

DIGNIFIED DISPLACEMENT:

Enhancing liveability of refugee settlements through
designing with ecosystem services on Lesbos,
Greece.



COLOFON

DIGNIFIED DISPLACEMENT

Enhancing liveability of refugee settlements through designing with ecosystem services on Lesbos, Greece.

MSc Thesis Landscape Architecture (LAR80436)

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Preface

In the time it took me to write this MSc thesis, a war started and a new refugee crisis emerged, driving millions of Ukrainians from their homes. While most have showed great compassion with the displaced people, recent events made it painfully clear that, even within our Dutch borders, the systems in place for temporarily housing the displaced show big hiatuses.

With the imagery from the 2015 refugee crisis still clear in my head, this thesis started from my sincere wondering in how far landscape architecture, the profession that I chose, could play a role in improving the impact that our sometimes failing refugee response systems can have on very real human beings. I am aware that the impact landscape architects can have on these very political issues is extremely limited, so I want to express that this thesis should be read as a positive approach to explore whatever limited, yet important, role landscape architects could have to improve the lives of refugees.

I sincerely hope that this thesis can bring about even the smallest mindset change, and to come a bit closer to a future where people on the run will be treated with more dignity and respect.

'In the camp you are a refugee, being helped, fed and guarded. In the face of nature, we are equal. It doesn't matter what you wear or what job you do, the mountains don't know, and the nature doesn't care' (camp resident Epirus, Greece)

Abstract

Planned refugee camps form places with a unique form of rapid urbanization that need to be better understood, considering rising trends in migration flows and possible increases in climate refugees in the future. The premises of this thesis is that for a refugee settlement to be more liveable, the natural and biological characteristics of the environment should be incorporated into the design considerations, while respecting the general needs of the population. To attain this goal, this thesis aims to find out how more liveable planned refugee camps can be designed using the goods and services that are derived from the natural and biological systems: ecosystem services. Using the framework of nature-based solutions, these NBS can be bundled into applicable spatial elements.

With a history of overcrowding, fire outbreaks and both mental and physical health issues, Greek refugee camps have clear steps to take to improve their liveability. Therefore, as a case study an alternative design is proposed for a new Reception and Identification Centre currently being developed on Lesbos, Greece: Vastria.

Using a Research Through Design approach, multiple models were designed for the Vastria site, with design principles grounded in theory and applied with the help of a systemic site analysis. The models were consequently tested using an adapted version of the Liveability Spatial Assessment Model. Through a combination of qualitative input by experts in the humanitarian field and a criteria selection procedure based on a thorough context analysis, the models were tested for their quantitative features in two design iterations. The outputs of this testing were liveability scores for both iterations, and a list of design remarks from additional expert review during the final iteration.

Built on the outcomes of the 2 design iterations, this thesis also presents a final design as a case proposition for the Vastria site, with design recommendations that could possibly be applied in similar contexts. While aware of the limitations of design as a solution to these complex political landscapes, this thesis provides practitioners with a relevant new approach to the design of planned refugee camps.

Keywords: liveability, ecosystem services, nature-based solutions, planned refugee camp, refugee, landscape design, landscape architecture, research through designing, Greece, Lesbos

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Abbreviations and Acronyms

COA – Centraal Orgaan opvang Asielzoekers
DEM – digital elevation model
EC – European Commission
ES – ecosystem services
GIS – geo Information Science
GP – general population
IRC – International Rescue Committee
LA – landscape architecture
MD – minimum distance
MDD – minimum driving distance
MHPSS – mental health and psychosocial support
MWD – maximum walking distance
NGO – non-governmental organization
PRC – planned refugee settlement
RIC – reception and identification centre
RSM – Rank Sum Weight
RTD – research through design
UNHCR – United Nations High Commissioner for Refugees
VFS – vegetated filter strip
VRH – variable retention harvesting



1 Introduction

1.1 Problem description and relevance

In 2015, 24 people were forced to leave their home every minute, seeking refuge in other places (Ghosh, 2018). In 2015 alone, over two million asylum applications were filed spread over Europe (Ghosh, 2018). Since then, a big influx of people mostly from the Middle-East has continually been flooding into Europe, searching refuge from war and political instability (Al Jazeera, 2022; Bregman, 2015). When in April 2015 the so-called ‘hotspot approach’ was implemented in the European Agenda on Migration, ten locations distributed over Greece and Italy were selected where reception and identification of refugees would be concentrated (Mentzelopoulou & Luyten, 2018).

Despite initial intentions, political unwillingness and a lack of European unity in legislation have caused for people be stranded at the entrance (Bregman, 2015; Lischer, 2017). Greek islands have seen many people coming over by boat only to find more uncertainty. Here,

Non-Governmental Organizations (NGO’s) such as the United Nations High Commissioner for Refugees (UNHCR) with best intentions try to organize shelter and food, and have a lot of experience with quickly setting up camps for these situations. Mostly due to political sensitivity and pressure, planned refugee camps (PRC’s) are intended and designed for short stay. The reality of the situation, however, does not match these design intentions; people often stay in PRC’s for years (Rooij et al., 2016), and what should be temporary turns out to be indefinite. In contrast with more informal camps that often form organically like cities, but lacking very basic infrastructure, the Greek camps have shown to form rigid places where only sometimes facilities are adequate and inhumane conditions start to thrive (Fairs, 2016). Often, the camps are exposed to the elements, lacking pleasant environments for people to relax and forget about their worries. It is unrealistic to keep thinking of these places as being of ‘temporary’ nature, as it is estimated that modern refugee crises last for about 20 years and refugees spend on average 17 years in a settlement (Rooij et al., 2016; Vermeulen, 2013).

Even though the UNHCR handbook states that “In addition to meeting the immediate needs, planning should take into consideration the long-term provision of services even if the situation is expected to be temporary” (UNHCR, 2020, p. 3), the reality is that UNHCR by mandate has to plan for the temporary nature of an emergency settlement and operates under the assumption that refugees will soon transfer or return to their place of origin (Vermeulen, 2013).

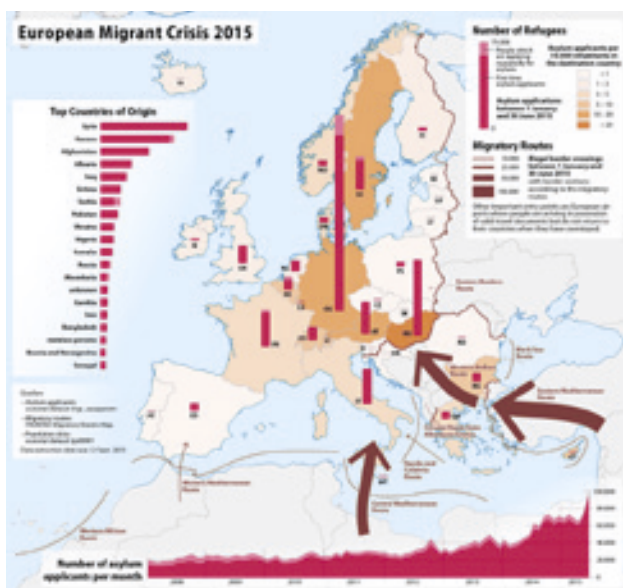


Figure 1. European migrant crisis overview, source: https://nl.wikipedia.org/wiki/Europese_vluchtelingen-crisis



Figure 2. Detention style new RIC on Leros, Greece, source: M. Smit

When looking at examples of Greek PRC's it shows that often overcrowding is an issue, and the site, its infrastructure and services are not fit for the duration of stay nor for the intensity of use (Fairs, 2016).

To find solutions for these problems, a landscape architectural approach to the design of refugee camps can prove useful, overseeing scales with a multidisciplinary basis (Bruns et al., 2016). As stated by Etteger (2018) the scope of this thesis should address an issue that can be solved by: “systematically organising functions in their appropriate location, shaping locations with green tools like trees and plants, shaping the land and directing water flows and by shaping urban open spaces” (p. 2). In the humani-

tarian sector there are many engineers and architects, which works well on a technical level, yet there seems to be a need for a more holistic approach, also overseeing different layers and phases through time (F. de Heer, personal communication, May 20, 2021).

Concluding, the engineer approach to planning refugee settlements provides for very practical, but very rigid and inflexible lay-outs. The specific context of the landscape and its advantages and disadvantages is often not analysed and used, but rather bulldozed and ignored. While it appears to be the main focus of these places to adequately create a liveable temporary home for vulnerable communities, camps often prove to be barren, exposed places stripping inhabitants of their dignity. Considering that global migration is expected to double in the coming 25 years begs for us to start designing PRC's to incorporate liveability in every aspect and for them to be able to adapt to the changing circumstances. As humanitarian expert Killian Kleinschmidt states in a talk held at the Dutch Design Week: “certainly don't design yet another shelter for refugee's, [...] get back to really design spaces which can grow, which can adapt, which can be flexible, deal with different people” (De-zeen, 2017).

1.2 Knowledge gap

Most research and practice in relation to liveability in landscape design is focused on urban areas. Research into these concepts for the specific setting of a refugee settlement seems to be rare, yet some papers touch upon the matter. A report by De Rooij, Wascher & Paulissen (2016) on how “(temporary) sustainability strategies and support measures addressing social, envi-

ronmental and economic assets as developed by Metropolitan Solutions, can contribute to the strengthening of the liveability and resilience of refugee camps” (p. 3) concludes that camps need more self-sufficiency and self-organizational structures. The authors then recommend that social and environmental impacts of these camps can be reduced through taking up sustainable design principles such as circular economy, inclusiveness, nature based solutions (NBS) and ecosystem services (ES). The latter of these recommendations, namely using ES and NBS as a framework for increasing liveability of refugee camps, seemed to have potential for a strong landscape-based approach. This approach flows from one of the six main directions of Metropolitan solutions: “Creating liveable and healthy

refugee camps by developing innovative approaches based on ecosystem functions that are linked with the overall landscape of the site” (Rooij et al., 2016). As mentioned, there is theoretical background surrounding this subject, yet practical application seemed to be lacking. In this sense, a gap was lying in envisioning design strategies based on NBS and working with site relevant ES to tackle prevailing liveability issues in PRC’s. Additionally, handbooks rarely address the phasing of camps and how it should respond to sudden influx of people. It was considered a valuable angle of the research to take this phasing into account.

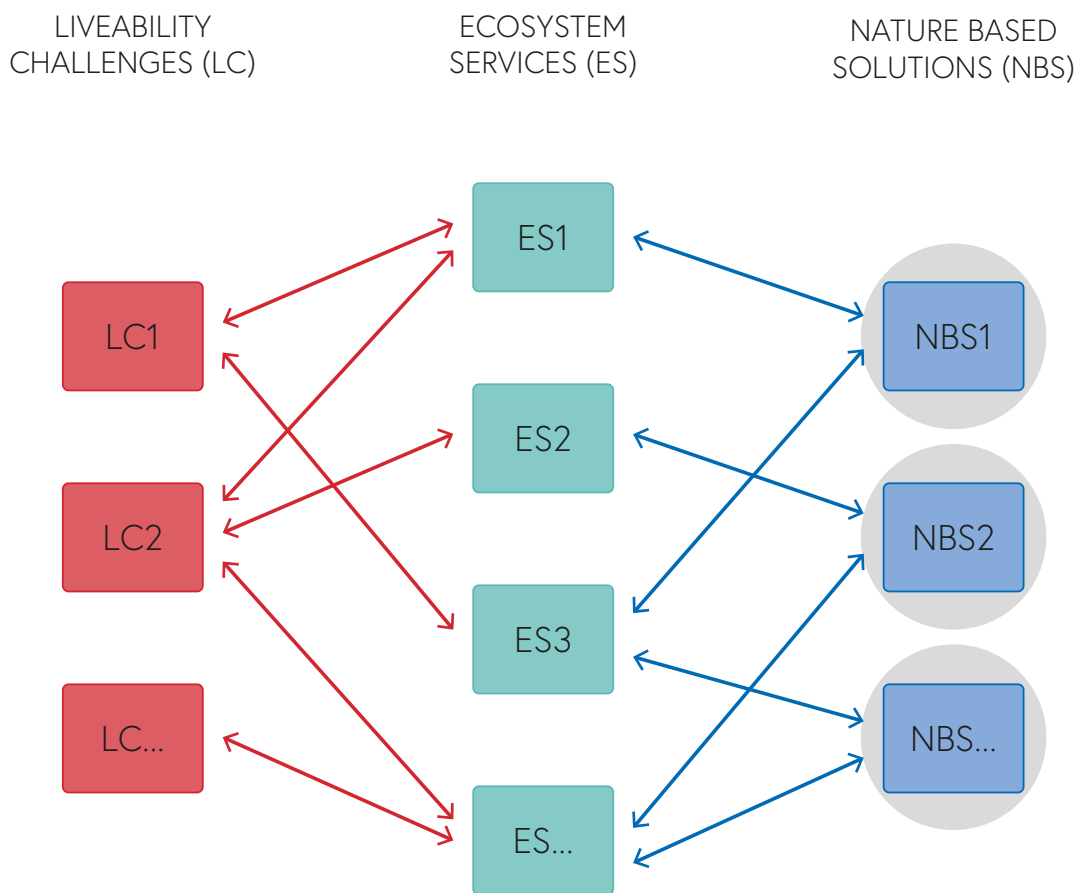


Figure 3. Simplified LC-ES-NBS scheme, adapted from Babí Almenar et al. (2021)

2 Research design and methods

2.1 Research objective

To fill this knowledge gap, and while aware of the fact that often bad conditions in PRC's are at least partly fuelled by global, regional or local politics (Bathke, 2021; Kettenis, 2021; Oxfam International, 2021; Vermeulen, 2013), this thesis aims to explore the possibilities of operating within the field of landscape architecture (LA) to create better living conditions in PRC's. Within the scope of this thesis, research was done into the concept of spatial liveability of PRC's during different phases of implementation, and how and which ES could contribute to this concept. This has led to the following research question and sub-questions.

2.2 Research questions

RQ: How can liveable planned refugee camps be designed based on ecosystem services?

SQ 1: How can liveability be defined in relation to the site and its future refugee inhabitants?

SQ 2: Which ecosystem services can improve liveability in planned refugee camps?

SQ 3: How can landscape design contribute to liveability in planned refugee camps?

2.3 Case of Vastria

In order to answer these questions, a case study was performed to be able to apply design principles and guidelines and test the design for its liveability. As briefly mentioned in section 1.1, Greece has had a main role in the refugee crisis starting in 2015.

On the Greek islands, the 'hotspots' chosen by the EU started being flooded with arrivals, at a rate of over 14.000 per day (Ghosh, 2018). This was double the hotspots' estimated capacity, so when the Moria camp on Lesbos burned down in September 2020, the camp was at more than six times its original capacity. Most inhabitants were relocated to Mavrovouni camp, where even worse conditions were reported (Kingsley, 2020). Adding to that, the adjacent Kara Tepe 1 refugee camp, considered "one of the few places that guaranteed security and dignity to nearly 400 vulnerable men, women and children" has been closed and absorbed by Mavrovouni camp in 2021 (Artsen zonder grenzen, 2021). As the

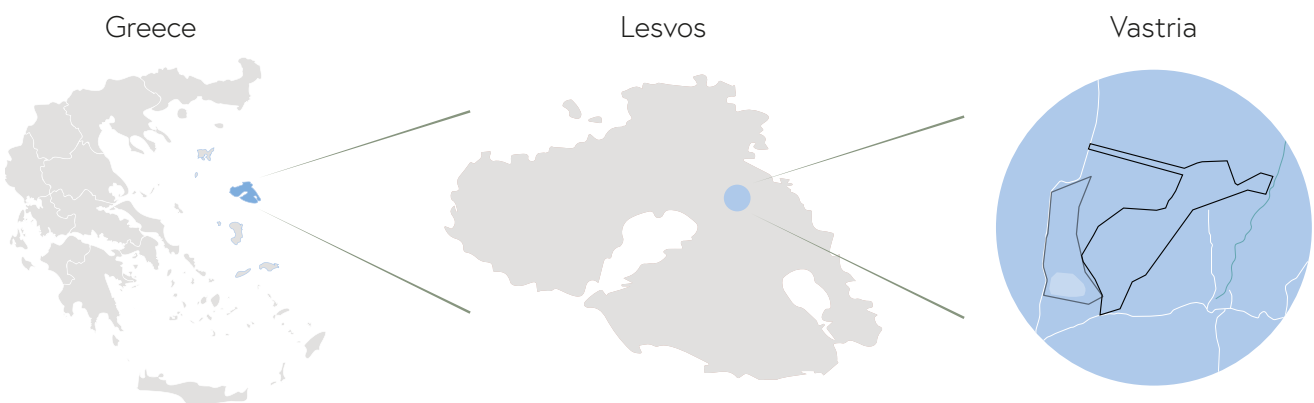


Figure 4. Location zoom in

Mavrovouni camp was meant to be a temporary solution, options for new sites were being explored and the choice was made for the Vastria site, considered the least suitable on the list of ten sites presented by the European Commission (EC) (M. Smit, personal communication June 9, 2022).

Vastria, as funded by the EU and planned by local actors, is planned to have a maximum capacity of 3.000 people (Bathke, 2021). The intended function will be that of a Reception and Identification Centre (RIC), meaning that the amount of time actually living at the camp should be minimal and from here, refugees with approved asylum applications can be distributed over the rest of the EU (UNHCR, 2021a). Vastria is located far in land, on a mountainous piece of private land that is mostly naturally vegetated. Objections were made by many organisations concerning the choice of the Vastria site for the future liveability for its inhabitants. Vastria has been selected as a case study for applying the concepts produced in this thesis.

2.4 Research methodology

To answer the main research question, several models for the case of Vastria have been designed and tested as one of the methods to collect data. This thesis uses the term Research Through Design (RTD) for any research methods that include using the outcomes of a design process, as described by Lenzholzer et al. (2013). Next to designing, other methods have been used to inform the design in order to answer the research question.

Figure 5 depicts a methodological scheme for the entirety of the thesis, with the research divided into the theoretical analysis, landscape

analysis and assignment analysis (Etteger, 2019). The theoretical analysis consisted mostly of literature study and has led to design criteria, which have been used to test designs, and an analytical framework. The landscape analysis had the aim of getting to know the site and used geographical data analysis, literature review and field observations as methods of knowledge gathering. The outcomes of this include spatial data in graphical representation and a list of site-specific challenges. The assignment analysis has looked deeper into the practice of designing and managing refugee camps as well as analysing examples of other camps and settlements, through the methods of literature study, reference studies and interviews. These outputs have been translated to design principles that form the basis for a site masterplan, a detailed zoom in, applied design strategies and several sections and principle clarifications as outcomes of the two design iterations.

2.4.1 Data collection methods

Figure 5 depicts a data collection scheme showing which methods have been used to answer the sub questions and the outputs they deliver that fuelled the design iterations. These data collection methods are elaborated on below.

Spatial data analysis



Geo Information Science (GIS) software such as ArcGIS Pro and QGIS have been used to analyse data such as Digital Elevation Models (DEM), land use maps and other relevant geological and geographical data in order to produce relevant maps. These maps helped understand the adjacencies and connections of

Vaustria with its surroundings and its topographically relevant characteristics. In addition to this, Google Earth pro and Google Maps have been used to explore the site and its surroundings.

Literature study



A literature study has been performed throughout the thesis to consolidate key outcomes of existing literature and to build on these outcomes while making design considerations. The thesis draws from both academic sources for theoretical background, as well as non-academic sources such as the Sphere and UNHCR handbooks for practical input.

Reference study:



In order to not ‘reinvent the wheel’ when it comes to good refugee settlement design, reference studies ‘of a specific event, situation or complex phenomenon investigated in their real world context’ (Bruns et al., 2016, p. 122) have been performed. Both quantitative and qualitative data was gathered and visualised for two different references where liveability seems or seemed to be relatively high.

Expert interviews



Experts in the field of humanitarian work and specifically refugee settlement management/design were engaged in order to get a good scope of current practice and to inform on design decisions. The expert interviews were conducted both as unstructured interviews, in which the interview structure, contents and questions was flexible, as well as semi-structured, with predetermined open questions (Kothari et al., 2014). Experts were interviewed both online as well as live on Lesbos during a field trip.

Key experts that were interviewed are Fiona de Heer, Oana Baloi, Killian Kleinschmidt, Margriet Smit and Kiki Michailidou, shown in figure 4. Fiona de Heer is a landscape architect currently working for the UNCHR as an emergency settlement planner. Oana Baloi is a programme management consultant at UN habitat. Killian Kleinschmidt is CEO of a network for humanitarian expertise and has previously worked for UNHCR. Margriet Smit is an architect with long-standing experience in the Netherlands working for Centraal Orgaan opvang Asielzoekers (COA) and is currently working for the European Com-

Kilian Kleinschmidt



- CEO of network for humanitarian expertise
- Former UNHCR director of Za'atari refugee camp

Fiona de Heer



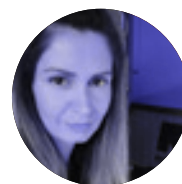
- Landscape Architect & urban designer
- UHCR Emergency Settlement planner responsible for piloting the masterplan approach

Oana Baloi



- Landscape Architect
- UN Habitat programme management consultant

Kiki Michailidou



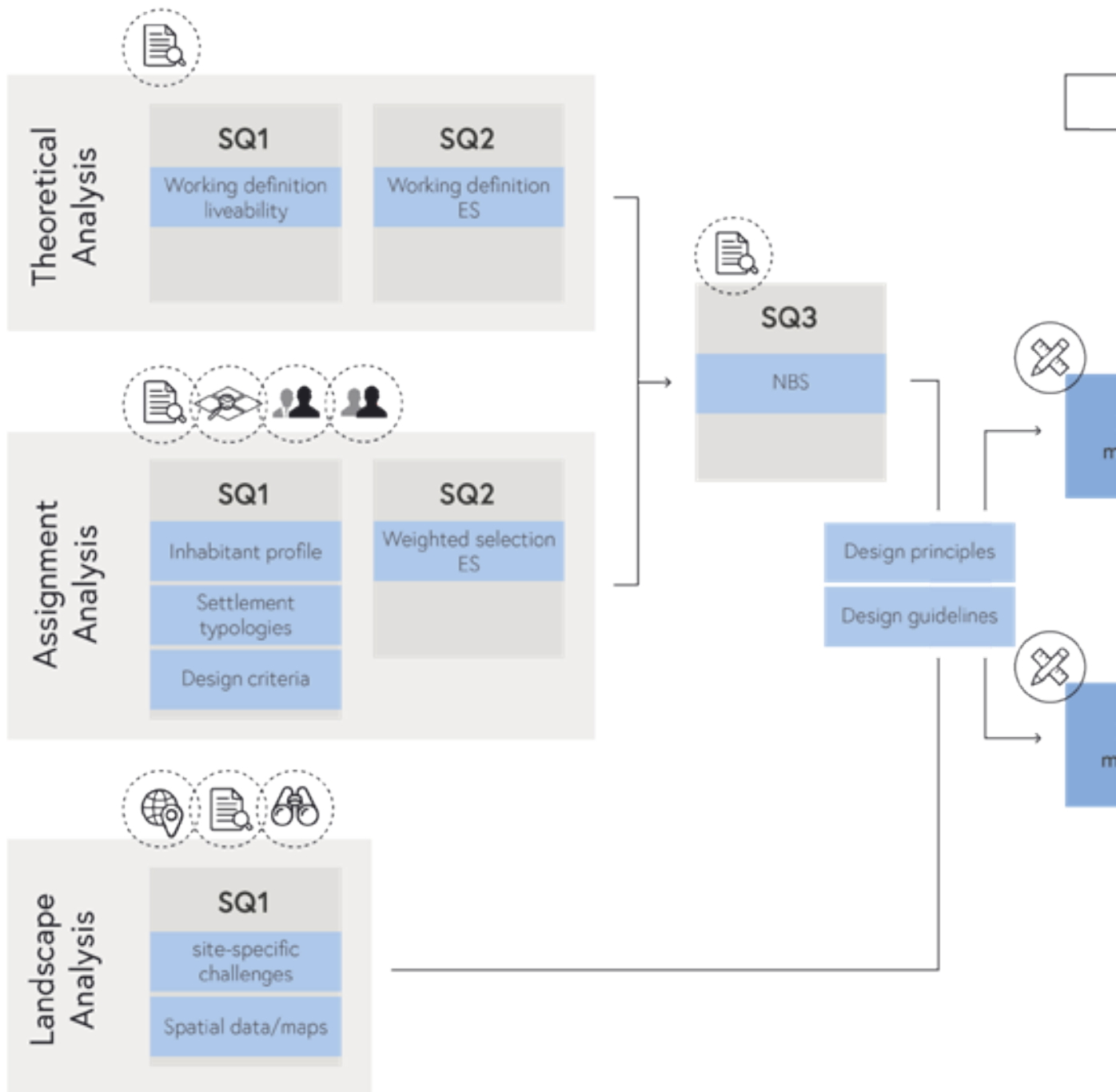
- Camp psychologist
- IRC Mental Health and Psychosocial Support manager

Margriet Smit



- Architect
- Former experience as architect for Centraal Orgaan opvang Asielzoekers
- European Commission Taskforce for migration site planner / projectmanager

Figure 5. Key experts



METHODS

Litarature study



Refugee interview



Spatial data analysis



Expert interview



Field observation



Reference study



ACTIVITIES

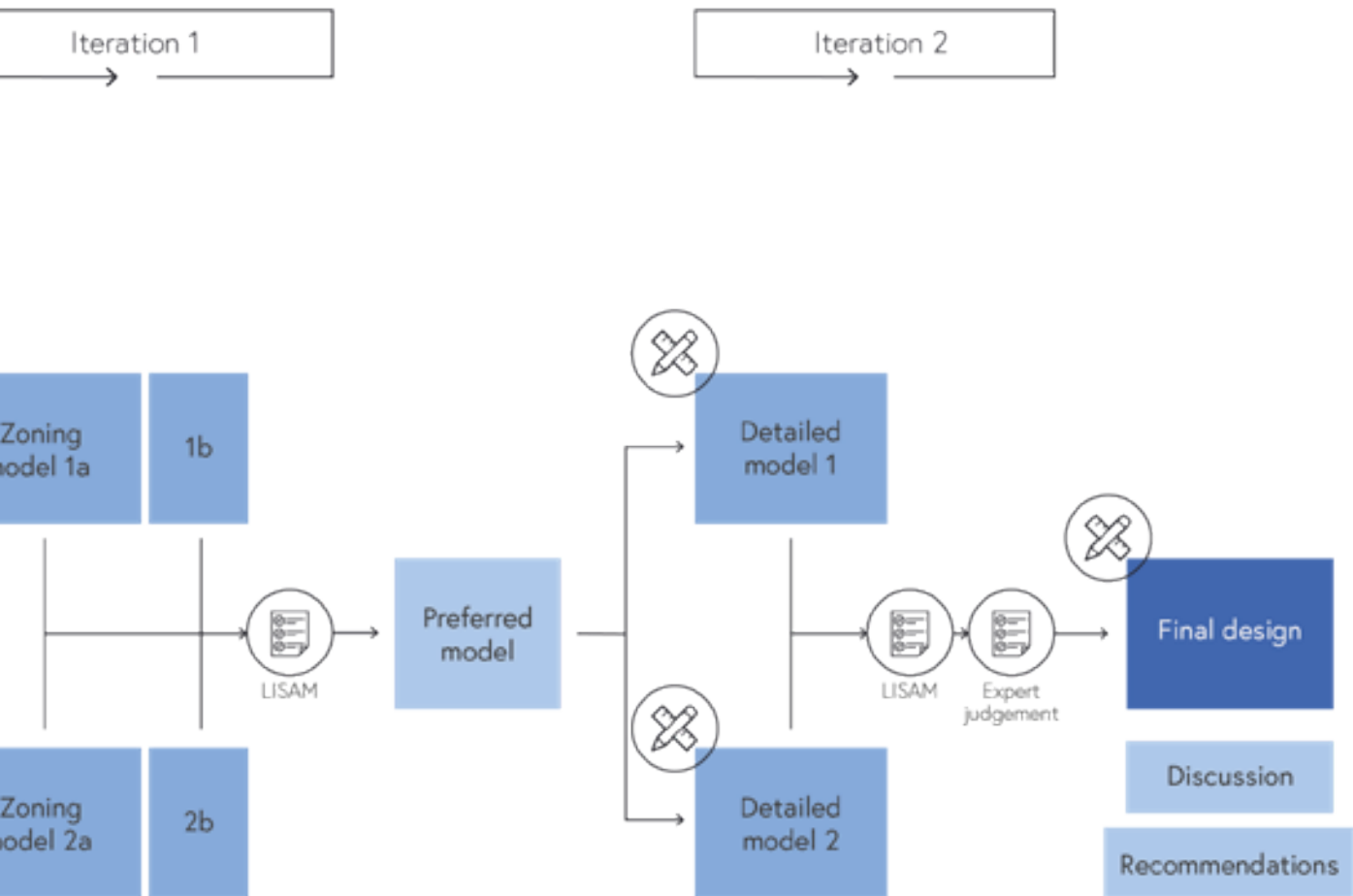
Designing



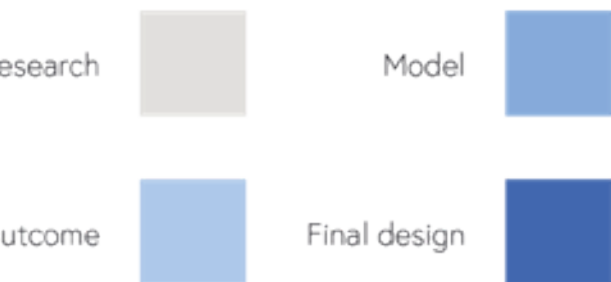
Testing



Figure 6. Methodological scheme



MATERIALS



UNHCR portal:
Emergency Handbook, demographics of refugee population

GIS data:
Elevation, vegetation, infrastructure, hydrology, soil

mision (EC) as a representative leading camp planning for the Greek islands. Kiki Michailidou is Mental Health and PsychoSocial Support (MHPSS) manager at the International Rescue Committee office on Lesbos.

Refugee interviews



Semi-structured interviews with inhabitants of Mavrovouni camp were held during a field trip to Lesbos. Because access to the camp was not granted, a community centre just outside the camp was visited, where interviews were held. Because of the vulnerable status of these inhabitants, extra attention was given to explaining consent and names were be anonymized. Through the interviews, insight into the perspective of the inhabitants of refugee camps was gained and it was ascertained what they felt was spatially missing from the Mavrovouni camp.

Field observation



A field visit was carried out at the beginning of June 2022 in order to get to know the Vastria site and get a feel for the surroundings. As construction of the new camp just begun as of June 2022 and it is heavily guarded in order to protect the site from protesting Greeks, there was no opportunity to enter the site itself. Instead, the surrounding landscape, local towns and a refugee community centre were visited. During this visit, observational methods such as a stop motion walk, drawing and taking pictures were employed, taking note of both ecological and social factors. Also, informal and semi-structured interviews were held. This helped understand characteristics of Vastria, relationships with its adjacencies, historical development and

predispositions of its inhabitants and other actors.

2.4.2 Testing methods

In previous sections, the concepts of liveability and ES were introduced, which are central concepts in this thesis and give the research clear boundaries. This subsection elaborates on how the design outcomes were tested in relation to these central concepts and how criteria were achieved through a novel adaptation of existing models.

Figure 6 visualizes the LIveability Spatial Assessment Model (LISAM) as developed by Antognelli and Vizzari (2017), which bridges the gap between the concepts of liveability, ES and spatial features by assessing liveability in terms of ES and Urban Services (US) through both objective spatial qualities of the landscape as well as subjective input from stakeholders (Antognelli & Vizzari, 2017). The model was designed for measuring regional liveability and was subsequently adapted to fit the context of this thesis. The adapted LISAM operates in four steps:

(1) Designing a hierarchical classification of the ES and US. The hierarchical classification of ES and US as designed by Antognelli and Vizzari (2017) is divided in four different sections of services, elaborated on in section 4.2, 14 divisions and 66 classes. Because the scale and context of this thesis is significantly different to the scale and context of the Antognelli and Vizzari case study, these 66 classes were trimmed down and adjusted to 9 classes for iteration 1 and 15 classes for iteration 2. These classes directly translate to the design criteria of this thesis, as elaborated on in section 4.3.

