of palynological data from five pollen sequences from what became one of the key power centres in the medieval eastern Baltic; one from the moat at Cēsis castle (formerly German Wenden) and four from its territory or commandery. From 1413, the castle became increasingly used as the residence of the Livonian Master, eventually resulting in his permanent relocation from the Order's regional headquarters in Riga. The castle was located adjacent to the site of the former Iron Age hillfort and central place of the indigenous Vends. However, even today large parts of the surrounding landscape retain significant woodland with only sparse settlement and limited agriculture. The pollen studies from across this landscape present an interesting case-study examining the ecological impact of cultural change on the marginal landscapes of a key power centre, providing a comparison to existing published palynological data across the region and from a range of landscape and cultural settings (Brown et al 2019, Stivrins et al 2015, 2016, 2019).

To what extent were indigenous landscapes transformed as a result of the crusades and what is the evidence for the maintenance of indigenous land-use practices? How does the environmental profile from an apparently marginal landscape compare with palaeoenvironmental data from varied landscape contexts across Livonia and Prussia (e.g. close to castles and urban centres, sparsely and intensively settled areas), and what does this suggest about the interplay of factors involved in shaping, changing and/or maintaining the landscape?

2. Study Area

2.1 Archaeology and history of the Cēsis and Livonia

Cēsis is situated in present day north-eastern Latvia, located within the Gauja Valley within the northern part of the Central Vidzeme Upland (fig. 1). Modern names for places and territories are used throughout this article, with the first use followed by its equivalent in brackets. During the Iron Age the landscape was divided between a series of tribal territories. These groups have been assigned geographical territories based on associated distinctive material cultural, although directly correlating material culture and ethnicity is problematic.

During the Iron Age, an indigenous group called the Vends occupied a hillfort (Riekstu hillfort) located adjacent to where the medieval castle would be built. The Vends appear to have been part of a north-eastward migration of Livs from Curonia (present-day western Latvia) in the 10th century. The hillfort at Riekstu is located within a borderland between the Livs and Latgalians, a defined group in eastern Latvia that emerges from the 7th century (Šnē 2005, 2006; Apala and Apals 2014, 116-117).

Late Iron Age settlement patterns have been interpreted in terms of hierarchical power, with hillforts at the top. The hillfort at Riekstu Hill is the only indigenous central place within this region, although other important settlements have been investigated within the wider landscape. These include the important fortified lake settlement at Āraiši (former German Arrash, ca. 8km south-east of Cēsis), occupied from the 9th to mid-10th century (Apals 2012, Meadows and Zunde 2014), and later the site of a medieval castle founded in the 14th century.

During the course of the 13th century crusading armies conquered the eastern Baltic with the aim of converting indigenous pagan communities, protecting existing Christian converts and acquiring new territories. The Livonian Crusade began with the conquest of the Livs and Latgalians (1209-1227) (eastern Latvia) by the armies of the Bishops and Order of the Livonian Brothers of the Sword, and later, following by partially successful crusades in western Latvia (1219-1290) resulting in the subjugation of Curonia and northern Semigalia. Following their defeat by the Samogitians in 1236, the Sword Brothers were merged into the Teutonic Order.

In 1212, the Sword Brothers established a base at Cēsis on the site of the Riekstu hillfort. Occupation of the hillfort overlaps with the initial phases of construction of the adjacent stone castle. The construction of the castle was accompanied by the development of the adjacent town that received its charter in the AD 1224. The castle was significantly expanded in the latter half of the 14th century, representing an important centre for controlling the route linking Riga with the central territories of the Order in Livonia. The castle was increasingly used as the residence of the Livonian Masters from the early 15th century and would become one of the most important centres of power in the eastern Baltic during the final phases of the Orders rule in Livonia during the 15th and 16th centuries.

The territory of Wenden adopted the River Gauja as a border and included a series of several smaller districts governed by advocates, based in the castles at Valmiera (Wolmar), Trikāta (Trikaten), Burtnieki (Burtneck) and Ergeme (Ermes), with the castle at nearby Āraiši (Arrasch) also subservient to Wenden. Data on the surrounding settlement is provided by a series of land audits, although dating only from the late 16th century. These settlements will have been largely occupied by the local native population, with migrants communities limited to Wended castle and town. A 1601 Swedish land audit indicates that Cēsis castle had at least 95 farmsteads in 4 parishes and Āraiši with 116 farmsteads in 6 parishes, with a further 122 listed between the two castles, (Svabe 1933, 489). An earlier Polish land audit from 1582 documents listing 290 settlements in these 10 parishes (Ose 2011). However, not all these settlements were occupied; for example, only 10 of the 30 settlements in Gaidan parish are listed as occupied in the 1582 audit, no doubt a consequence of the ravages of the Livonia War (1558–1583).

The power of the Teutonic Order in Livonia gradually waned into the 16th century, and the defeat of the Order by Muscovite forces in 1560 (part of the Livonian War) led to the Order seeking protection from Poland under King Sigusmund II. Following the secularization of the Order's Livonian branch in 1561, and conversion to the Lutheran faith, the territory became part of the Duchy of Livonia and Cēsis was garrisoned by Polish troops. However, large parts of the Duchy of Livonia later came under Swedish rule from 1621 during the Swedish-Polish wars, almost a century (1710) later falling under Russian rule following the Great Northern War between Sweden and Tsarist Russia.

