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# A Millennium of Resilience, Vulnerability and Sustainability at Rome, c. 200 BCE-800 CE

## *Abstract*

The contribution uses the four phases of growth, conservation, release, and reorganisation of the adaptive cycle model from resilience theory in a study of developments at Rome in the millennium from the late Republic through late antiquity. In addition, the study applies the concepts of vulnerability and sustainability to investigate responses to crises. The focus is on change in the size of the city of Rome, the relationship between city and hinterland, and how society tried to adapt to environmental, economic, political, and social challenges. It concludes that, in the end, the city of Rome proved resilient, and entered the medieval period still the largest city of the Latin world.

This volume is about the three themes of resilience, city, and hinterland. In this contribution, I aim to combine these themes and apply them to the city of Rome.<sup>1</sup> The study looks at changes in the size of the city of Rome, in the relationship between the city and its hinterland, and how Roman society adapted to environmental, economic, political, and social challenges in the long term, during the millennium from the late Republic until late antiquity. It will also investigate the interplay between urban resilience, vulnerability, and sustainability to see how these concepts might give us a better understanding of developments at Rome. To use resilience in conjunction with vulnerability and sustainability might provide us with a more specific understanding: resilience of what, when, and how much?

This study attempts to apply resilience theory on long-term urban developments in Rome.<sup>2</sup> It combines research results from many different scholars working on Rome and its hinter-

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<sup>1</sup> I would like to thank my co-organizer and co-editor Eivind Heldaas Seland for all his support, the staff at the Norwegian Institute in Rome for their hospitality, encouragement, and generosity, and especially Manuela Michelloni for her editing work. I am most grateful to Bryan Ward-Perkins, Roland Fletcher, and the anonymous reviewer, for their comments on the text. I also want to express my gratitude to the Meltzer Foundation for its economic support which allowed study visits to Rome.

<sup>2</sup> It builds upon my research on the connection between movement and urban development in Rome, with special focus on urban peripheries and the Tiber: Malmberg 2009a; Malmberg 2009b; Malmberg, Bjur 2009; Malmberg, Bjur 2011; Malmberg 2014; Malmberg 2015; Malmberg 2021; Malmberg, 2023.

land, and will inevitably contain simplifications, misunderstandings, and errors. Instead of presenting new empirical knowledge, my contribution will be to apply theoretical concepts that might facilitate our interpretations of the mass of evidence at our disposal to better understand long-term change.

The city of Rome, being the cradle and centre of the empire, and also located at the centre of the Mediterranean world, could be viewed as a pre-eminent example of Roman urbanism. But it could equally be viewed as a strange and unique case. However, I argue that Rome is relevant in a study of urban resilience because it:

- offers an early parallel to modern cities in its size, form and challenges
- is among the best-documented cities of the ancient world
- has extreme levels of both vulnerability and sustainability

The focus of this contribution is on urban size, both demographic and spatial, and how size was managed through infrastructural, administrative, and legal means. Demographic studies of Rome have their well-known problems when it comes to specific numbers, although scholars agree that we can observe both a significant increase and decrease of the population in ancient Rome and its hinterland at specific periods in time. These demographic fluctuations in turn had repercussions on the size of the inhabited area, though perhaps not immediately. They might also have had a major impact on the relationship between city and hinterland. The study is not concerned with absolute numbers of inhabitants, which avoids the extensive debate about how to translate shifting amounts of state-supplied food rations, or the vexing numbers of domestic housing listed in the regionary catalogues, into meaningful demographic statistics. Instead, I will look at large-scale, relative demographic trends and their effects on the levels of vulnerability and sustainability of the city.

For the purposes of this study, I understand the concept of resilience applied to socio-ecological systems as the capacity to adapt to changing circumstances in order to maintain its structure and functions. The concept is useful in how it facilitates our understanding of adaptations in human behaviour in relation to environmental and societal stress. The adaptive cycle model, based on resilience theory, can then be applied to interpret the variety and velocity of change. The cycle identifies four stages: growth, conservation, release, and reorganisation.<sup>3</sup> The adaptive cycle allows scholars to move away from debates on continuity versus change. We can instead begin to investigate different adaptive strategies, some of which led to sustainable cities.

The concept of vulnerability has been common in the field of geography since the 1990s, with urban vulnerability, and especially the vulnerability of megacities, receiving increased attention.<sup>4</sup> But there is a lack of common understanding of the concept. In my study, the concept will be related to geographical circumstances that might create a high risk for urban disaster or systemic breakdown, and the ability of Roman society to cope with such challenges.<sup>5</sup> The concepts of vulnerability and resilience should not be viewed as opposites, but as related concepts which fuse social and ecological models. Vulnerability can be defined as the degree

<sup>3</sup> Holling, Gunderson 2002; Fath *et al.* 2015; Bradtmöller *et al.* 2017.