(2) Calculation of service weights with the involvement of experts. This was done by providing the service classes, subdivided by their section, in a survey presented to several experts. In this survey, the experts ranked the services on their importance in the context of a PRC. The outcome of these surveys consisted of average rankings, which were then translated into class weights using the Rank Sum Weight (RSM) method (Roszkowska, 2013). The survey questions and outcomes can be found in Annex 1.

(3) Modelling the spatial accessibility. This entails the models developed for the two design iterations and will be elaborated on in section 6.1. The design aspects and level of detail of the models were linked to what could be tested with the criteria classes available for that iteration.

(4) Weighting and aggregation of spatial indices (Antognelli & Vizzari, 2017). Using Auto-

CAD, the surface areas, Euclidean distances, Maximum Walking Distances (MWD's) and Minimum Distances (MD's) needed to assess the service classes were calculated for all the different models. These were then recalculated to complementary distances and areas by relating them to the highest of the values being compared. As values where a higher numerical value was better were needed, the values where a lower numerical value was better were related to either a maximum value as described in UNHCR or Sphere handbooks, or an imaginary maximum value. Using these values and following cumulative formulas, liveability scores (0-1) were derived for the classes, divisions and sections of the models alike. A full overview of the adapted LISAM can be found in Annex 1.

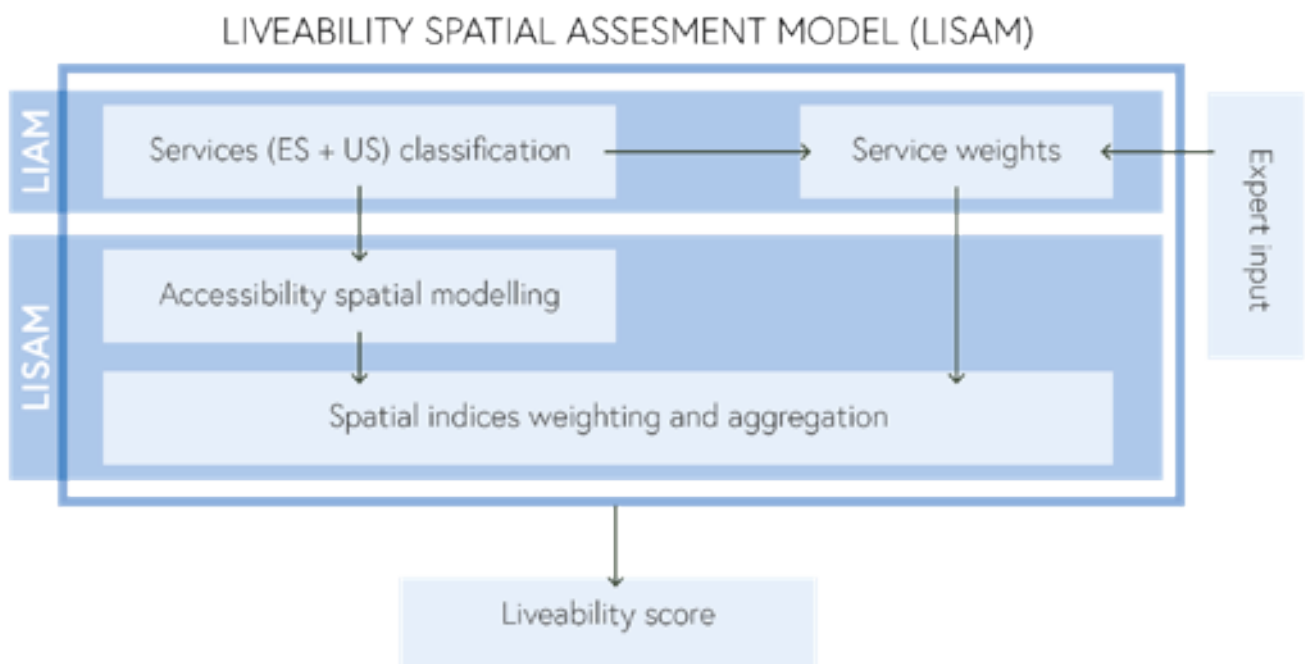


Figure 7. LISAM operationalisation scheme, adapted from Antognelli, S., & Vizzari, M. (2017)

3 SQ 1 - How can liveability be defined in relation to the site and its future refugee inhabitants?

3.1 Introduction

Traditionally, much of the research into landscape liveability in relation to ES has been focussed on developed urban settings (Antognelli & Vizzari, 2017). In the context of PRC's, liveability might be assessed with different standards than in a developed urban context. In this section, the concept of liveability is elaborated on and related to the specific context of the case for this thesis. For this, a definition of liveability is distilled from literature. Using this definition, an analysis of the population, the organizational context of PRC's and the analysis of the Vastria site practical outcomes and challenges can be formulated.

3.2 Liveability in theory

Considering the context of this thesis, a big part of the focus of achieving a liveable place was through fulfilling a person's basic needs. In his paper 'A theory on human motivation', Maslow

explores what motivates human beings through the proposal that "all human activity is (directly or indirectly) motivated by innate needs, which can be physiological (such as the need for water and oxygen) or psychological (such as the need for love and independence)" (Maslow, 1943, as cited in Desmet & Fokkinga, 2020, p.3). For creating any community, including in an emergency settlement, the challenge does not stop simply at fulfilling all the basic, physical needs, but extends all the way up the hierarchy until the need for self-actualization (Rooij et al., 2016). The eventual design principles of this thesis aim to address the different levels of the 'Hierarchy of Needs' as described by Maslow (Maslow, 1943).

Building on this theory and relating to a spatial context, a specific definition of liveability as mentioned in Ruth and Franklin's (2014) seems valuable:

"The notion of a liveable city in the sense of "fit to live in" or "inhabitable" requires two elements to be, and remain, in synch with

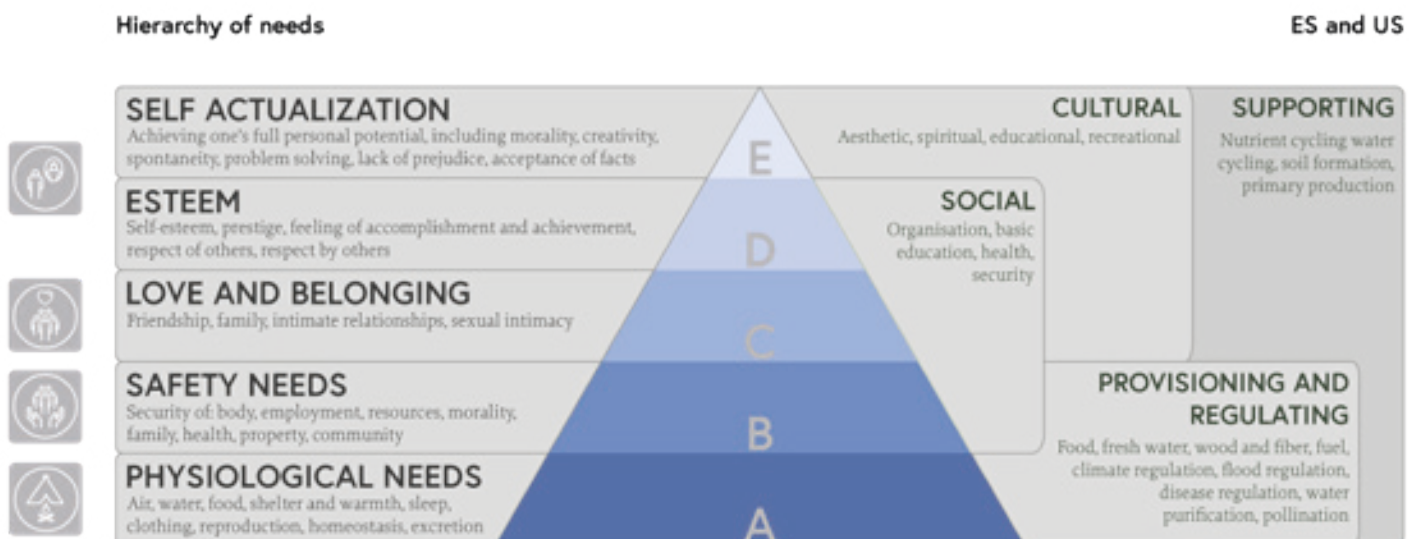


Figure 8. Hierarchy of needs vs. ES, adapted from Maslow (1943) & Millennium Ecosystem Assessment (2005)

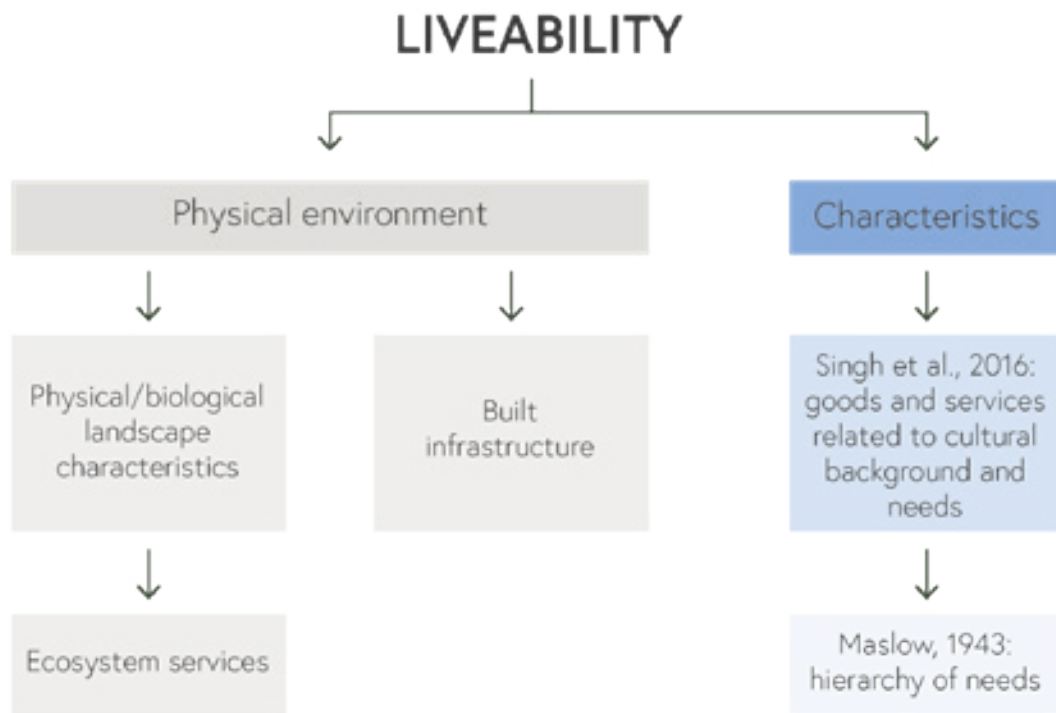


Figure 9. Liveability concept scheme, adapted from Ruth & Franklin (2014)

each other. One of these concerns the characteristics of the population that demands those goods and services, such as shelter, energy, water and food, waste management and assimilation, health and public safety, education and entertainment, social engagement, economic contributions, creativity, and much more. (...) A second element of liveability comprises the city’s environment, as defined by its physical and biological characteristics the built infrastructures and ecosystems that provide the goods and services on which lives and livelihoods in the city depend.” (p. 1)

In the context of a PRC, important characteristics in this could be cultural background, age, sex and group configuration, but also experiential background and skills. The importance of characteristics of the population within this definition are confirmed by Singh et al. (2016): “Liveability is often related to the values and

preferences local community places for amenity, well-being aspect and sense of place or belonging” (p. 5). That does however imply that due to high diversity of cultural background in emergency settlements, a replicable definition of liveability is undermined and has to be assessed anew for every new situation (Ruth & Franklin, 2014), making it outside the scope of this thesis to take every aspect of demographics into account.

While it is possible to achieve high levels of liveability for a short period of time by undermining the environment, ecosystems and their ES, for sustained communities liveability is directly tied to environmental sustainability (Ruth & Franklin, 2014).

Concluding, for the scope of this thesis liveability in a PRC can be achieved through analysing specific demographic needs and biophysical landscape characteristics so that design considerations could ensure these 2 elements to be in sync with each other.

3.3 Settlement analysis

The average lifespan of refugee settlements is 17 years, yet there is a great variation in types of refugee settlements. UNHCR categorizes 4 different types of refugee settlements; planned camps (or PRC), spontaneous camps, mass shelter and dispersed settlement. Vastria is first and foremost a PRC with the specific function of a RIC, which is a planned camp with a specific dynamic demographic that is further elaborated on in section 3.4. Outputs of this thesis can be more broadly applicable to any type of planned camp, so the Vastria site will be referred to as a planned camp. Planned camps are defined by UNHCR (2007) as a: ‘type of settlement (...) where refu-

gees are accommodated in purpose-built sites where a full range of services, within possible means, are provided’ (p. 208).

Within the scope of this thesis, a PRC has been looked at as an urban system with rapid demographic, environmental and socioeconomic change. These types of systems need to be flexible in order to respond well to liveability challenges (Ruth & Franklin, 2014). As previously mentioned, PRC’s in Greece have often shown they are not able to handle sudden influxes of a population, resulting in overcrowding on which dangerous situations can follow (Artsen zonder grenzen, 2021; Gooi, 2021; Kingsley, 2020). With local contractors in charge of design, shelters are

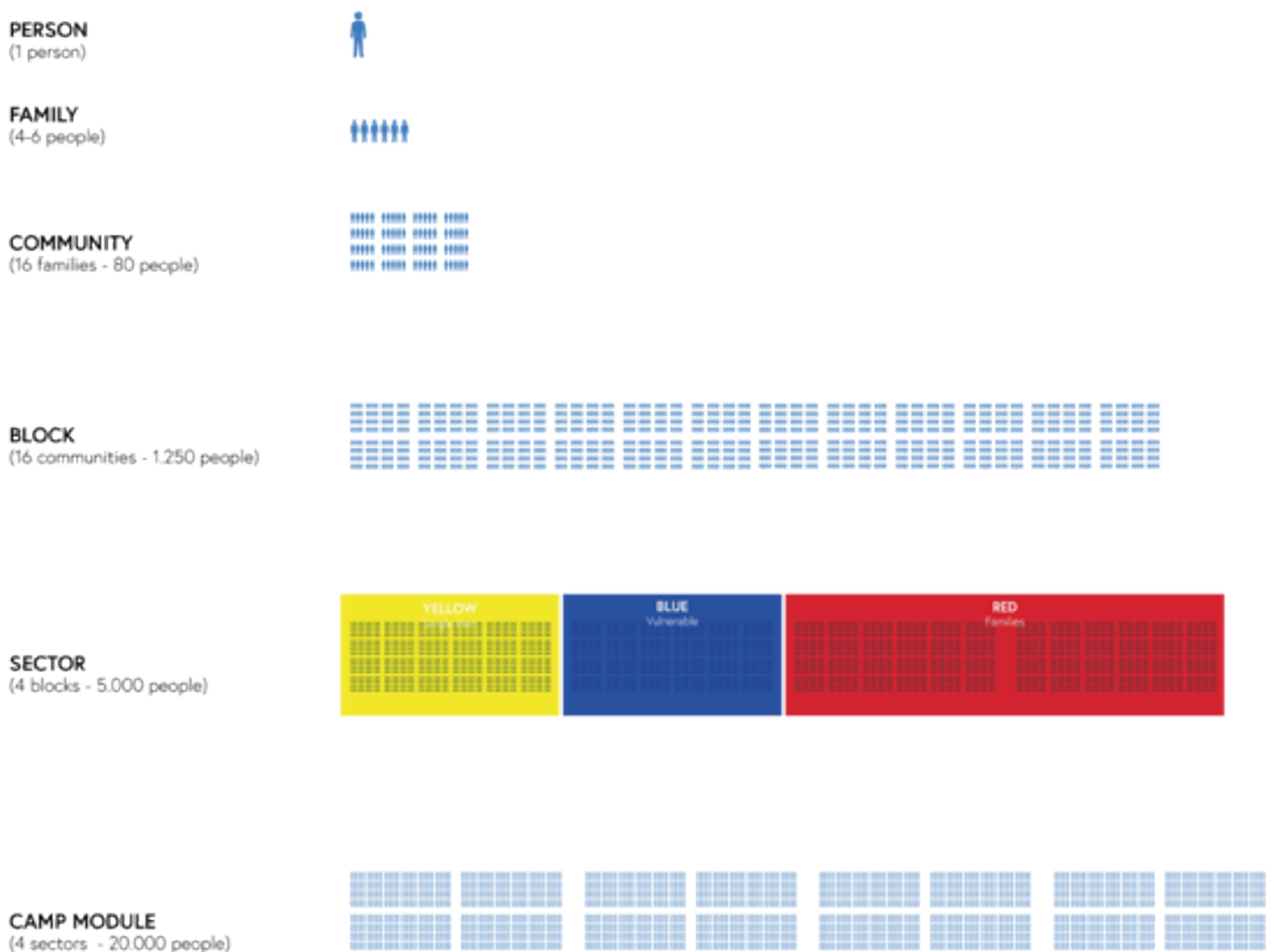


Figure 10. Camp module units, adapted from UNHCR (2008)

often placed in military style matrices to ensure efficiency. The rigidity and pre-set nature of the camp layouts have additionally shown to leave no room for self-organization of space, while this could potentially have a positive effect on inhabitants such as a feeling of ownership or education (Rooij et al., 2016). Extension of shelters is often one of the first things people implement after settling (Chamma, 2017; M. Smit, personal communication June 9, 2022), showing peoples eagerness to adjust their surroundings. From the interviews in annex 2, it appeared that wind nuisance, fire hazard, safety of vulnerable communities lack of social space and lack of communal space were key issues with previous camps on Lesvos. As taking phasing into account seems relevant, the following phases of a PRC lifespan were determined: i) pre-emergency, ii) emergency, iii) post-emergency, iv) influx, v) post-influx and vi) post-PRC.

Furthermore, the UNHCR dictated nature of a planned camp with a full range of services present on site, often leaves people dependant on these services that might not have a guaranteed quality, while features of the site greatly inhibit people to be more self-sufficient (K. Michailidou , personal communication June 10, 2022; Mohammed, personal communication June 9, 2022). A textbook PRC is divided into different modules as seen in figure 9. As IRC's often host vulnerable groups such as women, children or LHBTQIA+ precautions are taken by additionally dividing camps in different zones with thematic colours. The yellow zone is for single men, the blue zone for beforementioned vulnerable groups and the red zone is for families. Still however, there are incidents of attacks on these vulnerable groups up to a point where some do not dare to go to the bathroom at night (Smith,

2021; K. Michailidou , personal communication June 10).

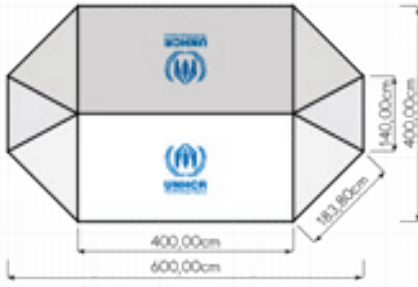
Shelters are usually categorized in emergency, transitional and durable shelters (UNHCR, 2016). As An RIC is meant to be temporary, this thesis has only taken emergency and transitional shelters into account. All shelters in this setting should be temporary, however as previously mentioned crisis' tend to drag out and shelter extensions are a common practice. UNHCR family tents are often used in the emergency phase, as they are easy to ship and set up. However, these tents are not suitable for 4 seasons and have a limited life span. RHU's are a new type of emergency shelter with modular elements forming a small house, however the durability of these is not good either. A preferred solution in some situations is a shelter kit containing suitable local materials that can be used by inhabitants to build their own shelters in accordance to their specific cultural and social needs. For more sturdy 4 season compatible housing, the Greek hotspots have used so called ISO-boxes, which are similar to shipping containers that can be outfitted with for example solar panels and air-conditioning. Often used materials include heavy duty plastic sheeting, wood beams, plastic poles and metal poles. Possible usable local materials are further explored in section 3.5.

Settlement challenges

- Overcrowding
- Lack of influence on surroundings
- Independence
- Fire hazard
- Safety of vulnerable groups
- Protection from elements
- Lack of social space
- Lack of communal space

UNHCR family tent

3-5 5°-40° 30 minutes 1 year



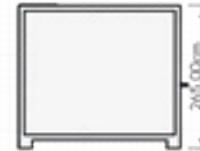
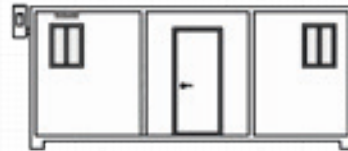
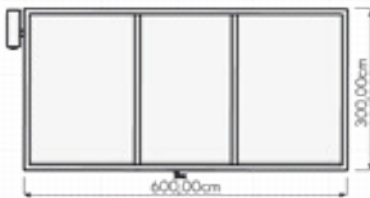
Refugee Housing Unit (RHU)

4 5°-45° 5-6 hours 3 years



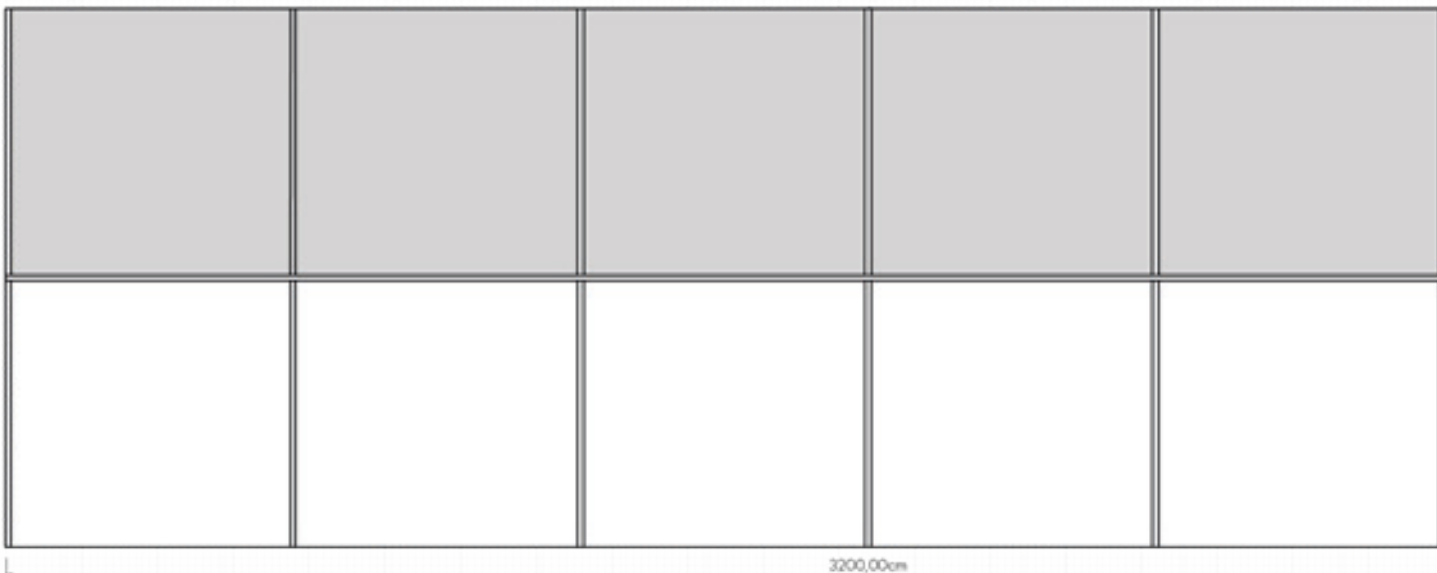
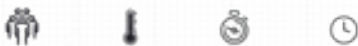
ISObox

3-5 5°-45° 0 hours 5-10 years



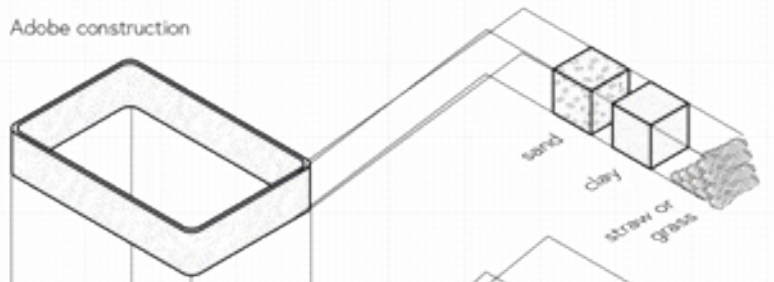
Rub hall

20-30 5°-45° 2-3 hours 3-5 years

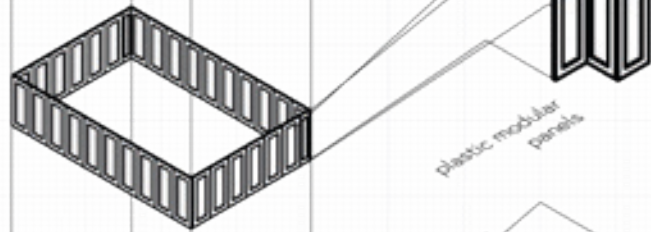


DIY solutions

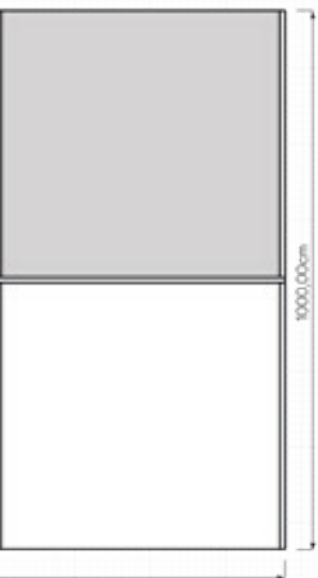
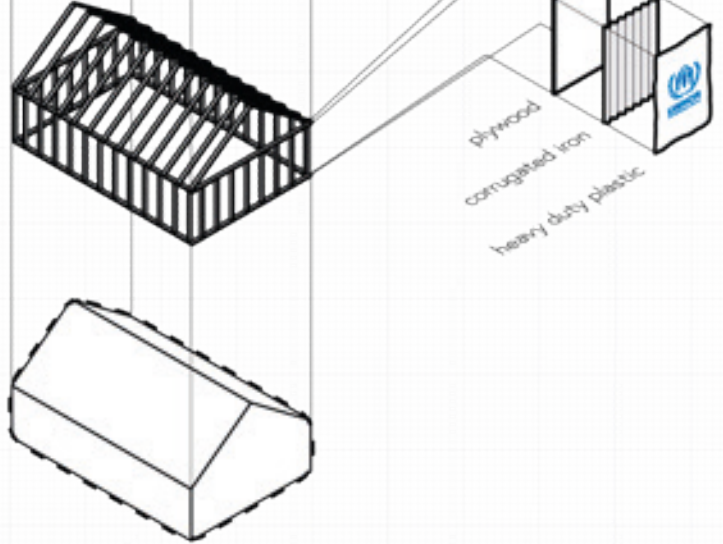
Adobe construction



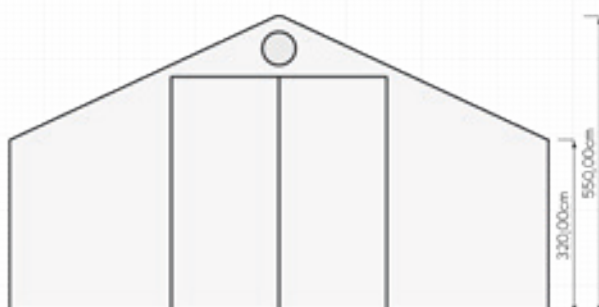
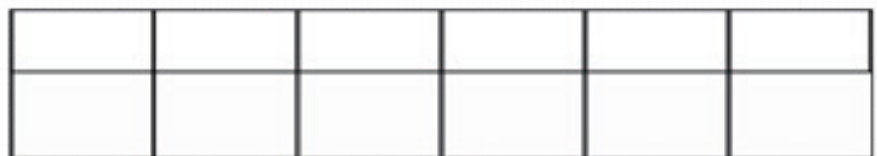
Modular construction



Timber frame with plating



50%



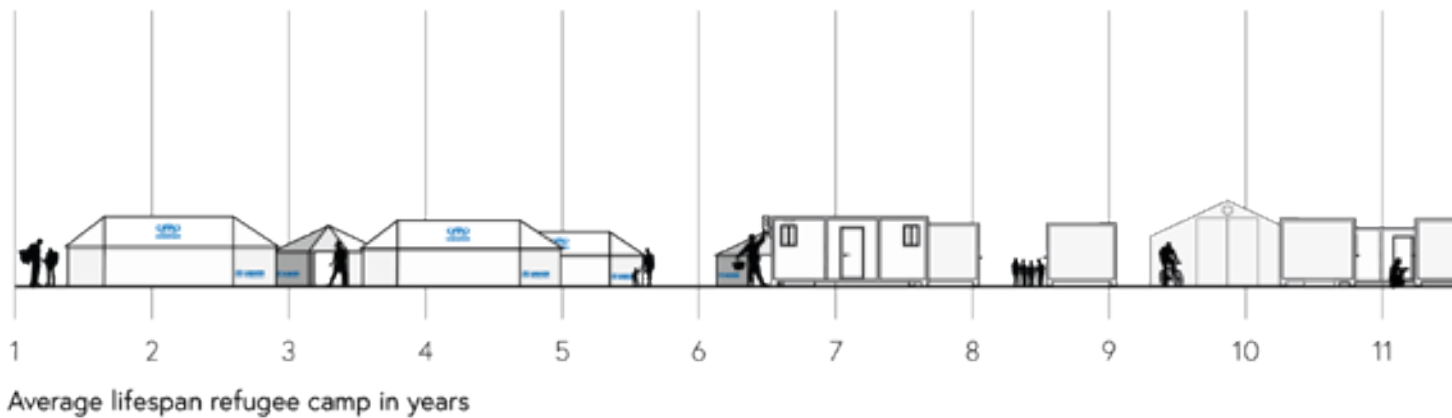


Figure 12. Average lifespan refugee camp, based on data from Kennedy (2008)

3.4 Population analysis

Considering that the characteristics of the population are an important factor in our definition of liveability, this section builds a rough profile of different population groups that will inhabit Vastria. As previously stated, Vastria will have the function of a RIC, meaning in theory many people will stay for only a short period of time, with continually changing demographics. Reality however has shown that people stay for much longer in the camps on Lesbos, thus it might be more valuable to take demographics into account in the design.

To start with the biggest categorization, all

inhabitants are asylum seekers, meaning: ‘civilians that seek safety in countries other than their own’ (UNHCR, 2007, p. 17). To register as an asylum seeker is the first step towards being recognized as a refugee. People inhabiting Vastria are all in a phase of the asylum application procedure. This procedure usually takes considerable time and is often the reason for a prolonged stay in an RIC. The uncertainties that arise here account for much of the stress that inhabitants experience while staying at an RIC (K. Michailidou, personal communication June 10, 2022).

Going into more detail about the population, demographics and statistics from 2019 were used, as they were available in multiple sources.