2.2 Biogeography and climate of central Latvia

Latvia belongs biogeographically to the hemiboreal vegetation zone, characterised by mixed boreal coniferous and deciduous (boreo-nemoral) forests dominated by *Pinus sylvestris*, *Picea abies*, *Betula* and *Alnus glutinosa, Alnus incana*, along with smaller quantities of broadleaved trees including *Fraxinus*, *Ulmus*, *Tilia*, *Quercus* and *Corylus avellana type*. Today forests form approximately 55% of the land-area of Latvia (Forest Europe, UNECE and FAO 2011), with a lesser component covered by agricultural land (*c.* 32%), with peatlands forming a 10% of the total land-area (Kalniņa et al 2015). The relief of the eastern Baltic has been shaped primarily during the last glaciation and deglaciation, characterised by largely low-relief averaging no greater than 100 m a.s.l, with the highest points at *c.* 312 m a.s.l in the Vidzeme Uplands, north-east Latvia (Zelčs and Markots 2004). The climate is transitional with mean January and July temperatures varying between -3°C – -8°C and +16 – +18 (Draveniece 2009)).

3. Pollen sampling sites

Five sediment sequences were selected for palynological analysis, three from bogs, one from a small herbaceous fen basin infill, and from sediments infilling the moat at Cēsis castle (fig. 1), forming part of a wider program of pollen analysis from sites across the south-eastern Baltic region, undertaken as part of the ERC funded Ecology of Crusading Project (2010-2014, FP7/2007-2013; grant no. 263735; Pluskowski 2019a, 2019b). The aim of the coring program was to target suitable sites representative of the likely range of landscape settings and patterns of land-use. The samples from the four off-site locations are reflective of the more marginal habitats existing within the hinterland of Cēsis. The data builds upon recently published data from Lake Āraišu (8 km south of Cēsis castle) associated with the site of an Iron Age lake settlement and medieval castle (Stivrins et al 2015), and Lake Trikatas, located adjacent to the medieval castle and village of Trikāta (former German Trikaten) (Stivrins et al 2016). All sites are located within the medieval territory of Cēsis castle.

3.1 Blusu mire (57°17’28’’ N, 25°17’20.1’’ E)

Medium sized bog (*c.* 45 hectares) located on the present south-eastern edge of Cēsis, *c.* 2.2 km from Cēsis castle. The bog is chiefly covered in *Pinus*, *Betula* and *Picea* woodland, especially along the margins. The centre of the bog is dominated by dwarf shrubs and bryophytes dominated by *Sphagnum* species. Coring within the bog indicates a relatively shallow depth of peat to a maximum depth of 1.5 m, but typically no more than 0.75 m. The core was taken from the greatest depth of deposits within the central area of the current bog, comprising moss (*Sphagnum*) peats (0.10–1.06 m) overlying structureless organic matter (1.06–1.50 m). The peat overlies silts, suggesting a former now infilled lake. Pollen was focused on the top 0.72 m of the core covering the last 1500 years; the peat at 1.4 m dated to 4878±33 BP (GU-29816, 3710-3540 cal. BC).

3.2 Nineris mire (57°20'10.4" N, 25°17'16.5" E)

Small bog (c. 30 hectares) located adjacent to Lake Nineris and extending a further 800 m to the west. The bog comprises a sequence of ombrotrophic peats several metres deep. The bog surface is currently covered with young pine trees and a surface layer of dwarf shrubs, surrounded on the dry ground by mature *Pinus* plantation woodland. The top 2.5 m was sampled, comprising a *Sphagnum*-dominated moss peat, with palynological analysis undertaken to 2.18 m on sediments dating from the fourth century AD.

3.3 Blaņķu mire (57°23'12.4'' N, 25°18'05.1'' E)

Large bog (*c.* 300 hectares) 8 km north of Cēsis castle. The bog is largely open, dominated by dwarf shrubs and bryophytes with a sparse cover of young *Pinus*; the margins of the bog are surrounded by *Pinus*-dominated woodland. Coring across the bog indicates a shallow depth of moss peat to a maximum depth of 2.25 m overlying lacustrine silts. The peat was sampled to a depth of 2 m, *c.* 150 m from the western edge of the bog. Analysis focused on the top 1.1 m covering the last 1500 years, comprising a well humified *Sphagnum* moss peat. The peat at 1.65 m dated to 2575±29 BP (GU-29811, 810-570 cal. BC).

3.4 Rāmuļi (57°12'49.3'' N, 25°22'43.2'' E)

Small (4 hectares) basin infill 14 km ESE of Cēsis, located within the edge of pine-dominated woodland adjacent to agricultural fields 1 km from the settlement of the same name. The deposits comprise a sequence of structureless herbaceous peats to a depth of 2.35 m; only the top 1.75 m was sampled, with analysis undertaken on the top 0.5 m, covering the last 1000 years.

3.5 Cēsis castle moat (57°18'46.7" N, 25°16'14.3" E)

Coring and excavations revealed a deep sequence of waterlogged sediment extending to a depth of *c.* 4 m within the moat fronting the southern range of the castle. Pollen samples were taken from 0.8–2.34 m, avoiding disturbed sediments at the top and overlying a timber drain at *c.* 2.5 m, dendrochronologically dated to AD 1374/5. The sediments underneath the timber drain are both archaeologically and geochemically sterile and were not sampled; these sediments, homogenous in character, most likely accumulated rapidly after construction, eroding into the moat before the banks stabilised with vegetation.