<sup>4</sup> Jones, Kandel 1992, 68-70.

<sup>5</sup> Weichselgartner 2001, 87-89; Romero-Lankao *et al.* 2016, 5-6.

to which a system may react adversely to a hazardous event, with the degree and quality of the reaction partly conditioned by the system. Resilience, on the other hand, is the system's capacity to absorb and recover from the hazardous event.<sup>6</sup>

Urban sustainability, although a much-contested idea with many different interpretations, is here understood as urban development in a manner that can be sustained in the long run. One extreme view of sustainability, the development paradigm, assumes economic growth to be primary for humans, while technology can compensate for the overexploitation and deterioration of the environment. The deep ecological paradigm, the other extreme, views the environment itself as the primary resource, which has to be protected to provide sustainability.<sup>7</sup> This study will more closely adhere to the latter rather than the former view. In Roman society, with its limited technological resources and relative slow pace of innovation, the risk of unmitigated overexploitation of the environment posed a considerable threat.

### *Ecology at Rome*

Rome is situated in an advantageous natural location. The volcanic soils around the city are among the most fertile in the whole Mediterranean area. They are also well-watered by plenty of runoff from the surrounding mountains, which is distributed mainly through the Tiber and its many tributaries. The gently undulating plains, especially to the east of the city, facilitate agriculture, and also make transport across the countryside fairly easy. To the north and south, the Tiber and many of its adjoining rivers are navigable and provide excellent opportunities for convenient transport of large quantities of goods. These natural characteristics bestow the city with a large potential for growth, both through its high natural sustainability, and a relatively low level of vulnerability.<sup>8</sup>

However, there are also some major drawbacks with the location. The uneven distribution of annual rainfall causes winter and spring flooding, sometimes with devastating results. This also means that the Tiber and other rivers, although potentially navigable all year, are often dangerous to use for several months in winter and spring. River transport from the Mediterranean also suffer from an almost complete lack of natural harbours along the coast, and a river mouth that is hard to navigate due to sandbanks. The flooded river plain also forms a breeding ground for malaria-carrying mosquitoes and other diseases. Moreover, although volcanic activity has ceased, the area still experienced devastating earthquakes in antiquity. These factors introduce a degree of natural vulnerability, although most of them were predictable by following an annual pattern.<sup>9</sup>

Ecological developments in the millennium under investigation had a major impact on urban sustainability. The late Republican period might have seen the beginning of state-organized clearing of woodland for agricultural use. Ancient authors describe the removal of much of the Cimina forest in the middle of the third century BCE, which can be seen as symptomatic of these large-scale projects. The ancient texts are, at least partly, confirmed by pollen analysis, which shows traces of extensive deforestation around Rome in the late Re-

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<sup>6</sup> Timmerman 1981, 3, 21.

<sup>7</sup> Anderies *et al.* 2013; Redman 2014; Sellberg *et al.* 2015; Romero-Lankao *et al.* 2016, 4.

<sup>8</sup> Carandini 2009; Capanna, Carafa 2009; Del Monte *et al.* 2016; Claridge 2018.

<sup>9</sup> Malmberg 2015; Malmberg 2021, with further references.

public, and samples from the coastal lagoons seem to confirm a marked increase in the level of cultivation. Pliny noted that beech had grown in the Tiber valley in the fourth century BCE, but in his own day it was considered exclusively a mountain species.<sup>10</sup> The early Empire saw an even higher over-exploitation of the landscape. Forests probably did not exist close to Rome by this period, so timber had to be moved from further inland, mainly using the Tiber. There was a large use of wood construction, but the main demand was probably in connection with heating of private homes, public baths, lime, and pottery kilns, and not least the booming brick and tile industry.<sup>11</sup>

The intense exploitation of the landscape in the late Republican and early imperial periods probably led to increased soil erosion and deposition. The tributaries to the Tiber began to meander less, and there are signs that the rapid flowing water cut into the valleys. At the Tiber mouth, there was an increased erosion of the banks, and in the accumulation of sediment deposits. The city of Rome also experienced a higher number of devastating floods in the early Empire, although this might also be due to the increased urbanisation of flood-prone areas such as the Campus Martius. A whole new type of infrastructure had to be constructed to manage these detrimental effects on agriculture and settlements, consisting of drainage ditches, dams, and earthworks, as well as building underground tunnels to divert flash streams.<sup>12</sup>