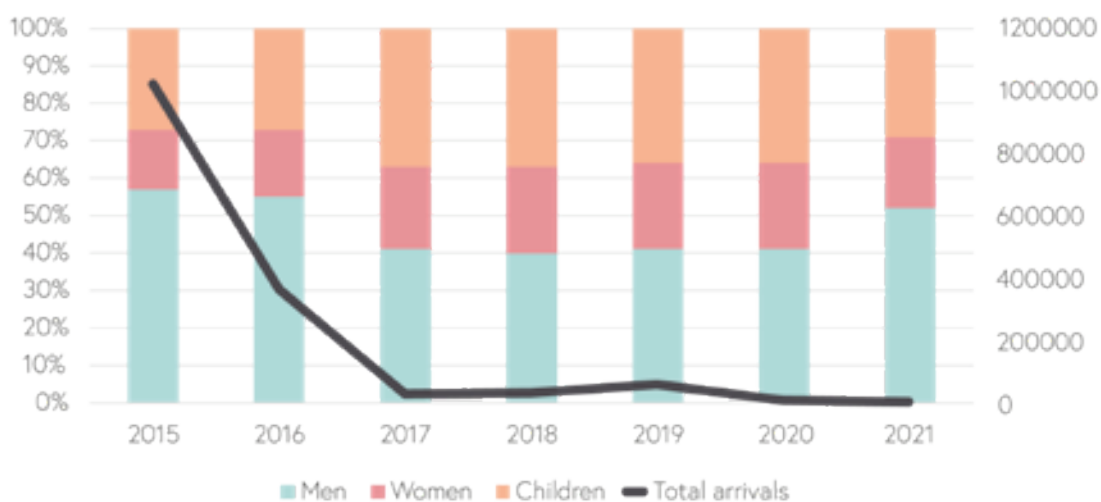
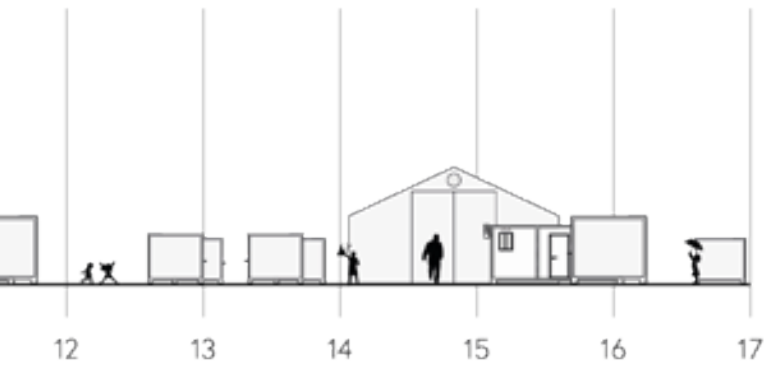


Figure 11. Demographics of refugees present in Greece over time



es and accurate compared to more recent statistics. The scope of this thesis is however limited to broad demographics such as male female ratio, families or singles and children or adults. In 2019, of asylum seekers on Lesbos, 42% were children and 58% were adults (59% men and 41% women). Of these, the great majority of people were from the middle east (86%) Three smaller groups within this demographic were identified, being unemployed men with low levels of education (28%); urban residents with high levels of education (12%); and females with high levels of education and female students (9%). Furthermore, 60% of asylum seekers on Lesbos were with at least one family member while the other 40% percent either were alone or did not know (Jauhiainen & Vorobeva, 2020). As demographics do still constantly change, these demographics have been used with big margins, and the design considerations needed to be able to adapt to changing demographics.

Population challenges

- Trauma
- Social vulnerability
- Stress
- Loneliness
- Sudden influxes

3.5 Site analysis

As previously stated, this thesis focusses on the newly assigned settlement site that will replace the Mavrovouni camp on the Island of Lesbos, Greece, shown in figure 12. Lesbos island is a geological assemblage of different metamorphic soils and rock formations within a Mediterranean climate context, resulting in high biodiversity mixed with human land management systems such as grazing, crops, agroforestry and olive groves ranging over terraced landscapes, fields, graze lands and wetlands (DEIMS, 2021; Sluis et al., 2014). Climate profiles range from arid to sub-humid, with habitat types as displayed in figure 12 thermo-Mediterranean (phrygana, scrub, pine forests), meso-Mediterranean (evergreen to semi evergreen oak forests), through to supra-Mediterranean (deciduous oak and chestnut forest).

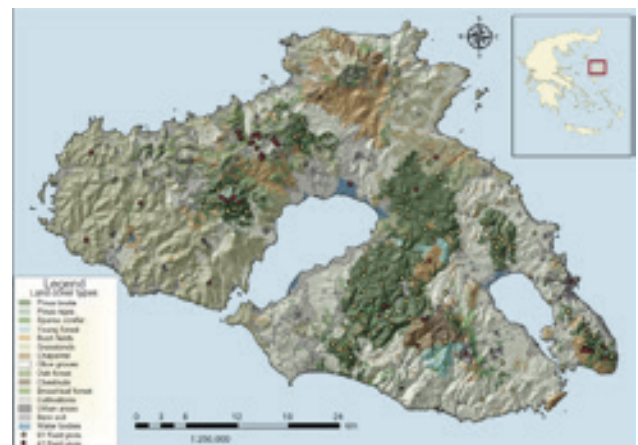


Figure 13. Land cover map Lesbos, Greece, source: Palaiologou et al. (2013)

The Vastria site, with a total surface area of about 65 hectares, is located on a hilly stretch of land between the Agia Paraskevi and Loutropoli Thermis regions in a thermo-mediterranean transition zone between a dense natura2000 pine forest, with species like *Pinus halepensis*,



Figure 14. L-scale land use and US map



Figure 15. Dry hillside pine forest adjacent to Vastria with wild fire warning sign



Figure 16. Typical lower small stream vegetation adjacent to Vastria site

Pinus brutia and *Pinus pinea*, and a sparsely scattered pine forest with shrubs and *phrygana* vegetation (DEIMS, 2021; Kalabokidis et al., 2013). Human intervention and increasing droughts and wildfires give rise to more monospecific forest stands. Exploitation in these forests has been known to lead to decreasing competition between species. Under-management on the other hand can result in dense monocultural monospecific *P. halepensis* forest with even higher wildfire vulnerability and low productivity (Mauri et al., 2016). Forest management approaches such as Variable Retention Harvesting (VRH) where mature overstory trees are retained and a patchwork of clearings emulating the effects of natural ecological disturbances could potentially ensure a more diverse regrowth (Nyamai et al., 2020). Combining this with more opportunities for water retention could increase the opportunities for rarer species such as *P. brutia* to develop and take stand. The *Montivipera Xanthina* or

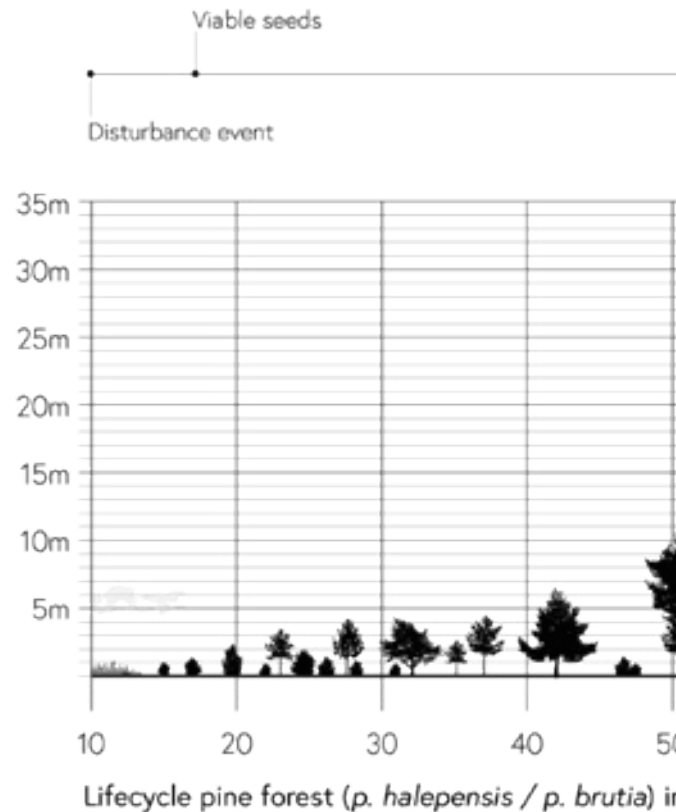


Figure 17. Average lifespan refugee camp, based on data from...

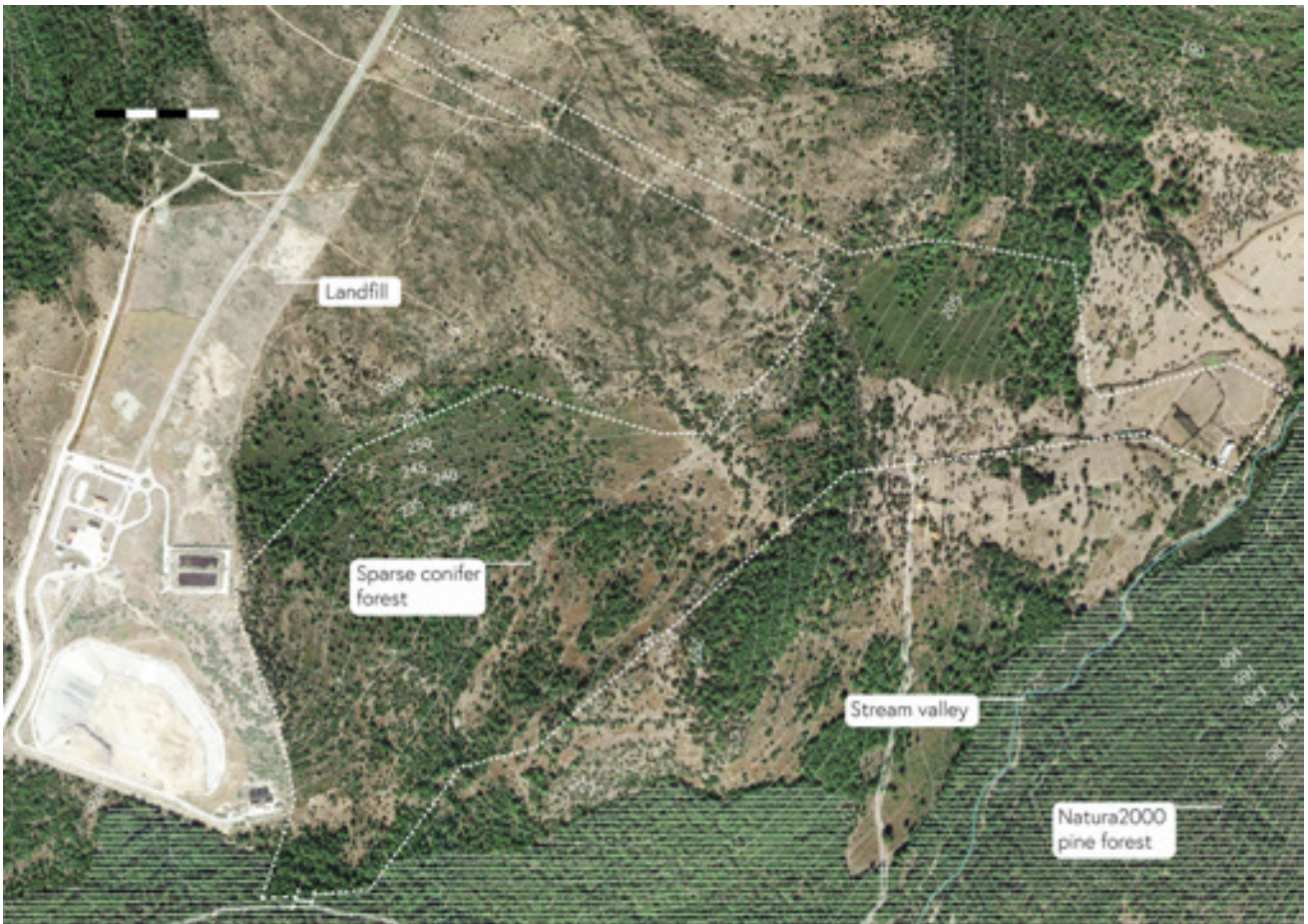
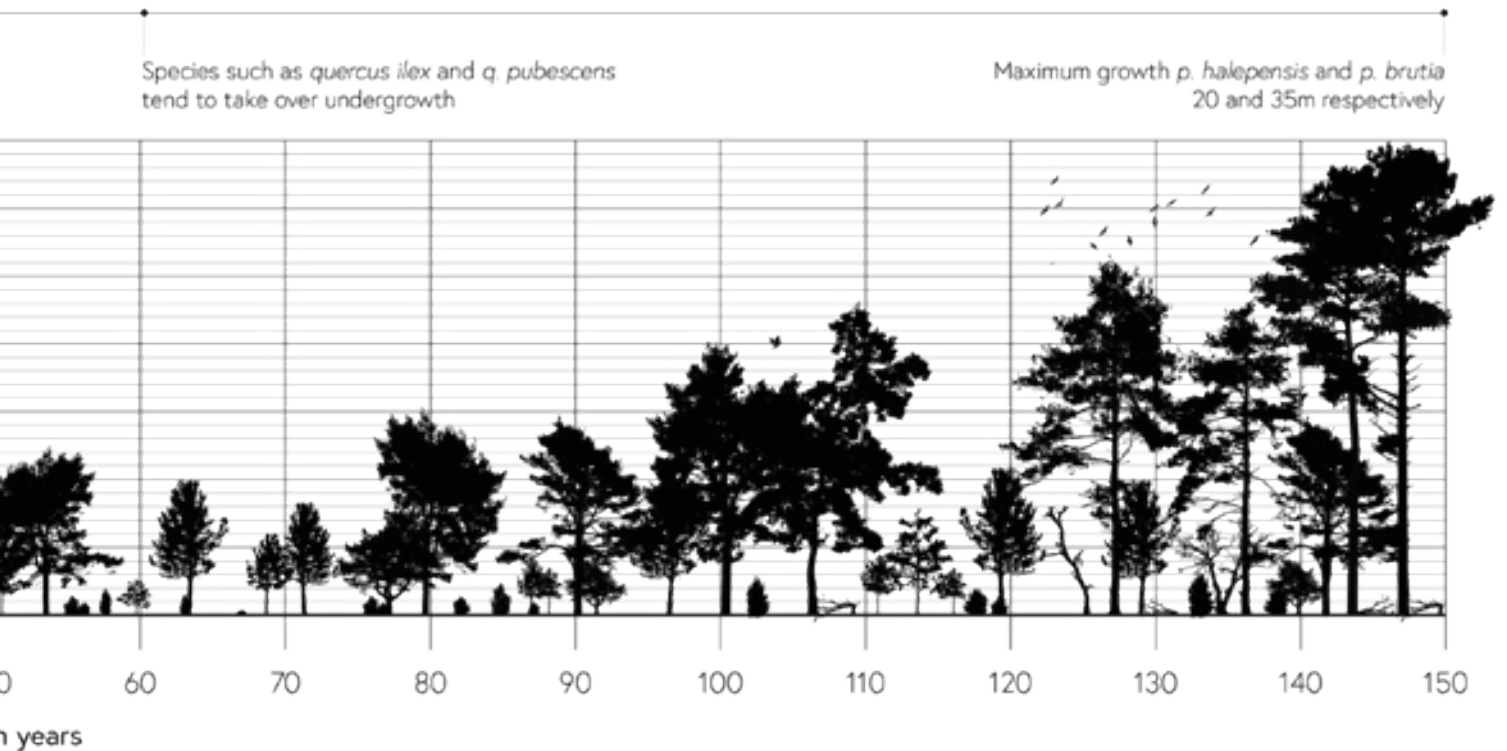


Figure 18. Vastria boundaries and surroundings



from Kennedy (2008)

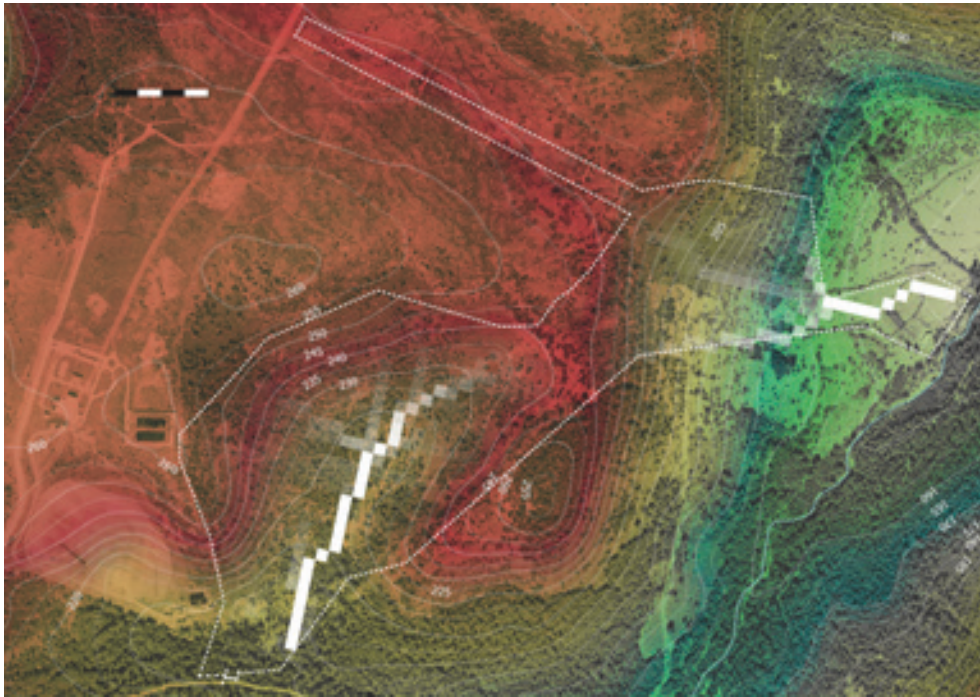


Figure 19. Shaded relief map + flow accumulation analysis

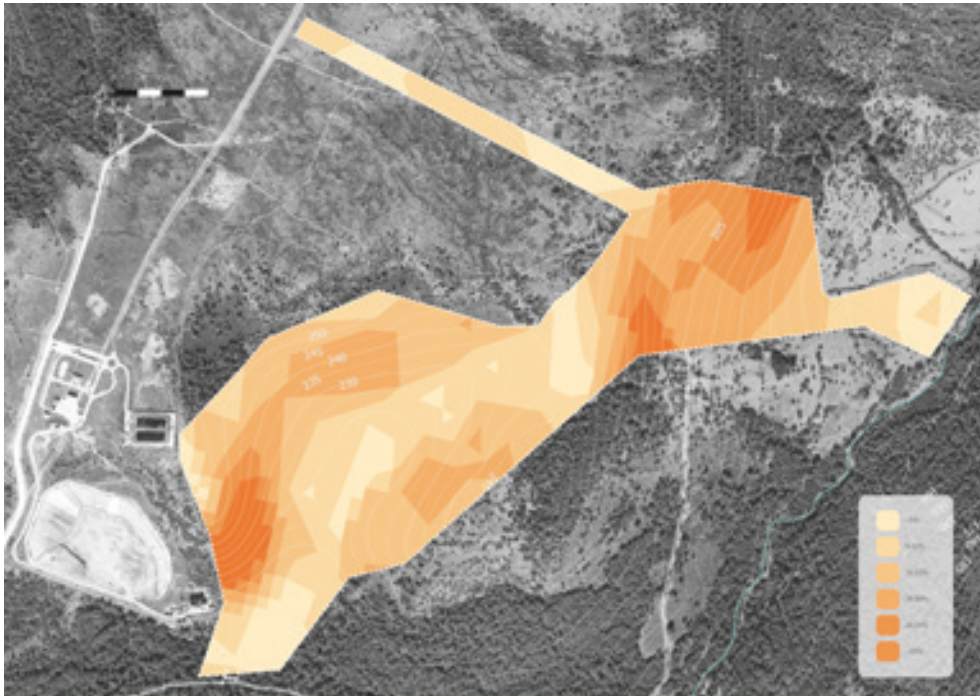


Figure 20. Slope zones map

Ottoman Viper, a venomous snake that prefers a rocky and vegetated habitat (Afsar et al., 2019), is known to be present on Lesvos Island.

As seen in figure 17, adjacent to Vastria on the south-western side lies a landfill. During field observations it was noticed that a strong smell is present surrounding the landfill. However, as can be seen in figure 18, a ridge protects the biggest part of Vastria from smells being carried in on the wind. Only a small corner in the south-western most part of the site might be dealing with smell nuisance when the wind is blowing from the south-west. The local climate and elevation make this area prone to wildfires (George et al., 2019; Skov-Andersen & Geiger, 2022).

A small stream valley lies adjacent to the site, causing for height differences on the site of over 100 meters. The site contains about 20 ha of moderately steep area (15-30% slope) and 0.5 ha very steep area (>30%). Any slope above 17.63% would be prone to landslides when the soil is unvegetated and/or poorly managed (Norris et al., 2008). Due to intensive human intervention in refugee camps, some margin in this will be used, incorporating all areas with a slope higher than 15% into the risk areas. A natural valley is present on the site, through flow accumulation analysis it was ascertained where precipitation and drainage water will accumulate, as shown in figure 18. Lastly, the valley shape of a big part of the site can cause for local high winds (M. Smit, personal communication June 9, 2022).

Figure 20 summarizes locally available materials that could be used for construction or other purposes in the PRC. Pine wood that becomes available through site excavation can be milled and used for shelter kits. Spanish cane, *Arundo donax*, is of frequent occurrence on Lesvos and

can be used for many different purposes similar to elephant grass. During construction, many rocks will be displaced and gathered in low rows surrounding communities. These rocky areas in combination with low vegetation can form a good habitat for the Ottoman viper, this needs to be taken into account for the design. Excavated earth in combination with lime from local limestone and water can be used for making adobe structures.

As shown on figure 13, Vastria is relatively far from nearby settlements. Several stakeholders have expressed great concerns on what this might mean for its future liveability and independence of its inhabitants (Artsen zonder grenzen, 2021; Oxfam International, 2021).

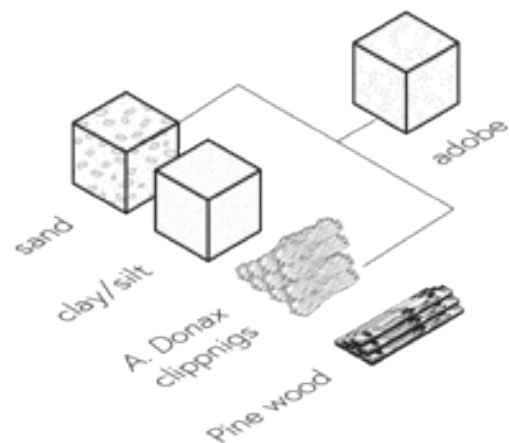


Figure 21. Useful locally available natural materials

Site-specific challenges

- Protection from climate
- Protection of natural resources
- Wild fires
- Steep slopes
- Drainage
- Soil erosion and soil instability
- Venomous snakes
- Proximity of landfill

3.6 Liveability challenges

Combining the outcomes of this section, table 1 presents a series of liveability challenges on the scales of settlement, population and site. As these challenges have different impacts on liveability, while there is a certain overlap, they have been subdivided in the 4 different need types as described by Maslow (1943) in order to find some hierarchy within the challenges. These challenges form the first step in establishing connections between LC, ES and NBS.

3.7 Conclusion

This section has explored the concept of liveability and expressed that in the context of a PRC, liveability can be defined as the specific needs of the changing demographics and the biophysical characteristics to be in sync with each other.

The type of settlement of a PRC with specific RIC function has been explained as a site where a full range of services is provided for the inhabitants, as they go through their asylum application procedures. It can be abstracted to being an urban system with rapid demographic, socio-economic and environmental change, of which the design seems to have been too rigid in past examples on Lesbos which led to overcrowding and lack of private space.

Furthermore, it is desirable to provide for more opportunity for independence of inhabitants. This could be achieved by providing better cooking facilities, providing space where people could grow their own food and providing for space where people can trade. It is also important to have clear camp distinctions for different inhabitant groups.

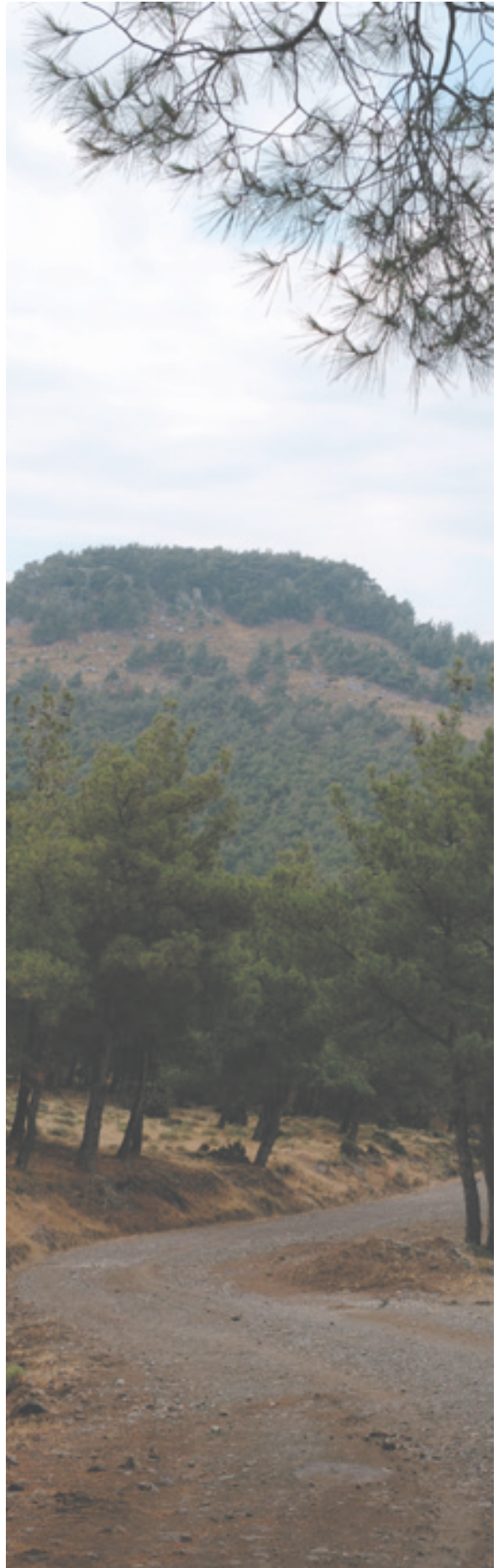
An overview of shelter options points toward

the preferable use of ISO boxes for shelter with optional use of shelter kits to encourage inhabitants to build extensions with suitable materials.

Important demographics are described, with the single to family ratio and men-women-children ratio being important in design considerations such as zoning and space of different functions. It is also important to provide space for vulnerable inhabitant groups.

The site analysis has generated important data on the specific situation of Vastria and its landscape characteristics. Physical aspects such as slope, flow accumulation and the proximity of the site to other functions and services need to be taken into account, as well as biophysical elements such as flora that can be used and preserved, and locally available natural materials for building.

The LC's presented in table 1 as an outcome of this section amount to all the challenges encountered in this section and are categorized so they can be better used for further design considerations. It needs to be noted that there is a certain overlap in the LC.



LIVEABILITY CHALLENGES



PHYSIOLOGICAL NEEDS

- **Overcrowding**
Both having an adequate amount of quality shelter for influx situations as well as adequate capacity of infrastructure and facilities
- **Protection from climate**
Protection from sun, wind, rain and high or low temperatures
- **Protection from (natural) disasters**
Protection from heavy rainfall, landslides, heat waves, wildfires
- **Air quality**
Dust and particulate matter
- **Lack of fresh food**
Catering services, distance to supermarkets and space for growing own food
- **Smell/noise nuisance**
Bad smells from land fill, sanitary facilities or stagnant water, noise from construction on landfill



SAFETY NEEDS

- **Soil instability**
Lack of vegetation could cause for landslides and bad air quality on certain slopes
- **Fire outbreak**
Improvised cooking facilities, bad energy grid and lack of firebreaks can cause rapid fire outbreak and spread
- **Water quality**
Bad quality of tap water, surface water, drainage water or ground water can cause disease spread or damage to the environment
- **Waste water management**
Related to water quality; if waste water (grey water and black water) is not properly managed it can increase disease spread and damage to the environment
- **Drainage**
Big increase of water discharge from camp functions compared to natural situation, needs to be managed properly to keep the site inhabitable and counter erosion
- **Waste disposal**
Waste separation, collection and processing
- **Wildlife**
Rocky and vegetated that can form a habitat for the Ottoman viper

Table 1. Liveability Challenges categorized by need groups



LOVE AND BELONGING

- **Social vulnerability**

Vulnerable groups such as women, children and LGBTQIA+ and spaces that allow for a safe camp environment for these groups

- **Loneliness**

Social services and spaces that allow for interaction between inhabitants, mostly aimed at single inhabitants

- **Lack of social space**

Social spaces such as parks, squares, markets that can increase feelings of belonging

- **Lack of communal space**

Smaller scale social spaces that allow for communal safety



ESTEEM AND SELF-ACTUALIZATION

- **Depletion of natural resources**

Sustainability of the camp and the footprint it has on local environment

- **Lack of open space**

Open space that can aid in feeling less trapped

- **Lack of influence on surroundings**

Rigidity of structures and spaces

- **Dependence**

Dependence of inhabitants on organizations and camp management for all goods and services that might not be of high quality

- **Trauma**

Often traumatic events that have led to inhabitants' displacement and the psychological negative effects that need tending to

- **Stress**

Physically and psychologically stressful environments and places where one can have distance from this

4 SQ 2 - Which ecosystem services can improve liveability of planned refugee camps?

4.1 Introduction

As mentioned in earlier sections, natural systems are intricately tied to the spatial liveability of any sustainable community. In this section, the concept of ES will be elaborated on, defined and related to the specific context of PRC's. For this, an inventory of services relevant to the context of this thesis is made. This is cross-referenced against the criteria from LISAM to conclude on design criteria for the two design iterations.

4.2 Ecosystem services in theory

For a definition of the base concept of ES, this thesis has stuck closely to that provided by the Millennium Ecosystem Assessment report (2005):

“Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food, water, timber, and fibre; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling.” (p. 9)

The use and awareness of ES is strongly connected to the liveability of urban areas (Fitter et al., 2010; Singh et al., 2016). Singh et al. (2016) state that “For cities to be liveable and sustainable into the future there is a need to maintain the natural resource base, food production and the ecosystem services in the peri-urban areas

surrounding cities” (p. 4). On a city scale, use of ES is hard to integrate into the core of the city. On the scale of a PRC however, it can perhaps be far more integrated into the fabric of the community, especially because of the rare opportunity to create a community completely anew. PRC's can be a burden on the local landscape, and trying not to deplete local environmental resources has been an aim in the planning of PRC's for some time (UNHCR, 1982, 2014, 2020). Focusing on a sustainable site design could not only reduce or prevent irreversible environmental impacts of an emergency settlement, but perhaps even leave behind a healthier landscape after an emergency settlement stops to exist or possibly develops into a more permanent state (Alexander et al., 2016; Rooij et al., 2016). This could possibly lead to less friction with local communities.

In a paper by Almenar et al. (2021), a list of most frequently mentioned ES in literature was selected through literature review and consequently checked against a set of urban challenges, similar to the liveability challenges comprised in section 3.6. This list, combined with a selection of relevant ES as mentioned in the Millennium Ecosystem Assessment report (2005), has resulted in the list of ES as shown in figure 21, subdivided in three major categories; provisioning services, regulating services and cultural services. A slight adaptation was made in these categorizations, as often literature refers to four categories, the beforementioned categories with the addition of supporting services (e.g. nutrient

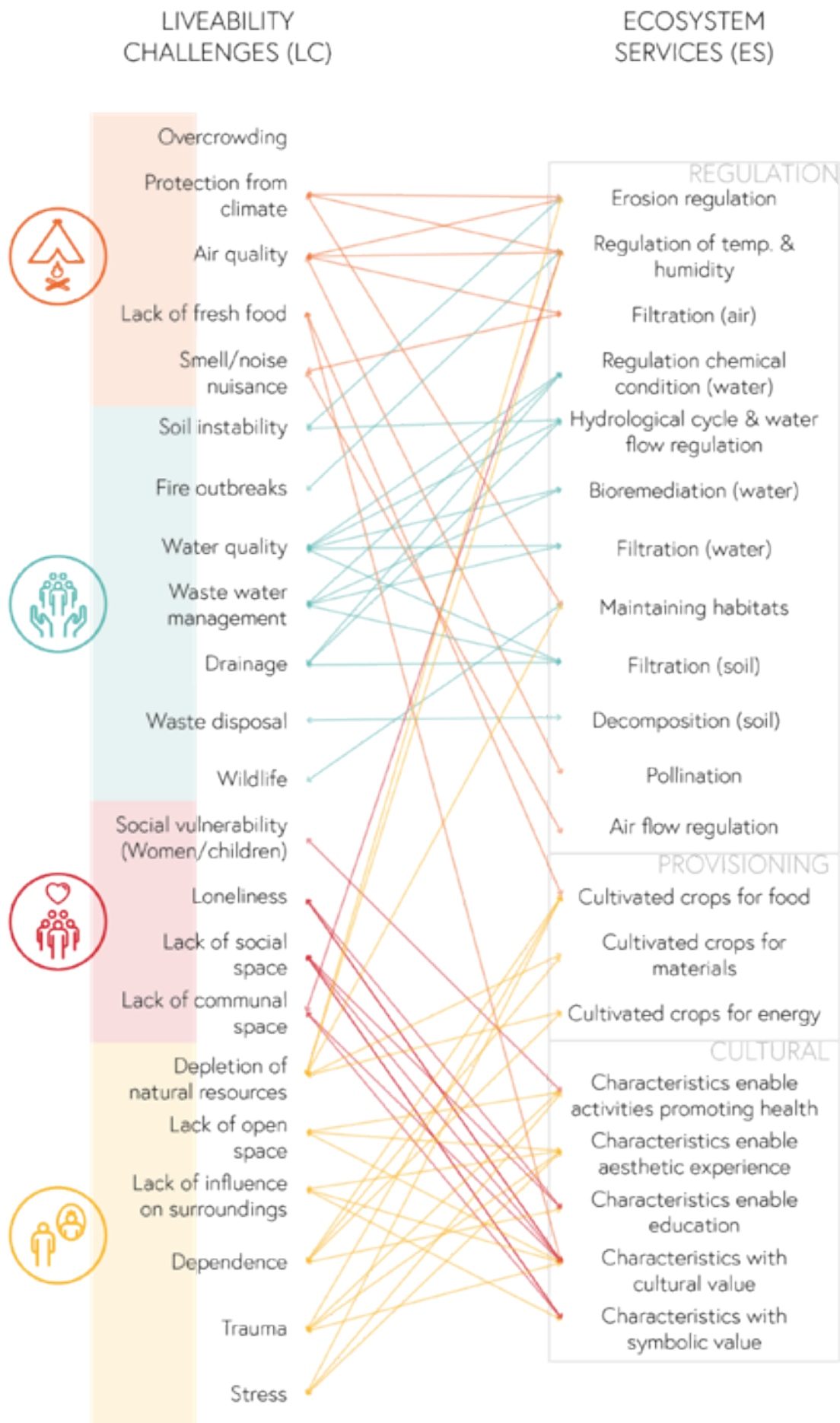


Figure 22. LC-ES nexuses, ES adapted from Millenium Ecosystem Assessment report (2005)

cycling, soil formation). However, for the scope of this thesis it would not be possible to assess the effect of design decisions on these extremely complex systems.