4. Materials and methods

4.1 Sampling

Half metre cores were taken using a 5 cm diameter Russian auger, starting at the surface, with duplicate cores taken to cover the overlap. Cores were wrapped in cling film and foil, placed in plastic guttering and refrigerated prior to sampling.

4.2 Pollen analysis

Samples for pollen analysis were taken at intervals varying between 0.5 to 4 cm, focusing on sediment of Iron Age, medieval and later date. Samples were prepared following standard laboratory techniques (Moore et al 1991) and mounted in glycerol jelly stained with safranin. A minimum of 500 pollen grains of terrestrial species were counted for each level. Pollen percentages are calculated based on terrestrial plants. Fern spores, aquatics and *Sphagnum* are calculated as a percentage of terrestrial pollen plus the sum of the component taxa within the respective category. Identification of cereal pollen followed the criteria of Andersen (1979). Identification of indeterminable grains was recorded according to Cushing (1967). The pollen diagram was produced using Tilia version 1.7.16 program (Grimm, 2011). Pollen zones are based on the principal archaeological periods rather than local pollen assemblage zones.

4.3 Radiocarbon dating and chronological modelling

A total of 29 AMS ^{14}C radiocarbon dates were obtained from SUERC (Scottish Universities Environmental Research Centre), nine from Blusu mire and, eight from Blaņķu mire and Nineris mire and three from Rāmuļi (Table 1). Due to the absence of terrestrial plant macrofossils, radiocarbon dates were derived on bulk peat, taking care to identify any potential issues of contamination with old or young carbon.

Calibrated age ranges were calculated using OxCal 4.1 (Bronk Ramsey, 2009) using the IntCal13 calibration dataset (Reimer et al 2013) and modelled using the Bacon Bayesian statistical program (Blaauw and Christen 2011), using default settings for calculation of prior information (e.g. accumulation rates) (fig. 3).

A single dendrochronological data was produced on the remains of a spruce timber drain revealed in the base of southern moat of Cēsis castle

5. Results

5.1 Chronology

Reliable chronologies are a fundamental component of palaeoecological investigations. Although terrestrial plant macrofossils are considered the most reliable material for radiocarbon dating, samples of bulk peat from bogs are considered reliable material for dating (Nilsson et al 2001; Blaauw et al 2004). The peat deposits reflect treeless habitats, although some herbaceous plants growing in fens, such as sedges, have roots systems which can penetrate own 2m, with the potential to introduce young carbon unless removed (Valrianta et al 2014). However, no roots or evidence for rotting by either trees or herbaceous plants was recorded during the sampling of the cores. The radiocarbon dates for all sequences show a strong linear progression (fig. 3) and contamination of peat by young or old carbon is considered unlikely.

5.2 Blusu mire (AD 500 – 1800) (fig. 3)

During the middle and late Iron Age the vegetation is dominated by woodland comprising *Betula* (20-30%), *Picea* (15-20%+), *Pinus sylvestris* (25-35%) and *Alnus* (10-15%), with smaller quantities of other arboreal taxa including *Corylus avellana* type (<5%), *Quercus*, *Ulmus*, *Tilia* and *Carpinus betulus* (≤1%). *Alnus*, *Betula* and *Pinus sylvestris* are likely to have formed the primary component of woodland growing within bog, with a ground flora including dwarf shrubs (*Calluna vulgaris* and Ericaceous plants) and bryophytes (largely *Sphagnum*). Occasional pollen grains of ruderal taxa (*Artemisia* type, Chenopodiaceae) may reflect the activity of wild grazers and browsers within the bog. However, microscopic charcoal levels (ca. AD 550-700) may reflect small-scale slash and burn agriculture in the surrounding landscape not visible in the pollen record.

Significant vegetation change is not apparent until the early/mid-fourteenth century with the first appearance of *Secale cereale* and an increase in grasses and ruderal pollen (*Rumex acetosa*/*acetosella* type), intensifying during the fifteenth century and including cereal pollen grains of *Avena-Triticum*, *Hordeum* and very occasional *Fagopyrum esculentum*. *Picea* declines from 20-5% from AD 1200-1400, with higher values for *Pinus sylvestris* of up to 40% (AD 1250-1400) (30-40%) declining sharply thereafter to 15%. Dwarf shrubs (*Calluna vulgaris*, Ericaceae) and *Sphagnum* expand on the bog surface; the increase in *Sphagnum* (up to 60%) occurs at the transition from largely herbaceous to moss peat, reflecting the development of ombrotrophic bog. The increase in *Calluna vulgaris* (10%) likely reflects its growth on drier hummocks and ridges in the bog that often forms in-between wetter areas dominated by

Sphagnum. Pollen of cultivated, disturbed and open ground flora generally increase in during the post medieval period, although declining values and lower palynological diversity are apparent during the 17th century.

