

Greening Potosí

- Making Use of Green Infrastructure in a Dense, Informal Settlement of Bogotá

Amanda Hultman & Johanna Svahn

Master thesis at the Department of Urban and Rural Development

Landscape Architecture programme, Uppsala 2016



Swedish University of Agricultural Sciences
Faculty of Natural Resources and Agricultural Sciences
Department of Urban and Rural Development, Division of Landscape Architecture, Uppsala
Master's thesis for the Landscape Architecture programme
EX0504 Degree Project in Landscape Architecture, 30 HEC
Level: Advanced A2E
© 2016 Amanda Hultman, e-post: a.hultman@hotmail.com, Johanna Svahn, svahnmarkt@hotmail.com
Title in English: Greening Potosí - Making use of green infrastructure in a dense, informal settlement of Bogotá
Title in Swedish: Gröngöra Potosí- Att göra nytta av Grön Infrastruktur i en tät, informell bosättning i Bogotá
Swedish supervisors: Madeleine Granvik and Maria Ignatieva, Department of Urban and Rural Development
Colombian supervisors: Sandra Caquimbo Salazar and Jaime Hernandez Garcia, Pontificia Universidad Javeriana
Examiner: Zeinab Tag-Eldeen, Department of Urban and Rural Development
Assistant examiner: Per Berg, Department of Urban and Rural Development
Cover image: View of the surroundings of Potosí
Other photos and illustrations: all featured, texts, photographs and illustrations are property of the authors unless otherwise stated. Other materials are used with permission of the owner.
Original format: A3
Keywords: green infrastructure, informal settlement, Potosí, public green space
Online publication of this work: <http://stud.epsilon.slu.se>

Acknowledgements

We would like to use this space to thank all the people that we have come across during the work with this thesis. We could never have completed this thesis without the generosity and kindness showed to us by all fantastic people we have met.

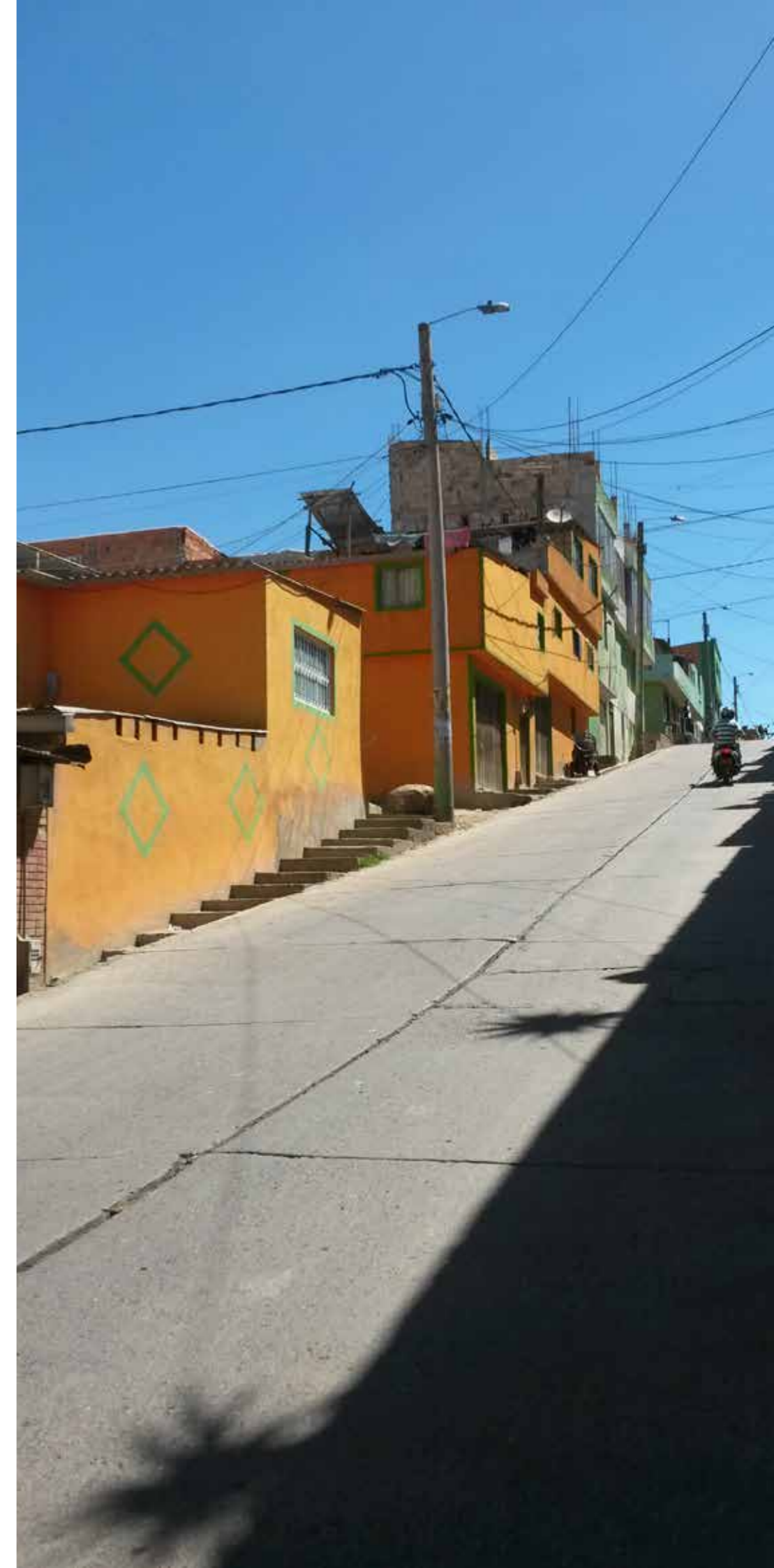
We would like to direct a special thanks to our Swedish supervisors **Madeleine Granvik** and **Maria Ignatieva** for their support and feedback in putting together our heap of material and thoughts into this thesis when returning home. To **Pontificia Universidad Javeriana** in Bogotá for the warm welcome and inclusion on campus. To our local supervisor **Jaime Hernandez-Garcia** for invaluable help with preparations, organization and conveyed knowledge and contacts. To our local supervisor **Sandra Caquimbo Salazar** for guidance, discussions, for questioning and confirming our ideas, and for priceless help in structuring our impressions and thoughts (when we needed to and before we knew we needed to). To the students of the course *Proyecto de vivienda popular* for receiving us with open arms, enriching our time in Colombia enormously and especially **Nicolás, Adriana** and **Juliana** for your patience, concern and assistance with everything (everything is almost an understatement) and particularly during the site visits to Potosí.

We would also like to direct a thanks to **SIDA** for funding and thereby making this field study, and the fantastic experience it was, possible.



Abstract

Today more people are living in urban areas than in rural and the global trend of urbanization is rapidly increasing. In Colombia, around 76 per cent of the population is living in urban areas, most of them in the capital city Bogotá. In the absence of governmental planning and land use regulations, the development in many parts of the city occurred in form of informal settlements. These have risen through “bottom up” processes within very limited resources, often not providing sufficient services to its inhabitants but characterized by a dynamism and constant transformation that contribute to a strong identity. The distribution of greenery and public places in Bogotá is spatially unequal – the poorer the neighborhood, the less green and public space there is. These problems are also present in the informal settlement of Potosí, where steep topography and issues regarding security and safety further complicates the matter. The purpose with this thesis is to investigate how a Green Infrastructure can be developed in Potosí to promote ecological, social and recreational benefits. To identify the preconditions and potentials for developing a Green Infrastructure we performed a case study of Potosí that included inventory, analysis, observations and interviews with people from the community. To identify what could be done to promote ecological, social and recreational benefits we turned to literature, reference projects and interviews with Colombian landscape architects. The proposal was designed with the concept More eyes on the greenery, where a green network of hubs, sites and links coincide with a network of well used paths and nodes. In this way active spaces go green and green spaces go active, to provide ecological, social and recreational benefits and at the same time improve the sense of security. To promote social and recreational benefits attractions are created and combined with tools for ecological benefits. In the Green Infrastructure plan, four Green parks with different themes are designed to attract different target groups and to extend the use during the whole day, six existing well-used nodes are developed ecologically into Green spots and Green paths creates a network of links that connects the parks and spots to each other, creating an interconnected Green Infrastructure. Create security, build solidarity and trust, utilize initiatives and engagements and allow for continuous development were aspects fundamental to consider in Potosí. These aspects depend on much more than the physical environment and are not possible to solve directly with a specific design solution or even in a green infrastructure plan, but nonetheless they constituted the core of what the development of Potosí had to be based in. To make a proposal adaptable to the dynamic character, the proposal is designed as a base that can be further developed by the community, rather than a finished product.



Sammanfattning

Inledning

Den globala trenden av en snabbt ökande urbanisering har satt tydliga spår i Colombia, där 76 procent av befolkningen lever i städer. De flesta är bosatta i huvudstaden Bogotá som har en forstsat befolkningstillväxt på två till nio procent per år (WPR 2015). Den starka urbaniseringen är i huvudsak ett resultat av att människor som tvingats fly våldet på landsbygden sökt sig till städerna (Brown 2012 p. 11). Regeringen i Bogotá saknade organisering, resurser och strategier för att kunna möta den massiva befolkningstillväxten. Avsaknaden av statlig planering och reglering i kombination med ett enormt behov av bostäder resulterade i en framväxt av informella bosättningar (Brown 2012 p. 11), mer än 50 procent av Bogotá stadsstruktur har vuxit fram genom informella processer (Hernández-García w.y.a, p. 3). Informella bosättningar uppstår, i så kallade ”botten upp”-processer, genom invånarnas egna initiativ, engagemang och ofta inom mycket begränsade tillgångar (Hernández-García w.y.c, p. 12-13). Det leder ofta till en avsaknad av många sociala funktioner, fungerande infrastruktur (UN-Habitat 2003), grönstruktur och allmänna platser (HDM 2015).

Fördelningen av grönska inom Bogotá avspeglar sociala, politiska och ekonomiska ojämlikheter i staden; ju fattigare ett område är, desto mindre grönska finns det (Brown 2012, p. 1). Grönområden sammanfaller ofta med allmänna platser och därmed är ekologiska, sociala och rekreativa fördelar också ojämnt fördelade i staden. I Potosí, ett av de informella bostadsområdena i Bogotá utkant, kan de ovan nämnda problemen skönjas; otillräcklig förekomst och kvalitet av grönska och allmänna platser, avsaknad av fungerande infrastruktur och brist på olika servicefunktioner. Situationen kompliceras ytterligare av en mycket tät stadsstruktur, stora höjdskillnader och problem angående säkerhet och trygghet.

Syfte

Syftet med denna uppsats är att undersöka hur en Grön Infrastruktur kan integreras för att upgradera den täta urbana miljön i det informella bostadsområdet Potosí. Gestaltungsförslaget har ett fokus på att främja ekologiska, sociala och rekreativa fördelar för lokalsamhället, dra nytta av existerande resurser och förbättra brister i den urbana strukturen. Ett syfte med gestaltningen är också att skapa en flexibel lösning där den gradvisa utveckling som är vanligt förekommande i informella bostadsområden bemöts.

Frågeställning

Vilka förutsättningar och potentialer finns för utveckling av en Grön Infrastruktur i Potosí och hur kan detta göras för att främja ekologiska, sociala och rekreativa fördelar?



Skillnaderna mellan formella och informella Bogotá är stora. Det två översta bilderna visar bebyggelse och en park i centrala staden och nedanför det visas motsvarande för Potosí.

Metod

Arbetet genomfördes som en fallstudie i tre delar; Teori & Koncept, Förståelse för Potosí i ett större sammanhang och Platsstudie Potosí. För detta har olika metoder använts. För att identifiera vilka förutsättningar och potentialer som finns för utveckling av en Grön Infrastruktur i Potosí genomförde vi en platsstudie som inkluderade *inventering, analys* och *observationer* i samband med våra vandringsturer och deltagande i en workshop samt genom *intervjuer* med invånare. Detta gav oss kunskap om den existerande strukturen och förutsättningar på platsen. För att identifiera vilka grepp som kan tillämpas för att främja ekologiska, sociala och rekreativa fördelar, använde vi oss av *litteraturstudier, referensprojekt* och *intervjuer med sakkunniga*. Vår *designprocess* fortgick under hela arbetet genom kontinuerligt skissande och utvecklande av idéer.

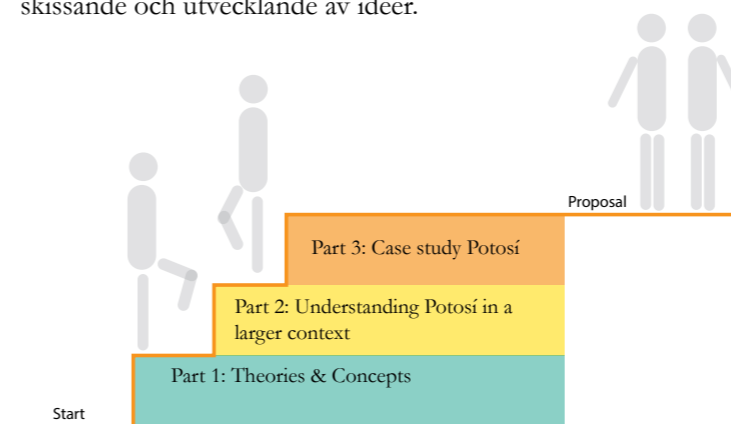


Illustration av de tre stegen som vårt arbete bestod av

Teorier och koncept

Grön Infrastruktur (GI)

Benedict och McMahon (2006, p.1) definerar GI som ”ett sammanlänkat nätverk av naturliga områden och andra platser som bevarar värden och funktioner av naturliga ekosystem, renar luft och vatten och tillhandahåller en bredd av värden för människor och natur”. GI bidrar med många ekologiska, sociala och rekreativa värden samt ökar tillgängligheten till grönområden och därmed även stärker kontakten mellan människor och natur (Rouse and Bunster-Ossa 2013, p. 12-13). En GI består av hubbar, lokaliteter och länkar som kopplas samman till en sammanhängande struktur (Benedict & McMahon 2006, p. 13-14).

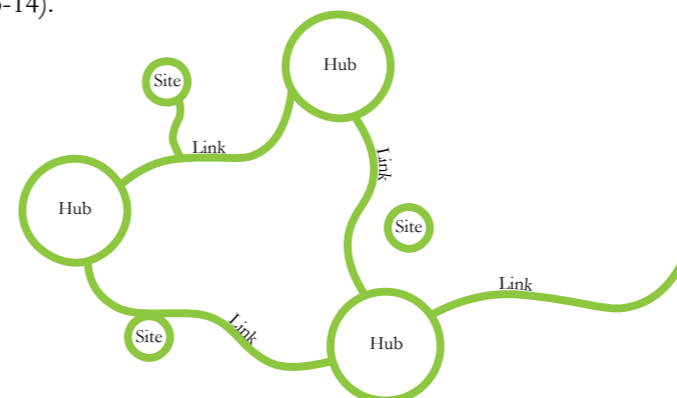


Illustration av hur hubbar och lokaliteter länkas ihop till en sammanhängande struktur

Ekologisk Design

Van der Ryn och Cowan (1996) definierar Ekologisk Design som ”*alla former av design som minimerar miljömässiga destruktiva effekter genom att integrera sig själv med levande processer*”. Ekologisk Design syftar till att skapa ökad kontakt mellan människor och natur (Rottle & Yocom 2010, p.6-7) och bidrar till att skapa hållbara, motståndskraftiga och regenerativa urbana strukturer (Rottle & Yocom 2010, p.74).

