

03:37 - AMATRICE STILL EXISTS

Disaster recovery design for the post-quake landscape of Amatrice



Merel Cozijnsen
Msc Thesis Landscape Architecture
October 2019
Wageningen University

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COLOPHON

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PREFACE

Before you lies my Master's thesis '03:37 – Amatrice still exists. Disaster recovery design for the post-quake landscape of Amatrice'. I have written this thesis as part of my Master Landscape Architecture and Planning. More than three years ago a severe earthquake struck Central Italy at 03:36 A.M. After this nightmare several earthquakes followed and discussions arose about what actions were needed. During this period, I was on exchange in Milan at the Polytechnic University, where the issue often determined the subject of debate.

My fascination for the incredibly complex situation was born and I was motivated by the relevance of my profession. Thanks to Prof. Giuseppe Amoruso, I was invited to the 'INTBAU' summer school 'Cultural Landscape and Heritage Skills' in Borgo Lizori (Umbria), which provided me of an introduction of the topic of Italian cultural heritage. I want to thank Giuseppe for his assistance and, together with Polina Mironenko, for our nice trip to Amatrice. Furthermore, I want to thank my supervisors Gabriëlle Bartelse and Kevin Raaphorst, and Marlies Brinkhuijsen for their feedback and enthusiasm. Finally, I want to thank my parents and friends for their continuous support.

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ABSTRACT

On August 24th 2016 a powerful earthquake struck Central Italy by surprise during the middle of the night at 03:36, causing around 300 victims and devastating entire towns in the regions Marche, Umbria, Abruzzo and Lazio. The municipality of Amatrice, containing one of Italy's most beautiful towns, has become the symbol of the earthquake. Here, the earthquake had the biggest impact by taking the life of 234 people and devastating most of its towns. Today, more than three years after the earthquake, the area still resembles a war zone. The current focus is on rebuilding what was there: a process that will take a long time and makes that the current temporary state risks of becoming permanent. An integrated spatial strategy for the future of Amatrice is not envisioned. A hands-on 'Disaster Landscape Recovery' (DLR) framework including general design principles could give input to the recovery process in post-quake landscapes such as Amatrice.

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1. INTRODUCTION

INTRODUCTION

CONTEXTUALIZATION

On August 24th 2016 a powerful earthquake with a 6,2 magnitude and depth of only ten kilometers, struck Central Italy by surprise during the middle of the night at 3:36 AM exactly. After that event, several heavy earthquakes followed in October that year and January 2017. Now, more than three years after the devastating earthquake of August that killed around 300 people, most of the area where the perceived shaking was strong, located in the regions Marche, Umbria, Abruzzo and Lazio (figure 1), still resembles a war zone (Fiorentino et al., 2018).

Within the regions that are affected by the earthquakes, the three municipalities of Amatrice, Accumoli and Arquata del Tronto have been hit hardest (figure 2). Of these, Amatrice has become the symbol of the earthquake. Here, the earthquake had the biggest impact by taking the life of 234 people, of the 300 in total, and devastating eighty percent of the towns (Fiorentino et al., 2018). Besides, the historic center of the town of Amatrice dates back to Medieval times and is appreciated because of its historic value, which is confirmed by its certificate as one of the most beautiful Italian towns (in Italian 'I Borghi più Belli d'Italia'). Amatrice has received this certificate

not only because it is a valuable Medieval town, but also because its valuable natural landscape and rich local culture, confirmed by its title as 'Town of Taste' (in Italian 'Il Borgo del Gusto') ('Amatrice,' 2017). The municipality consists of 69 hamlets, or so-called 'frazioni', and the main town Amatrice itself and counted around 2600 permanent inhabitants. The earthquake hit the area during summer time, when many second homeowners and tourists visit the place and the amount of people in the area can be six times as many. Generations of second homeowners used to live in Amatrice, but have left the area behind mainly for job opportunities elsewhere. This trend of shrinkage is present for decades and explains the many signs of degradation, of which vacancy of buildings is one (Giovanni, 2016).

MOTIVE

After the earthquake temporary pre-fabricated buildings have tried to meet the basic needs of the great amount of homeless inhabitants. On the scale of the entire affected area, emergency housing solutions, so-called 'SAE' (in Italian 'Soluzioni Abitative in Emergenza'), were installed, as shown by figure 2. The municipality of Amatrice comprises most of these 'SAE' areas, including more than

five hundred 'SAE' cabins (Civile Protezione, 2018). People have lived already for more than three years in these "temporary" cabins and loose more and more hope while time passes. The earthquake and successive reaction have transformed the landscape into a landscape of 'islands'. These islands, of e.g. temporary cabins, commercial centers and temporary essential facilities, are spread over the territory and developed independently from each other.

Rebuilding of the historic centers and all what was there before the earthquake is prioritized but not concretized. No overarching and integrated spatial strategy is envisioned, which makes that the process of rebuilding will take a long time. Several indicators make that the current "temporary" risks of becoming permanent. Based on experience of the major earthquake in the region of d'Abruzzo of 2009, filling the gap between emergency and permanent rebuilding of historic centers is necessary (Amoruso, 2018). Current problems of temporariness, namely the livability at risk and the fragmented landscape of 'islands', should be approached.

In literature disaster recovery is often seen as one of the phases in the post-hazard period (Ayres, 2011). A significant amount of literature is dedicated to specific 'types' of disaster recovery such as social recovery, which comprises issues as community participation and restoration of social ties. However, these intangible recovery approaches make it hard to determine what overall approach of disaster recovery is most effective and successful and how that approach should be implemented spatially.

In order to concretize the necessary approach, the spatial aspect of disaster recovery should be investigated. In literature the bigger scale is mainly approached by the field of spatial planning, which often discusses several 'settlement rebuilding models' in order to determine where to rebuild and where not. Relocation, often chosen because of time and/or safety, is compared with rebuilding 'in situ' where people hold strong ties with their origin (Iuchi, 2014). Regarding the design aspect of recovery, mainly engineers and architects are involved, who are mostly concerned with temporary living solutions for the emergency phase and with buildings constructions and

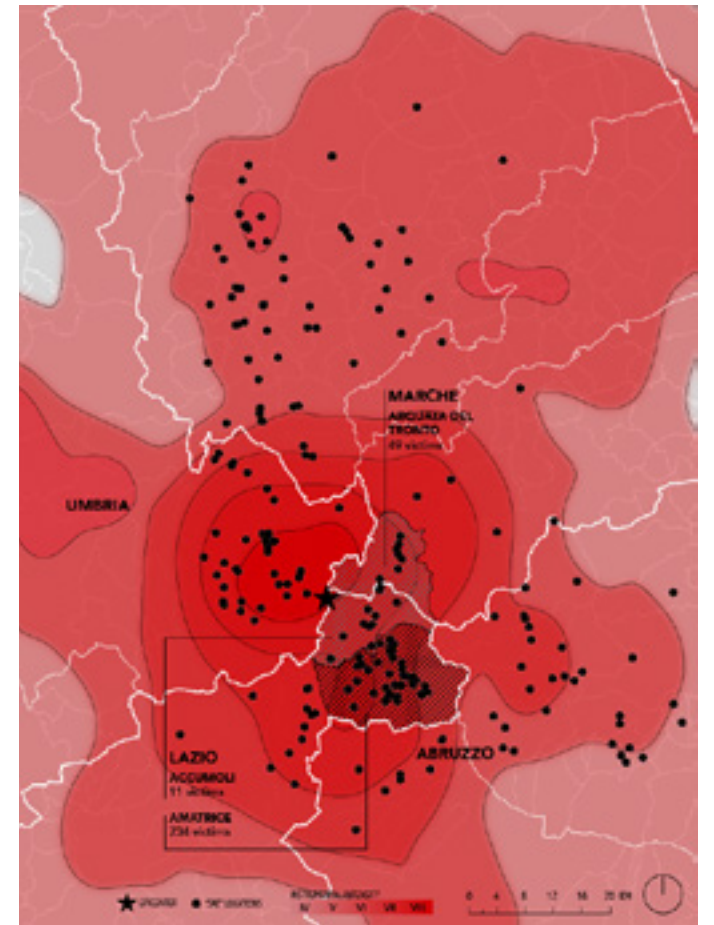


Figure 2 - Hardest hit municipalities and 'SAE' locations in the earthquake region (data retrieved from Civile Protezione, 2018)

technologies in case of rebuilding. Literature discussing the design aspect of disaster recovery in a more broad sense is often a review of specific cases or in contrast, is too general that it is not able to support other disaster recovery approaches one-to-one.

In order to develop a spatial, overarching recovery plan, the physical landscape should be approached as an 'integrated whole', as landscape architects do, including open space in between buildings and the natural landscape. Until now the open space is not seen as crucial in the recovery process and knowledge of designing open space for recovery and resistance to seismic risks is limited (Allan & Bryant, 2011; Jayakody et al., 2016). In literature (Pizzo et al., 2013) and (Allen et al., 2016) are one of the few who do address the topic, but research to the role of public open space in disaster recovery is of great need because it is still at an early stage (Allan & Bryant, 2010). Although the profession of landscape architecture does address the topic of disaster protection, this often concerns hazards such as flooding and drought. The experience of designing for post-quake landscapes is limited (French, 2017).

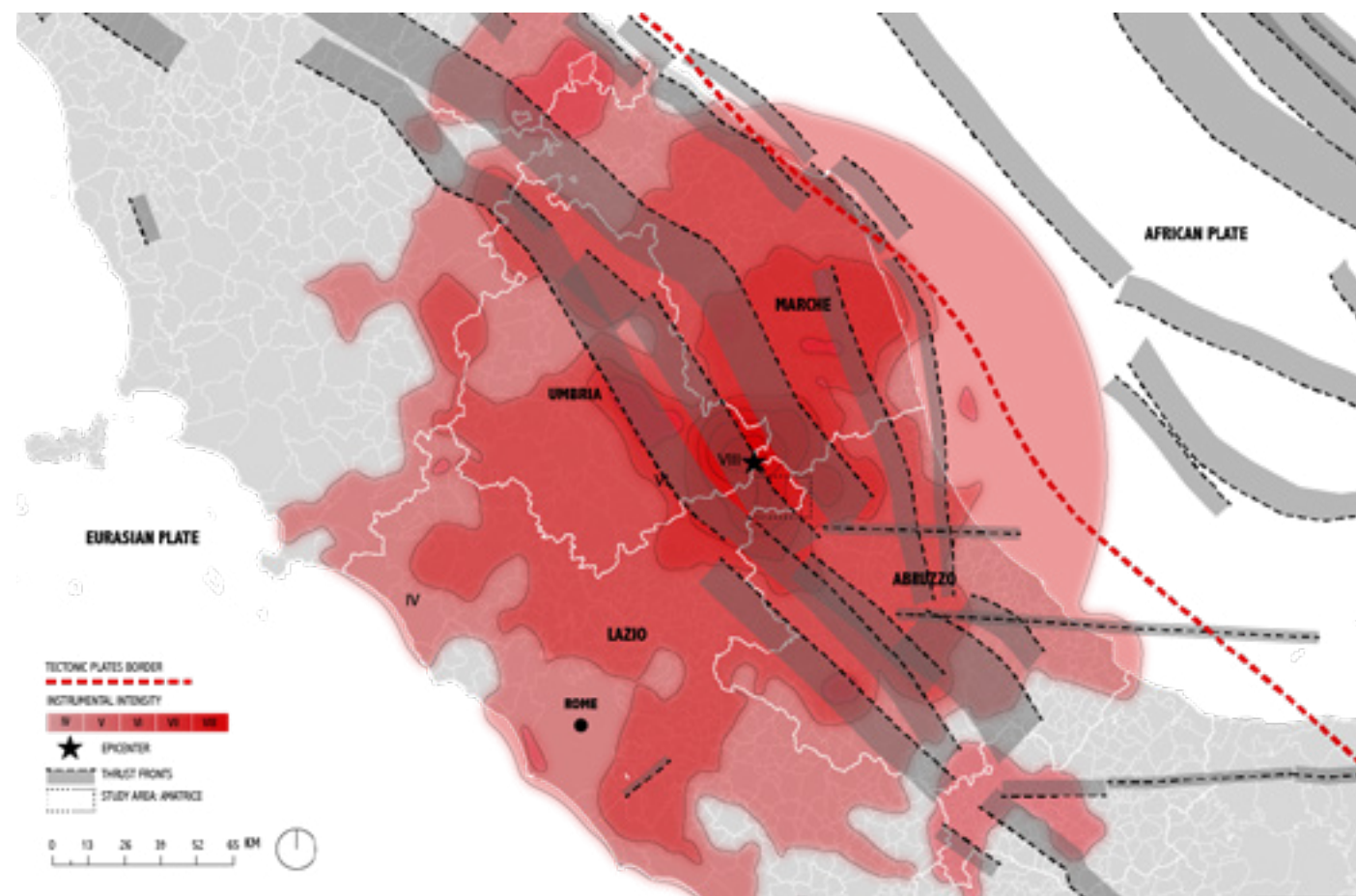


Figure 1 - Area hit by the earthquake of the 24th of August 2016 (data retrieved from USGS, 2016)

Besides dis-integration at spatial level, hazards are often treated with a special focus, as if they stand on their own. Not only the hazard itself should be analyzed, but also daily life in general. The profession of landscape architecture combines knowledge of many disciplines and can be valuable for the comprehensive process of disaster recovery because of its holistic character. Linking the natural open landscape with the built environment and with the activities that take place is necessary in order to make an integrated design. The expertise of landscape architecture can approach the recovery in a more strategic way, approaching ongoing trends, providing solutions for current problems and anticipating on the long-term future. Before the earthquake the area already became more and more vulnerable due to ongoing demographic decline and economic stagnation (Giovanni, 2016). Approaches such as the concept of ‘smart decline’ could help anticipate to this vulnerability. This pre-quake history makes the current vulnerability even higher and worsens the future perspective. The earthquake should be used as eye-opener to approach the pre-quake vulnerabilities that have worsened by the earthquake.

KNOWLEDGE GAP

In short, the current focus is on rebuilding what was there: a process that will take a long time and makes that the current temporary state risks of becoming permanent. Current problems of temporariness, namely the livability at risk and the fragmented landscape of ‘islands’, should be approached. An integrated spatial strategy for the future of Amatrice is not envisioned. In literature a hands-on framework with general design principles that could give input to the recovery process in post-quake landscapes is missing. This framework should be based on a transition from fast emergency interventions in the initial response phase to more complex and time-consuming interventions, which prepare for the possible next hazard, in the later phases of reduction and readiness.

THESIS STATEMENT

The environmental problem of Amatrice will be approached by investigating: (1) a ‘disaster recovery design strategy’ that organizes quality for the remaining residents and (2) a ‘disaster recovery design’ that creates quality by the use of the public open space.

OBJECTIVE

The objective of this thesis is to inform and direct the recovery process of the post-quake landscape of Amatrice and by this to develop a ‘Disaster Landscape Recovery’ (DLR) framework that could give input to the recovery process of similar post-quake landscapes.

RESEARCH QUESTIONS

The objective will be supported by the following research questions (also shown by figure 3):

Main question- Research through design

What ‘Disaster Landscape Recovery’ (DLR) framework is needed to help recover post-quake landscapes such as Amatrice?

The DLR framework exists of general strategic design principles at the ‘bigger’ scale and general design principles for the public open space at the ‘smaller’ scale.

SQ1 – Research

How did the landscape of Amatrice develop until the hazard and what has been the impact of the earthquake?

SQ2 – Research

How can the concept of ‘smart decline’ inform the municipal strategy that needs to tackle current ‘problems of temporariness’ and anticipate to future earthquakes?

SQ3 – Research

What places of the public open space of the town of Amatrice can be identified that are used in both the context of everyday life and of a hazard?

SQ4 – Design

How can the post-quake landscape of Amatrice recover from its disaster by using its public open space on local scale that incorporates a municipal ‘smart decline’ strategy?

KEY CONCEPTS

In order to answer the aforementioned questions, the following key concepts will be used. The concept of ‘disaster recovery’ implies a ‘recovery’ of the ‘disaster landscape’. Regarding the latter, the hazard, here the earthquake, is seen as the ‘triggering event’ (Joakim, 2011) or ‘interruption’ (Clemente & Salvati, 2017). An interaction

between the hazard and (pre-hazard) vulnerabilities causes the impact of the disaster. The ‘landscape’ is perceived here as the product of interaction between the natural and the cultural (Antrop, 2005). Because the vulnerability, and thus the disaster, is significantly higher when people and their activities are involved, the ‘disaster landscape’ concept can be seen as an interaction between the natural and the human environment. Finally, the process of ‘recovering’ this ‘disaster landscape’ is seen as a trade-off between speed and deliberation, so between acting fast and building back better (Kim & Olshansky, 2014).

Because the ‘disaster recovery’ contains both speed and deliberation, the following concepts of ‘smart decline’ and ‘slow movement’ are introduced. The first concept focuses on speed and efficiency and creates more compact communities to maintain quality of life. The latter key concept is introduced to ensure that the design (strategy) is in line with the culture and identity of the place and uses local qualities to build back better.

RELEVANCE

SOCIETAL RELEVANCE

As shown by figure 4, in some years earthquakes cause more than 200.000 deaths. However, what strikes about the data represented, is that numbers do not decrease through time, although technology improves. Earthquakes have a transformative impact, creating a disaster landscape that represents a social fracture (Clemente & Salvati, 2017) and psychological devastation (Bowring, 2012) and accelerates existing trends (Moatty & Vinet, 2016). The enormous amount of disruptive consequences makes the post-hazard period a time of making complex decisions. Because the phenomena in need for deliberation are of high relevance for the development of the area, attention for disaster recovery is of crucial importance for a sustainable future of the landscape.

SCIENTIFIC RELEVANCE

Scientific research could support landscapes in their process of disaster recovery, so that landscapes could recover faster and more sustainable. Because disaster recovery can be seen as a “time compression” (Kim &

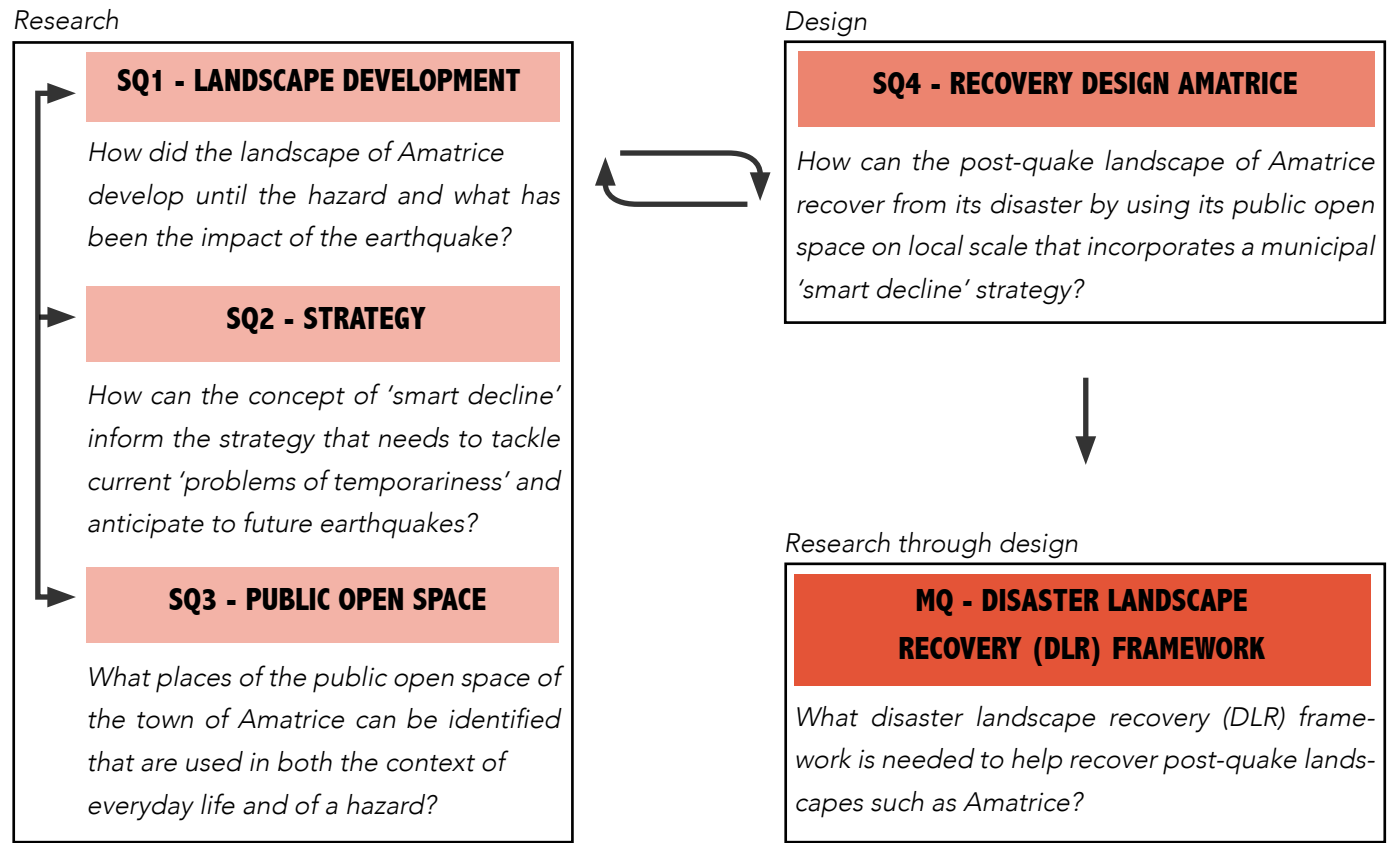


Figure 3 - Relations between research questions

Olshansky, 2014), it is important that scientific literature provides a hands-on supportive framework that stimulates successful recovery. Currently such a framework is lacking, which makes the scientific relevance and need for research on this topic of great importance.

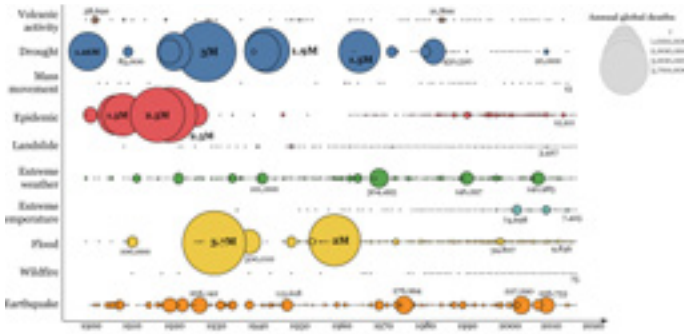


Figure 4 - Global deaths from natural disasters, by type (1900-2016) (EMDAT, 2017)

STRUCTURE OF THESIS

This thesis consists of thirteen chapters, briefly listed below.

The first chapter is the introduction of the thesis and discusses the context, motive, knowledge gap and thesis statement. The theoretical framework will be discussed in the second chapter. Here, the concepts of ‘disaster landscape’, ‘disaster recovery’, ‘smart decline’ and ‘slow movement’ will be explained in detail. The methodological framework of chapter three links the concepts of the theoretical framework to the research questions and to the methods that are used during the entire process.

Chapters four until ten together shape the total analysis. The fourth chapter discusses the territorial context by an analysis of the physical landscape. Chapter five explains how Amatrice developed until the earthquake. It portrays the main developments and events in the history of the area. Chapter six discusses the situation of Amatrice just before the earthquake, and what has been the impact of the earthquake. This is done in a physical, social and economical way. The seventh chapter contains an analysis of the current municipal strategy, of the ‘National Strategy for Inner Areas’ and a multi-criteria livability assessment. Chapter eight zooms in to the town of Amatrice and discusses the public open space of the town. Finally, chapter nine puts the earthquake in context by analyzing three references: Venzona, Nocera Umbra and L’Aquila.

Chapters ten until thirteen include the design, of which the tenth chapter explains design principles. Chapter eleven

discusses the design at the scale of the municipality, while chapter twelve does this at the scale of the town of Amatrice.

Finally, chapter thirteen contains an evaluation, divided in a discussion, conclusion and recommendations.

2. THEORETICAL FRAMEWORK

THEORETICAL FRAMEWORK

In literature the topic of disasters is discussed by many disciplines, simply because disasters have a great set of consequences. Originally, the practice of disaster management deals with the disaster process, although it is officially acknowledged as discipline for a short time only. The management process is divided in the following four stages: reduction and readiness before the disaster event and response and recovery after the disaster event, as shown by figure 5 (Ayres, 2011). Figure 6 explains the relations between the different concepts discussed after this.

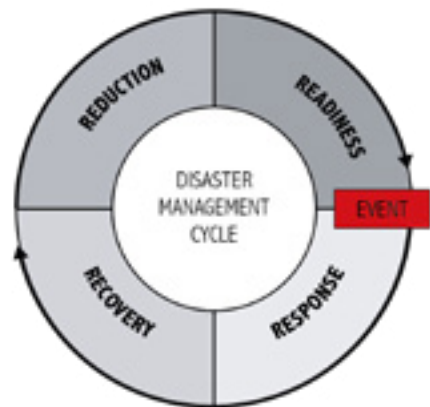


Figure 5 - Stages of the disaster management cycle (Ayres, 2011)

THE DISASTER LANDSCAPE

As already discussed in the introduction, the hazard, here the earthquake, is seen as the 'triggering event' (Joakim, 2011) or 'interruption' (Clemente & Salvati, 2017). An interaction between the hazard and (pre-hazard) vulnerabilities causes the impact of the disaster. The disaster has more impact when people are involved, so the disaster concept also implies an interaction between the natural and the human environment. This is related with the definition of the cultural landscape. Antrop (2005) states the landscape evolves during time because of an interaction between the natural and the cultural. The cultural landscape is the product of successive "reorganizations of the land in order to adapt its use and spatial structure better to changing societal demands" (Antrop, 2005, p.22). Based on the aforementioned, the 'disaster landscape' can be seen as an interaction between the 'vulnerable basis' and the 'hazard', and between the natural and the human environment.

DISASTER RECOVERY

As discussed in the introduction, the period of disaster recovery is often explained in the discipline of disaster management by terms of 'vulnerability reduction', 'increasing capacities' and 'building back better' (Joakim, 2011).

RESILIENCE

Speaking in terms of space, more precisely the public open space, in literature the concept of disaster recovery is often approached by the concept of resilience. Allan & Bryant (2011) uses the resilience attributes as a framework to link urban structure, recovery and resilience, and has three concluding remarks regarding successful recovery. The first conclusion is the need for spatial and functional diversity, both in quantity and quality. So, open spaces should be distributed equally, covering the quantity, and the sizes should vary to meet different needs and thus the necessary quality. Secondly, the terms modularity and connectivity are mentioned to indicate that every 'module' should be "safe to fail" and well connected to other modules. Finally, variability should ensure that redundant spaces are able to absorb a variety of functions (Allan & Bryant, 2011). According to Jayakody et al. (2016) after an earthquake, the open spaces become the 'second city' where people have to rely on. The open spaces should (1) allow different kind of functions and activities, (2) mitigate the hazard risk and/or impact, (3) be well connected to other open spaces, and finally (4) contribute to the everyday use.

However, if these resilience 'attributes' would be taken as guidebook for disaster recovery, then what is the difference between 'good' urban design and disaster recovery?

SPEED VS. DELIBERATION

As (Allan & Bryant, 2011, p.34) discuss "good urban design and best practice earthquake planning are often contradictory." This because disaster recovery is a trade-off between speed and deliberation, so between acting fast and building back better (Kim & Olshansky, 2014).

Fast interventions that aim to solve problems quickly tend to result in total randomness (Cucinella, 2018) and 'non-places' (Bauman, 2000). People find it hard bonding with these places because no "expressions of identity, relations and history" (Bauman, 2000, p.102) are represented. These 'simplified' places take much of the public space and transform sites into generalized worlds. Many Italian towns and cities have been rebuilt according to the so-called 'new town model'. Whether this was to create an "ideal" new environment as in the case of the region of Calabria in the eighteenth century, or to create a new

identity by the involvement of famous artists in the Sicilian town of Gibellina in the 1960s or just because of time reasons such as in the city of L'Aquila after the earthquake of 2009 (Clemente & Salvati, 2017): new towns are build as if the landscape is a black slate.

On the other hand, a devastating hazard could also cause a moment of reflection after which another direction could be taken with the aim of 'building back better'. Deliberation ensures a careful process of interventions, which aim to improve the situation of before the earthquake. The 'where it was, as it was' model is an example of post-quake deliberation and takes into account the local context by critically investigating characteristics that determine the identity and culture of the place. In the 1970s several towns in Northern Italy have been rebuild stone for stone. However, this is not enough to build back better, so amongst others more stable structures have been tested and applied. Because interventions are deliberated carefully, the recovery process lasts for a long period and people's patience and feeling of hope is tested (Clemente & Salvati, 2017).

IDEAL DISASTER RECOVERY?

Both the 'speed' scenario and the 'deliberation' scenario are hard to accept by the society of today, which has lost its feeling for time-space relationships. The current society lives in "a 'culture of immediacy' wherein the gap of time and space is not simply compressed but completely transcended" (Osbaldiston, 2013, p.2). Bauman (2000) calls this the time of 'Liquid Modernity' in which people go wherever they want to go in order to find what they are looking for, like better job opportunities, a bigger house or a more vibrant environment. With this in mind no ideal way to recover from a disaster seems possible because

feelings of alienation, abandonment and desperation are inevitable in both the cases of speed and deliberation, and could result in a massive out-migration of inhabitants, companies, investments and so on.

What can be concluded here is that the disaster recovery strategy should be fast and well deliberated at the same time, and thus should include factors of efficiency as well as factors concerning the identity and quality of the place. For this reason the following concepts of 'smart decline' and 'slow movement' are introduced. The first should ensure an efficient, hands-on approach, while the latter highlights the local qualities and aims at site-specific interventions. A literature review is done to the concept of 'smart decline' and related concepts, which can be found in Appendix A.

SMART DECLINE

Consequence of the current 'culture of immediacy' is that spatial differences are becoming bigger since more and more people concentrate in the urban environment. This uneven spatial development can lead to shrinking regions (Wirth et al., 2016). Shrinkage is a phenomenon characterized by a vicious cycle between demographic and economic processes (Gruber et al., 2015), which are strongly related and intensify each other (Wirth et al., 2016). The 'Decline, Ageing and Regional Transformation' project (DART, 2012) lists four demographic change indicators for shrinkage: (1) decline of total population, (2) ageing of population, (3) change of household structure and size and (4) change of spatial distribution due to migration. These demographic indicators are related with the economic stagnation of a shrinking area. Consequence of this trend is that the quality of life decreases, by for example the closing of facilities, increase of vacant buildings and lack

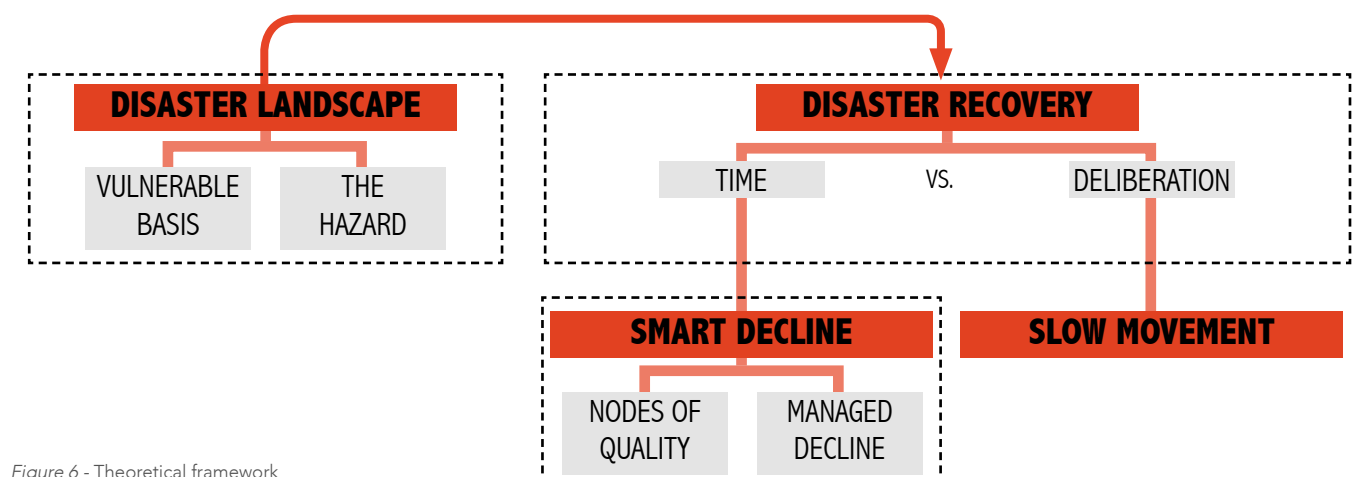


Figure 6 - Theoretical framework

of maintenance of infrastructure. Approaches to shrinkage are often based on a trend of spatial growth. These growth-oriented approaches do not acknowledge the shrinkage as reality, and try to tackle the 'problem' (Heins, 2012).

On the contrary, the rationale of 'smart decline' and similar concepts as 'smart shrinkage' and 'right-sizing' implies an adaptive approach to shrinkage, which acknowledges the presence of the phenomenon. A smart decline approach creates more compact communities, in order to "ensure that the best quality of life – including adequate service delivery – is possible for remaining residents" (Heins, 2012, p.2). The rightsizing strategy of Newman et al. (2018) approaches the problem of shrinkage by joining of forces. On one hand activities are relocated into node(s) and on the other hand, areas outside of these nodes are managed in decline to enable the rightsizing. The nodal development approach clusters activities in area(s) with development potential, to maintain livability for people who still live in the area. In contrast, regarding areas with less potential, ways are investigated to manage decline, by for example transforming vacant land into green. The spatial-territorial reorganization model (SRM) of rural settlement of (Mao et al., 2017) is comparable to the rightsizing strategy as it makes a distinction between consolidated towns and central settlements. Based on a questionnaire, which investigates relations between settlements, the network performance under attack is tested, by for example removing some of the nodes, and in this way the consolidated towns are identified. After this, based on four factors, these towns are relocated to "adjacent high-related central settlements to reduce the separation between villagers after consolidation." (Mao et al., 2017, p.2).

Areas that are prone to hazards already contain a certain amount of pre-hazard vulnerability. However, this level of vulnerability is even higher when a trend of shrinkage comes into play. Anticipating to these vulnerabilities in the disaster recovery is important in order to minimize the risk of the hazard. The concept of 'smart decline' focuses on the present quality and efficiently maintains and improves this by 'joining of forces'. The concept of 'smart decline' aims for a new balance in order to overcome the problem of spatial relations. However, uneven spatial development, of

concentration of people in mostly urbanized environments versus a shrinking population mostly in the countryside, is a dynamic and ongoing process.

SLOW MOVEMENT

The 'fast world' people live in today, of increasing technological dominance, unlimited supply of information and non-stop communication, has its dark side. As reaction to this fastness a 'slow movement' has grown, starting from organized movements such as Carlo Petrini's Slow Food, which aims for more meaning and authenticity in life (Radstrom, 2005). The Cittaslow movement for example, enhances its effort against the globalization that fades the sense of place. Although 'slow living' is possible at any place, some places are better able to provide or stimulate slowness than others. This is related with the extent these places are involved in the fast and globalized world (Parkins & Craig, 2006). The opportunities for a slow experience seem greater in remote and rural towns. This is the foundation of slow tourism, which implies an escape to the slow world where people go to for personal reflection, to 'live' instead of to 'stay' by integrating with the local culture, and to experience authenticity to its fullest (Rojek, 1993). However, is travelling to an authentic remote town far from the busy city then enough? The concept of the slow movement is more about offering opportunities to slow down and find more meaning, by for example the type of transportation, the type of possible activities and accommodations, or the presence of characteristic, local elements. However, these factors can only stimulate and enhance the experience, which starts at the individual. Concrete examples of these stimulating factors are slow lanes, roads separated from the fast traffic, slow food, food prepared traditionally and of local resources, and historic buildings.

To come back to the disaster recovery, besides efficiency, the strategy should be in line with the culture and identity of the place, and use qualities to build back better. As Carlo Petrini stated about Amatrice after the earthquake: "if we are headed towards a chasm, the multitude could reverse the course" (Rocchi, 2018).

3. METHODOLOGICAL FRAMEWORK

METHODOLOGICAL FRAMEWORK

OVERALL METHOD

The overall method of this thesis is ‘research through design’, which implies that research and design alternate and its relation is thus not linear. The design process could require more research input and the other way around, just as one specific research question could trigger the others to be investigated more in-depth. In general the outcome of the three specific research questions creates input for the specific design question. The outcomes of the specific research questions create parameters, which form the basis of the different design models. The design method itself is an iterative process, which switches between designing and testing, the basic principles of the ‘research through design’ method (Van den Brink et al., 2017), resulting in the design synthesis. The design synthesis will be generalized, discussed and evaluated in order to develop the ‘Disaster Landscape Recovery’ framework. The relations between the questions, theoretical concepts and methods are shown by figure 7.

Literature review

THEORY AND RESEARCH

The first specific research question (SRQ) comprises an analysis of the landscape of Amatrice from its origin back in the days, to the situation before the earthquake, until the current situation after the earthquake. This is done with a special focus on the physical, social and economical aspects. The second SRQ indicates that the needed strategy should adapt during time. Thus, setting priorities and crucial first steps is of great importance. Input regarding the maintained current and planned municipal strategy is necessary in order to anticipate well to this. Furthermore, already executed strategies in post-quake landscapes are input for this question. The third SRQ zooms in to the town of Amatrice and focuses on the use of the public open space. Data should be very detailed in order to portray an accurate image of the main activities in the town.

The concept of disaster recovery is overarching for all SRQs. The first SRQ discusses the disaster itself, by investigating the hazard, its consequences and the followed reaction, so the first steps of recovery. The second SRQ discusses the recovery strategy, so the method to approach the post-quake situation, and investigates and portrays the differences between speed and deliberation. The third SRQ shows the disaster at a detailed scale and focuses on the impact of interventions taken after the earthquake, whether these fall under speed or deliberation.

