

ALL WE ARE IS DUST IN THE WIND | THE CONSTANT THREAT OF SAND DRIFTS

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Abstract

Practically every Pre-modern society experiences a sort of risk or natural hazard. Even in the moderate climate zone of Europe natural hazards such as floods, storm surges and sand drifts threatened entire societies and could eradicate occupation and exploitation in a region. Some societies, however, were able to withstand such hazards and reduce them to natural events, while others were unable to mitigate such shocks and suffered from the disaster that followed. The question therefore remains, why some societies were able to cope and create subcultures of disaster, while others could not. By looking at the late medieval Campine area, located in the cover sand belt that was prone to produce sand drifts, I will advance that we have to look in to the institutional arrangements, property structures, power balances and commercial strategies to understand why a region was able to succeed in a region of risk.

Article

Why are some societies able to cope with natural hazards, while others suffered the full blow because of unpreparedness or vulnerability? Our collective awareness concerning climate change and extreme natural events has spurred our endeavours to understand the causes behind disasters, evaluate what makes societies vulnerable to hazards and how we can explain failing responses to such disastrous events. Until fairly recently, disasters were generally acknowledged as sudden, unforeseeable manifestations of nature, to which human societies were subjected as passive victims. Even though this perspective has not been abandoned all together, more and more scholars start to acknowledge the societal component of disasters and emphasize that disasters are social rather than physical occurrences (For an overview of the debate see: Meier, 2007; Fara, 2001; Tierney, 2007, Helbling, 2006; Adger, 2000). It has been stated that disasters occur when unprepared and vulnerable societies are exposed to risks and hazards.¹ Historians have greatly contributed to our understanding of disasters. First of all by stressing that risk is not a modern phenomenon and that Pre-modern societies did not only suffer from external disastrous events (Gerrard and Petley, 2013). Second, according to Greg Bankoff, only through an appreciation of the past a true measure of the real impact that hazards have played on societies can be gauged (Bankoff, 2003). The main focus, however, has been placed on the most devastating events with large number of casualties, such as earthquakes, floods, droughts, mortality crises or dearth, epidemics and so forth. These events have left most traces and affected our past societies more profoundly than others. Nevertheless, even societies within “safer” regions experiencing less devastating shocks (Gerrard and Petley, 2013), were subject to hazards and had to cope with “regions of risk” (Hewitt, 1997, Bankoff, 2013), since small scale threats could easily deteriorate to disasters if not handled efficiently. A region of risk is defined by Kenneth Hewitt as an area characterised by frequently recurring natural hazards of similar type (Ibidem). Therefore even the moderate climate zone of North-western Europe has come into the picture of historians studying disasters. The entire zone of the North Sea area has often been described as “civilisations d’eau” or hydraulic societies where disaster was a frequent life experience (Bankoff, 2013).

While most attention has been paid to societies suffering from disasters and therefore failed to cope with hazards and natural shocks, our attention is now also directed to communities or societies that discovered the key to success. Some societies became adapted to the constant and recurrent hazards and created “subcultures of coping”. These are cultural patterns that are geared towards the solution of problems arising from an awareness of a periodic disaster threat (Anderson, 1965). Greg Bankoff, Franz Mauelshagen and Tim Soens discovered that in the North Sea area several Pre-modern societies were able to build a typical landscape designed with dykes to halt the constant and periodic winter floods and storm surges (Bankoff, 2013; Mauelshagen, 2007, Soens, 2013). Such resilience towards natural hazards was however not evident and societies could lose their grip on the situation and become more vulnerable towards hazards. For example Tim Soens discovered that from the late fourteenth

¹ For a debate concerning the definition of risk and vulnerability see: Alexander, 1997; Blaikie, 1987; Garcia-Acosta, 2007; Adger, 2000)

century onwards floods and inundations became significantly higher in coastal Flanders, than during the twelfth and thirteenth centuries. Soens links this heightened vulnerability towards floods to a shift from peasant smallholders towards a concentration of property in the hands of absentee landlords or urban investors, instead of the rise of the little Ice Age. Due to a separation of the environmental risks and benefits, investments in infrastructure to cope with the region of risk was lacking and led to an increase in disastrous floods (Soens, 2011). Historical societies, located within a certain “region of risk” therefore can have a changing level of preparedness through time.

In this article I will therefore focus on the question what type of society was able to cope with the threat of natural hazards in a region of risk and which ones did not? Which socio-economic, political or cultural aspects are decisive to understand their resilience towards crisis? In order to answer this question, the late medieval Campine area was chosen as a case study. This region did not suffer from floods or storm surges, but water was not the only threat to Pre-modern societies. Sand drifts were similar insidious hazards that were the most common environmental challenge in sandy heathland regions. In the coversand belt that stretched from the Brecklands in England all throughout continental Europe till Russia, the top layer existed of loose quartz layers (Koster, 2007). In these fragile ecosystems, uncontrolled drifts of sand can rapidly destroy the vulnerable zones of intensively cultivated arable land usually situated in close proximity to village centres. Overexploitation and mismanagement, could easily push this fragile ecosystem over the limit, with sand drifts as a devastating result. The continuous re-sedimentation created a similar region of risk, even though it was rather a dusty one.

It has been generally acknowledged that from the fifteenth century onwards western European common heathlands were severely degraded by mismanagement by the common pool resource institutions and the ever increasing population pressure. The period has been identified as one when the environment was significantly degraded and sand drifts scourged rural settlements (Van Zanden, 1999; Derese, 2010; Vera, 2011). I will advance however, that this view is largely derived from the misconception that any drift sand phase was necessarily a disaster. Few studies differentiate between the hazard of drifting sand, that is bound to happen in a region of risk such as the coversand belt, and the occurrence of a disaster, whereby fields, houses or increasingly larger areas are covered by sand. Nevertheless, recent tendencies within the field of ecological history have shown that we must discern between natural events and human disasters. “Events are recognizable by virtue of their relatively sudden onset and the causalities, damage and disruption they cause”. Disasters, on the contrary, could be labelled a social affair (Tierney, 2007, 509; Mauelshagen, 2007; van Bavel and Thoen, 2013, 16). The way societies organise themselves and interact with nature determines whether or not a sustainable development or rather a disaster is created (Tierney, 2007, 520). While certain ecosystems and landscapes generate specific natural events that are able to create a “region of risk”, such events do not necessarily have to lead towards a disaster (Lubken and Mauch, 2011; Tierney, 2007; Liverman, 1999). Following Tierney, it is important to pay attention of the social causes of disasters and consider which societies were able to detect hazards as foreseeable episodes, and which did not (Tierney, 2007, 509). Disasters, such as a mortality crisis, substantial loss of land, massacre of livestock, etc., are

endemic to certain societies that were not organised to resist shocks, while others had efficient ways to mitigate or cope with hazards.

Thanks to new geological research and especially new methods of dating sand deposits, namely optically stimulated luminescence (OSL) dating, our perspective on Pre-modern sand drifts must be altered. Geological and archaeological reports show that sand drifted continuously, but with certain periods of heightened activity (Derese, 2010; Sevink et al., 2013; Van Mourik and Ligtenag, 1988). For the Campine area, against all odds, these peaks are not situated in the late medieval period. Jan Sevink, Eduard Koster, Bas van Geel and Jakob Wallinga, for example, have recently discovered that even late Neolithic communities that lived around 3000 BC would have been able to start a major drift sand phase (Sevink et al., 2013). In addition, also the Roman settlements and early medieval hamlets have encountered devastating drifts (Verhaert et al., 2001-2002; Derese et al., 2010; Heidinga, 2010; Koster, 1978).