Trygghet genom aktivitet

Känsla av trygghet och säkerhet i utomhusmiljön är grundläggande för att en stadsstruktur ska vara funktionell och välanvänd av dess invånare. ”Fler ögon på gatorna”, minskad anonymitet, belysning samt logiska och orienterbara stadsstrukturer är strategier för att öka känslan av trygghet och säkerhet (Carmona, Tiesdell, Heath & Oc, 2010, p. 150; Jacobs 1992, p. 30-36; Gehl 2010, p.101).

Informella bosättningar

Då informella bosättningar uppkommer utanför politisk planering och reglering, genom så kallade ”botten-upp” processer, beror både uppkomst och skötsel av anläggningar i utomhusmiljön i huvudsak på invånarnas egna engagemang (Hernández-García w.y.c, p. 12-13). Informella bosättningar avspeglar människors liv, kultur, önskemål och möjligheter (Hernández-García w.y.d, p. p.22) och karaktäriseras av en ständig förändring och utveckling, vilket gör dem till en dynamisk del av den urbana miljön (Hernández-García w.y.c, p. 12-13). Informalitet innefattar utöver urbana strukturer, även sociala och kulturella aspekter (Hernández-García w.y.c, p. 1), vilket ofta leder till en rik och stark estetik. Dock är det inte säkert att denna typ av självstyrande utveckling medför att viktiga funktioner och service sprids ut jämnt över en plats eller till de människor som lever där (Hernández-García w.y.b, p. 2).



Två av de referensprojekt vi besökte i Colombia; de informella stadsdelarna Patio Bonito i Cali och San Javier i Medellín



Platsen för vår fallstudie, Potosí

Fallstudie Potosí

I västra utkanten av Bogotá ligger Potosí, en stadsdel som uppkommit genom informell bosättning och som uppskattningsvis har runt 8000 invånare. Potosí består av en tät stadsstruktur där flera viktiga funktioner så som allmänna platser och grönstruktur ofta fått ge vika på grund av platsbrist. Den grönska som idag finns håller en låg kvalitet och är många gånger svårtillgänglig. Stadsdelen, speciellt dess utkanter, präglas av stora höjdskillnader. En hög efterfrågan på platser att bo på har lett till bosättningar även i den branta terrängen, trots risken för skred och därmed fara för de boende. Större delen av Potosí är försett med el, vatten och avloppssystem men fullgod infrastruktur och många sociala funktioner saknas. För att förbättra den urbana miljön har vissa insatser gjorts, bland annat anläggande av vägar och en park längs den kanal som löper längs området.

Under vår fallstudie identifierade vi ett stort engagemang för olika projekt i lokalsamhället, bland annat urban odling och stor omsorg för det egna huset och dess angränsande gator. Den allmänna samlingslokalen Cocinol, skolorna, dagiset och sportplanen utgör viktiga platser i stadsdelen och är välanvända och välrespekterade av invånarna. Genom konversation med boende blev det dock tydligt för oss att det finns ett bristande förtroende mellan invånarna och att stadsdelen till stor del även präglas av gäng- och drogrelaterat våld. De platser som av de boende utpekades som otrygga sammanfaller ofta med grönområden vilket skulle kunna resultera i att grönområden i allmänhet förknippas med en känsla av osäkerhet.

Utifrån fallstudien sammanställdes de aspekter vi ansåg nödvändiga att åtgärda och dessa utgjorde senare grund för vårt gestaltungsprogram. Fyra av aspekterna identifierades som fundamentala att beakta för att skapa en Grön Infrastruktur men samtidigt svåra att åtgärda genom design. Dessa fyra är; *skapa trygghet, bygga solidaritet och förtroende, ta till vara på initiativ och engagemang* samt att *tillåta kontinuerlig utveckling*. Dessa kom senare att utgöra riktlinjer och användes tillsammans med programmet som utgångspunkt för gestaltungsförslaget.



Den branta topografin skapar problem i utemiljön på många vis



Vy över Potosí från en utsiktsplats i en av de få anlagda parker som finns i området



Det finns ett stort engagemang för odling i området



Ofta breder engagemanget för den egna bostaden även ut sig i gatumiljön

Gestaltungsförslag

Med konceptet *Fler ögon på grönskan* som grund integreras en Grön Infrastruktur, anpassad efter identifierade förutsättningar och potentialer, i Potosí. Konceptet går ut på att ett grönt nätverk av hubbar, lokaliteter och länkar skapas och att dessa sammanfaller med ett nätverk av redan välanvända stråk och noder. Det innebär att aktiva platser kan gröngöras och att gröna platser kan aktiveras för att få *fler ögon på grönskan* och därmed öka känslan av trygghet.

För att uppnå en fungerande Grön Infrastruktur i Potosí var det nödvändigt att de gröna områdena skulle bli uppskattade och välanvända, då det skapar förutsättningar för omhändertagande och bevarande av dem. Men anledning av det utformade vi attraktioner, vars syfte var att skapa aktiva mötesplatser integrerade i grönstrukturen. Attraktionerna kombinerades med verktyg för att främja ekologiska funktioner, bestående av principlösningar lämpliga och möjliga att använda i Potosí.

Förslaget är på en konceptuell nivå och innebär att fyra nya parker av olika teman anläggs i områdets utkanter samtidigt som sex befintliga och välanvända platser utvecklas ekologiskt genom gröna tillägg som reflekterar och underlättar platsernas nuvarande användning. Ett urval av områdets gator utvecklas till gröna länkar som kopplar ihop de nya parkerna och befintliga noderna. Planen för den gröna infrastrukturen kompletteras med ett antal principlösningar som visar på hur specifika platsförutsättningar kan tas omhand och hur utformning av detaljer kan göras för att knyta an till områdets karaktär. För att förslaget skulle kunna bemöta och anpassas efter den dynamism som karakteriserar informella bosättningar är det utformat som en bas som svarar mot vårt syfte, men där fortsatt utveckling utifrån lokalsamhället möjliggörs, snarare än att vara en slutgiltig produkt.



Vårt förslag på hur ett av områdets befintliga platser utvecklas ekologiskt.

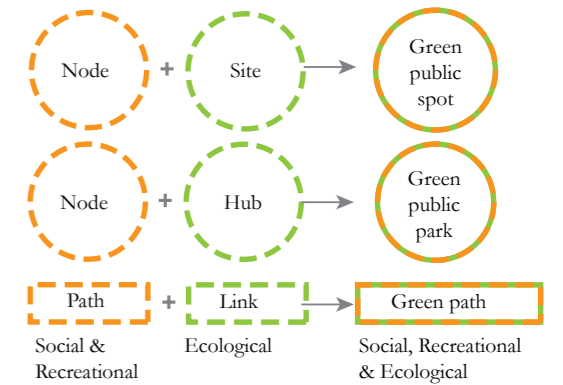
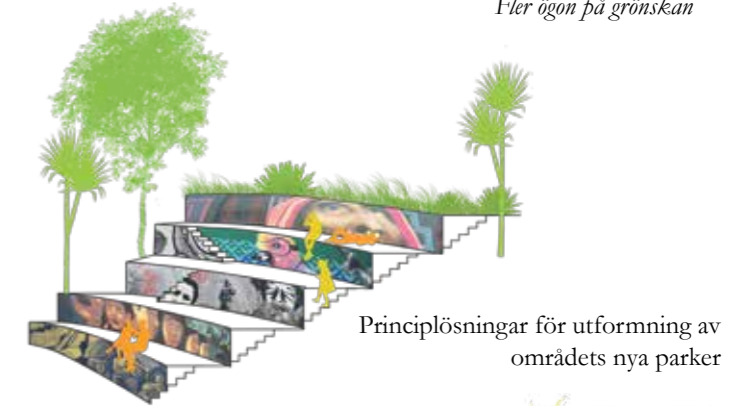


Illustration av vår strategi utifrån konceptet *Fler ögon på grönskan*



Principlösningar för utformning av områdets nya parker



Vår plan för den Gröna Infrastrukturen

Definitions and terminology

Barrio

The local name for neighborhood

Cancha

The local name for sport field

Cerro

The local name for mountain

Cocinol

The name of the community house in Potosí

Corridor

A linear or narrow space providing opportunities for flows of ecological functions and/or of people

Designed

Created according to a specific idea of form and function

Edge zone

Zones of varying size with natural vegetation that are not designed and that constitute the transitions or border of surfaces or areas

Green Infrastructure (GI)

Defined by Benedict and McMahon (2006, p.1) as “*an interconnected network of natural areas and other spaces that conserves natural ecosystem values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife*”

Green structure

The structural form and layout of the greenery

Greening

Implementing and increasing the amount of greenery

Informal settlements

Residential areas that develop outside of planning and building regulations, but are growing and formed by its residents

JAC-group

Junta de Acción Comunal which can be translated to Local Action Group. Every neighborhood in Bogotá has a JAC-group which is elected by the residents to represent the community and create a link between the community and the city government (Hernández-García w.y.a)

MFS

Minor Field Study. A program for students at university level financed by SIDA (Swedish International Development Cooperation Agency) with the purpose to give Swedish students the opportunity to do a field study in a developing country. (SIDA 2015)

Native plants

Species of vegetation that has its origin or occur naturally in South America and Colombia

Perceived accessibility

The perceived accessibility was defined by us as to having a reason of accessing a place and to not be hindered by perceived barriers, for example insecurity.

Private

Belongs to a specific person or organization and legal access and use is limited

Public

Legally accessible and open for everyone to use

Public place

A defined public space with important for social and/or recreational functions, for example a specific park or playground

Public space

All spaces that are accessible and open for everyone to use, for example streets, sidewalks or parks

PUI

Integral Urban Projects. A planning model established in Medellín where the idea is to create a hub or a node where social and recreational services like schools, sports fields, library and hospitals are centralized to increase the accessibility of social and recreational benefits (Interview with Gloria Aponte)

Rural

Non-urban areas

Safety

Freedom from the risk of danger, harm, injury or damage

Security

Freedom from sense of fear, anxiety, danger or doubt

Semi-public

Spaces that are either accessible to everyone but only at specific times, or only to some groups of people but at all times.

Slope

Very steep terrain where the accessibility is very restricted, for example a hillside or a steep street

Street greenery

Vegetation along streets, for example street trees or planting strips

Traditional plants

Species of vegetation that is connected to the cultural history of Colombia or that is frequently used in the site.

Urban

An area or space inside, of, constituting or comprising a city structure

Table of contents

1. Introduction

Project background	10
Problem statement	10
Purpose	10
Research question	10
Limitations	10
Target group	10

2. Methodology

First part: Theories & concepts	12
Literature study	

Second part: Understanding Potosí in a larger context

Literature studies	
Interviews with professionals	
Reference projects	

Third part: Case study Potosí

Observations	
Inventory and analysis of existing green structures	
Inventory of trees and plant species	
Inventory and analysis of existing structures and site conditions	
Interviews with the community	
Analysis based on Kevin Lynch	
Analysis of green infrastructure	
Design process	

3. Theories & Concepts

Green Infrastructure	16
Ecological Design	16
Security by Activity	17

4. Understanding Potosí in a larger context

Colombia	19
Bogotá	19
Interviews with professionals	21
Reference projects	22

5. Findings of Case study Potosí

Site description	26
Inventory & Analysis	27
Interviews & workshop	34
Lynch analysis	36
Compilation	37

6. Proposal for Green infrastructure in Potosí

Vision	39
Program	39
Concept	39
Design GI	42
Principles for site specific designs	43

7. Discussion

Discussion of results and proposal	49
Discussion of methods	50
Own reflections	51

References	52
------------	----



1. Introduction

This chapter will briefly describe the project background, problem statement, purpose and research question as well as the limitations and target group that defines the frame and scope of the project.



Project background

This part will describe the background of our project and related problems to our site, the informal settlement Potosí in Bogotá.

Urbanization

Today, more people in the world are living in urban areas than in rural and the global trend of urbanization is rapidly increasing. In 2014, 54 per cent of the world's population was residing in urban areas and UN predicts that by 2050, two thirds of the world's population is going to be urban (United Nations 2014, p. 1-3). All these people need to be provided with shelter, employment and urban services (UN-Habitat 2003, p. 5). The urbanization is mainly taking part in developing countries (United Nations 2014, p. 1), but because of lack of financial resources and long-term land regulations many cities in developing countries are unable to meet all of these needs. Colombia is no exception; around 76 per cent of the population is living in urban areas and most of them are located in the capital city Bogotá. In 2014, 8 million people were living in Bogotá (WPR 2015) and the population of the city is still growing (United Nations 2014, p. 14). The strong urbanization has mainly been a result of people fleeing the violence on the country side (Brown 2012 p. 11). Many of these new residents cannot afford the housing rents, which has contributed to the development of informal settlements (Barrios & Lazarevski 2009, p. 92).

Informal settlements

“Informal settlements, slums, and other poor residential neighborhoods is a global urban phenomenon” (UN-habitat 2015, p. 2). They are often a result of organisational, economic, demographical or social factors. Problems that generally are present in informal settlements are lack of sanitary services such as access to drinking water, social services such as education and healthcare (WHO 2005, p. 4), necessary infrastructure such as storm-water drainage, paved footpaths, roads for emergency access, street lights as well as places for the community to meet and socialize, safe places for children to play (The World Bank w.y, p. 1), public places and green spaces (UN-habitat, 2015, p. 1). Informal settlements are often located in the periphery of urban areas making them isolated from the physical and social infrastructure (UN-Habitat 2003, p. 85). Their locations also often coincide with areas that are hazardous because of vulnerability to natural disasters and effects of climate changes (UN-habitat 2015 s. 6).

Informal settlements in South America and Bogota

As the case for many developing countries in the world, Colombia had poor strategies for regulations at a time of rapid urbanization. The local government of Bogotá lacked organization, resources, focus, and finances resulting in poor capabilities to handle the massive urbanization. In the absence of governmental planning and land use regulations, the development in many parts of the city occurred in form of informal settlements (Brown 2012 p. 11). These areas have risen through “bottom up” processes within very limited resources, where the residents have their used own initiatives and imagination to form the environment (Hernández-García w.y.b, p.1). Jaime Hernandez Garcia means that this results in that both buildings and the urban layout is under constant process of transformation and development making dynamism an important characteristic of informal settlements (Hernández-García w.y.d, p. 12-13). More than 50 per cent of Bogotá has grown in patterns of informal settlements, which are mainly located in the peripheral areas of the city (Hernández-García w.y.a, p. 3).