5.3 Nineris mire (AD 400 – 1950) (fig. 4)

Woodland predominates throughout the Iron Age. *Pinus sylvestris* values range between 35-65%, with *Betula* declining from 40% (AD 400) to <20% (AD 600-700), remaining constant at 30% during the late Iron Age (AD 800-1200). *Picea* values increase from AD 600, up to 30% (AD 650), decreasing from 20% to <10% at ca. AD 1050. Other arboreal taxa are present, particularly *Alnus* (ca. 10%) along with small quantities of *Corylus avellana*-type (<5%), *Quercus*, *Ulmus*, *Tilia*, *Carpinus betulus* (≤1%) and occasional *Salix*, *Fraxinus excelsior*, *Fagus sylvatica* and *Acer*. Small-scale agricultural activity is suggested during the Iron Age by occasional cereal pollen grains of *Secale cereale*, *Avena-Triticum* and *Hordeum*.

The proportions of arboreal pollen taxa remain relatively stable until the 14th century when *Picea* declines (<10%), followed by *Betula* to <20% by AD 1500. There is however a gradual increase in *Alnus* (5-15%) over the course of the medieval period, accompanied by higher values for Ericaceae (up to 5%) and Calluna vulgaris (max 10%). *Secale cereale* is sporadically present through the medieval period, with occasional *Avena-Triticum* and *Hordeum* and a single pollen grain of *Fagopyrum esculentum* recorded during the 15th century. Ruderal (*Rumex acetosa*/*acetosella*-type, Chenopodiaceae) taxa also increase from the 14th century along with pollen of Poaceae. The post-medieval is characterised by an expansion in Ericaceae (5%) and *Sphagnum* (40-60%) on the bog surface, with *Alnus* increasing (15-20%), most likely growing on moist soils. During the post-medieval, the period of Polish/Swedish rule sees a decline in evidence for agricultural activity although values for cereal and ruderal pollen increase again into the eighteenth century. Woodland however remains dominant, with *Pinus sylvestris* increasing in value from 20-60% (AD 1800) but with a decline in *Picea* (5%), *Alnus* (5%).

5.4 Blaņķu mire (800 BC – AD 2000) (fig. 5)

Woodland dominates the majority of the sequence, largely comprising *Pinus sylvestris*, *Betula* and *Picea*. During the Bronze Age arboreal pollen is initially dominated by *Picea* (30%), declining sharply to <10% (700 BC), with an increase in *Betula* (20-45%) and *Pinus sylvestris*

(10-30%) by the end of the Bronze Age. *Alnus* (10%) and *Corylus avellana* type (5-7%) occur in smaller quantities along with *Tilia*, *Quercus* (≤4%), *Ulmus* and *Carpinus betulus* (<1%) and a range of other arboreal taxa.

During the early Iron Age *Betula* declines to 20% at 500 BC, with an increase in *Picea* to 35% at 100 BC, declining to <10% by AD 100. *Pinus sylvestris* values gradually increase during the early Iron Age from ca. 20-40%. *Alnus* and *Corylus* maintain broadly stable values whilst both *Quercus* and *Tilia* decline (<1%). *Betula* increases during the middle Iron Age to 40%, declining to 30% during the late Iron Age, with *Pinus sylvestris* constant at ca. 30% and *Picea* increasing to 15% at ca. AD 400 and AD 600 and to 20% by AD 900. Picea declines sharply however to 10% from AD 1100. The surface ground vegetation of the bog is represented by *Calluna vulgaris* and spores of *Sphagnum* (10-60%) and occasional pollen of a range of herbaceous taxa (e.g. Rosaceae, *Filipendula*, *Potentilla*).

There is minimal evidence for human activity during the Iron Age, with only a single wind-pollinated *Secale cereale* pollen grain from the early 12th century. This single grain could have been transported over a long distance within the pollen source area of the bog and is insufficient on its own to suggest localised agriculture.. Pollen of cultivated and ruderal species only increase towards AD 1300, with wind-pollinated *Secale cereale* most prominent along with increasing frequencies of *Rumex acetosa*-type, *Artemisia* type and Poaceae, suggesting areas of meadow and pastureland. Although woodland still dominates, *Picea* forms a minor component (<10%) of a canopy largely comprising *Pinus sylvestris* (30-40%) and *Betula* (20-25%)

The evidence for increasing agricultural activity during the medieval period, from AD 1300, contrasts with the latter half of the 16th and 17th century during the period of Polish-Swedish rule. Lower values for cereal and ruderal pollen suggest some regression in arable and pastoral land-use at this time, accompanied by an increase in arboreal pollen. This is followed by an increase in *Secale cereale* and *Rumex acetosa*/*acetosella* type during the 18th century.

5.5 Rāmuļi (AD 1000 – 1700) (fig. 6)

Woodland dominates the sequence, largely comprising *Picea*, *Pinus sylvestris*, *Betula* and *Alnus*. During the Iron Age arboreal pollen largely comprises *Picea* (ca. 25-40%) and *Pinus Sylvestris* (ca. 15-33%), but with a shift during the mid-14th to 15th century with increasing

Pinus sylvestris (ca. 45%) and a significant decline in *Picea* (ca. 10% by the end of the 15th century). *Betula* values increases, particularly from the 16th century (ca. 30-35%).

There is little evidence for human activity in the pollen sequence prior to the 13th/14th century with an increase in Poaceae and intermittent grains of *Secale cereale*, *Avena-Triticum* and *Hordeum*, occasional *Centaurea cyanus* and ruderal taxa are associated with a decline in arboreal pollen.