This article questions therefore, why the Campine area was able to prevent disastrous sand drifts during the late medieval period, while the pressure on the environment was at its peak. In order to understand why, I will analyse when sand started to drift and under which conditions these drifts deteriorated into disasters. In order to assess the disastrous character of sand drifts therefore, geological and OSL studies such as those in Pulle and Lille, together with excavations in similar regions such as Laarder Wasmeren and Kootwijkerzand, will provide the evidence that historical data cannot offer. Next these geographical findings will be put into a historical perspective so as to dedicate more attention to the exact location, intensiveness and devastating character of the drifts rather than merely analysing when these drifts happened (Sevink et al. 2013; Heidinga, 2010; Koster, 1978; Derese et al., 2010). The question will focus on subculture of disaster. How did they prevent the disasters and why is this particular society able to cope while they themselves failed before and others failed during the later Middle Ages? It is important not only to analyse the environment and direct reactions to hazards or disasters, but also to look at the social context, to fully grasp the causes and effects of natural induced events such as disasters. In addition, studies on similar regions such as the Veluwe and het Gooi will be used as supplementary evidence to understand sand drifts, as OSL dating studies are still thin on the ground in the Netherlands and Belgium.

Until now, quite a number of models have been put forward to explain why historical communities were able to cope with natural events and disasters. Ostrom stressed the importance of commonly managed resources via common pool resource institutions (Ostrom, 1997), Daniel Curtis stated that the socio-economic layout of the society was determinant and labelled egalitarian persistent and dynamic societies as most resilient (Curtis, 2012), while Rosa Congost, Rui Santos, Susan Hanna, Tim Soens, Bas van Bavel and Erik Thoen have put property rights forward as explanations (Congost and Santos, 2010; Hanna, 1995; Soens, 2011; van Bavel and Thoen, 2013). I will state however, that none of these factors on their own can explain why a region is resilient or not. Due to the case study of the late medieval Campine area I will advance that a combination of strong and long-term property claims, effective and accepted common pool resource institutions and a balanced distribution of

power between smallholders and elites was vital to design a subculture of disaster that was able to cope with the hazard of sand drifts.

The classical perspective | Aeolian depositions and late medieval sand drifts

One of the most basic characteristics of the Campine area is the dominance of sandy soils. During the last Ice Age, dating back 114000 – 10300 years and especially the young Dryas period, also known as the Loch Lomond stadial (12,700-11560 BP), these wind-borne sand deposits were introduced, and defined the Campine's superficial geology and structure (Koster, 2010). In fact the Campine area is only a tiny part of the cover sand belt that was created during that period, ranging from the Brecklands in England till present-day Russia (Ibidem). Afterwards these cover sand belts were overlaid by vegetation. The vegetation was initially most probably open heathland vegetation, followed by a period where woodlands were dominant (Bastiaens and Deforce, 2005; Bastiaens et al., 2007). Consequently, the cover sands were consolidated and remained stable. The circumstances required to initiate the drifting of the cover sands are the presence of top layers of loose quartz, together with fairly dry conditions, extensive open spaces, wind and uncovered soils (Koster, 2010). Therefore, as long as the vegetation covered the sand layers beneath, no re-sedimentation or drifts could occur.

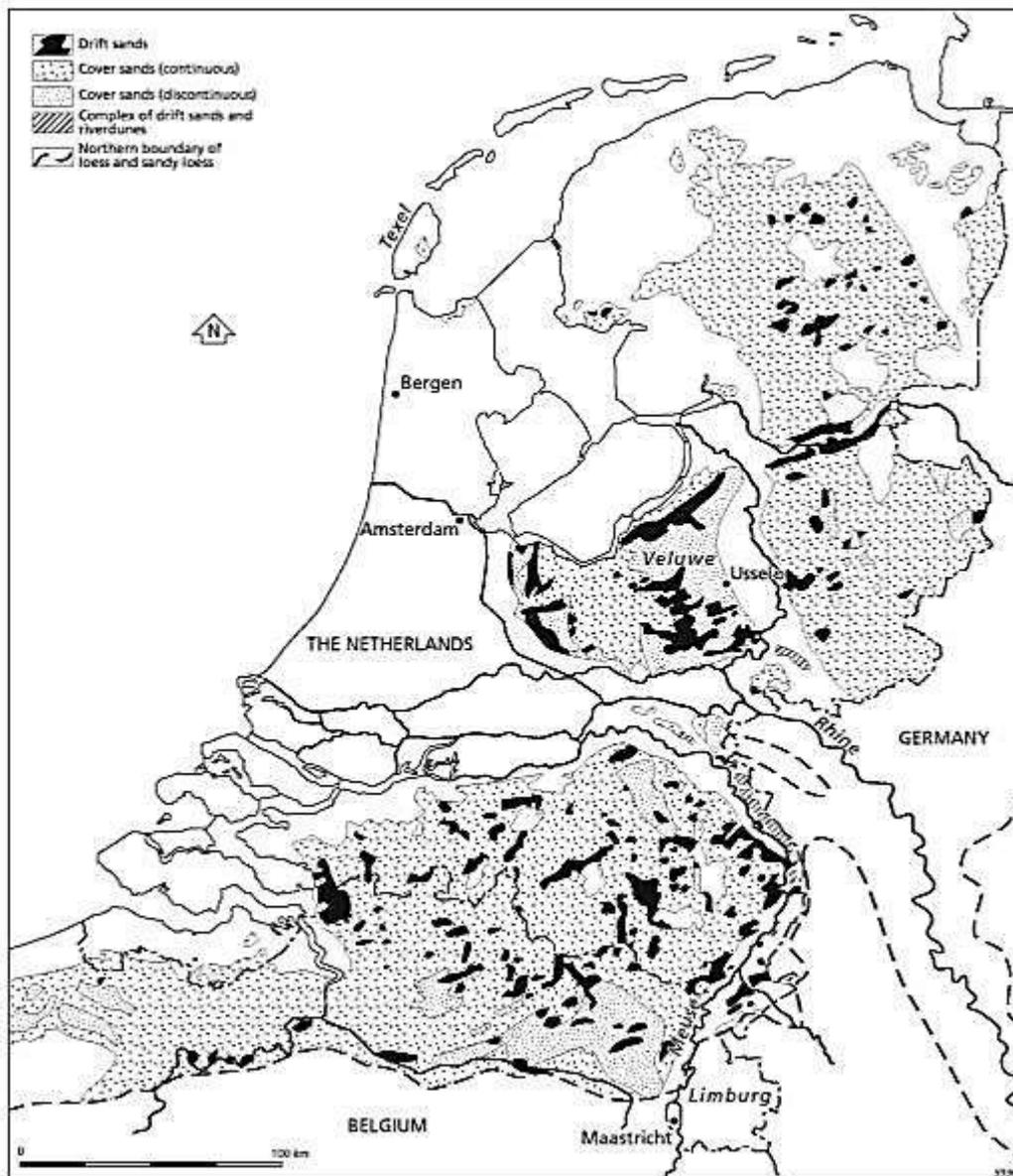


Fig 1 Map of the Low Countries showing Aeolian deposits. Source: Koster, 2010

When the vegetation, however, was destroyed or degraded, these original sand layers or uncovered top soils could easily start to drift. In addition, once a sand dune had become active, it regenerated itself quite easily, so that it was difficult to stop the process and consolidate it again. Holocene sand drifts were a continuous process in the entire cover belt area. According to Koster, local re-sedimentation by wind of terrestrial deposits, resulting in so-called drift sands, occurred on a large scale from the beginning of the Neolithic period up to the present mainly in the western part of the sand belt (Koster, 2010). Only fairly recently has it been established that the topsoil was uncovered enough to create major drifts from the late medieval period onwards. Due to the expansion and intensification of agriculture through the use of grazing herds and plaggen fertilisation, the woodlands and, later, even heather vegetation was degraded to such a degree that sand drifts started to threaten the region (Beerten, Deforce and Mallants, 2012; Vera, 2011; Fanta and Siepel, 2010). In addition, the