The concept of ‘smart decline’ mainly informs the second SRQ. Here, the concept aims at helping to set priorities because it focuses on the joining of forces in order to ensure quality of life for remaining residents (Heins, 2012; Newman et al., 2018). The first SRQ is also informed by the concept as it investigates (pre-quake) vulnerabilities, problems of temporariness and opportunities. These

are factors that later determine the level of quality of the towns and thus the priority level. The quality of life for remaining residents takes a central position in the third SRQ. At the human scale, of the public open space, is investigated what is the impact of the earthquake on the living environment by the help of facilities.

The slow movement concept mainly covers the third SRQ as it focuses on the everyday life experience. By centralizing facilities and people’s valuable places, a connected public open space network is mapped, which includes characteristic elements determining the authenticity of the place. In order to understand the identity or sense of place, the first SRQ comprises a study of the historical development of Amatrice, focusing e.g. on the agricultural system. Finally, to aim for a strategy that is in line with the local culture, current plans and other already executed Italian cases are studied.

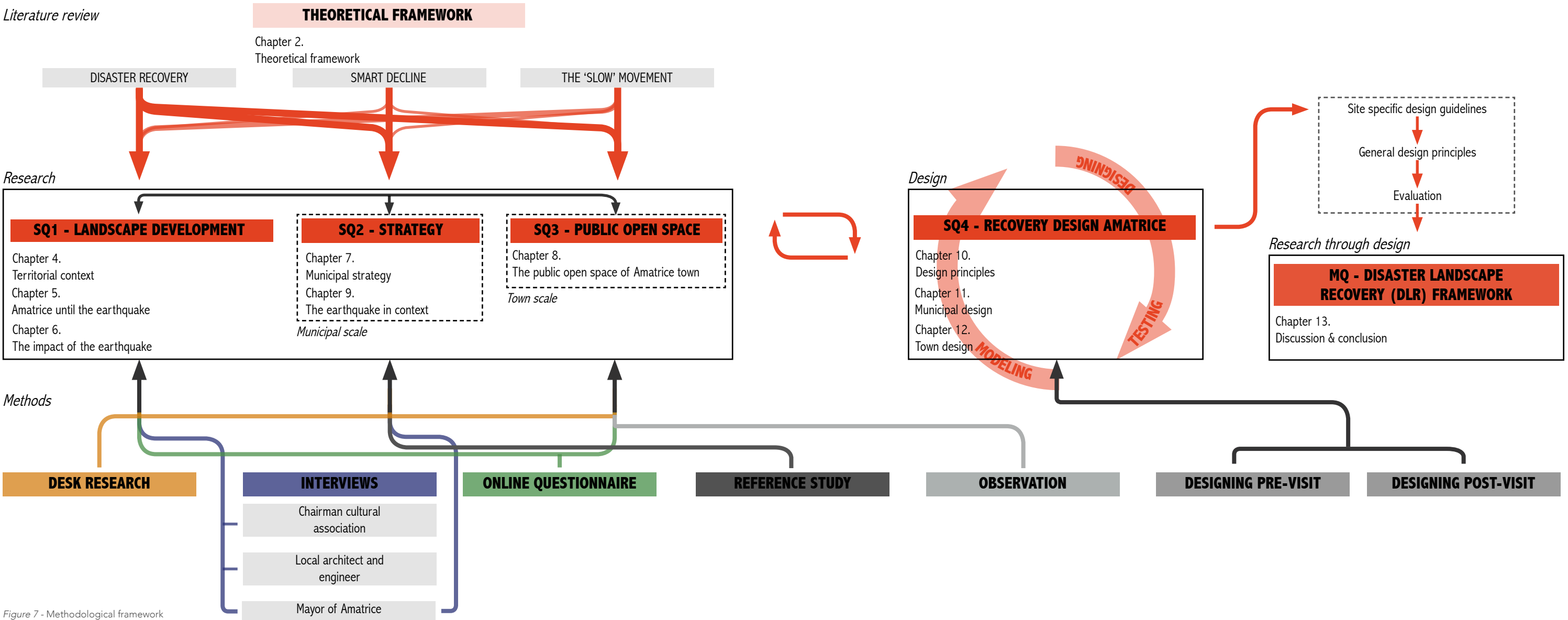


Figure 7 - Methodological framework

METHODS

Multiple methods are used in order to give answer to the main question. Below each method will be discussed. The timeline of figure 8 shows when the methods are used, and in some cases shows details about the content.

DESK RESEARCH

The method of desk research is used for all research questions and comprises multiple materials and/or sources. Secondary reports are used throughout the research part, covering topics such as geology, the local history and national policies regarding post-quake planning. For both SRQ one and SRQ three, historical maps have been conducted, and for all SRQs maps of the areas have been used. Necessary geo-datasets have mainly been requested at governmental institutions. Google Earth and Google Street view have been used for the first and third SRQs mainly to analyze pre-quake situations.

INTERVIEWS

Three interviews have been carried out, which inform the first two specific research questions. The ‘Associazione

Culturale Cola dell’Amatrice’ is a cultural association founded in 2003 that publishes journals about Amatrice its local culture, art and history in general. Mario Ciaralli is chairman of the association and is interviewed by a semi-structured in-depth interview. The interview has informed the historical development of Amatrice, as well as the impact of the earthquake, so the first SRQ (Appendix D).

Local engineer Alessio Serafini and architect Brunella Fratoddi have been interviewed by an unstructured interview because the meeting was not planned, and thus improvisation was needed. However, this type of interview made possible to ask very specific questions that responded to the research already carried out. Moreover, the interview was carried out next to the model of the town of Amatrice as it was in 1900, which supported the answers visually. Mainly the physical historical development of Amatrice has been discussed and in this way informed the first SRQ (Appendix E).

Antonio Fontanella is the mayor of Amatrice since May

this year and was interviewed by a semi-structured in-depth interview. He informed the first SRQ by discussing the maintained strategies of his predecessors and corresponding consequences. Besides, the second SRQ is informed by discussing the current and future difficulties, challenges, opportunities and planned strategy (Appendix C).

Both semi-structured in depth interviews comprised introductory questions, questions about the pre-quake situation, the impact of the earthquake and the future plans and/or ambitions (Appendix B).

QUESTIONNAIRE

In order to get insight in people’s perception regarding the situation before and after the earthquake and the maintained municipal strategy, an online questionnaire (Appendix G) is set up and distributed via Facebook groups containing Amatrician members. In order to reach as many people as possible, the questionnaire is in Italian (Appendix F) and consists of forty-five questions, of which only one open-ended question, four matrixes and forty

closed questions. The outcome (Appendix H) mainly informs the first SRQ because it addresses topics as living conditions and safety feeling. For a part the third SRQ is informed by the questionnaire because it shows people’s valuable places.

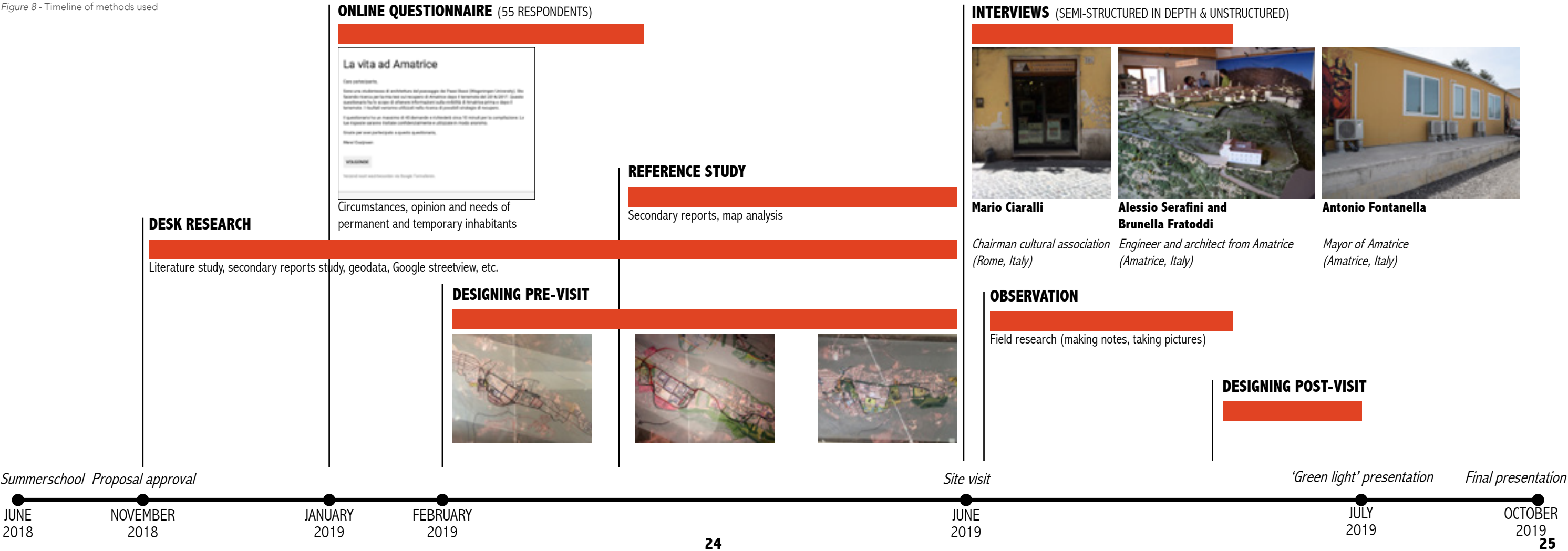
REFERENCE STUDY

A selection of Italian earthquakes and associated reconstruction processes of the period after World War II are investigated. The selection of cases has been done based on several criteria, which will be discussed in chapter 9. The reference study includes three cases and informs the second SRQ.

OBSERVATION

The method of observation is applied at the smaller scale of Amatrice town. Aspects as tree species, materialization and the latest developments and changes have been observed to inform the third SRQ.

Figure 8 - Timeline of methods used



4. TERRITORIAL CONTEXT

TERRITORIAL CONTEXT THE NATURAL LANDSCAPE OF AMATRICE GEOLOGY

The 'Laga Basin' is an intra-mountain depression of the Central Appennines and is located between the north-western Sibillini Domain and the Gran Sasso Domain in the south. The fold-and-thrust belt is created by an eastward movement of the mountains west of the basin, in combination with a west-downward movement of the basin itself, which goes underneath the so-called hanging wall. Thrust or reverse faults make that older grounds are pushed on top of the younger ones. The basin consists of a variety of sedimentary rock layers, so-called flyschoid successions (figure 9), which are typical for deep marine foreland basins on the edge of a growing mountain ridge. The older grounds of the mountains mainly consist of limestone and sand (Vignaroli et al., 2019).



Figure 9 - Geology of Central Apennines showing the main stratigraphic-structural domains (Vignaroli et al., 2019)

The 'Amatrice Basin' is located in the southwestern area of the bigger 'Laga Basin'. The western part consists mainly of reverse faults which cause that the basin migrates underneath the Sibillini Domain. The migration of the basin underneath the Sibillini Domain makes that the crust stretches and becomes thinner, causing west-dipping

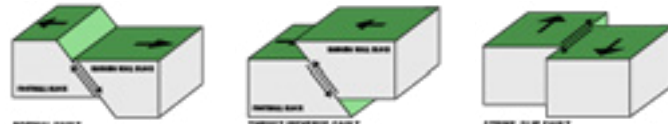


Figure 10 - The three main types of faults (Geologypage, 2017)

extensional fault systems. Figure 10 schematically explains the different types of faults systems (Vignaroli et al., 2019).

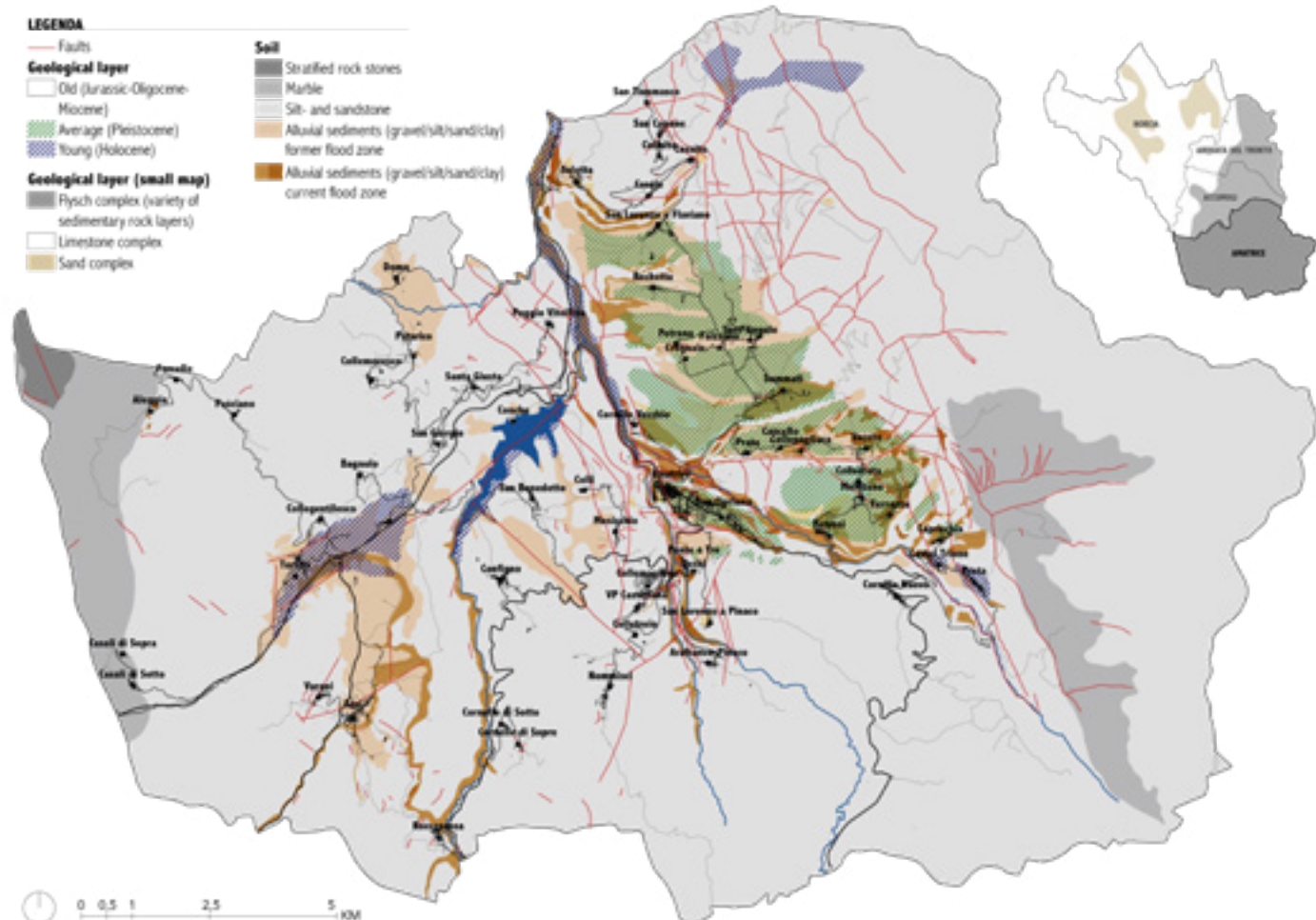


Figure 11 - The different stratigraphic-sedimentary systems of the 'Amatrice Basin' (data retrieved from Regione Lazio, 2017)

Although the main stratigraphic-structural domain of the 'Laga Basin' consists of 'flyschoid successions', on the smaller scale of the 'Amatrice Basin' different stratigraphic-sedimentary systems can be distinguished (figure 11). From bottom to top these are: the Miocene substratum, the Pleistocene continental deposits and the Quaternary continental deposits. The first system consists of different formations and varies from the deeper stratified rocks and marls to silt- and sandstone. Stratified rock stones are present in a very small part in the northwest, marble grounds can be found in the most western part and a part in the eastern mountains, while the biggest part of the municipality consists of silt- and sandstone. These grounds, without other layers on top of this system, are the oldest within the area since they are shaped in Jurassic, Oligocene, or Miocene times. In some parts of the municipality, mainly along streams, this system is covered with continental deposits that consist of alluvial sediments with a maximum of 60 meters thickness, depending on how active the stream is on specific locations. These grounds of the second system are in general shaped or deposited

in the Pleistocene and are thus of average age. Finally, the third system consists of the youngest grounds, which are clayey and shaped in the Holocene, vary from steep river flanks, to landslide and anthropogenic deposits and are distributed over the entire area (Vignaroli et al., 2019).

HEIGHT AND LAND-USE

The entire municipality is elevated with a minimum of 700 meters above sea level (figure 12). Amatrice town is located on a rocky foothill of the mountain, which is enclosed at the northeastern side by the Tronto River and at the southwestern side by the Castellano River. The main branch of the Tronto River flows northward and cuts deeper after passing Amatrice, creating steep flanks with height differences to 40 meters within a few meters. The Rio Scandarello River is fed by the Scandarello Lake, and joins the Tronto River northeast of the lake. The valley, where the Tronto river and its branches and the Scandarello lake are part of, is mainly enriched by mixed forests.

Within Amatrice, east of the Tronto River and surrounding Torrita and Bagnolo gentle slopes between 800 and 1000

meters enable dominant agricultural use. North and south of the lake, less gentle slopes result in a mix of forests with some agricultural activity. Besides, here the roads are curvier and less rational than on the gentle slopes. Except from the northern border where the rivers flow, all borders of the municipality are steep mountains reaching to 1500 meters.

In total, 69 small settlements are distributed within the municipality of around 175km². These settlements are mainly located between the 900 and 1100 meters. Amatrice had a total population of 2646 inhabitants in 2011, distributed over three types of inhabited places, as maintained by the ISTAT (National Institute of Statistics): the inhabited centre ('centro abitato'), the inhabited core ('nucleo abitato') and scattered houses ('case sparse'). To put things in perspective, the following numbers are compared with the average of all municipalities located in the 'crater', so municipalities affected by the earthquakes. In Amatrice 51% of the population lives in inhabited centers, compared to 79,3%. An inhabited center contains a succession of houses with in between squares and

streets, plus services and public buildings such as schools should be present to act as center. The most significant difference can be found regarding the inhabited cores. In Amatrice 45,5% of the population lives in cores, while the average of the 'crater' is 7,9%. This number explains the large number of settlements. An inhabited core has a group of neighboring houses, with intermediate vegetable gardens, small squares and/or streets, with at least five families. Finally, 3,4% lives in productive locations or scattered houses versus 12,7% average. The houses are scattered in a way that the place cannot be labeled as 'built area'. Both the core as the scattered houses depends on the inhabited center for facilities and other services (ISTAT, 2016).

The SS4 state highway from Rome to the Adriatic Sea enters the area in the west and turns north after passing Santa Giusta. Besides, provincial roads pass Scaia and head from the city of L'Aquila to Amatrice.

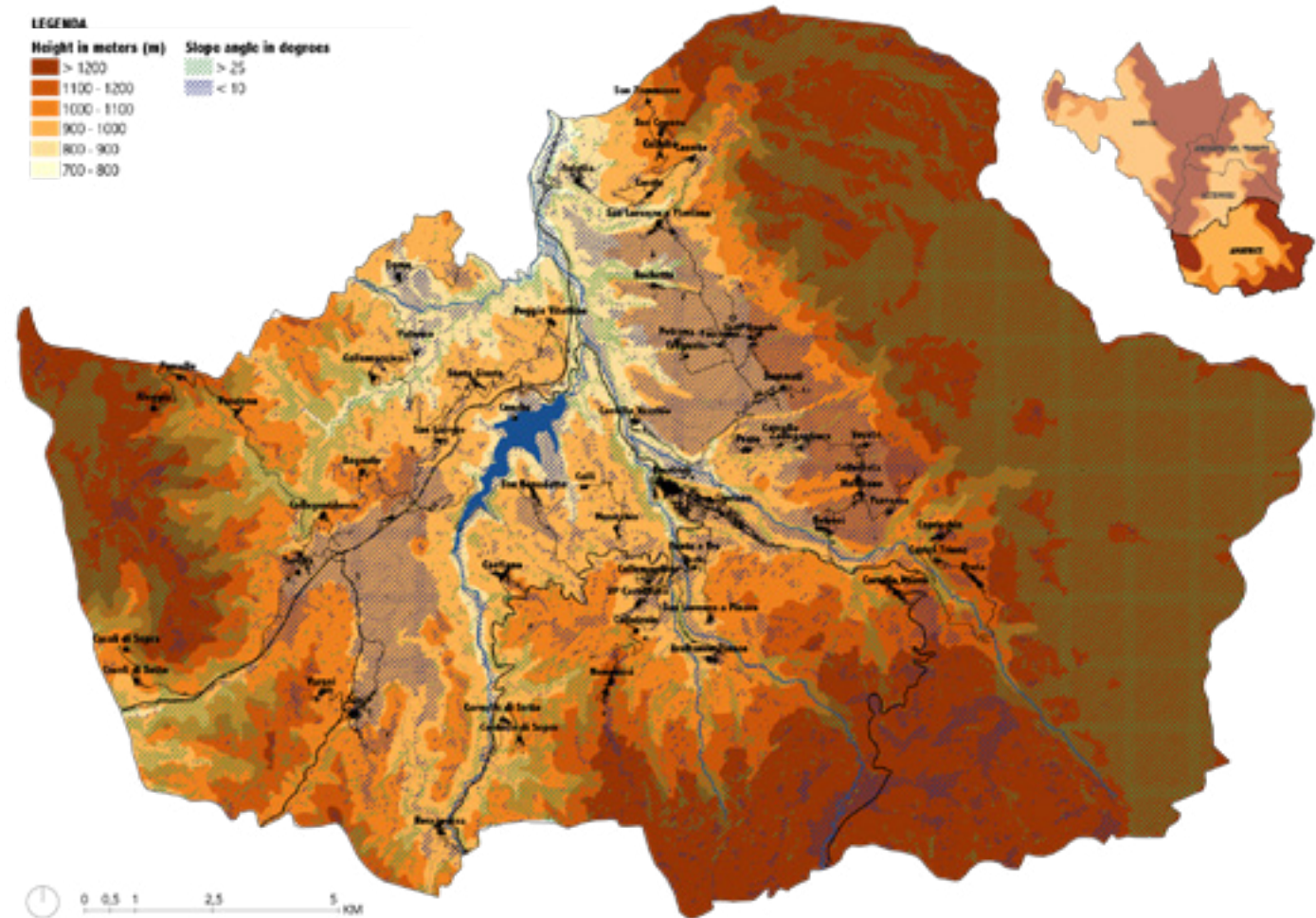


Figure 12 - Height and slopes of the 'Amatrice Basin' (data retrieved from Regione Lazio, 2017)

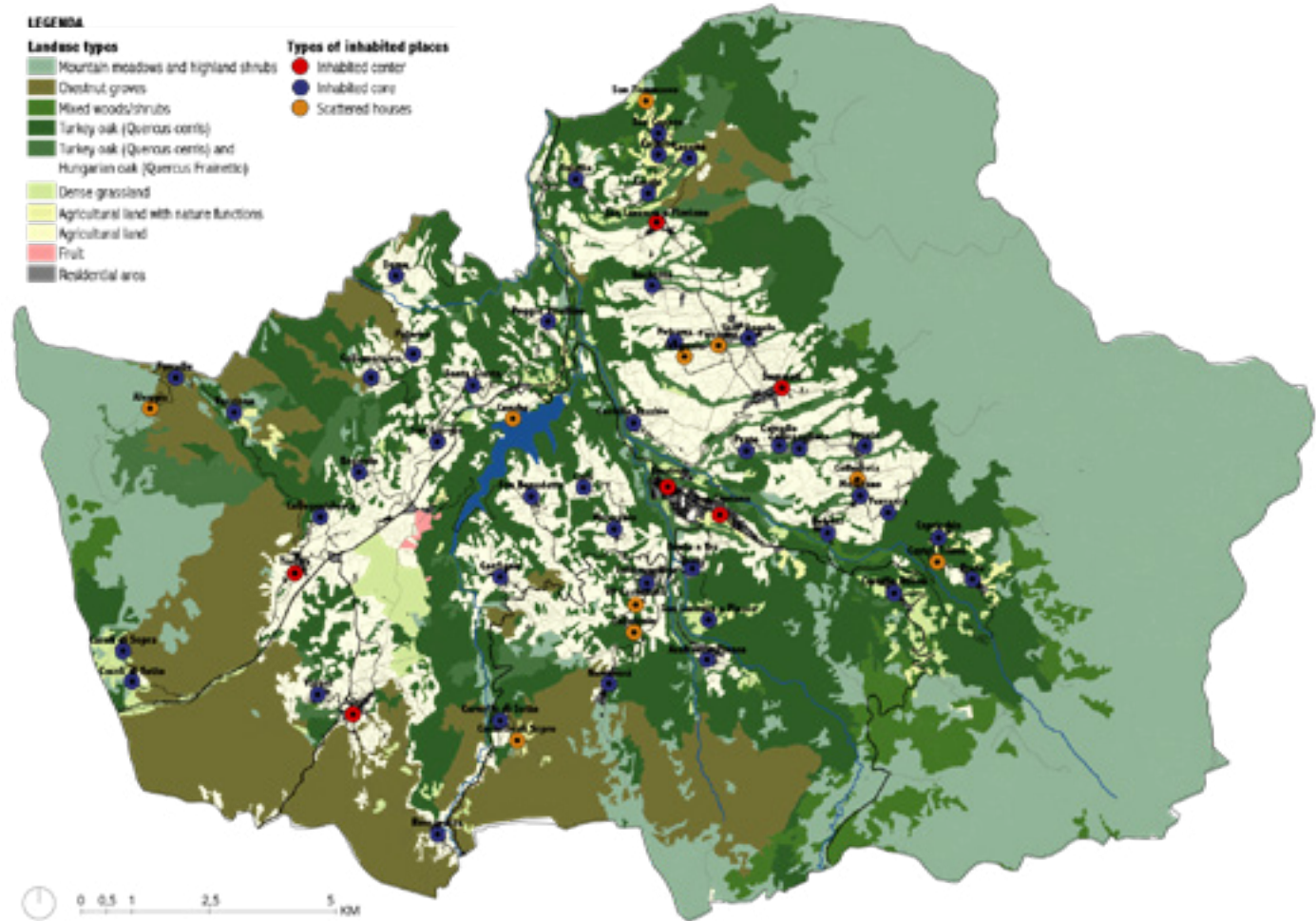


Figure 13 - Landuse types and types of inhabited places of the 'Amatrice Basin' (data retrieved from Regione Lazio, 2017)

LANDSCAPE TYPOLOGIES

The landscape of Amatrice, as described aforementioned, can be subdivided in multiple sub-landscapes that distinct themselves from each other (figure 13). The different landscapes merge naturally and have their own set of characteristics or layers, which are strongly linked with each other. After general descriptions of the main landscape typologies, they will be addressed in more detail.

‘The valley’ is the lowest part of the municipality, between around the 700 meters and 900 meters in height, and can be divided in geologically old parts with sedimentary rock layers and the younger flood zone that is clayey and located along the streams. The same can be done with the areas located between the 900 and 1100 meters. The parts of average geological age are former flood zones and thus contain some gravel, clay and silty sand. Finally, the areas higher than 1100 meters, ‘the mountains’, all have geologically old grounds, but differ in soils.

THE VALLEY

‘The valley’ (figure 14) is located between 700 and 900 meters and mainly has very steep flanks along the main water streams. The Tronto River and Castellano River run through the valley and the Scandarello Lake is the central reservoir. Because of wet circumstances and fertile soils, the valley is rich of trees, mainly humid species. Especially the main roads of the area lead through the valley, along the water streams and steep slopes. In the center and east, some bridges give access to the other side of the valley.



Figure 14 - Landscape typology: ‘the valley’ (Google, n.d.)



Figure 15 - Landscape typology: ‘the productive grounds’ (Google, n.d.)

THE PRODUCTIVE GROUNDS

‘The productive grounds’ (figure 15) characterize themselves by its gentle slopes and runoff water streams. Mainly farmland dominates this landscape, interspersed by some bushes and surrounded by mixed forests, creating chambers, or a so-called ‘bocage landscape’. Because of the flatter relief, roads are more linear and settlements could settle with more ease than in surrounding landscapes. Together with the next typology ‘the mixed grounds’, around ninety percent of all settlements is located in these landscapes, so between the 900 and 1100 meters.

THE MIXED GROUNDS

‘The mixed grounds’ (figure 16) differ in some aspects from ‘the productive grounds’. The slopes are somewhat steeper and the agricultural grounds are interspersed by mixed forest to a greater extent. Because of this, the chambers are smaller, the roads are curvier and less big scale agriculture is possible.

THE MOUNTAINS

Higher than 1100 meters, in ‘the mountains’ (figure 17), the slopes are very steep and source water flows downwards. In the lower parts needle-leaved forests dominate the landscape, while in the higher parts this is mountain vegetation. Just a few very curvy roads lead to the highest parts, where only some settlements are hidden.



Figure 16 - Landscape typology: ‘the mixed grounds’ (Google, n.d.)



Figure 17 - Landscape typology: ‘the mountains’ (Google, n.d.)

SETTLEMENT TYPOLOGIES

The great amount of settlements of Amatrice can be subdivided into different types (figure 18) based on their physical layout: built versus open space. This resulted in four main settlement typologies and three specific exceptions. The ‘linear’ or ‘street’ settlement typology characterizes itself by buildings positioned in a row, mostly along the street. A ‘cluster at end of road’ typology is mostly a dead-ending street with some scattered housing, mostly farms. A ‘cross-road’ settlement typology consists of a road-crossing with buildings at the corners and along the streets, while a ‘green-village’ looks similar but contains a clear central public open space such as a square. Finally, the specific typologies: the ‘walled village’ of Amatrice is an exception because of its history as fortress. The towns of Collemagrone and Villaggio Poggio Castellana, ‘planned’ towns, can be characterized by their

post-war buildings and, since the earthquakes, by many temporary housing modules. Finally, Ponte a Tre Occhi is not an inhabited place but a ‘bungalow park’.

The different settlement typologies contain several characteristic elements categorized in the following: (1) churches, (2) walls and/or fences, (3) fountains and street furniture, (4) planting and (5) pavement. The characteristic elements of the town of Amatrice, the ‘walled village’ will be discussed in more detail in chapter 8. Here, the settlement typologies ‘linear’ or ‘street’, ‘cluster at end of road’, ‘cross-road’ and ‘green-village’ will be illustrated shortly. The latter two mentioned ‘planned’ and ‘bungalow park’ settlement typologies have no significant historic background and because of this reason will not be discussed.

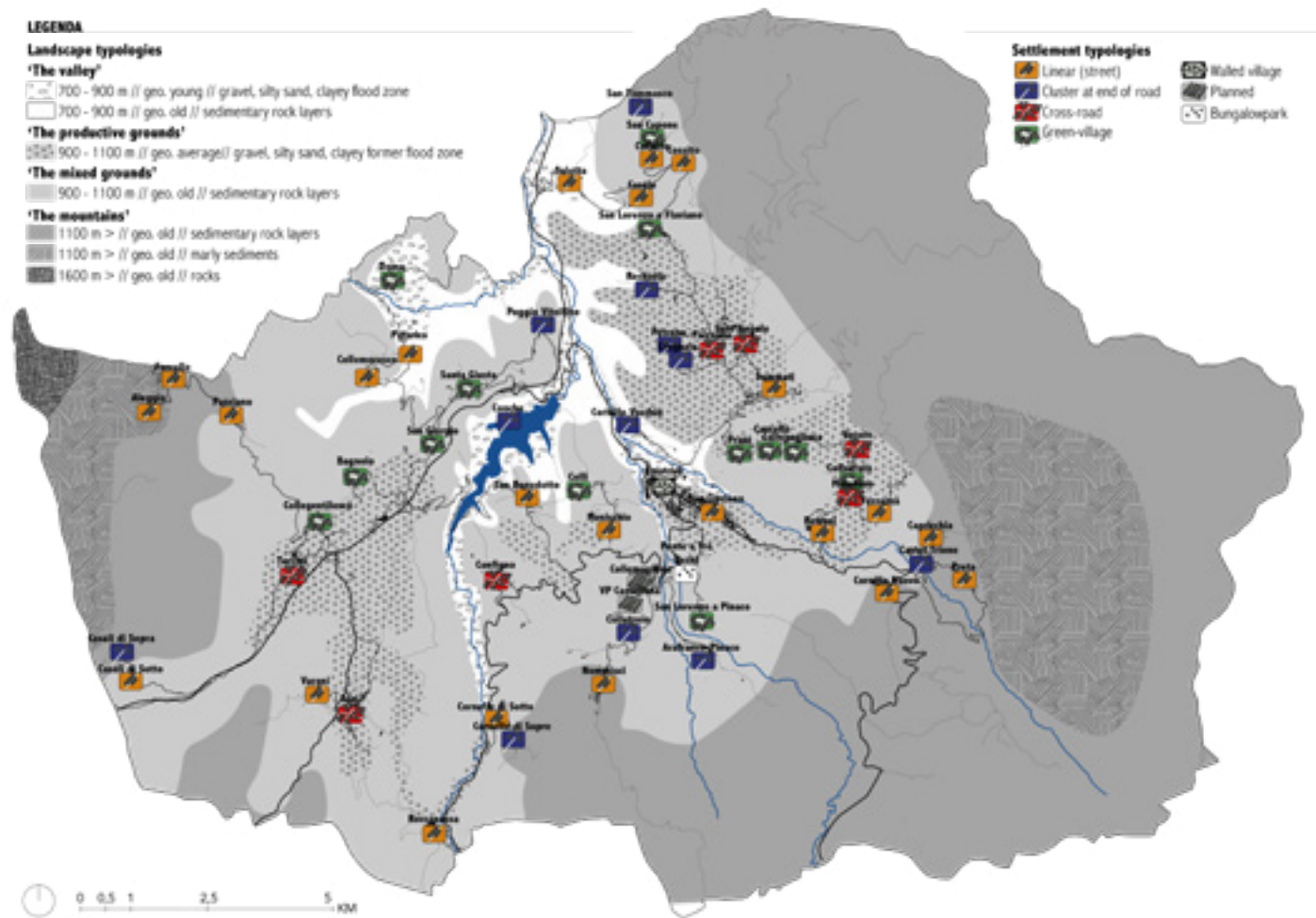


Figure 18 - Landscape and settlement typologies

PUBLIC OPEN SPACE OF SETTLEMENT TYPOLOGIES
‘GARDEN-VILLAGE’



Figure 19 - Settlement typology: 'garden-village'

The characteristic small squares of the 'garden-villages' (figure 19) are often recognizable by central positioning of the church, in combination with cobblestones pavement. Regarding greenery solitary trees such as pine trees (*Pinus Sylvestris*) or chestnut trees (*Aesculus Hippocastanum*)

are sometimes present at the square. The small squares provide space for social activity since benches make social encounters likely to happen and it often is the place where all streams are directed. Finally, small picturesque fountains often decorate the 'garden-villages'.

‘LINEAR’

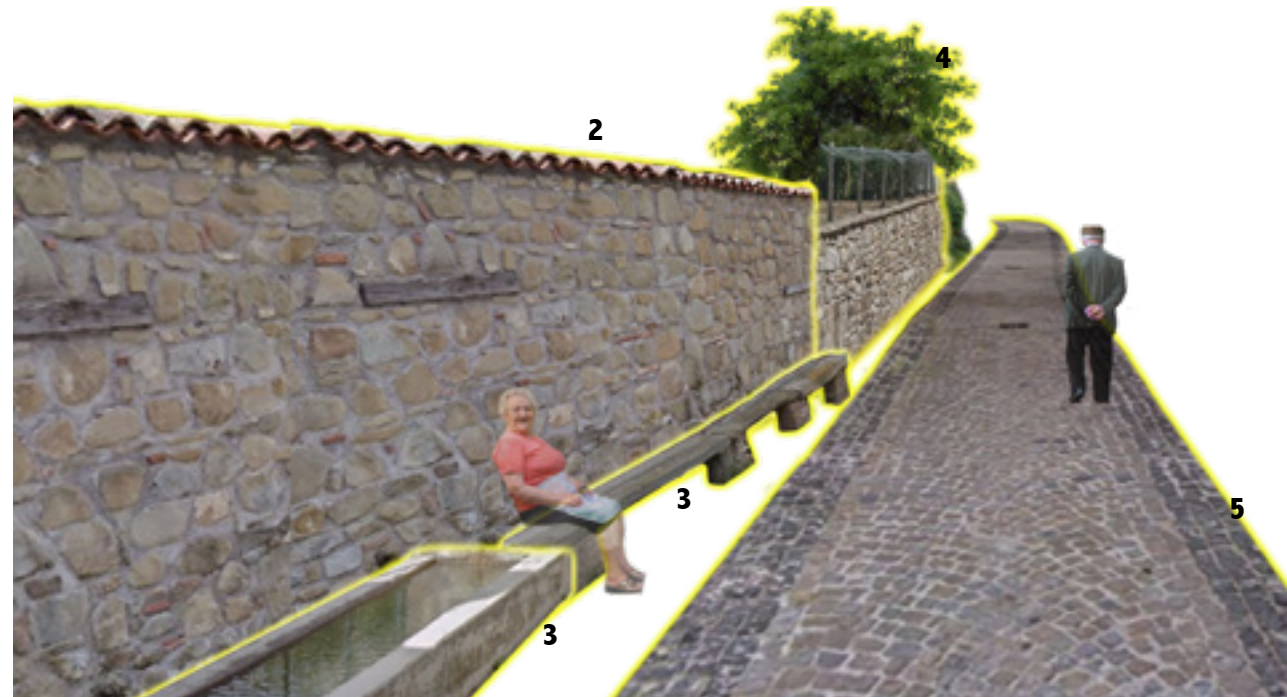


Figure 20 - Settlement typology: 'linear'

In 'linear' or 'street villages' (figure 20) linear structures, mostly streets, are guided by buildings that sometimes alternate with open spaces. Often, these spaces, for example private (kitchen) gardens, are lifted and enclosed by walls of medium height. It is common to find objects

such as benches or basins for agricultural use, adjacent to the buildings or walls. The street often distinguishes itself from the sides by different types of pavement. For example, the street is paved by cobblestones while the sides have different or no pavement.