5.6 Cēsis castle moat (fig. 7)

Interpretation of the pollen sequence rests on the assumption (in the absence of evidence that the moat was ever cleaned out) that the sequence reflects the gradual accumulation of sediment following the construction of a timber drain, dendrochronologically dated c. 1374/5. The deposits contain significantly less arboreal pollen than off-site sequences (ca. 30-40%), largely comprising *Pinus sylvestris* (ca. 20%) and *Betula* (>10%). There are significant quantities of cultivated taxa (10-20%), including *Avena-Triticum*, *Hordeum*, *Secale cereale* and *Fagopyrum esculentum*, accompanied by pollen of field weeds such as *Centaurea cyanus*, *Scleranthus* (knawels) and *Agrostemma githago* (common corn cockle). Ruderal taxa include *Rumex acetosa*, Chenopodiaceae, Brassicaceae (mustards/cabbages) and Artemisia.

6. Discussion

6.1 The Iron Age

Pollen analysis from sites around Cēsis showed a landscape dominated by mixed boreal coniferous and deciduous woodlands throughout the late Iron Age and medieval periods, chiefly comprising pine, spruce and birch. Occasional pollen grains of cereal and ruderal taxa point towards some small-scale agricultural land-use within the wider Cēsis landscape during the late Iron Age. The generally low level of human activity in the pollen sequences is perhaps not unsurprising. Many are located in isolated settings peripheral to areas of human settlement, or, as in the case of Nineris, Blusu and Blaņķu mires, are located in areas with largely sandy soils (European Soils Portal) of marginal to poor agricultural potential. Predominantly sandy soils are distributed to the north, north-east and north-west of Cēsis and today these areas retain a heavy woodland cover. However, heavy boulder clay soils more suited to intensive cultivation are distributed to the south-east of Cēsis where paleoenvironmental analysis suggests a mosaic vegetation landscape in places during the late Iron Age.

Pollen and fungal spore analysis from Lake Āriašu, 6.5 km south of Cēsis, revealed significant evidence for human activity during the late Iron Age (Stivriņs et al 2015) associated with a lake settlement occupied from c. AD 780 to the early/mid-eleventh century (Apals 2002; Meadows and Zunde 2014; Punning et al 1968). Although the first appearance of cereals and a gradual opening up of the woodland environment occurred towards the end of the middle Iron Age (AD 400–800), land-use was most intensive between the mid-eighth to mid-eleventh centuries, resulting in a semi-open landscape surrounding the lake comprising a mosaic of cultivated land, meadows and pasture. Despite the abandonment of the lake settlement by the mid-eleventh century, intensive agricultural land-use continued in the surrounding landscape for the remainder of the late Iron Age.

By comparison, pollen studies from Lake Trikāta, 37 km north-north-west of Cēsis, suggest a heavily wooded landscape with minor agricultural land-use during the late Iron Age (figs. 2 - 6; Stivriņs et al 2016), despite the reference in Henry's *Chronicle of Livonia* (IV, 12) in 1208 to Trikaten as the location of one of two strongholds ruled over by the local Lettish chieftain.

Available radiocarbon dated pollen studies from southern Livonia support the picture of a heavily wooded landscape across much of the landscape (see Brown and Pluskowski 2014 for a broader discussion of the available pollen data from Livonia), at least beyond the immediate locales of settlements, with several sequences from peripheral locations, including Rozu and Zilais mires, showing little or no evidence for human activity during either the Iron Age or medieval periods (Kalniņa et al 2014; Ozola 2013). Small increases in pasture and arable land were recorded in the Lake Kūži sequence from 925±30 BP (cal. AD 1030-1180, Kangur et al 2009), from c. 1000 at Zosna peatland (Ozola 2013), with a continuous *Cerealia* pollen curve from c. 500 BC and intermittent rye pollen from the tenth century at Lake Kurjanovas (Heikkilä and Seppä 2010). The sparse palynological evidence from Latvia for intensifying land-use during the late Iron Age, apart from around central spaces such as Āraiši (Stivrins et al 2015) contrasts with the archaeological and historical record from the eastern Baltic that demonstrates this was a period of demographic and economic expansion (Khino and Valk 1999) and reflects the peripheral location of many pollen sequences away from archaeological sites. and

The settlement record for Estonia shows an increase in new sites during the eleventh to thirteenth centuries (Laul and Valk 2007), particularly focusing in the north-west and on the island of Saaremaa. The archaeological material points towards a rapid development from the 10th century with the Danish book of land taxation (*Liber Census Daniae*) listing 3000 farmsteads on Saaremaa by the AD1300 (Ligi 1992), and several pollen studies showing increasing human impact on the landscape during the Iron Age (Poska and Saarse 2002; Hansson et al 1996). In southern Estonia these concentrate mainly in the south-east where palaeoenvironmental data suggests increasing landscape openness in places during the late Iron Age (Poska et al 2008, 2014; Niinemets and Saarse 2009; Kihno and Valk 1999). South-western Estonia by comparison was more sparsely populated, largely as a consequence of the many large bogs and vast tracts of woodland covering the landscape.