growing number of roads and pressure from increased levels of transport, have been considered as being detrimental (Augustyn, 1992, 260-261). This, after all, is the dominant vision, portrayed both by historians as well as geologists and archaeologists (Broers, 2014). The periods prior to the later Middle Ages were considered ecological stable periods (Derese, 2010, 340). According to Hein Vera, several rent registers and charters indicate that sand-drifting became an acute problem from the fourteenth century onwards. Rent registers listed fields covered with sand and charters from the Duke of Brabant reveal threats against communities that failed to stop the drifting of sand, between the fourteenth and fifteenth centuries (Vera, 2011). For the provinces of Overijssel, Groningen and Drenthe, Jan Luiten Van Zanden has outlined a similar picture. Examining the disappearance of wood coverage in those regions, Van Zanden stated that it resulted in serious deterioration of the environment particularly during the sixteenth century. The main causes, according to Van Zanden, were a rising population which could not be halted by the Marks (CPRI's), as well as the failure to manage or apply rules effectively. Consequently, sand drifts were considered a later medieval and Early Modern phenomenon that was only halted in the eighteenth century (Van Zanden, 1999).

This image largely corresponds with a more general opinion about late medieval communities and their destructive attitude towards their environment. For coastal Flanders, sand drifts and the degradation of coastal dunes have also been a hotly debated issue. Just like in the inland areas, it is the late medieval period between the thirteenth and fifteenth centuries that has been labelled disastrous because of sand drifts (Soens, 2009; Idem, 2011, Idem, 2013). According to Beatrijs Augustyn, the old coastal dunes were created during the last Ice Age, after which they stabilised until the high Middle Ages, since the rural communities and the Count of Flanders limited their occupation and agricultural activities to the zone behind the natural flood defence line (Augustyn, 1992). The original sturdy vegetation of European beach grass had by then turned into the climax vegetation: birch woodlands (Ibidem). From the thirteenth century onwards, however, the Count of Flanders founded several cities precisely in the Dunes. Oostende is one of the best examples of this. Both habitation and pastures were transported into the dunes and sheep had largely made way for cattle at this time. Finally, the cities had to be connected by roads, which led to intensive transport levels. Consequently, the cover vegetation was degraded and, in the case of Oostende, the dunes were even levelled. This resulted in large-scale sand drifts with the creation of new dunes more inland. These uncovered and drifting dunes were no match for the infamous storm floods that were prone to hit the North Sea coastline, resulting in several floods such as the Vincentius flood of 1334 which washed away the greater part of Oostende (Ibidem). In the near surroundings, several other villages and hamlets were either covered by drift sands or flooded because of a degradation of the dunes.

OSL | New methods, new results

This classic image of inland sand drifts in the cover sand belt is, however, largely due to a lack of evidence and the presumption that intensive exploitation must have been the cause for the sand dunes that we can still witness today. Dating the exact period when sands started to drift has been extremely difficult until now. Sites without archaeological elements or organic matter suitable for carbon dating have remained a mystery. One has had to rely on the presence of peat layers, specific plant remains or charcoal to perform precise ^{14}C dating (Castel, 1991; Sevink, 2013). New techniques, however, may well have provided a solution. Thanks to optically stimulated luminescence (OSL) studies, sand layers on their own can be dated quite accurately (Wintle, 2008). While in 2007, Koster remained sceptical as to the accuracy of these tests, advances have been made and OSL techniques have been consistently used to date sand drifts and quartz layers (Koster, 2007; Derese, 2013). Consequently, the image of an increasing pressure on the ecological environment prior to the late medieval period must be revised.

Jan Sevink and his colleagues have studied the Groot Wasmeer near Hilversum in the region het Gooi which is, ecologically speaking, extremely similar to the Campine area and have discovered that the prehistoric period was not as stable as presumed. The sand dune is located in the former wet and swampy part of the heath lands surrounding the hamlets and villages near Hilversum. After being open and wet for the period after the last Ice Age, the region eventually became wooded (Sevink et al., 2013). Their most striking conclusion was that ericaceous vegetation was predominant from very early in the Holocene period onwards. The earliest Holocene soil that was buried by drift sand occurred around 6500 BC. A major drift sand phase, however, is to be located around 3000 BC, exactly when the first intensive period of land exploitation took place. The main causal factors seem to have been grazing and burning of the vegetation for exploitation (Ibidem).

Later periods witnessed very similar processes. According to Verhaert, Roman settlements also encountered sand drifts, as indicated in the village of Ravels, within the Campine area (Verhaert et al., 2001-2002). During an excavation of a burial place in Ravels-Weelde it was discovered that the entire site, had been covered by a sand layer and that was big enough to protect the graves present at the site from disturbances in later periods (Ibidem). Roman settlers, therefore, already exploited the area to such an extent that a significantly extensive area was uncovered and became victim to raging winds so strong as to create sand drifts. After a period of relative abandonment and stabilisation when the forests and vegetation were partly recovered, the early Middle Ages witnessed a renewed exploitation period (De Keyzer, 2014). By the seventh and eighth centuries, the high sandy ridges, best suited for arable production, were again reclaimed and large unenclosed fields were created (Renes, 2010).² Despite the absence of large sheep herds and pluggen fertilisation, the exploitation was

² It is likely that the late medieval open fields could have dated back to much earlier exploited fields as described by Renes, (2010)

intensive enough to clear the surrounding forests for the collection of construction wood and create pasture for livestock. Even though these settlements were considered to have been harmless for the environment, the studies of Van Mourik and Derese suggest otherwise. In a recent excavation of a site in Pulle, in the Campine area, Cilia Derese and Nele Eggermont discovered an abandoned habitation site near present-day Pulle. The site was certainly inhabited from 430-600 CE, 640-780 CE and 770-900 CE, according to carbon dating and scarce pottery shards (Derese et al., 2013; Eggermont et al., 2008). Traces of Iron Age habitation on the site have even been encountered. In the excavated site, several traces of pole pits, huts and wells have been discovered, suggesting that this was an inhabited site (Eggermont et al., 2008). Proof of late medieval habitation is, however, missing. Instead the layer was covered by a 40 cm thick layer of drift sands (see Fig 2).