‘CLUSTER AT END OF ROAD’



Figure 21 - Settlement typology: 'cluster at end of road'

In most cases the 'cluster at end of road' settlements (figure 21) comprise a group of farms. Sometimes a small church is present at the end of the road. These roads are mainly made of gravel or degraded asphalt. Wooden

fences often enclose agricultural fields, groups of bushes and small vegetable gardens, and water basins are often an indication of agricultural activity.

‘CROSS-ROAD’

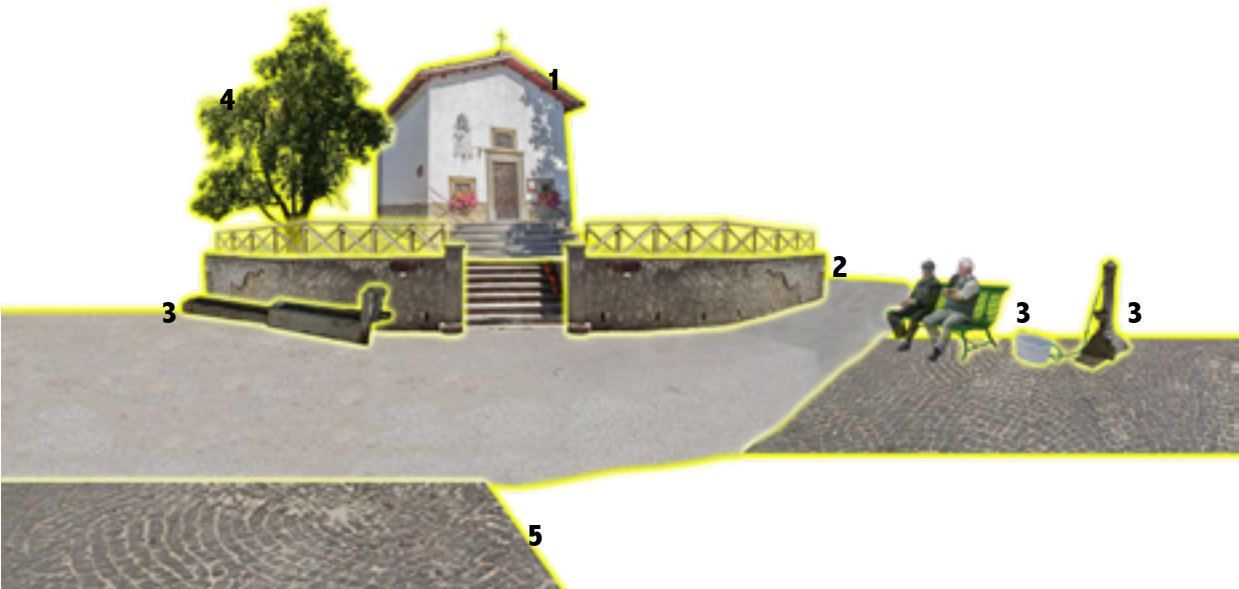


Figure 22 - Settlement typology: 'cross-road'

The name of the typology already indicates that 'cross-road' settlements (figure 22) consist of road-crossings. At these crossings often the church is located, sometimes lifted by characteristic walls from the street level. Often,

if the crossing consists of a municipal main street in combination with an entrance of the settlement, cobblestones, benches and water basins indicate the entrance.

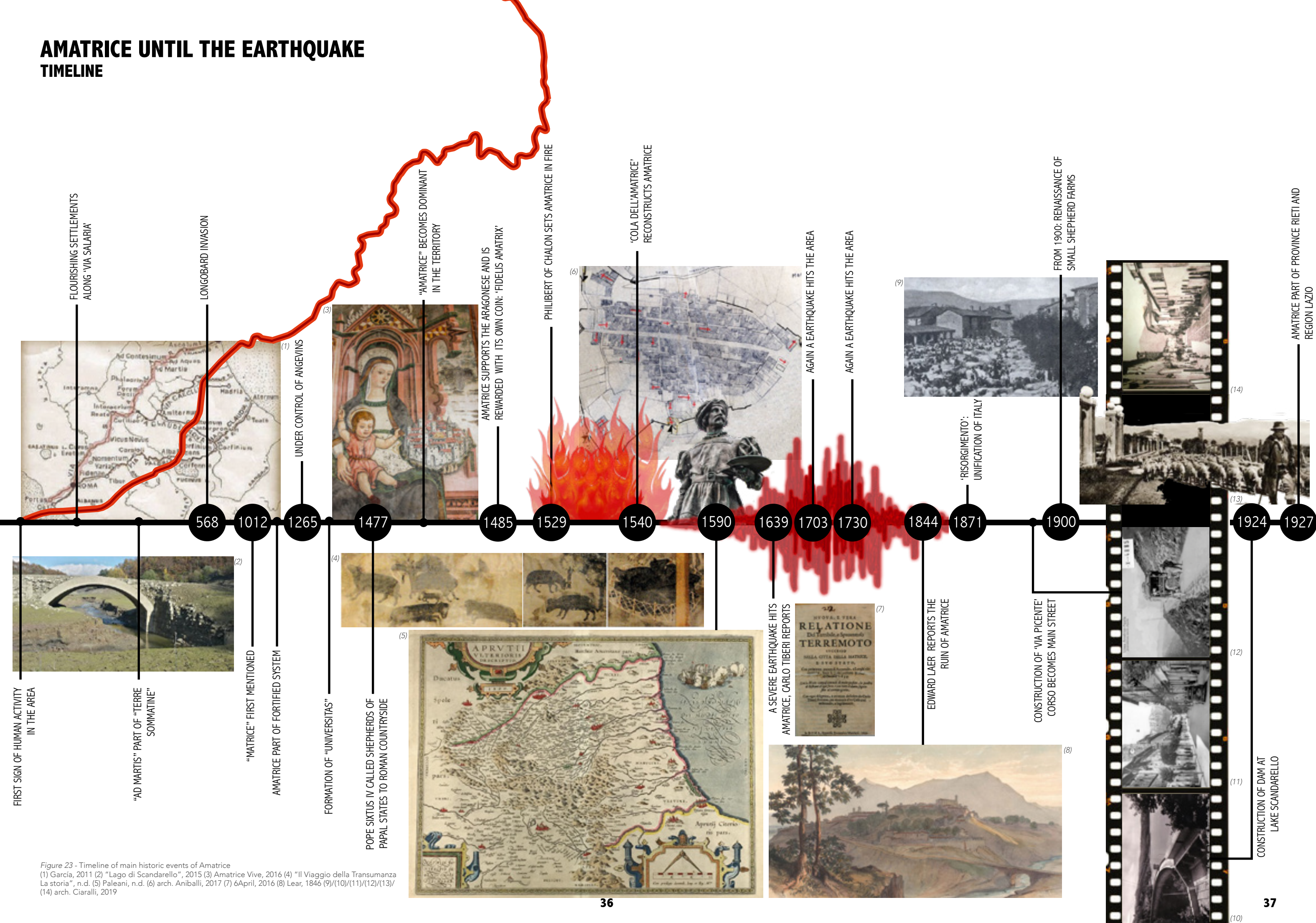
CONCLUSION OF THE CHAPTER

The 'Amatrice Basin' is located in a fold-and-thrust belt. The basin is part of the bigger 'Laga Basin', which is an intra-mountain depression of the Central Appennines and is located between the north-western Sibillini Domain and the Gran Sasso Domain in the south. Within Amatrice, the western part consists mainly of reverse faults which cause that the basin migrates underneath the Sibillini Domain. Different stratigraphic-sedimentary systems can be distinguished, which are expressed in a varied landscape varying from 700 to above 1100 meters height. The landscape can be divided in several typologies and further subdivided in sub-landscapes that distinct themselves from each other.

'The valley' is lowest located and is rich of trees because the Tronto River and Castellano River run through the valley and the Scandarello Lake is the central reservoir. Somewhat higher, 'the productive grounds' are because of gentle slopes and runoff water streams mainly used as farmland. The landscape has characteristic chambers, creating a so-called 'bocage landscape'. 'The mixed grounds' are similar but have steeper slopes and are covered by forest to a greater extent. Higher than 1100 meters, in 'the mountains', the slopes are very steep and source water flows downwards. The municipality contains 69 small settlements, which can be designated to different typologies based on the physical layout. The settlement typologies 'linear' or 'street', 'cluster at end of road', 'cross-road' and 'green-village' all have their own characteristics for each category.

5. AMATRICE UNTIL THE EARTHQUAKE

AMATRICE UNTIL THE EARTHQUAKE TIMELINE



THE CREATION OF WEALTH

THE BEGINNING

The timeline of figure 23 shows the main historic events. Amatrice is located along the historic 'Via Salaria' road, which leads from the Tyrrhenian Sea in the west to the Adriatic Sea in the east. Today, this is mainly the current SS4 state highway. In prehistoric times this road was already used as communication line, as can be explained by traces of objects of that time. Besides, the Sabines used the road for transportation to import salt from the salt marshes at the mouth of the Tiber River at the west coast, and other sites at the east coast as well. Rome had a strategic position on this route and, according to some, greatly benefited from the trade in salt making possible the real beginning of Rome and her prosperity (Bagnato, n.d.).

During times of the Roman Empire, the 'Via Salaria' road gained even more importance due to the connection via Ravenna with Constantinopel. Settlements along the road flourished because of logistic and military reasons. Back then, Amatrice was not acknowledged yet, but the territory of Amatrice called 'Summa Villrumde', referring to the higher located settlement of Sommati, was. However, the map below of figure 23 shows that Amatrice was already indicated as 'Ad Martis'. The ancient Roman bridge 'Ponte Scandarello' located in the Scandarello Lake refers to this time.

The first traces of Amatrice town, located between the Tronto River and Castellano River, date back from the eleventh century. In 1012 the name 'Matrice' is mentioned for the first time, which could be related with the Tronto River, referring to 'La Madre del Tronto', so the mother of the Tronto or to the church 'Chiesa Madre' (Bagnato, n.d.).

THE TIME OF REVOLTS AND PROSPERITY

In the twelfth century Amatrice was built and fortified as part of a system of fortified villages, leading along the 'Via Salaria', that acted as defense of the northern borders of the Kingdom of Sicily and the later Kingdom of Naples. In

1265 Amatrice becomes part of the Kingdom of Naples under the control of Charles of Anjou. It is a time of many succeeding revolts, but Amatrice manages to become sort of autonomous by the formation of the "Universitas". It meant that Amatrice governed itself through a parliament and was not ruled by a feudal lord.

The defensive system comprised the villages of Cittaducale, Antrudoco, Borgo Velino, Leonessa and Cittareale (figure 24), which became more important with their strategic position, resulting in different flourishing periods. Regarding the urban layout of the towns, similar features can be found, but the differences explain the different times of growth and urban expansion. Leonessa is probably built prior to Amatrice, and Antrudoco and Cittaducale after, since the latter two have a more regular street pattern and a clear central square, while Leonessa has curvier roads and no central square. Amatrice lies in between with its semi-regular street pattern and square split in multiple parts (Giammarini, 2017).

At the end of the fourteenth century, Amatrice started flourishing more and more, and the fortified village overruled the settlements of the countryside. The influence of Amatrice even reached the area of Campotosto, Cittareale, and villages at the other side of the mountains in the east. The name "Amatrice" becomes more dominant than the former "Terre Sommatine", which shows that Amatrice developed its identity increasingly. Because Amatrice was the last town defending the border of the Kingdom of Naples, special attention was paid to the wall structure and other defensive elements. The two rivers enclosing Amatrice together with steep slopes acted as natural defense. Defensive walls and strongholds protected the village against opponents and six public gates gave access to the inner center. Behind each city gate an enwalled road, a kind of tunnel (figure 25), ensured that only few people could enter at the same time and thus attacks from outside were less likely to occur. This

characteristic is unique of Amatrice and cannot be found in other similar towns (Appendix E). Back in the days the current public park, located close to the historic center, was probably a bastion. This is derived from its triangular shape and adjacent street 'Via dei Bastioni'. Analysis of the fortification and important buildings shows that the original village was possibly strategically located in the western part, with steep slopes at the side where incoming troops could enter (Giammarini, 2017)



Figure 25 - Gate and enwalled road or 'tunnel' ('Porta San Francesco') (author's picture)

THE AGRICULTURAL ECONOMY

Amatrice was driven by its agricultural economy, which was strongly related with the nature of the territory and its landscape of distributed small towns or "villas". The Amatrician farmers responded to the different seasons by migrating before winter times via green-grass routes to the more temperate climate of the Roman countryside or Adriatic coast. During spring the farmers returned to the mountains of Amatrice for fresh grassland and clean air. This seasonal migration is called 'transhumance'. Many different 'transhumance' trails crossed the country, and until around the fourteenth century mainly the north-south directed trails were prioritized, which headed from the current Abruzzo region to Puglia in the south (Bagnato, n.d.).

The east-west trails came of great importance in 1477 when pope Sixtus IV called all shepherds of the Papal States to migrate with their cattle, mainly "Sopravvissana" sheep at that time, along the 'Via Salaria' and 'Via Flaminia' roads to the Roman countryside. Shepherds practicing 'transhumance' had to leave behind their home and family for the entire winter and walk seven days long to the Roman countryside (Appendix D). Along the road several places for rest and refreshment and religious practices were present. The famous dish 'Pasta all'Amatriciana' is

the symbol of Amatrice and dates back to the early times of 'transhumance'. However, the dish originates from the 'Pasta alla Gricia' that was only prepared with spaghetti, pork cheek and pecorino cheese. Farmers practicing the 'transhumance' used to prepare the dish on their way to stay warm during the often-severe circumstances. After the tomato sauce was discovered and imported, it was added to the recipe and the 'Pasta all'Amatriciana' was born. Arriving in the Roman countryside, shepherds stayed in a self-made temporary village. Such a village was enclosed by fences and consisted amongst other of wooden huts, fireplaces and a big hut for the making of cheese. They spent their day by selling products such as wool, milk and cheese on the market and working in the "village" (Bagnato, n.d.).

The products that resulted from the agro-pastoral-system were the most important properties of the area. The Amatrician society became a rich production class by the processing of for example wool into clothes and mattresses. The prosperity was translated into the rise of many churches and monasteries in the area, such as the 'Chiesa di Santa Maria di Filetta' in 1472 and the 'Santuario dell'Icona Passatora' in 1480. However this wealth went hand-in-hand with conflicts with surrounding cities and castles. Amatrice and the city of Ascoli Piceno often supported each other during conflicts with the cities of L'Aquila and Arquata del Tronto.

TRAVEL OF TRANSHUMANCE

The agricultural seasonal migration called 'transhumance' is still practiced in the area with some insurmountable changes. The 'Travel of Transhumance' project has organized two events every year between 2011 and 2014 during both the arrival and departure of shepherds, as it was back in the days, is imitated (figure 26). The route consisted of stops to eat and even overnight stays in farms, hotels and campings. By organizing these seasonal ecotourism events, the project aims to create awareness of the value of the traditional way of practicing agriculture and its meaning for the history of Amatrice ("Il Progetto "Il Viaggio della Transumanza", " n.d.).



Figure 26 - Travel of Transhumance 2014 (Transumanza Amatrice, 2014)

LEONESSA



AMATRICE



CITTADUCALE



ANTRODOCO



Figure 24 - Comparison of urban structures of fortified villages Leonessa, Amatrice, Cittaducale and Antrudoco (Google, n.d.)

RUINATION AND RECONSTRUCTION

FIRE AND SUBSEQUENT RECONSTRUCTION

In the 16th century, Amatrice became in fight with the incoming troops of Philibert of Chalon that ended again in domination of the Spanish. Because of the violent Amatrician resistance that lasted for five months, Philibert punished the village by setting it in fire in 1529. The village was totally ruined and even big parts of the town wall were destroyed (Giammarini, 2017).

In 1540, the new leader Alessandro Vitelli called The Amatrician architect and painter Nicola Filotesio, better known as 'Cola dell'Amatrice', to rebuild the village. Nicola Filotesio has been responsible for the significant urban design of the village. However, he actually followed the plan that dates originally from the 13th century. The main axis, the street 'Corso Umberto I', leads from east to west and is smaller in the eastern part. Seven other streets are located parallel to this main axis. The main street and the most northern and southern streets join at the square in front of the 'Sant'Agostino' church in the east, where back in the days a church was located (Giammarini, 2017).

Architect and writer Enrico Guidoni (1939 – 2007) has developed a research method to analyze historic urban structures, which is based on drawing triangular shapes between main buildings (figure 27) (Giammarini, 2017). Applying this to the village of Amatrice shows that the triangular scheme is perfectly in line with the convents just outside the historic center, of which some existed until the earthquakes. Besides, within the historic center Guidoni's triangular study has shown that, using the bell towers of the 'Sant'Agostino' church in the east and the 'San Francesco' church in the south, together with the 'Santissimo Crocifisso' church in the northeast, the center of gravity is exactly located on the civic tower.

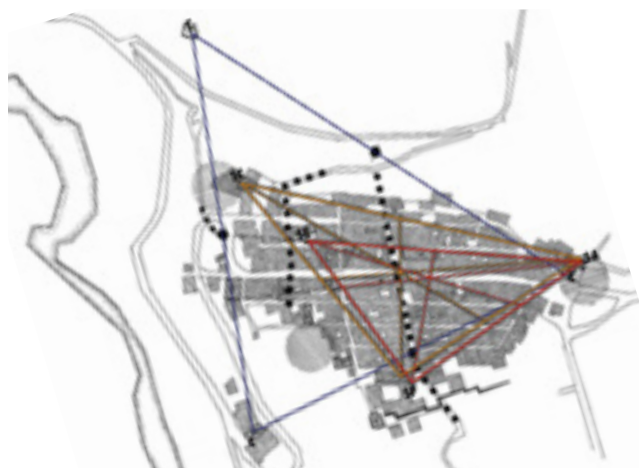


Figure 27 - Triangulation method of Enrico Guidoni (Giammarini, 2017).

THE PERIOD OF EARTHQUAKES

In October 1639 a severe earthquake woke the inhabitants of Amatrice during the night. The Italian writer Carlo Tiberi precisely described the consequences of the earthquake in his report, which is the main source of information about what happened during and after that event. The earthquake has caused around five hundred victims and several severe aftershocks followed. Inhabitants fled to the surrounding countryside to live in emergency tents, while others fled even further to the cities of Perugia, Rome and Ascoli Piceno because the losses of livestock were too big. However, the earthquake has not devastating all buildings to ruins, because until the 2016 earthquake, many monuments of before 1639 still existed. After this earthquake two severe ones followed (Ciccarelli, 2015).

TRANSFORMATIONS AND ADOPTIONS

Because Amatrice is damaged and ruined several times during history, many small alterations and transformations have been made to the structure of the town. At first sight, the street pattern seems regular in block sizes and axes, but shows irregularities and alterations when analyzing more precisely. The slightly curved streets could be the result of alterations of a perfect rectilinear pattern, or could be the opposite, namely a rational alteration of a more organic street structure.

Besides alterations of the street structure, the heart of the town is changed as well. The main square of before the earthquake of 2016, located at the civic tower and the town hall, was divided into separate parts. Some historians speculate about locations of a hidden "piazza" (Giammarini, 2017). Some are convinced that the square seemed to be at another location back in the days. This is related with the fact that the tower was once connected with the church of 'Santa Lucia'. The first alternative location of the square is between the 'Sant'Emidio' church in the west and the former stronghold at the 'Santissimo Crocifisso' church in the ultimate northwest corner, where always an open space has been present. The second alternative location of the main square is less precise since it indicates any open space in between the civic tower and the 'Sant-Agostino' church. This is more in line with the other side of the story, namely that no real square was present in Amatrice back in the days. By using the term "piazza" confusion is created, because one searches for a clear compact open space. However, the long and wide main street acted as "piazza" because here the town life took place with its commercial activities and people

socializing (figure 28). A classic medieval road was very small, so the street was very wide for that time. This is related with the fact that Amatrice was founded as city ("citta") and not as village ("borgo") (Appendix E).

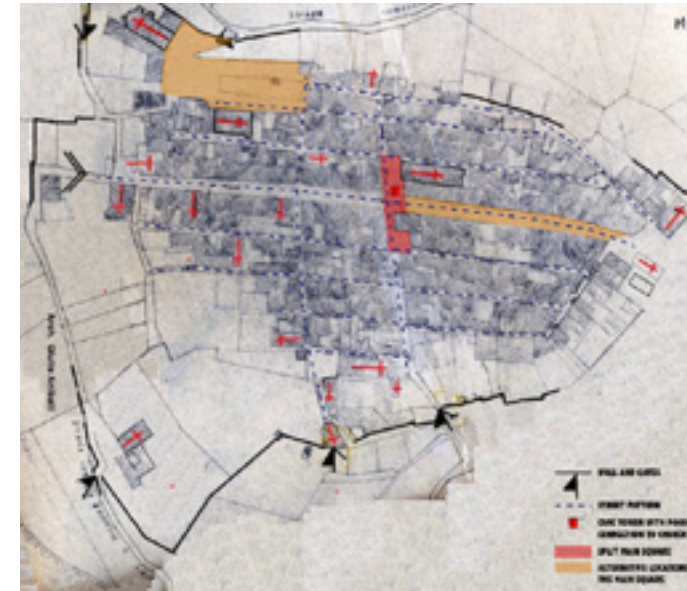


Figure 28 - Analysis of Amatrice's urban design (arch. Aniballi, 2017)

IL BORGO PIÙ BELLO D'ITALIA

In 2015, one year before the earthquake, Amatrice received the title as one of the most beautiful towns of Italy (in Italian "I Borghi più belli d'Italia"). The association aims to promote the culture historic value of the Italian "borghi", which means a small town that is mostly fortified and dates back to the time from Middle Ages to the Renaissance. The towns have to meet certain requirements to become member of the club and together create a tourist network of high quality. Architectural and/or natural heritage should be certified, the town should have heritage of urban or architectural quality and the town should meet non-physical requirements such as promotion and development. Amatrice is certified because of its natural landscape and rich local culture, good livability and food tradition. Amatrice is promoted as the town of taste, "Il Borgo del Gusto", and maintained its membership after the earthquakes out of respect ("Amatrice," 2017).



Figure 29 - Drawing from report of Edward Lear's travel to Amatrice (Lear, 1846)

MODERN TIMES

STILL IN RUINS

At the end of the eighteenth century Amatrice is still in ruins as can be concluded from the words of Leandro Alberti. English writer and landscape designer Edward Lear reported his travels, collected in the book 'Illustrated Excursions in Italy' (1846). On October the 5th 1844, Edward visits Amatrice and documents his experience verbally and visually, as shown by figure 29. This drawing is made from a point that he describes as "...a beautiful view of the Tronto valley, with Amatrice on a ridge, in the center." The state of Amatrice at that time becomes clear after the following words:

"...the deserted walls of Amatrice, once an illustrious city, began to interest me as I approached it: it is a neglected and ruined place, devastated by earthquakes and infighting. ... Forty-five houses depend on this decayed city, whose five gates, whose walls once powerfully fortified, still bear witness to its past grandeur. ... Some tall bell towers are picturesque and resemble those of Lombardy, especially the one in the market square." (Lear, 1846, pp.134-135)

MODERNIZATION

During the second half of the nineteenth century the 'Via Picente' road is built, leading from L'Aquila to Amatrice. From then on the 'Corso Umberto I' main street becomes the most important access road, replacing the town gates. Because the new road connected the cities of L'Aquila and Ascoli Piceno, Amatrice became a transit town between the regions Abruzzo and Marche. However the connection with the 'Via Salaria' road still relied on the Romanella path, which leads from the town of Amatrice, through Colli, to the Scandarello Lake. In 1924 this connection improved with the introduction of the Scandarello dam.

From the twentieth century onwards, the market of Rome expanded and demands increased. Because of this, shepherds with a maximum of around five hundred sheep, so-called "Moscetti", disappeared rapidly. Besides, the farms that received the sheep of the "Moscetti", named "Masseria", expanded and innovated to adapt to the changing needs. The Amatrician shepherds went to the Roman countryside and enriched their products for the Roman market until this seasonal migration was not possible anymore around the fifties or sixties, because of modern developments such as new road networks and alternative markets. Because of the strong link with Rome, Amatrice became part of the region of Lazio and province of Rieti in 1927.

CONCLUSION OF THE CHAPTER

The historic 'Via Salaria' road has been of great importance for the development of Amatrice. At first it acted as communication line between the Tyrrhenian Sea in the west and the Adriatic Sea in the east. Later, the transportation of salt has contributed to the development of Rome. Settlements along the road started flourishing more and more, and in the twelfth century some of these even became part of a system of fortified villages that had to defend amongst others the Kingdom of Naples. The towns had similar characteristics, but special attention was paid to the fortification of Amatrice from the moment it gained more importance. Unique characteristics as the wall system at each of the gates distinguished Amatrice from the rest.

Amatrice mainly relied on its agro-pastoral system called 'transhumance', which was strongly related with the landscape. Dependent on the season, shepherds migrated between the more temperate climate of the Roman countryside and the fresh meadows of the Amatrician mountains. 'Transhumance' is the foundation of the growing economic success and local culture at the same time. During history, Amatrice is ruined multiple times, for example by the fire of Philibert of Chalon in 1529 or the earthquakes of 1639. However, the level of ruination varied and the town was rebuilt as much as possible as it was by following for example the street pattern.

Because of modern developments, the season-dependent migration adapted to changing circumstances and needs. The accessibility of Amatrice improved and the main street gained importance over the use of the town gates.

INTERMEZZO: THE EARTHQUAKE

On August 24th 2016 a severe earthquake hits Amatrice during the middle of the night at 3:36 AM exactly (figure 30). Residents and the many visitors, who spent their holidays in the mountains, ran into the streets. In the morning several shocks followed whereupon rescue teams started their activities to save as many lives as possible. Sergio Pirozzi, mayor of Amatrice back then, pronounced

the iconic words: "Amatrice does not exist anymore". The historic center was totally devastated and declared inaccessible. In the midst of the emergency phase, in October that year and later in January 2017 again, other earthquakes strike the area again. Only a few skeletons of buildings have remained in the historic center of the town (figure 31) (Cagnazzo et al., 2016).



Figure 30 - Situation of Amatrice's historic center after the earthquake of August 24th 2016 (Borgia, 2016)



Figure 31 - Situation of Amatrice's historic center after the successive earthquakes (Il Foglio, 2018)

6. THE IMPACT OF THE EARTHQUAKE

THE PHYSICAL IMPACT DAMAGE

The severe earthquake and multiple aftershocks have created an immense impact on the territory. The seismic intensity distribution is mapped based on the Mercalli-Cancani-Sieberg (MCS) scale (figure 34). As shown, Amatrice and Petrana have extreme damage with a MCS value higher than ten, which means that the settlements are raised to the ground. After these, Saletta, Casale and Crognale are almost completely destroyed and San Lorenzo e Flaviano, Sant'Angelo, Prato and Retrosi (figure 33) are partly destroyed with a MCS value of between the nine and ten. However, for example Collemagrone has no to moderate damage with a MCS value of six or lower, although it is close to Amatrice, which is totally raised to the ground (Valensise et al., 2017). Difficulties arise when analyzing the damage that the earthquake has created to the large number of settlements within the municipality. No damage pattern is visible because there is a big variety in MCS values, but also in building typologies. Besides, some buildings were already abandoned and not maintained before the earthquakes (figure 32). So, based on the damage levels no conclusions can be made.

MICRO-ZONATION

After the devastating earthquake in the Abruzzo region in 2009, the Italian Parliament has introduced a new law regarding national seismic prevention. Part of the mandatory seismic risk prevention plan is the seismic micro-zonation (SM) of municipalities and towns. SM maps indicate zones based on their ground stability, which in line are based on e.g. ground motion tests, geologic studies, studies to the presence of active faults and prone soils, etcetera. SM maps contain different levels depending on the specificity of the data (SM Working Group, 2015).

To start with the first level of SM, within the municipality

of Amatrice three types of seismic micro-zones or general (un)stable areas can be indicated. Only a very small part in the northwestern high mountains can be assigned as 'stable zone' with no expected effects because of its rocky outcrop, so old stratified stone substrate with no layers on top. Almost the entire municipality has stable grounds that are prone to local amplification of the seismic motion. This means that seismic activity triggers ground motion that can be created because of geological and/or geomorphological characteristics, since these grounds are covered with silt- and sandstone or alluvial sediments. Within the study area many zones are prone to instability, which are the result of ground movements. The following four types of slope instabilities can be indicated: collapse or rollovers, slow superficial flows, landslides and complex slope instabilities (figure 36). These locations of instabilities are especially dangerous during and after earthquakes and can create secondary hazards. The pictures of Appendix I show the pre-quake situation of the locations where road constructions were necessary after the earthquake. Especially steep slopes and bridges seem vulnerable. Other phenomena that can create instabilities are active and capable faults. The difficulty regarding this lies in the determination of its activity, which relies on detailed studies and big datasets. An active fault, which has moved in the last 40.000 years, is capable when it is superficial and the rupture is visible in the soil. In the study area many faults can be identified. The instable zones, corresponding with the active and capable faults, are based on the surface trace of the faults plus the adjacent settlements and moving grounds (Chiaretti & Nibbi, 2017).

The second and third level SM maps are more specific since amplification areas are mapped with corresponding specific amplification factors (in Italian 'Fattore di Amplificazione', FA in short). The FA shows the motion of



Figure 32 - Example of abandonment before the earthquake in Faizzone (Google, n.d.)



Figure 33 - Damage after the earthquake in Retrosi (author's picture)

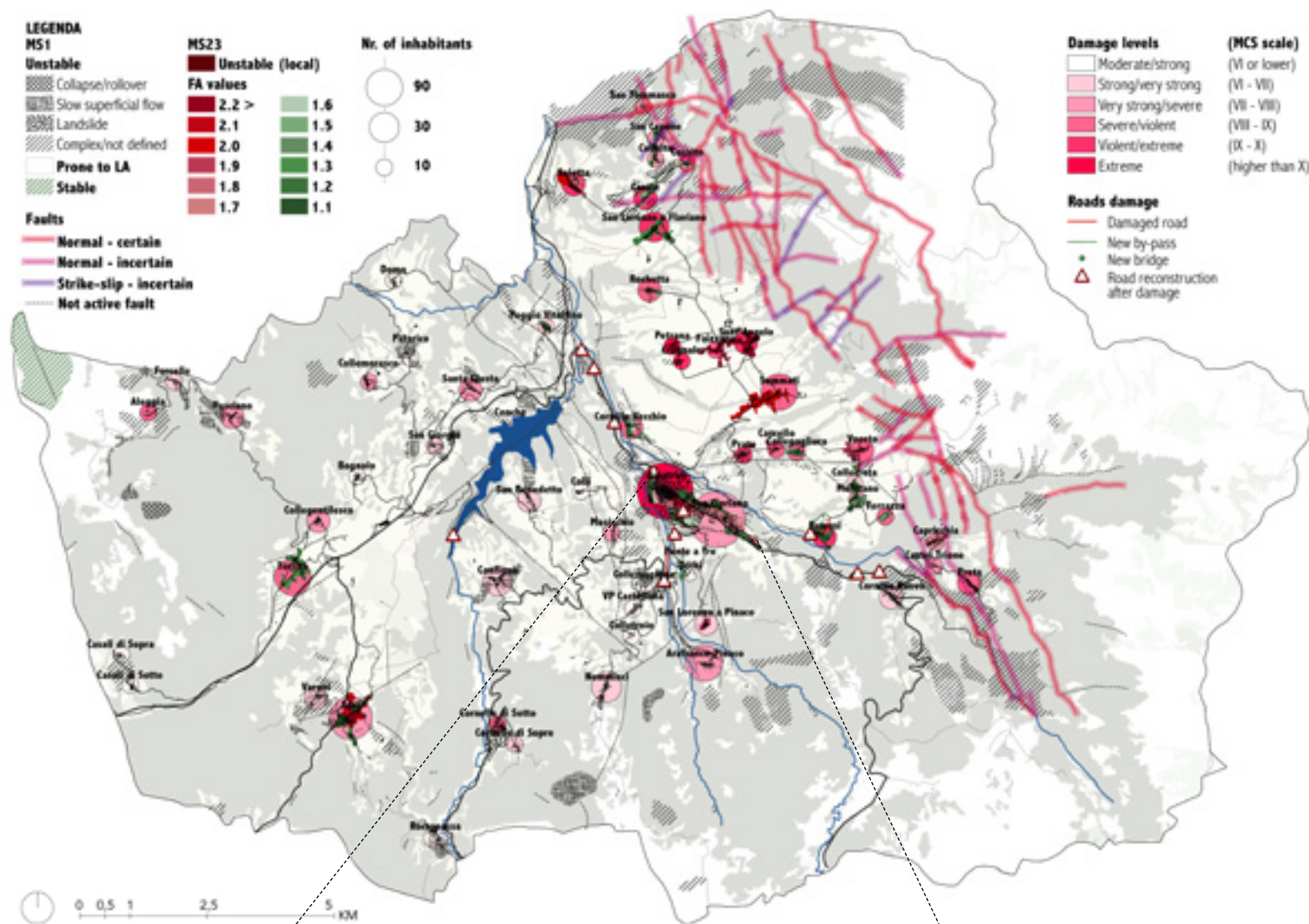


Figure 34 - The physical impact of the earthquake: seismic intensity distribution, population numbers, MS1, MS23, faults and road damage (data retrieved from USGS, 2016; ISTAT, 2016)

* All FA values are based on period intervals of 0.1-0.5 s



Figure 35 - The physical impact of the earthquake in Amatrice town: MS1, MS23 and faults (data retrieved from USGS, 2016)

different bedrock. In general, solid bedrocks such as the earlier mentioned stratified stone substrate have lower FA values than poorly consolidated sediment such as silt- and sandstone and alluvial sediments. Damage levels depend on the construction material and method of buildings in combination with this intensity of ground shaking. Thus, what could be stated is that rebuilding of settlements is prioritized in areas with low FA values. This is especially the case for strategic structures such as hospitals and fire stations (Chiaretti & Nibbi, 2017).

Within the municipality of Amatrice, only the somewhat bigger settlements are investigated regarding their FA value. In the east of the study area, Amatrice, Sant'Angelo, Faizzone, Crognale, Petrana and Saletta all have FA values of more than 2,2* compared to stable grounds, that have a FA value of 1. This while Scai has parts with FA values of only 1,1 and Poggio Vitellino, Cornillo Vecchio, some parts of San Cipriano, Collepagliuca and Retrosi have FA values of 1,2. At the first level SM maps many faults are identified, but at the second and third level these are further investigated based on the catalog of capable faults of ITHACA (ITaly HAZard from CAPable faults) and literature data. This is only a preliminary investigation until further specific studies will be carried out, and can only indicate faults that are 'potentially active and capable', shown in colors on the map. As shown on the map in grey, especially the western faults are not active and capable. In the east two systems are identified, namely the Gorzano-Laga Fault and the Amatrice Fault System with dominantly normal fault segments, which are potentially active. Some of the faults cannot be mapped with certainty; here an estimation of the location is made (Chiaretti & Nibbi, 2017).

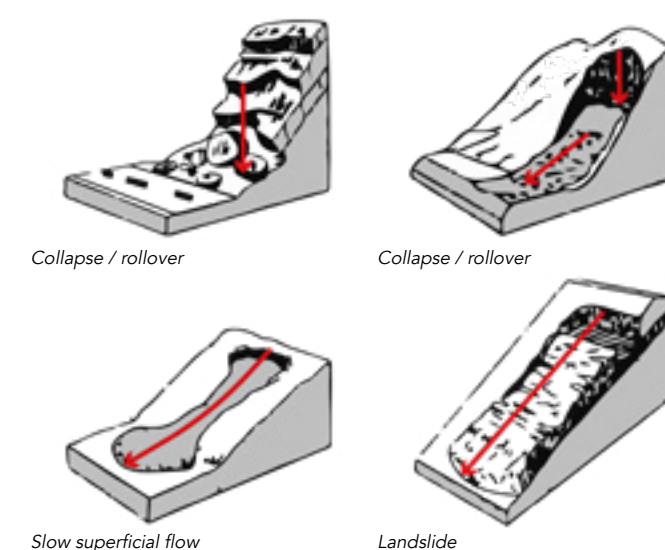


Figure 36 - Four types of slope instabilities present in the municipality of Amatrice

AMATRICE TOWN

On the smaller scale of the town of Amatrice even more difficulties arise. As shown on the map (figure 35), damage is concentrated in the historic center, while less damage can be found in the eastern part. This can be explained by the fact that this part is built more recently than the historical buildings in the center, of which its history is discussed in chapter 5. However, also newer buildings are devastated and the reason could also be found in FA values. These values are higher in the historic center and lower further away from the core. So, it is difficult to indicate clear relations and causes. But, thinking in terms of risk mitigation, it would be more resilient not to build in areas with high FA values. Since Amatrice is located on the foothill of a mountain and contains rocky soils, the slopes are sensitive for ground instabilities. Primary the southwest slope of Amatrice is critical and contains risk of landslides. Besides, the northern slope of the historic center could possibly collapse or cause rollovers. Other instable areas are not directly linked with the built environment of Amatrice. Although several faults cross the town, these are not indicated as active.

The earthquake has also damaged multiple roads, in some cases causing a total blockage. For example near the settlement of Ponte A Tre Occhi, where severe damage of a bridge resulted in the need to construct a bypass and even a new bridge (figure 37). Amatrice is only connected from east to west by the main street, the 'Corso Umberto I', leading through the historic center. Besides the vulnerable east-west connection, the traffic from the south depends on the main street as well, because no connections on the north side exist. Even on the bigger scale, Amatrice takes a key position because it gives access to all directions. This explains the consequences of the mentioned blockage near Ponte A Tre Occhi, namely a blockage of the entire direction.



Figure 37 - New bridge constructed at Ponte A Tre Occhi (Corriere Roma, n.d.)