6.2 The medieval period

The palynological evidence from the Cēsis commandery does not suggest a significant change in the intensity of land-use at the beginning of the medieval period. Sustained increases in cereal and ruderal pollen are only apparent from the late thirteenth/early fourteenth century at Blaņķu mire, from the late fourteenth/early fifteenth century at Blusu mire and Rāmuļi, and from the early sixteenth century at Nineris mire. This pattern is reflected in many radiocarbon dated pollen sequences across southern Livonia that show only small increases in pollen indicative of pasture/meadow and arable land during the medieval period; at Eipurs bog from a level dated 689±50 BP (cal. AD 1230–1400), Dzelve-Kronis bog after 757±55 BP (cal. AD 1170–1380, Kušķe et al 2010) with intermittent increases in rye pollen at Bazi Mire from 742±90 BP (cal. AD 1045–1410, Pakalne and Kalniņa 2005). Pollen from extensive mires located in peripheral areas of otherwise low agricultural potential is unlikely to produce evidence for significant human impact on the environment, providing potentially false-negative evidence for human activity. However, the consistent although low values for rye and other cereals, and intermittent weeds, at least point to an increase in arable fields and pastoral land in the wider landscape surrounding Cēsis from the late thirteenth century. Although wind-pollinated rye typically occurs in larger quantities in pollen sequences than other self-pollinated cereals, it may have been preferred in areas with nutrient poor sandy soils because of the ability of its fibrous root system to exploit water to a greater depth than other cereals (Vaughan and Geissler 1997).

The reduction in arboreal pollen in sequences surrounding Cēsis, particularly spruce, also points towards increasing human impact within the landscape during the medieval period. Declining spruce values have been linked in parts of Sweden and Finland to expanding agrarian land-use (Segerström 1990) including canopy thinning to create meadows and forest pastures (Segerström and Emanuelsson 2002); such a strategy may have been employed around Cēsis in areas of poorer arable potential.

Prior to the fourteenth century, the picture from pollen sequences therefore appears to be one of continuity or even decline in the intensity of agricultural activity during the thirteenth century. However, at Lake Trikāta major changes in vegetation and intensification in land-use are apparent in the pollen data following the crusades (Stivrins et al 2016). Declining arboreal pollen is accompanied by an increasing range and frequency of cultivated and ruderal taxa from the mid-thirteenth century, suggesting significant clearing of the surrounding woodland and the development of a mosaic landscape of arable, pastoral and disturbed ground. The mosaic nature of the landscape suggested by the pollen is further emphasised by documentary sources listing a range of different land-uses. Descriptions of a boundary dispute, dating from 1472 and involving the subjects of Trikaten, contain references to wood-felling sites, meadows, fields and bee gardens within the wider district of Trikāta (LGU 1, 487). Documentary sources from across medieval Livonia often refer to fields, meadows, mills and rights related to pasturing, fishing, cutting of firewood, and beekeeping.

The picture of land-use from northern Livonia (Estonia) during the medieval period is marked in pollen sequences by contrasting patterns of vegetation change and land-use, characterised in some areas by increasing intensity in agricultural activity and in other areas by stability or even a decline in land-use. There are suggestions of relative stability and intensification in land-use across south-eastern and northern Estonia (Niinemets and Saarse 2009; Sillasoo et al 2009). However, short-term decreases in cereal pollen and open land are argued to reflect the impact of battle and plague, including at Parika Mire (central Estonia) c. 1200-1250 (Niinemets et al 2002), and a clear decline in arable and pastoral indicators at Lake Lasva during the mid-14th century ascribed to the impact of the Black Death (Niinemets and Saarse 2009). There is clearly a danger in linking historical events and palaeoecological data without a sufficiently robust chronology, and most pollen sequences across Livonia are rather ambiguous without clear evidence for the impact of plague or conflict. Very little is known about the Black Death in Livonia, but the late arrival and relatively sparse population density may have largely limited the impact to the key urban centres with more limited impact on more isolated rural landscapes.

6.3 Cēsis castle environs

The evidence from the hinterland pollen sequences contrasts with data from the moat at Cēsis where pollen suggests that the immediate environs of the castle are likely to have been largely cleared by the 14th century when the castle underwent a major phase of expansion. Many of the cereal, weed and ruderal pollen taxa are present in the plant macrofossils record (Brown and Badura 2017; Banerjea and Badura 2019), including plants characteristic of disturbed soils (hemp nettle, pale persicaria, common chickweed), meadows (ragged robin, creeping buttercup, tormentil), segetal weeds (cornflower, black-bindweed, sheep's sorrel, annual knawel) and farinaceous plants (rye, wheat, oat and buckwheat) the latter group forming the basis of the diet of the castle inhabitants. The single seed of fig (*Ficus carica)* also provides evidence for long-distance trade and the high status of the castle.

However, interpretation of the data requires an understanding of the varied sources of the palaeoenvironmental remains. Cereal pollen in the moat likely derive from numerous sources, including grain stored in the outer bailey, a component of animal dung and fodder, as well as kitchen and latrine waste flushed into the moat. The majority of plant macrofossils recorded from the moat were most obviously washed in as waste material from the kitchen and latrines. Cereal pollen has been shown to be present in grain products even after baking (Greig 1982), also surviving in beer (Rösch 2005).