Figure 21 additionally shows linkages between liveability challenges as posed in section 3.6 and the selection of ES.

4.3 Design criteria

In order to test the designs for their liveability, criteria are needed to be able to objectively assess influence of design choices on liveabil-

ity. Considering the aim of this thesis, and as throughout last sections of this thesis it was made clear that ES play an important role in liveability, ES form the basis of the criteria that any design is tested against.

LISAM, as elaborated on in section 2.3.2, clearly lays out a variety of ES and US and provides tools to give values to the expression of each of these criteria. These criteria were enriched with crucial services identified in earlier sections and many criteria were deemed irrelevant for the scope of this thesis. A full overview of the spa-

DESIGN CRITERIA	
	Iteration 1 & 2 Iteration 2
PROVISIONING	<ul style="list-style-type: none"> • Cultivated crops (0,139) Local production of cereals, vegetables, fruit, etc. for human consumption
	<ul style="list-style-type: none"> • Food from food shops (0,194) Local presence of food shops
	<ul style="list-style-type: none"> • Water from water distribution networks (0,222) Local presence of drinking water distribution network
	<ul style="list-style-type: none"> • Materials from plants, algae and animals for agricultural use (0,083) Local production of compost
	<ul style="list-style-type: none"> • Materials from shops (0,139) Local presence of shops
REGULATING	<ul style="list-style-type: none"> • Shelters (0,109) Density of households
	<ul style="list-style-type: none"> • Mass stabilisation and control of erosion rates (0,190) Local land uses that increase water infiltration and reduce erosion sensibility, such as permanent grassy and wooded features
	<ul style="list-style-type: none"> • Fire outbreak protection (0,190) Local land uses that prevent fire outbreak or stop fire spread
	<ul style="list-style-type: none"> • Filtration/sequestration/storage/ accumulation by ecosystems (0,238) Local presence of parts of ecosystems able to limit pollution of lands, water, etc. through pollutant accumulation, such as in clay soils, where clay accumulates nitrogen and other pollutants, avoiding leaching
	<ul style="list-style-type: none"> • Maintaining nursery populations and habitats (0,048) Local presence of ideal environments for plant and animal reproduction (such as wetlands for bird reproduction, etc.)
CULTURAL	<ul style="list-style-type: none"> • Possibility of bequest of the natural environment for future generations (0,036) Local presence of agri-natural elements in good condition that could be used by future generations
	<ul style="list-style-type: none"> • Spatial cultural adjustment (0,091) Local spatial adjustments to suit different cultural groups and ethnic groups
	<ul style="list-style-type: none"> • Social space (0,127) Parks, squares, communal space or other social gathering space
	<ul style="list-style-type: none"> • Family space (0,091) Availability of private space for families

Table 2. Design criteria table

tial indexes, subdivisions and methods of calculation of each criteria can be found in Annex 1, but in the table 2, all selected design criteria are listed.

4.4 Weighting

In order to know the relevance of each of these criteria and to be able to have more reliable testing of the designs, weights have been assigned to each of these criteria. Through a questionnaire (Annex 1), several experts in the humanitarian field ranked these criteria for their importance to the context of a PRC. Through RSM calculation, each criteria received a corresponding weight with a value between 0 and 1, 1 being higher. Table 2 shows the weights of each criteria, placed between brackets after the listed criteria.

4.5 Conclusion

In this section, ES have been defined as consisting of the benefits that people obtain from ecosystems, including provisioning services, regulating services, cultural services and supporting services. For the scope of this thesis, only the first three of these categories of ES were taken into account.

There is a strong link between ES and the liveability of urban areas. Integrating provisioning of ES into the communities can be considered a good opportunity for improving liveability of rapidly growing urban areas. Considering of the temporary nature of a PRC, using ES wherever possible can potentially leave behind healthier ecosystems causing for less pressure on the landscape and possibly decreasing friction with local communities.

Furthermore, a selection of ES and their linkages with the LC determined in section 3 was

shown, selected on their applicability for the context. These have led to the selection of 15 design criteria as an outcome of this section, departing from the extensive list of criteria from LISAM and filtering and adding to these to suit the context of a PRC. During design iteration 1, 9 of these can be used to test the design and during design iteration 2 all of these can be used.

Finally, it needs to be noted that the LC 'overcrowding' is not directly positively influenced by any ES, thus DP's have taken this LC specifically into account.

5 SQ 3 - How can landscape design contribute to liveability in planned refugee camps?

5.1 Introduction

This section explores how to bridge the gap between theoretical concepts elaborated on in previous sections and practical design choices and interventions. By first analysing what principles are present in two best practice reference studies, some final lessons can be learned concerning planning practice in real life. Bundling several ES, some nature based-solutions to the liveability challenges are suggested, which make for tangible building blocks to take further into the design phase.

5.2 Reference studies

In order to better understand how PRC's are designed, how they develop over time and what has proved to be successful in their design, a best practice reference study is elaborated on below. The first reference study is on Kara Tepe camp. This site was selected for the similar context of Lesvos, Greece and because it was intended for vulnerable communities only, possibly resulting in a more human centred design. The second reference study explores the case of Minawao in Cameroon, where clear design interventions using ecosystem services were made in order to tackle liveability issues, giving nature a more central role.

5.2.1 Kara tepe

Location	Lesvos, Greece
Settlement type	Planned camp
Year	2016-2021
Size	5,7 ha
Capacity	1.250 people
Density	220 people / ha
Inhabitant type	Refugees & asylum seekers



Figure 23. Kara tepe camp layout

Intro

Kara Tepe refugee camp was chosen as a best practice reference study site relating to the EGO model because it was considered to be one of the few places that guaranteed security and dignity to vulnerable refugees on Lesvos (Artsen zonder grenzen, 2021; ASNA, 2021).

Kara Tepe was taken into operation with the function of being an overflow camp of Moria refugee camp. The purpose of both Moria and Kara Tepe refugee camp was to temporarily house asylum seekers as they wait for registra-

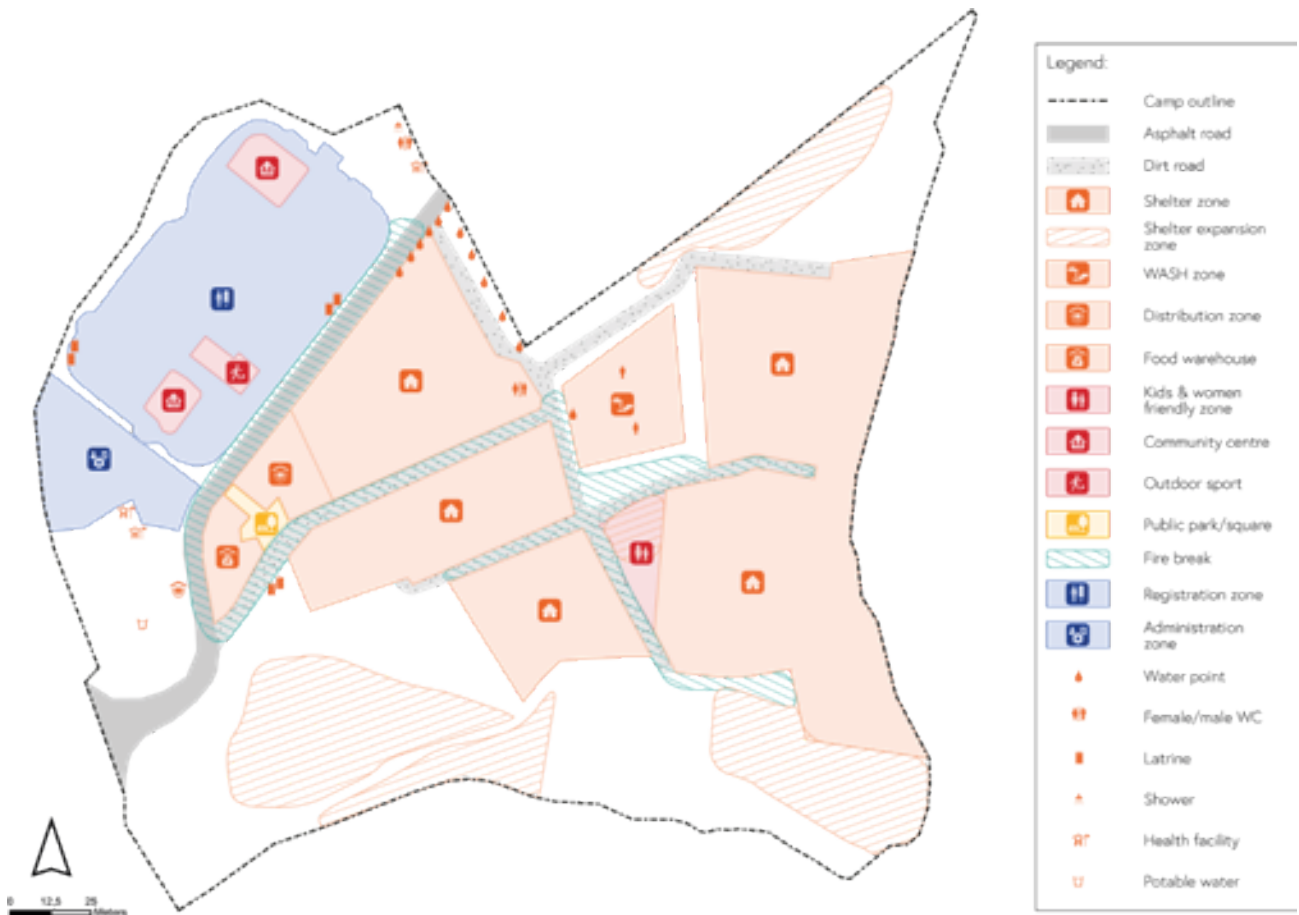


Figure 24. Kara tepe camp zoning

tion processes to be completed. Compared to Moria, Kara Tepe was well regulated and was to house only families and vulnerable people. As there was a waiting list for transferring to Kara Tepe and refugees had to spend a minimum of 25 days in Moria before being transferred to Kara Tepe, the population of Kara Tepe was relatively stable. (Jauhiainen & Vorobeva, 2020;

Kara Tepe Refugee Camp, 2021) After Moria had burnt down, Mavrovouni camp was built as a temporary camp. Then, as plans for a new site were approved, Kara Tepe was closed early, and all inhabitants were moved to Mavrovouni awaiting the opening of a new camp. As of April 2022, this has not yet happened.



Figure 25. Public space in Kara tepe (UNHCR, 2021)



Figure 26. Tree cover throughout Kara Tepe (UNHCR, 2021)

Site analysis

The site is situated 120 meters west from the coastline of the Aegean Sea, surrounded by trees and other vegetation, presumably shielding the site from harsh winds. The site is situated on a relatively flat plateau, on average 26 meters above sea level. The majority of the site has slopes under 5% rise, and the entire site has no slopes higher than 10% rise. The site is located in a small township, with basic services like a Lidl supermarket and a shopping centre. The centre of Mytilini city is located 2,5 km south-east of the site. During the development of the site, most of the tree cover that was already present was kept, providing shade and protection.

The site started out with RHU's placed in grids, but as these were only a temporary solution these were replaced by so called ISO boxes in 2017, which are insulated, heated and airconditioned. It was however discovered too late that the local energy grid could not handle the power needs, so the heating and cooling was mostly dysfunctional (Jauhiainen & Vorobeva, 2020). The ISO boxes were aligned in grids, placed together in pairs, leaving 2-4 meters space between the pairs that serve as little alleys or communal space. There were five shelter zones separated by dirt roads functioning as fire breaks and access routes, later extended by two more shelter zones, one in the north-east and one in the south-west. These zones were connected to the rest of the infrastructure with dirt roads. In the middle of the five original shelter zones is a male-female separated WASH station. A children- and women safe area was planned on the west side of the south-eastern most shelter zone, but was in 2017 mostly replaced with ISO boxes, moving this functionality to the registration zone. The administration and registration zones

are located in the north-west of the site on the other side of an asphalt road. In the registration area, also some community spaces and a soccer field is located. The firebreaks are roughly 10-15 meters wide.

Learning outcomes

Keeping in mind that the Kara Tepe site was able to avoid overpopulation because Moria was heavily overpopulated, the lay-out of the Kara Tepe camp proved to work well in several ways. The shelter expansion zones proved useful and allowed for a significant growth in population size without causing very crowded and dangerous situations. Also, it appears that a reasonably high density is possible in the context of Greece while maintaining liveable situations. Planning public space near food and supply distribution points also seems smart, considering people will wait there and meet naturally. Another important learning outcome was found in the way the vegetation of the old grove that was already present was kept in place and offered protection from wind and sun, proving natural solutions offer positive ES to PRC's.

5.2.2 Minawao

Location	Cameroon
Settlement type	Planned camp
Year	2017-present
Size	502 ha
Capacity	>60.000 people
Density	120 people / ha
Inhabitant type	Refugees & IDP's



Figure 27. Minawao camp layout

Intro

After Boko Haram conflicts arose, many people, mostly Nigerians, were forced to seek refuge in other places. Minawao was one of the places selected to host refugees in a planned camp settlement. The camp hosts more than 60.000 refugees divided over 4 camp sectors. Due to the considerable size of the entire site, for this reference study only sector 4 will be analysed, as seen in figure 26. This camp and specifically this sector was selected as a best practice case study because active steps were taken to use reforestation and planting to improve the liveability of the camp, after aridity of the local climate and

rapid deforestation by the sudden influx of people resulted in undesirable living conditions.

Site analysis

The area is situated in the Sahelian savannah in the far north of Cameroon, with an arid climate. The site is relatively flat with slopes almost exclusively under 5% rise. It is located 3 km north of the closest town, Gawa. This town is accessible by a main road. The sector was developed in 22 blocks, with shelters in a grid layout with smaller communities of 10 to 12 shelters. The shelters as provided during the emergency phase were mostly tent shelters, which later developed to being improvised/semi-permanent shelters (UNHCR, 2015). The blocks are either no bigger than 300m by 300m with a fire break gap between blocks, or they are bigger because for example the stream valley runs through the block, providing a natural fire break.

Before implementation, the site had a sparse tree cover, with some trees usually 5-20 meters apart. During the emergency phase, many of these trees were cut down used either for timber or fuel due to the sudden influx of people who were looking for means to survive and make money (Kodji et al., 2021). Because of the significance of vegetation to the inhabitants of the camp, not only for timber and fuel but also for food (fruits, leaves, bark, roots), shade (comfort and protection of crops), medicine (bark and roots used for treating malaria and yellow fever) and soil stability, efforts were made to restore vegetation cover in years to follow. Through donations, UNHCR and several NGO's were able to start big scale reforestation projects and provide inhabitants with fruit trees. The reforestation efforts were made mostly on the western edge of the sector, forming a protective ridge as seen in figure 28. Inhabitants also have endogenous

knowledge on combatting regressing vegetation cover, that they use to improve the liveability of their shelter plots. This includes home gardening and planting trees to protect the crops from scorching in the sun during dry season (Kodji et al., 2021). It was noticed however, that on a larger scale deforestation would not be helped with these interventions, as a more integral approach including other villages would be needed.

Learning outcomes

Minawao has a completely different demographic, climatic and landscape context than the Vastria case, however some important lessons can be learned. It seems important to think well about natural resources available on site, and how to avoid that these resources will be fully exploited. As can be seen in the Minawao case, the inhabitants gained many ecosystem services from the natural resources that were present in the site, however certain functions like using the trees for firewood or timber depleted these natural resources too rapidly to be compensated by regrowth. Thus, it makes sense to make sure inhabitants of PRC's receive adequate amounts of fuel and good cooking facilities, otherwise similar situations might occur leaving a big mark on the landscape and possibly increasing tension with local inhabitants. Additionally, Minawao shows that solutions based on ES can prove as an efficient and sustainable way of tackling liveability issues.



Figure 28. Inhabitants of Minawao planting trees, source: <https://landlifecompany.com/projects/minawao-refugee-camp-cameroon/>



Figure 29. Effects of greening efforts in Minawao, source: <https://www.premiere-urgence.org/en/faecal-sludge-management/>

5.3 Nature-Based Solutions

The reference studies showed that productive and natural vegetation solutions can provide with several ES that improve liveability of PRC's. These solutions often offered multiple ES in one tangible solution, providing with increased liveability over a range of time scales and needs levels as well as providing with more environmental sustainability.

Because ES rarely function on their own, and are often hard to use solely as a tangible design solution (e.g. cultivation of crops, pollination and seed dispersal), Nature-Based Solutions (NBS) will be the framework for bundling several ES into tangible design solutions. NBS will

be defined as “actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits” (Cohen-Shacham et al., 2016, p. 20), distinguishing from ES by human intervention, “actions”. Three types of NBS are often distinguished: “i) better use of ecosystems; ii) sustainable and multifunctional management of ecosystems; and iii) design and management of new ecosystems” (Babí Almenar et al., 2021, p. 2), however it is important to keep all three in mind. Based on the local environment and social conditions of the context, a list of relevant NBS was derived from literature (Babí Almenar et al., 2021) and can be seen in figure 29. These NBS can be used as building blocks for conceiving design principles.

5.4 Conclusion

This section has revealed good practice reference cases where liveability seemed relatively high. Certain design aspects that could potentially have led to this higher liveability were analysed and the studies furthermore showed the successful implementation of solutions that offer a certain set of ES to inhabitants of PRC’s. The section concludes with identifying NBS as a framework of making ES applicable for designers. Combined with designing for a good accessibility of basic US such as sanitation facilities, it is through these types of design solutions that landscape design can contribute to a higher liveability of PRC’s.



Figure 30. Selected NBS

6 Design principles & guidelines

6.1 Introduction

In order to translate the outputs of previous sections into design, this section describes spatial design principles and more detailed design guidelines. The design principles are informed by the outcomes of the SQ's by playing in to LC's that were identified, and are built up from NBS. Additionally, they are informed by existing UNHCR and Sphere standards aimed to tackle liveability challenges. Thus, each DP can ensure delivery of several ES for inhabitants of Vastria. The design principles are visualized with clear diagrammatic illustrations, and given context and scientific relevance with a theoretical background. The design guidelines presented in this section take the design principles further in design detail. The guidelines will inform the design up to the plot scale, responding to challenges that arose from the site analysis. Additionally, other significant design guidelines necessary to design a PRC are categorized and elaborated on here.

6.2 Design principles

As the scope of this thesis does not allow for the entire range of analytical processes that are required for the planning and design of a real-life planned refugee settlement, this section describes the most important spatially relevant principles that were based on outputs of all previous sections and consist of the building blocks that the NBS have formed. The premises of this thesis includes that sustainability and flexibility are of paramount importance in planning and designing liveable refugee camps. Consequently, these concepts are embedded into every design principle (DP), without needing to be separately mentioned.

SOLUTIONS (NBS)

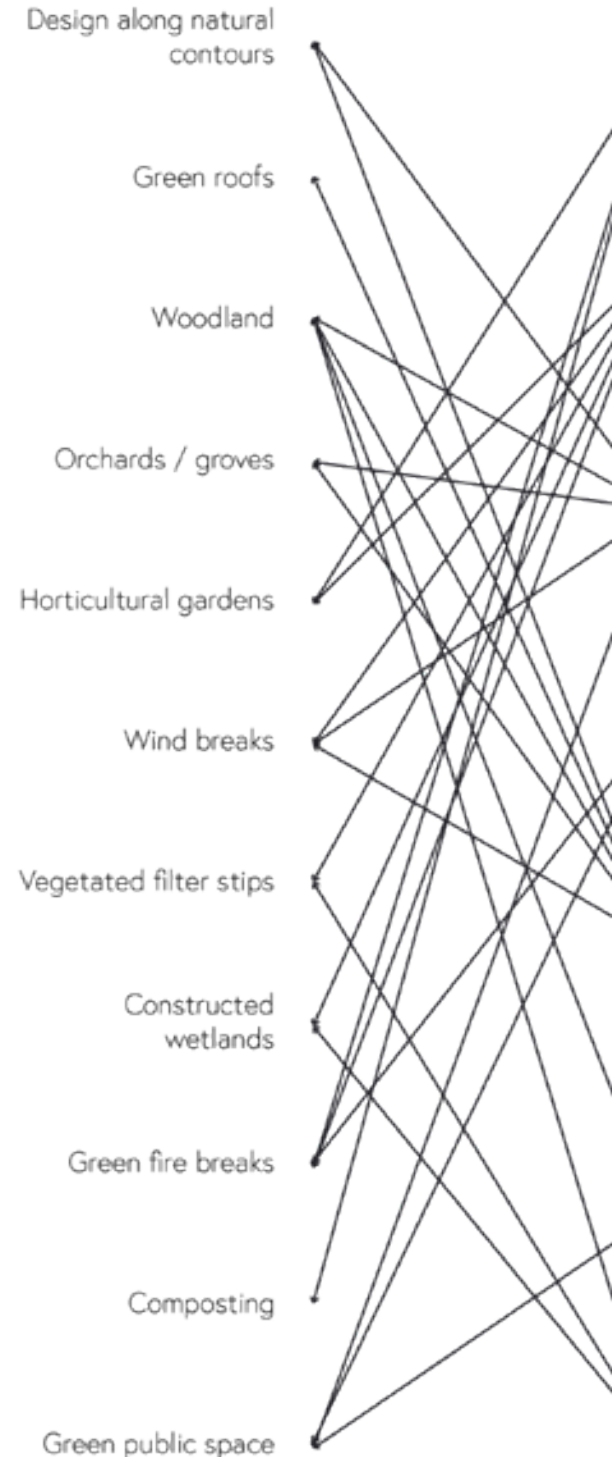


Figure 31. NBS-DP nexuses

PRINCIPLES



Allocate space for crops



Multifunctional space



Retain trees and work with nature for infiltration and protection of the climate



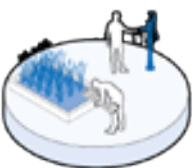
Safe green space



Community units against climate change and communities



Green public space for self-organization and preferences



Design allows for resources

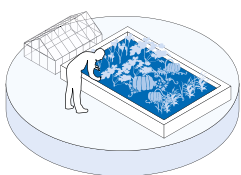
Camp layout should cater to the most basic **physiological needs** by providing good infrastructure for inhabitants to cater to their basic needs for survival, including water, food and shelter. The layout should cater to **safety needs** by aiding inhabitants to feel physically and morally safe, should provide for the possibility of acquiring resources and protecting property, and should provide for a basis for building of safe communities. The layout should enable the need for **love and belonging**, by providing opportunity for privacy of individuals, friends and family, as well as by encouraging social gathering between families and communities. Finally, the camp layout should enable the need for **esteem and self-actualization** by encouraging self-reliance, by allowing inhabitants to participate in the evolution of their surroundings and by creating an environment where people can live with dignity, as well as provide for spaces where inhabitants can develop new skills, where creativity and initiative is encouraged.

This has resulted in the following DP's:

- Space for every household to produce crops
- Multifunctional firebreaks
- Retain trees and other vegetation where possible and work with new planting to stabilize soil, improve infiltration and provide shade and protection from the climate
- Safe green spaces for vulnerable groups
- Community units are designed for protection against climate and better interaction with other communities
- Green public spaces that encourage self-organization to adjust to personal and cultural preferences
- Design allows for sustainable harvest of natural resources

6.2.1 Theoretical background design principles

1) Space for every household to produce crops



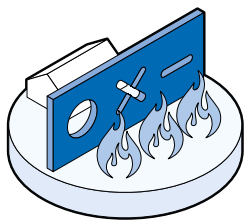
In many protracted refugee settlement situations, urban agricultural practices flourish at any given stage in camp de-

velopment, with or without top down support (Rooij et al., 2016; Tomkins et al., 2019). These home gardens provide self-sufficiency by supplying fresh food, can be places for healing trauma and can help in refugees teaching each other new skills (Tomkins et al., 2019). Even though the UNHCR handbook states that 15m² garden space per person should be included in the site plan from the outset, in many cases this space is not included perhaps due to the intended temporality of the situation (K. Michailidou, personal communication June 10, 2022) or simply due to a lack of space.

Having community gardens close to the households will increase chances of successful cultivation and will require less permission. Moreover, placement of gardens adjacent to streets will increase social interaction and can cause for more inhabitants to follow in practicing home gardening (Tomkins et al., 2019). Where Syrian refugees are present, it has often been shown that eventually water features will be added that provide for cooling in the summer and also remind residents of home (K. Kleinschmidt, personal communication February 23, 2022; Tomkins et al., 2019).

A distribution point for seeds, seedlings and plants should also be planned for. Planting of trees might not only be frowned upon by local authorities, but also by inhabitants themselves, as planting trees is often perceived as a “sign of permanence” (Tomkins et al., 2019, p. 114), so should be planned beforehand as well as be allowed to plant in own gardens if so wished (Tomkins et al., 2019; K. Kleinschmidt, personal communication February 23, 2022)

2) Multifunctional firebreaks



As the events in Moria camp on Lesvos Island in September 2020 show (Kingsley, 2020), protection against fire outbreaks are of great importance to the safety of inhabitants of refugee camps. Proper use of firebreaks plays a primary role in designing against fire outbreaks, and guidelines for the minimum spatial requirements of firebreaks are discussed in both the Sphere and the UNHCR handbook. Fire breaks in forest setting often exist of fuel-breaks, limiting or completely taking away biotic fuel material, creating fire roads, gullies or bare-soil firebreaks (Cui et al., 2019). In the case of refugee camps, firebreaks are simply defined as an “area with no buildings” (UNHCR, 2007, p. 219), making sure a fire outbreak can stay contained. The UNHCR handbook also briefly suggests that these spaces are ideally used for different functions such as community gardens and recreation, yet in many cases (see section 6.2), these spaces either left out completely or simply left empty. To achieve a more flexible camp lay-out, multifunctionality of these spaces should be further explored. In this paragraph, several options for multifunctional firebreaks are explained.

Green firebreaks, using multi-layered struc-

tures of low-flammable vegetation, are a proven method of achieving sustainable, effective, low-maintenance and biodiverse fire breaks (Cui et al., 2019). According to Cui et al., green firebreaks should have different layers of low-flammable vegetation, have a somewhat sparser structure, be at least 10 meters wide and placed perpendicular to the prevailing wind direction. The structure of a green firebreak is usually composed of a tight crown of broad-leaved trees, shrubs, herbaceous plants and fungi. The tight crown makes for a cooler microclimate underneath with shade tolerant plants with higher moisture content (Cui et al., 2019). Tree species that can be imagined making up the crown layer in the Mediterranean climate of Lesvos include sclerophyllic trees such as *Quercus ilex*, *Myrtus communis* and *Arbutus unedo*. For the shrub layer, species like *Olea europaea*, *Laurus nobilis*, *Phillyrea latifolia* and *Rhamnus alaternus* would be suitable. Ground cover plants could include *Thymus* and *Chrysopogon zizanioides*. These green firebreaks can be linked to design principle 3, ensuring good stabilization of the soil and preventing soil erosion.

Shopping, food and trade are functions that could also be imagined as double functions for firebreaks in the context of refugee settlements, taking for example the Champs-Élysée in

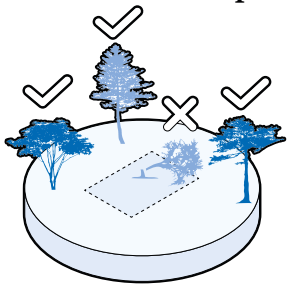


Figure 32. Champs-Élysées of Za'atari camp in Jordan, source: <https://ikeafoundation.org/blog/the-champs-elysees-of-zaatari/>

Za'atari camp in Jordan as seen in figure 31. The initiatives should be bottom up, but space can be appointed. Some acupunctural interventions like official food stores along a firebreak, leaving space for spontaneous growth could stimulate competition with official stores, perhaps rendering the official store useless after time.

Close to WASH stations, swales could find a function within the fire break. In a swale, excess water could infiltrate into the soil. During peak rainfall, water could also be redirected here.

3) Retain trees and other vegetation where possible and work with new planting to stabilize soil, improve infiltration and provide shade and protection from the climate



It is widely recognized that refugee settlements, planned or unplanned, can have major effect on vegetation, soil and ground cover, resulting in increased soil erosion,

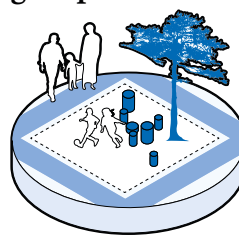
leading to hazards like formation of dangerous gullies, dust clouds or landslides (Gillebo & Leknes-kilmork, 2018; Rooij et al., 2016; Sphere Association, 2018; UNHCR, 2007). For slopes under 5%, the UNHCR and Sphere handbooks indicate some concrete spatial interventions to slow down this process. With slopes of more than 5%, the Sphere handbook resorts to 'engineering techniques' (p. 272) to prevent erosion. In this paragraph, more options to use natural systems, plants and trees for maintaining and improving soil stability, whilst offering comfort to inhabitants, are explored.

One of the ways for limiting erosion as suggested in the handbooks is retaining trees wherever possible, because their roots help stabilize

the soil throughout and preserve topsoil. As Vastria currently has a significant tree cover, there is a big potential for retaining trees wherever possible. Adding to this, ground cover plants such as the *phrygana* vegetation currently widespread in Vastria and their root systems are also of great importance in holding the soil in position (Norris et al., 2008), so these should also be maintained or added wherever possible. When new vegetation is added, it should be focussed on a combination of deep rooted shrubs and trees such as *Atriplex halimus*, *Anthyllis cytisoides* and *Tamarix canariensis*, and grasses with fibrous root systems such as *Lygeum spartum*, *Stipa tenacissima* and *Brachypodium retusum* (Norris et al., 2008). Green firebreaks, as discussed in principle 2, could play a role in this.

Furthermore, infrastructure such as roads, paths and drainage networks should follow natural contours, this can help minimize soil erosion and also prevent excessive flooding (UNHCR, 2007). Next to this, disruption of natural drainage should always be kept at a minimum. (Sphere Association, 2018)

4) Safe green spaces for vulnerable groups



Play is important in children's general emotional development (Acar, 2013; Khan et al., 2020), and is specifically important to development of feelings of achievement and self-security (Acar, 2013). In turn, designing safe places for children to play in refugee settlements can cater to the satisfaction of esteem and self-actualization needs articulated in the hierarchy of needs (Maslow, 1943). The UNHCR handbook highlights the importance of social

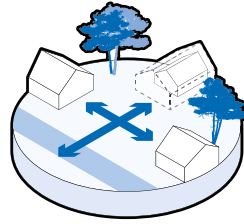
infrastructure for children and stresses that “Underestimation of surface area required for social infrastructure and communal services, including a playground for children, is an issue which will adversely affect the creation of a humane environment for refugees, and should be avoided” (p. 218). It does not offer any guidelines for the specific design of these places.