Neglected Green structure in Bogota

Bogotá is a very dense city and green urban structures are insufficient, the city only provide 6.3 square meter green public space per inhabitant (Alcalde Mayor de Bogotá 2013, p. 84), which is far below the recommendations from WHO who states that 15 square meter green public space per inhabitant is desirable, and 10 square meter per inhabitant should be the minimum (Alcalde Mayor de Bogotá 2013, p. 66). The distribution of greenery in Bogotá is also spatially unequal, which reflects the social, political and economic inequalities in the city. The poorer the neighborhood, the less green space there is (Brown 2012, p. 1). Many times places with greenery also coincide with public places, which are important for social and recreational functions. Hence, the benefits of both greenery and public places are unequally distributed. Informal settlements are many times characterised by high population densities and lack of green areas and public spaces.

Advantages with greenery

Urban greenery has many benefits by creating qualitative urban environments that improves the living standard and quality of urban life. In societies with rapid urbanisation, however, urban greenery is often neglected and many environmental problems that has an impact on mainly lower socioeconomic groups could be mitigated by a sufficient green structure. For example, incidence of street trees has many environmental benefits, such as urban cooling and cleansing of the air, as well as social, by stress reduction and neighborhood cohesion, and not least aesthetic functions (Brown 2012, p. 2). Urban green structures can also provide a wide range of ecosystem services, which are the benefits people obtain from ecosystems (Rouse & Bunster-Ossa 2013, p. 12).



The geographical limitation of our proposal



Bogotá's location in Colombia

Potosí's location in Bogotá

Problem statement

As we have seen, many informal settlements lack sufficient amount and quality of greenery as well as adequate infrastructure, provision of social services, access to public places and opportunities for recreation. These problems are present in the barrio of Potosí where the situation also is complicated by steep topography and issues regarding security and safety. In Potosí, existing green spaces tend to coincide with areas considered unsafe by the community, resulting in hesitant attitudes towards greenery that further complicates the matter.

Purpose

Our purpose with this thesis is to investigate how a Green Infrastructure can be integrated to improve the dense urban environment in one of the informal settlements of Bogotá; Potosí. The plan of the Green Infrastructure for Potosí will focus on providing ecological, social and recreational benefits to the community that utilizes existing resources and handles shortages in the urban structure. The purpose is to create a design proposal that will be flexible to suit the dynamic character that are common in informal settlements.

Research question

What are the preconditions and potentials for developing a Green Infrastructure in Potosí and how can this be done to promote ecological, social and recreational benefits?

Limitations

Our design proposal is geographically limited to the barrio of Potosí in Bogotá with the addition of two green areas connected to it. However, it is necessary to also consider Potosí in a larger scale to be able to put our proposals in relation to its surroundings. The timeframe of the thesis is twenty weeks and out of these, eight weeks were spent doing the field study in Bogotá, Colombia. During the site survey, our work was limited in some ways by our knowledge of the language as well as the security aspect on site.

Target group

Our thesis could be of value for professions like city planners and landscape architects and for organizations that work within informal settlements, primarily in Bogotá but it might also be interesting in a more global perspective, since informal settlements are a widespread phenomenon. The thesis might also have some value for the municipality of Bogotá or for the community of Potosí.



2. Methodology

This section will firstly describe our organization and objectives of collecting information and secondly provide details on how the different methods were executed and why the used methods were selected.

Three Parts

We have been working in three different parts with the collecting, analyzing and processing of information for this thesis, all of them necessary to deepen our knowledge enough to achieve our aim, but in each of the parts with a slightly different objective. There is a chronological logic in the order of the three parts but we have been working simultaneously with them. This more flexible approach has been helpful with the limited amount of time for research but also in providing us a more holistic view of the studied site through enabling the parts to “feed” each other. We have used different methods in the different parts depending on the focus but some methods have been used in more than one part but with a different focus.

First part: Theories & Concepts

In the first part, the aim was to gain a general knowledge in which concepts and theories appropriate to use when proposing a development of the green infrastructure in an informal settlement. Methods used in the First part were:

- Literature studies

Literature studies

The Literature studies took place before, during and after the field study with the purpose to get familiar with current research and definitions on key theories and concepts used in this thesis. They are the following:

- Green Infrastructure (GI)

The purpose is to deepen our knowledge about GI, which benefits we can obtain from it and how to design with GI, both on local and regional scale. Our main literature was *Green infrastructure: A Landscape Approach* by David C. Rouse and Ignacio F. Bunster-Ossa and *Green Infrastructure: Linking Landscapes and Communities* by Mark Benedict and Edward T. McMahon.

- Ecological Design

To gain a base of knowledge on principles for designing to promote ecological, social and recreational functions we turned to the concept Ecological Design. Our main literature was *Ecological design* by Nancy Rottle and Ken Yocom and *Ecological Design* by Sim Van den Ryn and Stuart Cowan. A selection of concepts and principles derived from ecological design to study closer was done since we assessed that some concepts and principles were not applicable in the site.

- Security by activity

To obtain information on what aspects that are important to improve safety and security we mainly used the literature *Cities for people* by Jan Gehl, *Public places, urban spaces* by Matthew Carmona, Steve Tiesdell, Tim Heath & Taner Oc and *The Death and Life of Great American Cities* by Jane Jacobs.

Second part: Understanding Potosi in a larger context

When doing this thesis we were really taken out of our normal work settings and we had to put in a lot of effort to gain an understanding of the culture, traditions, organization, policies and situation of both Colombia and the city of Bogotá to be able to approach our site, the barrio of Potosí with adequate knowledge of its background. Methods used in the second part were:

- Literature studies
- Interviews with professionals
- Reference projects

Literature studies

It was important to understand the dynamics of the informal settlements in Bogotá; how they have raised, how they are developed, common problematics, potentials, aesthetics as well as their spatial, social and ecological context. To find out which things are vital to take into consideration when planning in an informal settlement (that by definition don't have the tradition of planning, at least as we know it) we turned to literature on the subject. We also studied the ambitions, policies and plans for development of the city of Bogota concerning green spaces.

Interviews with professionals

To better understand the current questions concerning landscape architecture and the role of landscape architects in Colombia and Bogotá, we conducted semi-structured interviews with practicing Colombian landscape architects. In a semi-structured interview, “*the researcher has a list of questions or specific topics to be covered (...) but the interviewee has a great deal of leeway in how to reply*” (Bryman 2012, p. 471), providing a flexibility that we found beneficial in this situation.

The landscape architects that we interviewed were:

- *Martha C. Fajardo*, President of the firm Grupo Verde Ltda. In the work of Grupo Verde, emphasis is on encouraging interaction and deepen people's connection to nature through designed green spaces. Martha has also been involved in International Federation of Landscape Architects (IFLA) as well as being a part in founding the Latin American Landscape Initiative (LALI) working for landscape strategies based in the Latin-American context through developed collaboration between the countries of the region.
- *Noboru Kawashima*, Vice president of Grupo Verde Ltda. Noboru is a biologist, urbanist and landscape architect and has worked in Colombia for many years and also has experience of the district of Ciudad Bolivar where our site, Potosi, is located.
- *Gloria Aponte García*, founder and director of the master's program in landscape architecture at the Pontificia Universidad Bolivariana in Medellin and involved in IFLA Americas EAA Committee. Before moving to Medellin, Gloria was based in Bogotá and was, among other things, involved in projects in informal settlements including Ciudad Bolivar where our site, Potosi, is located.

The interview questions were prepared in advance and depending on the interviewee's background. We interviewed Martha and Noboru at the same occasion which provided a good climate for discussions that focused on green infrastructure and place making. With Gloria, focus was strategies for working with greenery in informal settlements. Both of these interviews were of a more general character since they didn't know specific details of our site, Potosi. Discussing differences in people's perception of greenery depending on background as well as the potential of changing people's mind through good designs and carefully selected methods was a big part of both these interviews. The interviews were conducted in English and the interview questions are accounted for in Appendix: Interview questions

- We also had meetings with representatives of the botanical garden in Bogotá, *Andrés David* and *Dario Gerardo Zambrano* with the purpose of learning more on local plant material. These meetings were of more informal character and no specific interview questions were prepared.

Reference Projects

The purpose of the study of reference projects was to find good examples of design solutions and functions applicable in Potosí. Since this was our first visit to South America and the culture is quite different from Sweden it was really important for us to be able to study design and planning features and also peoples use and relation to outdoor environment. The selection of projects to visit was made to provide a wide range of public places and green spaces such as parks, public gardens, infrastructure solutions, and PUI:s that could inspire us in the work with a Green Infrastructure plan for Potosi. Many of the projects were located in informal settlements but some of them were more traditional and in the formal parts of the cities. The only general criteria for the selection of the reference projects was that the project had to be in Colombia and also that we could visit the site to make observations. The selected projects were located in the cities of Bogotá, Medellin and Cali and selected because they either were upgrading of barrios similar to Potosí, representative for traditional aesthetics and design in Bogotá or providing input on the use of plant material.

The reference projects selected were:

- Barrio Santo Domingo, Medellin
- Morro de Moravia, Medellin
- Campus Javeriana, Bogotá
- Botanical garden, Medellin
- Jardín circunvalar, Medellin
- PUI la Aurora, Medellin
- Library San Javier, Medellin
- Puente del Indio, Bogotá
- Escaleras eléctricas, Medellin
- Patio bonito in Comuna 1, Cali
- Library Virgilio Barco, Bogotá

On site we mainly studied strategies and solutions connected to the following concepts and aspects:

- Urban agriculture
- Handling slopes
- Recycling of materials
- Efficient use of space
- Vegetation
- Initiating engagement in public space
- Retaining settling in hazardous areas and sprawl
- Safety and Security
- Aesthetics and use of materials
- Education

The reason for studying these specific aspects were their connection to prerequisites and potentials identified during the case study in Potosí.

During all visits we took notes, photographs and complemented this with sketches and measuring when necessary. When possible, we also had conversations with park staff to get a better understanding of the background, use and maintenance of the site.

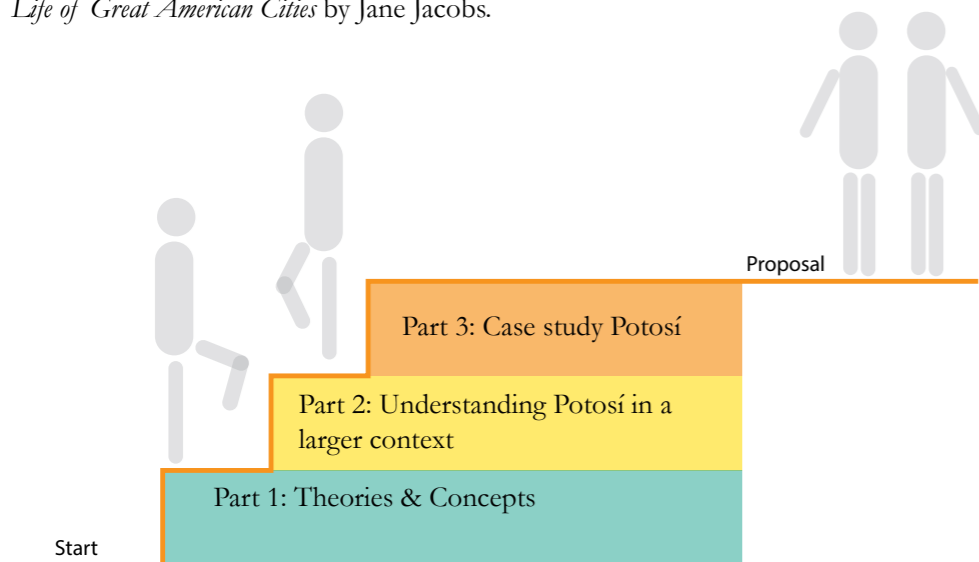


Illustration of our three parts

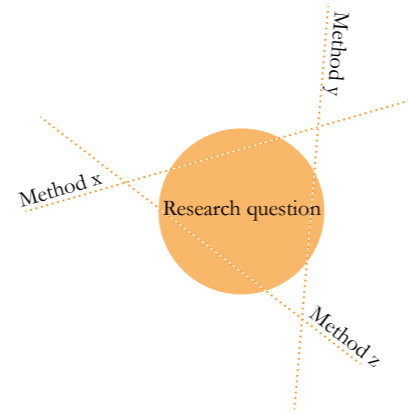
Third part: Case study Potosí

In the third part the aim was to get to know the details of the existing structures and conditions of Potosí, both in the ecological, social and recreational aspect. This was necessary in order to comprehend which of the guidelines, concepts, theories and inspirations studied in the first part that both make sense within the context studied in the second part and that are spatially applicable as well as could answer to needs of the community.

The case study approach means that we will use a combination of methods to gain information on different aspects of our site and its settings. The case study methodology is appropriate to use when you work with a subject “that merges in with its context so that precise boundaries are difficult to draw” (Gillham 2010, p.1) and when “no one kind of source is likely to be sufficient (or sufficiently valid) on its own. This use of multiple sources of evidence, each with its strengths and weaknesses, is a key characteristic of case study research.” (Gillham 2010, p. 2). There can be deviation in the collected information because of many reasons and a more accurate evaluation of the results can be accomplished when using multiple methods to “triangulate” the research question. In his book *Social research methods*, Alan Bryman also means that triangulation is a good way to cross-check information and mentions the example of researchers using interview questions as a complement to observations in order to determine potential misunderstandings of their own (Bryman 2012, p. 392).

Methods used in the third part were:

- Observations
- Inventory and analysis of existing green structures
- Inventory of trees and plant species
- Inventory and analysis of existing structures and site conditions
- Interviews with people from the community
- Analysis based on Kevin Lynch
- Analysis of green infrastructure
- Design process



Observations

The observations made were of informal character and no protocol was followed enabling us to get a wider perspective on daily life in the barrio than if we would have followed criteria stated beforehand.

Walking tours

We performed walking tours with the purpose of observing peoples use of the existing outdoor environment and to gain an understanding in where they go, what paths they use and also problematics that occur in the use of the outdoor environment. We performed observational walking tours on three occasions in as many days covering the entire barrio. The walking tours took place both in the morning and in the afternoon; unfortunately the safety aspect prevented us from visiting the barrio in evenings and during night time. Generally we started the tours around 9 AM and ended between 2PM and 3 PM. The first walking tour included a visit to the school Instituto Cerros del Sur (ICES) and to the community center Cocinol to meet with representatives of the school staff respectively of the JAC-group. They introduced us to the aspects they considered important to know about Potosí and we also had the opportunity of asking them questions. At the end of the field study we spent a fourth day returning to sites in the barrio to validate and complement the material from our previous observations.

The walking tours were performed together with the students and teachers of the architect program of Javeriana and also with a local guide. Since the teacher and

student group were familiar with both our work and the context of the barrio it was really valuable for us to be able to discuss our observations with them and also with the teachers, whom possess a lot of general knowledge of informal settlements in Bogotá and also of the specific site, Potosí.

Our main guide during the walking tours was Nini, a woman in her late twenties who has grown up in the barrio. She and her two kids accompanied us during all our walking tours which allowed us to ask her questions and discuss our perceptions of the barrio. This communication was done with help of the students of Javeriana that kindly volunteered to interpret.

Participation in workshop

We also took part in a workshop arranged by the Pontificia Universidad Javeriana of Bogotá, where we constructed a playground in the Barrio of Potosí. During this workshop we had the opportunity to interact with people from the community as well as the other students and teachers which was really valuable for our understanding of the barrio and the attitudes towards public space in the community.