Many of the segetal weeds are likely to have been brought into the castle along with the grain. The high values of grass pollen may reflect the open ground within and surrounding the castle but may also have been contained within hay used as fodder or bedding, perhaps for horses stabled in the castle. The remains of food, grain products and animal fodder will have resulted in rotting food waste, along with human and animal faeces, that are likely to have attracted insects themselves transporting pollen from plants growing with the surrounding environment.

The pollen and archaeobotanical material from the moat clearly reflect the diet and socioeconomic status of the castle inhabitants but is also a reflection of the provisioning capacity and political power of the castle in the 14th and 15th centuries. Documentary sources from the 15th century show that Cēsis was an important storehouse of cereals, with the grain stored in the castle accounting for almost a third of all stored grain in Livonia, a significant part of which was used to concentrate power with the Livonian Master. Moreover, the town and castle of Cēsis was situated on an important Hanseatic trade route. Documentary sources emphasise that during the fifteenth and sixteenth century, in addition to goods from Russia and the west, residents of Cēsis also sold their own goods including linen, hemp, flax, hops, leather, honey and beeswax (Kļaviņš 2012), no doubt grown on farms in the surrounding landscape.

6.4 Long-term continuity of pre-medieval land management practices

One of the noticeable aspects of the palynological sequences is the relatively small quantities of microscopic charcoal, suggesting that fire formed a relatively minor aspect of land-management practices. However, in a recent paper, Jääts et al (2010) reviewed the historical evidence for the long-term maintenance of fire cultivation in Estonia up to the nineteenth century. They argue Estonia formed part of a wider zone of fire cultivation, including Latvia, Scandinavia and parts of northern Russia, where this form of land-use was both more prevalent than previously thought and persisted for far longer than in other parts of Europe. In addition to slash and burn and burn beating, the latter technique involving the burning of branches covered in soil, small plots of land were also cultivated in areas covered by young trees and bushes, termed bushlands. These bushlands are argued to have made up as much as 25% of all farmlands in southern Estonia by the nineteenth century (Meikar and Uri 2000), replacing earlier techniques of fire cultivation which were argued to have been more widespread across Livonia during the sixteenth and seventeenth centuries (Ligi 1963).

These forms of agricultural land-use therefore seem likely to have persisted in use during the medieval period alongside the development of more intensive cultivation within permanent fields. Fire cultivation is potentially rather difficult to identify in the palynological record from Latvia, limited to small clearings within woodland that will have severely constrained the wider dispersal of microscopic charcoal particles and cereal and herb pollen. Declines in alder and spruce pollen during the Iron Age have been linked with developments in agriculture, such as the use of iron implements, and an increasing requirement for more agricultural land as populations expanded (Saarse et al 2010). Clearance of spruce often followed the clearance of alder, a pattern that is visible to varying degrees in the pollen sequences presented here as well as from both Trikāta and Āraiši during the Iron Age and medieval period (Stivriņs et al 2015).

Declines in alder are not necessarily linked to human activity but instead may be at least partially linked to disease and pathogen attack widely recorded in palynological data across Europe at the end of the first millennium AD (Latałowa et al 2019). The declines in spruce in several cases precede and are apparently unconnected to increases in human indicators. It seems likely however in these cases that spruce declines are reflecting land-use occurring within the wider landscape that is otherwise palynologically invisible, perhaps of the form discussed by Jääts et al (2010) and occurring largely within small forest clearings. The increase in cereal, field weed and ruderal pollen from the fourteenth century reflects intensification in crop cultivation, characterised in part by the expansion of permanent rotation field systems. This occurs against a backdrop of increased political stability, the growth of urban centres, the growing significance of the Hanseatic League and foreign trading networks, the establishment of serfdom and the development of the manorial system that created an increased demand for agricultural produce. The growing importance of cereals, particularly rye, is demonstrated not only by the pollen evidence but through documentary and archaeobotanical evidence for its growing significant as a consumable, tradable and taxable commodity (Sillasoo and Hiie 2007). It seems likely, however, that traditional forms of land-use continued in use, perhaps persisting in more rural areas further from the principal towns. Colonization occurred at a significantly lower rate within Livonia and the continuation of pre-conquest practices is reflected not just in the use by indigenous communities of Iron Age farming implements on medieval sites (e.g. Mugurēvičš 1990, 2008), but also the survival of traditional burial customs and continued use of sacred natural places (Laul and Valk 2007; Valk 2009); the palynological evidence contributes to this picture of change and continuity.

6.5 Comparing Livonia and Prussia

In both cases the conquest of Livonia and Prussia was facilitated by fragmented tribal polities and the expansionist agendas of the conquering powers. However, in Prussia, a larger proportion of the indigenous population was killed during the crusades, with comparatively small numbers of casualties in Livonia where there was a greater survival of indigenous power structures. Moreover, the survival of indigenous populations can be linked with levels of colonization which were far greater in Prussia than in Livonia where colonists were largely restricted to the towns and castles (Pluskowski 2019a).