Natural experience is an important aspect in children’s playing environments, and children prefer places where the environment provides with a “tactile auditory, oral and olfactory experience” (Acar, 2013, p. 301). In relation to the site, it would make sense that modular wooden play components could be placed, that can be climbed and where kids can play sports. Location wise this would be in an area that can be observed but is not in the vicinity of any busy transportation routes. It would be preferred that there are natural elements present in the site such as trees that can be climbed or bushes that can be used in games.

“Early shipments to the refugees could include basic play resources for helping the children cope with their trauma. One child summed it up this way, “If I only had a ball to play with I wouldn’t be so sad!” (Drumm, Pittman, & Perry, 2003, p. 84)

Women often find themselves in the position of being afraid to go to the toilet at night and having no place where they can sit down, take off their headscarf and converse at ease with other women. Safe spaces for women are sometimes incorporated within camp layouts, but are often placed in the back of a hall, not places that might be deemed comfortable. Similar issues are identified for people with LHBTQIA+ association (K. Michailidou, personal communication June 10, 2022).

5) Community units are designed for protection against climate and better interaction with other communities



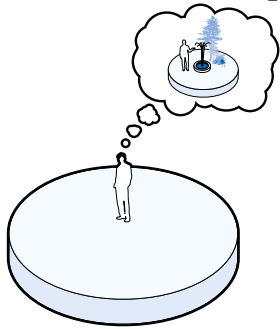
In many emergency settlements in the past, shelter communities have been designed in a classic grid-lay-out, which is easy to imple-

ment, easy to service and requires little planning effort. Unfortunately for the planners, whenever camps are in use for longer periods these layouts, when strictly maintained often result in discontent inhabitants and when less strictly managed are slowly morphed into smaller, semi-closed communities, with abandoned structures “vandalized” for parts to extend and repair shelters (Dalal, et al., 2018; Tomkins et al., 2019; K. Kleinschmidt, personal communication February 23, 2022). In the case of Za’atari camp in Syria, in these transformed clusters “families and relations gathered, beginning to share resources and establish socio-spatial patterns that are often reminiscent of habitats left behind in Syria” (Dalal, et al., 2018, p. 67). To make some of the inevitable (and positive) personal community modifications unnecessary, communities will be designed in open H-shape or U-shape to closer resemble urban communities and to improve interaction between communities (UNHCR, 2007).

Following recommendations in an article by Jim Kennedy (2005) for Forced Migration Review, taking into account population growth over the years, communities will preferably consist of only 11-13 households. A more generous space allocation from the start will also allow for sufficient community and private space as well as taking inevitable extensions of shelters into account. This can be organized by inhabit-

ants themselves to create a greater sense of belonging, and can make individual responses to trauma seem more manageable (Drumm et al., 2003).

6) Designing (green) public spaces that encourage self-organization to adjust to personal and cultural preferences



Specific spatial guidelines of public spaces are lacking in both the Sphere and UNHCR handbook and public space is only shortly commented on as a necessity in the layout of planned settlement in the Sphere handbook: “Site layouts should be based on urban design and town planning principles, with connecting components such as access points, intersections and public space” (p. 251). This principle has in practice often been neglected or left out. When open space is being treated as secondary space and with focus lying on the classic, easy to manage, grid-layout, cases have shown that over time a dynamic of both top down interventions and bottom up reactions have produced camp public spaces that often were not designed to be in that place or to be used in that manner (Saleh, 2021; K. Kleinschmidt, personal communication February 23, 2022). In order to avoid this spatial power struggle as much as possible, public spaces have been regarded equally important as shelter during the design process for this thesis, and several spaces should be left open in the emergency phase of implementation, only to find out where social activity is naturally taking place and expanding on design there.

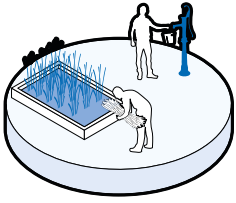
Additionally, several cases have shown that

self-organization in these settings help inhabitants of PRC’s to “take up responsibilities, develop new skills and knowhow, open economic opportunities and to even teach or educate other refugees” (Rooij et al., 2016, p. 15). Public spaces have only basic infrastructure such as paths, lighting and big landscaping interventions designed top-down, after which users could organize the rest of the space with movable objects such as benches, tables and chairs. The public spaces should be located along busy walking infrastructure to improve the feeling of safety.

Literature on the positive effects of nature on people and their (mental) health such as *The Experience of Nature* written by Kaplan and Kaplan (1989), has started to make the scientific community more aware of the importance of human interaction with nature. Although previous research is not specified to the specific case of refugees, this thesis is operating under the assumption that in the inhabitants of refugee settlements are also positively influenced by natural elements, which is why public spaces should be designed to include natural features, either existing or newly implemented. Green public spaces such as parks in developed urban settings are a good way of providing with a calm environment that allows for this interaction with nature. In the context of this thesis, in the potentially stressful environment of a closed refugee settlement, it can be imagined that places reserved for quiet contemplation, social activity and interaction with nature might be at least equally important

7) Design allows for sustainable harvest of natural resources

Self-sufficiency is often overlooked in intentions to offer aid to a refugee population, while



there is an abundance of expertise and competences present in PRC's. Besides being useful to the community, promoting self-sufficiency could give people a sense of purpose and useful learning experiences (Perkins et al., 2017). As DP 1 already discussed self-sufficiency of food, water is another resource that is required high up in the hierarchy of needs. Camp infrastructure is often designed to move potable water in and out of the sites boundaries as quickly as possible (Sphere Association, 2018; M. Smit, personal communication June 9, 2022), while many refugees would like to be able to reuse grey water at their own plots. Considering that local water systems are often overloaded due to underestimation of wastewater volume by camp planners (Perkins et al., 2017), it would be useful to reuse this important resource on site. However, because water quality cannot be guaranteed, the water needs to be filtered to be able to use it for a variety of purposes such as watering gardens, cleaning, personal showers or even drinking.

The water filtration in Vastria will take place in twofold: firstly through draining and collecting all grey water and other drainage water in a central Vegetated Filter Strip (VFS) and consequently cleaning it further in Constructed Wetlands (CW). The VFS functions by letting water pass by deep rooted rhizomatous perennial grass species which take up toxins from the water and convert it into biomass (Mersie et al., 2003). These species should preferably be native. Following this, CW's have the same functionalities but let water percolate more slowly through a vertical flow basin with macrophytes planted which also take up toxins from the water. The

clean water can then be stored in cisterns that allow for harvesting and can also be used to counter droughts in summer.

Additionally, CW's can provide for other natural resources, as the systems need to be maintained by harvesting the macrophytes in winter. The clippings that are harvested such as those of *A. donax* can have a myriad of functions such as construction, pressed into bricks that function as a heat source or converted into biogas, generating possible tradable or sellable goods for inhabitants and generating income (Nanninga, 2011).

Finally, the initial aimed clearing of the communities and other structures on the short term generates wood that can be used by local population or to make into construction materials for Vastria. On the long term, these clearings can cause diversification of the ecosystem and be the start for a sustainable old growth forest.

6.3 Design guidelines

Through experience and trial and error, organizations like UNHCR and Sphere have developed detailed design guidelines for planned refugee settlements (Fiddian-Qasmiyeh, 2010; Sphere Association, 2018; UNHCR, 2007). UNHCR has recently introduced the 'masterplan approach' and along with Sphere gives some detailed guidelines regarding space requirements of specific functions. However, detailing of maps produced before site construction begins is often limited to showing significant infrastructure such as large buildings, medical centres, water points and roads, leaving space on plot-scale undetermined (Tomkins et al., 2019). Furthermore, these handbooks would be greatly aided by more landscape oriented guidelines (M. Smit,

personal communication June 9, 2022). In this section, the design principles previously formulated are made site specific and more detailed by translating them into guidelines. In addition, all relevant Sphere and UNHCR handbook guidelines are mentioned and translated to the site.

6.3.1 Principal guidelines:

Allocate space for every household to produce crops

Provide for 15m² space for every household for allotment gardens (UNHCR, 2007). Having garden space be visible from streets is preferred. Provide for central distribution point for gardening materials.

Multifunctional firebreaks

20-25 m fire breaks must be included every 300m (UNHCR, 2007). Wherever possible, the firebreaks are placed perpendicular and parallel to the prevailing wind direction. Also take elevations into account, wherever possible making breaks follow contour lines. For the Mediterranean climate, use species such as *Quercus ilex*, *Myrtus communis* and *Arbutus unedo*, *Olea europaea*, *Laurus nobilis*, *Phillyrea latifolia* *Rhamnus alaternus*, *Thymus* and *Chrysopogon zizanioides* for green fire breaks. These can be planted in a small swale along contour lines in the middle of a break. The borders of the PRC will be guided by a ten meter clearing to prevent fire spread to the surrounding landscape.

Retain trees and other vegetation where possible and work with new planting to stabilize soil, improve infiltration and provide shade and protection from the climate

Trees should be retained wherever possible, clearing only strips needed access roads, paths

and placement of shelters and buildings. Lower vegetation as well, keeping in mind that it does not create shielded off areas that jeopardize safety due to a lack of social control. For the context of Lesvos low vegetation should be avoided in rocky and moist places, to avoid snake habitats. Vegetation in fire breaks should be slow burning (e.g., trees such as *Atriplex halimus*, *Anthyllis cytioides* and *Tamarix canariensis*, and grasses with fibrous root systems such as *Lygeum spartum*, *Stipa tenacissima* and *Brachypodium retusum*).

Safe green spaces for vulnerable groups

Include safe spaces for vulnerable groups (Sphere Association, 2018; UNHCR, 2007). Shielded of safe spaces for women and children should be available for every block. This is of added importance to the blue zone with vulnerable and red zone with families. Provide with at least one playground per block. Playgrounds should be well visible, along busy public space and well lit. Natural elements like wood logs and rocks from excavation can be used to create play elements, as well as intended playground structures. Shading by natural elements is preferred wherever possible.

Community units are designed for protection against climate and better interaction with other communities

Each household should be able to open to a courtyard or private space. Communities should be designed in U-shape or H-shape (UNHCR, 2007) and exist of 11 household plots. Each household should have access to both private space and communal space. Trees are maintained in courtyards wherever possible to provide shade, counter erosion and protect from high winds.

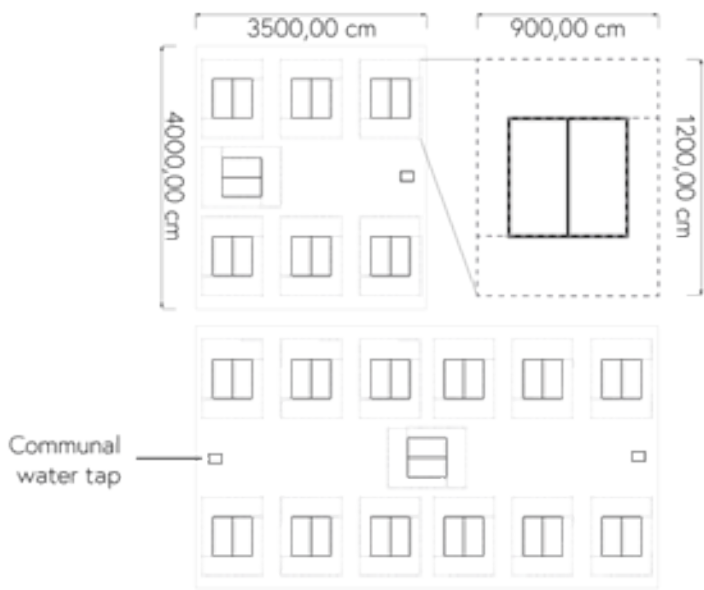


Figure 33. Schematic representation of standard community U and H shapes

Designing (green) public spaces that encourage self-organization to adjust to personal and cultural preferences

15-20% of entire site should be dedicated to open public space and public facilities (UNHCR, 2007). This includes educational facilities, markets, sanitation facilities, communal cooking areas, administration, recreation areas, parks and health care facilities. Plan four 1/2 community size open public spaces per block, seeing after the emergency phase which spaces are naturally being used most as public gathering space. These can then be further developed, and the other spaces can be transformed to having another function. When final public spaces have been selected, design pathways to usage patterns, additional lighting and implement movable objects such as chairs and benches.

6.3.2 Other guidelines:

Water

Maximum 500m distance from any household to the nearest drinking water point and maximum 250 people per drinking water point (Sphere Association, 2018; UNHCR, 2007). That means at least 12 water points for the base population of 3.000 inhabitants and 40 water points for high influx scenario of 10.000 inhabitants.

As there are no real significant sources of surface water except for the small stream on the north-eastern border of the site (which will most probably be dry in summer), drinking water will have to be trucked in. However, to retain as much water as possible and to reuse it, natural water filtration facilities could be present on site.

The site will be drained via a primary Vegetated Filter Strip (VFS) along the main boulevard and via secondary ditches on the downhill edges of each community. The VFS should be at least 3 meters wide and contain deep rooted rhizomatous perennial grass species like *Panicum virgatum*, also usable as bio fuel, (Mersie et al., 2003) and *Schismus barbatus*. Tree species such as *Salix nigra* and *P. brutia* can be used in sparse alcoves oriented on the south side of the VFS to create shading and counter erosion, as well as lowering flow speeds.

Based on estimated total basic water consumption of 15 litres/person/day (Sphere Association, 2018), assuming that 80% is converted to wastewater and of that wastewater 65% is greywater (Mizzouri & Mohammed J, 2017), grey water is estimated to amount to 23,5 m³/d for a scenario with a base population of 3.000 inhabitants and 80 m³/day for a high influx scenario of 10.000 inhabitants. With an infiltration rate of 0,5 m/d, that would amount to 47m² of constructed wetland needed for scenario 1 and 160m² for scenario 2. Three 5 m x 15 m CW's

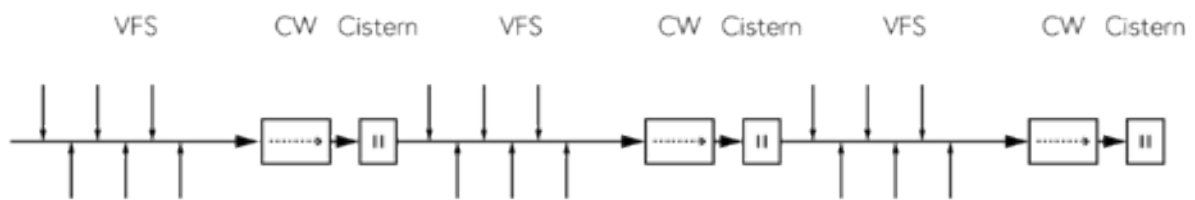


Figure 34. Schematic representation of water drainage and filtration system

should be sufficient for both scenarios, able to take in additional rainwater as well with a capacity of 225 m³/d. Grey water drainage from communities can follow the VFS from north-east to south-west, along the way stored in three cisterns that retain the water for dryer times and eventually leading towards the natural stream that can take the excess overflow of water.

Species to be used for the CW's are *Juncus effusus*, *Scirpus Validus*, *A. donax* and *Typha latifolia* (Rahman et al., 2020).

Food

Provide with household- and community food storage facilities, secure against pests and rodents and protected from weather conditions (UNHCR, 2007). Safe, clearly marked and accessible food distribution points with plenty of space for queuing and sightlines for social control. Clear queue lines should be incorporated. Provide spaces along busy routes where market activity can take place.

Sanitation facilities

Minimum distance of 30m between excrement containment facilities and water sources; bottom of pits minimum 1,5m above groundwater table; maximum 50m distance between any household and shared toilet; minimum 1 toilet per 20 people. 150 toilets for base population / 500 toilets for high influx scenario. Single-access gender neutral toilets with ramps or level entries for people with disabilities at a minimum ratio of 1 per 250 people (Sphere Associ-

ation, 2018; UNHCR, 2007). Sanitation facilities are located to minimise security threats to users, especially to women and girls and people with other specific protection concerns. They should also be separated from sanitation facilities for men. Sanitation facilities are well lit during night time and entrances are located to have direct sightlines with busy public space such as main pathways.

Shelter

Tents should only be used in a first emergency phase of an influx of people, after which families or individuals get time to opt for plots so that community building can start. The basis of the shelters will be dedicated ISO boxes with modular tools provided by camp management for safe construction of any additions to the shelter. Also, ISOboxes should be outfitted with easy attachment points to make inevitable shelter extensions easier and safer and to match with extension kits.

Waste

Provide households with convenient, adequately sized and covered storage for household waste or containers for communities, with a separate composting space per block. This composting space should have at least 20 meter distance from the closest shelter due to rats.

Usable space

Areas with slopes steeper than 10% will generally be avoided due difficult useability, costly

site preparation and erosion sensitivity. The site offers an area of 25,6 ha with slopes under 10%, mostly throughout the middle of the south-western part of the site, which is just enough for the base population. Therefore, areas with slopes from 10-15% will also be used resulting in 43,5 ha of usable space with more costly site preparation but providing adequate space for both scenarios. It can be considered to have some of the steeper areas used for other purposes, for example allowing inhabitants to create terraces for food cultivation purposes only where there is no significant natural vegetation present. About one third of the site is unusable for many of the functions and activities as described in subsection 5.4.1, due to steepness or other terrain issues. Aside from this, the north-easternmost point of the usable site (about 4,6 ha) is separated from the rest of the site by a very steep slope. This part can only be used if a safe pathway is created and can only have a function that does not require close proximity to the rest of the site.

Minimum 89m² per person usable space. That means the base population should have 26,7 ha of usable space. For the high influx population, a minimum of 45m² will be aimed for, resulting in a total of 45 ha of useable space.

Roads and paths

Externally the site should be well accessible from other areas in the region. Internally, roads and paths should be connecting all areas and facilities, with major and minor access roads being all-weather accessible, above flood levels and having good drainage. All structures should have a minimum distance to access roads of 5 m to increase safety (UNHCR, 2007). Preferably, Major access roads follow natural contours wherever possible to avoid unnecessary erosion.

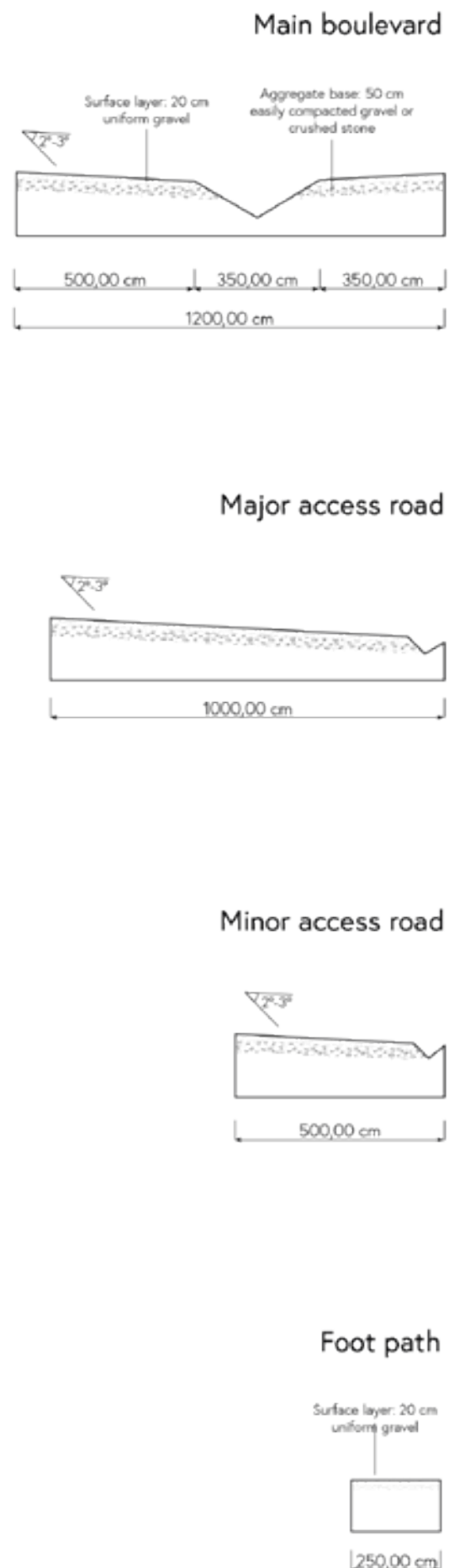


Figure 35. Schematic representation of standard measurements roads and paths

7 Synthesis through design

7.1 Model study

Building on the design principles and design guidelines, the design phase of this thesis consist of two design iterations. The design aspect of iteration 1 is limited to zoning plans roughly displaying where different functions are, how they are connected and how much space they take up. These zoning plans are split up into two models. Both models are roughly following UNHCR and Sphere guidelines, with addition of spatial concepts developed in the design principles. Model 1 (Ego) focusses on fulfilling all the layers of the hierarchy of needs emphasizing on development of the higher levels (esteem, self-actualization). Model 2 (Eco) focusses more on a healthy natural environment, ecosystems and long-term natural development. Within these models, two scenarios of the camp development are distinguished. Scenario 1 assumes a base population of 3.000 inhabitants, while scenario 2 simulates a sudden influx of refugees, resulting in 10.000 inhabitants. This results in 4 zoning plans as input for the testing phase of iteration one, including a list of surface figures. The first iteration will be tested by entering the numeral figures into the adapted LISAM. This will generate liveability values (0-1) for the different models in general and for the different order subdivisions. The output of the first itera-

tion is one preferred model, based on analysis of the liveability values generated by LISAM. The following spatial zoning elements are included in iteration 1:

Planned features iteration 1

- Shelter areas
- Major roads and paths
- Main drainage system
- Registration areas
- Administration areas
- Educational Facilities
- Health facilities
- Warehousing facilities
- Distribution centres
- Community centres
- Communal cooking areas
- Sanitation facilities
- Agricultural sites
- Natural Protection sites
- Playgrounds
- Sports areas
- Spaces for religious activities
- Markets
- Public squares and parks
- Fire breaks
- Water treatment facilities
- *Expansion areas



Figure 36. Schematic representation of Ego and Eco model studies of iteration 1

Iteration 2 starts by creating a zoning plan with the same features as described for iteration 1 that is the basis for two different detailed design models. This zoning plan is an enhanced version of the preferred model from iteration 1.

The following features are added to the detailed design models for iteration 2:

Added planned features iteration 2

- Minor paths
- Shelter areas:
- Shelters
- Community spaces
- Commerce structures
- Composting areas
- Energy crop areas
- Erosion prevention methods
- Permanent planting typologies
- Reared animal sites

Similar to iteration 1, the models for iteration 2 take slightly separate directions: Model 1 (ego) focusses more on fulfilling all the layers of the hierarchy of needs emphasizing development of the higher levels (esteem, self-actualization). Model 2 (eco) focusses more on a healthy natural environment, ecosystems and long-term natural development.

7.1.1 Iteration 1 process, testing and results

The base layout for both ego a/b and eco a/b started from the analysis of useable slopes. As discussed in section 3.5, all slopes steeper than 15% were deemed unusable. In order to have one coherent site, the strip in the easternmost part of the site and the separated corner in the north-western most part of the site also were excluded, as seen in figure 36. With help of a flow accumulation analysis the main natural drainage of the site was located. The main drainage of the site was combined with the main axis to

form the main boulevard. This means that main traffic will follow the most efficient way up and down the hill. Additionally, this means that during construction of the primary infrastructure, drainage can be dealt with simultaneously. The secondary infrastructure is mostly staying parallel to natural contours in order to counter erosion and to make walking and cycling down these considerably easier. The zoning is divided with registration and administration at the top of the camp, providing oversight of the camp and allowing for a logical flow when new inhabitants are welcomed into the Vastria. The blue zone with vulnerable populations and the yellow zone with single men are located nearest the registration and administration zone. This allows for good social control for the yellow zone and closeness to most important services for the blue zone. The red zone with families stretches out over the rest of the southern part of Vastria. Some essential services such as WASH stations are distributed over the camp, the same locations in ego a/b and eco a/b.

Model ego a, first of all differentiates from eco a through the use of the multifunctional firebreaks. In ego a, the multifunctional firebreaks have double functions such as community spaces, sport spaces and agricultural sites. Additionally, ego a provides space along the main boulevard for shop initiative. Eco a on the other hand mostly uses green firebreaks and extensive agricultural areas as functions for the firebreaks. The olive groves along the extension roads on the northern slopes and the VFS along the main boulevard are also unique to eco a.

Model ego b shows the high influx scenario for ego a. Here, in model ego b and eco b alike, additional shelter space is realised in the outskirts of the existing camp on the slightly steep-

er slopes and on the strip of land that borders the entrance road in the north of the Vastria. Differentiation between ego b and eco b is made in spaces that get sacrificed for the sake of additional shelter. In ego b, mostly park space gets sacrificed for additional housing as well as the shop initiative space along the main boulevard. Eco b sacrifices mostly community space and park space for additional housing. Additionally,

the groves lose their function of publicly attended groves.

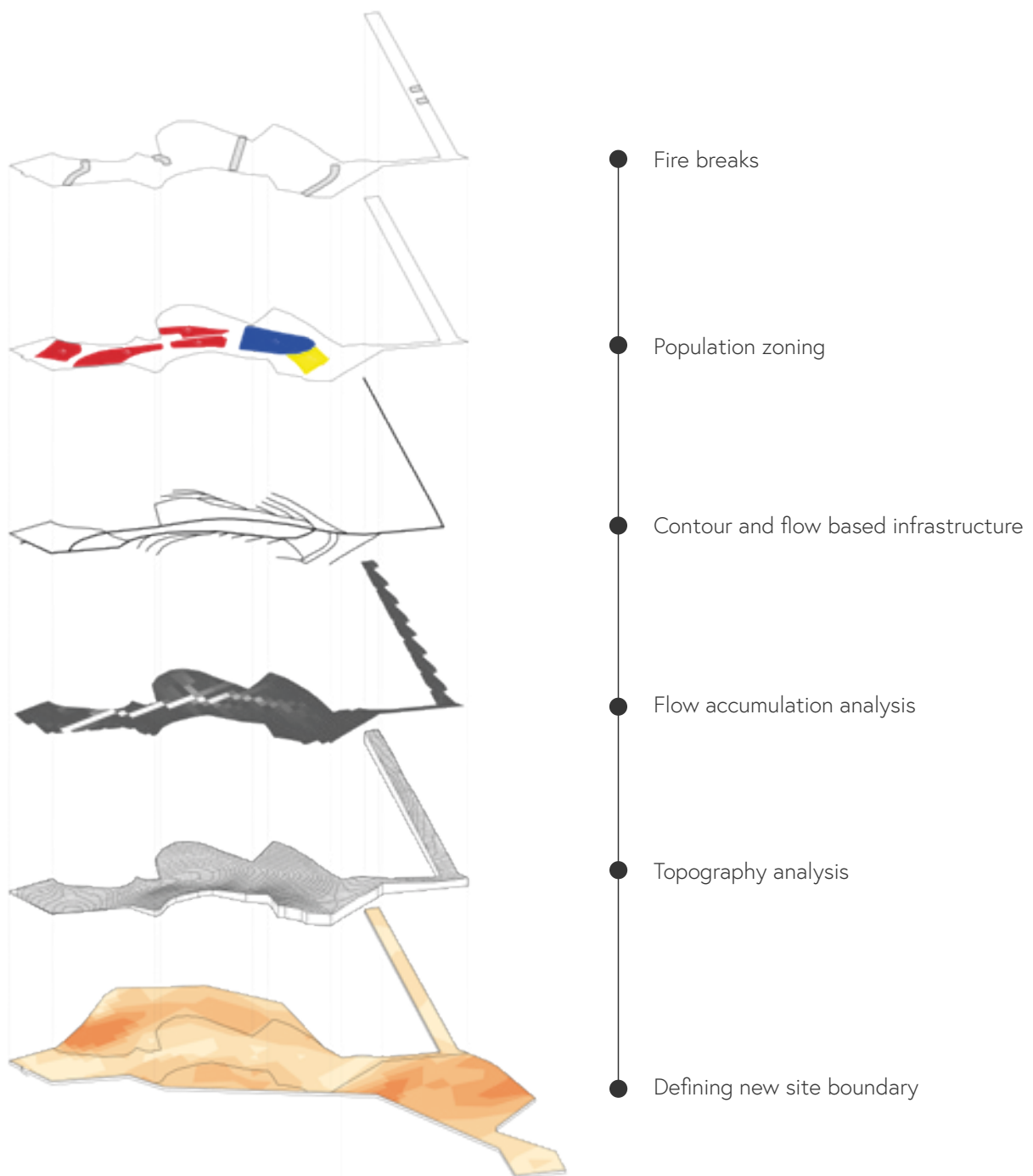
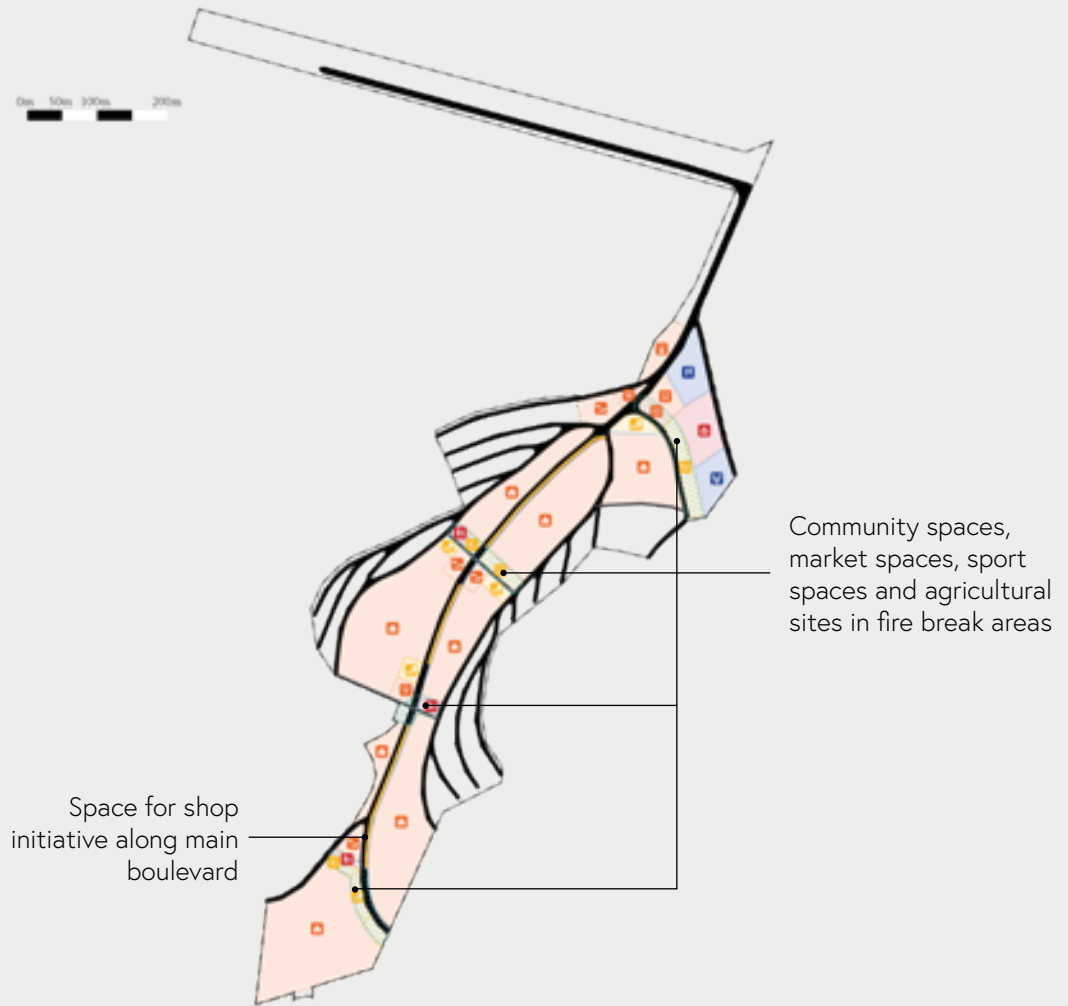