THE IMPACT ON EVERYDAY LIFE

The territory of Amatrice can be divided into two 'spheres': the town of Amatrice where activities related to commerce and public administration take place, and on the other side there is the small rural settlements, which are distributed within the countryside and are historically established for the cultivation of land (Appendix D). As stated before, in 2011 the municipality of Amatrice counted 2646 permanent residents. This number has decreased to 2500 in 2017. The permanent residents occupy only 24,3% of the total amount of dwellings and 75,7% is empty or occupied by non-residents, compared to 30,8% average in the 'crater municipalities'. These numbers can be explained by high vacancy rates and the large amount of people who own a second house in the area. The mass migration from the countryside to big cities such as Rome started in the 1960s. People either left for good or kept their home in the countryside as second home. They became wealthier and often upgraded and retrofitted their second home by implementing modern elements and they changed uses by for example transforming farms into dwellings (Appendix D).

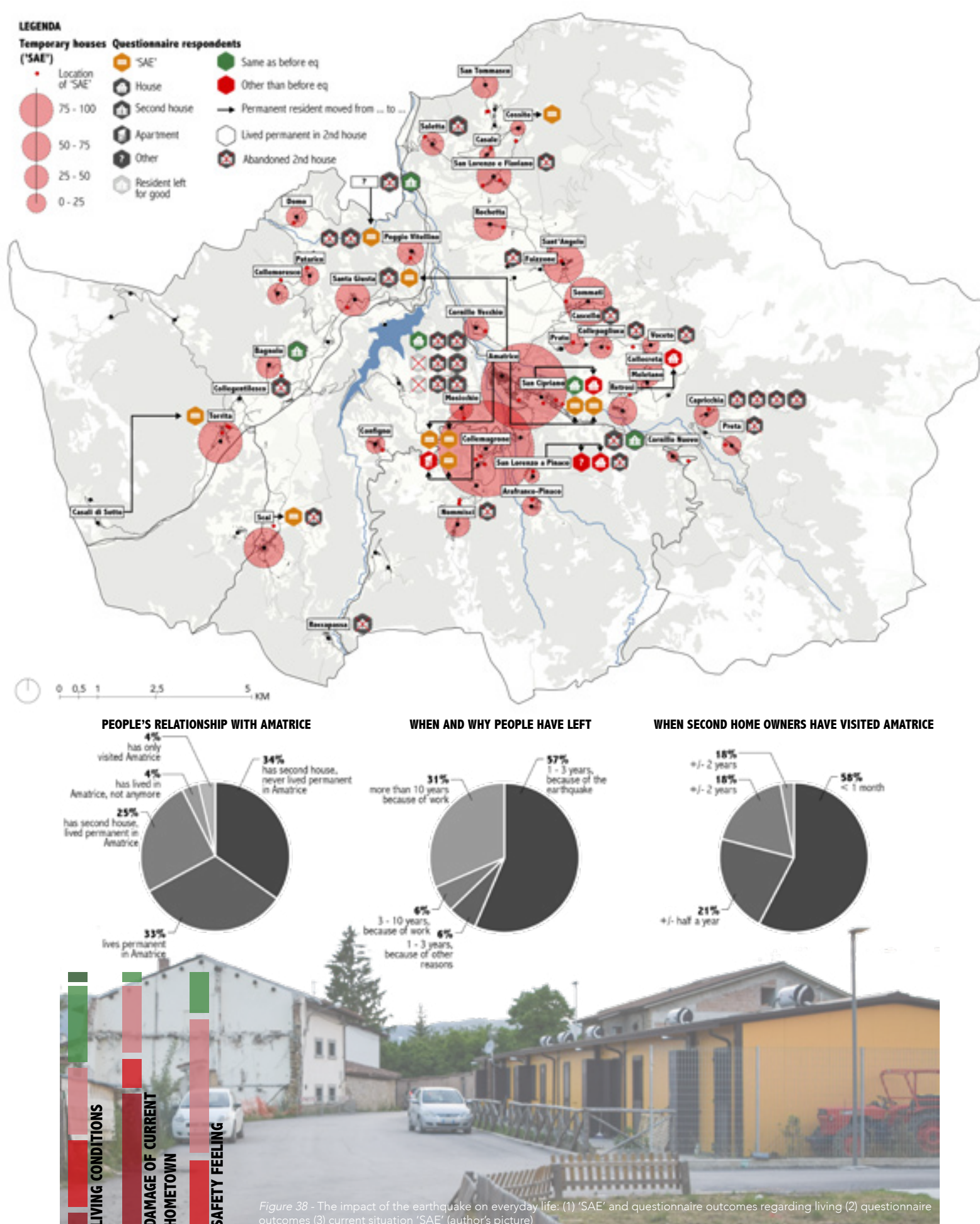
According to the outcome of the questionnaire almost 60% of the participants has a second house, of which 25% has ever lived permanently in Amatrice (figure 38). Of these people, and those who do not have a second house (anymore), the majority has left the area the last one to three years because of the earthquake or other reasons. The rest has left longer than three years ago for work related reasons. Most second homeowners and people who have lived in Amatrice, 89% according to the questionnaire, live permanently in other parts of Lazio. During holidays and summer days second homeowners are used to return to Amatrice. Together with the amount of visitors and tourists, the amount of people in the area could raise to fifteen thousand. However, after the devastating earthquake, many people, 91% according to the questionnaire, do not visit Amatrice for overnight stays and 42% has not even visited Amatrice in the last six months. The map of figure 38 shows abandoned and still occupied second houses of questionnaire respondents, and indicates if the dwelling has ever been occupied permanently.

After the earthquake, the majority of the permanent residents had to move to temporary cabins, so-called 'SAE' (in Italian 'Soluzioni Abitative in Emergenza'). These emergency housing solutions vary from 40 to 60 to 80 square meters. In all affected regions, Marche, Lazio, Umbria and Abruzzo, a

total of 3260 'SAE' have been placed. In the municipality of Amatrice 532 'SAE' have been installed, as shown by figure 38, and around 1500 people have found shelter here. The table of Appendix J shows precise numbers of all 'SAE' areas and explains how the number of 1500 is calculated (Protezione Civile, 2019). As shown by figure 38, almost half of the questionnaire participants, who live permanently in Amatrice does not live in the same settlement as before the earthquake anymore. Several reasons explain how this is possible. First of all, the 'SAE' are placed in relatively bigger settlements, so people who lived in very small settlements such as Casali di Sotto had to move to 'SAE' in another settlement, in this case Torrita. Secondly, Amatrice and San Cipriano contain four 'SAE' locations, which were not enough to provide shelter to all people from Amatrice who lost their home. Thus, Collemagrone, southwest of Amatrice, has been transformed into a 'SAE' village where people from Amatrice stay. Finally, a part of the permanent residents now lives in a dwelling other than 'SAE'.

The questionnaire respondents are distributed over the entire municipality including many close to the town of Amatrice. The town was and still is the center for the municipality since it contains necessary facilities such as a supermarket and other food supply facilities, schools, and before the earthquake there was even a hospital as well. The facilities are mainly concentrated here, however the satisfaction regarding access to these facilities after the earthquake is rated positively only by 12%, while before the earthquake this was 57%.

The outcome of the questionnaire shows that only 31% knows who are working on plans for the future of the municipality and only 37% knows what the plans include. This could be related with the aversion of inhabitants to politics. According to Mario Ciaralli (Appendix D) people are abandoning all political decisions and they are afraid to protest. This lack of public participation is expressed by the placing of the 'SAE'. The municipality did not take into account where people lived before the earthquake and separated people from each other by randomly placing them in 'SAE'. The distrust came to light during the latest municipal elections of spring 2019, when only 50% of the inhabitants voted. Mario Ciaralli states that it is needed to build a multi-functional center that strengthens the community and stimulates social interaction. Besides its social function, here the future of Amatrice should be discussed (Appendix D).



THE ECONOMICAL IMPACT

AGRICULTURE AND TOURISM

Till the 1940's the economy of Amatrice was mainly driven by the wool industry, which was based on the activity of transhumance. Many families invested in the commerce until wool from Australia and New Zealand entered the market with significant lower prices. The wool industry of Amatrice collapsed and families shifted investments to Rome in e.g. the construction industry, but also in retail and the food- and catering industry. During the economic boom in Rome, these prominent families who are currently established in Rome actually have roots in shepherding and thus also in Amatrice (Appendix D).

Shepherding is not the main business anymore since it is replaced by local food production and the processing of products into for example the famous delicatessen such as Amatrician Pecorino and Ricotta cheeses (Appendix D). Based on data of 2014 of registered agricultural engine users, the so-called 'UMA' (in Italian 'Utenti Motori Agricoli'), Amatrice contains 110 farms with an average of 24 hectares per farm (Regione Lazio, 2014). The agricultural land is dominantly used as grassland, for the use of pastoral farming, divided in mountain meadow-pasture, normal grassland and grassland for one or two years, and some parts are occupied by forest. Striking is that the dominant cattle types are cows, buffaloes, sheep and goats, and that only 7% is intended for poultry, while this is 92% in other 'crater municipalities' and 88% national average. The biggest farms are spread over the area and mainly practice pastoral farming, except from Sant'Angelo where mainly sugar beets and potatoes are cultivated (figure 42). The type of agriculture is strongly related with the natural landscape, what makes a diverse agricultural landscape. Chestnut groves are present in the south and west of the area, which explains that chestnut fruits are cultivated at the town of Nommisci. On the flatter slopes

near Bagnolo and the Scandarello Lake, the farm 'Casale Nibbi' has a great production of grapevines, fruits, olives and hazelnuts.

As mentioned in the previous part of this chapter, the area used to be visited by many second-home owners. People working and permanently living somewhere else, especially in Rome, return home during holidays. These visits can be seen as second and third generation "tourism". Although the area has not been confronted with mass tourism, such as in the famous nearby city of Norcia, the opening of the Gran Sasso Monti della Laga National Park has stimulated the tourism industry. In 1991, the Park opened officially with its borders passing through three regions: Abruzzo, Lazio and Marche. The Park attracts many visitors and tourists, who can admire the valuable treasures by a network of several museums and visitor centers, walk and hike trails in the mountains and stop at places to eat and sleep. The Park translates its ambition for high quality and sustainable products by a shared network of local producers who offer authentic products. In this way the Park aims for the protection of the identity of the area and the support of local economies. Within the municipality of Amatrice several farmers are connected with the Park's network of producers, which makes them able to sell their products provided with the Park's label (figure 43). Typical products of the area provided with the label are cheeses, such as the Pecorino and Ricotta, wild berries, Turchesa potatoes and honey (Ente Parco Nazionale del Gran Sasso e Monti della Laga, 2019).

Some farmers in the area host a farm shop next to their daily agricultural activities. Here house-made products are sold directly to visitors. For example the earlier mentioned farm 'Casale Nibbi' sells its own yoghurt, spaghetti,

cheese, fruit, potatoes, wine and oil. Besides a farm shop, some farmers use their farm as 'agriturismo'. This secondary activity in the branch of tourism is beneficial for the agricultural economy since it has more chance to survive with side-activities as these. Besides, 'agriturismi' offer tourists an experience and alternative for hotels and holiday homes. After the August earthquake nine out of ten cattle stables collapsed (ISTAT, 2016), so the consequences of the successive earthquakes are not even taken into account here. Farmers had to deal with the effects of the earthquake by installing tunnels for their cattle and on-site mobile homes for their own shelter. Because the historic center is completely vanished away, the tourism sector suffers the consequences and tourists even have to be chased away from the rubble, where the historic center of Amatrice used to be (figure 39).

INITIATIVES AND DEVELOPMENTS

The disaster has motivated many people to help Amatrice, resulting in one of the initiatives called 'Una Amatriciana per Amatrice' (figure 40). This initiative is lead by Carlo Petrini, founder of the International Slow Food Movement, together with food and wine associations. The initiative asked restaurant owners to put the symbolic pasta Amatriciana dish on their menu for one year to collect money for the thousands of people in emergency ("Una Amatriciana per Amatrice," n.d.).

Besides this initiative, an international Italian food chain, called 'Eataly', started a collaboration with the Amatrician farm 'Casale Nibbi' to help them recover from the devastating earthquake. The biological farm cultivates amongst others cherries, apples, grapefruits, olives and potatoes. The latter are sold at the 'Eataly' stores, where the story of the farm is shared with the public to create awareness of the products' origin. According to 'Casale Nibbi', the uniqueness of the products lies in the location,

because the mountainous area contains fresh air and temperature alterations. The earthquake has damaged many buildings and caused that the dairy is not working anymore and had to be moved to another improvised place ("Amelia Nibbi, orgoglio amatriciano," n.d.).

The newly built 'Food Area' (in Italian 'L'Area del Gusto'), has ensured that the tourism and agricultural economy have not been collapsed completely. The area contains a square surrounded by eight restaurants, which were first mainly located in the historic center. However, this mono-functionality makes that, according to the current mayor (Appendix C), the tourism economy now only relies on restaurants and cafes. All other branches, such as shops selling local products and souvenirs, are not stimulated because of the lack of integration of functions.

Part of the 'Amate Amatrice' ('Love Amatrice') project, in the 'Food Area' local dishes are served to locals, visitors and tourists, to help strengthen the local food economy. Even the television show 'Masterchef' has dedicated an episode to the iconic place and food culture of Amatrice (figure 41).



Figure 39 - Tourists have to be chased away from the rubble of the historic center (Cimaglia, 2017)



Figure 40 - Initiative 'Una Amatriciana per Amatrice' ("Una Amatriciana per Amatrice," n.d.)



Figure 41 - Television show 'Masterchef' at the 'Food Area' of Amatrice (Il Gazzettino, 2018)

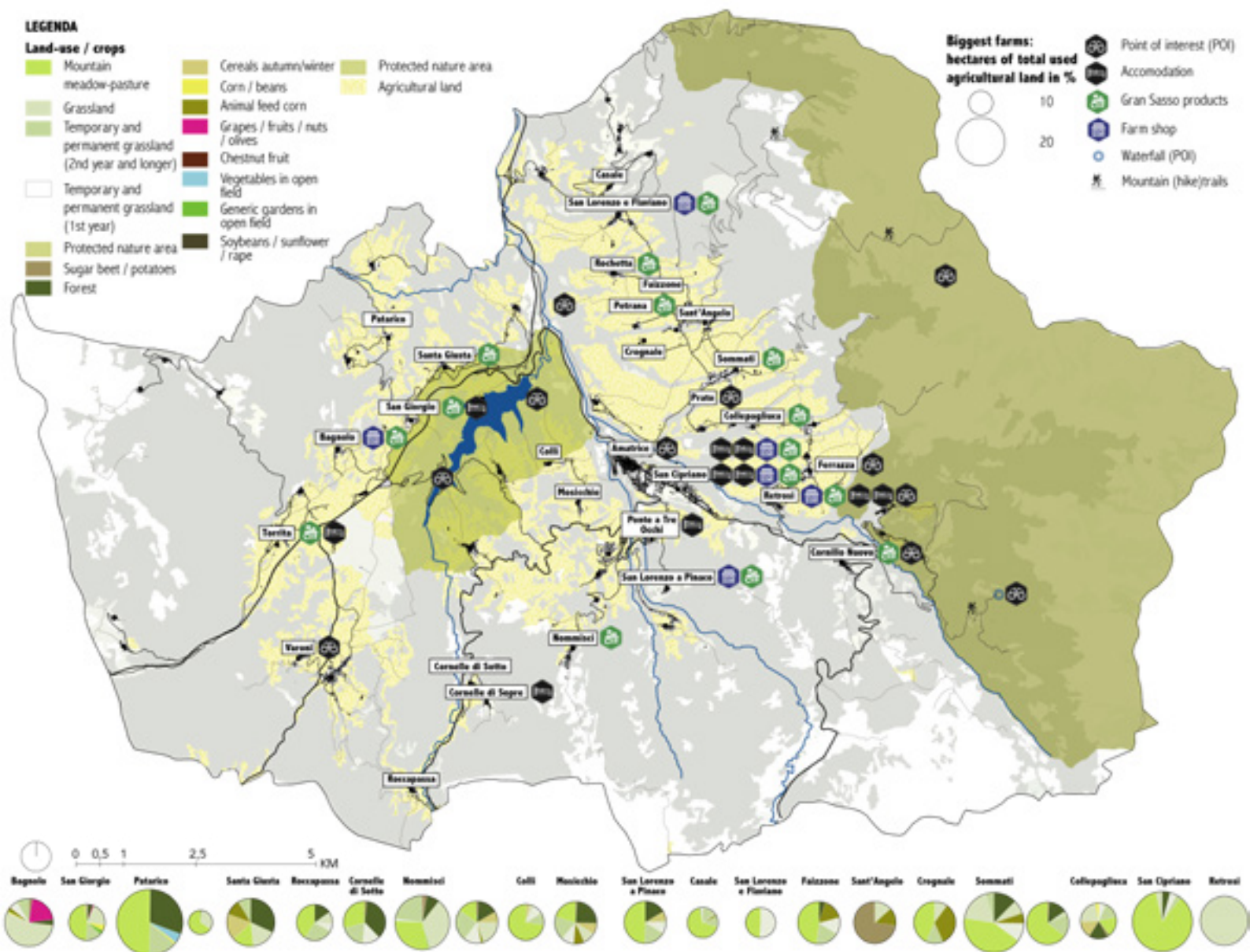


Figure 42 - The economical situation after the earthquake: agriculture and tourism mapped



Figure 43 - Amatrician farmers selling and/or producing products that are sold in a farm shop and/or that are connected with the Gran Sasso Park's network of producers (data retrieved from Ente Parco Nazionale del Gran Sasso e Monti della Laga, 2019)

CONCLUSION OF THE CHAPTER

THE PHYSICAL IMPACT

Although Amatrice has a great amount of settlements and all with different levels of damage, no damage pattern is visible. Almost the entire municipality has stable grounds that are prone to local amplification of the seismic motion. Besides, many zones are prone to instability as result of ground movements, such as slow superficial flows and landslides. The more specific SM maps, comprising the second and third level, present amplification areas with corresponding specific amplification factors of towns investigated. Regarding instability caused by faults, in the east two systems are identified, namely the Gorzano-Laga Fault and the Amatrice Fault System with dominantly normal fault segments, which are potentially active. On the smaller scale of Amatrice town, damage is concentrated in the historic center, FA values vary and some unstable areas are present. However, it is difficult to indicate clear relations, but thinking in terms of risk mitigation, it would be more resilient not to build in areas with high FA values.

THE IMPACT ON EVERYDAY LIFE

Amatrice characterizes itself by a large amount of temporary residents or second homeowners and high vacancy rates. Because of this, only around one fourth of the dwellings is occupied by permanent residents, while three fourth is empty of occupied by non-residents. Currently, the majority has left the area the last one to three years because of the earthquake or other reasons and the rest has left longer than three years ago for work related reasons, according to the outcome of the questionnaire.

After the earthquake, the majority of the permanent residents had to move to 'SAE' cabins, of which 532 have been installed in Amatrice. Besides, many people now live in another settlement than before the earthquake. Amatrice town was, and still is, the center for the municipality since it contains the necessary facilities. However, access to these facilities is rated negatively by many of the questionnaire participants. Another important problem to overcome is people's distrust in the government.

THE ECONOMICAL IMPACT

The economy of Amatrice is mainly driven by the businesses of local food production and the processing of products. The agricultural land is dominantly used as grassland for the use of pastoral farming. Besides, some farmers have secondary activities such as a farm shop or

'agriturismo'. After the August earthquake nine out of ten cattle stables collapsed and farmers were forced to use tunnels to continue their activities.

Besides agriculture and related activities, second homeowners and tourists stimulate the economy. The opening of the Gran Sasso Monti della Laga National Park in 1991 stimulated the tourism industry and currently also contributes to the promotion of local products by a shared network of local producers who offer authentic products. Within the municipality of Amatrice several farmers are connected with the Park's network of producers. However, tourists were also attracted by the historical value of the settlements, which are completely vanished away because of the earthquakes. After the earthquake many initiatives have helped the recovery of Amatrice. Besides, the newly built 'Food Area' has ensured that the tourism and agricultural economy have not been collapsed completely.

7. MUNICIPAL STRATEGY

MUNICIPAL STRATEGY CURRENT MUNICIPAL VISION AND STRATEGY

Since the earthquake of 2016 several municipal councils have alternated until the current council, which acts since the 27th of May this year. According to the current mayor, just after the earthquake the council did not have the strength and the ability to say that resources were preferred to the building of the artifacts themselves. Amatrice was under high pressure because it received most fast emergency solutions from external donators, who broadcasted their gesture on national television. Examples of these donations are the temporary library donated by Amazon, the re-opening of the public park by Land Rover and Jaguar and the school buildings by the municipality of Trentino. According to the mayor, these donations naturally helped the recovery of Amatrice, but also created new issues because a vision was lacking. "The donations in some way took the attention of the 'real' reconstruction ... small and large artifacts, more or less temporary and semi-stable have occupied all areas outside the historic center" (Appendix C).

An example is the donation of a youth center. A group of municipalities in Garfagnana raised money to donate the prefabricated building of 80mq, which resembles a 'SAE' cabin. The former municipal council decided to assign the current 'Don Minozzi' public park for the center. However, the current council wanted to discuss the location because it would occupy a big area of the already-renovated park. Moreover, the fire fighters have a temporary building in this park and should move if the center would be placed here. However, the problem is that many places are occupied already and that strategic functions, such as the fire fighters, are still hosted in temporary buildings, just as the town hall (figure 44). The combination of the dependence on donators, the lacking vision and the occupation of most

of the open spaces outside of the historic center makes that a new landscape of randomness and disintegration is created (Appendix C).

The current new council will maintain a different approach. According to the mayor this is how it goes: "emergency, chaos, planning, rebuilding". He states that the difficulty lies in developing ideas and projects in a way that they can be realized, because all difficulties need to be taken into account. Figure 46 schematically explains the municipal approach, as illustrated by the current mayor (Appendix C). The new council has begun by the commissioning of the reconstruction team. The reconstruction plan will concern the historic center, based on the realized model that is based on the situation of the year 1900 (figure 45), and the peripheral appendices. Regarding the other part of the town the mayor says: "There is all this newer part that has been occupied by various things and for this we will need to think about. So, we have to study this area as well in order to organize because we cannot think of leaving everything as it is as you have seen" (Appendix C).

Settlements that have suffered high levels of damage and contain certain historic and/or landscape value have been listed and appointed to meet certain requirements, so-called 'perimetrazioni' within the determined borders of the towns. Besides Amatrice, forty settlements have been listed, as shown on the map of figure 46. However, thirteen of the rural settlements have issues related to e.g. the soil and geology such as landslide risks, where it would be wise not to rebuild. Furthermore, it is important to rebuild the infrastructure parallel to the rebuilding of the towns, otherwise rebuilt settlements are not connected to the network. The rebuilding phase could start in settlements



Figure 44 - Strategic structures, here the town hall, still hosted in temporary buildings (author's picture)



Figure 45 - A model of the historic center of Amatrice in 1900, exhibited in a temporary building next to the town hall (author's picture)

without requirements, together with the area outside of the historic center where no complicated constraints are present (Appendix C).

Currently the municipality has several priorities. First of all, rebuilding the ‘Alberghiero’ (in English ‘hospitality institute’) as soon as possible because the institute is of great importance for Amatrice. “It attracts many tourists because it expresses the connotation that Amatrice is famous all over the world for cooking and ‘Spaghetti all’Amatriciana’” (Appendix C). Besides this, it is essential to rebuild the hospital. Before the earthquake

the hospital was located just outside the historic center, while now a temporary structure is located at the ‘Don Minozzi’ institute. Also other state buildings such as the ‘carabinieri’, town police and town hall are still hosted in temporary buildings. According to the mayor, these need to be rebuild as soon as possible. Finally, the opening of a reconstruction office, which has all required financing, would give a sign of the official start of the reconstruction. The rebuilding of rural settlements without requirements could start within one year. (Appendix C). Regarding the time management of the entire reconstruction, no clear indication can be made.

WHAT?
RECONSTRUCTION PLAN
> HISTORIC CENTER
- based on 1900 model
> RURAL SETTLEMENTS
- including infrastructure
REBUILDING PRIORITIES:
- 'ALBERGHIERO' (as soon as possible)
- HOSPITAL
- STATE BUILDINGS ('carabinieri' & police)
- RECONSTRUCTION OFFICE (start of reconstruction!)

WHO?
RECONSTRUCTION TEAM
07 / 06 / 2019

WHERE?
START REBUILDING:
- RURAL SETTLEMENTS (without requirements, "perimetrazioni")
- OUTSIDE HISTORIC CENTER (no specific constraints)

WHEN?
- START WITHIN 1 YEAR
- ENTIRE RECONSTRUCTION 1,5 YRS >

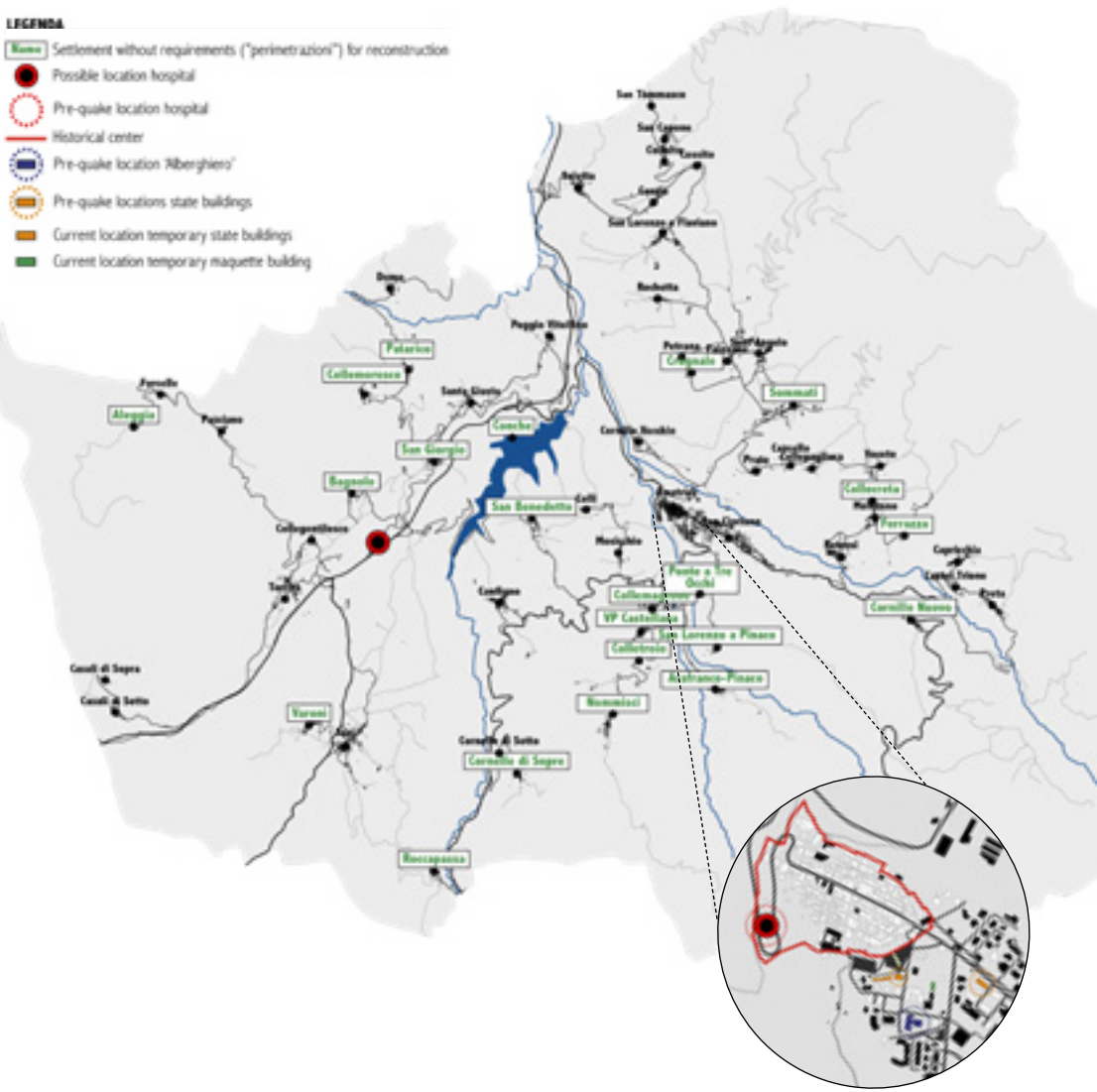


Figure 46 - The current and planned municipal strategy visualized (based on Appendix C)

‘NATIONAL STRATEGY FOR INNER AREAS’

As mentioned in chapter 6, more than three quarter of the residences is vacant or occupied by non-residents. Many people left for good, resulting in vacant buildings, while others remain connected with the area by a second house. This trend of shrinkage is going on for decades. In 1971 Amatrice had a population number of 3696 and in 2011, forty years later, the municipality counted 2646 inhabitants, a loss of 28,4%. Besides depopulation, Amatrice deals with a strong aging population: 20,8% of the inhabitants was 65 years or older in 1971 and 31% in 2011, compared to 23,5% average in the ‘crater’ municipalities (ISTAT, 2016).

The ‘National Strategy for Inner Areas’, in short ‘SNAI’ (in Italian ‘Strategia Nazionale per le Aree Interne) faces the trend of shrinkage and has the main goal of reinforcing the demographic structure of Inner Areas (Barca et al., 2014). Inner Areas are located far from the essential services: education, health and mobility. On the other hand, these areas are rich in environmental resources. Many of the Inner Areas are in a state of degradation since the 1950’s. Here, degradation means population decline in combination with aging, high unemployment rates and undervalued environmental resources, and finally a decline of (essential) services. In post Second World War times, economic growth was concentrated in some specific areas within the country. Two distinctions can be made: economic differences between the macro-regions North, Central and South-Italy, and differences within these macro-regions, mostly between urban areas and the countryside. The focus has long been on the first mentioned macro-regions, and unequal developments on a smaller scale have not been point of discussion (Barca et al., 2014).

* A big hospital is a “Grade 1 emergency care hospitals (DEA)”
** A ‘Silver-type’ railway station “(medium/small systems) includes all the other medium/small systems with an average degree of uptake for metropolitan/regional services and shorter long-distance journeys than GOLD stations”
*** The goals of the ‘SNAI’ are the following:
- Improve the quality of life and wellbeing of local communities
- Increase local employment and work opportunities
- Recover un-valorized natural resources and territorial capital
- Reduce the social cost due to the progressive depopulation trend characterizing these areas
- Strengthen local development factors (Barca et al., 2014, pp.23-24).

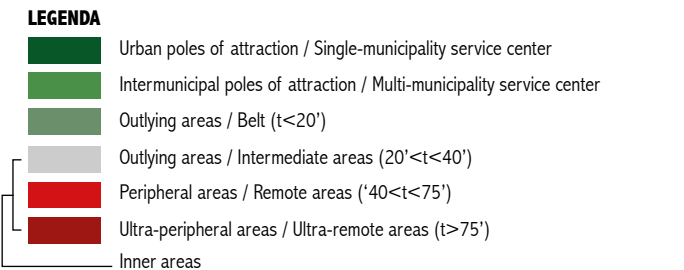


Figure 47 - ‘SNAI’ categories applied to the surrounding municipalities of Amatrice, lowest three belong to ‘Inner Areas’ (data retrieved from Barca et al., 2014).

The ‘SNAI’ subdivides the country in areas based on their travel time to ‘service centers’, which characterize themselves as places containing a great amount of schools, at least a big hospital* and at least a ‘Silver-type’ railway station**. Of these categories, listed in figure 47, the lowest three comprise the Inner Areas. Amatrice falls in the category of ‘Peripheral areas’ with a travel time between 40 and 75 minutes to the ‘service center’. The municipalities and/or cities of L’Aquila and Ascoli Piceno are ‘service centers’ and provide Amatrice with the essential services mentioned before.

The ‘SNAI’ maintains two types of actions to pursue its goals***:
1. Improving the essential service provision in amount and quality
2. Encourage local development projects

The first type of action is a pre-condition for the second since the presence of services strongly influences the willingness of people to live, work and invest in the area. Regarding the first type of action, the essential services of the ‘health’ category carry a contradiction. In terms of efficiency and quality, small health facilities should be closed, but by closing these, Inner Areas degrade even further. The mobility of Inner Areas should be improved to strengthen connections with ‘service centers’ and thus improve the access to essential services. Finally, education is of crucial importance because it is directly related with the current and future demography (Barca et al., 2014).



LIVABILITY ASSESSMENT INDICATORS

In order to develop a municipal strategy that focuses on the current inhabitants and livability, the existing qualities and potentials of the municipality should be investigated. A multi-criteria assessment (MCA) of the livability of all settlements in the municipality is based on indicators that measure the level of ‘quality’ (Appendix K). Many indicators have low scores compared to other ‘crater’ municipalities and especially compared to the national average. However, in line with the concept of ‘smart decline’, the indicators will be assessed relatively from each other. This MCA should naturally not be the only input for defining a municipal strategy, but develops an approach that defines priorities.

The MCA is based on the following indicators: demography, accessibility, basic needs, facilities, tourism and agriculture (Appendix L). Regarding the demography, population numbers and the amount of young people and elderly are taken into account. The accessibility of towns is measured based on the distance to bus stops of the lines ‘Amatrice – L’Aquila’ and ‘Rome – Ascoli Piceno’, in combination with the distance to the state highway and closest regional road. The final indicator of the ‘living’ category is the access of basic needs. For this, the travel time in minutes to the town of Amatrice is calculated because here all basic needs, namely health (‘PASS’), education (schools) and food (e.g. supermarkets), are located. The category of ‘economy’ can be subdivided in the following indicators: facilities, tourism and agriculture. The former consists of the presence of restaurants, cafes and commercial shops. The tourism indicator represents the presence of accommodations and/or points of interest (POI). Finally, the indicator of agriculture represents the agricultural activity, which is based on the presence of ‘big farms’, and partly on the presence of agricultural grounds.



Figure 48 - The outcome of the livability MCA of the category ‘living’ (see also Appendix M)

The outcome of the MCA shows the level of ‘quality’ for the category of ‘living’ (figure 48), as well as for the category of ‘economy’ (figure 49). Combining the two categories, by measuring the average of the two scores (Appendix M), results in the final settlement scores of ‘quality’.

TPOLOGY AREAS

Based on the levels of ‘quality’, as well as on natural landscape characteristics, eleven different typologies of areas can be assigned (figure 50). Facilities are distributed in the area and vary from ones that survived the earthquakes to others that are newly built after the earthquakes. Most facilities are concentrated in Amatrice and San Cipriano, of which some have been discussed already, and others will be discussed in the following chapter. These settlements, ‘the complete center’, serve the municipality in terms of basic needs and facilities, and besides score positive on all other factors.

Towns along the state highway, ‘the accessible strip’, score well mainly because of their accessibility, but could improve if they would be located closer to basic needs. Regarding facilities, a restaurant in Bagnolo, and an ‘agriturismo’ and re-build local bar in Torrita serve the inhabitants of this area.

Settlements on the eastern slope have much agricultural activity and are thus together called ‘farmers’ slope’. The access to basic needs is good, but the settlements mainly lack good accessibility. In the town of Sommati, the third-generation restaurant called ‘La Fattoria’ has been rebuild and serves dishes of own and local production. Settlements near the Scandarello Lake, part of the ‘lake district’, do not have distinct negative scores because of their central location. Ponte a Tre Occhi, ‘at the foot

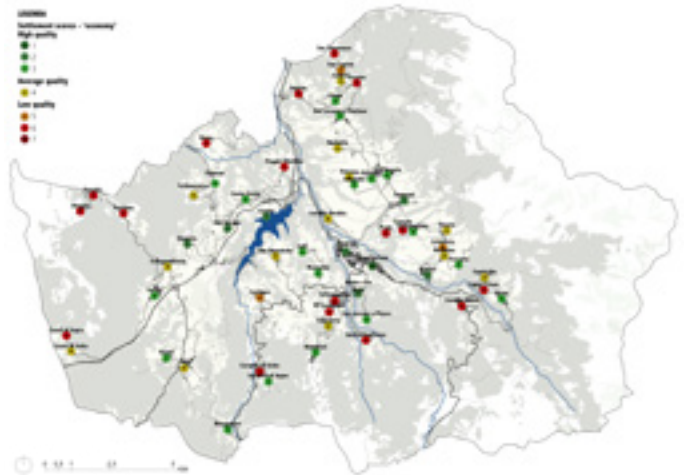


Figure 49 - The outcome of the livability MCA of the category ‘economy’ (see also Appendix M)

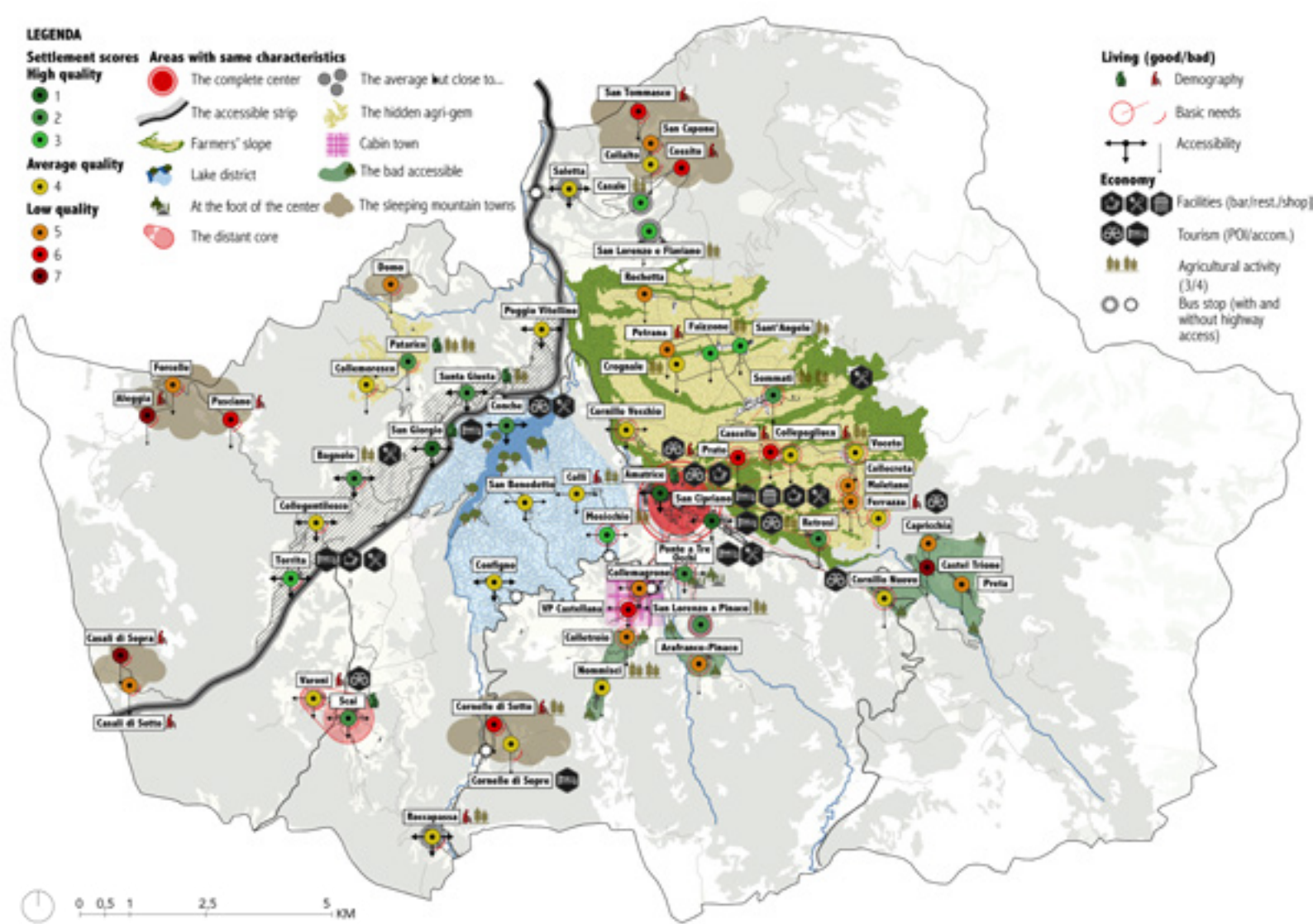


Figure 50 - The outcome of the livability MCA translated into eleven typologies

of the center’, is located close to ‘the complete center’ and scores well for almost all indicators. This settlement together with Conche, part of the former typology, are real ‘visitor hubs’ and contain both a few restaurants. The settlement of Scai is located somewhat isolated in the west next to the settlement of Varoni, together part of ‘the distant core’. Despite its location, the adjacent provincial road makes that the accessibility scores well, but access to basic needs is poor. Several towns are part of the typology ‘the average but close to...’ because the scores are mainly average, except from one indicator which

scores better. For example, Saletta in the north scores well for accessibility because it is located close to a highway access, and San Lorenzo a Pinaco is close to ‘the complete center’ and thus scores well for basic needs. The following typologies distinguish themselves in either a positive or negative way. ‘The hidden agri-gem’ contains some big farms, ‘cabin town’ is located close to Amatrice and has a great amount of ‘SAE’ cabins, and ‘the bad accessible’ are naturally bad accessible. Finally, ‘the sleeping mountains towns’ score very poor for several indicators.