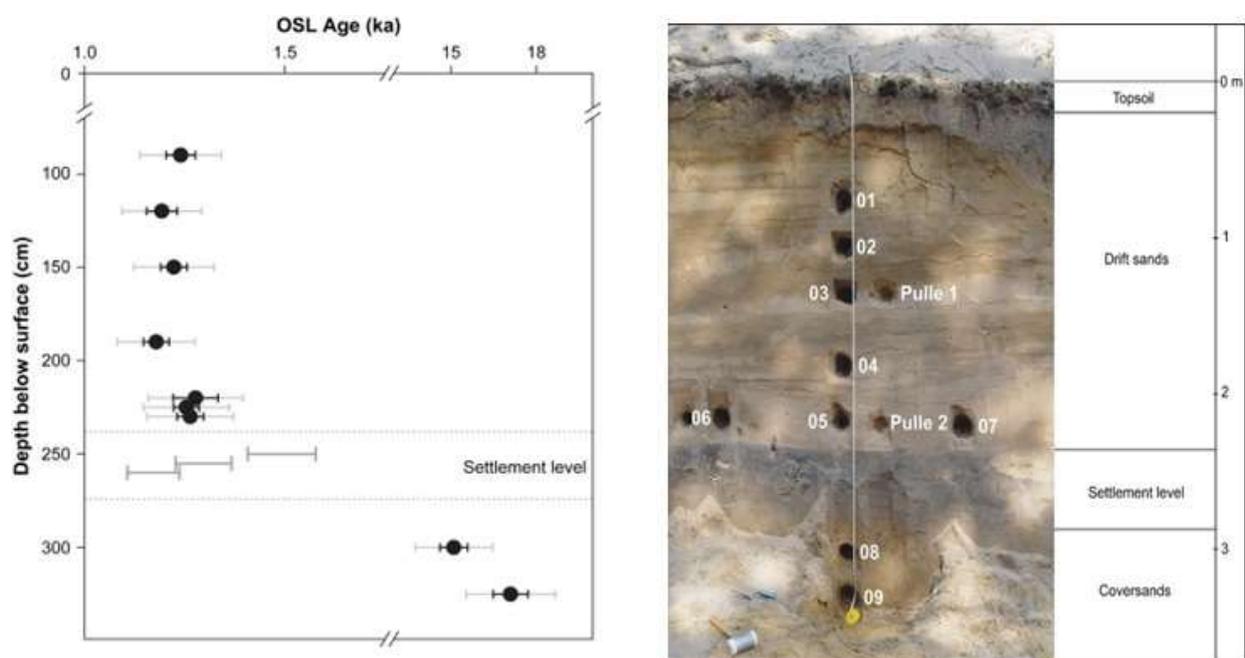


Fig 2 Plot of the optical and radiocarbon ages against the depth below the surface and photograph of the investigated dune profile, showing the location of the samples collected for optical dating. Source Derese et al, 2013.

After OSL dating, it was discovered that the entire layer had approximately the same age, indicating that Pulle witnessed a short period of sand drifts, covering this part of the habitation, which would have forced the inhabitants to leave the site (Derese et al., 2013). The early medieval hamlets, therefore, had reclaimed vast and unenclosed arable fields so as to induce sand drifts that threatened even early medieval villages. The same process was witnessed in a comparable region in the Veluwe in the Netherlands, called Kootwijkerzand. It appeared that the site was inhabited from around the year 700 after a long period of desertion after the Roman occupation. By the ninth century, the hamlet was greatly expanded and large arable complexes were reclaimed from the surrounding wood- and wastelands. This large-

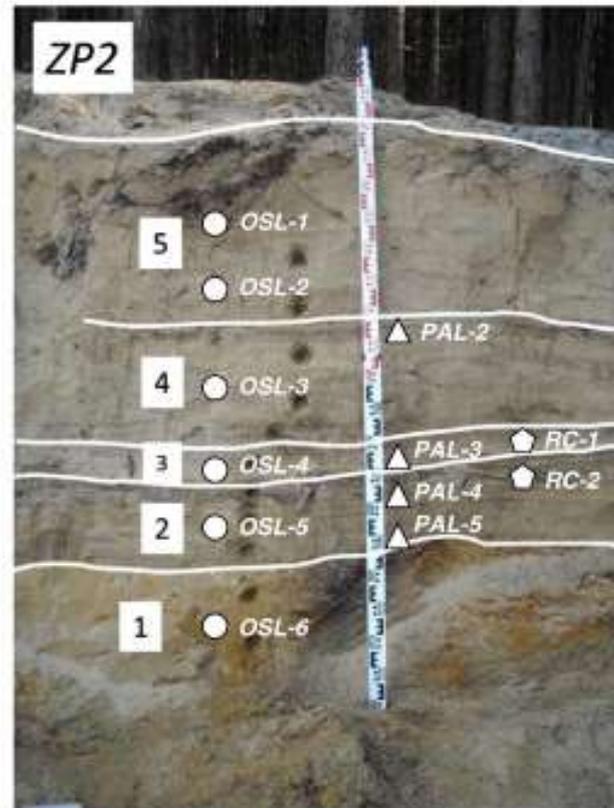
scale reclamation created the sand drift that would eventually cover the entire village. Arable production became impossible, wells were destroyed and the inhabitants had to move elsewhere (Heidinga, 1984a; Idem, 1984b; Van Mourik, 1987; Van Mourik, 1988b). This brought Derese to the conclusion that the early medieval period can no longer be considered as a stable period, one with only minor sand drifts (Derese et al., 2013).

The late medieval period | Disasters or natural events?

Nonetheless, it is still widely accepted that the major sand drifts occurred during the late medieval period, from the thirteenth century onwards (Derese et al., 2013; Broers, 2014). After all, the Campine area witnessed a sustained growth after the thirteenth century, which lasted until the second half of the fifteenth century. In the coastal region, the combination of thirteenth century growth and intensification, had created the worst drift sands and floods ever recorded (Augustyn, 1992). The culmination of the ecological pressure reached in the fourteenth century continued during the fifteenth century. Both population pressure, arable production, cattle grazing and sod collecting ensured a high level of ecological pressure (De Keyzer, 2014). Consequently, these were the perfect circumstances to induce an ecological or Malthusian crisis.

As a result, one would expect that hazardous sand drifts only increased from the eighth century onwards, to culminate in a true disaster by the end of the fifteenth or sixteenth century. At first sight, geological studies do confirm this image. Sevink, for example, witnesses that the sand dunes of the Groot Wasmeer continuously drifted between the fourteenth and fifteenth centuries (Sevink et al., 2013). Historians portray the same image. Historical evidence, however, is thin on the ground. Vera relies on scarce evidence within a limited amount of rent registers and charters (Vera, 2011). These are, however, sources that only appear from the fourteenth century and therefore give only a periodisation *ante quem*. Rent registers list all plots once granted by the duke or lord, even though they were lost because of sand drifts. Nevertheless, they can date back to the very beginning of exploitation of the region when the lord got hold of these lands. Furthermore, Jan Luiten Van Zanden links historical evidence of population pressures, intensive agricultural practices and the presumed malfunctioning of the common pool resource institutions with the acknowledgments that sand dunes were referred to in charters and are visible on historical maps and exist in the present landscape (Van Zanden, 1999). Geological evidence, however, must provide the final answer to the question.

On an excavation in Mol, in the southern part of the Campine area, near the Nete valley, Beerten and his team performed several diggings and discovered that within the wastelands near Mol, sand continuously drifted and relocated itself between 1400 and the eighteenth century (Beerten, Deforce and Mallants, 2012).



Sample	Unit	Depth (cm)	Moisture content (%)	U-238 (Bq/kg)	Th-232 (Bq/kg)	K-40 (Bq/kg)	Dose rate (Gy/ka)	D_e (Gy)	Age (ka BP)
OSL1	5	35	10 ± 5	6.0 ± 0.4	4.6 ± 0.3	126 ± 6	0.75 ± 0.03	0.26 ± 0.02	0.34 ± 0.03
OSL2	5	50	10 ± 5	5.3 ± 0.4	4.6 ± 0.3	121 ± 5	0.71 ± 0.03	0.26 ± 0.02	0.37 ± 0.04
OSL3	4	85	10 ± 5	5.2 ± 0.4	4.2 ± 0.3	121 ± 6	0.70 ± 0.03	0.30 ± 0.02	0.43 ± 0.04
OSL4	3	105	10 ± 5	4.3 ± 0.3	3.9 ± 0.3	110 ± 5	0.65 ± 0.03	0.28 ± 0.03	0.44 ± 0.05
OSL5	2	125	10 ± 5	6.1 ± 0.4	5.0 ± 0.3	122 ± 6	0.72 ± 0.03	0.37 ± 0.02	0.51 ± 0.05
OSL6	1	150	15 ± 5	8.1 ± 0.4	6.8 ± 0.4	172 ± 6	0.88 ± 0.04	15 ± 1	17 ± 1

Fig 3 Details of profiles and OSL dating of Mol excavation. Source: Beerten et al, 2012, 75 & 81.