Routes for the walking tours



Workshop in Potosí



A typical walking tour in Potosí

Inventory and analysis of existing green structures of Potosí

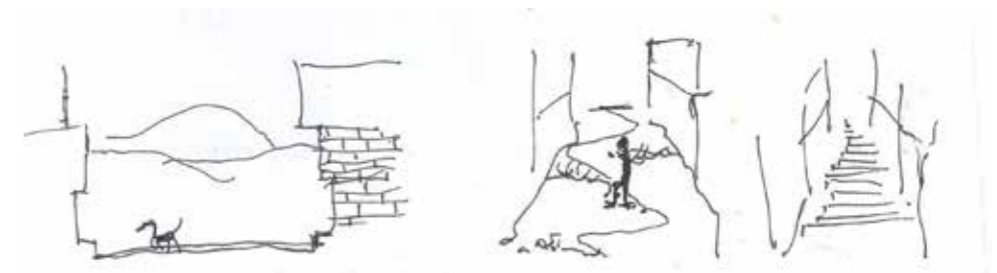
We used a combination of map studies and on site-inventory to map the structure and quality of the existing network of green structures in Potosí. We needed to map all existing green spaces in Potosí to take them into consideration when proposing a development of the ecological network. With the inventory of the existing green structure as a foundation we analyzed their potential of constituting hubs, links or sites according to the literature study on Green Infrastructure. We also identified existing and potential connections to surrounding nature and desirable connections between the greenspaces within the barrio.

Inventory of trees and plant species

As a base for selection of plant material in the final proposal we did a inventory of the existing trees and plant material in the barrio. The position of the trees was determined with the help of the map service from the government (<http://mapas.bogota.gov.co/portalmapas/>) with the purpose to utilize them in our proposal. During field visits we also documented species of trees, shrubs and plants that seemed to cope particularly well with the climate and level of maintenance in the barrio. This was made in order to potentially reuse the same species in our proposal. Some species were known to us but our prior knowledge was complemented with discussions with representatives from the botanical garden. The purpose with the identification of species was purely referential, hence the specie of each positioned tree or the position of shrubs or plants were not determined.

Inventory and analysis of the existing structures and site conditions

We used a combination of map studies and on site-inventory to map the existing structures and site conditions of Potosí. The inventory of the existing structures and site conditions were important to gain sufficient information to perform well-grounded analyses of the site. The site conditions that we considered most important were land use, hazardous zones, topography, quality of the road network and the location of important places such as schools, businesses, public transport hubs and public places. The mapping was complemented with photographing, sketching and measuring when necessary.



Sketch from our first visit illustrating the big differences in quality and accessibility of streets in the barrio.

Interviews with people in the community

The interviews conducted with people from the community were a combination of structured and semi-structured interview. We started the interview by asking open questions where the interviewees had the possibility to make additional comments and develop their answers when needed. The aim with these questions was to validate our own observations of people's use of the outdoor environment in Potosí and to get a deeper understanding in the reasons for it. For the last question we provided the interviewees alternatives of functions and activities that are commonly used in outdoor environments and that we, through inventory and conversations had identified to be missing or being insufficient in the barrio. The aim with this was to get a input on which social and recreational functions that are insufficient or non-existing but desired within the community.

We conducted seven interviews with residents of Potosí and we made an effort to select people of different lifestyles because they were likely to have different views and priorities. However, since we visited the barrio only during daytime it was difficult to find interviewees that held an employment which in general were men. We interviewed one retired man, one schoolboy aged nine and five women in the ages 25-40 but that all had quite different lifestyles and family situations. Four of the interviewees were also asked about their thoughts on a series of design principles for integrating more greenery. The principles were constructed by us and both described in words and visualized in a sketch to minimize the risk of misunderstandings.

The reason for not asking these questions to all of the initial interviewees was unfortunately lack of time to do so. All questions were prepared in advance and conducted with the assistance of students from the architect program at the Javeriana since none of the interviewees spoke English and neither one of us speak fluent Spanish. Since the context was new to us it was valuable for us to get our perceptions and observations confirmed by the community in order to create a proposal that both preserve the existing values of the barrio and that create new places that are meaningful for the residents.

We also performed a semi-structured interview with *Wilder Andrey Tellez Gonzalez*, who is the person in charge of a urban farming initiative in Potosi. Focus was his perception on the benefits and difficulties of the initiative today and the potential for developing it. The interview with Andrey was also conducted in Spanish and with the assistance of a student from the Javeriana architect program. The interview questions are accounted for in Appendix: Interview questions



One of the interviews conducted with people from the community.

Analysis based on Kevin Lynch

In his book *The image of the city*, Kevin Lynch breaks down the structure of a city into five types of elements; Paths, Edges, Districts, Nodes and Landmarks in order to be able to classify the physical forms of the city depending on how observers perceive them (Lynch 1960, p. 46). We used Lynch's method as a model to systemize the results of our observational walks (our perception) together with the results from the interviews with the community to better comprehend the structure of Potosi.

We have used the following definitions of the five elements (Lynch 1960, p. 47-48):

- Path: the channels along which an observer moves and also along which other elements are arranged.
- Edge: Physical or perceived boundaries that can constitute either a barrier that divides two areas or a seam that consolidates two areas.
- District: An area with common characteristics that is identified and defined by the observer, from the inside or outside, as separate from its surroundings because of a perceived identity.
- Node: Points in the city where use is concentrated.
- Landmark: External references that the observer use for orientation

Design proposal

The proposal is suggested on a conceptual level in a way where green areas are developed in correspondence with existing infrastructure and requests from the local community. This is complemented with design principles applicable in different situations. For some selected sites in Potosi we felt the need to provide more site-specific solutions.

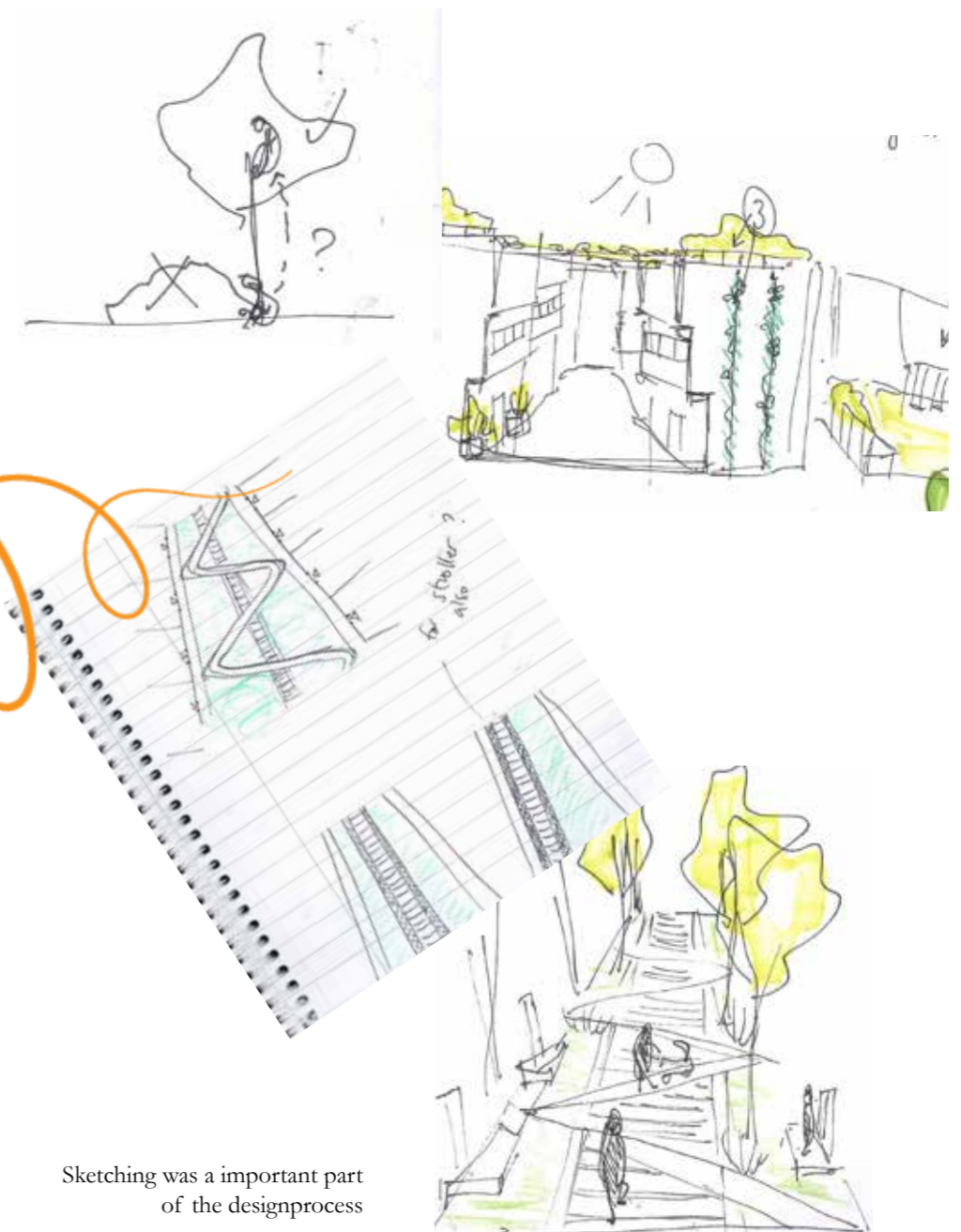
Design process

Our design process started at the time of the first field visit and continued throughout the work with the thesis although the methods varied during the different stages. It was clear to us quite early that our design had to be well anchored in the community and this knowledge had a big impact on our first stage of the design process. Our observations and analysis of reference projects in similar settings constituted the foundation for deciding which functions that should be provided or developed in the proposal. Interviews with community was a big complement to our design process. Another important aspect of the process was the understanding that our proposal should be flexible and adaptable for future scenarios.

During the minor field study we did a lot of brainstorming and sketching mainly on design principles (non site-specific design solutions) that could help us to answer our research question. The two of us sketched separately to generate ideas and together to discuss and refine them. An important feature when working in this new context was also to get feedback from people that were more familiar with it. We had weekly meetings with our co-supervisor Sandra Caquimbo Salazar where we discussed the possibilities and difficulties of our ideas. This early sketching also gave us the opportunity of asking the opinions of both residents of Potosi and the landscape architects that we interviewed as well as mentally testing our ideas on site during the field visits. This was often followed up by further discussions and refining among the two of us.

Before returning from the field study we formulated a programme for the design proposal and did a first sketch of the proposal in order to get the chance to discuss our thoughts on the structure with our local supervisor and also to realize if there were important pieces of information missing while still having a chance to potentially collect it.

Back in Sweden we formulated a vision and a concept that would help us make decisions for the design. We continued sketching but with a clear focus on combining our ideas into a network that could meet our purpose. The attractions derived from the empirical study and the tools derived from the literature studies on Ecological Design was an important part of the design process. A selection of principles from the concept had already been done where the ones not possible or prioritized for our research question had been rejected and now we made a selection on which of those accounted for in theories and concepts that could be seen as physically applicable components. These were combined with the attractions and spatially organized in a structure that could provide social, recreational and ecological benefits. In the further work of creating design principles and more specific design the study of reference projects constituted the main input.



Sketching was an important part of the design process



3. Theories & Concepts

This chapter will describe the theories and concepts used in this thesis; Green Infrastructure, Ecological Design and Security by activity. These will constitute the theoretical base on which our proposal of a Green Infrastructure that is sustainable both through ecological and social perspective will be developed. Each theory or concept is accounted for in a separate section containing definitions, benefits and how it can be used in a design.

Green Infrastructure

The concept of **Green Infrastructure (GI)** was studied to gather information on how green structures can be designed to provide benefits for the ecology, community and economy, both in local and regional scale. The economic benefits of GI is briefly mentioned here but will not be further developed in this thesis.

Definition

GI is a concept that appears more and more frequently in discussions about urban planning and city development. Today, it exist many different definitions of GI. Benedict and McMahon defines it as “an interconnected network of natural areas and other spaces that conserves natural ecosystem values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife?” (2006, p. 1). GI is a natural life-supporting system that can be used as a framework to provide environmental, social and ecological health (Rouse & Bunster-Ossa 2013, p. 11). As other infrastructures, the GI should be the underlying foundation for the city structure and urban growth (Benedict & McMahon 2006, p. 1). The purpose of GI is to preserve, construct and connect habitats and green spaces, grounded in their functions for human beings by tying areas that can supply relevant ecosystem-services together into a network. This network creates a spatial organization that can spread the services over bigger domains, accumulates the services and increase their benefits for humans and the environment (Czechowski, Hauck & Hausladen 2015, p. 20-21). The GI integrates, infuses and connects buildings, streets and different utilities together, which creates connectivity also between urban elements and structures (Rouse & Bunster-Ossa 2013, p.11).

Benefits

The GI produces a wide range of ecosystem-services, which are functions ecosystems provide that are benefiting for human health and wellbeing. The benefits that GI provides can be categorized in benefits for the *ecology*, for the *community* and for the *economy*.

Among benefits for the *ecology* are preserving, restoring and increasing ecosystems and biodiversity by providing habitats for flora and fauna. GI has capability to absorb storm water, reduce runoff, mitigate flooding and erosion, store water for dry times, clean air and water, store carbon and reduce fossil fuel emissions. Greenery can help to lower the temperature in cities and reduce the energy consumption for cooling systems. Thereby, the GI can contribute to climate change adaption and mitigation and make cities more resilient (Rouse and Bunster-Ossa 2013, p. 12-13).

The GI also provides several benefits for the *community*. A developed GI makes green areas and nature more accessible and connected to people, and thereby strengthens the interaction between humans and the landscape they live and act in (Rouse and Bunster-Ossa 2013, p. 12-13). This creates engagement in the nature that provides cultural, ecological, and psychological linkages between people and their environments (Lafortezza et al. 2013, p. 3). The GI can create places where people can gather, socialize, express art and culture, which can strengthen the community spirit and connection to the place. By being accessible for all inhabitants GI promotes environmental justice and equity. Greenery has positive effects on the public health by improving environmental conditions such as air and water quality, lower stress, and promotes healthy lifestyles by providing outdoor recreation and activities and not least, GI has a big aesthetic quality for urban areas (Rouse and Bunster-Ossa 2013, p. 12-13).

The GI also brings several *economic* benefits. It creates job and business opportunities and it can stimulate retail sales and economic activity for local business. By its

capacity to reduce energy use by adapting to and mitigating effects of climate changes, to reduce healthcare cost by providing healthier lifestyles and reduce infrastructure cost by increasing sustainable opportunities of traveling (Rouse and Bunster-Ossa 2013, p. 12-13).

How to design with it

GI is depending on the social and ecological framework, and therefore its character is changing according to different contexts. The GI is a dynamic and evolutionary system and therefore also GI designs should be open-ended and able to evolve over time (Hagan 2015, p.). The overall matrix of the greenery is important, the more fragmented the greenery is, the less connected it is which result in loss of ecological functions due to more disturbance. Big, coherent green areas are preferable before small ones (Benedict & McMahon 2006, p. 111-112). GI consists of assets of both green and blue structures, and includes different environments including urban and rural landscapes and public and private places. To create a GI, these assets should connect to each other in a system of hubs, links and sites. Hubs, links and sites can vary in size, form and functions (Benedict & McMahon 2006, p. 13-14).