CONCLUSION OF THE CHAPTER

CURRENT MUNICIPAL VISION AND STRATEGY

Since the August earthquake multiple municipal councils have passed. According to the current mayor, the main problem is that many places outside of the historic center are occupied already and that strategic functions are still hosted in temporary buildings. The combination of the dependence on donators, the lacking vision and the occupation of most of the open spaces outside of the historic center makes that a new landscape of randomness and disintegration is created. The new council has started its activities by the commissioning of an official reconstruction team that will work on the reconstruction plan. This plan will concern the historic center, while the ‘newer part’ has to be thought of. The rebuilding phase could start in settlements without requirements, together with the area outside of the historic center where no complicated constraints are present. The municipality has several priorities regarding what to rebuild, namely the ‘Alberghiero’, the hospital, state buildings and a reconstruction office.

‘NATIONAL STRATEGY FOR INNER AREAS’

The ‘SNAI’ faces the trend of shrinkage and approaches ‘Inner Areas’, which are areas located far from the essential services: education, health and mobility. Amatrice is such an ‘Inner Area’ and falls in the category of ‘Peripheral areas’ with a travel time between 40 and 75 minutes to the ‘service center’. The strategy contains two types of actions: (1) improving the essential service provision in amount and quality, and (2) encourage local development projects.

LIVABILITY ASSESSMENT

A multi-criteria assessment (MCA) of the livability of all settlements in the municipality is based on indicators that measure the level of ‘quality’. The MCA is based on the following indicators: demography, accessibility, basic needs, facilities, tourism and agriculture. These can be divided into the categories of ‘living’ and ‘economy’, and together result in an average score: the final settlement scores of ‘quality’. Based on the levels of ‘quality’, as well as on natural landscape characteristics, eleven different typologies of areas can be assigned. These typologies have similar characteristics and could be the basis of an approach that defines priorities.

**8. THE PUBLIC OPEN SPACE OF
AMATRICE TOWN**

THE PUBLIC OPEN SPACE OF AMATRICE TOWN
TOWN LIFE BEFORE AND AFTER

After the earthquake the life of Amatricians has changed completely. Before live was concentrated in the historic center where people went to facilities such as the bakery, pharmacy or local bar for their coffee. Activities were concentrated in the main street ‘Corso Umberto I’ and main square, adjacent to the civic tower. The main street amongst others consisted of shops, restaurants and cafes, municipal buildings and dwellings, some with characteristic private enclosed gardens (figure 55 - zoom S2) that used to be open to the public back in the days.

After the earthquake and aftershocks, the community ended up in a state of emergency and had to act immediately to provide necessary shelter and facilities. The ‘SAE’ cabins were installed at places where it allowed, and the hospital, police offices, town hall and similar strategic structures moved into temporary structures distributed within the town. Later the ‘Food Area’ was introduced in the ultimate east of San Cipriano. Most of the facilities were located in the historic center, before the earthquake destroyed the entire site (figure 51). These shops and other enterprises have been reopened in two newly built commercial centers. After this, a supermarket was built in the same area, on the border of Amatrice and San Cipriano town, along the main street that connects the two towns. The ‘School

Area’ was built next to the ‘Food Area’, where enough space was available for ‘poles’ as these. Because of the devastation of the earthquake and the introduction of new buildings after the earthquake, the urban layout of the town has undergone an incredible transformation. The new areas are mainly realized in former parking spaces and open fields owned by farmers. San Cipriano used to be a town of low building densities and presence of pastures, but has lost this character by the arrival of many new buildings. The historic center was the most densely built area but is totally vanished away. The changed open-closed ratio has naturally affected the views and sightlines. Currently, just east of the historic center there are more views on the mountains then before, while the views on the border of Amatrice and San Cipriano have become restricted. The risks regarding population and building densities are more distributed after the earthquake, but the strong dependence on the main roads, as described in chapter 6, remained.

The historic center, once the liveliest area of the municipality is nowadays a bare plain with only some skeletons of buildings left, without any sign of life. The earthquake destroyed many of the public places that people find valuable according to the outcome of the questionnaire. Figure 52 shows that for example the

valuable churches (figure 55 – zoom N2), main square, cinema and ‘logge’ (a covered arcade underneath the town hall, figure 55 – zoom S1) are all destroyed. However, the civic tower (figure 55 – zoom N1), symbol of the town and currently showing the symbolic time of the earthquake, remained intact. In figure 54, the town is subdivided in areas based on three circles with rays of 100 meters, except from the entrance to the historic center that contains two circles. The map is supported by the section of figure 55, which includes ‘before’ and ‘after’ pictures of the facilities along the main street, and materialization and planting on the detailed map. It is clearly visible that most of the facilities that were in the historic center before the earthquake reopened in the east.

East of the historic center, in the area named ‘the center’, some facilities were already located before the earthquake. Besides a big sports hall that includes a soccer field, this area contains all of the public parks the town counts (figure 55 – zoom N/S3), which are highly valued by the inhabitants: 26% of the questionnaire participants mentioned the parks as valuable places. At the crossing of the main roads a local bar is located that re-opened after the earthquake and serves its visitors and is valued by the inhabitants (figure 52). The police and town hall were moved here and operate

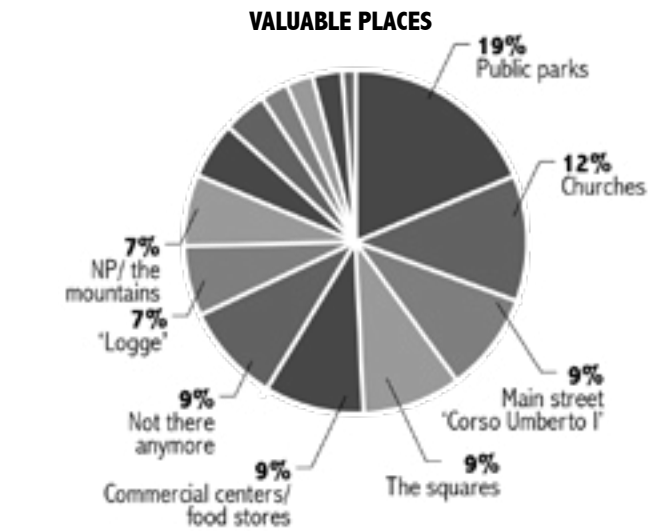


Figure 52 - People's valuable places according to the outcome of the questionnaire (Appendix H)

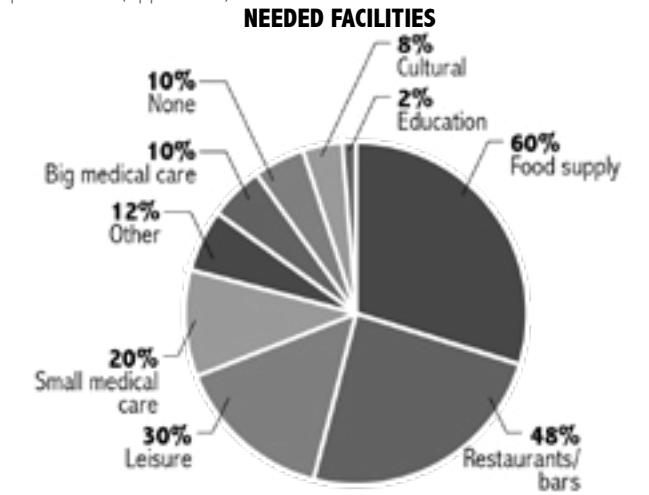


Figure 53 - Needed facilities according to the outcome of the questionnaire (Appendix H)



Figure 51 - The physical impact of the earthquake visualized by ‘survived’, ‘damaged’ and ‘new’ buildings and changed open spaces

in temporary structures. The latter will be rebuild on the same location as the temporary structure. The educational buildings that were present in this area are totally destroyed. The schools have been moved to the new 'School Area' in San Cipriano, but the 'Alberghiero' is still not rebuild. At the location of the school a recreational area is planned.

The area of the 'Don Minozzi' institute is characterized by the building itself because the main road leads parallel and expresses the grandeur of the building. The road is separated by characteristic fences (figure

55 – zoom S4) and contains a sidewalk that acts as belvedere (figure 55 – zooms N4/5) providing a wide view on both the building and the mountains. Currently at and around the terrain of the 'Don Minozzi' institute, many temporary structures are located, namely the church 'Sant'Agostino', the temporary health facility, the so-called 'PASS' (in Italian 'Posto di Assistenza Socio Sanitaria'), and the museum 'Diocesano'. In the future the institute will be transformed into an educational center. Finally, the commercial center 'Il Corso' is located in the area, at the former bus parking space.

Before the earthquake, the area named 'Il Triangolo' characterized itself by an alteration of low-density housing, chambers of meadows and groups of trees and a small historic square including a church (figure 55 – zooms N6/7). The main road had a variety of wide and restricted views, but has become more restricted after the earthquake by the introduction of a new commercial center, named 'Il Triangolo', and a new supermarket.

Finally, the area of 'poles', before only containing an 'agriturismo', currently consists of both the 'Food Area' and the 'School Area'. The restaurants and schools are

mainly moved from the historic center and surroundings to this area. It can be stated that the current everyday life of Amatricians does not resemble to the situation before the earthquake. According to the outcome of the questionnaire, currently there is a need for several facilities (figure 53). Striking is the need for food supply facilities, indicated by 60% of the participants, this is followed by restaurants and bars by 48% and leisure by 30%.

AREAS OF FACILITIES (based on ray 100m)

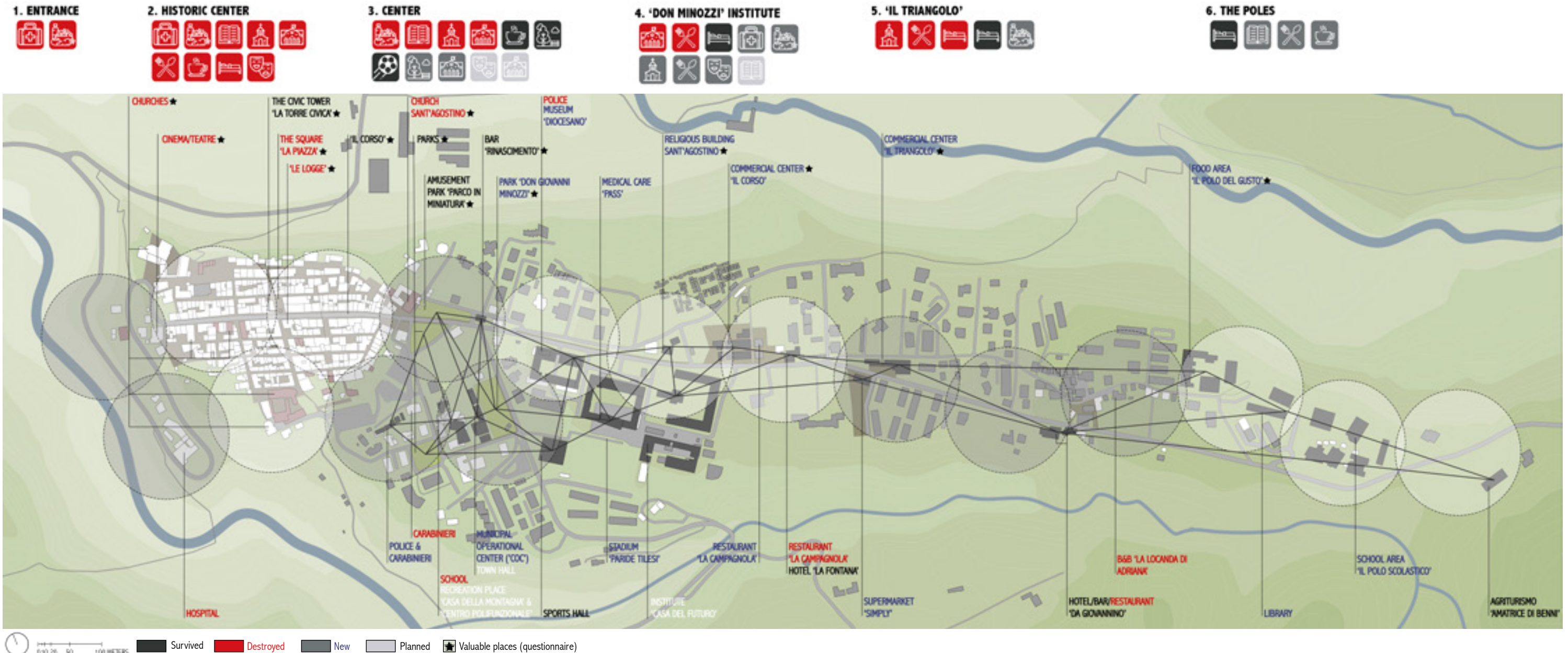


Figure 54 - The town of Amatrice divided in areas, showing 'destroyed', 'survived', 'new' and 'planned' facilities (and people's valuable places)

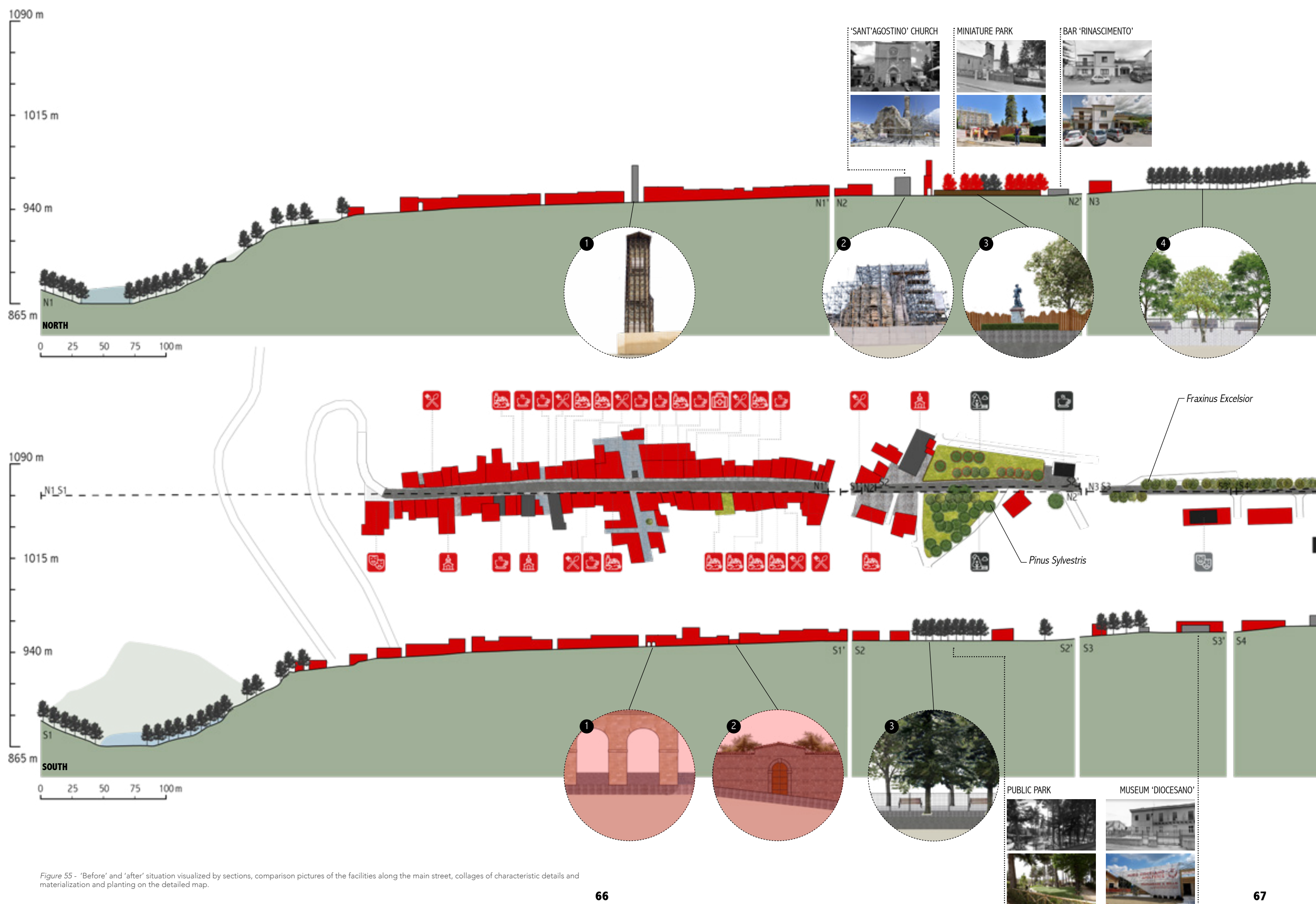
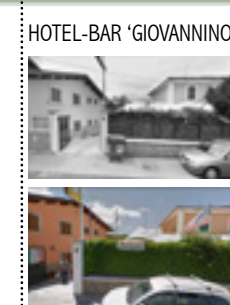
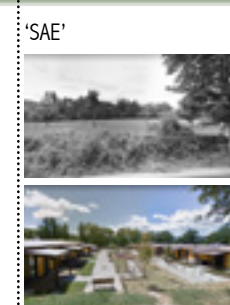
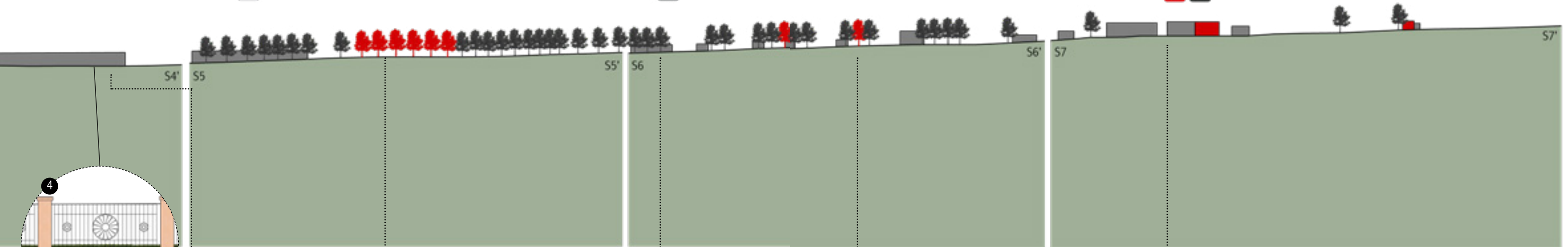
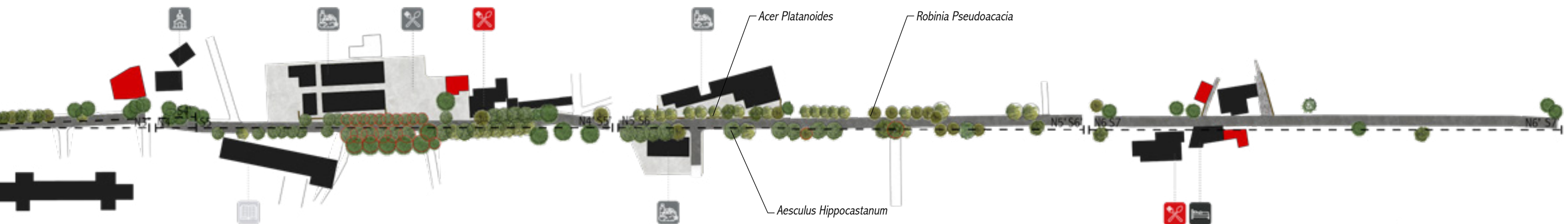
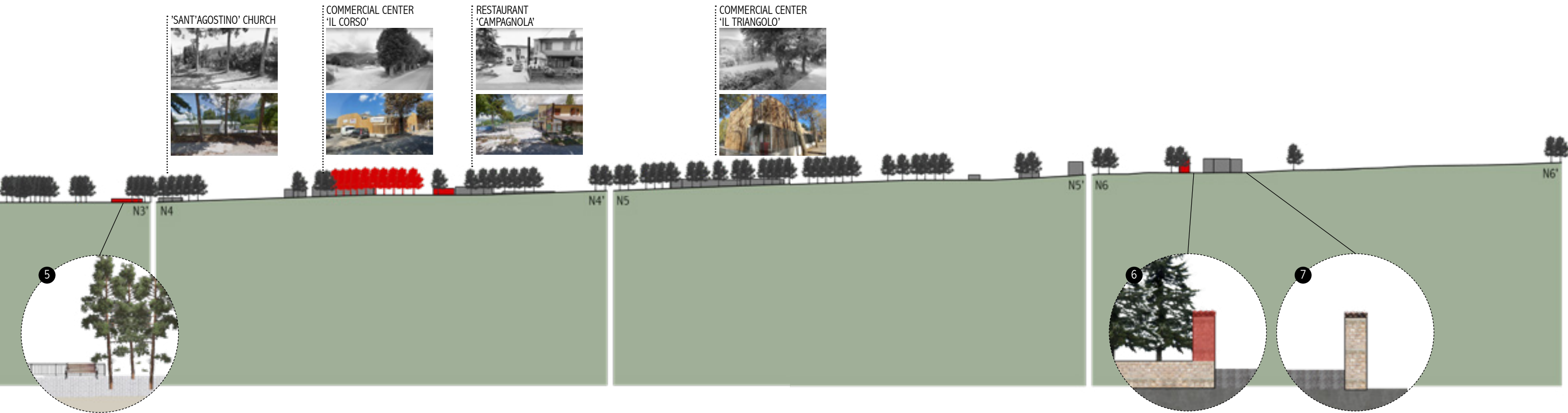


Figure 55 - 'Before' and 'after' situation visualized by sections, comparison pictures of the facilities along the main street, collages of characteristic details and materialization and planting on the detailed map.



FACILITIES DESCRIBED



CHURCHES

Because the earthquake has demolished or heavily damaged all of the valuable churches that were present, the 'Sant'Agostino' church is now located in the temporary building shown by figure 56. This building is located at a crossing somewhat lower than the sidewalk that leads in the direction of the historic center. The gravel space in front of the building mainly acts as parking space for visitors of the church. This is in great contrast with before, where the public open spaces in front of most of the churches acted as meeting ground and place of social activity.



Figure 56 - Temporary building of the 'Sant'Agostino' church (Google, n.d.)



EDUCATION

Schools

The schools, consisting of five grades, were located in the historic center and in 'the center'. Children living in the town could easily walk to school and enjoy their breaks at the square. As Mario Ciaralli states, currently children have to walk almost two kilometers from the core to the 'School Area' (figure 57), also under severe circumstances such as heavy snowfall, which is no exceptional happening in the mountainous area (Appendix D).

Alberghiero

The 'Alberghiero' (figure 58) is an institute where children between fourteen and eighteen are educated in the specialization of hospitality, which prepares them for professions such as chefs and sommeliers. The scholastic institute is highly rated because of its program and collaborations with starred chefs, active participation in competitions and international internships. The earthquake has totally devastated the complex that was located southeast of the historic center and because of that the institute moved to the city of Rieti. As mentioned in chapter 7, one of the four top priorities of the municipality is rebuilding the institute as fast as possible.

House of the Future

Amatrician Don Giovanni Minozzi, born in the settlement of Preta, dedicated himself initially to the poor of the Roman countryside. Later during the First World War, he created a network of Soldier's Houses, which provided the orphaned children suffering from the war with recreational facilities, libraries and schools. One of these Houses was

located in Amatrice (figure 59) and transformed in the 1920s into the National Opera for Southern Italy, a network of orphanages and other institutions (Aniballi, 2017). Many of the lanes disappeared during time and some of the buildings and facilities of the 'Don Minozzi' Institute have been excluded from the institute, such as the soccer field that is taken over by the sports hall and the annexes were used by amongst others the police. The site has an open character and only some trees interrupt the wide fields. Besides, some main sightlines, often in line with the lanes, reach far into the landscape. After the earthquake the site changed into an emergency site with many temporary buildings.



Figure 57 - School Area partly still in construction (ATlproject, 2017)



Figure 58 - 'Alberghiero' institute (Nicola Zingaretti, 2015)

In the summer of 2018, 'Stefano Boeri Architects' has launched the project 'Casa del Futuro' (in English 'House of the Future') that restores and gives new functions to the 'Don Minozzi' complex (figure 60). The project is "designed to be a place of rebirth and innovation offering space to an extensive program of activities dedicated mainly to the young and focused on training and research activities" (ARQA, 2018). The program could attract young people to come or stay in the area, what could help the

recovery of the area. The complex will be divided into four parts and aligned with the civic tower and maintain the historic layout of courtyards and porticoes. The 'House of the Future' will include amongst others areas that tell the story of the complex, museums, and research buildings. "Students" will focus their research on integrated ecology, addressing the themes of sustainability, biodiversity and forestry, and they will stay in the complex to be able to follow courses (ARQA, 2018).

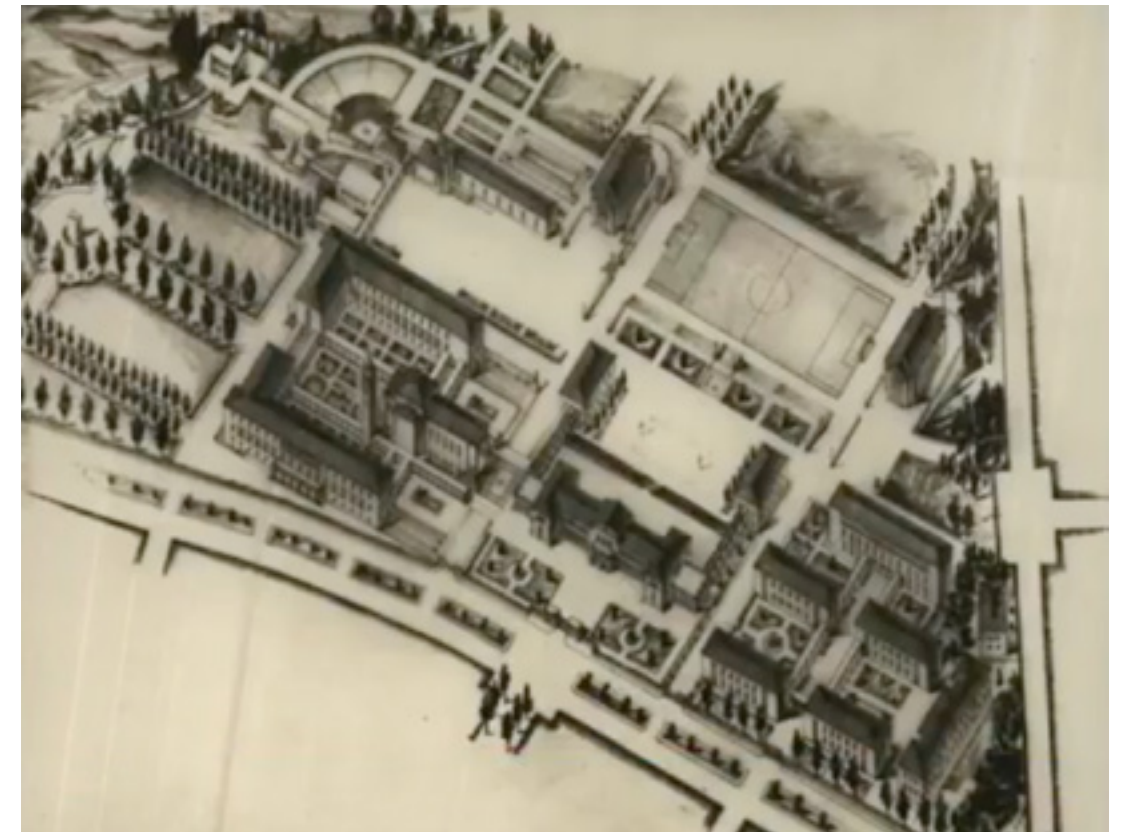


Figure 59 - The 'Don Minozzi' complex as part of the network of Soldier's Houses in the 1920s (arch. Ciaralli, 2019)



Figure 60 - The planned 'House of the Future' designed by Stefano Boeri (Boeri, 2018)

PUBLIC PARKS

In 2010, part of the project “The gates of the Park” (in Italian “Le Porte del Parco”), the miniature park “Parco in Miniatura” officially opened in Amatrice with the aim of representing the Gran Sasso e Monti della Laga National Park. The miniature park was built on the site of a part of the current public park ‘Giardino degli Alberi’ that was not maintained well. Important historic buildings such as the ‘San Francesco’ church are represented in miniature and geomorphological information is provided to understand the area in multiple ways and appreciate the value of the Park (Comune di Amatrice, n.d.). The miniature park gives visitors a wide view on the mountains of the Central

Apennines. The still-existing ‘Giardino degli Alberi’ (figure 63) contains primarily tall pine trees and some chestnut trees along the road. As can be seen by figures 61 and 62, the park has been the green entrance to the historic center for a long time. However, now the park borders on the plain that evokes horrible memories. Another public park is located south of this, named after priest Don Giovanni Minozzi (figure 64). Just after the earthquake the park acted as emergency site, but in 2018 it transformed into a public park again. It gives room to commemorate the earthquake by the presence of memorial statues and artistic works, but is a place for leisure as well.



Figure 61 - The green entrance to the historic center in 1912 (arch. Ciaralli, 2019)



Figure 63 - Revitalized ‘Giardino degli Alberi’ in 2017 (Corriere, 2017)



Figure 62 - The green entrance to the historic center after 1915, when the ‘Giardino degli Alberi’ was opened (arch. Ciaralli, 2019)



Figure 64 - Revitalized ‘Don Minozzi’ park in 2019 (Il Giornale, 2019)

FOOD SUPPLY

Before the earthquake all food supply facilities were located in the historic center and direct surroundings. One supermarket was located at the entrance in the west and the other supermarket in front of the ‘Sant’Agostino’ church, in the east of the historic center. Facilities such as bakeries, butcheries and greengrocers were concentrated mainly in the ‘Corso Umberto I’. The earthquake has devastated all of the food supply facilities.

So, in 2017 the first commercial facilities were reopened, starting with the supermarket (figure 67) and commercial center ‘Il Triangolo’ (figure 65) next to the ‘SAE’ cabins, hosting 28 companies. The same year the commercial center ‘Il Corso’ (figure 66) followed, containing 43 companies that were located along the ‘Corso Umberto I’ street as the name already indicates (Rieti Life, 2017). Although 13% of the questionnaire participants mentioned the commercial area as valuable, in order to realize this new commercial area many necessary interventions have changed the identity of the place entirely. The characteristic ‘bocage landscape’ consisting of pastures enclosed by rows of trees, forests and bushes is hardly recognizable because the ‘chambers’ are closed by new buildings and parts of the green framework are removed. Here chestnut trees mainly enrich the main road and cause an enclosed image. Because the area is not intended for visitors and the use as center, cars are dominant and walkability is limited.

RESTAURANTS/BARS

Before the earthquake, restaurants and cafes were located in the historic center. In other parts of the town, restaurants were mostly present in combination with a pension, hotel or ‘agriturismo’. Currently eight restaurants are concentrated in the ‘Food Area’ (figure 68) of which most were originally located in the historic center. However, for example restaurant ‘Campagnola’ moved to a temporary building next to the original one (figure 69), which is not suitable anymore. Although the restaurant ‘Giovannino’ did not collapse, moving to the new ‘Food Area’ was preferred to restoring the original building. The ‘Food Area’ is like the future ‘House of the Future’ designed by ‘Stefano Boeri Architects’. “A square. A place where to eat local food specialties, by all means. But also a place to meet up, to play and to stay together, in a multifunctional covered space...” (Boeri, 2016).



Figure 65 - Commercial center ‘Il Triangolo’ opened in 2017 (Corriere di Rieti, 2017)



Figure 66 - Commercial center ‘Il Corso’ opened in 2017 (Corriere di Rieti, 2017)



Figure 67 - Supermarket in front of commercial center ‘Il Triangolo’ opened in 2017 (Il Giornale di Rieti, 2017)



Figure 68 - The ‘Food Area’ containing eight restaurants opened in 2017 (Legnolandia built by nature, n.d.)



Figure 69 - The temporary restaurant ‘Campagnola’ (Google, n.d.)



CULTURE

All cultural facilities, such as the library, museums and the theatre and cinema could be found in the historic center. Now, the 'Diocesano' museum is hosted in a temporary building at the former police building, near the 'Don Minozzi' institute. The library is opened in a temporary building (figure 70) in the 'School Area' and no theatre and/or cinema is present anymore. The planned multi-functional center (figure 71) in 'the center' will include a theatre and cinema and will host in the other building the 'Casa della Montagna' (in English 'House of the Mountains') run by the Italian Club of Alpinists (CAI) (ANPAS, 2018).



Figure 70 - The temporary buildings of schools and the library (Rietinvetrina, 2019)



Figure 71 - The planned multi-functional center and 'Casa della Montagne' (Stinghen, 2019)



SPORTS

The sport complex in 'the center', the so-called 'Palazzetto Dello Sport', has survived the earthquake. However, the building and soccer field were used as emergency site. Currently, the function has returned and a new stadium has been introduced (figure 72).



Figure 72 - The renovated soccerfield and stadium next to the 'Palazzetto Dello Sport' (Rinaldi, 2018)



ACCOMMODATIONS

The earthquake has destroyed all accommodations in the historic center and many in the other parts. Nowadays only three accommodations are left in the town. One of them is the 'agriturismo' in the ultimate east. Unlike the restaurant of 'Giovannino', the hotel was not damaged and could still operate until today (figure 73). Finally, also pension 'La Fontana' could continue its activities.



Figure 73 - Hotel 'Giovannino' has survived the earthquake (Google, n.d.)



MEDICAL CARE

Before the earthquake, Amatrice contained a hospital at the western entrance of the historic center (figure 74). Multiple pharmacies were located inside the historic center. After the earthquake none of the health facilities were present anymore. Emergency buildings, including the 'PASS', were initially positioned near Bagnolo, along the state highway, and were later moved. At the 'Don Minozzi' terrain is the so-called 'PASS' located (figure 75) and inside the commercial center 'Il Triangolo' a pharmacy provides medical care to the inhabitants. However, still no new hospital has been rebuild and plans for the future



Figure 74 - The former hospital at the western entrance of the town (Google, n.d.)

are still not concrete. Discussion about the location of the new hospital included both the location along the state highway, where the initial emergency site was located, and the original location. The new hospital is one of the priorities of the current municipal council (Appendix C).



GOVERNMENTAL INSTITUTIONS

Governmental buildings were distributed within the town, but are currently concentrated in 'the center'. All governmental institutions are now situated in temporary buildings. Next to the town hall (figure 76), the fire station is positioned inside the 'Don Minozzi' public park. At the other side of the town hall, the police and 'carabinieri' are located at the other side of the road, and the 'forest rangers'



Figure 76 - The temporary town hall, next to the 'Casa della Montagne' in construction (author's picture)



Figure 75 - The temporary medical care facility called 'PASS' (Il Giornale di Rieti, 2018)

are situated in front of the town hall. Regarding the town hall, again 'Stefano Boeri Architects' has designed the new buildings (figure 77), which will be at the same location, next to the multi-functional center. However, although the current municipal council prioritized new permanent buildings for the other governmental institutions, no plans are realized for these (Appendix C).