Unlike the village of Pulle, that witnessed a very short event, covering at least part of the habitation with one layer of sand, the profile of the sand dune in Mol was multi layered (Ibidem). Next, the village of Lille showed a similar process, as fine quartz was found mixed with the plaggen soils. The plaggen soils are most probably late medieval, but no significant results on the exact period of the drift sands could be obtained.³ Finally an ongoing investigation into the village of Vosselaar, near Lille in the Land of Turnhout, is undertaking the analysis of the “houtwal”, or sand dune, caught in the hedges adjacent to the ancient

³ Dixit Jan Bastiaens from the Flemish Heritage Institute (VIOE)

arable fields, right next to the church of Vosselaar. The OSL results are not yet available, but it appears that sand was deposited in the hedges surrounding the arable fields and therefore grew into a dune following the shape of the arable fields of Vosselaar. As this dune is captured in the wooden enclosure of the arable fields, it must date from the late medieval period or after.⁴

Sand drifts were therefore certainly a significant risk during the late medieval period, as they must have been in the early medieval period. We could therefore certainly speak of a “region of risk” (Hewitt, 1997; Mauelshagen, 2007). Nevertheless, I would suggest that to claim that they worsened from the thirteenth century onwards is difficult to prove. The early medieval sites that were discovered showed proof of arable fields and farmsteads, huts and wells that were covered by thick layers of sand. Even though the village of Kootwijk was most probably the site of one of the worst disasters, which cannot be projected onto all early medieval settlements even though the case of early medieval Pulle does show that the centre of the village, as well as farmsteads and fields were under threat (Heidinga, 2010; Derese et al., 2013). By immediately reclaiming large parts of the sandy ridges and organising them in an unenclosed system, the perfect circumstances were created for the wind to stir up the sandy fields and create unstoppable drifts. As a result, communities were unable to protect themselves and, within a short time span, parts of the cultivation or even habitation had become destroyed.

The late medieval sand dunes, however, display a fundamentally different pattern. First of all, we do not have evidence for abandoned or destroyed villages after 1000 AD. Historical documents would certainly report major incidences such as that. For example, Beatrijs Augustyn discovered such sources for the coastal dune villages and cities. When late medieval communities had uncovered most of the old dune belts near the Belgian coast, sand drifts caused the creation of new dunes more inland and hamlets to be covered. By the fourteenth century, the dunes were so degraded and uncovered that floods, such as the Vincentius flood of 1334 and the Saint Elisabeths flood of 1404, swept away entire villages, fields and polders as far as 15 kilometres from the coast. Such disastrous events did not go unnoticed in the written records. Charters as well as chronicles reported the events, and rent or tithes registers showed the loss of earnings (Augustyn, 1992). In the late medieval Campine area, however, no such evidence is encountered.

⁴ Ibidem

Parishes	Land loss by sand drifts and tidal waves	
	(ha)	Sand-covered villages
Knokke	3,5	Ten Vijfhuuse
Knokke	44,2	Staerte
Heist	35,4	De Panne
Blankenberge	88,5	
Wenduine	35,4	Harendike
Wenduine	22,1	
Wenduine	8,8	Vogheldike
De Haan	663,7	Scoone doorpen
Bredene-Oostende	265,5	
Oostende- Middelkerke	132,7	
Total	1300	

Fig 4 List of the sand-covered or flooded parts of coastal villages between Knokke and Middelkerk during the later Middle Ages, according to Beatrijs Augustyn, 1992, 329.

In addition, the sand dunes investigated in Mol, Lille and Vosselaar, are all located either in the wastelands surrounding the hamlet and its arable plots or right next to the wooden fences or hedges which protected the arable fields for cattle but most probably also from sand drifts (Beerten, Deforce and Mallants, 2012). In the Groot Wasmeer in het Gooi, the dune is also located far from the centre of the hamlets and villages in the area (Sevink et al., 2013). While comments over the location of the dunes, might come across as splitting hairs, it is vital to distinguish between natural events that occurred in the cover sand belt region once the environment had been exploited and cultivated, and a disaster that is beyond human control and threatens the presence and occupation of the local population (Tierney, 2007; Lubke and Mauch, 2011). The sand discovered in the plaggen soils of the arable plots of late medieval communities such as Mol and Lille was evenly dispersed within the plaggen layers, suggesting that the sand was continuously ploughed into the other layers. Cultivation was therefore permanent and not fundamentally disturbed by a surge of sand. In addition, large-scale sand drifts, depositing thick layers of sand, have not been discovered. As the layer sequence of Mol demonstrated, constant re-sedimentation of thin layers of sand occurred (Beerten, Deforce and Maalants, 2012). As Koster claimed, existing sand dunes, were lasting entities that could barely be halted and continued to drift on a small scale (Koster, 2007).

The sand drifts that took disastrous forms, however, did return, but only from the eighteenth and nineteenth centuries onwards. Jan Van Mourik performed an excavation of a sand dune covering the “enk” or open field of Nabbegat located in the village Zeeland between ‘s Hertogenbosch and Nijmegen. While Van Mourik was able to assess that sand drifted quite continuously throughout the Pre-modern period, arable fields were only covered during the nineteenth century (Van Mourik and Ligtenag, 1988). In addition, Cilia Derese has suggested that the eighteenth and nineteenth centuries were a period of time consisting of heightened drifts, covering even arable fields (Derese et al., 2013).

A remarkable resilience | Communities and their struggle with a risky environment

In contrast to previous studies, I would therefore advance the argument that late medieval sand drifts were continuous drifts, but not necessarily disasters. Campine communities knew the risks and problems connected with living in a cover sand belt and acknowledged the presence of sand drifts as foreseeable episodes (Bankoff, 2013). According to Franz Mauelshagen, strategies for coping with risk environments are based on the expectation of repetition drawn from the experience of repeated disasters (Mauelshagen, 2007, 134). It has been assessed that natural hazards and catastrophes have a history: “They are anticipated long in advance and they are remembered, often for a long time after the actual event takes place” (Lubken and Mauch, 2011, 1). Having learned from the first swift and irreversible drifts from the early Middle Ages, late medieval Campine communities adapted their agricultural practices and infrastructure. Knowing that uncovering the cover sands could trigger the process of drifting, the strategy of working with large open fields was abandoned (De Keyzer, 2014). Instead, a type of bocage landscape was created through the introduction of hedges and wooden fences around practically every plot of arable (Ibidem). This would protect the arable from being covered or start to drift itself. Vast spaces of open land, vulnerable to strong winds were, after all, a precondition for drifting. Next, the common wastelands, consisting of sturdy grasses, heather and shrubberies, were added to with the implementation of the strategic planting of trees, bushes and shrubberies on the dunes and fragile drift sands were introduced by the village communities (Ibidem). Even though they could not stop the sand indefinitely, they were able to protect their valuable arable fields and prevent large-scale drifts, threatening entire villages, as was the case with the “houtwal” near the village of Vosselaar.

I will, therefore, argue that the Campine area was built, both literally and figuratively speaking, for resilience. This is what Franz Mauelshagen has called “a landscape of coping”. In a region of risk, a specific type of cultural landscape had to be created in order to manage that risk (Mauelshagen, 2007). As stated before, communities constructed an infrastructure to prevent drifts. The common wastelands were planted with trees and shrubberies. Practically every village government obligated its inhabitants to help with the planting and maintenance

of these plantations.⁵ The village of Retie, Kalmthout, Ravels, Geel and Arendonk all refer to small plantations or wooded areas, called “*heibossen*” (heather forests), that were constructed on the wastelands in order to prevent or limit drifts (Helsen, 1949; Ernalsteen, 1935; Koyen, 1958; Prims, 1944; Verhoeven, 1907). The community of Retie could appoint two men who were responsible for the protection of the community against the sand and planting trees (Helsen, 1949). In addition, once a year community members were required to perform communal tasks such as maintaining woodlands planted on the common heathlands. The byelaw of Ravels and Eel, for example, stated that “the wood, needed to stop the sand, will have to be repaired by everyone on the punishment of 6 stuiver” (Koyen, 1958). Besides, several villages had received the right to plant trees on the commons, ten foot behind their private land.⁶ This “pootrecht” secured their basic needs for timber, but equally functioned as a barrier against drifting sand. Beatrijs Augustyn saw the same measures introduced for the planting of European beach grass in the coastal dunes, although the failure to actually apply and abide by those rules was put forward as one of the main reasons why the sand drifts could not be halted (Augustyn, 1992). These rules were all formally written down by the sixteenth century, however, as the institutions predated this homologation these preventive strategies were probably older.