The chain of events that led from deforestation to soil erosion, to flooding, probably also led to an increased prevalence of stagnant water that provided breeding grounds for malaria-carrying mosquitoes. It has long been taken for granted that Rome experienced endemic malaria throughout antiquity, but the only conclusive cases are from the early Empire onwards. Its appearance could be due to the deteriorating ecological conditions around Rome at this time. You can develop an immunity against the disease if you are infected during childhood, but when adult people from malaria-free areas migrated to Rome, it seems that the disease increased in mortality. To sustain its high population numbers Rome always had to rely on extensive immigration, but in the imperial period, with endemic malaria-driven mortality, probably even more so. If immigration dried up, as it did in the fifth century CE, the city could witness a dramatic fall in population, exacerbated by an ecological stress that further increased the prevalence of the disease.<sup>13</sup>

In late antiquity, there are clear signs of a transition in the hinterland of Rome from intensive agriculture to a pastoral economy focused on sheep and goats, with probable detrimental effects on vegetation and increased erosion.<sup>14</sup> The depopulated, malaria-ridden, pastoral landscape that surrounded Rome in the early modern period can be seen as the end product of this regional ecological breakdown, until modern medicine, artificial fertilisers and mechanised agriculture brought back the *campagna* as the main supplier of fresh foodstuffs for Rome in the course of the twentieth century.

<sup>10</sup> Plin. *HN* 16.15; Morselli 1980, 14–15; Marccone 1997, 278; Di Rita *et al.* 2010; Rajala 2016, 43.

<sup>11</sup> Veal 2017; Witcher 2020, 183, 187–188, 192.

<sup>12</sup> Brown, Ellis 1995; Aldrete 2007; Rendell *et al.* 2007; Witcher 2020, 165.

<sup>13</sup> Scheidel 1994; Soren, Soren 1999; Purcell 1999; Sallares 2002, 201–234; Gowland, Garnsey 2010; Killgrove, Montgomery 2016. Galen (7.135, 7.465) writes in the late second century CE that Rome was the best place to observe malaria.

<sup>14</sup> Patterson 2020, 249–250.

## *Growth*

Growth is the first stage of the adaptive cycle model often used in resilience theory, characterised as a period of high availability of resources and of high resilience. This is a stage that in my view dominated developments in the city of Rome from the end of the fourth century BCE, and in its hinterland from the late second century BCE, until the end of the Augustan period.

From the late fourth century BCE, Rome politically controlled the whole surrounding region, which could be exploited to feed the city's needs and allow its growth. After securing naval supremacy in the Mediterranean in the Punic wars, the wider economic hinterland of Rome was extended overseas with food imports from Sardinia and Sicily. With more lands coming under Roman rule, this economic hinterland could be extended to eventually include all regions around the Mediterranean, culminating in Augustus' conquest of Egypt and control over the Alexandrian grain fleet.<sup>15</sup>

Rome becoming the sole dominating urban centre of the region opened up new opportunities for the city, but arguably had detrimental effects on parts of the surrounding hinterland. The period 250-150 BCE seems to show a drastic reduction in the number of settlements north of Rome, in the Tiber Valley. This is paralleled in this area by a similar decline in pottery finds, and the rapid reduction of black-gloss pottery, which probably indicates population decline and a general impoverishment. Simultaneously, there was probably also a process of contraction, or almost complete abandonment, of several of the towns of the northern part of the hinterland. The region was one of the primary recruiting grounds of the Roman army, which fought unusually long and costly wars in this period. The death or impoverishment of farmers through war probably led to the collapse of many smallholdings, which also had to compete on an agricultural market that by now included large overseas imports. When combined with an extensive emigration from the hinterland to new colonies in northern and southern Italy, and not least to Rome itself, it might have had a catastrophic impact on the northern hinterland demographic and economy.<sup>16</sup>

However, this trend should not be overstated since other parts of the hinterland of Rome show a smoother demographic trajectory. Moreover, the downward trend in the Tiber Valley was turned around in the late second century BCE, and the last century of the Republic might have seen a general dramatic increase in settlements, both villas and smallholdings. This resettlement has been seen as due to the Gracchan land reforms, but also as an effect of the large-scale settlement of veteran colonies around Rome during and following the civil wars at the end of the Republic.<sup>17</sup>

Returning to Rome itself, the incorporation of overseas resources into the economic hinterland of Rome increased the demographic sustainability level of the city and led to a fast growth in population in the last two centuries of the Republic. But it also increased the vulnerability of the city's essential food supply, which now had to be transported long distances across the dangerous waters of the Mediterranean, notorious for its winter storms and easily

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<sup>15</sup> Garnsey 1988, 182-188; Morley 1996, 59-62; Horden, Purcell 2000, 115-122; Malmberg 2015.

<sup>16</sup> Liverani 1984, 42-46; Coarelli 1988, 34; Clemente 1990, 88-90; Lo Cascio 1999a; De Ligt 2007; Di Giuseppe 2020, 108-112.