Figure 77 - The planned new town hall designed by Stefano Boeri (Boeri, 2018)

CONCLUSION OF THE CHAPTER

The earthquake has had an incredible impact on the life of Amatricians, by totally vanishing away the historic center. The historic center, once the liveliest area of the municipality, consisting of amongst others shops, restaurants and cafes, is nowadays a bare plain with only some skeletons of buildings left, without any sign of life. The facilities have been reopened in newly built commercial centers,

supermarkets, poles and temporary buildings. According to the outcome of the questionnaire, currently there is especially a need for food supply facilities, restaurants and bars and leisure. Many of the public places that people find valuable were destroyed, although new ones were created as well. The introduction of new buildings changed the urban layout of the town completely.

9. THE EARTHQUAKE IN CONTEXT

THE EARTHQUAKE IN CONTEXT SELECTION OF REFERENCES

DESTRUCTIVE POST-WORLD WAR II ITALIAN EARTHQUAKES

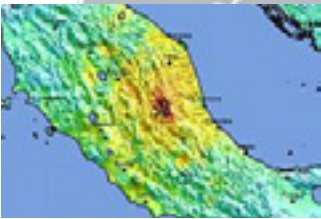
The country of Italy has been shaped by its long and dynamic history of many earthquakes and other natural disasters. All these disasters were followed by reconstruction processes, each with a different approach and outcome, which makes that the country has a great experience in post-quake circumstances. According to Clemente and Salvati (2017) since the Middle Ages more than 4800 post-quake reconstructions have been executed in Italy. Although each disaster is unique and requires customized solutions, this experience should be used in current and future reconstruction processes. Here, Italian earthquakes and associated reconstruction processes of the period after the destructive World War II are investigated. This because since then modern techniques were used and the knowledge regarding

earthquakes increased progressively. In order to make a relevant selection of references, that could inform the reconstruction process of Amatrice, similar characteristics are important. The most important criterion is the level of damage of the historic center. Besides this, preferably the municipality should have multiple settlements, about the same territorial size and amount of inhabitants. However, responses to an earthquake are time-dependent for a great part and Italy has a variety in regions, where amongst others different economic and cultural circumstances are present. Thus the references should represent different time blocks and different macro-regions, north, central and south, within the country. This has resulted in the selection of three municipalities as references, namely: Venzone, Nocera Umbra and L'Aquila. Figure 78 gives an overview of the most destructive earthquakes.

LAZIO, UMBRIA, MARCHE & ABRUZZO - 2016

Amatrice (LA)

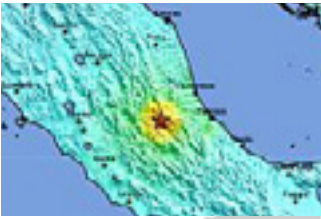
2500 inh. - 69 settlements - 175 km²
HC damage: totally destroyed



ABRUZZO - 2009

L'Aquila

71000 inh. - 67 settlements - 467 km²
HC damage: almost totally destroyed
Fontecchio
440 inh. - 2 settlements - 17 km²
HC damage: intermediate



MOLISE - 2002

San Giuliano di Puglia

1148 inh. - 1 settlement - 42km²
HC damage: local

SICILIA - 1968 & 1978

Gibellina (1968)

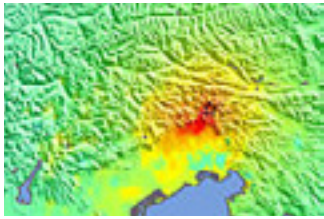
4558 inh. - 4 settlements - 45km²
HC damage: totally destroyed

EMILIA ROMAGNA - 2012

FRIULI-VENEZIA GIULIA - 1976

Venzone

2326 inh. - 12 settlements - 54km²
HC damage: almost totally destroyed
Germona del Friuli
11000 inh. - 7 settlements - 56km²
HC damage: severe



UMBRIA & MARCHE - 1997

Foligno (UM)

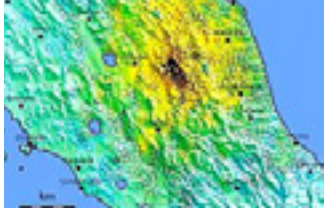
57000 inh. - 82 settlements - 264km²
HC damage: severe

Nocera Umbra (UM)

6130 inh. - 51 settlements - 157km²
HC damage: almost totally destroyed

Serravalle di Chienti (MA)

1162 inh. - 18 settlements - 96km²
HC damage: almost totally destroyed



CAMPANIA & BASILICATA - 1980

Figure 78 - The most destructive post-War II earthquakes

VENZONE, FRIULI-VENEZIA GIULIA - 1976

Although the total Italian population increased between the '50s and '70s, in Upper Friuli, the region where Venzone is located, population numbers decreased by around 22%. A trend of emigration was present and more and more inhabitants used to commute to nearby regions for jobs, mainly in the public and industrial sectors (Hogg, 1980).

In May 1976 the north-east of Italy was confronted by a severe earthquake, which devastated much of the built environment in the region (figure 79). The period after this characterized itself by people living in tents and rapid reconstruction works to ensure a fast return to 'normal'. Many industrial companies already resumed their activities only a few months after the earthquake. However, in September 1976 another earthquake hits the area, destroying all the work that was already carried out and creating even more damage than before. People had to move to touristic apartments in coast towns such as Grado and Lignano, so the reconstruction works would not be disturbed. The relocation of inhabitants to the coast was organized in a way that local communities were placed together and assisted by special delegations. Besides the inhabitants, even doctors, schools (figure 81) and the town hall moved there. Direct bus connections made possible that people who still worked in the area of origin could easily travel there. While people living at the coast tried to move things forward, at the devastated site more and more temporary buildings occurred (figure 80) (Baiutti, 2016).

In the spring of 1977 the finishing of the temporary towns ensured the return of inhabitants to their hometown. After the relocation of inhabitants to temporary dwellings, the approach of the reconstruction is discussed. Two



Figure 79 - Devastation after the earthquake of Venzone in 1976 (Nembri, 2016)



Figure 80 - Temporary buildings after the earthquake (Miani, 2017)

key principles of the reconstruction were defined: (1) 'where it was, as it was' and (2) first the factories, then the dwellings and finally the churches. Within a year factories and industrial companies are reconstructed and innovated at the same time. After a year the employment levels were the same as before the earthquake and in 1978 these were already exceeded. In these first years also the University of Udine is established and a new highway and railway are built in order to foster the economic development (Baiutti, 2016).

Regarding the town's reconstruction, the community is involved by public meetings and municipal offices, which are open to public and become the platform of the reconstruction. Each local community has their own administrator where discussions about the future of their neighborhood are held. The proximity of the temporary towns and reconstruction sites stimulated the public discussion and involvement. This public dimension characterizes the 'Friuli-model' of reconstruction. In order to define concrete interventions, a detailed plan of the town divided in sections, including a 'before' and 'after'



Figure 81 - Schoolbuses at the coast towns (Archivio Rcs, n.d.)

situation (figures 82 and 83), acts as communication tool. The reconstruction map does not include the areas outside of the city walls, which shows that the reconstruction is focused on the historic center (Baiutti, 2016).

As mentioned, the historic center of Venzone is rebuilt by the model 'where it was, as it was', which implies conservative restoration of existing building structures. Venzone is rebuilt by the use of original stones, which were collected for each individual building (figure 84). Because seismic engineering is still at its start in the '70s, many tests are executed, new construction methods are investigated and micro-zonation studies are done for the first time in history. Most of the reconstruction of dwellings and municipal facilities was finished within a decade after the earthquake, but the reconstruction was officially finished in 1990 (Baiutti, 2016).

In 2017 Venzone is listed as the most beautiful Italian village and wins the competition because of its exceptional post-earthquake recovery (figure 85). Today, people can observe the reconstruction of the Medieval town and explore its story in the museum 'Tiere Motus'. The region even opened an academy (SERM Academy) in collaboration with the University of Udine, which specializes in seismic studies (Baiutti, 2016).



Figure 82 - Venzone before the earthquake (Camiz, 2012)



Figure 84 - Organizing the original stones of the 'Duomo di Venzone' (Pellizzari, 2016)



Figure 85 - Venzone in these days. (10Cose, n.d.)



Figure 83 - A detailed plan of the town divided in sections for the reconstruction (Camiz, 2012)

NOCERA UMBRA, UMBRIA - 1997

In September 1997, after several earlier earthquakes, a devastating earthquake hit the region of Umbria, causing the highest levels of damage in the municipalities of Foligno and Nocera Umbra. Here, around 85% of all buildings was declared as unusable. The landscape of Nocera Umbra has a linear character because of its location in a valley, with its historic center at an iconic location on top of a hill. After the earthquake, during the emergency phase, the entire historic center was closed for public. An emergency area, containing the necessary facilities and shelter, was installed, west of the historic center (figure 86). However, also after the emergency phase the historic center remained closed, in total more than a decade. Partly because of this, many people left behind the area and did not turn back (Šćitaroci et al., 2019).

Pizzo et al. (2013) has developed a method for the reduction of urban vulnerability, that can be used as planning tool for seismic risk prevention at the urban scale. ‘Strategic’ elements of the urban structure are identified, based on for example their prevention from seismic risks or role in the post-quake emergency phase. Together they create a system: the Strategic Urban Structure (from now on SUM, in Italian ‘Struttura Urbana Minima’). Nocera Umbra is one of the studied cases and its SUM has been identified for different periods in time (figure 90). As figure 90.2 shows, the “concentration of functions and public spaces within the historical centre” (Pizzo et al., 2013, p.27) is the main criticality of the SUM before the earthquake. By the closing of the historic center, all facilities and activities moved outside the center, some in temporary buildings and

others in more permanent structures. After some years temporary residences were built at several dedicated areas, and facilities moved north-east where currently still many of these are located (figure 87). In 2014 the historic center opened again (figure 88), which was reconstructed by the model ‘where it was, as it was’. However, many buildings remained empty and a great part of the facilities stayed in the ‘new’ structures. Two years later, in 2016, the reconstruction was officially completed by the introduction of new permanent schools (figure 89), which were hosted in temporary structures until then and seem not to be prioritized in the reconstruction process. The reconstruction efforts were rewarded after the earthquakes of 2016, which have not demolished one of the buildings in the town (Alvaro, 2016).

Out-migration has caused that currently more than fifty percent of the town is still empty (Šćitaroci et al., 2019). According to Giovanni Bontempi (Alvaro, 2016), mayor of Nocera Umbra since 2011, revitalizing the historic center is the main challenge of today. Introducing new functions such as galleries, museums and theatres should attract young couples and foreigners to come live in the town. According to the mayor the revitalization could make the town well-known again



Figure 86 - Emergency area outside of the historic center of Nocera Umbra (Osservatorio Ricostruzione, n.d.)



Figure 88 - Nocera Umbra in these days (I Luoghi del Silenzio, 2017)



Figure 87 - Temporary dwellings and facilities outside historic center (Osservatorio Ricostruzione, n.d.)



Figure 89 - New constructed school at the foot of the historic center (Google, n.d.)



1. SUM before the earthquake (Pizzo et al., 2013)



3. SUM just after the earthquake in 1997 (Pizzo et al., 2013)



2. Potential critical elements of the SUM before the earthquake (Pizzo et al., 2013)



4. SUM after the earthquake between 1997 and 2002 (Pizzo et al., 2013)

L'AQUILA, ABRUZZO - 2009

L'Aquila is a medium-size city located in the region of Abruzzo in the south of Italy. On 6 April 2009 a severe earthquake hit the region with its epicenter in Poggio del Roio, only a few kilometers from the city of L'Aquila. Before the earthquake, the economy was driven by small enterprises and shops and depended on large companies located in the countryside. On national level the city did not play a great role, amongst others because of its little industrial sector. Because of the earthquake, which mainly hit the historic center, the economic activities that were present could not function anymore (Alexander, 2018).

Only a few weeks later it was decided that nineteen designated areas spread over the territory, of which only one was located in L'Aquila, would turn into 'new towns' (figure 91). These areas would receive thousands of homeless people in earthquake resistant and environmental friendly units, so-called C.A.S.E. (in Italian 'Complessi Anti-sismici Sostenibili ed Ecocompatibili') and temporary housing units, part of the M.A.P. project (in Italian 'Moduli Abitativi Provvisori'). The C.A.S.E. were earthquake resistant because of the implementation of seismic isolation under the basement of the blocks (Contreras, 2016).



Figure 91 - New towns built after the earthquake of 2009 in L'Aquila (Valent, 2014)

Because of the fast housing solutions, mass out-migration has been prevented (Alexander, 2018). However, the inhabitants were placed in the new dwellings without taking into account mutual relations (Alexander, 2013). Besides, the conditions of the dwellings were questionable. At first no wastewater treatment was present, there was a lack of basic services and urban facilities and the new towns were isolated because of their location and bad connectivity (figure 93) (Contreras, 2016; Contreras et al., 2013). Contreras et al. (2013) have investigated the connectivity of the new towns and found out that "there is a strong

correlation between the dissatisfaction among people who relocated to new settlements and the distance and travel time to central L'Aquila" (Contreras, 2016, pp.288-289). A part even decided to leave the area behind for this reason. During time it more and more seemed that the temporary houses became permanent solutions (Contreras et al., 2017).

Although the construction industry sector received a boost after the earthquake, the sectors L'Aquila relied on before the earthquake failed to revive. The few shops and restaurants that opened, closed again in 2014, likely because of safety reasons regarding the construction works (Contreras, 2016). This wrong signal of life turning back to normal has contributed even more to the later out-migration.

The approach of reconstruction included several aims (Giovanni, 2016, p.122):

- 1) identification of 'Homogeneous Areas' (HAs) for strategic sectors of interventions
- 2) restoration of natural and historical networks
- 3) improvement of regional and local mobility networks
- 4) diffusion, capillarity and efficiency of infrastructures and services



Figure 92 - The temporary unions ('HA': Homogeneous Areas), all with their leading municipalities, would be the basis of the reconstruction process (Giovanni, 2016)

The temporary unions ('HAs'), were seen as 'optimal entities' for the reconstruction and all had a leading municipality (figure 92). The municipalities within the 'HAs' had to collaborate and support each other in the entire process. However, difficulties arose because some municipalities went faster in the process than others and some municipalities even switched 'HAs' (Giovanni, 2016). Because L'Aquila did not have a crucial role in the national economy and because of the nearby earthquakes of 2016, the reconstruction process delayed constantly (figures 94 – 96). The historic center was reconstructed according the



Figure 93 - The C.A.S.E. fast housing solution located in isolated 'new towns' (Studio Calvi, 2009)



Figure 94 - Reconstruction works in the historic center of L'Aquila (1) (Guerrieri, 2019)

model 'where it was, as it was' and according to (Contreras, 2016) in 2016 major steps had been made regarding reconstruction activities here. Besides, the housing conditions improved because of new bus stops and the introduction of new facilities. Just as in the case of Nocera Umbra, the earthquakes of 2016 have shown that the reconstruction is on the right track regarding earthquake resistance since all buildings survived the shocks.



Figure 95 - Reconstruction works in the historic center of L'Aquila (2) (Agenzia di Stampa Nazionale, 2018)



Figure 96 - Reconstruction works in the historic center of L'Aquila (3) (Agenzia di Stampa Nazionale, 2018)

CONCLUSION OF THE CHAPTER

Italy has had to deal with earthquakes and following reconstruction processes frequently, all with its unique approach and outcome. Because of this, the country has built great experience, which can be learned from. Three references have been selected, namely: Venzone, Nocera Umbra and L'Aquila.

VENZONE

The reconstruction process characterizes itself by the relocation of people to touristic apartments in coast towns so that on-site rebuilding was not disturbed. Local communities were placed together and facilities such as doctors, schools and the town hall were also relocated. People were relocated again after all temporary buildings were finished, nearby the devastated site.

Two key principles of the reconstruction were defined: (1) 'where it was, as it was' and (2) first the factories, then the dwellings and finally the churches. Within a year factories and industrial companies are reconstructed and innovated at the same time. The involvement of inhabitants in the reconstruction process characterizes the 'Friuli-model'. Buildings in the historic center were rebuilt stone for stone. Most of the reconstruction of dwellings and municipal facilities was finished within a decade after the earthquake, but the reconstruction was officially finished in 1990. In 2017 Venzone was listed as the most beautiful Italian village because of its admirable post-quake recovery.

NOCERA UMBRA

After the earthquake, the entire historic center was closed for public and an emergency area was installed downhill. The historic center closed in total more than a decade, which partly is the reason why many people left behind the area and did not turn back.

Investigating the Strategic Urban Structure (SUM) of Nocera Umbra shows that the "concentration of functions and public spaces within the historical centre" (Pizzo et al., 2013, p.27) was the main criticality before the earthquake. In 2014 the historic center opened, reconstructed by the model 'where it was, as it was'. However, many buildings remained empty and a great part of the facilities stayed in the 'new' structures. Two years later,

in 2016, the reconstruction was officially completed by the introduction of new permanent schools, which were hosted in temporary structures until then and seem not to be prioritized in the reconstruction process. However, the reconstruction efforts were rewarded after the earthquakes of 2016, which have not demolished one building in the town. Out-migration has caused that currently more than fifty percent of the town is still empty (Šćitaroci et al., 2019).

L'AQUILA

Only a few weeks after the earthquake, it was decided to build nineteen 'new towns' comprising the so-called C.A.S.E. and temporary housing units, part of the M.A.P. project. Because of the fast housing solutions, mass out-migration has been prevented (Alexander, 2018). However, the inhabitants were randomly placed in the new dwellings (D. Alexander, 2013) and the conditions of the dwellings were questionable. There was a lack of basic services and urban facilities and the new towns were isolated because of their location and bad connectivity (Contreras, 2016; Contreras et al., 2013).

The reconstruction was organized in temporary unions of municipalities, so-called 'HAs'. However, difficulties arose because some municipalities went faster in the process than others and some municipalities even switched 'HAs' (Giovanni, 2016). Although out-migration was prevented at first, later out-migration increased because of bad living conditions, time, and wrong signals of life turning back.

The historic center was reconstructed according the model 'where it was, as it was' and according to Contreras (2016) in 2016 major steps had been made regarding reconstruction activities here. Besides, the housing conditions improved and the earthquakes of 2016 have shown that the reconstruction is on the right track regarding earthquake resistance since all buildings survived the shocks.

10. DESIGN PRINCIPLES

DESIGN PRINCIPLES

Supported by the previous analysis chapters, several design principles can be listed and related to the theoretical framework of chapter 2. Although the principles overlap and could be placed at more than one concept, the scheme of figure 97 clearly shows the general relations and differences between 'time' and 'deliberation'.

VULNERABLE BASIS AND THE HAZARD

Because the pre-quake vulnerability is mainly determined by ongoing demographic decline and economic stagnation, it is important for the future, and thus the strategy, essential services are improved or introduced. This is related with the 'nodes of quality': towns that are designated because of their relative quality, but are subjected to the trend as well. Besides the pre-quake vulnerability, the strategy naturally has to deal with the consequences of the earthquake. The first two design principles concerning the 'earthquake safety' cover the suitability of the location by excluding unstable areas and potentially active fault zones and by prioritizing areas with low FA values. Because an earthquake has less impact when functions are distributed, 'risk', including e.g. strategic functions such as hospitals, and 'safety', meaning e.g. open spaces such as parks, should be distributed within the territory. Furthermore, places of 'safety' should be flexible to use and diverse, for example parks should have different sizes. Finally, the connectivity and permeability are important and should make it possible for functions or modules to fall without blocking 'the system'. The design principles related to the hazard are linked with the deliberation part of disaster recovery because the aim of these is to 'build back better'. Since a combination of the vulnerable basis and hazard create the disaster landscape, responding to these is seen here as the basis of a disaster recovery approach.

TIME

Disaster recovery is approached here as a combination of time and deliberation, and thus should include factors of efficiency as well as factors to 'build back better'. Regarding time, the concept of 'smart decline' is supportive since it focuses on the organization of the quality already present. By focusing on nodes of quality, forces are joined, input can be concentrated and thus time is saved. A further downscaling of what to rebuild, so for example which towns and what parts within the

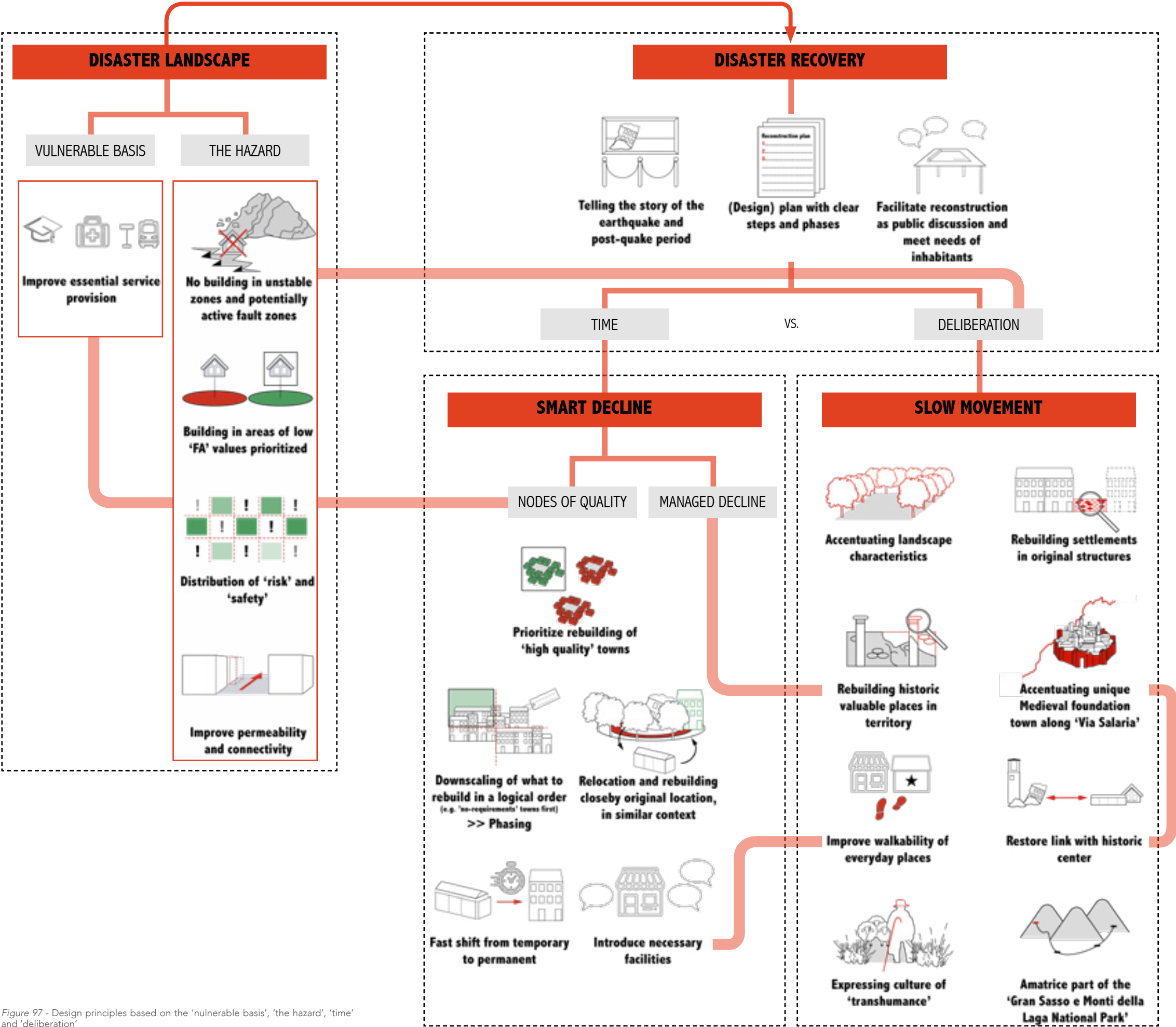


Figure 97 - Design principles based on the 'vulnerable basis', 'the hazard', 'time' and 'deliberation'

towns, and in what order makes that resources are used in the most efficient way. In order to overcome the current problems that are related with the temporary situation, it is important to shift fast from the temporary to permanent buildings. However, many of the temporary buildings are placed in totally different contexts outside or within outskirts of the nodes of quality. Relocation should thus be executed to the nodes of quality and buildings should be rebuilt, if possible, close to the original location and in similar context. Finally, besides the already-mentioned essential services, necessary facilities should be introduced because many of these are in temporary buildings or have not returned after the earthquake.

DELIBERATION

Besides fast interventions that aim to solve problems quickly, the earthquake should also be used as a moment of reflection after which another direction could be taken with the aim of 'building back better' and preventing the creation of 'non-places'. The disaster landscape should protect its identity and prevent interventions of total randomness. The 'slow movement' concept supports the deliberation part of disaster recovery by highlighting the local qualities and aiming for site-specific interventions. First of all, the interventions should accentuate the landscape characteristics, such as the chamber landscape or green valley. Besides, the rebuilding of settlements should be done in their original structure, for example the linear village, and should strengthen characteristics such as historic walls. Historic valuable places should be rebuild, also if these are located outside of the nodes of quality. The most historic valuable place was the historic center of Amatrice town amongst others because of its Medieval wall system and gates, towers and street pattern. The historic center should be rebuild, disregard the way of rebuilding, and linked to the current used 'newer part'. Because the majority of the everyday facilities had to reopen outside of the historic center, where the urban design is not designed for these purposes, the walkability should be improved for convenient everyday use of the public open space. Amatrice has a strong local culture and identity because of its 'transhumance' history. The physical landscape, of hilly meadows and small settlements, is the basis of the 'transhumance' and the rich food culture is translated into for example local specialties, initiatives and projects and a famous hospitality school. On the bigger

scale of the 'Gran Sasso e Monti della Laga National Park' some of the farmers are linked to a food network. Using this bigger network in combination with a local 'food experience' network could help promoting the area and attract tourists again.

In general, the disaster recovery plan should include clear steps and phases to foster an efficient and natural process. Besides, the entire process should be open to inhabitants and public discussion should be facilitated. Thinking in long-term future plans, the story of the earthquake and post-quake period could be presented in e.g. a museum to inform visitors about the background of the place and other reconstruction processes.

11. MUNICIPAL DESIGN

MUNICIPAL DESIGN ORGANIZATION

As discussed in chapter 7, the multi-criteria livability assessment is based on the following indicators: demography, accessibility, basic needs, facilities, tourism and agriculture. The outcome of the livability assessment mainly determines which settlements are best suitable for rebuilding, although the outcome of the earthquake-related study, to e.g. ground stability, should be taken into account here as well. A schematic overview of the strategy and followed steps is shown by figure 99.

REBUILDING?

In principle, settlements of low quality are questionable to rebuild, and are thus more suitable to relocate, while settlements of average or high quality are preferred to rebuild. However, the outcome of the earthquake-related study makes that some of the towns of average and high quality are excepted from this, and rebuilding becomes questionable (figure 97). The towns of Voceto, San Lorenzo a Pinaco, Faizzone, Sant'Angelo and Sommati have FA values of 1,9 or higher. Because the last three towns all have high quality levels and no relocation

possibilities, the surrounding area will be investigated for stable grounds. Voceto and San Lorenzo a Pinaco do have these possibilities, which makes rebuilding questionable here. This is also the case for the towns of Roccapassa, Varoni and Patarico, which contain unstable zones within the built environment of the town. Although quality levels are average or high, rebuilding is questionable here. Finally, The towns of Collalto and Cornelle di Sopre are vulnerable because the access roads go through fault zones or unstable areas, which makes rebuilding here questionable as well.

RELOCATION

Besides the indication of which towns should be prioritized or questioned regarding rebuilding, the location of where the towns could be relocated to should be taken into account. The location is based on several criteria, starting with the criterion that relocation should be within the same typology. As discussed in chapter 7, a combination of the quality levels of the towns and the natural landscape characteristics is the basis of eleven different typologies of

areas. An example is 'the accessible strip', including towns along the state highway that score well mainly because of their accessibility, but could improve if they would be closer to basic needs. If the rebuilding of towns within this typology is questionable and relocation is preferred, this should be executed within the typology. However, for example 'the average but close to...' typology consists of multiple small areas, here relocation should remain within the 'sub-typology'. If this is both not possible, because for example all other towns within the (sub-) typology have a low quality, relocation should be as close as possible to the original location in order to maintain social relations and prevent feelings of alienation.

Since both Collemagrone and Villaggio Poggio Castellana contain a great amount of people living in 'SAE' cabins, who lived mainly in Amatrice town, relocation is preferred back to the town where they come from. Besides, San Lorenzo a Pinaco could relocate best to Mosicchio because the nearby town of Ponte a Tre Occhi is not an inhabited place, but 'bungalow park'. Finally, Cornelle

di Sotto and Cornelle di Sopre could better relocate to Configno instead of to Nommisci because there other towns already possibly relocate to. Figure 98 shows the relocation model.

PHASING

Regarding the towns where rebuilding is preferred because of strategic reasons, organization in phases is of crucial importance. This because it is not efficient to start rebuilding more than twenty settlements distributed within the territory at the same time. Rebuilding is a matter of meeting current needs while anticipating on changes during the process. By rebuilding in phases, after each phase it is possible to reflect, revise and prepare for the next phase. Regarding the relocation of households (figure 98), only the numbers of 'SAE' are mentioned because data of households still living in the towns in other types of dwellings is lacking. Thus, the numbers provide an indication of the minimum amount of households that could relocate.

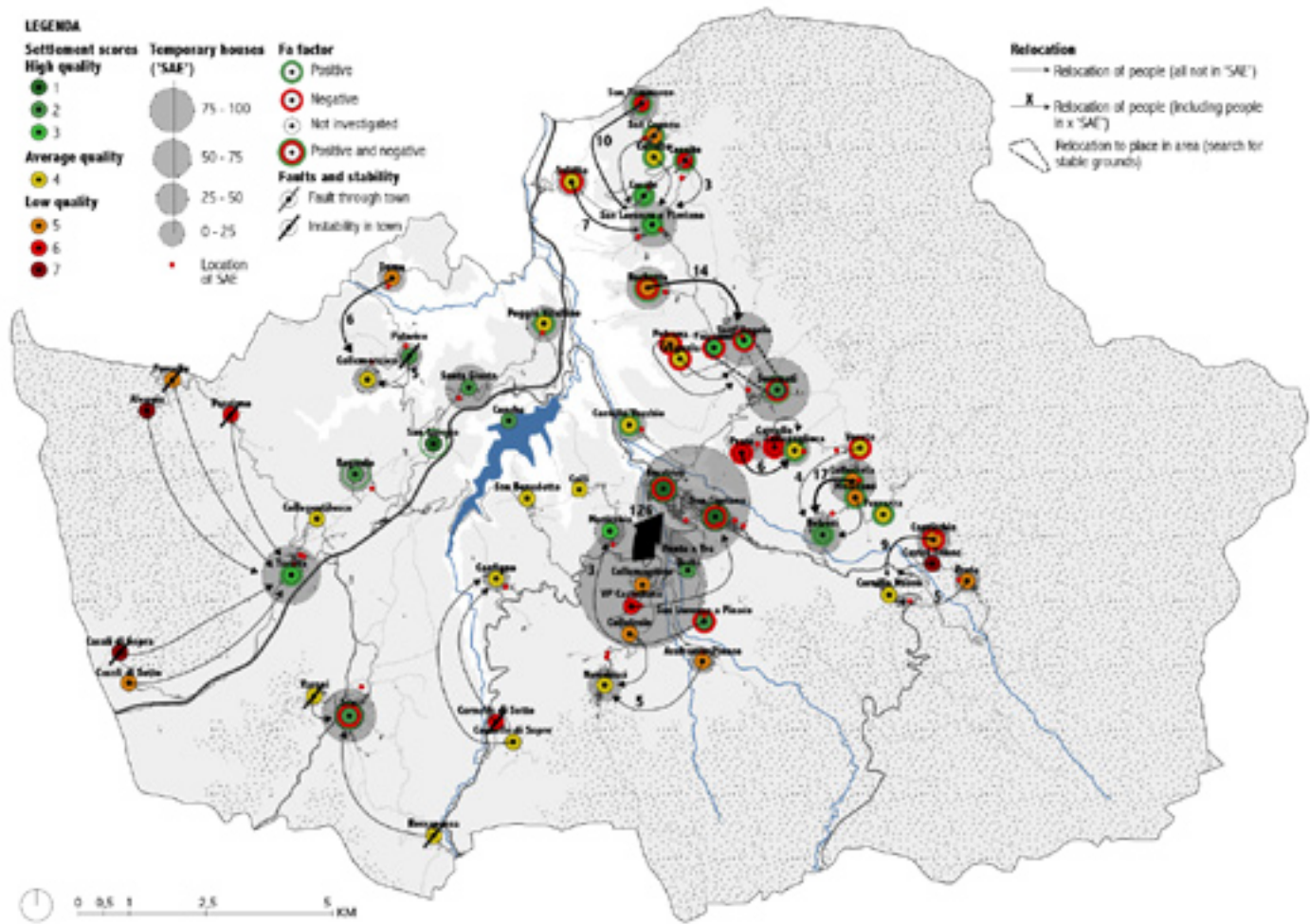


Figure 98 - Outcome of the livability MCA and earthquake-related study as basis of the municipal design

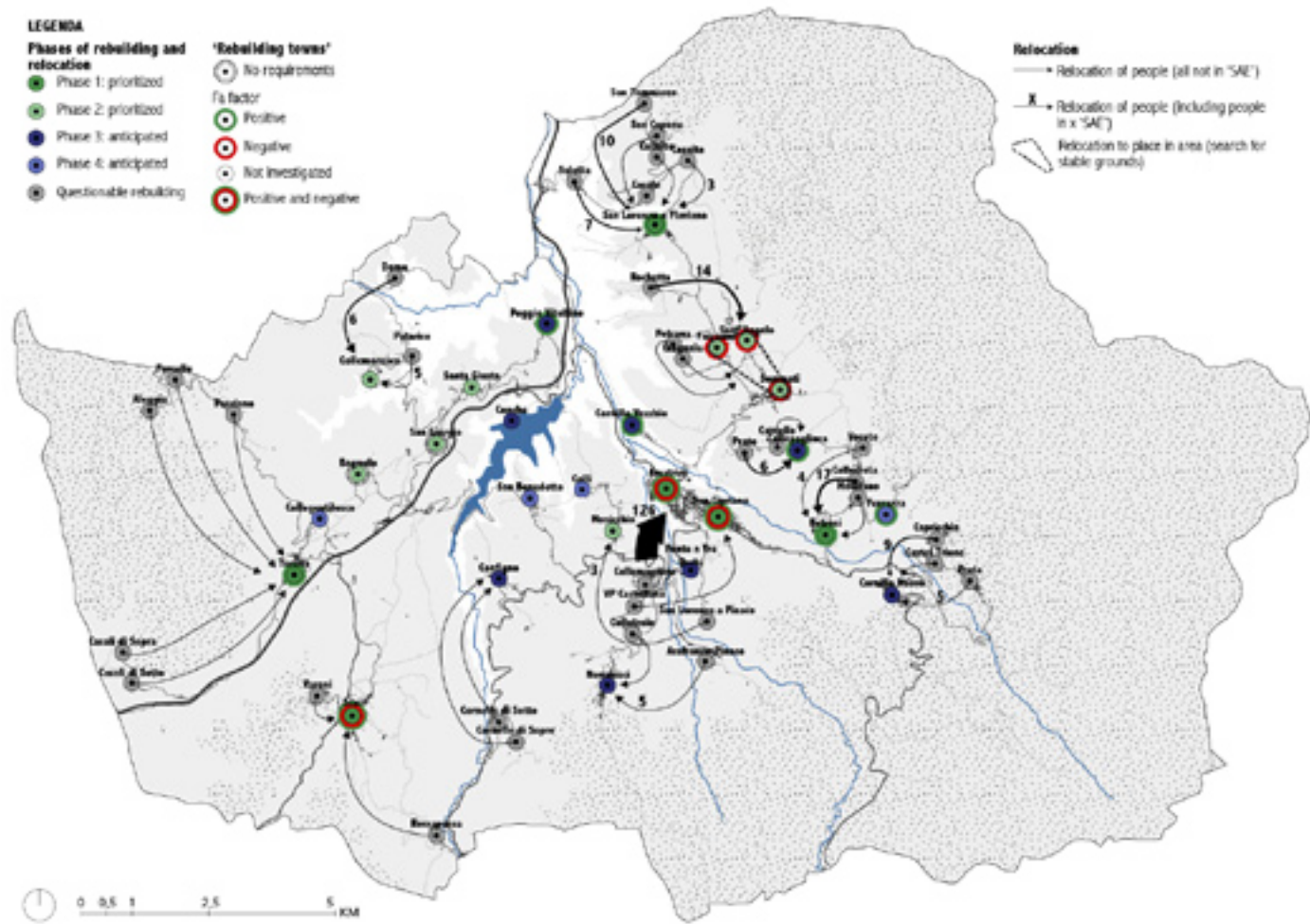


Figure 99 - The relocation model of the municipal design

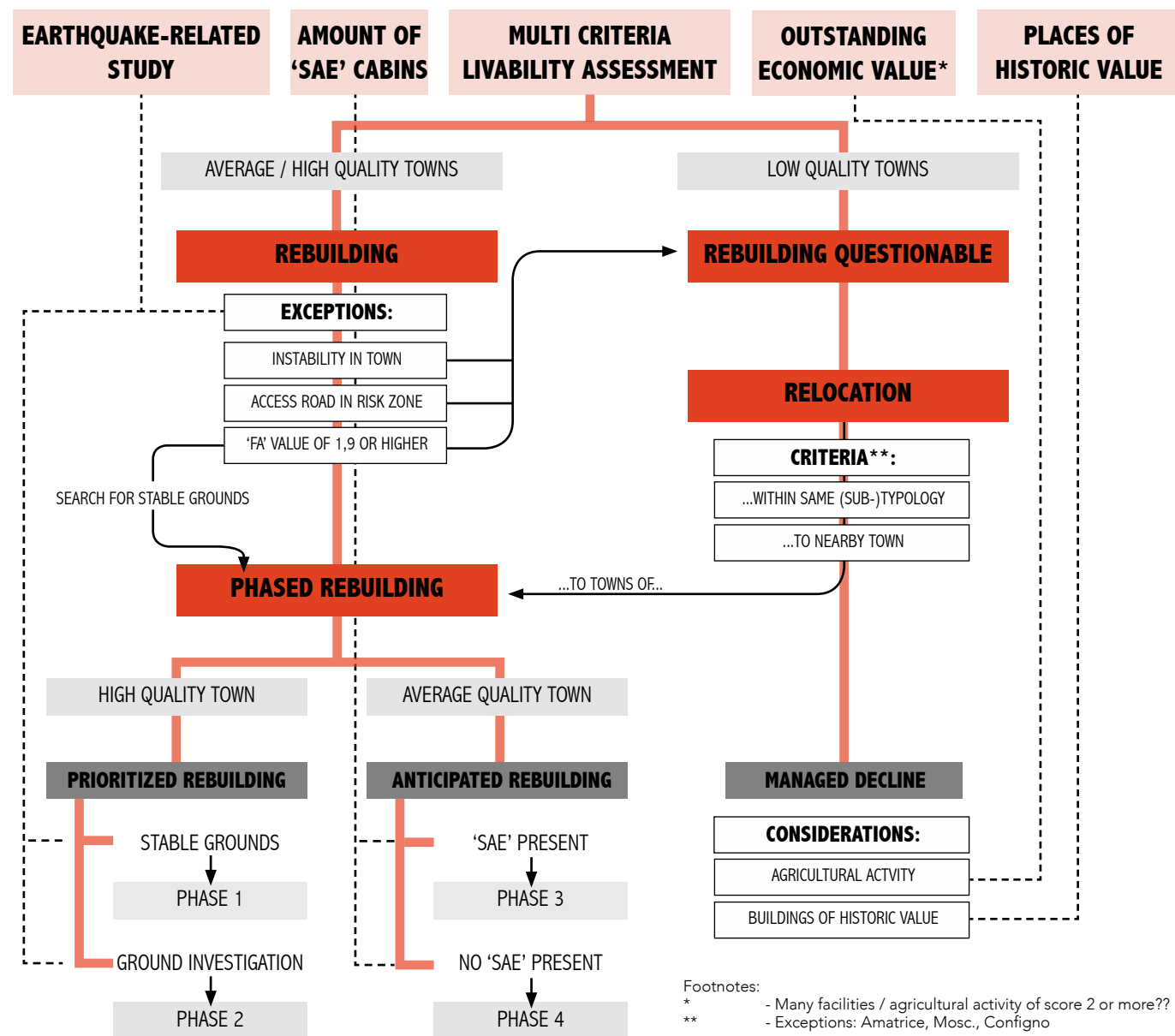


Figure 100 - Strategy and followed steps of the municipal design

The first phase is characterized by rebuilding of high quality towns that contain low FA values and no unstable zones. Amatrice town (including San Cipriano), Torrita, Scai, Retrosi and San Lorenzo e Flaviano will be rebuild in the first phase and will possibly receive 167 households from 'SAE', from towns where rebuilding is questionable. The second phase includes high quality towns that have unknown, to-be-investigated, FA values or values of 1,9 or more, where investigation to nearby stable grounds is necessary. Four towns west of the state highway, the town of Mosicchio close to Amatrice and a group of towns in the hills north of Amatrice will be rebuild in the second phase. In total 28 households from 'SAE' will have the possibility to relocate during this phase. The towns of Bagnolo and San Giorgio are not restricted by so-called 'perimetrazioni', and are thus suitable to start rebuilding in this phase.