All these tasks were supervised by the “*gemeeyntes*” and this leads us immediately to the Campine Common Pool Resource Institutions (CPRI’s).⁷ As Ostrom predicted, commons were not left unmanaged and the communities formed institutions for collective action that would regulate the appropriation of common resources. As Tine De Moor has claimed, several of these Early Modern communities did introduce seven main design principles which were deemed necessary to prevent a tragedy (De Moor, 2003).⁸ In general, the Campine area seems to have conformed to these principles.

⁵ These preventive measures against sand (but also the regulations to counter cattle plagues) are listed under the title prevention in Fig 5.

⁶ See for example: RAA, OGA Rijkevorsel, 12.

⁷ These are the set of working rules that are used to determine who is eligible to make decisions in some area, what actions are allowed or constrained, what rules will be used, what procedures must be followed, what information must or must not be provided, and what payoffs will be assigned to individuals dependent on their actions. (Ostrom, 1997, 51) Wat is het en design principles

⁸ 1: Clearly defined boundaries, 2: congruence between appropriation and provision rules and local conditions, 3: collective choice arrangements, 4: monitoring, 5: graduated sanctions, 6: conflict resolution mechanisms, 7: minimal recognition of right to organise, 8: nested enterprises. (Ostrom, 1997).

Village	Typology														Total IN
	Access		Commerce		Governance		Management		Prevention		Rights		Use		
	Total	% sand	Total	% sand	Total	% sand	Total	% sand	Total	% sand	Total	% sand	Total	% sand	
Arendonk	6	0	7	0	4	13	22	23	13	34	1	0	47	4	216
Brecht	4	0	0	0	4	0	21	17	14	25	0	0	57	0	28
Ekeren	4	0	4	0	11	0	30	25	7	0	7	0	37	10	27
Geel	3	0	4	0	14	20	25	17	3	50	0	0	51	11	71
Gierle	17	0	2	0	7	0	27	0	2	0	0	0	44	0	41
Herenthout	8	0	0	0	6	0	25	0	0	0	6	0	55	4	51
Hoogstraten	6	0	11	0	11	0	17	0	0	0	0	0	54	5	35
Kalmthout	0	0	0	0	38	0	63	20	0	0	0	0	0	0	8
Kalmthout- Essen-															
Huiberghen	0	0	3	0	22	0	31	30	13	25	0	0	31	20	32
Kasterlee	9	0	0	0	2	0	14	50	2	0	0	0	72	6	43
Oevel	6	0	3	0	0	0	19	33	3	0	3	0	65	5	31
Oostmalle	2	0	0	0	15	0	18	20	7	50	0	0	58	13	55
Ravels-Eel	3	0	3	0	15	0	13	40	13	40	10	0	44	6	39
Retie	5	0	4	0	4	0	13	14	15	75	5	0	55	20	55
Rijkevorsel	0	0	3	0	15	0	12	0	9	33	3	0	59	5	34
Terloo	4	0	4	0	15	50	27	29	0	0	0	0	50	15	26
Tielen	0	0	0	0	5	0	10	0	5	100	0	0	81	0	21
Tongerlo	0	0	3	0	3	0	24	13	0	0	3	0	68	0	34
Turnhout	0	0	18	0	5	0	5	0	9	0	0	0	64	0	22
Veerle	2	0	8	0	4	0	14	0	6	0	2	0	63	3	49
Vorselaar	7	0	0	0	3	0	17	20	7	0	3	0	62	0	29
Westerlo	8	0	0	0	1	0	26	23	5	0	2	0	58	8	86
Wuustwezel	4	0	1	0	6	0	40	21	13	33	0	0	36	12	70
Zandhoven	0	0	0	0	18	0	45	0	0	0	0	0	38	0	40

Fig 5 Percentage of rules dealing with sand drift prevention per type of rules in the byelaws introduced by a selection of Campine villages (De Keyzer, 2014).

Regarding sand drifts, however, most important was the communities' awareness of the necessary congruence between appropriation rules and local conditions. The majority of local byelaws dealt with appropriation rules and they showed an extraordinary knowledge of the possibilities and weaknesses of their region. They realised that uncovering sand was one of the worst threats and therefore almost every village tried to prevent this. Rules regarding

general management and maintenance made up a significant part of the bylaws, as shown by Fig 5.⁹ First of all, the areas where loose sand dunes were located were forbidden territory for practically all types of agricultural actions. As the bylaw of Arendonk states, “signs were placed by the steward and aldermen [to indicate the sand] and nobody can “*steken, vlaggen or maaien*”¹⁰ on the penalty of 24 stuiver” (Prim, 1944).

Digging for sods and mowing were considered to be especially harmful by late medieval communities, as this would remove the sturdy vegetation both covering and retaining the sand. Therefore, even the equipment used for mowing was prescribed. In Westerlo, for example, it was stated that nobody could use either a short or a long scythe (Lauwerys, 1937). Moreover, harvesting of heather vegetation or peat was limited to only certain amounts on the entire wastelands. Every household had the right to mow once a week, but not more. This could only be done by the family members themselves and hired labour was forbidden.¹¹ Digging for sods, meaning uncovering the soil, was always prohibited except with the permission of an official and only for building purposes (Prims, 1944).¹² The intensive kind of plaggen fertilisation, using both vegetation as well as organic layers, were more characteristic of the eighteenth century than of the later Middle Ages (Bastiaens and Verbruggen, 1996; Thoen and Vanhaute, 1999). Campine communities were, therefore, highly aware of the problem posed by sandy soils and adopted themselves to the circumstances. They knew what sand drifts could potentially cause and sought to protect themselves against it on an institutional level.

Social structures

Institutions for collective action, however, cannot fully explain the level of resilience of a society. As the projects of Angus Winchester and Tine De Moor have shown, CPRIs are remarkably similar and introduced practically the same type of rules everywhere in Europe. Nonetheless, outcomes in terms of environmental, social and economic resilience were highly divergent. In the Brecklands, in the county of Norfolk, for example, formal institutions could not prevent lords from monopolising the rights of fold course and overexploiting the open fields, outfields and wastelands with their manorial sheep herds. Despite countless complaints by local cottagers and tenants of the devastating effects and loss of yields on their private land, the manorial lords invested in commercial sheep breeding for their own profit, while degrading the environment and hampering arable production (Allison, 1957; Bailey, 1989;

⁹ I have categorised rules regarding general management and maintenance as ‘management rules’ while regulations dealing directly with prevention towards sand are contained in the column called ‘prevention’.

¹⁰ Gradation of the depth or intensity of mowing. ‘Steken’ refers to collecting sods with a layer of organic soil attached to it, while ‘vlaggen’ stands for cutting the vegetation to the bare soil, and finally ‘maaien’ refers to mowing in a normal sense, leaving both the soil as well as the bottom of the vegetation intact.

¹¹ For example in the village of Veerle it was stated that “Nobody will be allowed to harvest more sods than that one man can dig in one whole or two halve days”. AAT, Bundel Byelaws, Veerle

¹² In Arendonk the bylaw reads: “Nobody will make peat pits on the commons, unless the supervisors has been called for and has indicated a location”.