<sup>17</sup> De Ligt 2004; Di Giuseppe 2020, 112-116; Witcher 2020, 177; Attema *et al.* 2022.

cut off in times of war or by pirate attack. The lack of natural sea harbours near Rome also meant that most provisions had to be shipped to ports primarily in Campania to be loaded either on smaller coastal vessels for the final leg along the coast and up the Tiber or transported overland to Rome. Both these solutions were probably unsatisfactory and inefficient.<sup>18</sup>

This increased vulnerability might have been a major factor behind the urban subsistence crisis at the end of the Republic and led to increasingly frantic initiatives by the Roman authorities to secure the urban food supply. It might have been the main cause for the resettlement scheme of the urban hinterland in the last century of the Republic. The situation was eventually solved through a combination of state-controlled distribution of grain, tax-breaks, and other incentives to encourage increased amounts of private shipments, and a formidable expansion of transport infrastructure, thus artificially increasing the sustainable population size. The state *annona* was only a part of the total necessary provisions for Rome, but it might have covered the basic subsistence needs for an estimated 40% of the urban population. By the early imperial period grain shipment, storage and distribution were controlled by a permanent state bureaucracy headed by the *praefectus annonae*, with offices in Rome and other major port cities such as Ostia, Puteoli and Alexandria. By this time, grain shippers had formed into private associations who often entered into long-term state contracts with the aim of securing the grain supply, with similar arrangements also for the city's millers and bakers.<sup>19</sup>

An even more impressive achievement was the expansion of the physical infrastructure to feed the city. This began already during the middle Republican period with construction of a new road network, especially the roads connecting the city with the Campanian ports and administered by government road curators. Aqueducts, also directly under state administration, not only supplied Rome with good-quality household water, but also with water-powered industries, such as the large-scale milling of grain. Most important, however, were the large harbour projects, first in Rome, Ostia and Puteoli, and later the great artificial harbours at Portus, Centumcellae and Terracina, together with hundreds of specialized river barges to carry goods up the Tiber, under the supervision of a college of river curators. Physical structures had also to be provided in Rome and the seaports for the storage of supplies, which led to the construction of huge *horrea*, and distribution centres such as the Porticus Aemilia and Porticus Minucia in Rome, which came under the offices of the *annona*.<sup>20</sup>

### Conservation

The second stage of the adaptive cycle model is that of conservation, dominated by increased formalisation and control. The level of resilience declines as the system becomes rigid and specialised and is more resistant to adaptations if confronted by internal or external change. I would argue that this stage was dominant in both the city of Rome and its hinterland from the first to the middle of the third century CE.

<sup>18</sup> Garnsey 1988, 193-208; Virlouvet 1995; Adams 2012, 225-227; Beresford 2013, 14-39; Erdkamp 2013, 267-269; Malmberg 2015.

<sup>19</sup> Rickman 1980, 52-53; Garnsey 1988, 193-208; Virlouvet 1995; Erdkamp 2013, 264-266; Malmberg 2015; Erdkamp 2016; Malmberg 2021.

<sup>20</sup> Keay 2012; Malmberg 2015; Malmberg 2021, with further references.

After the upheavals in the final century of the Republic, and the reforms of the Augustan age, it can be argued that what characterised Rome and its hinterland in the following 250 years was continuity. The innovations in supply and transport infrastructure at the beginning of the imperial era were maintained, and continued to expand along similar lines, to accommodate an increasing population. The large increase in hinterland settlements that began in the last century of the Republic seems to have continued unabated until the late second century, after which a small reduction can be observed. Existing late Republican hinterland sites continued to be occupied until the middle of the third century, again demonstrating high levels of continuity.<sup>21</sup>

Rome in the early imperial period probably had around a million inhabitants, which was probably at least twice the size of any other city in the empire. It is an impressive achievement by the Roman state to be able to sustain a city of this size with the administrative, economic, and technological resources available to them, which by modern standards were very limited. Roman society was thus sufficiently resilient during the growth phase to be able to increase sustainability levels at Rome to avert a subsistence catastrophe. The price to pay, however, was an increase in urban vulnerability. With the empire's resources and innovative skills stretched to the limit, the city continued to attract new immigrants. Predictable risks such as flooding, earthquakes, disease, or inclement winter seas, all now risked decreasing sustainable population levels, with even small variations triggering bouts of famine and subsequent civil unrest.