The population of Prussia by the beginning of the 14th century has been estimated at 220,000 (Biskup 2002), concentrated most densely around the towns and castles in western Prussia, focused around the Kulmerland and Lower Vistula Basin extending from Toruń in the south to Gdańsk in the north and Elblag in the east. Environmental impact was therefore most pronounced in those areas most intensively colonised. In western Prussia the arrival of the Teutonic Order and German colonists is preceded in many areas by increasing deforestation and agricultural intensification associated with Slavic colonization from the 7th/8th centuries and the expansion of the Polish state from the mid-10th century (Brown et al 2015, 2019; Lamentowicz et al 2007, 2008; Latałowa et al 2009; Noryśkiewicz 2004a, b, 2005, 2013; Pędziszewska and Latałowa 2016; Święta-Musznicka et al 2013). Territories in the east, including much of the Great Masurian Lakelands, saw more limited colonization until the mid-15th century following the end of the Thirteen Years War (1466) where there is a variable pattern of both continuity and discontinuity in settlement and land-use before and after the crusades. The palynological evidence for variable land-use reflects the complex tribal politics of the Iron Age, the variable impact of the crusades and the subsequent development of the landscape as an unstable frontier zone with Lithuania over the mid-13th to mid-15th centuries. (Wacnik et al 2014; Gałka et al 2014; Szal et al 2014, 2016; Brown and Pluskowski 2014).

Parts of Livonia likewise developed into unstable frontier zones, particularly to the south bordering the Grand Duchy of Lithuania; a pattern mirrored on the opposite side of the border in north-western Lithuania (Curonia and Samogitia) where several pollen sequences show evidence for declining human activity and woodland regeneration Stančikaitė et al 2004, 2006). This is most obvious from Impiltis, an Iron Age hillfort on the Curonian coast where the reduction in human activity coincides with the destruction of the hillfort by the Teutonic Order in 1263 (Stančikaitė et al 2009); what was an actively settled land in the Iron Age and became a frontier zone in the medieval period.

7. Conclusion

The variability in land-use recorded in pollen sequences across Livonia and Prussia reflect a complex interplay of factors including; the nature of pre-conquest tribal politics; the degree of survival of indigenous populations and indigenous land-use traditions; the stability of the conquered territories and density and intensity of colonization, and the quality and productivity of the land and requirements for specific land-use practices.

Population densities were lower in medieval Livonia compared to those most densely settled areas in western Prussia but saw a greater survival of indigenous populations and power structures. Colonization was initially limited to the towns and castles, and around Cēsis pollen sequences suggest a high degree of continuity in vegetation and land-use in the century following the crusades. The intensification in agriculture in the 14^{th} century, a century after the crusades, occurs against a backdrop of increased political stability, the growth of urban centres, the growing influence of the Hanseactic League and foreign trading networks, the establishment of serfdom and the development of the manorial system that created an increased demand for agricultural produce.

Despite the low intensity of human activity recorded in the pollen sequences, indigenous land-use practices appear likely to have persisted throughout the medieval period alongside the introduction of new forms of land-use, including permanent rotational field systems. However, it seems plausible to suggest that the landscape to the north, north-east and north-west of Cēsis retains much of its natural character in terms of vegetation. Here the sandy soils are of marginal to poor agricultural potential and retain a heavy woodland cover, compared to the boulder clay soils located to the south-east of Cēsis where palaeoenvironmental evidence suggests more of a mosaic vegetation landscape since the late Iron Age.

Although Cēsis castle became a major power centre in Livonia from the 14^{th} century, and particularly in the 15^{th} century, its ability to concentrate power and resources from across large parts of Livonia was more significant than its impact on the surrounding environment; Cēsis was a major power centre located in a marginal landscape.

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Figure captions

Fig. 1 Location map showing A) part of the Baltic in detail: B) the Teutonic Order's territories comprising Prussia and Livonia and showing those pollen sequences mentioned in text, and C) Location of pollen studies. Pollen sequences mentioned in text: 1 – Āraiši (Stivrins et al 2015), 2 - Eipurs mire (Kušķe et al 2010), 3 – Dzelve-Kronis mire (Kušķe et al 2010), 4 – Lake Ķūži (Kangur et al 2009), 5 – Bazi Mire (Pakalne and Kalniņa 2005), 6 – Lake Kurjanovas (Heikkilä and Seppä 2010), 7 –Rožu Bog (Kušķe et al 2011; Kalniņa *et al.* 2014), 8 - Zilais Mire (Kalniņa et al 2014), 9 – Trikata (Stivrins et al 2016), 10 – Zosna peatland (Ozola 2013), 11 – Parika mire (Niinemets et al 2002),

Fig. 2 Age-depth models, Blusu mire, Nineris Mire, Blanku mire and Rāmuļi. Note that the age-depth model from Rāmuļi includes an addition radiocarbon date at 80cm whilst pollen was only analysed to 50cm core depth.

Fig. 3 Blusu mire, selected taxa percentage pollen diagram. Black curve = percentage of taxon, grey curve = values exaggerated x10.

Fig. 4 Nineris mire, selected taxa percentage pollen diagram. Black curve = percentage of taxon, grey curve = values exaggerated x10.

Fig. 6 Blaņķu mire, selected taxa percentage pollen diagram. Black curve = percentage of taxon, grey curve = values exaggerated x10.

Fig. 6 Rāmuļi, selected taxa percentage pollen diagram. Black curve = percentage of taxon, grey curve = values exaggerated x10.

Fig. 7 Cēsis moat, selected taxa percentage pollen diagram. Black curve = percentage of taxon, grey curve = values exaggerated x10.