Bailey, 1990; De Keyzer, 2013). Here the highly unbalanced distribution of power and growing gap between the different social strata of the Brecklands communities was to blame for this unsustainable management and diminishing resilience. Similarly, the charters, ordinances and rules introduced by the Count of Flanders for the villages in the coastal dunes had next to no effect on the management of the fragile dune slopes. Despite similar types of rules, namely regulations seeking to create a congruence between appropriation and the local circumstances and grant plant rights and duties, the dunes were increasingly degraded. The dune masters, appointed to control the actions of the appropriators, were also of no effect, due to the fact that they themselves were the tenants leasing pastures in the dunes without further control from bottom up or top down (Augustyn, 1992). According to Tim Soens these problems arose because of changes in the social distribution of power between smallholders and lords, which led to a separation of environmental risk and benefits. Consequently Less time, effort and money was invested in maintenance and control (Soens, 2005-2006; Idem, 2011).

In the late medieval Campine area, however, such a widening gap between interest communities or the faltering of formal or informal regulations and control did not occur which was highly beneficial for the Campine environment. First of all, the exclusion of poor groups within society, has for certain contexts been described as detrimental to the environment as they would attempt to exploit their environment to the maximum in order to survive (Adger, 2000). This was, however, prevented by the Campine communities, through the inclusion of poor households and providing basic relief in order to limit free riding and degrading activities. The Campine area showed an extraordinary inclusiveness as all social layers of a village were granted access to the commons and relied upon them for subsistence farming as well as commercial opportunities (De Keyzer, 2014). This strategy fits in a more general policy of the Campine Holy Ghost tables of supporting the village poor (Van Onacker, 2014). The case of Zandhoven, moreover, has indicated that 98% of the village actively used the commons on a yearly basis. The poor were therefore fully incorporated, in order to regulate and steer their appropriation, rather than forcing them into a clandestine circuit (De Keyzer, 2014). The village poor owned no cattle, however, digging peat, collecting heather and looking for building material could make a huge difference to the family budget. Access to the commons therefore would prevent them from forcing entry and undertaking over-exploitation. Such illegal actions, after all, meant an immediate exclusion from the Holy Ghost table and as such probably also from the commons as well which was a heavy penalty.

Next, the peasant communities were able to maintain a firm grip on the management and control of the commons. None of the Campine interest groups would benefit from degrading the commons to the extent that they would turn into real wastelands, in other words, existing of poor heather plains and drifting sand dunes. First of all the rural elites and better-off peasants, which I have called independent peasants, relied predominantly on sheep breeding for their commercial strategies and social standing. Sheep were easily fed, but the more diverse the vegetation was, the better. As sheep could most probably not enter the arable plots after harvest, the wastelands represented their final option (De Keyzer, 2014). In addition,

they too benefitted from sustainable commons, covered by shrubberies, woodlands, fens and loam pits, as purchasing these benefits from the market would hamper their opportunities as well. Next, both rural elites as well as independent peasants were engaged in mixed farming, requiring large amounts of fertilisers for producing sufficient yields for their own subsistence. The cottagers en micro-smallholders, equally required sustainable management of the waste lands, as the opportunity to collect heather, sods and hay was essential for their subsistence. Consequently they needed to maintain large parts of the commons available for mowing and collecting sods, which was impossible once the threat of sand dunes was too high. Finally feudal lords, abbeys nor the Duke of Brabant showed real interests in exploiting the commons in such a manner that sand drifting could become viral (De Keyzer, 2014). The strict rules of the abbey of Tongerlo towards tenants and investors exploiting peat, so as to fill up pits and prevent degradation of the soil, indicate that their awareness was similar to that of the local communities (Van Den Broeck, 2012). This stands in stark contrast with the rural elites – urban investors, the Count, abbeys and lords - of coastal Flanders, studied by Tim Soens (Soens, 2011). As urban investors in particular tended to invest in short-term gains, the ecological degradation of the region was considered an unavoidable side effect. In the Campine area, however, both peasants as well as tenant farmers followed a more long-term and sustainable strategy, and furthermore their willingness for new and short-term investments in neighbouring regions was less obvious.

Property relations

The attitude towards the environment therefore largely depends on the social context, economic interests and as stated by Susan Hanna and Bas Van Bavel on property relations of the local stakeholders (Hanna and Munasinghe, 1995; van Bavel and Thoen, 2013). While on the one hand scholars state that efficient property rights can only be exclusive, transferable and enforceable (Tietenberg, 2006), others claim that a dichotomy between common and private property must be discarded, when it comes to sustainability (Hanna and Munasinghe, 1995). Communal property could be sustained on an equal level as private or state property (Ostrom, 1997). The same vision is portrayed by Bas van Bavel and Erik Thoen: “No single way of formulating property rights in itself guarantees sustainability. The long-term effects depend on the exact formulation and the social context and the balance between the various groups and interests/goals involved” (van Bavel and Thoen, 2013, 38). The most important condition, according to Hanna is that “the design of property right regimes is to be congruent with societal objectives for economic performance, equity, and ecological maintenance. Objectives for long-term use of the resource must be specified within the regime so that expectations of resource users and the society at large remain consistent”. “A further requirement is to ensure that the incentive structure of rules reflects the long-term sustainability goals for the ecological system, such as long-term tenure and protection from the tyranny of short-term decisions” (Hanna and Munasinghe, 1995, 19). The same vision is portrayed by Tim Soens for the medieval coastal regions of the North Sea area. According to

Soens, coastal communities could be highly efficient in managing the water and preventing floods as long as the population consisted of largely smallholders, possessing strong property rights on their rather small-scale holdings, labour was cheap and all community members were responsible for maintaining the dikes, while depending and benefitting from the preventive acts themselves. Being small peasants with long-term property claims, investing in sustainable development and preventing inundations was the best strategy, as they had to secure both their own as well as their children's future as peasant producers in that polder region. From the later Middle Ages onwards, however, this social balance was tipped in the opposite direction and absentee landlords came to obtain the majority of land. Consequently, the land was owned by investors and laboured by short-term tenants. The risk for these investors was minimal, as they did not reside in the area and short-term profits were of more importance than long-term management. Peasants had lost their claim on the land as semi-proprietors, and were reduced to short-term tenants, which limited their opportunities and willingness to invest in dike management. Therefore, inundations multiplied with serious environmental repercussions for the area (Soens, 2009,; Idem, 2011).

Late medieval Campine society was largely based on common property rights together with private property that had common rights attached to them (De Keyzer, 2014). This was, however, not an inefficient nor unsustainable system. These property rights, like the ones Hanna described, were congruent with societal objectives and created strong power claims for the peasants, so as to protect them from the necessity of acting according to profit-driven and short-term decisions. As such they resembled pre-1300 peasant societies in coastal Flanders, but did not witness a transformation towards a polarised society with short-term leases and absentee landlords. "Cijnsgoed" or inheritable rent was the dominant type of property in the Campine area. Even though leaseholding did exist, most peasants only leased a small plot, in a long-term life-cycle strategy (Van Onacker, 2013), while relying on long-term and inheritable rent for most of their private land (Van Onacker, 2014). In addition, these peasants, both labourers, cottagers as well as rural elites, were all granted access to the commons. As such, their access was secured for a long time and possible threats to exclude them, or withdraw their communal rights, were effectively countered via several juridical and infjudicial levels (De Keyzer, 2014).