Why did the Roman state accept this vulnerability? Politically and symbolically, the city was essential as the cradle of empire, and a source of imperial legitimacy. Rome functioned as a striking backdrop for imperial ritual and commemoration, which necessitated a certain demographic and architectural size to be impressive. The state, however, lacked the means to control immigration into the city, with no legal restrictions or physical controls. In times of famine, foreigners could be temporarily expelled from Rome, although it is unclear how that was administered or enforced.<sup>22</sup>

Economically, Rome can be seen as a sinkhole for the state with a tax-exempt population craving free grain, lavish entertainment, and expensive facilities. Perhaps the emperors could cut back on the expenses, but this would be a huge political risk, with the plebs and, more importantly, the senatorial aristocracy up in arms. This, of course, did not stop the emperors from trying, as Augustus did when he restricted access to the grain dole, in the process transforming it from a right of the urban plebs to a restricted privilege.<sup>23</sup>

So, the Roman state of the late Republic and early Empire was probably caught in a trap, with population in Rome spinning out of control, much like the booming megacities of today. The authorities could react to and try to mitigate the most negative effects of the boom. But by providing an artificial increase in the sustainable population level, they also facilitated a further increase in population. This demonstrates how resilience can be a good thing in the short term, but in this case creating insurmountable long-term adverse effects during the conservation phase. The vulnerable and volatile state of the city of Rome might have contributed,

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<sup>21</sup> Witcher 2020, 130, 202-203.

<sup>22</sup> Moatti 2000. Foreigners expelled e.g., by Augustus (Suet. *Aug.* 42.3) and in 384 (Amm.Marc. 14.6.19; Symm. *Ep.* 2.7).

<sup>23</sup> Erdkamp 2016; Wallace-Hadrill 2017, 61, 68.

combined with new frontier policies, to the emperors effectively abandoning the city from the mid-third century onwards, similar to how some governments today leave the heaving, uncontrollable megacity for a new, manageable capital city.

### *Extended Urban Landscape*

The conservation phase in Rome, between Augustus and Aurelian, also saw an unprecedented level of integration between the city and its regional hinterland in the imperial period. As will be demonstrated, this makes the distinction between city and hinterland during this period partly irrelevant. The hinterland around Rome saw a dramatic increase of the number of settlements in the first and second century CE, with villas probably increasing by around 50% and farms doubling in number. This is a stark contrast to most other regions of Italy in this period, which had a static or decreased number of settlements. The increase was most remarkable along the Tiber and in the coastal areas, whereas some inland areas, such as northern Etruria, experienced a decline.<sup>24</sup>

Colonist allotments, together with the Gracchan reforms, might have helped break up the dominance of the great estates that were established in Rome's hinterland in 250-150 BCE. But that does not preclude that many of these smallholdings were later bought up and let out to tenants. With the high price on land many smallholders might have been tempted to sell their land to aristocratic landowners and move to the city to pursue social advancement. The lucrative possibilities of the urban market may have in turn tempted many immigrant tenant farmers to take over the running of the smallholdings. The tenants were probably more integrated into the urban market and had to produce a surplus to cover their rent. Stable overseas imports of bulk goods allowed local producers to instead specialize in fresh foodstuffs, such as fruit, vegetables, and dairy products for the urban market.<sup>25</sup>

The hinterland towns, that had seen a rapid decline in the Republican period, were now recipients of new patronage, both aristocratic and imperial. The towns were decked out with the appropriate monumental civic buildings. But they were often diminutive in area and population. Forum Novum in the Tiber Valley is often used as an example of the strange combination of a monumental centre, equipped with a forum, basilica, temple, amphitheatre, aqueduct, baths, and aqueduct, but with a settlement of only a few hundred people within a town centre that covered barely four hectares. Even though classed as *municipia* or *coloniae* by the Roman state, the urban status of towns like Forum Novum have been questioned by modern scholars.<sup>26</sup> Of course, this depends on how you choose to define urban: based either on population density or on function.<sup>27</sup> The hinterland towns, although small in demographic terms, obviously fulfilled important political, administrative, and economic roles that the surrounding countryside did not. Moreover, the towns were surrounded by a densely inhabited countryside with articulated urban taste in high-quality pottery, architecture, and luxury items.<sup>28</sup> Perhaps we should not only view the settlement nucleus around the town forum as

<sup>24</sup> De Haas, Tol, Attema 2011; Witcher 2020, 134, 170-172.

<sup>25</sup> Morley 1996, 59; Patterson 2006, 63; Witcher 2006; Garnsey, Woolf 1989; *contra* Potter 1979, 134.

<sup>26</sup> Marazzi 2001, 726-727; Gaffney *et al.* 2004, 247.

<sup>27</sup> Smith 2010, 138; Witcher 2020, 123; Emmerson 2020, 5-9, 47-50.