The third and fourth phases should anticipate to the previous phases in order to determine if rebuilding is wise or that relocation to already-rebuild towns is more strategic. The third phase comprises towns of average quality that contain 'SAE' cabins. Besides, two exceptions are included here, namely the towns of Conche and Ponte a Tre Occhi that have a high level of quality but are not prioritized because the towns are touristic 'hotspots'. During this phase 25 households from 'SAE' have the possibility to relocate, either to towns that already have been rebuild, in the scenario of 'no more rebuilding' because of strategic reasons, or to towns that will be rebuild. Finally, the fourth phase comprises towns of average quality that do not contain 'SAE' cabins. The towns will not receive households from 'SAE' neither from other types of dwellings.

IMPROVING QUALITY

Figure 100 shows actions, discussed in this part, for towns that will be rebuild and for towns where rebuilding is questionable. Although the towns that will be rebuild have an average or high quality, the quality could be improved by investigating the scores of categories of the livability assessment that can be influenced. Regarding basic needs, medical care is currently only provided by the 'PASS', because the hospital has not been rebuild yet. The location of rebuilding of the hospital is at point of discussion. Although the original site has a low FA value, the location is not strategic in terms of accessibility and available space. Besides, all functions are concentrated in Amatrice town, so if the town would fall away, the entire system is blocked. The location along the state highway, which is good accessible, has lots of space and makes that functions are distributed more evenly, seems thus a strategic intervention.

All settlements west of the state highway have an average or low score regarding basic needs. By rebuilding the hospital here, these scores will improve significantly.

However, all food supply facilities are located in Amatrice town and thus provide nearby towns of good accessibility of food. Introducing (a) food supply facilit(y)(ies) in the west of the municipality, e.g. in the central located town of San Giorgio, will ensure a good accessibility of food for all settlements.

Furthermore, the overall accessibility of the area could improve by connecting the two bus lines. The bus line that goes via the state highway and stops in Torrita and near Saletta, leads from coast to coast between the capital of Rome and the small Adriatic city of San Benedetto del Tronto. This is the most important public transport connection and will be connected with the bus line that leads to the city of L'Aquila by extending the latter towards the state highway. The bus stop at Torrita will be enriched by this second line, which will return to L'Aquila by an extra stop near the town of Scai. Because Torrita acts as important node, with two bus lines and highway entrances, the hospital will be rebuild as close as possible to this node, at the location of the initial emergency site.

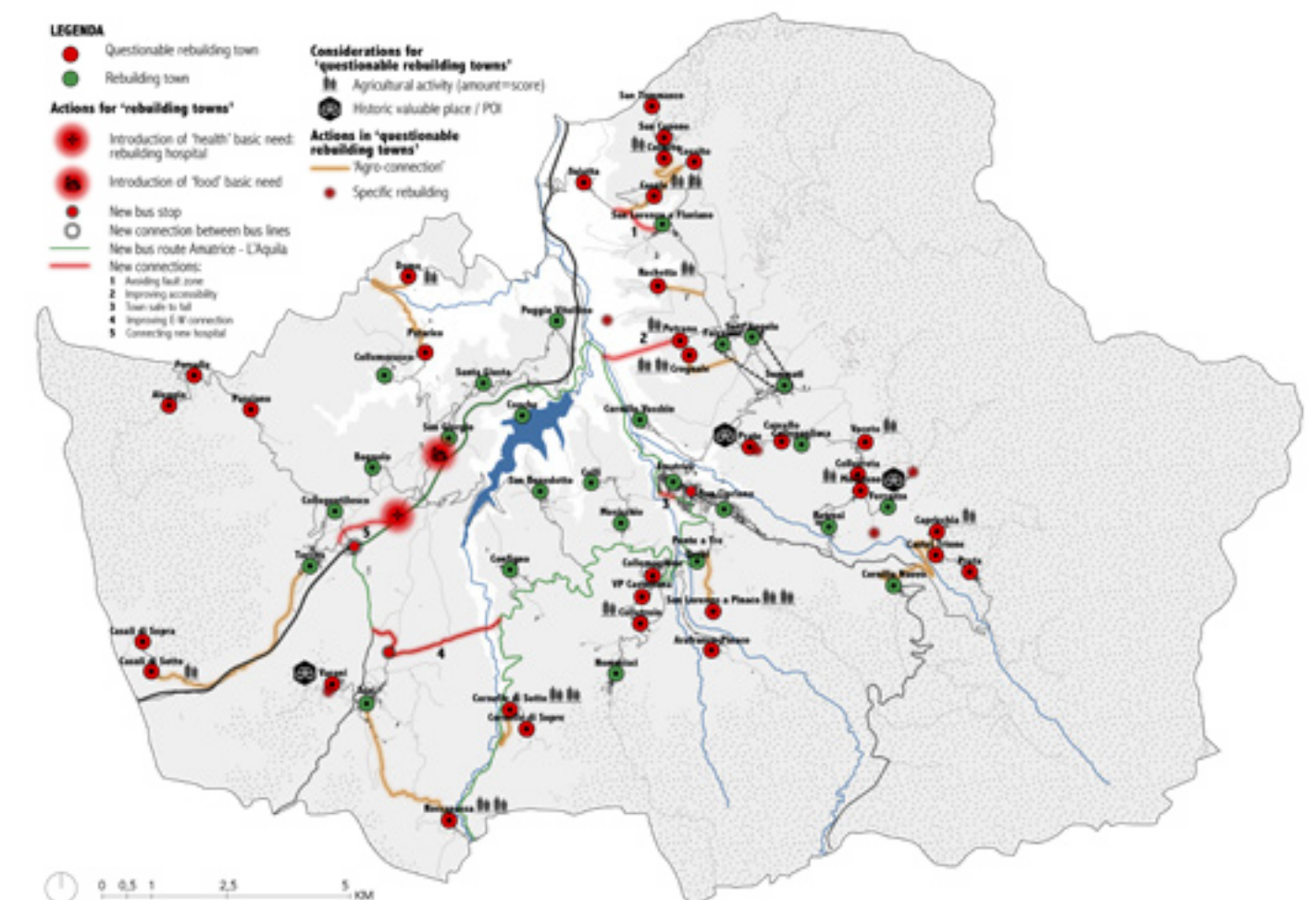


Figure 101 - Actions and considerations based on the relocation model

Besides new bus lines and stops, new connections will improve the accessibility, safety, by avoiding fault and unstable zones, and make possible that towns can fall away without blocking the system. San Lorenzo e Flaviano will be rebuild in the first phase, but should be provided with a new access road to avoid unstable and fault zones. The second new connection improves the accessibility of towns located in the hills north of Amatrice town and makes it possible for San Lorenzo e Flaviano to fall away without blocking the system. The latter reason also covers the introduction of the third new connection. In general, the accessibility at the scale of the municipality is mainly restricted by the lack of good east-west connections. This, in combination with the new bus connection between Torrita and Scai, has resulted to the introduction of a new east-west connection, north of Scai. Finally, the new hospital will be connected to the road system of the towns west of the state highway.

CONSIDERATIONS

Although towns where rebuilding is questionable are more likely not to be rebuild, qualities of these towns should be taken into consideration. Analyzing the towns shows that some have positive agricultural activities, with scores of 1 or more, and/or historic valuable places or points of interest (POI). Because the towns possibly fall away during time, it is important to maintain a connection for agricultural purposes, a so-called ‘agro-connection’. Besides, the specific historical valuable places should be rebuild so that people from the surroundings still are able to visit the places. For example, Amatricians are used to hold a yearly procession to the ‘Madonna di Filetta’ church to celebrate the finding of traces of the Madonna (Appendix D). This tradition is important for the inhabitants’ religion and community feeling and should thus be maintained. Moreover, many of the historic valuable places are mentioned in the questionnaire as valuable to inhabitants as well.

MANAGED DECLINE

Besides the considerations regarding these towns where rebuilding is questionable, their decline should be ‘managed’. Decline could eventually lead to total abandonment of the place, which turns them into ghost towns. Italy has a big amount of ghost towns, which are abandoned because of for example economic stagnation

or natural hazards such as earthquakes. However, these (almost) abandoned places could be revitalized, so that total disappearance is prevented. Many examples of revitalized Italian ghost towns can be traced back to the ‘Albergo Diffuso’ (in English ‘scattered hotel’) model (Pietrogrande & Vaccher, 2016). This model dates back to the 1980s, when Giancarlo Dall’Ara, who worked in the hotel industry, recognized a missed opportunity when visiting the towns of Upper Friuli, which were abandoned as a consequence of the earthquake of 1976. The sustainable tourism model uses abandoned dwellings, distributed within the town, as guest rooms, reception, restaurant, and so on. Instead of staying in a hotel where all functions are concentrated, tourists can experience the town as locals (Pietrogrande & Vaccher, 2016).

The town of Santo Stefano di Sessanio (figure 101), located in the Gran Sasso National Park, has been transformed into an ‘albergo difusso’ (figure 102) as one of the first towns. Castello di Postignano, located in the Central Italian region of Umbria, has dealt with two waves of emigration of which the second was after the earthquake of 1997. The transformation into an ‘albergo difusso’ in 2007 has revitalized the town. This revitalization is amongst others created by renovation of buildings, new job opportunities, people returning and new people coming. The official network ‘Associazione Nazionale Alberghi Diffusi’ provides ‘DOC’ labels to ‘Alberghi Diffusi’ that are recognized. In the municipality of Amatrice, ‘Villa Retrosi’ was recognized with the label, although it comprised just a few buildings (Associazione Nazionale Alberghi Diffusi, n.d.).



Figure 102 - Santo Stefano di Sessanio (Anselmi, n.d.)



Figure 103 - Santo Stefano di Sessanio as ‘Albergo Diffuso’ (Kihlgren, n.d.)

THE SLOW NETWORK

Besides the focus on living conditions by the rebuilding of towns, the economy of Amatrice should be stimulated in order to prevent degradation and abandonment of the area. The tourism industry of Amatrice is driven by second-homeowners, local visitors and tourists from abroad, and is characterized by its Medieval towns, strong local (food) culture and worth-seeing natural landscape. Although many reasons to visit the area have disappeared because of the earthquake, Amatrice still contains many attractive ingredients. However, these are not used (anymore) in the best way to take advantage of it. Besides tourism, the industries of local food production and the processing of products drive the economy of Amatrice. These industries are strongly related with the tourism industry and together could create a network of places that characterize the area. The area still contains several farms that contain a shop or ‘agriturismo’, restaurants and bars, (protected) nature areas, and some picturesque towns that have (partly) survived.

The network tells the story of the place and leads visitors through the territory. Visitors can stay in one of the ‘agriturismi’ and use the network to visit points of interest, buy local products at one of the farms and enjoy local

specialties at restaurants. Besides, the network improves the connectivity and walkability between and within towns at the smaller scale. The network should be well recognizable and accessible for visitors from outside in order to function well. Since the town of Torrita will become a strategic hub, as discussed before, linking the network to this hub seems most logical (figure 103). Visitors from outside arrive here by bus via one of the two lines or by car via the state highway. From here, the network is connected with the town of Amatrice via a new lake path. This path is connected with the existing green passage in the north and with the ‘Romanella’ path, the historic connection between Amatrice and the ‘Via Salaria’, in the southeast.

The ‘slow network’ is expanded through time because each phase contains a set of new interventions. Eventually, the towns that belong to later phases of rebuilding and are initially not been rebuild, could take advantage of the network and surrounding developments, by e.g. turning into an ‘albergo diffuso’.

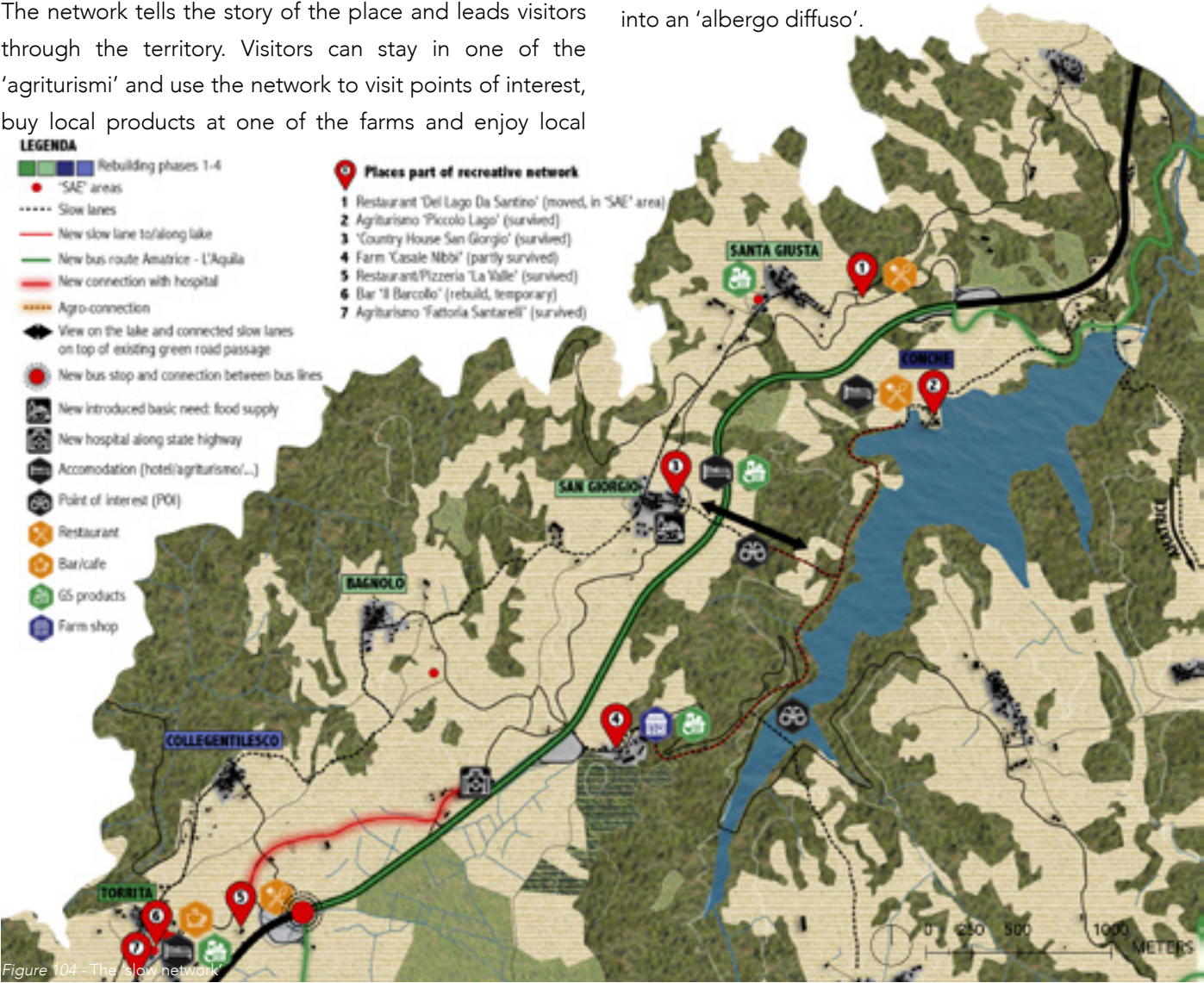


Figure 104 - The 'slow network'

12. TOWN DESIGN

TOWN DESIGN DESIGN MODELS

Although the town of Amatrice is indicated as ‘node of quality’ and scores well for all categories of the multi-criteria livability assessment, this quality is relative to other towns. Amatrice is naturally also subjected to the pre-quake vulnerability and the consequences of the earthquake. To prevent these ‘nodes of quality’, where activities and reconstruction will be concentrated, of becoming ‘non-places’, the disaster recovery design should use local qualities, focus on livability, and comprise site-specific interventions.

INGREDIENTS OF THE CONCEPT

The disaster recovery design should not only focus on rebuilding what was there, but also on current problems of temporariness, namely the livability at risk and the fragmented landscape of ‘islands’. By focusing on the public open space of Amatrice, the earthquake will not be treated with a special focus, as if it stands on its own, but everyday life will be taken into account as well.

The concept of the disaster recovery design is thus based on people’s everyday life, by mapping everyday facilities and people’s valuable places. The network of routes resulting from connecting all of these places is the starting point of the concept, which aims for both livability improvement and earthquake resistance. Besides facilities, the routing, or infrastructure in general, is the second ingredient of the concept. It unifies the several ‘islands’ and improves the walkability and town’s legibility. Finally, the last ingredient is where to rebuild, whether this is for housing or facilities, and where to leave space open. The consideration between building or leaving space open is crucial for the distribution of ‘risk’ and ‘safety’. At the same time it has impact on the identity of the place because it considers the landscape characteristics.

All three ingredients together create the concept and eventual disaster recovery design. The ingredients are still very general and not self-evident to concretize. This is related with the contradictory character of disaster recovery.

DESIGN MODELS

For the recovery of Amatrice, preparation for future hazards by searching for earthquake resilient solutions

that respect the historical value is of crucial importance. Because these two factors are often contradictory, two extreme scenarios or models are compared (Appendix N): model one prioritizes the culture historical value, while model two focuses on the earthquake resistance. For each of the three categories, the model considers its best alternative(s) based on the several possibilities present. Regarding facilities, many of the existing facilities need to move to permanent structures and some new necessary facilities should be introduced. The latter are based on the outcome of the questionnaire, a comparison between the before and after situation and municipal priorities. Seven categories of facilities will move or be introduced, namely: food supply, restaurants and/or bars, leisure or culture, health (pharmacy), education (Alberghiero), churches and government (police, town hall, ‘carabinieri’, etc.) Based on the ‘everyday routing’, bottlenecks regarding walkability are indicated and considered, as part of the infrastructure category of the two models. Finally, for both models the public open spaces are assessed by their suitability for building or not. For the sake of simplicity of comparing both models, the area is divided in sub-areas, namely: the ‘historic center’, ‘center’, ‘Don Minozzi institute’, ‘Il Triangolo’ and ‘the poles’. Appendix N discusses the two models in more detail.

The alternatives of each model are judged by the following parameters: history, earthquake safety, connectivity, walkability, access of facilities and time. This results in scores, ranging from six minus to six pluses and sometimes followed by a question mark because FA values are unknown. The scores of the alternatives of both models are compared (Appendix O) in order to define the final outcome (Appendix P).

CONCEPT

CONCEPT MAP 1 : 1000

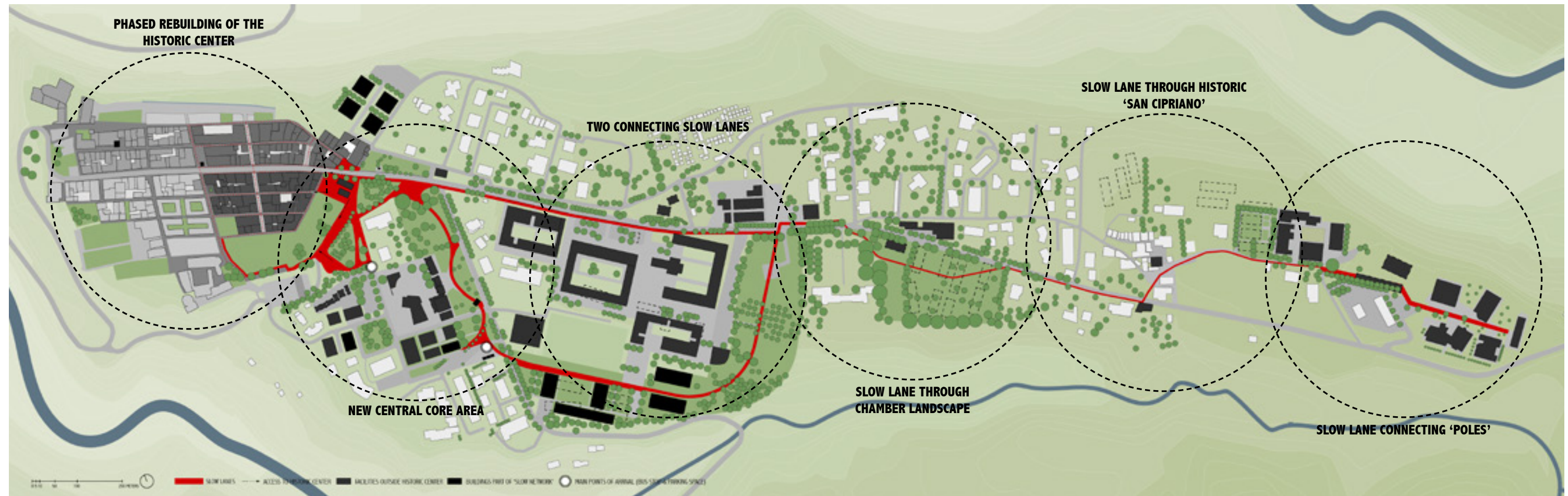


Figure 105 - The concept map (scale 1:1000)

THE CONCEPT

After the final design model, the design synthesis, some adjustments have been made because of several reasons. First of all, the design models are developed in the pre-visit design phase, so with these in mind the site-visit provided new insights and thus alterations to the design. Appendix P discusses the alterations in more detail. The design model and some alterations have resulted in the concept of the 'disaster recovery design' of Amatrice, shown by figure 105. The concept map shows facilities that will disappear or move through time, which are already in the area, and which will be introduced. The red paths indicate the main route of 'slow traffic' and connect all of these areas or 'islands'.

However, the concept represents the final situation and leaves out the process. The 'disaster recovery design' consists of phases that fill the gap between the current temporary state and the future permanent, 'normal' state. The design consists of three phases, which will be discussed in more detail after this. The phases are supported by a 1:1000 masterplan, sections, (a) detailed 1:500 plan(s) and impressions. After the third phase, the final situation will be discussed, supported by a detailed 1:500 plan.

MASTERPLAN 1 : 1000



Figure 106 - The master plan of the first phase (scale 1:1000)

Because of post-quake interventions, daily life has shifted to the east of the town and people have been forced to accept their new environment. They live distributed within the town, often without good connections and pedestrian friendly routes that could lead them to facilities such as the commercial centers or local bar. As mentioned in chapter 7, according to the mayor the 'real' reconstruction can start after the opening of a reconstruction office. This will imply the first step in the disaster recovery, and will be a sign of time changing. The masterplan of the first phase is shown by figure 106. In the office the commissioned reconstruction team can work on concrete plans for the future of Amatrice. Besides, the office will be located next to the 'model room', where the model of Amatrice as it was in 1900 (figure 110), acts as tool for public discussion. Inhabitants can walk in whenever they want and share ideas and participate in the design process. Currently many people, 69% according to the questionnaire, do not know who is working on the plan. By this transparent way

of working people feel engaged with the process and are aware of what the future could bring. Besides, the office will host a bar, which contributes to the area as a place of meeting each other. Until the earthquake the area was sometimes used for markets and further back in the days, this area was used as important market place where people and their cattle gathered. The model room will be rebuilt at the location of the disappeared covered watering place, which was meant for cattle (figure 109). Going further back in history, the area even contained a church (figure 107), in front of the Sant'Agostino church, which will be the location of the future reconstruction office and bar. The buildings will be located at the entrance of the former historic center and will provide a wide view on the bare plain (figure 108). This makes the location the perfect place for the development of new plans for the future of Amatrice.



Figure 107 - The historic urban design of Amatrice with some buildings that dissappeared through time (arch. Anibaldi, 2017)



Figure 108 - The future location of the reconstruction office, providing a wide view on the bare plain (Corradetti, 2019)



Figure 109 - The entrance of the historic center in 1912, with the watering place at the left (arch. Ciaralli, 2019)



Figure 110 - The model of Amatrice in 1900, which will be placed in the building next to the reconstruction office (author's picture)



The office and model room will be part of a new core area that is connected to other parts of the town. The design uses the two already-existing public parks and connects these in order to create one public garden (figure 111). The public garden consists of a square where local markets can take place and people can buy a newspaper at the kiosk (figure 115). Furthermore, people can give a helping hand in the community garden or have a drink at bar 'Rinascimento', which is located at the edge of the garden. Southwest of the 'Giardino degli Alberi' (in English 'Garden of the Trees', 'A' on map) the current parking space will be used as one of the future entrances to the historic center. The town wall will be restored and accompanied by 'robinia pseudoacacia' trees (figure 114). Local sandstone gravel will be used to accentuate the town's 'border' and entrance, while the rest of the current parking place remains asphalt. The reconstruction buildings are located on 'historic grounds' that will be paved by cobblestones, if not already present.

The public garden can be entered by two main directions, namely from the south through the 'Don Minozzi' public park ('B' on map) and from the east, the road that is an extension of the 'Corso Umberto I'. Both connections will be improved by the introduction of new 'slow lanes', where people can walk without interacting with fast traffic. The northern new connection, shown by figure 112, will be a lane that is parallel to the road and adjacent to the 'Don Minozzi' institute. More to the east, the lane meets the southern new connection and continues at the other side of the road (figure 113). The presence of many trees in this area makes that only a small space is available for the lane. The lane will pass the terrace of restaurant 'Campagnola' and head into the direction of the supermarket and second commercial center on the route. After the earthquake some trees have been removed south of the road because of construction works. This space will be used for the new lane, which 'stops' here because of the presence of a 'SAE' area.



Figure 112 - Section of the new lane adjacent to the 'Don Minozzi' institute (AA')



Figure 113 - Section of the new lane adjacent to the terrace of the restaurant 'Campagnola' (BB')



Figure 114 - Impression of the future situation of the new core (1)

FUTURE SITUATION



SITUATION BEFORE EARTHQUAKE



SITUATION AFTER EARTHQUAKE - CURRENT



Figure 115 - Impression of the future situation of the new core (2)

FUTURE SITUATION



SITUATION BEFORE EARTHQUAKE



SITUATION AFTER EARTHQUAKE - CURRENT

DISASTER RECOVERY DESIGN: PHASE 2 ‘CREATING LIVABILITY’
MASTERPLAN 1 : 1000



Figure 116 - The master plan of the second phase (scale 1:1000)

After the first phase, in which the start of the reconstruction and the creation of a new core and new connections take a central position, the second phase (figure 116) focuses on creating livability. Until the second phase inhabitants still live in ‘SAE’ cabins, distributed within the town, but also a few kilometers away in the town of Collemagrone. Besides the living conditions of the cabins itself, often the location, far from ‘home’ and neighbors, creates feelings of alienation. In order to restore people’s social relations and feelings with the place they used to be attached to, the second phase will include interventions that make it possible for people to move back to the town, to a location that is more central and closer to the historic center, and has better living conditions.

Within the second phase it is possible to move to (semi-) permanent dwellings within the town for all households living in ‘SAE’ cabins in Collemagrone and in ‘campo 1’, the most western ‘SAE’ area in Amatrice town. The

35 households living in ‘campo 1’ should leave their ‘SAE’ to newly built permanent complexes first, so that these ‘SAE’ can be removed and new (semi-) permanent complexes can be built here. Besides, 45 households from Collemagrone are also able to move to the newly built permanent complexes. After the (semi-) permanent complexes are finished, the last around 80 households from Collemagrone can return to their hometown again. These complexes, south of ‘Don Minozzi’ institute, will be (semi-) permanent because if in the future the historic center will offer dwellings as well, these complexes will possibly gain other functions. Furthermore, the design of this area is based on the historic design of the ‘Don Minozzi’ institute (figure 116.4). The historic layout of courtyards and porticoes is used as reference for this area.

Before and parallel to the aforementioned developments several necessary facilities will be build. However, these cannot be build at the same time, amongst others

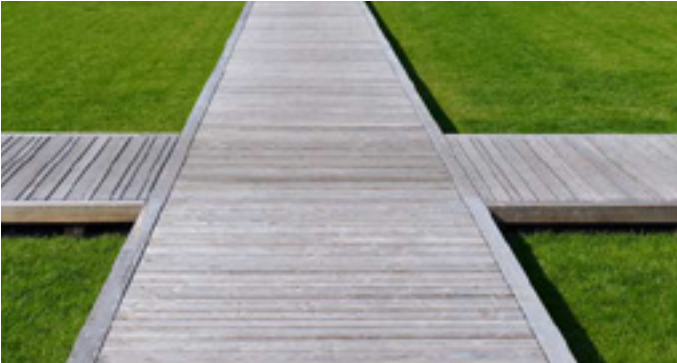


Figure 117 - Reference of boardwalks (Müller, 2015)



Figure 119 - Building skeleton of the church ‘San Francesco’ (Achtner, 2017)



Figure 118 - Building blocks seem to arise as pioneer plants (Corradetti, 2019)



Figure 120 - An example of local art that could be exhibited at the temporary park (Cristallini, 2019)

because there is simply not enough space. According to the mayor, amongst others the occupation of most of the open spaces outside of the historic center makes that a landscape of randomness and disintegration is created. Thus, it is very important to critically investigate the necessary interventions and the best order of executing these.

The area west of the temporary buildings of the town hall is used as parking place. Building here is thus not possible if no other area is designated as parking place. First of all, the buildings of the police and 'carabinieri' will be build, south of their current temporary buildings. After this, these temporary buildings can be demolished and the area will gain the function of parking place. Because the new permanent town hall (figure 116.2) will be build at the location where currently the temporary buildings are located, the town hall will temporarily move to the

site adjacent. After the permanent town hall is finished, the multi-functional center (figure 116.1), including e.g. a theatre and cinema, can be build here. Because both the town hall and the center have been designed already, it is possible to gain time.

Parallel to these interventions, the 'Alberghiero' (figure 116.3) will be build at the location where it used to be before the earthquake. However, the institute will be distributed over several buildings, so that at some levels dwellings will be realized. Besides, the 'Alberghiero' will manage its own restaurant and bar and will use products from its own kitchen garden (figure 121), adjacent to the building. In this same area, the building of the forest rangers and a pharmacy are located.

In order to ensure a pedestrian friendly town and to facilitate the future reconstruction works in the historic center, a

new road will be constructed outside of the town. In this way, people do not have to cross the entire town, including historic center, to go from the south of the town to places in the north and west of the town. The new bus station is positioned on this route, south of the 'Alberghiero' (figure 122), and is connected to the main routing of the town. Besides, the pharmacy is located in front of the bus station, so that people from outside of the town can easily access their necessary medical care. As mentioned in chapter 8, the 'Don Minozzi' institute will be transformed into the so-called 'House of the Future' (figure 116.5). This institute will be integrated with the surroundings by connections with the slow lanes in the north, south and east.

In the east of the town new slow lanes are introduced. The part where the lane crosses the small historic square, in front of the church, is not distinguishable by other materialization, but a historic wall is restored and clear

lighting ensures easy way finding during the night (figure 123).

Because the rebuilding of the historic center is a complex process and should anticipate on developments of other parts of the town, it is likely that no activities will take place here until this phase. However, the historic center used to be the beating heart of the town and municipality. Inhabitants are attached to this place and have lost many valuable places here. A connection with this place is thus of crucial importance. As can be seen by figure 118, the building blocks seem to arise as pioneer plants and green the bare plain. People will be able to enter the historic center by lifted boardwalks (figure 117) that follow the original street pattern. The plain will act as open-air museum, where people can admire the skeletons of some buildings (figure 119), but also works of arts from locals, such as shown by figure 120.



Figure 121 - Section of the new area around the future 'Alberghiero' (CC')

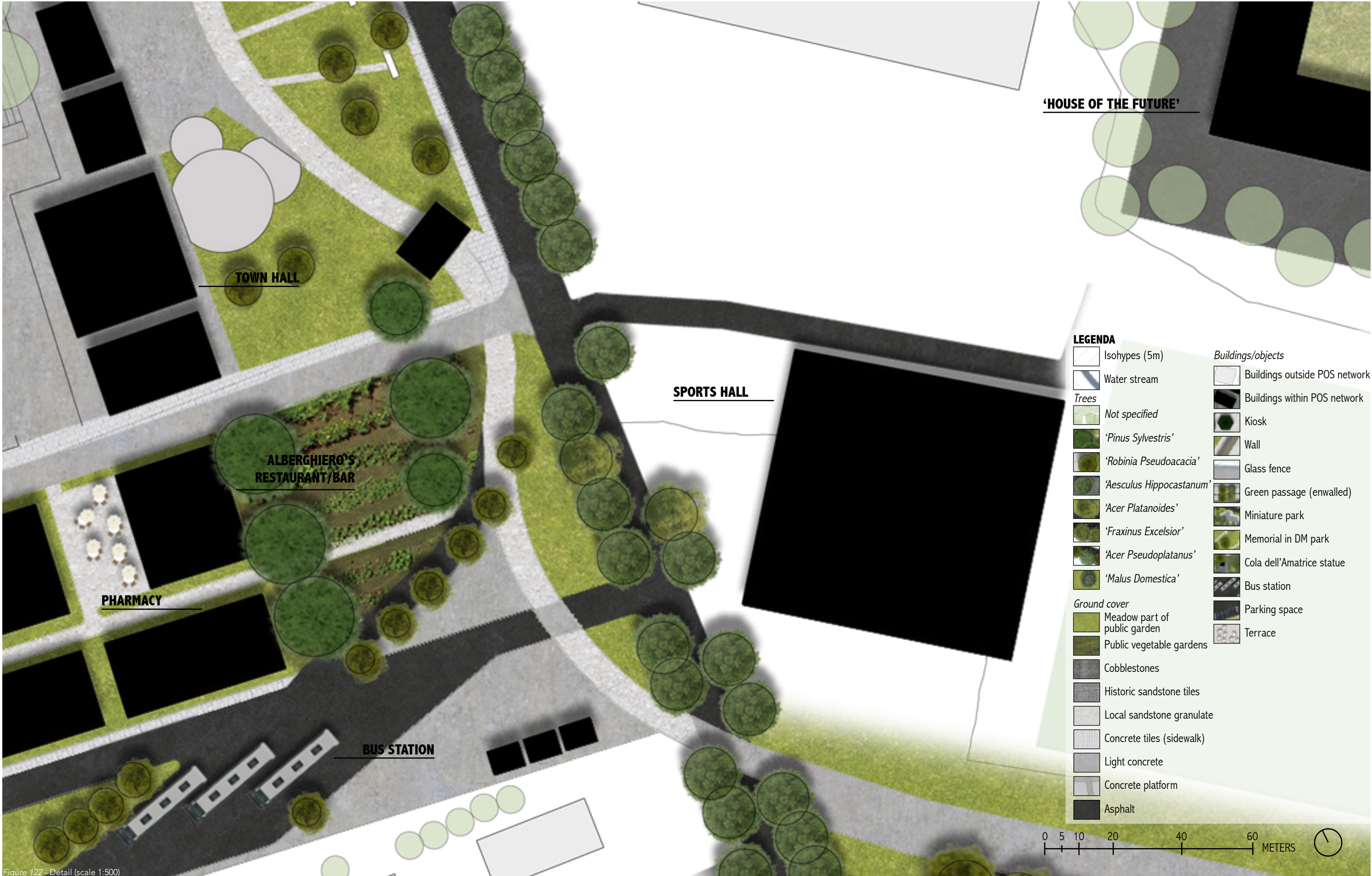


Figure 122 - Detail (scale 1:500)



Figure 123 - Impression of the future situation of the historic square in the east of the town

FUTURE SITUATION



SITUATION BEFORE EARTHQUAKE



SITUATION AFTER EARTHQUAKE - CURRENT

DISASTER RECOVERY DESIGN: PHASE 3 ‘BACK TO NORMAL’
MASTERPLAN 1 : 1000



Figure 124 - The master plan of the third phase (scale 1:1000)

In the third phase of disaster recovery, the focus is on returning back to ‘normal’, comprising rebuilding in the historic center and removing temporary buildings. All remaining ‘SAE’ areas will be removed and new pedestrian lanes will create one connected slow lane leading through the entire town. Before the ‘SAE’ and temporary buildings such as the library in the east can be removed, new permanent buildings have to be build. Rebuilding in the historic center is a complex process because values of all types, e.g. historical, emotional, social, etc., are concentrated here. Besides, it is important that the rebuilding gives the right signal to inhabitants, as proven by the case of L’Aquila. Here a wrong signal was given by opening shops and restaurants that later had to close again because of safety reasons. The historic center will be rebuild in phases that are based on the four quadrants of the historic center can be divided in. In the masterplan (figure 124) two quadrants are realized, with some alterations compared to how it was before the earthquake.