This particular combination of long-term claims on small plots of inheritable property together with firm use rights on the commons which were required for everyone's subsistence and additional commercial opportunities, created a situation where it was in the entire communities' interest to safeguard a sustainable development of these common wastelands. This was, in addition, ensured through abiding by the rules, catching and punishing trespassers and investing in preventive measures such as planting trees, hedges and covering sand dunes. In contrast with the coastal communities peasants with more life-cycle strategies and long-term investments, were not, after all, forced to change towards more short-term actions, as they possessed the means and power to fend off such pressures. The fact that the sand drifts became more destructive during the eighteenth and nineteenth centuries, does suggest that the abolishment of the commons, large-scale land redistribution and economic transformation had disturbed this attitude towards the environment (Vanhaute, 1988). This

type of society could rely on a strong sense of communal responsibility, which would strengthen the impact of social control. According to Tine De Moor, this form of infrajustice was far more effective than harsh punishments and high fines. The longevity of CPRIs significantly increased where rules were enforced by social control and pressure of neighbours, rather than external courts or formal fines (De Moor and Tukker, 2012). The fact that practically no fines were formally registered may be an indication of this.

To commercialise or not to commercialise?

Finally, commercial strategies are important as well. More often than not, market dependence is considered a risk to sustainable development, especially when a resource-dependent community focuses on one particular resource or product. By clearing mangrove forests in South-East Asia or South America in order to breed fish for commercial markets, for example, coastal communities have put themselves at risk for serious floods (Adger, 2000, 348). Similarly, the Brecklands in Norfolk were threatened by capitalistic sheep breeding resulting in the soil being degraded by the over-exploitation of the land, which resulted in lower yields (Whyte, 2011). Consequently, several scholars, studying Early Modern CPRIs have stated that commercialising resources obtained from the commons was often prohibited. This was one of their main strategies to prevent over-exploitation and degradation (De Moor, Shaw-Taylor and Warde, 2002). Van Zanden, on the contrary, claims that a lack of commercial spirit was exactly the reason why peasant communities were unable to prevent soil degradation, which then resulted in sand drifts. The institutions for collective action, called “marken”, introduced the indispensable design principles, even though they were unable to prevent the community of users expanding and enforcing the rules they had created. Monitors were not motivated, and in periods of crisis, their power dwindled or even disappeared completely. Only when they started to treat the commons as a commercial opportunity during the seventeenth century, by demanding entrance fees and charging appropriators per unit of cattle or day of collecting resources, the CPRIs were able to turn the tide and obtain a level of sustainable management (Van Zanden, 1999).

I would like to suggest that a more nuanced approach towards commercialisation is required and one cannot confuse commercialising ecological benefits derived from the commons with the commercial management of the CPRIs. Within the Campine area, and in most CPRIs in the Low Countries or neighbouring regions, commercialising resources obtained through the commons was regarded with suspicion. Nevertheless, all indirect products (such as wool, milk and hides) were free to be sold by community members (De Keyzer, 2014). This commercial attitude, moreover, existed from the very beginning and was never prohibited by the local byelaws. In addition, Campine communities did not even introduce maximum quotas for cattle or sheep that could be placed on the communal grazing grounds (Ibidem). Despite this freedom, Campine peasants did not bring hordes of sheep onto the commons, over-grazing the wastelands into mere sand bowls. According to McCarthy, engaging in collective action

immediately restricts individual peasants from over-stocking and has a negative effect on herd sizes (McCarthy, Kamara and Kirk, 2003, 236). This, together with the limited amount of meadows available for winter fodder and the strategy of the Campine peasants to maintain a form of mixed farming, reduced the average herd size to approximately 30-40 sheep per peasant household and maximum 90 sheep for a large tenant farmer. The records of the Tongerlo tenant farmers, do show that commercial gain was an objective, as both meat, wool and hides were sold on local markets as well as regional centres such as 's Hertogenbosch and Hoogstraten (De Keyzer, 2014).

The Campine peasants were, however, not market dependent. It is acknowledged that all peasant societies have been commercially active, but while some communities merely took advantage of their opportunities in order to supplement their subsistence farming with a little surplus and cash income, others opted to focus on commercial activities entirely in order to sustain themselves. The Campine peasants, and more specifically the independent peasants and tenant farmers, can be placed somewhere in the middle (De Keyzer, 2014). Reinoud Vermoesen has called this former strategy the "peasant continuum", indicating that peasants opted for all sorts of activities from subsistence to market integration, without tipping towards either of the two sides (Vermoesen, 2008). Wool and sheep were sold and peasants could make quite a profit from this, nevertheless they did not blindly follow the fluctuations of the markets, as the total amount of sheep indicate. Campine peasants, therefore, reached their golden age, but they did not enlarge their herds to a maximum or shift their mixed farming towards capitalistic sheep breeding, rather, they reacted quite moderately to this rising demand. Some authors have called this strategy "risk averse", while others refer to it as a "risk prevention". Daniel Curtis compared persistent versus dynamic communities and stated that persistent societies looked rather traditional, since they maintained fixed strategies and did not alter them according to external push and pull factors, while dynamic societies, such as Holland during the Golden Age, precisely secured a living through dynamically changing agricultural or commercial practices according to changing market circumstances. Both were equally resilient, as long as their social structure could be labelled egalitarian (Curtis, 2012). Late medieval Campine society, therefore, balances on the verge of what Daniel Curtis has labelled an "egalitarian persistent and dynamic societies". They exploited their resources to the full, without ever fully becoming market dependent and maintaining, yet constantly transforming, their mixed farming system to best suit and cope with their natural environment and social structures.

Campine communities were able to do this without having to resort to commercially managed CPRI, relying instead on a moral economy. Access was granted to all full community of members, even though the community was expanding and poor households made up 25 per cent of society. In addition, charging for placing animals on the common wastelands was known to occur in the Campine area, as Zandhoven has proved (De Keyzer, 2014). These entrance fees and charges per day for collecting heather and per cattle unit were, however, so small that practically every household was able to pay these sums. They were more a means to secure a steady income for the CPRI than to limit community members from entering the commons or limiting their herds, as 98% of the village actively used the commons.

Conclusion

Disasters are inherent in the social order of certain societies due to either a lack of preparedness, or the failure to properly react to threatening natural hazards. Late medieval Campine society, however, was fully aware of the risky environment and effectively altered their strategies and infrastructure to cope with this situation. While sand drifts were a constant and hazardous risk, threatening to cover villages and productive land, true disasters had been halted by the later medieval period. Sand continued to be re-sedimented and to drift, but did no longer threaten villages and infields as had happened in Pulle and Kootwijkerzand in the early medieval period. To become resilient towards natural hazards, societies had to develop a subculture of disasters and required a certain blue print to reduce risks. As such, I would argue, as did Tim Soens that weather conditions, such as droughts, the medieval optimum etc. were only of minor importance (Soens, 2011, Idem, 2009). Much more important were institutional arrangements, property structures, power balances and commercial strategies. The coastal dunes, located in the same climate zone and weather conditions, reached their most disastrous period during the late medieval period, while the Campine sand drifts were at their worst well before and after the late medieval period. Late medieval Campine society consisted of a majority of small peasant proprietors that possessed strong claims on both their private lands as well as the surrounding common wastelands. These peasants used this land for subsistence farming combined with commercial activities, however, without becoming dependent on the market, rather so as to supplement the family income. Moreover, all interest communities relied on the maintenance and sustainable development of the commons and arable fields for their survival. Consequently, it was in everyone's interest to invest in long-term strategies and limit ecological risks. As such, they engaged in collective action and created CPRIs so as to regulate appropriation as well as monitor and sanction trespassers. As this awareness was shared by the larger part of society, social cohesion and pressure greatly enhanced the enforcement of those rules. In order to reduce hazardous sand drifts, late medieval communities invested time and effort to plant hedges and fences around practically every arable plot as this would reduce the impact of the wind on the infields themselves, while keeping the sand from entering the arable plots from the wastelands. As such, they had abandoned the open field system and created a sort of bocage landscape. In addition, communal tasks included planting woodlands on the sand dunes and the remaining land, which consisted of heathlands, was not allowed to be uncovered by digging for sods. As a result, the Campine area was quite literally, but more importantly also figuratively speaking, built to reduce risks and this attempt was a successful one.

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