<sup>28</sup> Patterson 2006; Wallace-Hadrill 2008; Keay, Millett 2016; Witcher 2020, 138-139. See also Hohenberg, Hollen Lees 1996.



urban, but rather apply a low-density urban perspective on these hinterland towns that also include the surrounding, rather densely inhabited, so-called ‘countryside’.<sup>29</sup>

This perspective could indeed be applied to the relationship between the city of Rome and its immediate hinterland as a whole in the imperial period. Part of the argument is that settlements around Rome increased dramatically in number at the end of the Republic and in the first two centuries of the Empire, with migrants drawn to Rome and its surrounding region by imperial and aristocratic patronage, but also the opportunities offered by seasonal work, such as in the harbours, or the expanding industrial manufacture in the fields of bricks, pottery, textiles, and construction. The population density of the hinterland within a radius of 50 km from the city has recently been estimated to between 60 and 38 persons per square kilometre, a density unmatched around Rome until the twentieth century.<sup>30</sup> Of course, this density was unevenly distributed; areas close to the city, along the Tiber, and in the open landscape to the east of the city, probably had a higher population density than the more rugged western hinterland. Larger parts of the landscape might have been urbanised than hitherto imagined, e.g., a recent study of mine showed a dense harbour landscape along the Tiber for 18 km between Pons Milvius in the north and Magliana in the south.<sup>31</sup>

In addition to the increase in population density of the region, by the early Empire Rome had arguably a historically low food dependency on its hinterland due to the amount of overseas imports. It has been suggested that the relationship between city and its surrounding area in this period shifted from primarily economic integration to a mainly social and cultural one, from a focus on food production to that of competitive consumption. The proximity to the imperial court and the senatorial aristocracy could be seen as main drivers in the hinterland of urban tastes and activities, with the same preferences regarding monumental residences, entertainment and tombs, and the same privileged access to imported commodities such as ceramic fine-ware, window glass, glass vessels and marble.<sup>32</sup>

This unparalleled cultural and social integration between city and hinterland has drawn the attention of several scholars. Purcell called the phenomenon ‘a great dispersed city of which Rome is only the nucleus’, whereas Morley postulated that ‘Greater Rome’ might have included an ‘urban core and a less densely settled penumbra, stretching 5 km or so from the city’. Most recently, Witcher concluded that there was an ‘effective transformation of the suburbium into an extension of the city’, which formed an ‘extended metropolis’.<sup>33</sup> While recognising that the area around Rome had become urbanised, scholars have hitherto refrained from actually seeing them as part of the city itself, differentiating between the Roman nucleus or core, and the greater urban area.

I believe we should, at least in the period from Augustus to Aurelian, view this phenomenon as *one* city of different densities, an extended urban landscape, where it was hard to know ‘up to what point it is still the city and where it ceases to be the city; so closely is the city connected with the country, giving the beholder the impression of a city stretching out

<sup>29</sup> Fletcher 1995; Fletcher 2009.

<sup>30</sup> Witcher 2005; Malmberg, Bjur 2009; Dyson 2010, 327; Malmberg, Bjur 2011; Witcher 2011; De Ligt 2012; Malmberg 2015; Witcher 2017; Witcher 2020, 172, 195.

<sup>31</sup> Malmberg 2021, with references to previous research.

<sup>32</sup> Bodel 1997; Witcher 2020, 172, 192-194, 199.

<sup>33</sup> Purcell 1987, 36; Morley 1996, 38; Witcher 2005, 128; Witcher 2020, 119, 207. See also Quilici 1974; Patterson 2004; Erdkamp 2005; Witcher 2013.

indefinitely', as Dionysius of Halicarnassus put it in the time of Augustus. That it was hard for the Romans to define the urban limits is also shown by legal texts in the imperial period, where 'to be in Rome' is often defined as being in the area of 'adjoining buildings', or within a mile of these buildings, thereby introducing a flexible definition that could adapt to a swiftly expanding city.<sup>34</sup>

### *Release*

We now reach the third stage in the adaptive cycle model. The release phase is characterised by a combination of internal or external challenges, and a low level of resilience, that leads to a crisis in the system. This results in part of the system breaking down, and a subsequent re-ordering of functions and networks. In the case of Rome and its hinterland, I argue that this also entails a change both in state structure and in scale in the period between the middle of the third and the middle of the sixth century CE.

With the third-century empire-wide crisis came an increased reliance on the army for imperial legitimacy, prolonged civil war, and increased external threats. These can be seen as being among the most prominent factors why the city of Rome lost its hitherto pre-eminent political position in the empire, and why the emperors finally abandoned the city. By leaving the city, the emperors might have partly removed a major incentive for people to move to Rome, which was to curry favour with the imperial court or at imperial projects in the city, although Rome continued to be a centre for the imperial aristocracy and their patronage. Ironically, the departure of the emperors could then have partly solved the demographic problem. However, Rome still performed an important symbolic and political role, which also led to a brief return of imperial residence at Rome in last decades of the western Empire in the fifth century. The emperor had to be seen to protect the city, which was marked visibly through the erection of a new city wall in the 270s, and, more demographically important, by extending the *annona* to include pork and oil, as well as a subsidy on wine. Because the Roman state continued to support the artificially high sustainability level, the population size might in the third and fourth century have not been that much reduced, even with the emperors leaving the city.<sup>35</sup>