Figure 37. Common design steps and layers

MODEL EGO A

0,350



MODEL ECO A

0,448

Legend:

- Camp outline
- Major road
- Minor road
- Shelter zone
- Shelter expansion zone
- WASH zone
- Distribution zone
- Food warehouse
- Kids & women friendly zone
- Community centre
- Outdoor sport
- Public park/square
- Water filtration site
- Shop initiative area
- Fire break area
- Green fire break
- Registration zone
- Administration zone

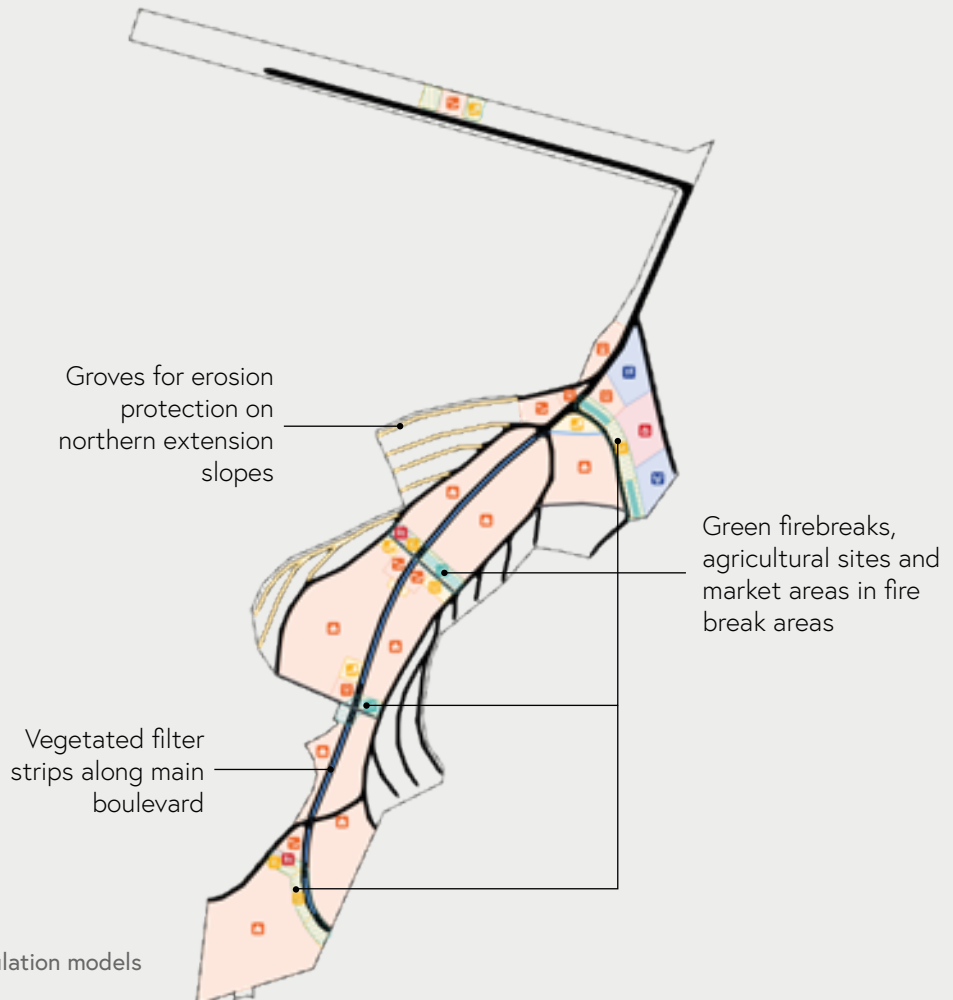


Figure 38. Base population models comparison

Base population models comparison

MODEL EGO B

0,158



Main boulevard space sacrificed for extra housing

Park space sacrificed for extra housing

MODEL ECO B

0,448

Legend:

- Camp outline
- Major road
- Minor road
- Shelter zone
- Shelter expansion zone
- WASH zone
- Distribution zone
- Food warehouse
- Kids & women friendly zone
- Community centre
- Outdoor sport
- Public park/square
- Water filtration site
- Shop initiative area
- Fire break area
- Green fire break
- Registration zone
- Administration zone

Groves not accessible anymore

Parks & community space sacrificed for extra housing

Figure 39. Influx population model comparison

Influx population model comparison

For iteration 1, the four models were tested through LISAM. In order to complete the testing, several categorizations had to be made:

Self-organizational spaces:

- Parks / squares
- Market places
- Agricultural sites

Social spaces:

- Parks / squares
- Community spaces
- Religious spaces
- Educational spaces
- Playgrounds
- Sports areas

The eco model showed a significantly higher liveability score for the base population scenario than the ego model (0,448 vs 0,350) with a slight advantage of the ego model over the eco model in de high influx scenario (0,158 vs 0,148). Both significant drops in liveability scores, which is due to the values all being related to the highest value of all models.

After analysis of the liveability scores over the different divisions and sections, an eco+ model was derived. Most features of the eco model were kept, however some additions were made that were concluded to be currently missing and were put in the place of features that would not significantly lower liveability scores. The first iteration resulted in the following outcomes:

Outcomes iteration 1

- Model ego a overall liveability score of 0,350
- Model ego b overall liveability score of 0,158
- Model eco a overall liveability score of 0,448
- Model eco b overall liveability score of 0,148
- Eco model preferred model
- Eco+ -> Shop areas in the registration community area
- Eco+ -> Communal areas in communities

7.1.2 Iteration 2 process, testing and results

The eco+ model formed the basis for the two models that were part of iteration 2. The eco+ model was taken a step further by going into more detail with shelter and community configurations, tertiary infrastructure and determination of private/communal space ratios. Again, the models were taken in separate directions by taking eco+ a towards more human centred design and eco+ b towards more nature centred design.

The eco+ a model differentiates specifically through creating more private space and by maximizing the useable space of communities by placing the shelters in efficient grids. The eco+ b model on the other hand, places communities and shelters more parallel to natural contours and leaving the negative spaces created to form interstitial green space. This means however that density for the communities in model eco+ b is higher to compensate for the lower

space efficiency.

The differentiations can be seen below.

Model Ego

Private space per household -> 53 m²

Garden space per household -> 15 m²

Communities with open U or H shape

Maximizing useable space of courtyards

Community units in grid like structures

Model Eco

Private space per household -> 30m²

Garden space per household -> 10 m²

Areas reserved for self-organization -> 50% of community space, private space, parks / squares, marketplaces, agricultural sites

Courtyards and general orientation shelters parallel to contour lines

Negative spaces left as interstitial green space

The models were tested through LISAM and through expert review. The LISAM generated liveability scores that were not significantly different, with a slight advantage of model ego (0,512 vs 0,503). A difference was noted mostly in the private/communal ratio, where increasing the amount of private space slightly already made a considerable improvement of the liveability score of the eco model.

The expert review was done by means of a slide presentation and a discussion afterwards. Margriet Smit (section 2.4.1) was the expert for this expert review. The author first introduced the research, its objective and the site. Then the build up towards the first iteration, the outcomes of this and finally the models of the second iteration were shown and explained. Overall, the eco model was preferred by the expert with conviction. She assessed this approach in

designing PRC's as innovative and necessary, and especially the eco model forced the camp design to exist in harmony with the natural environment, which would be a big improvement on the current approach that ignores the natural environment. According to here, this has big impacts not only on the environment but on the liveability for the inhabitants. Some additional remarks were made concerning design aspects that should be taken into account.

Outcomes LISAM

- Model ego overall liveability score of 0,512
- Model eco overall liveability score of 0,503
- Simple intervention of increasing amount of private space used for food tips the scales in favour of model eco

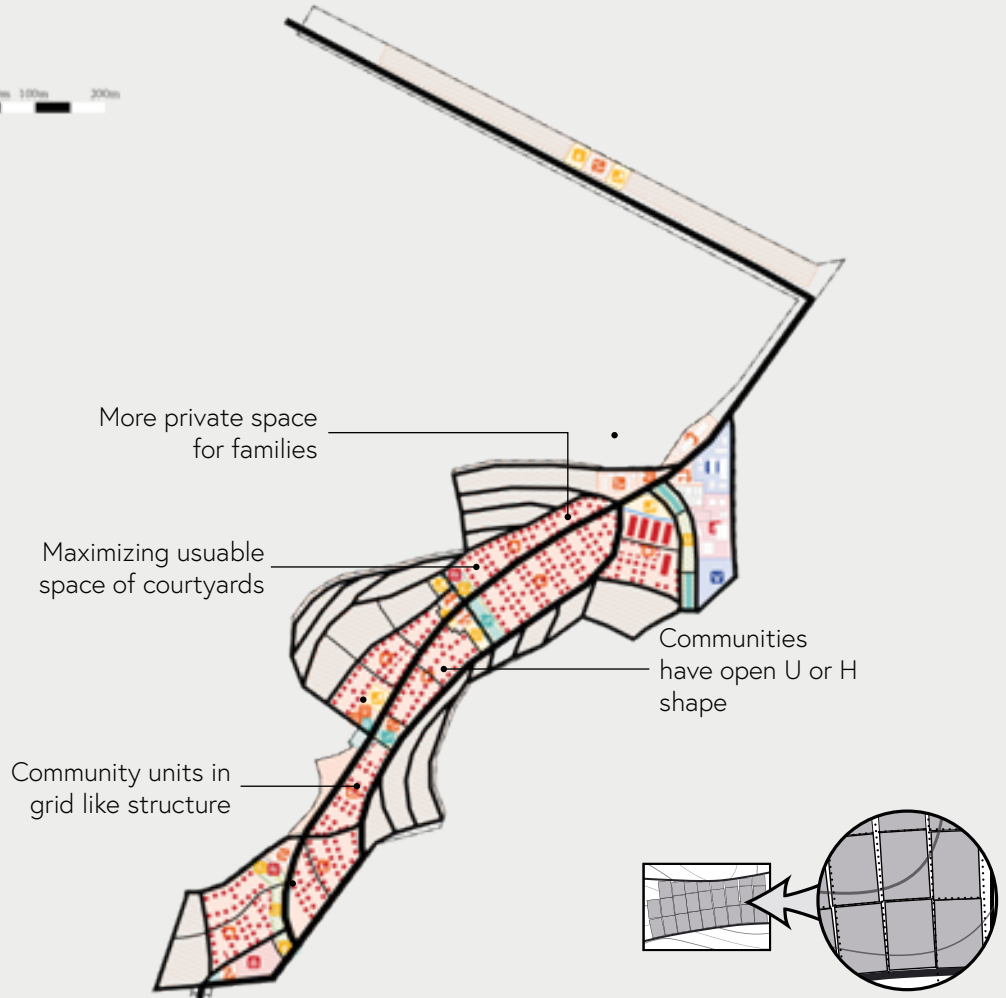
Outcomes expert review

- Eco model preferred model, as it forces green spaces instead of leaving it up to choice
- Firebreaks surrounding the camp
- Security posts throughout camp
- More, smaller WASH stations
- More medical posts, also central on the site
- Add escape routes at dead end roads
- Keep snake habitats into account
- Water retention
- Info points

MODEL EGO

0,512

+ expert review



MODEL ECO

0,503

+ expert review

Legend:

- Camp outline
- Major road
- Minor road
- Shelter zone
- Shelter expansion zone
- WASH zone
- Distribution zone
- Food warehouse
- Kids & women friendly zone
- Community centre
- Outdoor sport
- Public park/square
- Water filtration site
- Shop initiative area
- Fire break area
- Green fire break
- Registration zone
- Administration zone

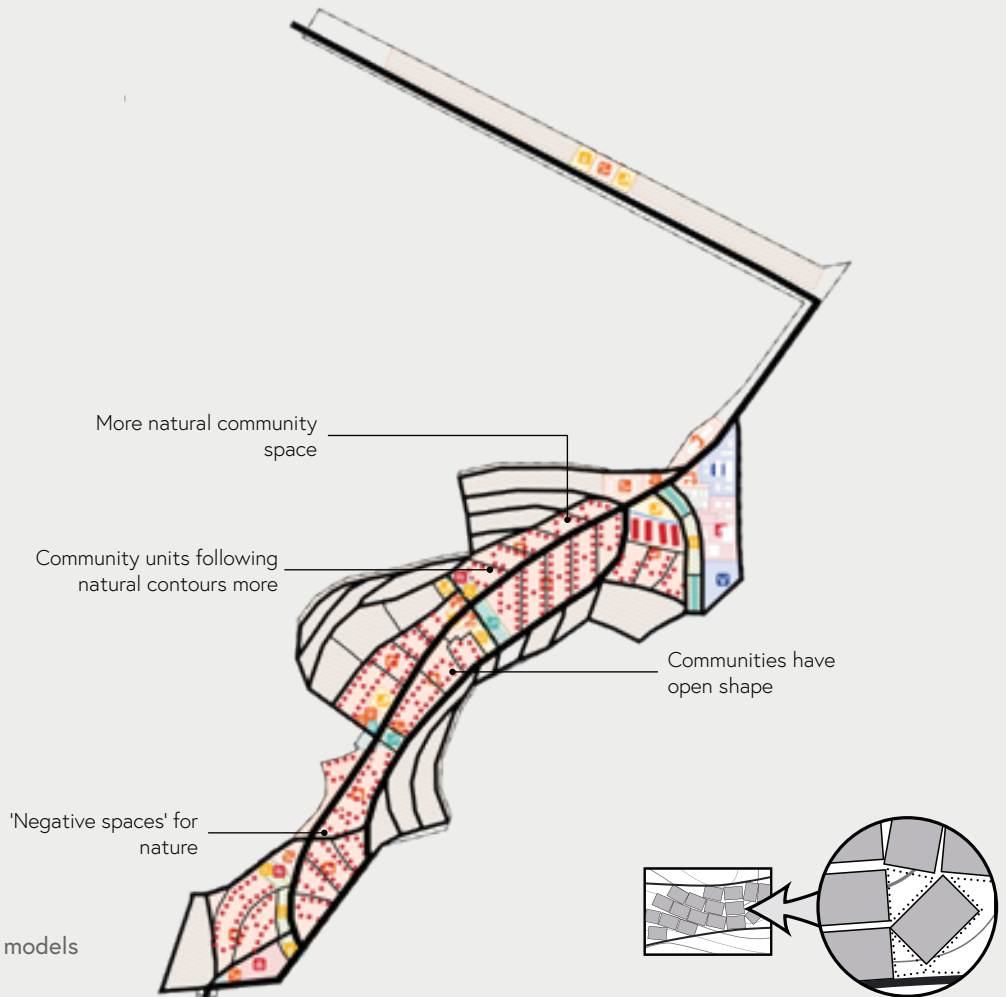


Figure 40. comparison

Iteration 2 models



Figure 41. Masterplan



215

190

220

150

155

205

155

145

160

165

170

175

180

185

230

235

240

245

250

255

260

265

270

205

275

280

285

7.2 Final design

The outcomes of iteration 2 were taken to a final zoning plan as a basis of the final master-plan design, which can be seen in figure 40. As the scale of the site was not suitable for a fully detailed design for the entire site, the master plan will be elaborated in several design strategies.

7.2.1 Strategies

Edges

As previously explained, the sites borders are predominantly shaped by the topography, with the sites borders roughly lying where slopes become too steep. A fence was placed along the edges of the camp. This can increase feelings of imprisonment for inhabitants, so three different strategies were made for the edges of the camps, as seen in figure 42. The edges have a five meter clearance on either side of the fences in situations bordering slopes lower than 15%, with low-maintenance plants, shrubs and trees

planted on the PCR side of the fence to lower the visibility of the fence and to prevent passer-by's from looking in. The species here are similar to the green fire breaks in figure 44. Where the PCR is bordering slopes higher than 15%, the fence is left out and replaced with a swale with dense shrubs. This reduces flooding and erosion during periods of high precipitation, increase biodiversity and increase water retention. The border with the landfill adjacent to it in the south-west of Vastria has a similar setup to the fenced edges, however with more dense, native planting that shield the communities from bad smells and that produces pleasant scents throughout the year such as *Bougainvillea* (November-May), *Elaeagnus ebbingei* (October-January), *Laurus nobilis* (May-June), *Coronilla valentina subsp. glauca* (May-July), *Lavandula* (July-August), *Thymus* (all year) and *Trachelospermum asiaticum* (July-September). This edge requires more maintenance, but can turn a undesirable place into a park strip people will want to walk by all year.



Figure 42. Strategy application locations

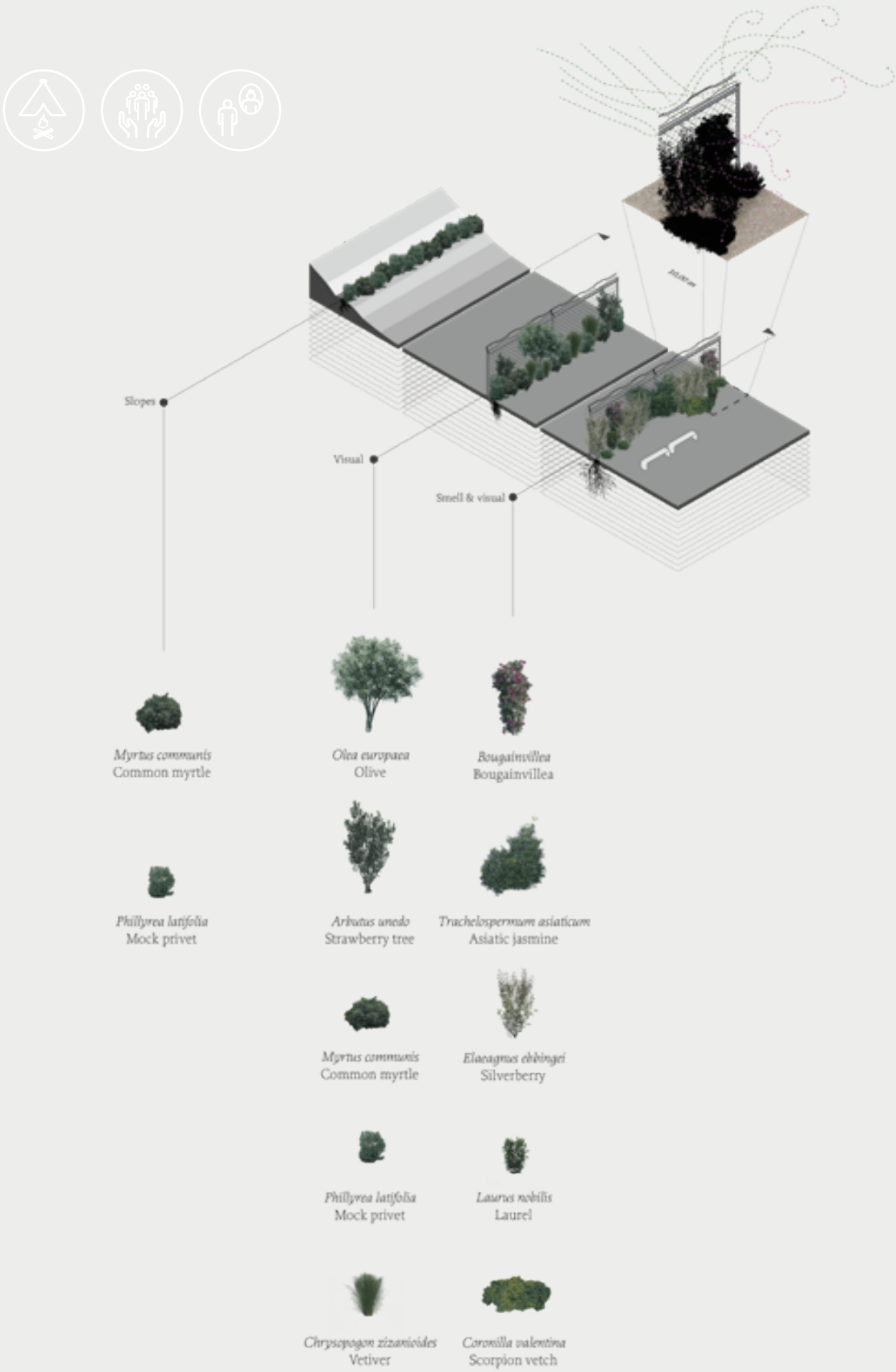
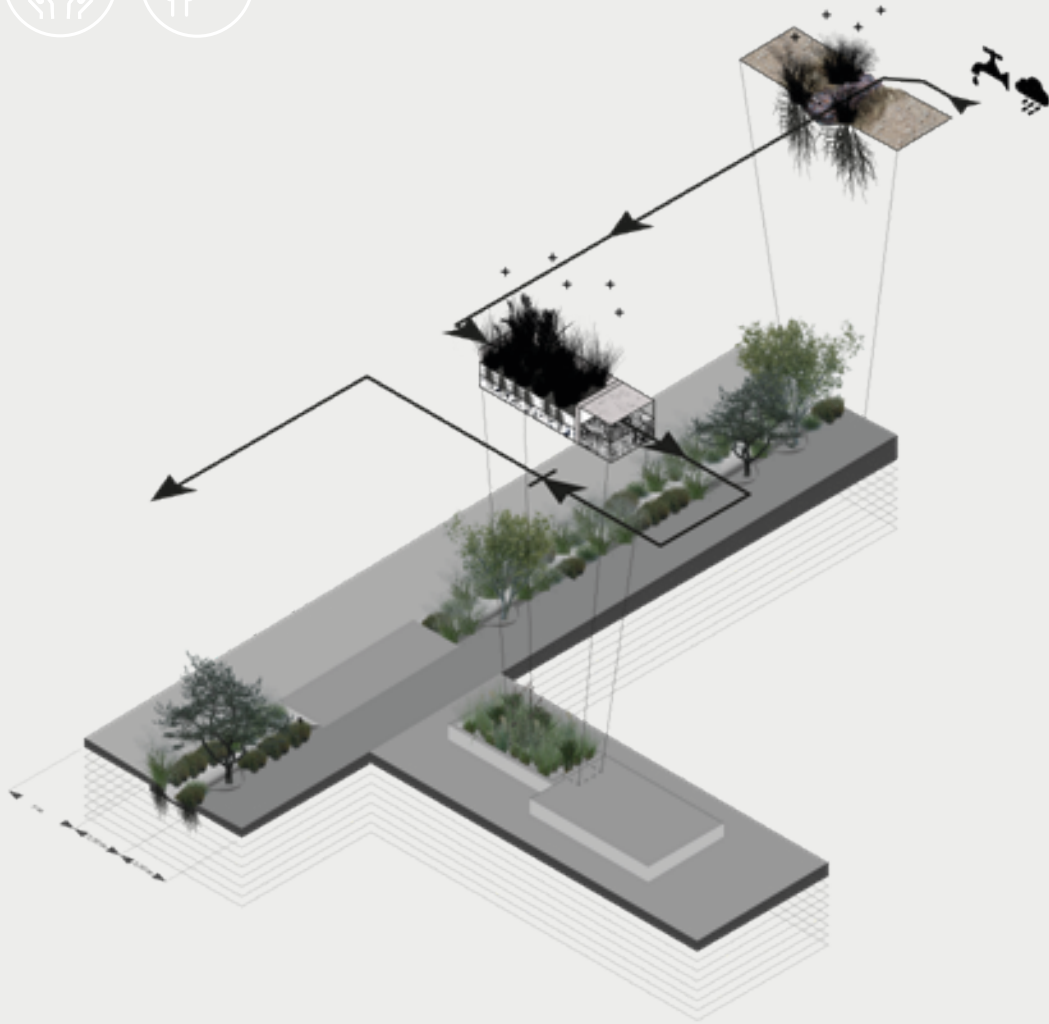


Figure 43. Strategies for edges



Pinus brutia
Turkish pine



Salix nigra
Black willow



Panicum virgatum
Switchgrass



Schizanthus barbatus
Mediterranean grass



Arundo donax
Spanish cane



Scirpus validus
Softstem bulrush



Typha latifolia
Broadleaf cattail



Juncus effusus
Common rush

Figure 45. Strategy for VFS

VFS

The sites borders and infrastructure are predominantly shaped by the natural contours, with the sites borders lying where slopes become too steep and with infrastructure guided along (secondary) or perpendicular to (primary) natural contours. The primary infrastructure forms the main boulevard. Running through the middle of this boulevard is the VFS, acting as primary drainage of the site. Besides drainage, accessibility, shading and aesthetic experience, the main boulevard through the VFS cleans the possibly contaminated water through multiple CW's along the boulevard, and retains clean water in cisterns close to the CW as can be seen in figures 44 and 46.



Figure 46. Strategy application locations



Figure 47. Render of main boulevard with VFS and communities



3,50 m

3,50 m



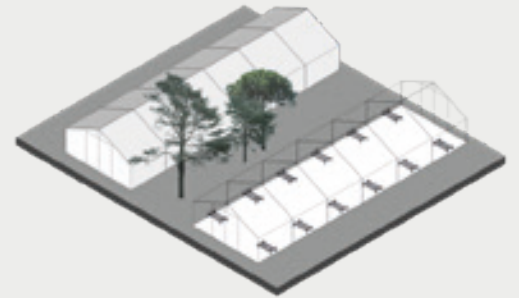
ZONE →

Blue

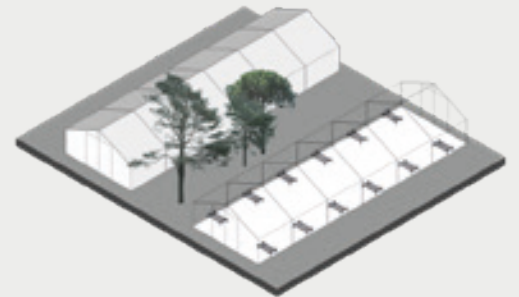
Yellow

PHASE ↓

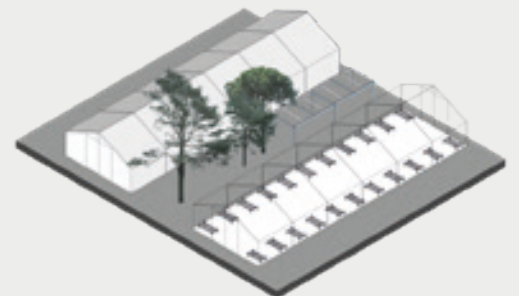
Emergency



Post-emergency



Influx



Post influx

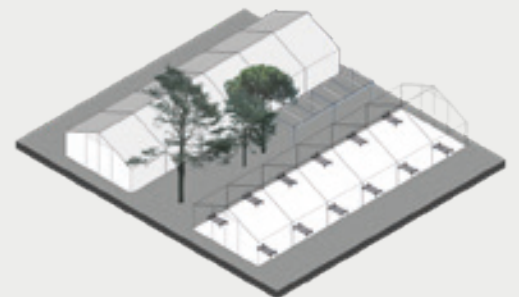
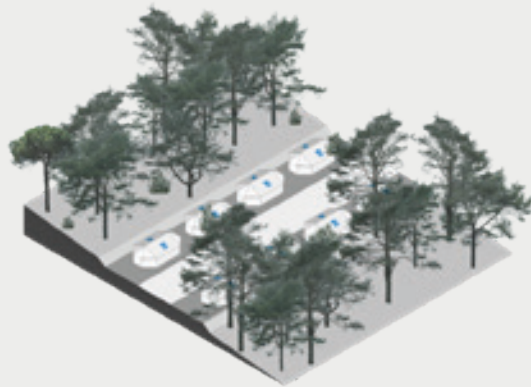
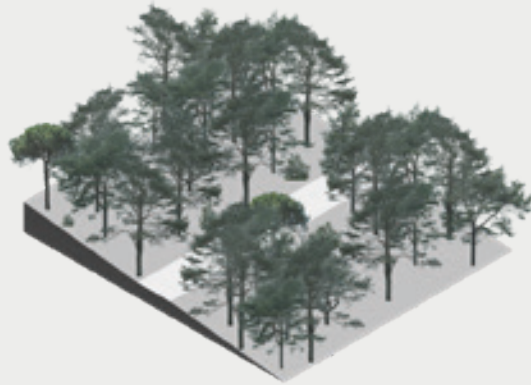
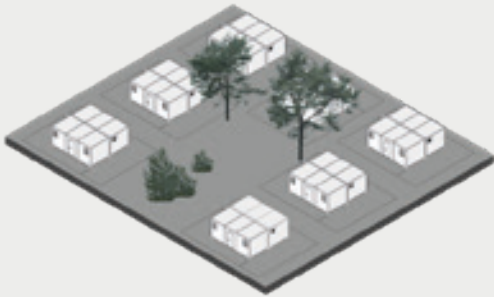
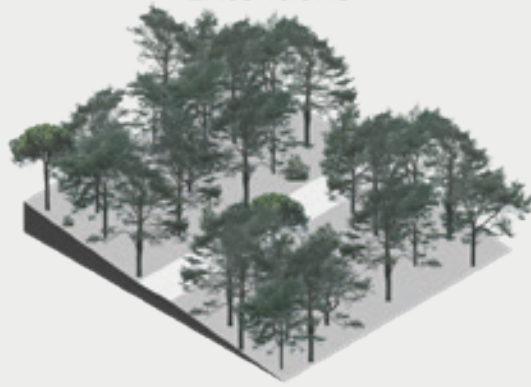


Figure 48. Strategies for communities

Red

Extentions



Communities

The communities are designed with the shelters forming open U or H shapes, improving interaction between communities and ensuring social control. The communities react differently to influx of inhabitants based on what zone they are in. In the red zone, the communities host additional shelter when necessary under an extreme influx situation as shown in figure 47, whereas the communities in the blue zone will not. This protects the more vulnerable population in the blue zone from further stress. The shelters are placed parallel to natural contours, with the middle shelter cluster connecting the two rows of structure lying higher on the level of the uphill most row of shelters in that community. This makes construction feasible, and allows for a walkway to the back of the community. Trees are cleared only in the U shape of the communities with a 3 meter buffer to that make construction possible and provides with the private space. locally available materials can be used by inhabitants to improve their communities. This can imply using Spanish cane and pine wood for creating a shaded pergola, creating adobe layers to cover rocky edged of the communities or to make walling for extensions.



Figure 50. Strategy application locations



Figure 49. Render of plotscale household





Quercus ilex
Holly Oak



Olea europaea
Olive



Arbutus unedo
Strawberry tree



Laurus Nobilis
Bay leaf



Myrtus communis
Common myrtle



Myrtus communis
Common myrtle



Phillyrea latifolia
Mock privet



Chrysopogon zizanioides
Vetiver



Thymus
Thyme

Figure 51.

Strategie for green firebreak

Firebreaks

Firebreaks are a necessary part of camp design, especially in the fire-prone area of Vastria. With a minimum width of 20-25m every 300m of camp space, the firebreaks take up significant space. As space is often sparse in PRC's, firebreaks will have several other functions residing in them that don't require flammable structures. The firebreaks their double functions are green fire breaks, safe spaces, playing grounds and market areas.

The green firebreaks function by digging a bioswale along the contour of the landscape and planting trees with a tight canopy that create a microclimate and layers of low flammable planting underneath, as can be seen in figure 50. Due to the swale, water can be retained better in the area, also after Vastria is taken out of commission.



Figure 52. Strategy application locations

Adjustable public spaces

Green public space is established throughout Vastria, ensuring inhabitants never have to walk far to take their mind off their stressful environment and stroll through a public space. As it is important that people have a feeling of ownership over their public spaces, during the emergency phase some spaces in every block will be left vacant, only to see which spaces people naturally start using as public space. After the emergency phase, some interventions such as paths will be implemented top down with some moveable furniture provided. After this, it is up to inhabitants to use and make the space, providing with opportunities for inhabitants to do some gardening, build furniture or organize small markets.

Furthermore, safe spaces for vulnerable groups will be implemented throughout Vastria. These places are shielded off by fences and provide for a place where women can take off their hijabs and children can play while being

watched. These spaces should preferably be shaded by trees to ensure a pleasant environment during summer and some roofing to take shelter.