First of all, several building blocks have been split to create new streets and improve the permeability. These new streets, which do not belong to the original street pattern, will be paved by light concrete to make a clear distinction between the historic structure and adaptations. Furthermore, people will be able to experience the town and its fortification of walls and gates by connected green spaces that make the wall structures clearly visible, such as in the case of the city of Lucca, shown by figure 125. In the southeast, the most outer building blocks will not be rebuild as this area will act as green entrance to the historic center. The most northern blocks will be visible as lifted concrete platforms, as shown by figure 132, and are part of the ‘Belvedere’ that provides a wide view on the mountains of the ‘Monti della Laga’. In 2013 a lookout called ‘Eco Giardino Belvedere Bastioni’ was opened to provide views on the mountains and complement to the touristic network of points of interest (figure 126) (Amatrice News, 2013). The platforms are connected to



Figure 125 - Lucca its green city wall as reference (Golden Ravioli, n.d.)



Figure 126 - The opening of the ‘Eco Giardino Belvedere Bastioni’ in 2013 (Amatrice News, 2013)



Figure 127 - Preparatory study of the artist Marco Guglielmi Reimmortal, example of art at the ‘Belvedere’ (Reimmortal, 2018)



Figure 128 - Art exposition at the town of Pietrasanta as reference for the ‘Belvedere’ (author’s picture)



SITUATION BEFORE EARTHQUAKE



SITUATION AFTER EARTHQUAKE - CURRENT

Figure 129 - Impression of the future situation of the current 'SAE' area

FUTURE SITUATION

enwalled gardens, of which some were already present before the earthquake and others have disappeared through time. The 'Belvedere' will be used as open-air museum, similar to that of the temporary park of the second phase. Figure 127 shows a preparatory study of the artist Marco Guglielmi Reimmortal in the ruined town of Amatrice for an art installation at the Biennale in Venice. Art installations such as these could be exhibited as in the town of Pietrasanta (figure 128), where art exhibitions often decorate the main square. The library will move to a building adjacent to this 'Belvedere', next to the museum of the earthquake. Here, the story of the earthquake and post-quake developments will be told. The 'Belvedere' leads visitors to the 'Giardino degli Alberi', which used to be a bastion back in the days. From here, the slow lane leads visitors to the next belvedere, in front of the 'House of the Future'. Further to the east, the 'SAE' area in front of the commercial center 'Il Triangolo' is removed and a new slow lane has been introduced (figure 129).

In the historic center, instead of a few hotel buildings, the concept of the 'Alberghi diffusi' will be applied, which aims for a more lively and dynamic town life. Furthermore, restaurants, bars and food supply facilities have been reopened at locations where they used to be.

FINAL SITUATION

DETAILED PLAN 1 : 500

Figure 130 shows at a detailed scale the 'final' situation of the town when the entire historic center is rebuild. Many of the original enwalled gardens or courtyards that the town used to have (figure 130.6), but disappeared through time, have been introduced again. However, these gardens are open to the public and act as green passages, such as in the case of the new school buildings. In the southwest of the historic center a large community garden provides amongst others the adjacent restaurant of fresh ingredients. This part of the historic center, surrounded by dense wall structures, has been used as garden and/or for small agricultural activities since ages.

The 'Corso Umberto I' has become more pedestrian friendly because the new road, south of the historic center, directs traffic around the town. Besides, the entrance of the main street, or long 'piazza', in the east has become more inviting by a new core area, which is connected by other parts of the town by several new lanes.



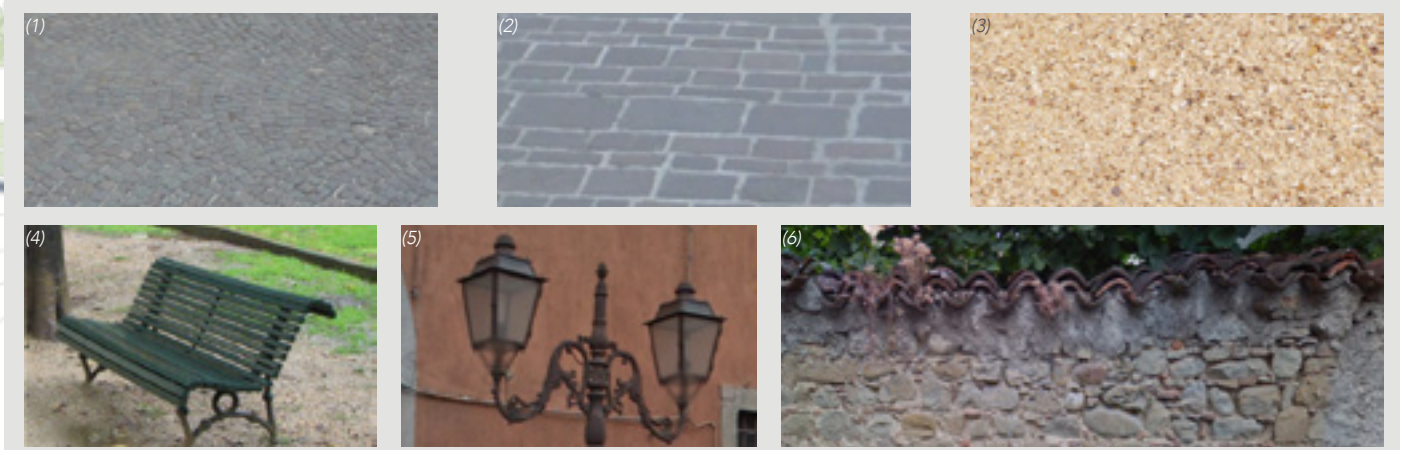
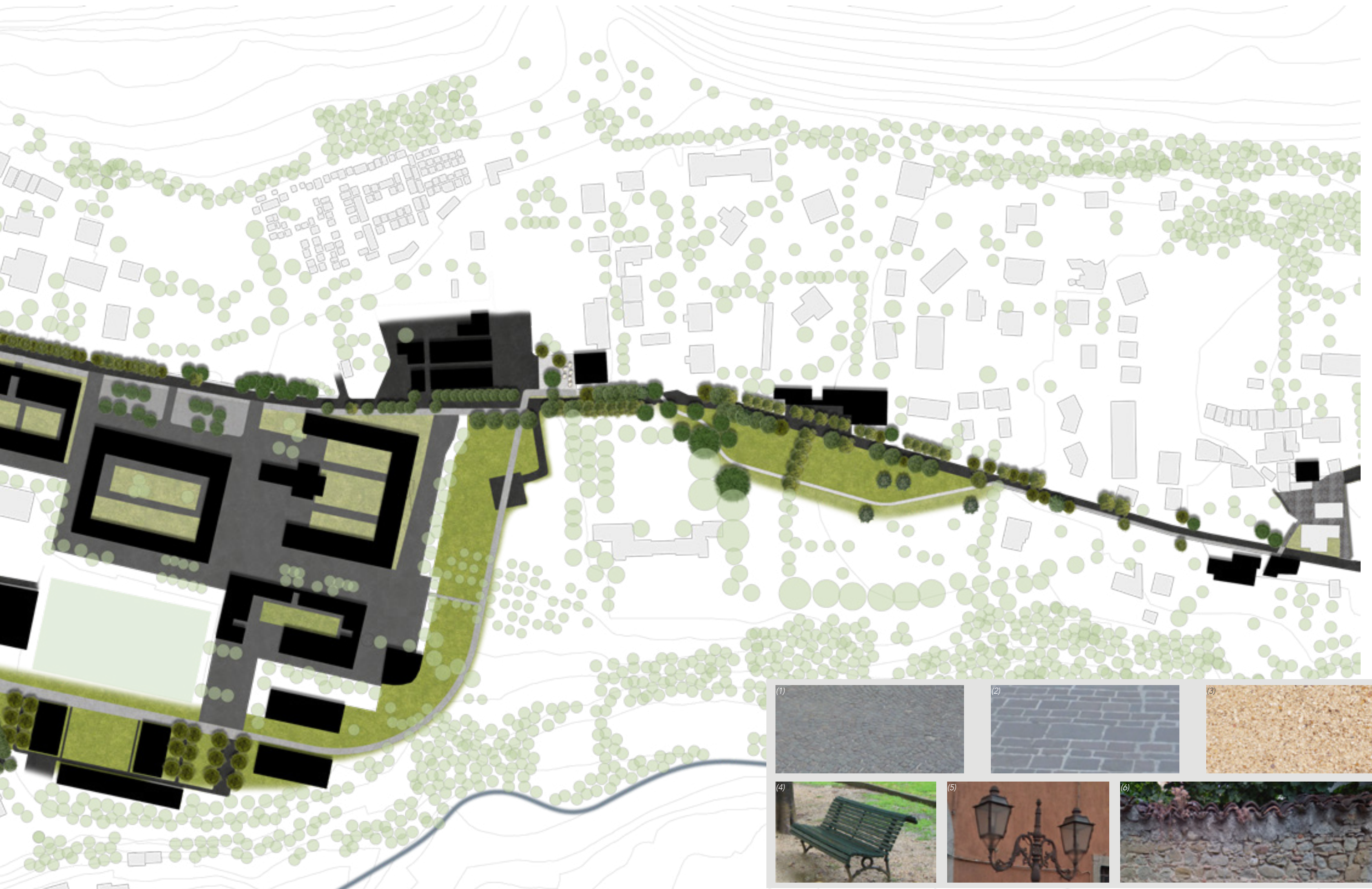




Figure 131 - Impression of the future situation of the 'Belvedere'

FUTURE SITUATION



SITUATION BEFORE EARTHQUAKE



SITUATION AFTER EARTHQUAKE - CURRENT

13. EVALUATION

EVALUATION DISCUSSION

In the introduction of this thesis, the problem contextualization is summarized as the problem of 'temporariness' and the lack of a concrete spatial strategy. However, although problems of 'temporariness' are still present, these were realized short after the earthquake, during the phase of emergency. Like the mayor has stated, the post-quake period is a sequence of "emergency, chaos, planning and rebuilding". The provided 'solution' here, namely the 'disaster recovery design', does respond to the problem of a lacking strategy, but does not propose solutions for the period already passed, in which this problem was created. It would have more added value by including solutions for just after the earthquake, so the entire post-quake period can be directed.

In order to get insight in people's perception regarding the situation before and after the earthquake and the maintained municipal strategy a questionnaire has been set up. However, by distributing this questionnaire in Facebook groups, many people are excluded and do not have the possibility to participate. The questionnaire would possibly reach more people via the website of the municipality.

The motive of this thesis is based on the current municipal approach to the post-quake situation of Amatrice. As mentioned in the introduction, the focus is on rebuilding of all what was there before the earthquake, without overarching and integrated spatial strategy. The proposed strategy here is based on prioritized rebuilding in 'nodes of quality' and 'managed decline' outside of these nodes. However, since probably not all inhabitants who live in towns of 'managed decline' are willing to move to 'nodes of quality', still some investments have to be made in these towns. Although the 'success' of 'managed decline' is more likely in this situation of people living in temporary cabins than in the situation of people who still live in their familiar environment, the concentration of quality and available capacities have to be placed in context.

The town of Amatrice is used as an example of how interventions at the scale of the 'node of quality' can be in line with the overall disaster strategy as well as improve the quality of daily life. However, the town of Amatrice cannot be compared one-to-one to other 'nodes of quality', such

as for example the town of Torrita. A study to other 'nodes of quality' that would result in design solutions, would add value to the research.

The final point of discussion is the issue of site-specificity, which makes it complex to develop a 'Disaster Landscape Recovery' framework that can be used for similar post-quake cases.

Internal validity

First of all, the design principle that is part of the 'vulnerable basis' could be applied to similar cases if a trend of shrinkage is present. So, economic stagnation, a decreasing population and worsening of facilities in quality and/or quantity are signals of this. This is related with the design principles that are part of the 'time' category because these are introduced based on the concept of 'smart decline', which anticipates to the trend of shrinkage. The design principle that prioritizes rebuilding of 'high quality' towns, based on the multi-criteria livability assessment, is suitable for Amatrice because of its great amount of towns. However, other municipalities that do not have this amount of towns should possibly rebuild all towns. Here, the assessment will not be suitable to define where to rebuild and where not, but will be helpful in defining what interventions are necessary to improve the overall 'quality' of towns. Furthermore, the introduction of necessary facilities is applicable to the case of Amatrice because of the level of devastation. So, the impact of the earthquake or the damage to facilities should be similar in other cases.

Amatrice is chosen as case study for this research because of its symbolic power. However, this 'power' is also a factor that is taken into account for the recovery strategy. The general disaster recovery design principle of 'selling the story of the earthquake and post-quake period' is based on the symbolic power of Amatrice, which in line is partly based on its culture historical value. Because the earthquake has struck an immense area, the site should be unique in order to 'sell' the story, just as in the case of Venzona. This makes this principle less generalizable for other cases, for example for other municipalities hit by the earthquake such as Accumoli and Arquata del Tronto.

The design principles that are part of the ‘deliberation’ category are mainly very site-specific because they are based on the concept of the ‘slow movement’, which aims for interventions in line with the culture and identity of the place. The principles covering the town’s Medieval foundation, culture of ‘transhumance’ and role within the National Park aim to enhance local qualities, and are thus not applicable in other cases. The design principle that aims to improve the walkability of everyday places is similar to the already-discussed principle of facilities. Depending on the impact of the earthquake, the walkability should be improved. Finally, restoring the link with the historic center is important in cases where a historic center is present and valued to a similar extent. Besides, it should have been devastated or become inaccessible. However, in cases where this is not the case, the design principle is not applicable.

In general, some characteristics that are very important in order to apply a similar approach are related to the culture. First of all, Amatrice is a municipality located in Central Italy, and is thus part of the Western culture. This makes that the approach is in line with the culture, and hard to apply in a different culture. Besides, Italy is very protective to its cultural heritage, what influences the approach within the historically valuable area of Amatrice. Other post-quake cases should thus have a similar attitude to heritage, and similar tools to deal with this.

External validity

Although many of the principles are hard to apply in other cases because of their site-specificity or because specific situations are required such as a totally devastated historic center or the presence of a trend of shrinkage, some principles could be applied to other post-quake cases.

First of all, the design principles that are part of ‘the hazard’ category are applicable to other cases as well. An earthquake always creates damage, instability and is always created by certain ground activity and fault zones. Besides this, the general disaster recovery principles that aim for a design plan with clear steps and phases and to facilitate reconstruction as public discussion could be applied to other cases. Regarding the ‘time’ category principles, the downscaling of what to rebuild, the fast

shift from temporary to permanent and the relocation and rebuilding nearby the original location could all be applied elsewhere. These principles aim for a strategic and efficient process, and are thus not related with the site. Finally, the category of ‘deliberation’ comprises some principles that could be applicable to other cases. These principles aim to accentuate landscape characteristics, rebuild settlements in their original structure and rebuild historic valuable places in the territory. However, the general points of discussion related to the culture-dependency are relevant here.

CONCLUSION

This thesis is structured by three specific research questions and one specific design question, which together support and give answer to the main question. The first specific question was:

How did the landscape of Amatrice develop until the hazard and what has been the impact of the earthquake?

In order to understand what has been the impact of the earthquake, the background of the study area, how it was before the earthquake have been investigated.

First of all, the study-area is analyzed by a natural landscape analysis, which has explained the seismic activities by a study to the geomorphology of the ‘Amatrice Basin’. This basin is located in a fold-and-thrust belt of an intra-mountain depression of the Central Appennines. The presence of, mainly reverse, faults cause that the basin migrates underneath the Sibillini Domain. These dynamic circumstances make that Amatrice has a rich and varied landscape varying from 700 to above 1100 meters height. The landscape is divided in several typologies that distinct themselves from each other by their own set of characteristics. Furthermore, all settlements can be designated to different typologies based on their physical layout. This has resulted in the design principles related to landscape and town characteristics.

The site is further contextualized by a profound historical description of the main events and developments that have shaped the area as it is today. The historic ‘Via Salaria’ road has been of great importance for the development of Amatrice. The town started flourishing after it became

part of a system of fortified villages that had to defend amongst others the Kingdom of Naples. The agro-pastoral system called ‘transhumance’ is the foundation of the growing economic success and local culture at the same time. During history Amatrice has been ruined multiple times, but each time found a way to rebuild as much as possible as it was. The historical background will be accentuated by the help of design principles that focus on historic valuable places, the Medieval foundation structure and the culture of ‘transhumance’.

The earthquake of 2016 had an impact that has never shown before, by taking the life of 234 people and devastating eighty percent of the towns. No damage pattern is visible and almost the entire municipality has stable grounds that are prone to local amplification of the seismic motion. Besides, many zones are prone to instability and contain potentially active faults. Based on this, the first two design principles of ‘the hazard’ category are defined. After the earthquake, the majority of the permanent residents had to move to ‘SAE’ cabins and the trend of out-migration strengthened. Many people now live in other settlements and living conditions have become questionable. A fast shift from temporary to permanent and rebuilding nearby the original location are design principles that are important to improve these. Besides, according to the outcome of the questionnaire, people are hardly involved in the reconstruction process. So, facilitating the reconstruction as public discussion and meeting the needs of inhabitants is of crucial importance. The earthquake has hit the economy of Amatrice hard, which is mainly driven by the businesses of local food production, the processing of products and the tourism industry. An active role in the ‘Gran Sasso e Monti della Laga National Park’ could be beneficial for both industries.

The second specific question was:

How can the concept of ‘smart decline’ inform the municipal strategy that needs to tackle current ‘problems of temporariness’ and anticipate to future earthquakes?

Based on a literature review, it can be stated that the concept of ‘smart decline’ focuses on the present quality and efficiently maintains and improves this by ‘joining of

forces’. This is the motive for the multi-criteria livability assessment, which is carried out to get insight in the current qualities and potentials. The assessment is based on the following indicators: demography, accessibility, basic needs, facilities, tourism and agriculture. It helped in determining priorities and defining interventions that improve the overall ‘quality’. The outcome is translated into the design principle that prioritizes rebuilding of ‘high quality’ towns. Besides this assessment, the municipal strategy is informed by the current municipal vision and strategy and the ‘National Strategy for Inner Areas’. The current municipal approach focuses on the rebuilding of the historic center and rural towns and puts the ‘newer part’ of the town on the back burner. Besides, the municipality has listed several priorities regarding what to rebuild. These necessary facilities should be introduced in the ‘nodes of quality’. The ‘SNAI’ is the basis of the design principle that covers the improvement of the essential service provision.

Italy has dealt with earthquakes and following reconstruction processes, all with its unique approach and outcome, many times. Because of this, the country has built great experience that can be learned from. A study to three references, namely Venzona, Nocera Umbra and L’Aquila, has further informed the strategy. This has resulted in design principles that focus on downscaling, a fast shift from temporary to permanent, relocation and rebuilding nearby the original location, restoring the link with the historic center and all general disaster recovery principles.

In short, the concept of ‘smart decline’ ensures an efficient municipal strategy that focuses on the present quality, and thus approaches ‘problems of temporariness’, and by more compact communities anticipates to future earthquakes.

The third specific question was:

What places of the public open space of the town of Amatrice can be identified that are used in both the context of everyday life and of a hazard?

The earthquake has had an incredible impact on the life of Amatricians, by totally vanishing away the historic

center. The historic center, once the liveliest area of the municipality, is nowadays a bare plain without any sign of life. Restoring the link with the historic center is very important for people's attachment with the place. The outcome of the questionnaire provided insight in people's valuable places and their need for specific facilities. This has resulted in the design principle that introduces necessary facilities. The public open space of Amatrice town has been analyzed by mapping the devastation of the earthquake in combination with the new, post-quake, interventions. Facilities, organized in several categories, are used as starting point, and give insight in which public open spaces are used most frequently. This analysis has portrayed the everyday life of before and after the earthquake. Moreover, the impact of the earthquake on the use of the public open space has become visible. Important criticalities regarding both everyday life and preparedness of the current post-quake situation became visible. It has shown what is necessary to improve the current livability and what has to be taken into account for possible future earthquakes. This is translated into the design principles that improve the permeability and connectivity, the walkability of everyday places and that comprise downscaling of what to rebuild in a logical order.

The fourth specific (design) question was:

How can the post-quake landscape of Amatrice recover from its disaster by using its public open space on local scale that incorporates a municipal 'smart decline' strategy?

The proposed design has shown that a (municipal) disaster recovery strategy is a pre-condition in order to improve quality at the local scale. Without setting priorities, defining crucial first steps and joining of forces, the available resources are not used in the most efficient way and the quality can thus not be improved at the town scale. Design principles such as the prioritization of rebuilding of 'high quality' towns and the downscaling of what to rebuild make it possible to 'create' quality within the 'nodes of quality'. The integrating capacity of the public open space can ensure strong spatial and social connections, which enable a prosperous recovery. Improving walkability of everyday places and introducing

necessary facilities are examples of design principles that stimulate an integrated public open space network. A municipal 'smart decline' strategy enables that resources and attention are paid to this public open space, and thus contributes to a faster disaster recovery.

However, sometimes when applying the design principles, contradictory alternatives came to light. Mostly design principles that are part of 'the hazard' category, e.g. which prioritize rebuilding in areas of low FA values, were contrary to principles that aim to build back better by the use of local qualities, e.g. restoring the link with the historic center. This resulted in different design models: model one prioritizes the culture historical value, while model two focuses on the earthquake resistance. The alternatives of both models have been compared, which resulted in the design synthesis. However, this synthesis has undergone several adjustments after the site-visit because of several reasons such as symbolic power, costs, relief, and etcetera.

The objective of this thesis was to inform and direct the recovery process of the post-quake landscape of Amatrice and by this to develop a 'Disaster Landscape Recovery' (DLR) framework that could give input to the recovery process of similar post-quake landscapes.

This objective was supported by the following main question:

What 'Disaster Landscape Recovery' (DLR) framework is needed to help recover post-quake landscapes such as Amatrice?

This thesis has used Amatrice as case study to approach the recovery process of post-quake landscapes. The presented 'Disaster Landscape Recovery' framework includes design principles that could give input to the recovery process in the post-quake landscape of Amatrice. The 'DLR' framework includes principles that deal with the pre-quake vulnerability, here shrinkage, and the hazard, so the earthquake, itself: together the 'disaster landscape'. Besides, 'disaster recovery' is approached as a combination of 'time' and 'deliberation', thus the framework includes principles of efficiency as well as principles that aim to 'build back better'.

However, as discussed in the first part of this evaluation, the site-specificity makes it complex to develop a 'DLR' framework that can be used for similar post-quake cases. But, generalization of the site-specific design principles could be a starting point.

RECOMMENDATIONS

In order to develop a 'Disaster Landscape Recovery' framework that could inform other post-quake landscapes in their process of recovery, it is recommended that more cases should be studied. The framework proposed, consisting of 'the vulnerable basis' and 'hazard' as part of the disaster landscape, and 'time' and 'deliberation' as part of disaster recovery, could be used as methodology for similar cases. First of all, in order to generalize the framework, the general design principles should be tested by other cases. Some of the principles are related with the wider context, such as the one that deals with the trend of shrinkage as the vulnerable basis, or the prioritization of rebuilding, which is related with the amount of towns. These principles determine a 'similar case' and thus the type of case to be studied. So, a similar case, amongst others, should also be subjected to a trend of shrinkage, should have been devastated to a similar extent and should contain a variety of towns. After selecting the case, the research should involve experts of several individual topics. For example, the physical impact of the earthquake and micro-zonation studies to specific FA values, fault zones, etc. should be investigated by an expert. Within this research some assumptions had to be made according this data, but by involving experts, the research will be more accurate. Besides, the questionnaire should reach more of the inhabitants in order to portray a detailed image of what is the inhabitants' perspective. Finally, a (separate) study to more references and in more detail, could give clear categories of approaches and corresponding outcomes. Based on the outcome of the study, the site-specific design principles should be generalized and adjusted. Based on a representative amount of similar case studies, the 'Disaster Landscape Recovery' framework can be defined better for other cases.

REFERENCES

REFERENCES

- Alexander, D. (2013). An evaluation of medium-term recovery processes after the 6 April 2009 earthquake in L'Aquila , Central Italy. *Environmental Hazards*, 12(1), 60–73. <https://doi.org/10.1080/17477891.2012.689250>
- Alexander, D. E. (2018). L'Aquila, central Italy, and the “disaster cycle”, 2009-2017. *Disaster Prevention and Management: An International Journal*.
- Allan, P., & Bryant, M. (2010). The Critical Role of Open Space in Earthquake Recovery : A Case Study (No. 34). Wellington, New Zealand.
- Allan, P., & Bryant, M. (2011). Resilience as a framework for urbanism and recovery. *Journal of Landscape Architecture*, 6(2), 34–45.
- Allen, L., Allan, P., Bryant, M., Becker, J., Johnston, D., & Saunders, W. (2016). Design for Resilience, (Cutter 2014), 1–9.
- Alvaro, L. M. (2016). Fu l'Amatrice dell'Umbria. Oggi Nocera Umbra deve essere il modello. Retrieved from <http://www.vita.it/it/article/2016/08/29/fu-lamatrice-dellumbria-oggi-nocera-umbra-deve-essere-il-modello/140537/>
- Amatrice. (2017). Retrieved September 30, 2019, from <https://borghipiubelliditalia.it/borgo/amatrice/>
- Amatrice News. (2013). Inaugurato oggi pomeriggio l'eco giardino Belvedere Bastioni: le immagini. Retrieved from http://www.amatricenews.it/apri_news.asp?id_news=259
- Amelia Nibbi, orgoglio amatriciano. (n.d.). Retrieved from https://www.eataly.net/it_it/magazine/produttori/amelia-casale-nibbi-amatrice/
- Amoruso, G. (Ed.). (2018). Putting Tradition into Practice: Heritage, Place and Design (3rd ed., Vol. 3). Springer International Publishing. <https://doi.org/10.1007/978-3-319-57937-5>
- Anibaldi, F. (2017). Don Giovanni Minozzi: L'Apostolo delle Case del Soldato alla Fronte. Retrieved from <https://didatticaluceinsabina.com/2017/12/11/2176/>
- ANPAS. (2018). Progetto Casa della Montagna Amatrice. Retrieved from <https://www.anpas.org/progetto-amatrice-a-tempo.html>
- Antrop, M. (2005). Why landscapes of the past are important for the future. *Landscape and Urban Planning*, 70, 21–34. <https://doi.org/10.1016/j.landurbplan.2003.10.002>
- ARQA. (2018). Casa del Futuro: restoration project for the Don Minozzi complex. Retrieved from <https://arqa.com/en/architecture-en/casa-del-futuro-restoration-project-for-the-don-minozzi-complex.html>
- Associazione Nazionale Alberghi Diffusi. (n.d.). Alberghi diffusi doc. Retrieved from <https://www.alberghidiffusi.it/alberghi-diffusi-doc/>
- Ayres, H. M. (2011). Disaster by Design The Role of Landscape Architects in the Canterbury Earthquake Recovery. Lincoln University.
- Bagnato, A. (n.d.). Amatrice. Viaggio Amaro nella Memoria tra Dolore Ricordi e Speranza. Retrieved September 30, 2019, from <http://www.lalbatros.it/index.php/costume/98-amatrice-viaggio-amaro-nella-memoria-tra-dolore-ricordi-e-speranza>

Baiutti, G. (2016). Friuli 1976-2016. Dalla ricostruzione a un nuovo modello di sviluppo. Forum Editrice.

Barca, F., Casavola, P., & Lucatelli, S. (2014). A Strategy for Inner Areas in Italy: definition, objectives, tools and governance.

Bauman, Z. (2000). Liquid Modernity. Polity Press.

Boeri, S. (2016). amatrice food area. Retrieved from <https://www.stefano-boeriarchitetti.net/en/project/new-refectory-for-amatrice/>

Bowring, J. (2012). Post-disaster Landscapes. *Landscape Review*, 14(2), 1–4.

Cagnazzo, R., De Feudis, L., & Montini, B. (2016). Terremoto in Centro Italia Almeno 159 vittime, 270 feriti Il sindaco: «Amatrice non c'è più». Retrieved October 2, 2019, from https://www.corriere.it/cronache/16_agosto_24/terremoto-magnitudo-6-centro-italia-crolli-molti-danni-30c313ca-69aa-11e6-a553-980eec993d0e.shtml

Chiaretti, F., & Nibbi, L. (2017). Microzonazione sismica livello 3.

Ciccarelli, C. (2015). Profilo storico. In *Amatrice. Forme e immagini del territorio*. Mondadori Electa.

Civile Protezione. (2018). Soluzioni abitative in emergenza: lo stato di avanzamento dei lavori Terremoto Centro Italia. Retrieved September 30, 2018, from http://www.protezionecivile.gov.it/jcms/it/soluzioni_abitative_sae_e.wp;jsessionid=491C9F4A9019C7C8EF3939ADCA1483FF.worker3?pagtab=1#pag-content

Clemente, M., & Salvati, L. (2017). 'Interrupted' Landscapes: Post-Earthquake Reconstruction in between Urban Renewal and Social Identity of Local Communities. *Sustainability*, 9, 1–13.

Comune di Amatrice. (n.d.). Parco in Miniatura. Retrieved from <https://www.comune.amatrice.rieti.it/parco-in-miniatura/>

Contreras, D. (2016). Fuzzy Boundaries Between Post-Disaster Phases : The Case of L ' Aquila , Italy. *International Journal of Disaster Risk Science*, 7(3), 277–292. <https://doi.org/10.1007/s13753-016-0095-4>

Contreras, D., Blaschke, T., & Hodgson, M. E. (2017). Technological Forecasting & Social Change Lack of spatial resilience in a recovery process : Case L ' Aquila , Italy. *Technological Forecasting & Social Change*, 121, 76–88. <https://doi.org/10.1016/j.techfore.2016.12.010>

Contreras, D., Blaschke, T., Kienberger, S., & Zeil, P. (2013). Technological Forecasting & Social Change Spatial connectivity as a recovery process indicator : The L ' Aquila earthquake. *Technological Forecasting & Social Change*, 80(9), 1782–1803. <https://doi.org/10.1016/j.techfore.2012.12.001>

Cucinella, M. (2018). Arcipelago Italia. Quodlibet.

DART. (2012). Final Report DART Declining, Ageing and Regional Transformation.

Ente Parco Nazionale del Gran Sasso e Monti della Laga. (2019). The Park's Products. Retrieved September 30, 2019, from <http://www.gransassolagapark.it/page.php?id=365>

Fiorentino, G., Forte, A., Pagano, E., Sabetta, F., Baggio, C., Lavorato, D., & Nuti, C. (2018). Damage patterns in the town of Amatrice after August. *Bulletin of Earthquake Engineering*, 16(3), 1399–1423. <https://doi.org/10.1007/s10518-017-0254-z>

French, E. L. (2017). Designing Public Open Space to Support Seismic Resilience: A Systematic Review. University of Guelph.

Giammarini, R. (2017). L'Impianto Urbano della Città di Amatrice. Geometrie, Adattamenti e Trasformazioni Secc. XIII - XV. In *Centri di Fondazione e Insediamenti Urbani nel Lazio (XIII - XX Secolo): da Amatrice a Colferro*. Edizioni Kappa.

Giovanni, G. Di. (2016). Post-earthquake recovery in peripheral areas: the paradox of small municipalities' reconstruction process in Abruzzo (Italy). *Italian Journal of Planning Practice*, 6(1), 110–139.

Gruber, E., Humer, A., & Fassmann, H. (2015). Managing rural decay. Strategies and responsibilities for declining regions in Austria. In *29th Annual AESOP 2015 Congress* (pp. 1156–1168). Prague.

Heins, P. (2012). Embracing Smart Decline. *Agora Journal of Urban Planning and Design*, 6, 1–6.

Hogg, S. J. (1980). Reconstruction following seismic disaster in Venzone, Friuli. *Disasters*, 4(2), 173–185. Il Progetto "Il Viaggio della Transumanza". (n.d.). Retrieved September 30, 2019, from <http://www.transumanzaamatrice.it/PAG/Itmain.htm>

ISTAT. (2016). Comuni dei crateri dei sismi del 24 agosto e del 26 e 30 ottobre 2016. Retrieved September 30, 2019, from <https://www.istat.it/it/archivio/199364>

Iuchi, K. (2014). Planning Resettlement After Disasters. *Journal of the American Planning Association*, 80(4), 413–425. <https://doi.org/10.1080/01944363.2014.978353>

Jayakody, R. R. J. C., Amaratunga, D., & Haigh, R. (2016). Planning and designing public open spaces as a strategy for disaster resilient cities : a review of literature. In *Building the Future - resilient environments* (pp. 156–168).

Joakim, E. (2011). Post-Disaster Recovery and Vulnerability, 1–26.

Kim, K., & Olshansky, R. B. (2014). The Theory and Practice of Building Back Better. *Journal of the American Planning Association*, 80(4), 289–292. <https://doi.org/10.1080/01944363.2014.988597>

Lear, E. (1846). *Illustrated Excursions in Italy*. Thomas M'Lean.

Mao, Y., Yanfang, L., Haofeng, W., Wei, T., & Xuesong, K. (2017). A Spatial-Territorial Reorganization Model of Rural Settlements Based on Graph Theory and Genetic Optimization. *Sustainability*.

Moatty, A., & Vinet, F. (2016). Post-disaster recovery : the challenge of anticipation. In *FLOODrisk 2016 - 3rd European Conference on Flood Risk Management*.

Newman, G., Hollander, J. B., Lee, J., Gu, D., Kim, B., Lee, R. J., ... Li, Y. (2018). Smarter Shrinkage : a Neighborhood-Scaled Rightsizing Strategy Based on Land Use Dynamics. *Journal of Geovisualization and Spatial Analysis*, 2(11).

Osbaldiston, N. (2013). *Culture of the Slow*. Palgrave Macmillan.

Parkins, W., & Craig, G. (2006). *Slow Living*. Bloomsbury.

Pietrogrande, E., & Vaccher, F. (2016). The Albergo Diffuso: an innovative model for tourism development and territorial

enhancement. In The 3rd International Conference S.ARCH 2016: NEXT ARCHITECTURE. Budva.

Pizzo, B., Di Salvo, G., Giuffr , M., & Pellegrino, P. (2013). Earthquakes , public spaces and (the social construction of) environmental disasters . The role of public space for risk mitigation and urban assessing the ' space of the Public '. Italian Journal of Planning Practice, 3(1), 1–38.

Protezione Civile. (2019). Soluzioni abitative: Sae e container. Retrieved September 30, 2019, from <http://www.protezionecivile.gov.it/attivita-rischi/rischio-sismico/emergenze/centro-italia-2016/soluzioni-abitative#pag-content>

Radstrom, S. (2005). A Place Sustaining Framework for Local Urban Identity : an Introduction and History of Cittaslow. Italian Journal of Planning Practice, 1(1), 90–113.

Regione Lazio. (2014). 'Utenti Motori Agricoli' Rieti.

Rieti Life. (2017). Amatrice, inaugurata l'area commerciale. Retrieved from <http://www.rietilife.com/2017/08/10/amatrice-inaugurata-larea-commerciale-foto-video/>

Rocchi, D. (2018). First Forum of Laudato Si' Communities in Amatrice. Petrini (Slow Food), "if we are headed towards a chasm, the multitude could reverse the course." Retrieved September 30, 2019, from <https://www.agensir.it/italia/2018/07/27/first-forum-of-laudato-si-communities-in-amatrice-petrini-slow-food-if-we-are-headed-towards-a-chasm-the-multitude-could-reverse-the-course/>

Rojek, C. (1993). Ways of Escape. Palgrave Macmillan.

Šćitaroci, M. O., Šćitaroci, B. B. O., & Mrđa, A. (2019). Cultural Urban Heritage: Development, Learning and Landscape Strategies. Springer.

SM Working Group. (2015). Guidelines for Seismic Microzonation. Civil Protection Department. Rome.

Una Amatriciana per Amatrice. (n.d.). Retrieved October 1, 2019, from <http://www.unamatricianaperamatrice.it>

Valensise, G., Tarabusi, G., Guidoboni, E., & Ferrari, G. (2017). The forgotten vulnerability: A geology- and history-based approach for ranking the seismic risk of earthquake-prone communities of the Italian Apennines. International Journal of Disaster Risk Reduction, 25, 289–300. <https://doi.org/10.1016/j.ijdr.2017.09.014>

Van den Brink, A., Bruns, D., Tobi, H., & Bell, S. (Eds.). (2017). Research in Landscape Architecture Methods and methodology. New York: Routledge.

Vignaroli, G., Mancini, M., Bucci, F., Cardinali, M., Cavinato, G. P., Moscatelli, M., ... Stigliano, F. (2019). Geology of the central part of the Amatrice Basin (Central Apennines , Italy). Journal of Maps, 1–10. <https://doi.org/10.1080/17445647.2019.1570877>

Wirth, P., Elis, V., M ller, B., & Yamamoto, K. (2016). Peripheralisation of small towns in Germany and Japan e Dealing with economic decline and population loss. Journal of Rural Studies, 47, 62–75. <https://doi.org/10.1016/j.jrurstud.2016.07.021>