Imperial patronage of the hinterland towns was kept up for most of the third century, with major restoration and construction campaigns until the time of Aurelian. Bishoprics were established in most of the towns in the fourth century, and the Church and the urban aristocracy seem to have assumed responsibility for any subsequent construction.<sup>36</sup> There was also a major imperial investment in road maintenance, especially in the period 284-364, as attested by milestones. Although the landowning elite had abandoned the villas, the remaining hinterland population still had access to fine African tableware and other imported goods until the

<sup>34</sup> Dion.Hal. *Ant.Rom.* 4.13.4-5; *Dig.* 3.3.6; 50.16.139 and 147; *Tabula Heracleensis* 20; Augusta-Boularot 1998, 51-53; Goodman 2007, 14-16; Emmerson 2020, 10-12, 33-38. I am most grateful to Prof. Roland Fletcher for giving me new insights into low-density urban settlements, and his suggestion to call the urbanized area around Rome an extended urban landscape.

<sup>35</sup> Tengström 1974, 82-88; Rickman 1980, 197; Viriouvét 1995, 51-59; Panella 1999; Lo Cascio 1999b; Papi 2000, 224-225; Panella, Sagui 2001, 763; Papi 2004, 67-68; Vera 2005; Dey 2011, 185-187; Erdkamp 2013, 266-267; Malmberg 2015; McEvoy 2017; Purcell 2019.

<sup>36</sup> Papi 2000, 174-177, 224; Papi 2004, 60-67; Fiocchi Nicolai 2007, 112-113, 117.

middle of the fifth century, and small coin denominations continued in circulation until the mid-sixth century, evidence of a continued market economy.<sup>37</sup>

The hinterland of Rome seems to have witnessed a gradually diminishing number of farms from the beginning of the third century, which were replaced by large agricultural estates through the fourth and fifth century. The number of settlements around Rome was probably reduced by half in the years 250-450. Monumental residences and tombs disappear from most of the hinterland. What had in the early Empire been elite villa residences, turned into pure farming estates, arguably tailored to maximise produce to supply Rome with its new pork, oil and wine dole. Aurelian and later emperors actively encouraged wine cultivation around Rome through the establishment of imperial estates and tax incentives.<sup>38</sup> In the fourth century, city and hinterland probably drifted apart also in their dietary habits; Rome continued to consume pork, while sheep and goat became the preferred meat of the countryside. Pollen evidence around Rome also show less cereal cultivation at this time, which might indicate more land being used for pasture. By the sixth century, it seems that the city had also shifted to a sheep and goat diet, setting the stage for the pastoral economy around Rome that came to dominate the landscape until the early twentieth century, with a negative effect on the ecological situation.<sup>39</sup>

These developments demonstrate that the dispersed city of Rome, and its associated close cultural and social integration between urban core and extended metropolis, had probably changed by the early fourth century. It can be argued that the pendulum had decisively swung back towards a division between an urban nucleus and an intensively farmed hinterland, now also separated by a new city wall.

In the 420s and 430s, it seems that sustainability levels at Rome finally collapsed, primarily with the loss of North Africa and its essential food supplies to the Vandals, but also the loss of imperial and aristocratic control over most lands in western Europe. The western part of the empire had a general dramatic loss of revenue at this time and could thus not keep up the expensive and complex infrastructure and administration that had carried Rome demographically up to this point. This most probably led to a rapid and catastrophic 90% decline in population in a century, which was then exacerbated by the prolonged warfare in Italy beginning in 535, that would see Roman, Gothic and Lombard attacks on the city, as well as repeated bouts of plague and famine.<sup>40</sup>

In the period 450-550, finds indicate an accelerating reduction of settlement numbers around Rome, affecting both smallholdings and larger estates. Most surviving settlements were either close to Rome or along the main roads and rivers. The hinterland towns were in many cases abandoned in the 6th century. In addition, there were few signs that the road and river infrastructure was maintained after the 420s. New farming settlements were founded close to Rome in the second half of the fifth century, which has been seen as an attempt to alleviate the loss of African grain. Also in the hinterland, pottery finds of all kinds decline swiftly in number in the fifth century, with a massive decrease of African ceramic imports

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<sup>37</sup> Laurence 1999; Papi 2004, 68; Rovelli 2009, 48-50; Patterson 2020, 242.

<sup>38</sup> Sennis 1996, 35; Papi 2000, 174-177; Marazzi 2001, 733-734; Pergola *et al.* 2003; Papi 2004, 5; De Sena 2005; Patterson 2020, 214, 218-219.

<sup>39</sup> King 1997, 398; Patterson 2020, 249-250. See also Arthur 2002, 116.