Hubs

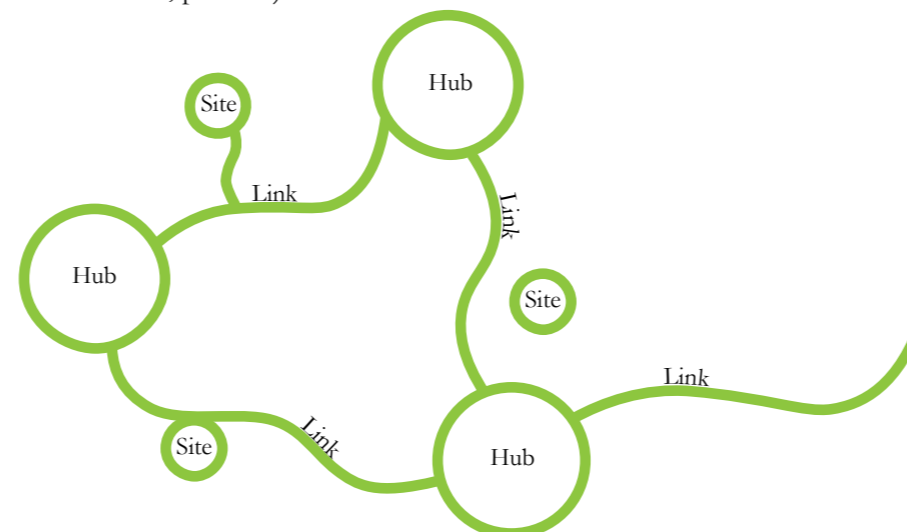
Hubs can be described as anchors, which provide space for native plants and animal communities, as well as origins or destinations for wildlife, people, and ecological processes that are moving to or through the system. Examples of hubs are reserves, managed native landscapes, working lands, regional parks and preserves, and community parks and recreational areas (Benedict & McMahon 2006, p. 13-14).

Links

The GI is tied together by links. These are connections that create opportunities for ecological flows that are crucial to maintain vital ecological processes and preserve healthy wildlife and biodiversity. By creating corridors for movement, the links are also important for recreational use. Rivers, stream floodplains, conservation corridors, greenways, greenbelts and eco belts are examples of links (Benedict & McMahon 2006, p. 13-14).

Sites

Sites are smaller than hubs. They are not always directly attached to the larger interconnected community and regional conservation systems, but still they contribute to the GI by providing important ecological and social values by protecting wildlife habitats and providing space for nature-based recreation (Benedict & McMahon 2006, p. 13-14).



Conceptual network of GI with hubs, nodes and links

Ecological Design and related principles

The concept of **Ecological Design** was studied to gather information on strategies to create a sustainable, resilient and regenerative green infrastructure. In the section “How do design with it” we account for the principles and concepts from Ecological Design that we consider to have the greatest impact on this project.

Definition

Van der Ryn and Cowan (1996) define ecological design as “any form of design that minimizes environmentally destructive impacts by integrating itself with living processes?” (Van den Ryn & Cowan 1996, p. 33). In the urban context, ecological design integrates an ecological approach into the concepts of sustainable urban development, and creates a tool for meeting environmental challenges in the cities (Rottle & Yocom 2010, p. 6). Primary goals of ecological design are creation of urban structures that are adaptive and resilient to future change or disturbance, self-regulating in their processes, self-renewing in form and composition (Rottle & Yocom 2010, p. 74) and that promote diverse and healthy natural and human communities (Rottle & Yocom 2010, p. 16). The aim is to improve the biological integrity, improvising ecological functions and preserve and generate resources for human use, both of the existing conditions as well as to achieve a sustainable future for both human and non-human communities (Rottle & Yocom 2010, p. 6 & 13).

Benefits

Ecological Design increases the biodiversity, creates natural systems that are self-maintaining and conserve and regenerate resources for a continued use by humans and other species. An increased contact between humans and nature has many positive effects, such as physical health, mental restoration, education and inspiration. This could also generate a sense stewardship which can secure enduring positive interactions between people and their environment. Ecological Design is formed to support human use, enjoyment and protection of the natural world (Rottle & Yocom 2010, p. 6-7).

How to design with it

There are many different design principles that can be used in the work towards an Ecological Design. The ones that had the greatest impact on our work are presented here:

Protection, restoration and rehabilitation of ecosystems

Primarily, existing biological integrity and functions should be protected. When working in a degraded site that has adequate potential, the goal should be to restore and rehabilitate the native ecological and historical functions of the site, such as soil health and water flows. If the originally conditions of the site has been radically changed it is important to determine if it is possible to simply replicate the historical forms or if new forms or processes has to be used. Water habitats and their edged should be prioritized for protection and restoration, since they harbor the most diverse assemblies of plant and wildlife processes (Rottle & Yocom 2010, p. 86-89).

Storm water collection, cleansing and reuse

There are different designs principles that can handle run-off water in an integrative way that improves the ecological conditions. In aboveground swales, storm water can be captured, detained and infiltrated. The soil and plant material absorb polluting chemicals, excess nutrients and heavy metals (Rottle & Yocom 2010, p. 150). Rain gardens are designed to collect precipitation and run-off in planting beds that retain and infiltrate rain water during wet periods, but dry out when the rains has ended. Rainwater can also be captured in tanks or barrels and then be used to supplement

water supply during dry periods (Rottle & Yocom 2010, p. 164). The collection, cleansing and reusing of storm water also provides habitats for different species and has also aesthetic benefits (Rottle & Yocom 2010, p. 114).

It is important to incorporate solutions for managing run-off also as a part in preventing landslides since the risk of landslide increases when the soil gets saturated. “*While saturation can happen naturally after heavy rains, human alterations to surface drainage can dramatically increase the likelihood of landslides?*” (Claghorn & Werthman 2015, p.54) making it important to have a solution for the water when for example paving streets in a risk area.

Reuse and recycling of material

A sustainable design aims to reduce material extraction as well as to reduce the energy use for producing or transporting material. Local material and soil of the site can be reused when forming new landscapes (Rottle & Yocom 2010, p. 156). Composts create a system of reuse of organic material, and the nutrient-rich soils that can be used to supplement existing soils in the area (Rottle & Yocom 2010, p. 163).

Planting design

Known requirements of keystones or representative species and habitats should be used as guidelines for the design, considered in the context of time, processes and successional stages (Rottle & Yocom 2010, p. 89). Using native plant material has many benefits. Since it is adapted to the climatic conditions of the region, less resources are required for maintenance and it provides natural habitats for the local wildlife species. A multi-layered planting design provides different types of habitats and ecosystems to the site, which increases the biodiversity. Street trees enhance local habitat conditions for insects and birds, produce shade that lower the temperature in cities and can be used as visual and physical distinctions between different areas. As street trees, planting strips provide habitats and food sources for insects and birds, create physical barriers between different area and function, but can also be designed to collect, detain and treat storm water. Urban structures, such as roofs and walls, can be adapted to provide places for plant growth and by that creates habitat for bird and insect species, collects rain water and reduce run-off as well as mitigate the effects of urban heat islands (Rottle & Yocom 2010, p. 163-164).

The nature-people relationship

Physical, biological and social relationships are in a constant flux in the landscape and are connected to each other through complex relationships. The interrelationship between environmental processes and human needs are essential in the Ecological Design approach (Rottle & Yocom 2010, p.8). Humans and other organisms constitute an ecology that mutually affects and influences the dynamics of the environmental systems (Rottle & Yocom 2010, p. 14).

Long-term stewardship

To achieve a long-term protection and stewardship, public engagement with the site and design process is important (Rottle & Yocom 2010, p. 78-79). Comprehension and attachment to the landscape and environment is important to foster appreciation and stewardship and this can be made by stimulating human appreciation of the landscape. Interventions to highlight the landscape, such as sculptures, gateways, viewpoints or boardwalks, creates attention, memories and references, present information and inquiry (Rottle & Yocom 2010, p. 124).

Urban agriculture

By growing plants and raising animals within and in connection to cities, the urban agriculture is integrated into the urban economic and ecological systems and provides an urban ecosystem. Urban agriculture has a big importance in increasing the greenery in the cities which enriches the biodiversity, regulates the micro-climate, reduces run-off, captures particles and CO2. Urban agriculture is an integral

part of the urban system that can compete for land with other urban functions. Urban agriculture produces food and medicinal herbs and contributes to poverty alleviation, food security and availability of healthy nutrition as well as to stimulate exchange and enterprise and create links between consumption and production. Urban agriculture can strengthen the sense of community and social inclusion by providing opportunities for interaction and can thereby be a strategy for enhancing urban environmental management. Urban agriculture also provides recreational opportunities where people can enjoy green areas which can enhance community self-esteem and stimulate actions for further improving the community's livelihood. The urban agriculture can also provide opportunities for educational functions (RUAF Foundation 2016).

Multi-functional use of space

Multi-use of urban spaces provides opportunities for diverse activities and attracts different people. A multi-use invites to a regular local use in different times of the day which fostering a sense of community, vibrancy and safety (Rottle & Yocom 2010, p. 158).



Example of rain garden from SLU campus Ultuna



Example of urban farming from the botanical garden of Medellin

Security by activity

Different theories and concepts about safety and security were studied to gather information on how a Green Infrastructure can be designed in a way that improves the sense of security.

Importance of safety and security

The five-step hierarchy of basic human needs by Maslow describes how the most basic human needs have to be satisfied before progress to a level can be made. But this is not always a linear process; the different needs are related to each other in complex interrelations. Safety and security includes both being and feeling safe from harm, and is one of the most fundamental needs for human health and well-being (Carmona 2010, p.134). There is a difference between feeling safe and being safe, and there is not always a direct connection between them (Carmona, Tiesdell, Heath & Oc 2010, p. 138). The feeling of safety and security in the city space is fundamental if a city is going to be well-functioning and well-used of the people (Gehl 2010, p. 97).

The role of the streets

Jane Jacobs stresses that the streets play a central role in creating a sense of security in a city. It is not the street in itself that generate fear and insecurity, the reason for crime and violence is often rooted in deeper and more complicated social issues and problems. But the streets, their adjacent uses and its users are interactors that create a

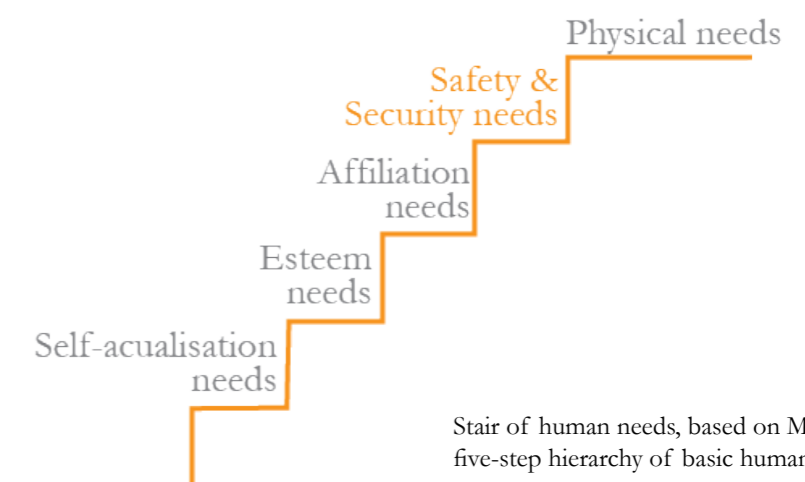
drama between the civilisation and barbarism, and it doesn't take many incidents of violence to make people fear the streets. If people feel insecure on the streets they will use them less, which will make the streets experienced even more unsafe. Jacobs claims that there is a clear connection between the presence of people and sense of security; a well-used street is perceived as a safe street but a deserted one is perceived as unsafe (Jacobs 1992, p. 30-34).

Social control

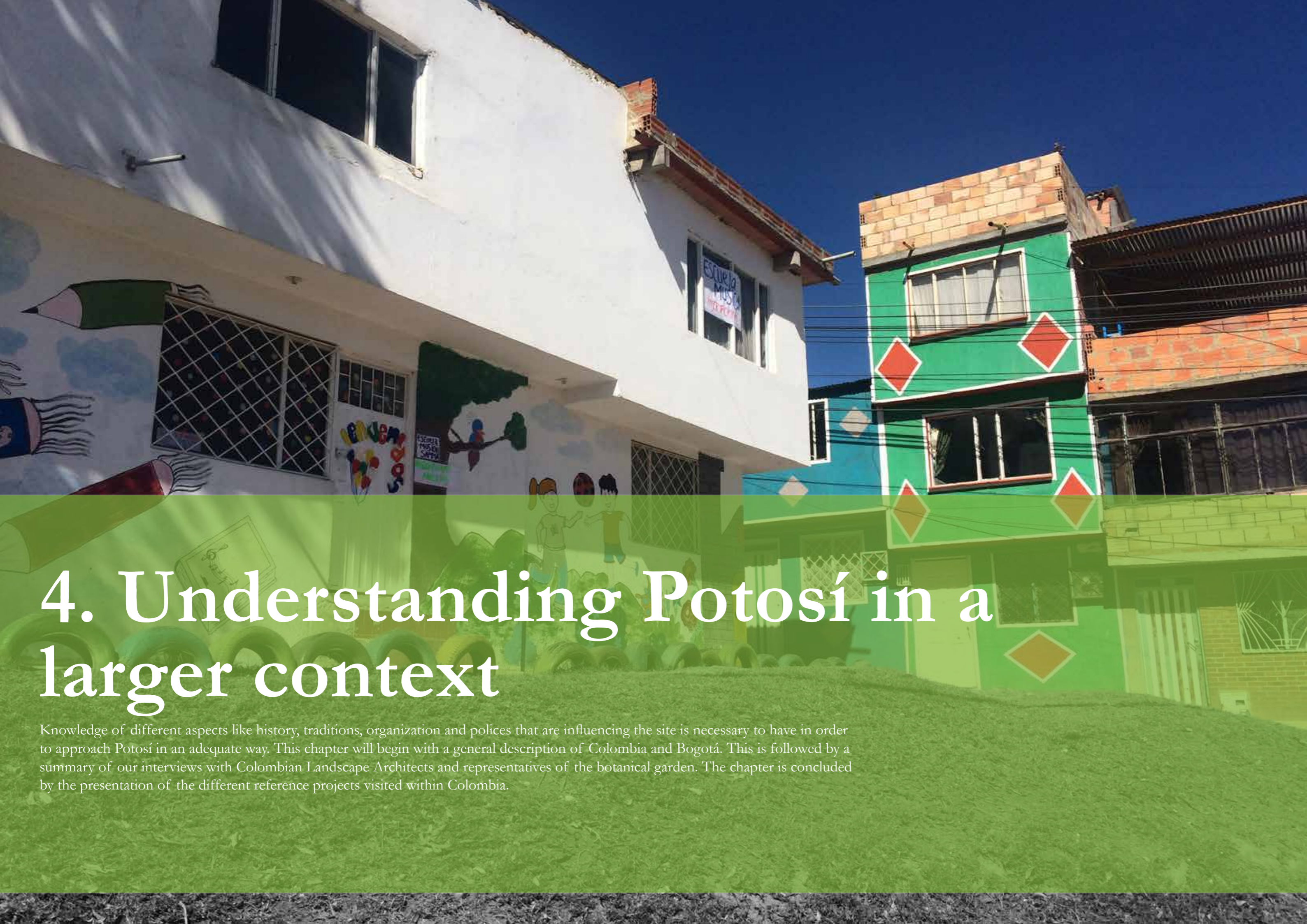
Simple individual urban crime-prevention solutions for protecting private property, such as barbed wire, iron bars and signs, are often not of much help. Instead, common use of the urban space in the city should be the strategy to create sense of security. The presence of other people indicates a safe place and when people move and walk around in the public space, both actual and the perceived security will increase (Gehl 2010, p. 97-98). Jacobs stress that in order to create safer streets we need to add more people continuously watching the streets and the activity going on there. The people themselves become a network of public voluntary (and many times unconscious) controllers that are keeping the streets safe (Jacobs 1992, p. 30-35). Gehl claims that “*life in the city means safer cities – and safe cities provide more life?*” (Gehl 2010, p. 98) and that there is a clear connection between creating sense of security in cities and strengthen city life. A lively place will attract even more people, and a lively street always has both its users and its watchers which increase the sense of security (Jacobs 1992, p. 35-36).