Figure 53. Strategy application locations

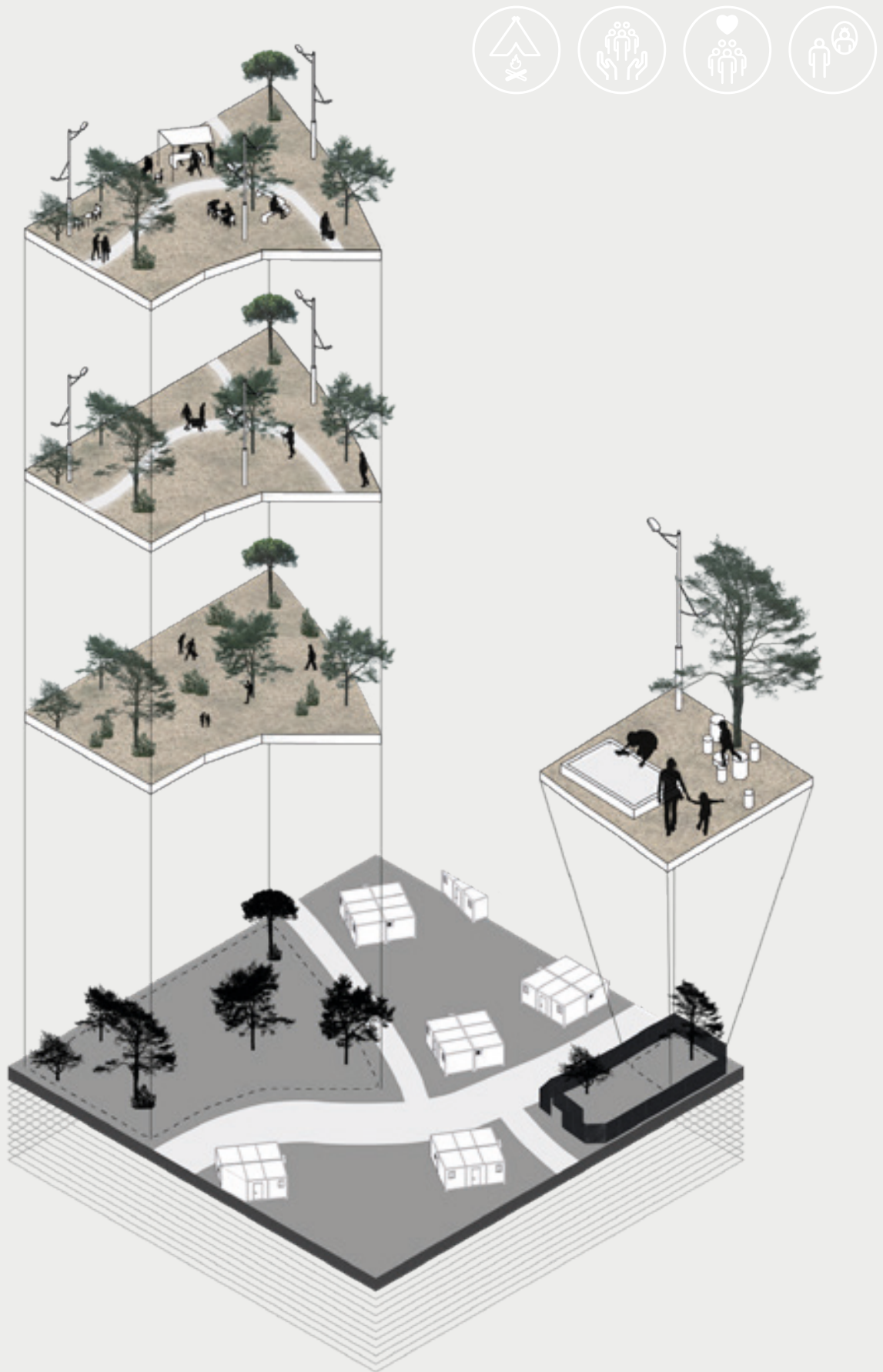


Figure 54. Strategies for public spaces

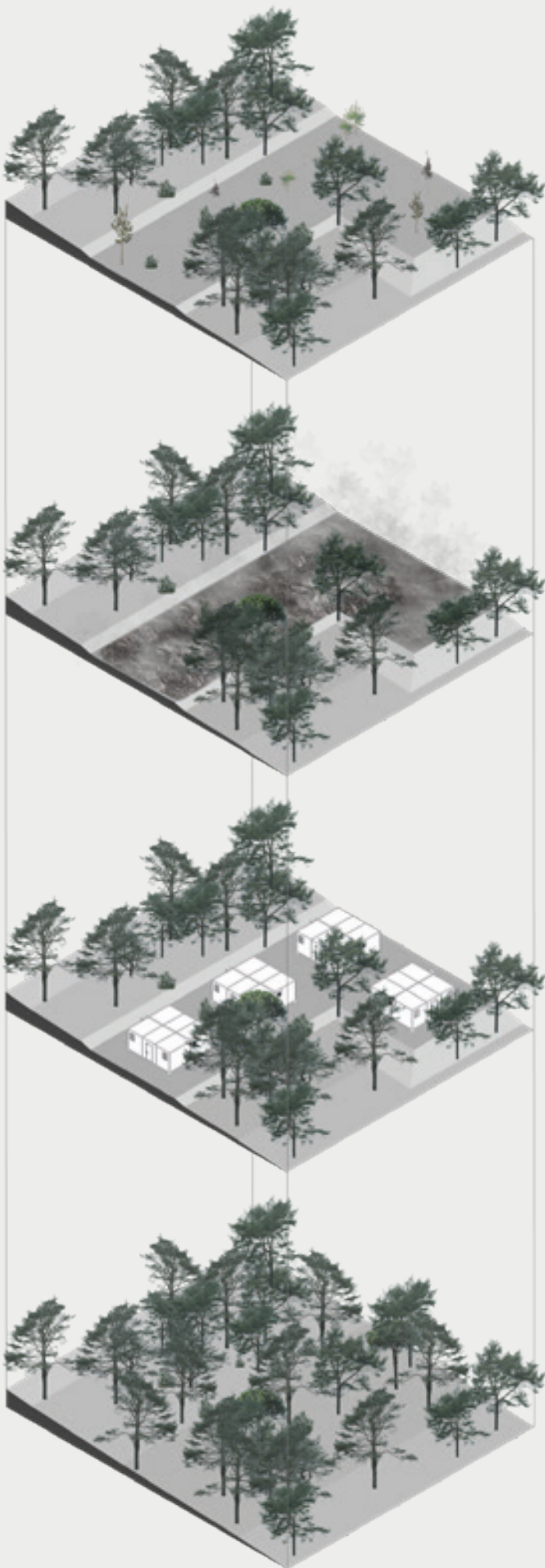


Figure 55. Strategy for ecological disturbance

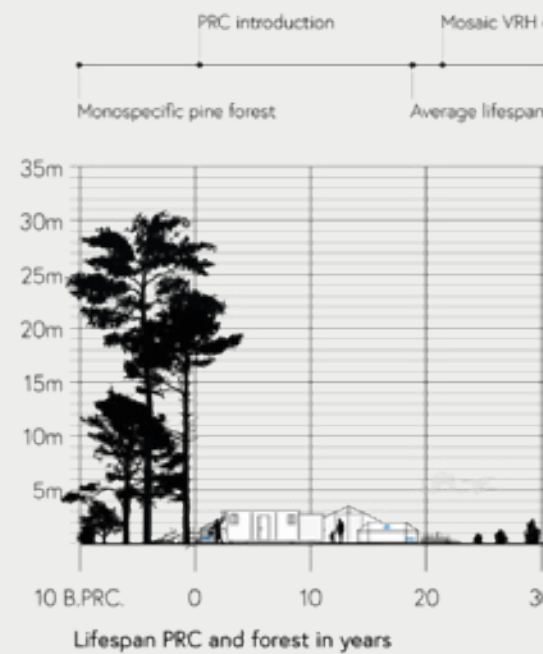
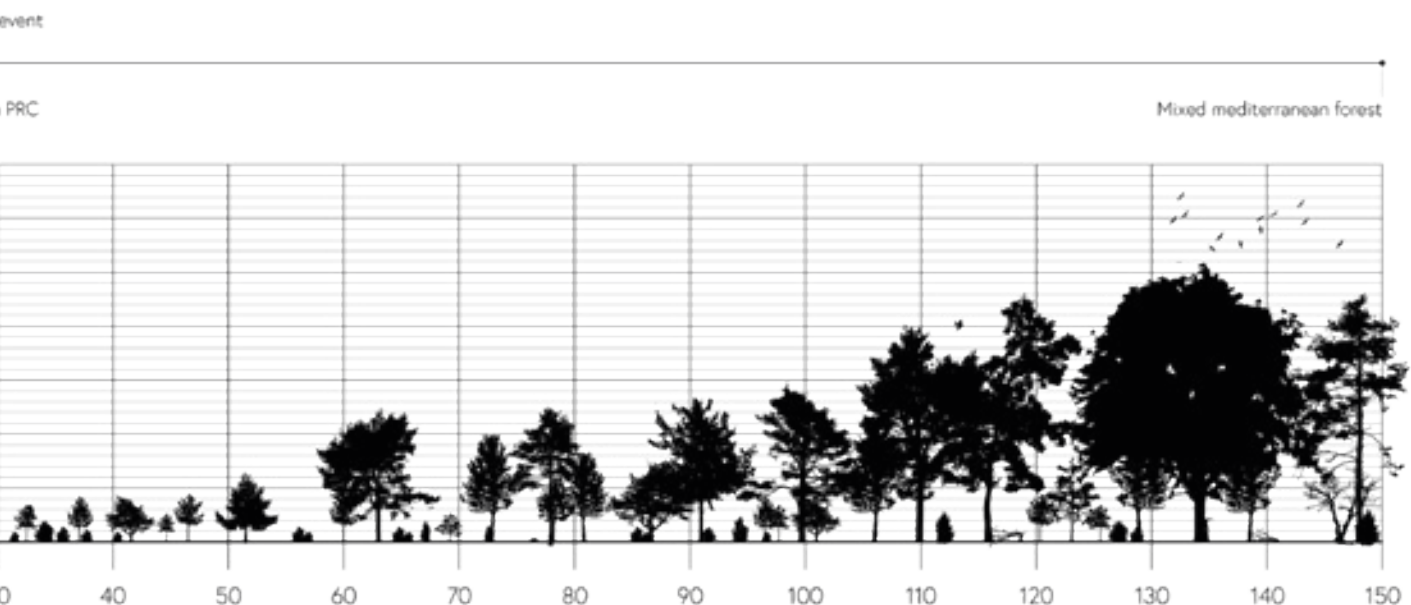


Figure 56. Average lifespan refugee camp, based on data from Kennedy (2008)

Ecological disturbance

PRC's will inevitably have a major impact on whatever landscape they settle on. Next to disrupting ecosystems, the footprint PRC's have can cause extra friction with local communities, endangering this already often fragile relationship. Through beforementioned strategies, the design presented will already have a greatly reduced impact on the environment compared to common practice. However, it could be useful to take this a step further and look at collateral benefits that might be obtained from this ecological disruption. Vastria is located on a site prone to wildfires, which over time has caused for a rather monospecific *P. halepensis* dominated tree growth, as this species is well adjusted to wildfires. However it is this same monospecificness that increases chances of fast wildfire spread. Through approaching the clearing of strips of vegetation as a Variable Retention Harvesting method, the camps temporary presence could be seen as a short partial ecological disturbance that provides with potential for a more diverse regrowth. After termination of the camp, a controlled fire and seed dispersal could, in combina-

tion with the mature tree cover neighbouring these clearings, provide with breeding ground for a more robust and diverse ecosystem.



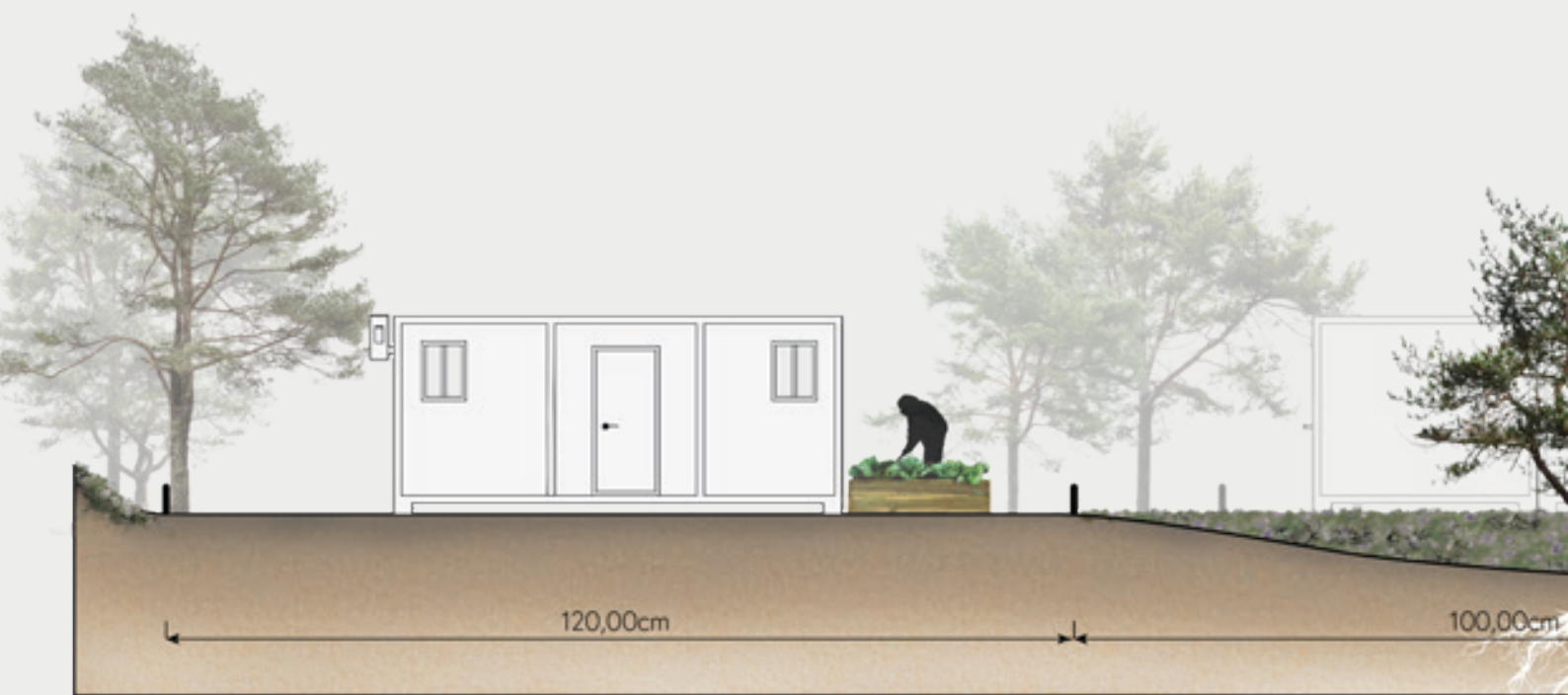


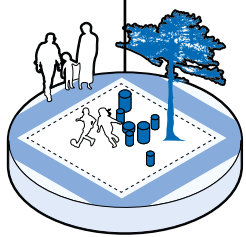
Figure 57. Section of a typical sloped community



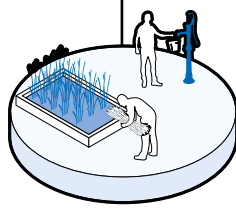


Figure 58.

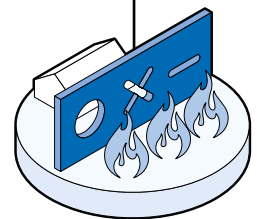
Detailed design plan



Safe green spaces for vulnerable groups



Design allows for sustainable harvest of natural resources



Multifunctional firebreaks

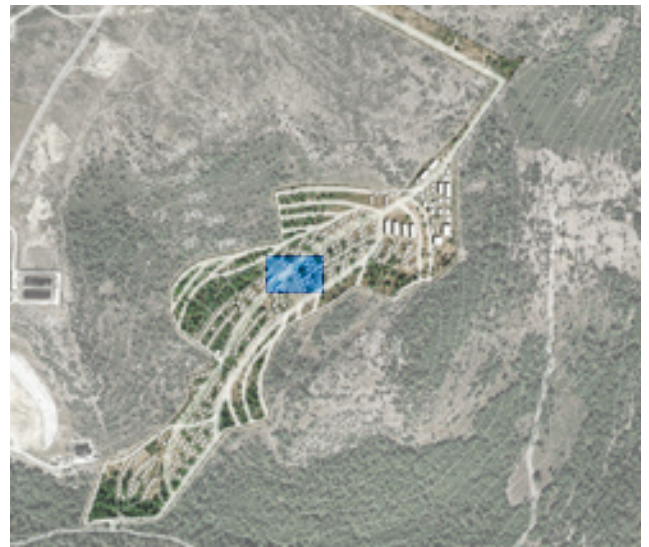
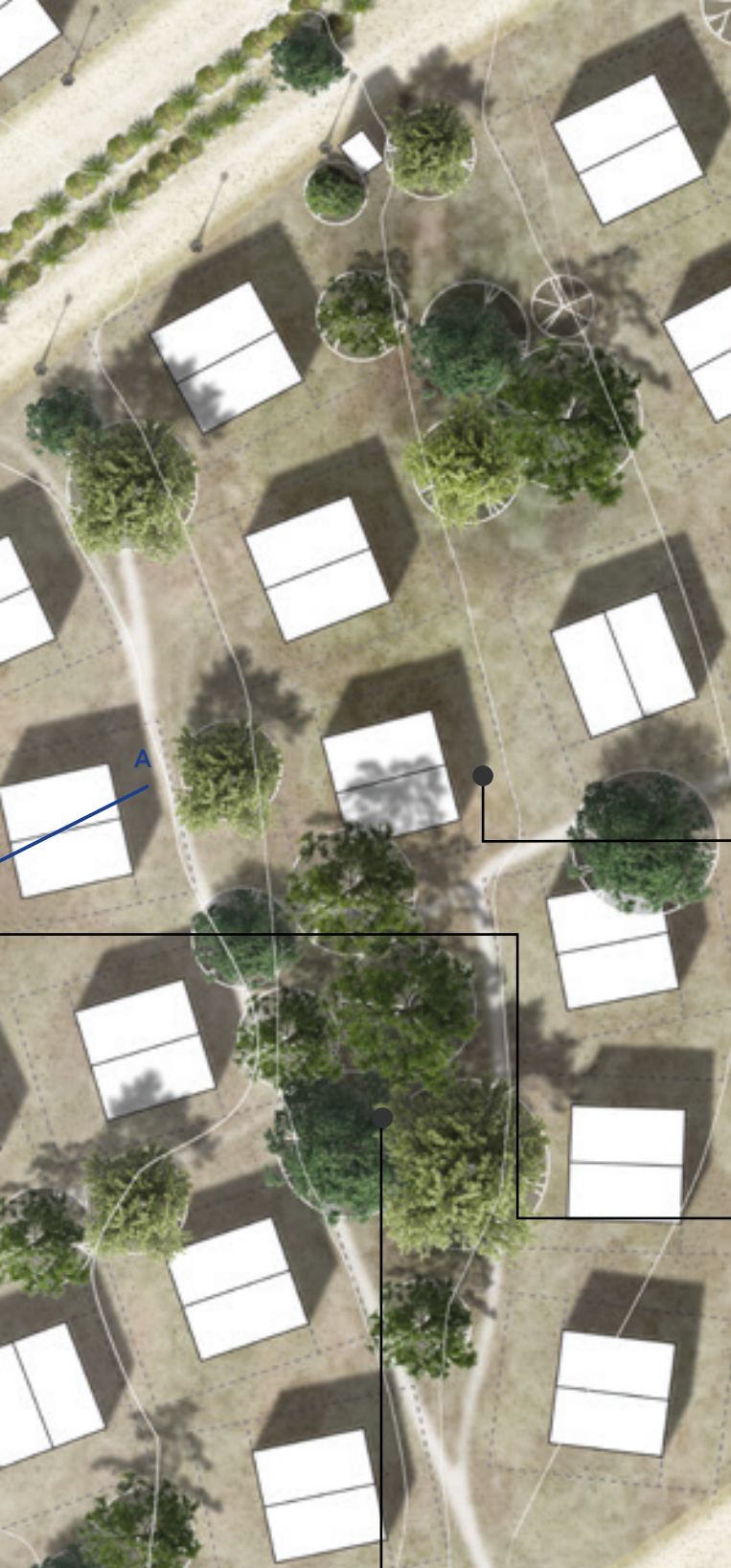
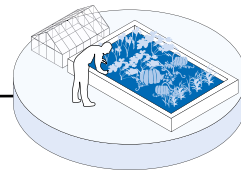
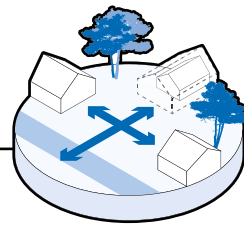


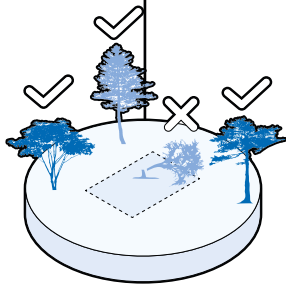
Figure 59. Detailed design location



Space for every household to produce crops



Community units are designed for protection against climate and better interaction with other communities



Retain trees and other vegetation where possible and work with new planting [...]

7.2.2 Detailed design

The detailed design shows how the camp layout is to be worked out up to the plot scale. The chosen site for the detailed design includes elements from almost all design principles, excluding the green adjustable public spaces principle, which can be seen in more detail in section 7.2.1. An additional section showing the intricacy of the height differences on community scale is provided in figure 56.

8 Discussion

With an ever growing need for good ways to temporarily house those that seek asylum in other countries, fleeing from war, climate or poverty, this thesis has aimed to find out how designing with ecosystem services could potentially improve liveability of PRC's. Where previous research has often halted at making vague recommendations, this thesis has generated design principles and tested them in a case study on Lesbos, Greece. The design principles were drafted through answering sub-questions that aimed to find out how liveability can be defined in the context, which ES could improve liveability here and how landscape design could specifically contribute to liveability. The design outputs of this thesis show a way these principles could be applied to Vastria, showing the potential of incorporating ES into the design of PRC's. In this section, the limits of the research, design and LA as a profession in this context are discussed and reflected upon. Additionally, remarks on the importance and applicability of the research and design are made.

Research critique

The research that was performed for this thesis requires critical review. The use of LISAM, however novel, potentially has its drawbacks. Developed as a model for testing regional liveability of existing places and landscapes, the model focusses on large scale implemented systems with criteria that match this scale. LISAM compares different raster pixels of a region on a set of 68 criteria, often limited by available data. For this thesis, the model was adapted to not only fit a smaller scale site and the context of a PRC, but also to test hypothetical situations.

This was done by filtering out any criteria that are not suitable for the smaller scale, by adding relevant criteria derived from literature and expert interviews and by not comparing different regions but by comparing different expressions of layout on the same site.

The first drawback of the way LISAM was used to predict spatial liveability of PRC designs, is the lower amount of comparisons available when calculating the liveability scores. The lower the amount of compared sites, the less valid the method might be. During the testing of the models in the first iteration four different models were being compared, whereas during the second iteration only two were compared.

Secondly, for the scope of this thesis the criteria of LISAM were filtered and supplemented to finally consist of nine criteria for the first iteration and fifteen for the second iteration. As this is a significantly lower amount of criteria than the original LISAM, this might also cause the validity to be compromised to an extent. It would also be very valuable for future research to take small scale liveability criteria (e.g. accessibility, thermal comfort) into account in design considerations.

However, the adapted LISAM does succeed in giving insight into the changes of design interventions on some pillars of liveability, which is a novel approach in designing PRC's and perhaps in designing any smaller scale site. Through the expert survey granting weight to the different criteria, the adapted LISAM finds value in its experiential input, building on the knowledge of practitioners.

To add to this, it would be useful if further research could explore adding inhabitants opinions to this experiential input. Due to constraints of this thesis, input of inhabitants for the

LISAM weighting was not possible. Other ways of participatory involvement of refugees in the design process are deemed essential if this thesis were not just exploring a hypothetical case.

Finally, due to restrictions field visits to other refugee camps were possible. This could have added great depth to both the settlement and population analyses in section 3, as well as the reference studies in section 5.

Design critique

There is no such thing as a perfect design, so some remarks need to be made concerning the design process of this thesis. With two design iterations and limited time, design decisions such as the general layout of the site (e.g. roads, paths, location of some different camp major camp components) were determined before testing. While based on design principles derived from literature, these elements could possibly have significant impact on spatial liveability of the site.

Following the aforementioned lack of criteria on small scale liveability, the scope of this thesis also did not allow for design principles that target this scale of design. Therefore, this has not explicitly been taken into account during the design process.

While during the design process several community layouts were considered, design on the scale of plots and shelters was not feasible for the scope of this thesis. Following comments by experts and recommendations in literature, the larger scale design choices were deemed more impactful on liveability and were thus emphasized more in the design process. Additionally, it has been observed that while there are many architects and students that have come up with innovative design solutions for shelters, the larger

landscape scale has not often been thoroughly reflected on in academic design practice. This does not mean that plot and shelter scale interventions are not an important factor in liveability of PRC's, so it would be advised to consider combining design recommendation produced in this thesis with possible solutions on the plot scale.

Finally, as the whole thesis has been an iterative process, many changes in the design principles and the design took place in moments that were often not foreseen. Several principles that were initially a part of my thesis have been left out. An example of this is the principle of modularity of structures. This could potentially be an important element of granting feelings of ownership to inhabitants while improving flexibility of the camp. However this principle was considered to be slightly out of the scope of this thesis, going into a detail that could not really be tested and perhaps deserving a separate study on its own.

Other principles were enriched during the later research phases or even added during the design phase. This was the case with principle 7: Design allows for sustainable harvest of natural resources. During the design it seemed logical that the main infrastructure could have other functions than only draining the site, and during an interview with Margriet Smit, the idea of storing the water in cisterns for dryer times came into existence. It is deemed valuable that some of the design principles have roots in the design itself, empowering the iterative process.

Limitations of the profession

There are also some significant limitations in what LA as a profession can achieve within the complex case of PRC's. While any alteration

of the landscape to achieve some means could be considered a political act, there is a political factor to the often poor liveability of PRC's that goes far beyond lacking good design principles. If design guidelines laid out in the UNHCR and Sphere handbooks would be followed to the letter, many PRC's would be far more liveable than they are in reality. At the basis of this are mostly geopolitical struggles that deserve in depth studies, but that are out of reach for the scope of this thesis. Greece and especially Lesvos seems to be one of the last locations where progressiveness in PRC design would be applied.

Another important factor in liveability of PRC's that lies outside the scope of LA is programming. In current practice often provided by NGO's, programming can have a big impact on how people feel and can provide with much desired distraction from the precarious situation that refugees find themselves in. Witnessed on Lesvos, one of the only places where many Mavrovouni camp residents could relax and take their mind of things, was a community centre run by an NGO. Here, people could work, eat, fix their bikes, work in a garden, play basketball and go to photo exhibitions by inhabitants. It was noted however that Lesvos happens to be a place that has received relatively much attention during the refugee crisis. Other Islands such as Chios have not received this same attention, and consequently hosted little or no NGO's and the services that they provide.

Finally, we need to be aware that while we can create green spaces, provide safe infrastructure, provide thermal comfort or ensure that food distribution sites are designed efficiently, people will still be stuck in a bureaucratic limbo with often no certain outlook on improvement. As Amin stated in one of the interviews that

were conducted: "If you make prison a paradise, people will still be prisoners".

However, we should not underestimate the ripple effect that good design can have. This thesis does provide with a relevant landscape based approach to designing refugee camps that did not previously exist in this manner. Following the design principles and guidelines produced for this thesis could ensure not only a more liveable PRC, but also potentially lower the impact that these places can have on their environment. It can be envisioned that this could cause for lower friction with local population which could have an entire political trickle-down effect. As clearly put by de Rooij et al. (2016, p. 3): "the burden of environmental and social impacts accompanying non-sustainable camps appears as counter-productive: the impacts of environmental crisis and decay, health and food security risks, economic and social tensions within camps as well as between refugees and the host region appear as a too high price to pay for accepting that temporary camps are by definition unsustainable."

Finally the power of LA and this thesis could very well be the power of visualising ideas in order to get the point across and make innovation desirable. In this sense, the role of LA might be lying more in influencing policy than undertaking every PRC design. Most likely many reports have been written on improving PRC's, yet it can sometimes take a powerful image to make an idea stick with people that have the power to make changes.

9 Conclusion

This thesis started through a knowledge gap that was identified in literature, namely what innovative design solutions based on ES could improve liveability of PRC's, yet never further explored, developed and applied to a case. Through answering 3 sub questions, design principles and design guidelines were generated and applied to the case of Vastria in the form of a master plan design with several different strategies and a detailed design.

To achieve these, sub-research question 1 has explored the concept of liveability, the practice of PRC's and analysed the population and the physical site. Through comprising a number of liveability challenges, this sub-question concludes that liveability in the context of this case can be achieved by making the site ready for sudden fluctuations of population, by encouraging independence of its inhabitants, by using adequate sheltering, by planning for the specific needs of the different demographic groups and by reacting to and working with the site specific biophysical aspects.

Sub-research question 2 explored the concept of ES and what design criteria would be suitable for this thesis. With the outcome of a selection of weighted design criteria, this sub-question concludes in emphasising a strong link between ES and liveability, with the added value of leaving behind a more healthy landscape after the camp is decommissioned.

Sub-research question 3 helped understanding the practice of PRC design better, and helped translating abstract ES into NBS applicable to the context of a PRC. The list of NBS concludes the sub-question and provided with building blocks for the DP of this thesis.

The DP's were based on knowledge built in all three sub questions and serve to inform the final design which is a main output of this thesis. The design section visualises and summarizes possible strategies that can be used to design with NBS, providing with many positive influences of the ES that would otherwise not be present. This in itself can be seen as an answer to the research question, focussed on this specific case.

More importantly, it can be ascertained that designing PRC's with ES in mind can have positive results for the liveability of these places, using all the collateral benefits of NBS while delivering a humane and dignified temporary home for those displaced by terrible conditions elsewhere. Taking phasing and influxes into account in PRC design can to a big extent prevent issues with flexibility. In contrast with current practice that often uses a tabula rasa approach, using principles explored in this thesis can potentially not only make PRC's more liveable, but also more sustainable. A positive, systemic and evidence based approach to designing places in these highly political contexts could have far reaching societal impact and should therefore be explored further.

A more generic outcome lies in the recommendations presented on the next page, extracting principles and strategies developed for the case of Vastria that can be generalised to other cases of PRC's.