<sup>40</sup> Durliat 1990, 99-107; Delogu 1993; Purcell 1999; Lo Cascio 1999b; Panella, Saguì 2001; Santangeli Valenzani 2004; Malmberg 2015; Lo Cascio 2018.

from the middle of the century, opposite to the situation in Rome. From this time there is also a clear divergence between pottery forms found in the city and the hinterland, again demonstrating the increasing separation between the two.<sup>41</sup>

### *Reorganisation*

Reorganisation is the final phase of the adaptive cycle model. After the release of the system in the previous phase, a high level of resilience is again gained that allows the system to adapt to changing circumstances. Alternatively, if the system is not resilient, it can collapse and cease to exist or be replaced by something completely different. At Rome, I would argue that the loss of empire dramatically displayed the extreme vulnerability of the city. But the city did not disappear, and by the late sixth century the population might have stabilised around perhaps 50-100,000 inhabitants, a size that still made it the largest city in the Latin world until the 11th century. This relatively high population level was maintained without any significant financial or infrastructural support from the imperial authorities.<sup>42</sup> However, the city was still the seat of a powerful aristocracy and a bishop with large landholdings in Sicily and the eastern Mediterranean which could sustain a large population through overseas imports. The increased prestige of the papacy through the medieval period might have provided further economic stimuli to the city. Rome thus had a continued religious, political, and military significance that potentially attracted immigrants.

Another important reason for the continued large population was arguably the high sustainability level of the site. The urban site had its natural bountiful local resources, although suffering from overexploitation. In the late antique and medieval periods Rome also enjoyed the legacy of its imperial infrastructure in the form of harbours, roads, aqueducts, and fortifications that were kept up to some degree by papal initiative. These circumstances formed the basis for a new round of the adaptive cycle, that could be seen to begin with a new growth phase in the late eighth century.

Despite fluctuating fortunes through the medieval and early modern period, Rome had a surprisingly stable population size until the reunification and industrialisation of Italy in the second half of the 19th century. This might indicate that a population of 100,000 was the natural maximum sustainable size of the city, helped by limited investments in infrastructure and administration. It also might show us the low vulnerability of this population level in comparison with what might be called the demographic anomaly of the late Republic and early Empire.<sup>43</sup>

### *Conclusion*

By applying the concepts of vulnerability and sustainability, together with the adaptive cycle model from resilience theory, this contribution has aimed to explain changes in the size of the city of Rome, the relationship between the city and its hinterland, and how ancient society adapted to allow Rome to continue its existence as a major city despite several challenges and

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<sup>41</sup> Delogu 1993, 13; Laurence 1999; Panella, Saguì 2001, 770; Bousquet *et al.* 2008; Patterson 2020, 221-224, 238, 249.

<sup>42</sup> Patterson 2020, 213.

<sup>43</sup> Moreland 2008, 862.

crises during the millennium under study. Although this study has been focused on a single city and its hinterland, I hope that it might also work as a model for how the adaptive cycle can be applied to better understand urban development in the long term at other cities of the ancient world.

The first phase of the adaptive cycle, that of growth, from the late fourth century BCE in the city, and the late second century BCE in the hinterland, until the end of the Augustan period, saw adaptive solutions to the urban supply crisis. It can be argued to have been a period with a high level of resilience, assisted by access to plentiful resources drawn from the whole empire.

The second phase, conservation, it is suggested can be observed between the early first and the middle of the third century CE. It arguably showed unparalleled links between city and hinterland, which formed into one coherent extended urban landscape with varying levels of population density. It seems that increased levels of control and formalisation in state organisation led to rigidity and less resilience, which might have been worsened by increased ecological stress due to overexploitation of natural resources.

The third phase, release, probably happened from the middle of the third until the middle of the sixth century. The system seems to have begun to break down during the third-century crisis. Social and cultural links between the city and hinterland were probably weakened, which marked the end of the extended urban landscape. It can, however, also be argued that there was an increased economic interdependence between city and hinterland. The system came crashing down when it could not adapt to the break-up of the empire and prolonged warfare in the fifth and sixth century. Urban population numbers probably fell off a cliff, with predictable consequences for a hinterland completely dependent on the city for marketing its foodstuffs.

The last phase, that of reorganisation, is suggested to have taken place from the middle of the sixth century until the late eighth century. This phase saw an increased separation between city and hinterland. The intensively farmed hinterland of early late antiquity seems to have been mostly replaced by a pastoral landscape with few long-distance connections. The city, on the other hand, was still part of a Mediterranean-wide trade network, although much diminished in scale. Despite ecological and economic disaster, continued overseas imports and the highly advantageous location, combined with the legacy of imperial infrastructure, allowed Rome to enter the medieval period still the largest city of the Latin world.

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