Designing for sense of safety and security

To create well-used and well-watched streets there must be attractions. Enterprises for public use attracts people to the streets, but do also lead people along connecting streets and past places without attractions that become populated by serving as routs. This is only valid in a short distance and therefore attractions must be frequently distributed in the city, but without spreading out people too thinly. Also there should be a big variation of type of attraction to make people crisscross the paths and by that create continuous circulations (Jacobs 1992, p. 32-36). Anonymity also has a big impact upon the aspect of safety and security. When people don't know their neighbours, the crime rate in a neighbourhood tends to increase and therefore it is important to make people interact with each other (Carmona et al. 2010, p. 150). It is commonly believed that proper lightning is the solution for creating safe areas. Jacobs agrees that good lightning is important since it improves the visibility. But she adds that the light is only a help for the eyes watching and that without the eyes the lightning in itself can do no good (Jacobs 1992, p. 41-42). The layout of the city also has a big impact upon the aspect of safety and security. It is important that it is easy to move around and orientate oneself. To help this, the individual links between different destinations within the city space should have clear and distinctive visual characteristics (Gehl 2010, p. 101).



Stair of human needs, based on Maslow's five-step hierarchy of basic human needs



4. Understanding Potosí in a larger context

Knowledge of different aspects like history, traditions, organization and policies that are influencing the site is necessary to have in order to approach Potosí in an adequate way. This chapter will begin with a general description of Colombia and Bogotá. This is followed by a summary of our interviews with Colombian Landscape Architects and representatives of the botanical garden. The chapter is concluded by the presentation of the different reference projects visited within Colombia.

Colombia

Colombia is situated in the northeast corner of South America and had a population of 48,2 million people in 2015 (Nationalencyklopedin 2016a). In the north the country meets the Caribbean Sea, and in east the Pacific Ocean. Because of a dramatic topography Colombia has a great variety of landscapes; the highlands of the Andes are dominating in the west, while two thirds of Colombia is characterized by swamps, savannahs, rainforests and the coastal plains along the north and west coast. The climate in Colombia is varying between different regions, due to the local altitude and annual rainfall (Behrens 2016).

Modern history

The country has a long and dark history of violence and weaponed conflicts (SIDA 2015). In the 16th century the Spanish invaded the country (Landguiden 2016a) and during almost 200 years Colombia was a Spanish colony. In 1819 Simón Bolívar defeated the Spanish and the country became independent (SIDA 2015). Since the beginning of the 20th century political conflicts within the country, poverty and strong social divergence lead to great dissatisfaction and to formation of guerillas, like FARC and ELN (Landguiden 2016b). The civil war broke out at the end of the 1960's and the civil population was exposed to kidnapping and landmines from the guerrillas but also from state actors (SIDA 2015). In the 1980's the drug trading increased and drug dealers infiltrated both the politics and the police causing corruption and escalation of the difficult situation (Retsö, Schmidt, Rojas & Horna 2016).

Urbanization

The violence, especially on the countryside, has forced a great part of the people to leave their homes and today there are three million internal refugees in the country. Every year 150 000 people are escaping from their homes (SIDA 2015). The migration from the countryside to cities created a period of extreme urbanization in Colombia (Barrios & Lazarevski 2009); in the 1950's the main part of the population were living in the countryside, but in 2015 76 per cent of the population were living in cities (Jonsson & Århe 2016). Bogotá has been the main destination for the migrants, and in 1990's, the city experienced a sustained rate growth of more than 90 per cent (Barrios & Lazarevski 2009).



Colombia has a great variety in landscapes, examples above are showing a coffee plantation, a desert landscape and a beach by the Caribbean sea



The Spanish invaded the country

1500

1600

1700

The Spanish were defeated 1819

1800

The civil war broke out 1960's

Increased drug trading 1980's

City growth rate of 90% in Bogotá 1990's

1900

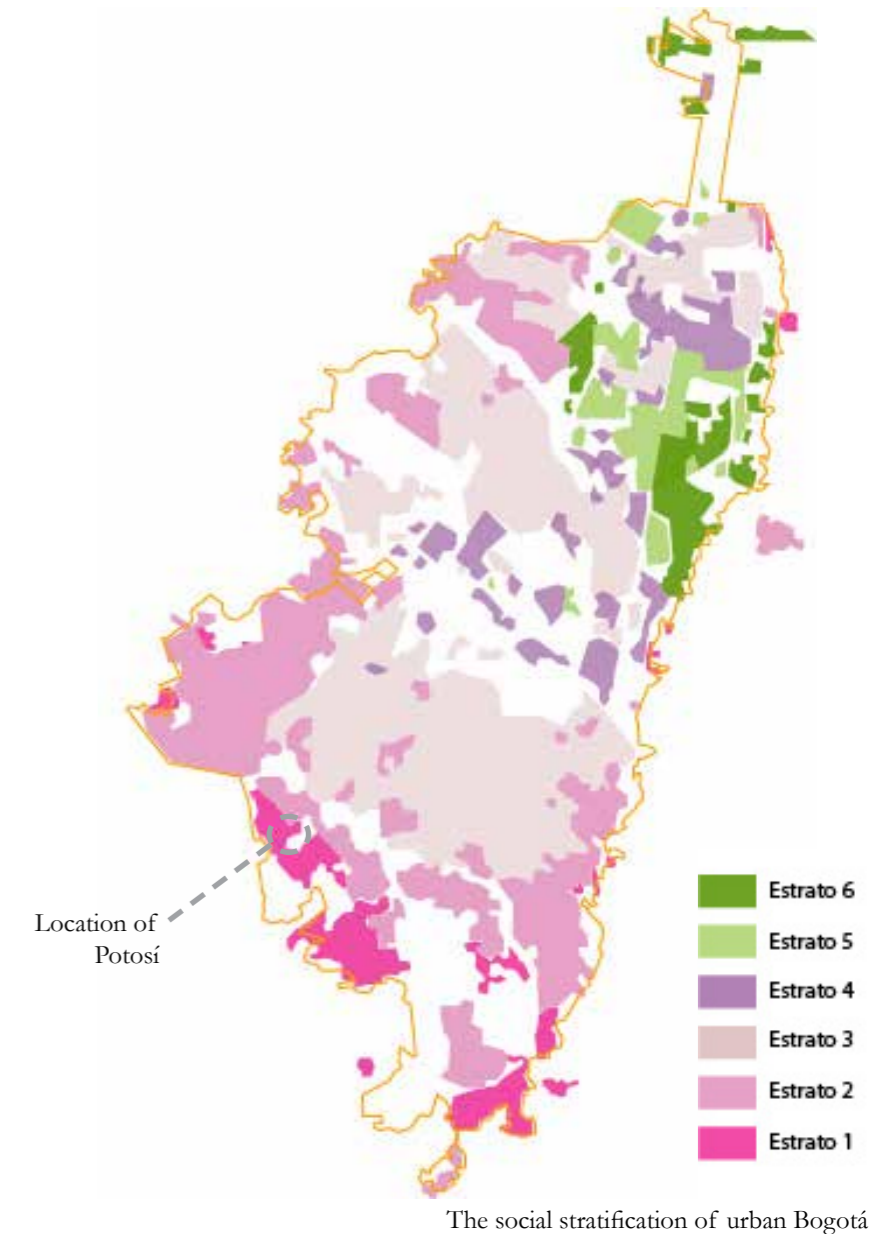
2000

Bogotá

Bogotá is the capital of Colombia and also the biggest city in the country with a population of 8 million people (2014) and a continuous growth rate of 2 to 9 per cent per year (WPR 2015). It is situated in the Bogotá plateau on the western slope of the Andes a bit northwest of the country's geographical middle. Bogotá has a cool climate with an average temperature of 13.5 °C (Climate-Data.org 2016) throughout the year, this because of the fact that the city is situated on an altitude of 2650 meters above sea level (Nationalencyklopedin 2016b).

Administration/organisation, UPZ

The city is administratively divided into different Zonal Planning Units, UPZ (Unidades de Planeamiento Zonal). In the 1980s, the public policy of Bogotá also instituted a social stratification of the city pattern, which resulted in an approximation of socioeconomic differences between its neighbourhoods. The structure of the city consists of six categories, called estratos (means stratum or levels), ranging from 1 to 6. The lowest number represent the poorest districts and the high numbers represents the wealthiest ones. There is a pattern in how the different estratos are located and it shows that there is a strong socioeconomic division within the city. The higher estratos are located in the north and northwest parts, and the lower estratos are located in the south and southwest. In Bogotá the social division in the city is clearly visible when moving across the socioeconomic lines (Brown 2012, p. 3).



City planning and management

The Urban Development Master Plan for Bogota is called the POT (Plan de Ordenamiento Territorial) and its purpose is to regulate the city growth. The tool deals with urban, environmental and economic development and provides guidelines directed towards achieving a balanced, equal and efficient territorial use. The POT has a time frame of ten years, but the vision for the document is based on a 30 year horizon (Hernández-García 2001, p.16-19).

Political investments in the urban environment

The Master Plan for Bogotá from 2005 declare that the aim for 2019 is to achieve 10m² of green public space per inhabitant of which 6m² should constitute of parks, squares or plazas and 4m² should constitute of reconstruction and protection of the main ecological structure (Alcalde Mayor de Bogotá 2013, p. 47-48). The policy for public space in Bogota has started to acknowledge that there is a need for more green space in the city, especially in the low-income areas and there has been a great political will to qualify the life of the city residents and to improve the public space of Bogotá for ecological, social and recreational benefits (Wright & Montezuma w.y., p. 1).

There is an intention from the government of Bogotá to develop a vegetated infrastructure within the city by using building for interfacing plant materials with build structures. In 2008, a research project at Universidad Nacional in Bogotá on how green roofs can be implemented in Bogotá was initiated, with the aim to implement practices of vegetated architecture as a framework for city development. Green roofs have the possibility to mitigate urban environmental problems and compensate for the lack of green areas within the dense cityscape. These interventions should be designed in a creative and resourceful way, with a wide range of low-cost alternatives to encourage a democratic practice of green roofs in the city. (Gutiérrez 2011).

To improve the accessibility and use of the city, different projects for upgrading the urban space has been done, including infrastructure developments, area beautification and recovery of sidewalks, parks, plazas, and commercial areas. In Bogotá many efforts has also been made to improve the accessibility and use of public space by promoting non-motorised transportat in synergy with restrictions that limit the usage of private vehicles. Every Sunday and holiday is the day of Ciclovía, when certain roads are closed for motorized vehicles in favour for cyclists, joggers, skaters and pedestrians and since 2000, a car-free day is held every February in the whole city. The municipality of Bogotá has also made an effort to construct a well-established bicycle network (Wright & Montezuma w.y., p. 4-6).

Un-planning in informal settlements in Bogotá

Many of the informal settlements in Bogotá have been growing on illegally held land (Hernández-García w.y.b, p. 1) through “bottom up” processes within very limited recourses, where the residents have used their own initiatives and imagination to form their living environment. Because of this, the production and maintenance of space in informal settlements is steered by the residents themselves. Jaime Hernandez Garcia means that this constant process of transforming and improving is an important characteristic of informal settlements, both of buildings and of the urban layout (Hernández-García w.y.c, p. 12-13). Urban informality is not only structural; it is a dynamic part of cities in physical, social and cultural terms, interwoven in all scales and level of the city (Hernández-García, w.y.c, p. 1). The environment becomes a reflection of people’s lives, cultures, desires and possibilities (Hernández-García, w.y.d, p. 22) which possess a powerful and rich aesthetic. But this way of self-steered city construction does not necessary deliver services equitably across the space or to the people living there (Beza & Hernández-García w.y, p. 2).

Greenery in informal settlements of Bogotá

In an inventory, 57 cases of open spaces in informal settlements of Bogota were studied and analysed through their amount of greenery. The study showed that 20 per cent of the cases didn’t contain any green areas or trees at all, 40 per cent showed some degree of greenery and 40 per cent considerable amount green space (Hernandez-Gracia 2010, p. 242). The main part of Bogota’s residents are living in estrato 1 and 2 where the streets don’t provide any space for greenery and there is almost a complete lack of trees and vegetation. There is also an absence of neighborhood parks, and the ones that exist are mainly in very poor condition and with low density of greenery. In comparison with estrato 1 and 2, the streets in estrato 5 and 6 usually possess a lot of trees, shrubs and grass. The streets in these areas are also often edged by green private gardens and there is a higher amount of public parks, which are also in better condition (Brown 2012, p. 6-8).



View of central Bogotá



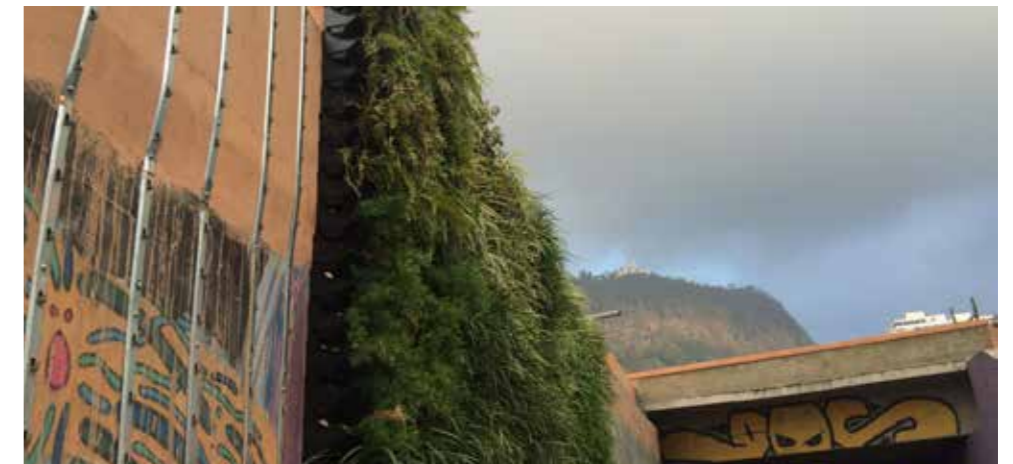
View of the surrounding barrios from Potosí



The Simón Bolívar park in central Bogotá



Park in Potosí designed by the community



Green walls constructed in the cityscape of central Bogotá



Playground la Cloaca in Potosí



Ciclovía Sunday in central Bogotá

Summary of interviews with professionals

To get an insight in planning traditions concerning Green Infrastructure and informal settlements in Colombia, we conducted interviews with three landscapes architects. This also gave us the opportunity to discuss other challenges concerning our project, for example security issues in informal settlements. To gather knowledge about plant material suitable for the conditions of Potosí and our project, we met with two representatives of the Botanical garden in Bogotá.