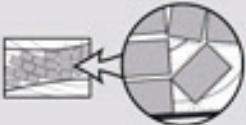
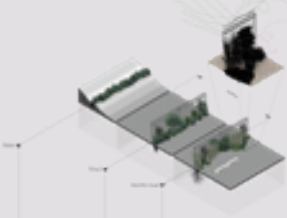

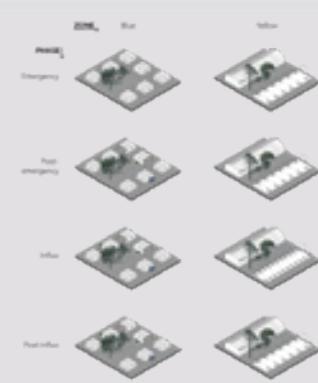

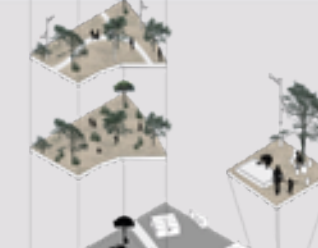

	RECOMMENDATIONS	PHASE	LC'S TACKLED	GENERALISABILITY	FURTHER ADAPTIONS
	Use of LISAM for site selection	Emergency	Potentially most	++	Original model would be more suitable for regional site selection, perhaps with some minor adaptations to suit the specific needs
	Designing along natural contours	Emergency	<ul style="list-style-type: none"> • Soil instability • Protection from (natural) disasters • Drainage 	+	More effective in sloped sites, similar strategies for flat areas should be developed.
	Natural edges	Emergency	<ul style="list-style-type: none"> • Protection from (natural) disasters • Air quality • Smell/noise nuisance • Wildlife • Social vulnerability • Stress 	+	If possible fences surrounding the site is not desirable for PRC's. Less suitable for more arid climates, planting needs adapting for different contexts.
	Harvesting of resources through VFS and CW's	Post-emergency	<ul style="list-style-type: none"> • Smell/noise nuisance • Water quality • Waste water management • Drainage • Lack of / depletion of natural resources • Dependence 	±	More effective in sloped sites. Requires knowledge and maintenance, making it less suitable to some situations. Planting should be adapted to local species.
	Open communities designed reacting to natural contours, vegetation present and population influxes	Emergency - post-influx	<ul style="list-style-type: none"> • Overcrowding • Protection from climate • Air quality • Soil instability • Drainage • Social vulnerability • Loneliness • Lack of communal space • Lack of open space • Lack of influence on surroundings • Stress 	++	Less applicable where there is either an extremely limited amount of space considering the amount of space taken up by 1 community or where there is a lack of accidentation and/or natural vegetation as then there might be less landscape features to respond to. This recommendation also includes providing for space for every household to produce crops, which might additionally need guidelines on setting up distribution points for gardening materials.
	Multifunctional firebreaks	Emergency	<ul style="list-style-type: none"> • Protection from climate • Air quality • Soil instability • Fire outbreak • Drainage 	+	Effectiveness of green firebreaks might be climate dependant, using firebreaks for other functions could be more applicable. Also depend on available knowledge.
	Adjustable public space	Emergency - post influx	<ul style="list-style-type: none"> • Protection from climate • Social vulnerability • Loneliness • Lack of social space • Lack of open space • Lack of influence on surroundings • Stress 	±	Dependant on individuals and/or NGO's that can kickstart a bottom-up initiative in GP public spaces. Additionally, safe spaces require staffing to guard entrances.
	Ecological restoration through VRH	Post-PRC	<ul style="list-style-type: none"> • Soil instability • Lack of / depletion of natural resources 	+	Disruption techniques depend on climate and habitat type, might not be as applicable in places where no vegetation is already present
	Incorporate principles and guidelines visually in handbooks	Pre-emergency	-	++	More technical drawings and clarifications might be needed to ensure a good implementation of guidelines in real life

Table 3. Liveability Challenges categorized by need groups

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Annex 1 - LISAM

ITERATION 1 TESTING RESULTS

Section	Average weight s	Division	Average weight d	Class	Type	Maslow	Spatial index	Method of calculation	Max value	Class weight	Irrelevance	Iteration 1	Value ego a	Value ego b	Value eco a	Value eco b	Complementary value ego a	Complementary value ego b	Complementary value eco a	Complementary value eco b
1 Provisioning services	0,153	1.1 Nutrition goods - provisioning of water and food	0,167	1.1.1 Cultivated crops – local production of cereals, vegetables, fruit, etc. for human consumption	ES	A	Communal gardens, private gardens, agricultural plots, agroforestry area	Area (m2) of productive food space per person (->)		0,139	x		3,81	3,810	4,718	3,673	0,808	0,808	1,000	0,779
				1.1.4a Water from water distribution networks – local presence of drinking water distribution network	US	A	WASH station	Number of people per WASH station (<)	2000	0,222	x		1125,00	333,333	1125,000	333,333	1,000	0,296	1,000	0,296
				1.1.4b Water from water distribution networks – local presence of drinking water distribution network			Water points	MWD to waterpoint from any household (<)	500	0,222	x		250,00	180,000	250,000	180,000	1,000	0,720	1,000	0,720
		1.2 Materials – provisioning of non-food materials and water	0,139	1.2.3a Materials from shops – local presence of shops			Non-food shops	Area of top down implemented shops per inhabitant (->)		0,139	x		0,282	0,099	0,000	0,000	1,000	0,350	0,000	0,000
				1.2.3b Materials from shops – local presence of shops	US	B	Non-food shops	Area (m2) allocated for shop initiatives per inhabitant (->)		0,139	x		0,946	0,143	0,503	0,121	1,000	0,151	0,532	0,128
				1.2.4 Shelters - Density of households	US	A	Households	Population density people per ha with one household = 5 people and density as people / ha of useable space	500	0,109	x		337,21	110,895	335,681	110,895	1,000	0,329	0,995	0,329

L Division ego a	L Division ego b	L Division eco a	L Division eco b	L Section ego a	L section ego b	L Section eco a	L section eco b	L ego a	L ego b	L eco a	L eco b
0,557	0,338	0,583	0,334	0,146	0,071	0,123	0,063	0,350	0,158	0,448	0,148

0,387 0,106 0,182 0,054

3 Cultural services	0,091	3.4 Spatial cultural adjustment - Local spatial adjustments to suit different cultural groups and ethnic groups	0,091	3.3.2 Spatial cultural adjustment - Local spatial adjustments to suit different cultural groups and ethnic groups	US	C	Public modular spaces, private space, other areas that are dedicated to bottom-up initiatives	Area (m2) reserved for self organization of layout (>)	0,091	x	2,222285714	0,4561	1,766285714	0,6259	1,000	0,205	0,794805863	0,281646953	
4 Social services	0,127	4.4.1 Gathering space - local presence green social gathering spaces	0,127		ES/US	C	Parks, squares, communal space, public space	MWD to social gathering space (<)	1000	0,127	x				0,722	1,000	0,722222222	1	
						C	Parks, squares, communal space, public space	Area (m2) of social gathering space (>)		0,127	x	260 3,846571429	360 0,9693	260 3,228571429	360 0,9494	1,000	0,252	0,839337443	0,246817203

MWD = Maximum Walking Distance (m, over official traffic routes); MD = Minimum Distance (m); RHU = Refugee Housing Unit

0,091 0,019 0,072 0,026 0,008 0,002 0,007 0,002

0,219 0,159 0,199 0,159 0,028 0,020 0,025 0,020

3 Cultural services	0,091 3.3 Services for spiritual, symbolic and other interactions with agri-natural elements and land- or sea-scapes – local presence of agri-natural elements for spiritual activities	0,036 3.3.1 Possibility of bequest of the natural environment for future generations – local presence of agri-natural elements in good condition that could be used by future generations	ES	E	Permanent plants, trees	Area (m2) of permanent plant cover + area (m2) of tree crown (>)	0,036				0,881	1	0,032	0,036		
3 Cultural services	3.4 Spatial cultural adjustment - Local spatial adjustments to suit different cultural groups and ethnic groups	0,091 3.3.2 Spatial cultural adjustment - Local spatial adjustments to suit different cultural groups and ethnic groups	US	C	Public modular spaces, private space, other areas that are dedicated to bottom-up initiatives	Area (m2) reserved for self organization of layout (>)	0,091	x	13815 59,81836667	15680 36,82	1,000	0,615502708	0,091	0,056	0,009418	0,006396
4 Social services	0,127 4.4.1 Gathering space - local presence green social gathering spaces	0,127	ES/US	C	Parks, squares, communal space, public space	MWD to social gathering space (<)	500	0,127	x		0,958	1	0,249	0,255	0,040	0,037
				C	Parks, squares, communal space, public space	Area (m2) of social gathering space (>)		0,127	x	320,00 12269,00	334,00 12269,00	1,000	1			
	4.4.2 - Family space - availability of private space for families	0,091	US	C	Private family space	Area (m2) of private space per household (>)		0,091				1,000	0,566037736	0,091	0,051	
										53,00	30,00					

MWD = Maximum Walking Distance (m, over official traffic routes); MD = Minimum Distance (m); RHU = Refugee Housing Unit

2 Regulating services	0,159 2.1 Regulation of natural physical phenomena - reduction of extreme phenomena such as landslides, flooding, arid climates, and other extreme climate phenomena	0,19 2.1.2 Mass stabilisation and control of erosion rates – local land uses that increase water infiltration and reduce erosion sensibility, such as permanent grassy and wooded features	ES	B	Tree cover, ground cover planting	Area (m2) of different erosion prevention methods (>)	0,190		13815	15680	0,881	1,000	0,1678207	0,190476	0,13112	0,135964
2 Regulating services		0,190 2.1.1 Fire outbreak protection	ES	B	Firebreaks	Area (m2) of firebreak per inhabitant (>)	0,190	x	4,923	4,923	1,000	1,000	0,190	0,190		
		0,238 2.2.2 Filtration/sequestration/s storage/ accumulation by ecosystems – local presence of parts of ecosystems able to limit pollution of lands, water, etc. through pollutant accumulation, such as in clay soils, where clay accumulates nitrogen and other pollutants, avoiding leaching	Supporting	A	Constructed wetland (CW) and bioswales	Filtration and infiltration surface CW and bioswales (m2) per inhabitant (>)	0,238	x	1,193666667	1,19	1,000	1,000	0,238	0,238		
	2.3 Regulation of natural biological phenomena – reduction of pest and disease spread, loss of agroecosystem functionality and biological equilibria	0,048 2.3.1 Maintaining nursery populations and habitats – local presence of ideal environments for plant and animal reproduction (such as wetlands for bird reproduction, etc.)	ES	A	Habitat of native flora and fauna	Area (m2) within site left untouched (>)	0,048		38,9	38,90	1,000	1	0,132	0,143		
		2.3.2 Pollination and seed dispersal – local presence of pollinators, birds, etc.	ES	A	Flowering planting, tree cover	Area (m2) of these these land uses (>)	0,095	x			0,881	1				
									13815	15680						

RANKING THROUGH EXPERT INPUT

1. What is your name?	2. What is your profession?	3. What is your affiliation with the humanitarian sector?	4. Have you personally visited a planned refugee settlement?	5. If yes, where?	Service ranking
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Sara El Samman	Landscape architect	not specified	Yes	bekaa camp and Karm el zeitoun in Lebanon.	
Oana Baloi	Landscape architect	Program manager of a humanitarian-development program in Ethiopia (and many years of similar experience working with IDPs, refugees and other vulnerable people)	Yes	Kenya, Ethiopia	
Saja Al-Rifaie	Landscape Architect	Master thesis, Sustainable Landscape Architecture in Azraq refugee camp	Yes	Jordan	
Kilian Kleinschmidt	CEO and Development Consultant	I have worked since 1989 on humanitarian and development issues, 23 years with the UN, advising governments	Yes	Kenya, Uganda, Ethiopia(IDPs), Pakistan, Sri Lanka (IDPs), Jordan, Iraq, Serbia, Bosnia, Greece	

6. Please rank these provisioning services that can be found on-site in planned refugee settlements. ↑ = more important | ↓ = less important

	<i>Food production (e.g. community gardens)</i>	<i>Animal rearing (e.g. chicken coop for eggs)</i>	<i>Food shops (e.g. super markets, prepared foods)</i>	<i>Drinking water distribution points (e.g. public taps)</i>	<i>Timber production (e.g. for construction, diy)</i>	<i>Composting (e.g. composting bins for use in community gardens)</i>	<i>Non-food shops for wide range of materials</i>	<i>Production of fast growing energy crops (e.g. for burning)</i>	
	3	7	1	2	5	8	4	6	
	5	7	2	1	6	3	4	8	
	3	5	2	1	8	4	6	7	
	5	4	2	1	7	8	3	6	
AVERAGE	4	5,75	1,75	1,25	6,5	5,75	4,25	6,75	
ROUNDED	4	6	2	1	7	6	4	7	
WEIGHT	0,139	0,083	0,194	0,222	0,056	0,083	0,139	0,056	
ROUNDED	0,139	0,083	0,194	0,222	0,056	0,083	0,139	0,056	

7. Please rank these regulating services that can be found on-site in planned refugee settlements. ↑ = more important | ↓ = less important

<i>Natural elements that improve soil infiltration and stability (e.g. trees on slopes against erosion)</i>	<i>Filtration of waste water (e.g. grey water filtration through helophyte pools)</i>	<i>Elements that reduce smell or noise pollution (e.g. hedgerows, line trees or buffer areas)</i>	<i>Elements that prevent fire spread (e.g. fire breaks, fire preventing vegetation)</i>	<i>Habitats for native flora and fauna</i>	<i>Presence of pollinators (and the habitat that attracts these)</i>
2	1	4	3	6	5
3	2	4	1	6	5
4	1	3	2	5	6
1	3	2	6	5	4
2,5	1,75	3,25	3	5,5	5
3	2	3	3	6	5
0,190	0,238	0,190	0,190	0,048	0,095
0,190	0,238	0,190	0,190	0,048	0,095

8. Please rank these cultural and social services that can be found on-site in planned refugee settlements. ↑ = more important | ↓ = less important

<i>Long term sustainable nature development (e.g. planting native forest for future generations)</i>	<i>organization of layout and function (e.g. for adjusting to cultural/personal preferences)</i>	<i>Urban transport (e.g. shuttle service to reach nearby towns for services not provided on-site)</i>	<i>Medical facilities (e.g. basic surgery, health counseling)</i>	<i>Pharmacie</i>	<i>(Social) public space (e.g. park, square)</i>	<i>Private family space (e.g. secluded back yard)</i>	<i>Availability of United Nations High Commissioner for Refugees (UNHCR) family tents*</i>	<i>Availability of Refugee Housing Units (RHU)**</i>	<i>Availability of modular/flexible housing</i>
8	7	5	2	3	4	10	9	6	1
10	6	9	3	8	4	5	2	1	7
8	6	5	1	2	3	7	9	10	4
10	5	8	2	6	4	3	1	9	7
9	6	6,75	2	4,75	3,75	6,25	5,25	6,5	4,75
9	6	7	2	5	4	6	5	7	5
0,036	0,091	0,073	0,164	0,109	0,127	0,091	0,109	0,073	0,109
0,036	0,091	0,073	0,164	0,109	0,127	0,091	0,109	0,073	0,109

Annex 2 - Interviews

Interview Margriet Smit

9-6-2022

Personal Details

- Humanitarian professional
- Werkzaam geweest als architect in sociale bouw, reguliere bouw, daarna lange tijd bij COA in Nederland. Gevraagd door Europese Commissie om mee te werken eerst aan Mavrovouni, bleek weinig mogelijk maar kleine studie/analyse verricht, toen weer COA om vervolgens gevraagd te worden weer om voor EC te assisteren in centra op Lesbos, Leros en Chios samos.
- Grootste ontwerp werk ligt bij aannemer (goedkoper) dus voornamelijk kleine dingen gedaan krijgen. +

Outcomes

- Organisation of communities can be organized better in 'hofjes'
- Outside spaces within communities are essential for day activities (wash places for families, sport courts for youths)
 - Central information point can be vital for less stress about procedures
 - Gardens often flourish
 - Guiding bottom-up initiative through design
 - RHU's are terrible quality, not made for long run, but better than tents
 - Housing extensions are often first DIY solutions in camp, yet space for this is not being accounted for in designs
 - Providing good materials for DIY can be detrimental for fire security
 - Providing cooking facilities important for fire safety (bad electric grid) and nature protection (natura 2000 zone next to site)
 - Bottom up is good, but everything needs to be able to be regulated otherwise illegal activities might flourish
 - Food lines made a big positive difference in daily food distribution
 - Rewards for bringing in recycling goods
 - In the winter often high peak rainfall, causing mud streams and pools on site
 - Lesbos has rich history of water management with cisterns and aqueducts, water retention could be very valuable because currently everything dries out in summer and soil erodes in winter
 - Wind stoppers necessary because big rep buildings make terrible sounds in high wind conditions
 - Sea is being used often for recreational purposes
 - Lighting and safety should be first concern in public spaces, then sustainability and people taking initiative
 - Design of camps can only respond well to sudden influxes by over dimensioning the space and infrastructure needed

Interview minutes

1. *What places/functions do feel are important to refugee inhabitants?*

Organisatie van communities is belangrijk. Werken met soort hofjes. (Heeft ze van ervaring met ter apel) Etniciteiten en kwetbare groepen kunnen samen. Buitenruimtes zijn essentieel geworden dan voor dagactiviteiten. Voorbeeld jongeren voetballen, families met speelplaats. Voorbeeld wasplaats centraal i.p.v. achteraf als sociale functie. Misschien nog belangrijker: informatiepunt . Procedure vaak ingewikkeld en uitgestrekt. Het liefst een punt gemanaged door kamp. Nu vaak versnipperd , verschillende ngo's met eigen agenda's hebben eigen infopunten. Maakt de procedure een stuk moeilijker.

2. *What does liveable mean to you in this context?*

Escapes van de dagelijkse sleur is erg belangrijk. Niks doen is een ramp. Onderwijs -> kids nu vaak naar of formal (scholen lesvos) of informal (in kamp, geen controle). Moestuintjes floreren vaak enorm. Erg belangrijk. Lastig is dat vaak neerkomt op eigen initiatief. Sturing voor initiatief binnen ontwerp.

3. *What changes have taken place during your period active at Mavrovouni and other hotspots?*

Transformatie van tenten naar containers en RHU'S. Staat niet echt achter RHU's, heel kwetsbaar, snel kapot (echt ikea product). Wel grote verbetering verhouding tot tenten. Wat heel opvallend is is uitbouwttjes/voorkamers die mensen meteen beginnen met bouwen. Mensen storten eigen douches. Moet rekening mee gehouden wat betreft ruimte in ontwerp. Materialen zijn hier belangrijk in, vaak brandgevaar. Lidl kookplaatjes. Elec net kan dat niet aan. Vorige week nog grephall afgebrand. Eigen communities ontstaan vaak. Soms ook gesloten, niet goed, geen toegang meer ook voor organisaties waarbinnen illegale zaken kunnen floreren. Toen overging van tenten naar andere accommodaties moesten deze organische communities weer opbreken. In Moria was het uit de hand gelopen en was er geen toegang meer, steekpartijen etc. Centrale controle is hier belangrijk in. Ruimtelijk kan je hier rekening mee houden door alles organisationele dingen bij de ingang, verder centrale assen waarbij je de communities goed kan inkijken. Nu voor sommige centra nu met drones moeten controleren omdat er geen overzicht meer is.

4. *What do you think is good about Mavrovouni centre and what do you think could be improved concerning;*

- *Water and food?*

Water is bijzonder slecht geregeld. Eerst voedselpakket uitdelen, werd chaos en ruzie, nu food lines. Werk beter, afdaakjes met staalconstructie, langr rijen met distributiepunt op t eind. Probleem was daarmee verholpen. Nieuwe kampen hebben vaak kantines met food lines. Losse verpakkingen

wel, gaf ontzettend veel rotzooi na uitgifte moment.

- *Non-food materials and water (shelters, distribution, shops)?*

Er wordt wel wat buitenruimte geclaimd maar er is erg weinig ruimte tussen units. Zou goed zijn als daar op wordt ontworpen. Als het niet enigszins wordt gealloceerd deze ruimte dan geldt meteen het recht vd sterkste. Afghanen doen nu vaak uitbouwjes bouwen, hebben daar hun trade van gemaakt.

- *Protection from the climate (shade, wind, fire, water)?*

Schaduw is er veeel te weinig. Alles wordt vaak gekapt en kaal gemaakt, op samos nu eindeloos beton en asfalt gestort. Leros is onder druk van medewerkers langs hekkrn plantenbakken gemaakt. Maar wordt meer ingezet als bescherming van het hek. Schaduw aanbrengen dus relevant om ook brandgevaarlijkheid terug te dringen. Wind bescherming wordt niets aan gedaan. Grote hallen klapert alles constant. Noordkant van de heuvel wel vrijgelaten omdat t daar te heftig is. Brandveiligheid wordt verder dan Europese bouwregelgeving niets aan gedaan. Vaak door diy oplossingen van zelfbenoemde electriciens die kabeltjes leggen van generatoren naar andere plekken ontstaan ook brandjes. Hier tegen ontwerpen is dus best lastig. Maar lever goede kookmogelijkheden aan. Momenteel bouwen ze bij vastria nu een groot hek tussen het kamp en het bos, maar mensen moeten ook naar buiten kunnen dus daar kan je maar beperkt wat aan doen.

Waterafvoer betonnen bakken storten om zsm water af te voeren. In de winter vaak koud, veel regen veel wind, hoge neerslag pieken. Modderstromen ontstaan snel. Rijke geschiedenis aan watermanagement met cisternes ed. Waterretentie nielt hoog in prioriteit in kampen door incident na incident. Zou wel heel belangrijk zijn. Momenteel droogt alles uit in de zomer en erodeerd het weg in de winter. Water is een probleem maar als er een aquaduct op het eiland is gebouwd zal er wel water zijn. Mt olympos is een grote bron maar wordt niet meer gebruikt. In het kamp was in de winter een probleem want er was geen warm water. In het begin überhaupt geen water aansluiting. Werd dan binnengetruckt en verwarmd met diesel generatoren maar die dingen gingen ook steeds stuk. Toen kwam er een slimme ondernemer die haal warm water uit de hotsprings en bracht dat dan naar het kamp.

- *Pollution (water, food, waste)?*

Vervuiling weinig aanwezig doordat het vooral water uit flessen betreft. Water aansluiting lokaal net duurde dus heel lang want bureaucratie. Afvalscheiding op Lesvos goed geregeld. Community leaders aangewezen. Plastic flessen werden geraapt door kids in ruil voor snoep koekjes dingetjes. Kinderen ruimde het hele kamp op. In Chios werd er niets wat betreft afvalverwerking geregeld door gebrek aan organisaties. Werd een ramp qua afval, rattenplagen etc. Unhcr iom redcross doen dit

niet want daar krijgen ze geen geld voor. Facility management moet altijd vanuit grieken zelf gedaan worden. Nu sinds kort zijn er schoonmaakdiensten die alles goed schoonhouden. Gebruiken karren die gemaakt zijn door organisaties.

- *Nature interaction?*

Zee is super, geeft uitzicht en wordt veel voor recreatie gebruikt. Berg ook fijn want er kunnen rondjes omheengelopen worden. Bovenop is een sportcomplexje (cruyff court). Combinatie berg/water is top. Maar de wind is natuurlijk dan een nadeel. Alles gebruiken waar je luwte kan creeren.

- *Culture (self-organization, cultural services)?*

Er is een bidplaats in Mavrovouni (zelf geregeld). Eigen plekken worden gemaakt, super leuk om te zien maar ook wel gevaarlijk met kolonisering. Vergeleken met NL heel anders want daar mag geen geloofsplekken zijn want dan moet je het voor ieder geloof doen. Belangrijkste is veilige plek voor iedereen.

- *Public space?*

Veiligheid is eerst belangrijk. Als dat geregeld is is duurzaamheid en mensen die verantwoordelijkheid nemen over de publieke ruimte. Verlichting ook er belangrijk. Duurzaamheids maatregelen miss wel enorm. Paar zonneboilers maar bij lange na niet genoeg. Groen is vrijwel niet aanwezig. Kleur toevoegen aan een muur of hek kan al veel verschil maken.

5. *How could design of planned refugee settlements respond better to sudden population influxes?*

Ik zou het geen flexibiliteit noemen, groot containerbegrip. Gebouwen zijn nou eenmaal niet flexibel. Wat je kan doen is extreem overdimensioneren van je capaciteit. Vrijwel nooit mogelijk echter want daar is nooit geld voor want niet nodig in de ogen van men. Werken met buffer zou goed zijn. Er moeten draaiboeken voor klaarliggen. Maar dit is allemaal politiek ook. Lege plekken hebben is politiek heel moeilijk. In mavrovouni nu helpt vh kamp niet bebouwd. Zet daar dan vast containers neer. Maar er is geen nood dus er wordt niet geïnvesteerd. Dus overdimensioneren met leegstand of gewoon lagere bezetting gespreid. Overbezetting is vreselijk probleem voor leefbaarheid. Er wordt ontworpen op tijdelijkheid en de kwaliteit is slecht.

Interview Kyriaki (Kiki) Michailidou

10-06-2022

Personal details

- Humanitarian professional
- MHPSS manager at IRC

Outcomes

- Important aspects for mental health:
 - Private space
 - Private sanitation facilities
 - Safe spaces for vulnerable groups (women, children, LGBTQIA+) closed of and entrance regulated
 - Freedom to leave the camp
- Basics such as electricity and water should be in order to be able to do daily chores without restrictions, also to counter fire outbreaks
 - Relative freedom in Moria had the downside of more violence, whereas strictness in Mavrovouni leads to lack of personal freedom and less liveability
 - Closeness of containers was alright in Kara Tepe due to overall better living conditions
 - Tree cover in Kara Tepe caused for considerably better living conditions during summer and winter due to more shade and less wind
 - Drainage is very important as it is a big problem in Mavrovouni
 - Closeness of the sea caused for safety issues
 - Simple elements such as spaces with a tree and a bench can make a big difference
 - Empower communities

Interview minutes

1. What places/functions do feel are important to refugee inhabitants?

First the basics: accommodation, private space, bathrooms and showers. The fact that the bathroom is shared creates feelings of unsafety. Private accommodations with private sanitation facilities would add greatly to liveability. Apart from that safe spaces for women and children and other vulnerable groups such as LGBTQIA+ that are accessible are important in feeling free to be who you are without being harassed. Here you could be participating in activities without feeling threatened. Another important thing is the freedom to leave the camp. For many months, with covid as an excuse, people faced restrictions to leave the camp to go to the supermarket or church or any of the services that are not provided within the camp. You could only leave if you had a serious reason to leave such as a doctor's appointment or a lawyers appointment. People were trapped. I know that housing has improved with the new containers but we still have a long way to go.

2. What does liveable mean to you in this context?

Liveability would be the ability to conduct your daily chores without restrictions of for example electricity cuts. Have ways to stay warm in winter and stay cool in summer. To be able to cook your own meal without being dependent on distribution. People do their own groceries so it would be great if there would be common facilities to cook or if they would have their own means. The electrical grid as it is now in Mavrovouni however cannot handle people cooking their own meals, as is shown by fires and electrical outages when people try to connect lidl cookers to the grid. Liveability in this setting should mean that you can do whatever you and I also want to be able to do within our own house, bathroom, cooking, showering.

3. *What changes have taken place during your period active at Mavrovouni and other hotspots?*

We've seen many changes, from Moria to Kara Tepe to Mavrovouni, I doubt however if things are really getting better. People don't have any more freedom, compared to Moria even less. People are more trapped right now. The freedom in Moria however came with the disadvantage of violence whereas the new camp is less violent due to control and police, which makes them feel safer. Facilities in Mavrovouni seem better too. Of course illegal activities such as were taking place in Moria need to be controlled, however I feel that this is not being done in a respectful way with randomly being checked in a way that compromises their personal dignity. Of course there should be a balance between freedom and control, my personal freedom should not interfere with your personal freedom. This should be the same within the camp community, and people need space for that. People now are allowed to leave the camp between 8am and 8pm, which is still restricting.

4. *What do you think is good about Mavrovouni centre and what do you think could be improved concerning;*

- *Water and food?*

There is a lack of water, people are sometimes struggling to take their medication due to this lack of water. It used to be that there were big tanks where people could fill their bottles, not sure if that is still the case. In Kara Tepe there used to be taps everywhere where people could fill their water bottles. Showers were also good here, hot water. In Mavrovouni water is also not available at certain times.

- *Non-food materials and water (shelters, distribution, shops)?*

Kara tepe containers were also quite close together but because overall living conditions were better this did not cause a lot of friction.

- *Protection from the climate (shade, wind, fire, water)?*

In the new camp also there are no trees at all. Even compared to Moria where they had an abundance of trees, this improved liveability a lot because they had places to find comfort during summer. This also gave some protection of wind. Mavrovouni is very much exposed to the elements. In summer it get very hot and in the winter its very cold, it's almost impossible then to go out of your container and walk around. Just for simple outdoor activities/ this partly due to the strong winds, but also rain. There are less fires now compared to Moria, they do still happen however but mostly because the basic conditions like electricity, cooking facilities and heating are not in order. Drainage is terrible in Mavrovouni, at Kara tepe there was no problem with this but in Mavrovouni whenever there is significant rain puddles start to form on the site. Perhaps it's the soil type. But it is not being drained efficiently.

- *Nature interaction?*

I feel like having people so close to the water at Mavrovouni is a major protection risk, especially children. When people just moved into the camp they didn't know yet about the dangers of the sea and kids would just play in it.

- *Culture (self-organization, cultural services)?*

This is a very important factor for people living in camps. I feel like the services provided in the Mavrovouni camp are not very culturally sound. Like I said for example they don't provide any safe spaces for women, for women to just relax and take their scarfs of.

- *Public space?*

Not really existing in Mavrovouni camp. When we were doing our mental health awareness group classes with the community it was very difficult to identify space in the camp with some benches where we could just sit down and have a discussion and where you would be visible so people would be able to join. They don't have that. The Afghan community had a space where they would hang out but this was not having spatial elements or objects like benches. Every village or town has a square but this is not existing in the camp. This is not due to a lack of space. Simple elements like a tree can be so important in creating social space, winter or summer.

5. *How could design of planned refugee settlements respond better to sudden population influxes?*

Mavrovouni has the space currently for sudden influxes, however the basic infrastructure like electricity and water should be sufficient from the beginning. If you guarantee these basics other disasters also in the case of a sudden influx could be prevented.

6. *From your surveys, what spaces do you feel people were generally lacking?*

Safe spaces, communal spaces, bathrooms, showers. Spaces like safe spaces for women, beside needing to be closed, also need staff or volunteers to make sure people are not just coming in and out. Also, organized activities can be important in this. Empowering a sense of community. People don't feel like they belong anywhere anymore.

Interview Amin

Personal details

- Refugee
- 47 years old
- Living on Lesvos since 5 years, currently in Mavrovouni

Outcomes

- Silent, peaceful places with greenery are important
- Day activities, work or chores, are important for keeping your mind of things
- No electricity from 8am to 1pm causes for extreme heat inside accommodations
- No public spaces, would be nice to have
- Hill and sea being used for recreation

Interview minutes

1. *What places/functions do you use on a daily basis or are important to you?*

No places. Camp life is sober. People not feeling free and independent. All the focus is on asylum decisions. When you're feeling relaxed, you work, you exercise you read, you listen. When you're not relaxed it's impossible to focus on other things. I was in different places: Athens, prison, the camp, the streets. Sometimes bad life sometimes good life. Right now I'm in the camp (Mavrovouni), for a few months I was in a house in Mytilini. Then I had to go back to camp, it was like coming back to prison.

2. *What does liveable mean to you in this context?*

A good place for me, and not only me, would be a silent place. Everybody needs a silent place. Peaceful, with some greenery. For sitting and enjoying. Unfortunately this is not available for refugees, not in the camp. So I spend a lot of time here (Parea). I've been working here for one year. This is a nice place. I spend a lot of time in here, have conversations with different people, and there is so much to do. It's very good, because I don't have time for thinking. Camp now is different. Some people got positive asylum, they are happy. Some get negative asylum, they are angry, sad and confused. It's different lives. one person happy one person sad.

3. *What do you think is good about Mavrovouni centre and what do you think could be improved?*

From morning 8am to 1pm there is no electricity. With this weather when you are inside it feels like you're in a sauna. Sweat all over your body. Big rep especially. Today i went in because I needed something and within 5 minutes I was wet all over my body. If you stay longer you are swimming. Also, there are no public spaces, we only have the backside of the sea. People go there for walking and

swimming. A few times I enjoyed the sea. When it was very busy last year I would go walking around the camp at morning time, before sunrise. Then I would go to the room and get breakfast. And I stay at the room, because there was nowhere else to go. I'm staying in the big rep. Now there's not so many people because many got asylum.

Q for tim: why do you choose this field, designing camps? Do you know the movie the Escape with Rambo and Arnold? They design a prison out at sea, in the middle of the ocean, noone knows where they are. Why design this when you could design nice things? If you make prison a paradise, people will still be prisoners that are not happy. Because when you're not free you will not feel happy. I give you paradise but I catch you in your mind. Places like this (Parea) are good, but its no more than taking your mind of things for some days.

Interview Mohammed

Personal details

- Refugee
- 28 years old
- Living on Lesvos since more than 1 year

Outcomes

- Shaded places to meet friends are needed
- Cooking facilities needed

Interview minutes

1. *What places/functions do you use on a daily basis or are important to you?*

Mostly my room and the shower facilities, but these often don't work or don't have hot water. Also I go up the hill sometimes to work out or walk. This place (Parea) is good, I like to come here and play basketball.

2. *What does liveable mean to you in this context?*

Having the possibility to do things, walk around freely and taking care of yourself.

3. *What do you think is good about Mavrovouni centre and what do you think could be improved?*

There is nowhere to just sit and meet friends. The camp isn't good overall, the new housing is better than the tents however. Also, many people want to cook but the facilities are not there. Also, it gets very hot in summer, I would like more cool places, still at night it is very hot and we have to be inside at 8.