Martha Fajardo and Noboru Kawashima are the president and vice president of Grupo Verde Ltda based in Bogotá and have great experience of Green Infrastructure planning in Latin America

Landscape architects Martha Fajardo and Noboru Kawashima, Bogotá

When meeting with Martha and Noboru we talked a lot about the strong connection between green and social aspects. They pointed out that GI should be seen more through a social perspective and that it is important that it is connected to people, Martha stated that *“People are central in Green Infrastructure”*. Noboru claimed that green is not only physically good, it is also an important symbol of the memory of the countryside since many people in Bogotá have rural background.

Martha continued to talk about how landscapes are for everyone; rich, poor and people from different cultures and backgrounds. It is a place for living together, to encounter, to connect, grow together and to be happy. But landscapes also connect people with the nature. This led the conversation to what Martha refers to as everyday landscape. She said that since 80 per cent of the people in Latin America live in cities, the everyday landscape is fundamental in creating and retaining these connections. On the matter of how to design the everyday landscapes Martha meant that it is important to design with *“the spirit of the place and the voice of the people”*; to identify and respect the character and identity of a place and to protect the cultural heritage. She stated that it is important to use the ethics and aesthetics of the people and that it is necessary to work with bottom up-processes.

We talked about contradictions between greenery and land use and greenery and security. Martha and Noboru were convinced that good places and projects can change people’s mind. Noboru stated that *“People’s behavior in a place change when the place has a value for them”* and that there is a need for common symbolic places, and also time for people to understand and accept changes.

Martha and Noboru concluded by saying that it is important to think about Green Infrastructure in a Latin American context concerning needs and traditions. Martha said that Latin America have a big young generation and that there is much hope for the future but that there is a lack of education about what the landscape is and what benefits it has for the people; both among citizens and among politicians. Martha and Noboru agreed that it is necessary to educate people about landscape.

“Showing greenery in organized ways where everyone can see it can give people ideas and inspiration for their private space”

(Gloria Aponte)



Gloria Aponte is founder and director of the master’s program in landscape architecture at the Pontificia Universidad Bolivariana in Medellin, and has been involved in several projects in informal settlements

Landscape architect Gloria Aponte, Medellin

When meeting with Gloria we discussed principles and ideas on how to improve informal areas in a green, sustainable and secure way. Gloria told us that it is common to work with PUI to upgrade informal settlements in Medellin where she is based.

We discussed different principles of how to integrate greenery in dense areas like Potosi. Gloria told us about a project about “greening” Ciudad Bolivar (the district in Bogotá where Potosi is located) where they used different principles; one was implementing greenery in traffic islands (“separades”) in the middle of the roads. Another principle was to integrate greenery along the streams where there is more unbuilt space. A third principal was a concept for how modules of greenery could be implemented in the empty lots of the urban grid. Gloria has also been working with spontaneous or assisted vegetation; to retain and help vegetation that is already at the place. In very dense areas like Potosi, Gloria suggested green roofs. We discussed the issue of proposing interventions in private spaces, and Gloria suggested that one idea could be to make green roofs on public buildings, institutions or the cable car stations (example from Medellin where she works) to show good examples. *“Showing greenery in organized ways where everyone can see it can give people ideas and inspiration for their private space”* and by that contribute to a greener neighborhood.

Gloria also talked about the importance to work with the community by communicating with the people, by workshops and to let the people take part in the implementation of projects. She stated that if people like the place and is involved in it, they will also take care of it. Gloria summed it up by stating that *“It is more the people and the interaction then the physical place”*.

We asked Gloria about how to handle the security aspect in our project. She confirmed that many times people can feel insecure because of shrubs or trees that limits the sight and offers a hide-out. She said that high trees are good but also pointed out that someone could hide up in the tree. She advised us to mainly work with low and transparent vegetation to support high visibility and pointed out that lightning also is important for the sense of security.

“Peoples behavior in a place change when the place has a value for them”

(Noboru Kawashima)

“People are central in Green Infrastructure”

(Martha Fajardo)

“It is more the people and the interaction then the physical place”

(Gloria Aponte)

Representative of the Botanical garden Andrés David, Bogotá

During our meeting with Andrés we discussed plant material suitable for dry conditions and that requires a low level of maintenance. The botanical garden has a wide range of local plant material for different conditions sorted in different themes and Andrés guided us through the garden giving us the opportunity to discuss the plant material while also getting a good sense of the character of the different species. We paid special interest to the desert themed garden considering the dry conditions in Potosí. Andrés has a lot of knowledge in how plant material traditionally have been used for cultivating, medical or religious purposes, and he told us about the importance to consider also the historical and cultural use of different plant species to connect to, and to preserve the cultural heritage.

Representative of the Botanical garden Darío Gerardo Zambrano, Bogotá

The Botanical garden in Bogotá is involved in many projects of implementing green public spaces and creating a bigger ecological structure in the city and Darío has a connection to some of these projects. He provided us with information concerning plant material, design principles, establishment and maintenance of greenery in public space. In our meeting we discussed the specific site conditions of Potosí and the design principles of rain gardens, flooding areas and green roofs and walls. Later on he provided us with lists of plant material suitable for street greenery, green spaces, flooding areas and green roofs and walls adjusted to the conditions of Bogotá, produced by or for the Botanical garden of Bogotá



Discussions during our guided tour with Andrés in Botanical garden of Bogotá

Reference projects

To study examples of strategies and solutions for designing and planning in informal settlements, we visited eleven different projects located in the Colombian cities Bogotá, Medellín and Cali. Based on the conditions and issues of our site we focused on identifying strategies and solutions connected to the following concepts and aspects:

- Urban agriculture
- Handling slopes
- Recycling of materials
- Efficient use of space
- Vegetation
- Initiating engagement in public space
- Retaining settling in hazardous areas and sprawl
- Safety and Security
- Aesthetics and use of materials
- Education



The different projects are described in text and photographs and are concluded by a listing of which concepts or aspects that it will serve as a reference for in our proposal.

Barrio Santo Domingo, Medellín

Santo Domingo used to be one of the most dangerous barrios in Medellín but has gradually changed into a neighborhood that we, at least, felt very secure strolling around in. There has probably been many factors playing a role in this but we find that one likely to effect this development is the investments that has been done in the barrio. When the city of Medellín invested in metro cable lines they built one of the stations here, increasing the accessibility to and from the city center. The Spanish library was built in proximity to the station, attracting people from the whole city to visit the barrio. There has also been investments done to increase the accessibility of different services to the community through a PUI that centralizes school, sports field, library and healthcare around the metro cable stations and where interventions of the outdoor environment are done. Here (and in other places), we noticed that investments done to improve the public space of the barrio, often is reflected by the residents through initiatives of their own. Our conclusion of this is that good investments really have a potential to generate a lot of engagement in the local area. One example from Santo Domingo is the decoration on the roofs that has appeared after the investment of the metro cable line made the roofs visible to many people.

Used as a reference for:

- Safety and Security
- Initiating engagement in public space

Painted roofs by metro cable in barrio Santo Domingo (1), the Spanish library (2)



Morro de Moravia, Medellín

In the barrio Moravia we visited a former dumpsite that has been transformed into a garden. There is still a lot of polluted material at the site and the soil is no good for cultivating edible crops. The garden is more a place for recreation and partly also representation, since it turns away from the barrio towards one of the city entrances. The area was a dumpsite for 35 years and with no alternatives people started to settle in the site, living under unsanitary conditions and with insufficient services. About ten years ago the transformation begun; people were relocated and a steep garden was created. In the steepest parts the plant beds has an inclination of around 50% but stairs and paths on terraces provides possibilities to move around also in this part. Along the path that leads you through the garden, artworks made out of recycled materials from the dumpsite works as a reminder of the history of the garden. The garden is being cared for by employees of the city and was funded by the municipality of Medellín.

Used as a reference for:

- Handling slopes
- Recycled materials
- Retaining settling and sprawl



Garden in steep conditions (3 & 4), sculpture of recycled material (5) and information board showing before and after the transformation (6) at Morro de Moravia in Medellín

Campus Javeriana Bogotá

The whole campus is located in the slope of the cerros flanking Bogotá's eastern side and we had the opportunity to study many stair and ramp solutions in the outdoor environment that was used to handle the topography. The outdoor environment provided many small spaces around campus that often were distinguished because of the sense of enclosure that the stairs provided. Much of the campus grounds are in brick which is a characteristic of the whole city centre. To provide variety and separation of surfaces, the bricks were often organized in patterns or in different angles.

Used as a reference for:

- Handling slopes
- Aesthetics and use of materials

Greenery and stairs at Campus Javeriana (7 & 8)



Botanical garden, Medellín

The main source for reference in the botanical garden was the urban farming section where we got a lot of inspiration on cost and surface effective as well as simple solutions for cultivating. A lot of recycled materials were used such as planting vertically in downpipes, creating planting beds out of tires and also solutions for collecting rainwater. We have seen other examples of urban agriculture but this one excelled in being designed and organized like a recreational park based on cultivation rather than a patch of land used for production and by that can fill multiple purposes and attract people of different interests.

Used as a reference for:

- Urban agriculture
- Recycling materials

Urban farming using recycled materials (9 & 10) and collection of rainwater (11) in the botanical garden of Medellín



Jardin Circunvalar, Medellin

Parque circunvalar is situated in comunna 8, stretching along the slope of Cerro Pan de Azúcar. The construction of the park started in 2012 and is still ongoing. When ready it will connect to a eco-park in the neighboring barrio. The park has five main purposes: 1) to control the expansion of the residential areas 2) to create a safer and more accessible green space 3) to create a including public space 4) to integrate sustainability in the territory 5) to create qualitative connections between the connecting barrios.

The control of city expansion is done by the location and size of the park; it forms a limit for expansion through occupying the land that might be found attractive to settle in. The park is equipped with 8 km of walking and bicycling paths that connect the three barrios the park stretches along as well as a playground, outdoor gym, sports field and locations for urban agriculture. For cultivating, there is both a collective garden shared by six families and individual lots and room for more lots if the interest would grow.

When planning the garden, a lot of effort was done to increase the sense of security; there is a staffed park center where natural education and workshops are also organized, surveillance cameras and generous lightening in the park. We had the opportunity to do a walking tour with one of the park guides that are employed to provide the visitors with information and sense of security.

As mentioned, this park is situated at the slope of a mountain and during our visit we saw several solutions for stabilizing the soil, handling erosion and preventing landslide. One was terracing where the terraces were planted with one type of plant that was particularly deep-rooted and helped fixate the soil in the depth combined with one that fixated the soil on the surface. The later one was of the fabaece family and also fixates nitrogen improving the soil health. There was also a design made out of bamboo for handling run-off throughout the park which helps in preventing landslides. During this visit, we also noticed how the construction of the park had generated initiatives among the people living nearby; in connection to the park, almost all residential houses had been renovated and painted in beautiful colors.

Used as a reference for:

- Handling slopes
- Retain settling and sprawl
- Safety and Security
- Education
- Initiating engagement in public space
- Urban agriculture

Staffed park center (12), solution for handling slopes (13, 14 & 15) outdoor gym and cancha (16 & 17) urban agriculture (18), and discussion with guide (19) in Jardin Circunvalar



PUI la Aurora, Medellin

The residential area by the metro cable station Aurora is quite recently constructed. A group of apartment buildings were constructed to inhabit people that have been relocated from hazardous zones around the city. The neighborhood la Aurora is also provided with healthcare facilities and a PUI including, gym, sports field, lecture hall, playground and swimming pool. These facilities were used by many during our visit. This visit showed us that relocation can improve people's quality of life and be appreciated but this very ambitious new neighborhood also made us realize that relocation should be done either within a barrio or offer a lot of improvements to compensate for the fact that people have to leave their home and neighborhood.

Used as a reference for:

- Retain settling and sprawl

New houses for relocated people (20) and cancha, playground and swimming pool (21 & 22) at PUI la Aurora



Library San Javier, Medellin

San Javier library is built in connection to one of the metro cable stations. Except for a collection of books, the library contains a lot of rooms with computers, a community center, urban farming, photo exhibitions and the office of Medellin Solidar (social services) and they also offer courses in for example Portuguese and playing guitar. The outdoor environment of the library is a well-used public space where there is also room for urban agriculture. This combination of attractions is both efficient in use of space and in creating a meeting place for people with different interests in a community. We left this visit with a changed view on what a library can be, and how it and its outdoor environment can constitute a valued center of a barrio.

Used as a reference for:

- Urban agriculture
- Efficient use of space
- Education



Puente del Indio, Bogotá

Punte del Indio is a park in Arbozadora alta, a neighboring barrio to Potosí, which was mentioned as particularly attractive and secure by people during our visits in Potosí. The park does not stand out based on equipment or design but it is equipped with several playgrounds, a Cancha and evenly distributed lightning. Our impression is that the high level of activity is what makes it special. The activity is probably a result of its busy location along the main road where buses stop and with both a school and a police station nearby. The amount of people passing by and spending time there also attracts street vendors which further adds to the activity.

Used as a reference for:

- Safety and Security

Square with street vendors (27) and playground (28) in Puente del Indio



Escaleras electricas, Medellin

In the neighborhood of San Javier we visited the electrical escalators in 6 parts that makes life easier for people living up the steep hill. They were arranged in zigzag and with planting areas and small areas for seating in between. The escalators are open from 7AM to 11PM and run both ways. They are constructed with transparent roofs that let in the sunlight but is also complemented with lightening for the dark hours of running. It was really a beautiful thing to see how the residential houses in the connecting areas all had been renovated and decorated to a much higher degree than houses further away from the escalators as if to contribute to the upgrading of the area that came with the investment of the escalators. A lot of people also had decorated the top of their roofs so that you would have a beautiful view when going up, this we also saw beneath the metro cable lines of the city.

Used as a reference for:

- Safety and Security
- Initiating engagement in public space

Below: Planting combined with walls for street art (29) and decorated facades and roofs close to the escalators of San javier (30, 31 & 32)



To the right: Space efficient playground (33), decorated stairs and vertical public space (34 & 45) and environmental pedagogics (36) in Patio Bonito

Patio Bonito in Communa 1, Cali

During a fieldtrip with Universidad Javeriana we visited a part of the informal settlement Patio Bonito in the outskirts of the city Cali. The section we visited is of similar size and situation as our site. Safety and security did not seem to be an issue, relations within the community seem strong and the outdoor environment exuberates of creative initiatives by the community.

The whole barrio is located in a slope of a mountain between one main road on the ridge and one on the northern mountain side. The south side of the ridge turns towards the natural landscape and is not built because of the steep topography. Between these two roads the only access is by foot and all pedestrian paths in south-north direction are stairs. The topography limits the possibility of constructing big public places and much of the activity occurs along the narrow streets of the barrio; children play, old men play board games and the stairs, paths and facades are heavily and playfully decorated. We visited the barrio together with our local supervisor Jaime, who referred to all the decorated supporting walls of the barrio as a type of “vertical public space”. These spaces constitute a big part of the identity of the barrio and they invite people to spend time in the streets. The decorations also signal engagement and human presence in the outdoor environment which we experience, increases the sense of security.

The use of land is highly efficient; we visited one compacted playground along one of the roads that had a width of not more than three meters but that still was equipped with a slide, seesaw and rocks. The big public park of the barrio is efficient in that way that it is combined with the barrio-library and by that lets the space being used in multiple ways and by different people. We have seen this combination of staffed institutions or centers in connection to bigger parks in many places and we perceive it to benefit them both by adding activity and increasing sense of security. One thing that we also will take with us is the environmental pedagogics of the barrio school. It was apparent that an ambition was to teach the students about recycling, the environment and sustainable way of life and much of the students work was displayed in the school yard to also reach parents and visitors.

Used as a reference for:

- Handling slopes
- Efficient use of space
- Safety and Security
- Education



Library Virgilio Barco, Bogotá

To study landscape architecture on a big scale we visited the Virgilio Barco library with its connecting park in central Bogotá. The library building and the park are designed as a unit using the same form language and materials and the design of the park has a strong focus on capturing and highlighting water in different ways. The structure of the park is mainly based on walking paths which start and return at the library but that leads you through different sites with arrangements displaying water. The park has a high level of detail close to the library but generally become less designed and programmed the further away from the library you walk. Much effort has also been done to strengthen sightlines within and outside the park through different levels creating interesting sequences in an otherwise flat surface.

Used as a reference for:

- Aesthetics and use of materials
- Vegetation



Different solutions for handling and displaying run-off water in public place (37, 38, 39 & 40) in the park at library Virgilio Barco

Summary:

- Good projects has a potential to generate a lot of engagement and initiatives in the local area, multiplying its effect on the outdoor environment
- Efficient use of space can be done both through creative design solutions that requires little space or through multiple use of spaces
- Multiple use of space is a good way to create connections between different people that might not meet otherwise
- Urban agriculture can take different forms depending on the opportunities of the site
- Staffed centers can be a solution to increase sense of security
- Steep slopes can be designed in different ways for accessibility and to embellish public space
- Even traces of human activity can increase the sense of security
- The public space and institutions are good places for reaching out to many people with education and good examples



5. Findings of Case study Potosí

In this chapter we present the preconditions and potentials derived from our Case study of Potosí. The chapter starts with a brief description of the site followed by inventory and analysis of the ecological, social and recreational aspects of the site. The inventory and analysis is complemented with interviews with people from the community and our experiences from the participation of a workshop on site. The information and insights of the inventory & analysis, interviews and workshop are summarized in a Lynch-analysis and a compilation.

Site description, Potosí

To be able to make a design proposal for Potosí, we first needed to get familiar with the site. The site description presents general background information that is of relevance to understand the background of Potosí as well as which aspects that has an impact upon the site.

Introduction

The barrio Potosí belongs to the UPZ Jerusalén, and is situated at the west boarder of the city. The topography in this part of Bogotá is quite steep and Potosí, as the neighboring barrios is located on hills. Potosí is surrounded by the barrios Caracolí in the north, Las Brisas in the east and Arborizadora Alta in the south. The western border of Potosí is constituted by a cerro where an extraction industry is located today. The location between two Cerros creates a very dry climate that varies a lot during the day, with strong sun in the daytime and cold nights.

History

Potosí has grown in informal ways since people started moving here around the 1960's by illegal occupation and pirate developing. There is a constant development of the housing in the barrio and the status of the houses can often be derived to the amount of time that has passed since construction started. Some residences and blocks havw had the time to develop into the same status as any formal neighborhood while some still are in poor conditions. People in the barrio often refers to higher and lower Potosí where the higher part is higher up on the hill but also seem to be of generally higher status than the lower. The status of the houses and its more beneficial location suggests that people settled in higher Potosí earlier than lower.

Services and Investment

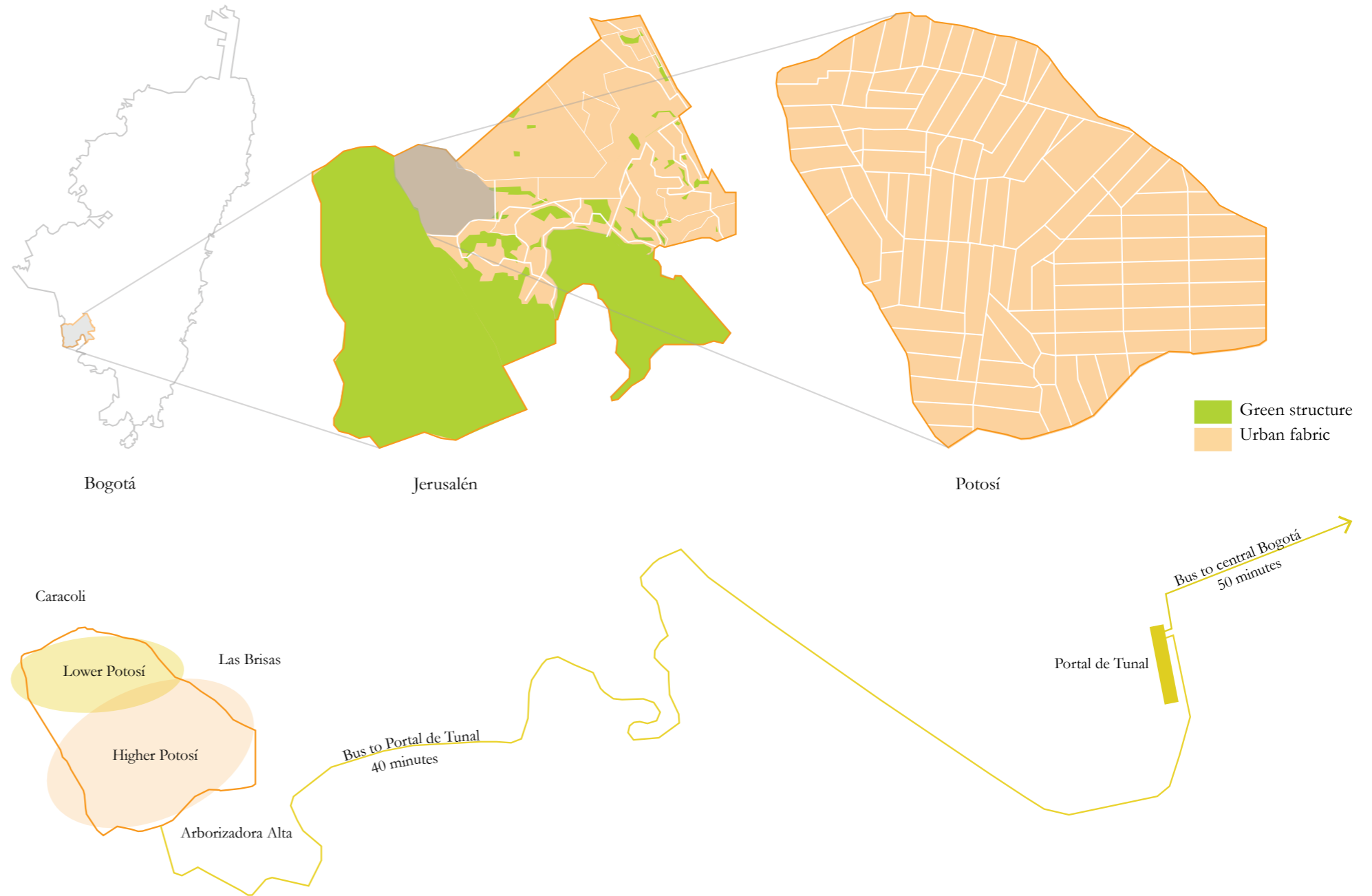
As a result of the development outside of governmental regulation, like in many informal settlements as mentioned, services to the public are neglected. The local government do gradual investments but it is a complicated matter because of the existing conditions and density of the barrio. The main part of the barrio is provided with electricity, drinking water and sewage and some investment has also been done in the street network and public space.

Population and social issues

The main way of arranging statistics in Bogota is by UPZ and information of specific barrios is difficult to access. An estimation of the population in Potosí based on the number of lots and the assumption that four people reside in every lot would make it a total of 8000 people. During our visits there were mostly children in school age or mothers with younger children active in the barrio. This is probably connected to the lack of employments in and close to the barrio. Through conversations during our walking tours we understood that adults with employment often work in more central parts of Bogotá, leaving them with a long transport to and from work and the barrio absent of adults. When we met with the staff of the school during our first walking tour they mentioned unemployment and gang- and drug related violence as the biggest issues in the barrio.

Connections to the city center

The main mode of access to Potosí from Bogotá is by public transport and the closest bus stop is in Arborizadora Alta. From this bus stop you embark on a feeding-bus which take you to the end station of the Transmilenio bus system where you transfer and continue to the centre of the city, the entire trip taking about 1,5 hours.



It is a complicated matter to do upgradings in the dense structure of Potosí. In this image, a street is being paved



View of Potosí and surrounding barrios

Inventory and Analysis

To be able to answer the research question: *What are the preconditions and potentials for developing a green infrastructure in Potosí and how can this be done to promote ecological, social and recreational benefits?* it was crucial to investigate not only the existing green structure and its ecological values but also which social and recreational values and functions that exist today and which are missing. The inventory and analysis consist of information gathered from both map-studies and from the walking tours we did with a local guide and a group of architect students, when we also got the opportunity to meet and talk to people in the barrio. Some of the aspects in this section (for example safety & security) are complemented with information from the interviews, which will be presented in the next section. Each aspect of the inventory and analysis are followed by a summary stating the most important things to consider in the design proposal. These are only accounted for in the first section where they appear.



Land use

In Potosí, as in the neighbouring barrios, the main land use is residential. There is a sprawl of the built structures both because of the massive urbanization and thereby demand for lots, but also because of traditions and limitations concerning acquisition of land, type of residency and construction. Businesses are typically located in the bottom floors of residential houses and orientated around the main streets of the area. There is a concentration of institutions in the southern part but they are scattered within this area.

The small size of the blocks requires a dense road network and much of the existing public space of the barrio is dominated by these. In addition to this, there are a number of public places offering attractions to the community; one park with a playground and two sport fields, or canchas, the main one of them combined with an additional playground but these constitute a very small part of the total amount of public space.

Where natural conditions such as topography and flooding limit the construction of the land uses mentioned above there is, what we perceive as vacant area. These spaces are generally on the edges of the barrio and of natural character with no construction but often clearly used by pedestrians, for garbage or mass disposal or sometimes, as mentioned, invaded because of the lack of more appropriate locations for residency.

There is no industrial use of land within the barrio but there is a mining industry extracting sand from the cerro west of the barrio that affects the barrio and

particularly its western edge. The mining company deter settling in the slope west of the canal and the community are not allowed to go past the road on the cerro with exception of for during a Easter procession each year since an important religious site is located in the mining area. The permission for the mining was temporarily revoked during our field study and there is a strong engagement from the community of Potosí to permanently close the mine in connection to the barrio. If this would turn permanent an issue that might occur is invasion of the land for residential purposes. This would be undesirable both out of safety reasons and for limiting further extension of the city structure. The slope of the cerro is today dominated by low shrubs but what we understand from conversations during our walking tours it used to be covered with trees. This feels likely since the cerros in the protected parts of Bogotá is covered in forest. This slope represents a substantial part of the unbuilt area of the barrio.

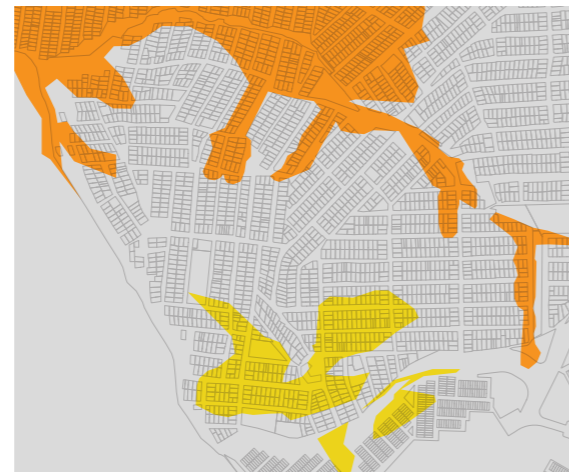
During our visits it became more and more apparent to us that there is a conflict between different land uses and that, naturally, the most urgent issue being the need of places for people to reside in, has been prioritized. Land reserved for public space providing social and recreational functions for the community have had to stand back creating an even bigger issue as the community grows. This has left even less room for ecological networks and functions that in the long perspective would be beneficial for the people of the community both in providing a safer and healthier living environment and to offer more possibilities of recreation and activity.

Summary:

- There is a need to work with a strategy for the development of the barrio and Cerro in a future without mining activity
- There is a need to implement greenery in combination with other needed improvements in the barrio to solve several issues at once
- The streets should be utilized in the proposal since they constitute the majority of the public space within the barrio.
- Primarily vacant areas should be used in the proposal



Some of the streets are so steep that it is impossible to drive a car



Risk areas of landslides: high (orange), medium (yellow) and low (grey) (based on information from mapas.bogta.gov.co)



Canal in the west



Some of the issues that occur because of the steep topography



Topography

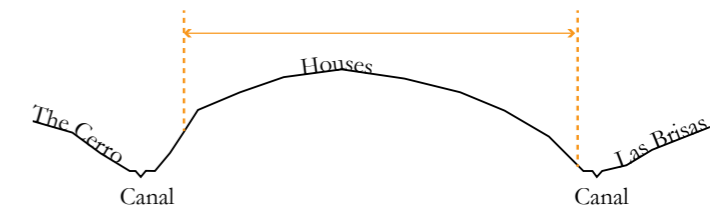
Because of its situation by the mountains, the topography of Potosí is very dramatic. The highest point is in the south part of the barrio, and from there the terrain is tilting in different directions towards the canals. In the south and central parts of Potosí the terrain is kinder, while the boarder in the west, northwest and some parts in the east are very steep. When moving along the streets the topography is constantly changing and there are many slopes and steep streets. Some of the streets are so steep that it is impossible to drive a car and sometimes also problematic to walk.

Landslide

Some of the houses in Potosí are built in the steep terrain. In these areas, the soil is unstable and there is a risk of landslides. This is a big issue for people's security and the ambition of the local government is that people should not reside in these hazardous areas but this is difficult to control. Through conversations during our walking tours we understood that the normal procedure is to relocate people at risk and construct fences to prevent resettling. However resettling occur, either by the same people that has grown fond of their block and oppose the relocation or by new residents settling because of lack of space and potentially also with insufficient knowledge of the risk. Poorly constructed houses further increase this danger.

Storm water management

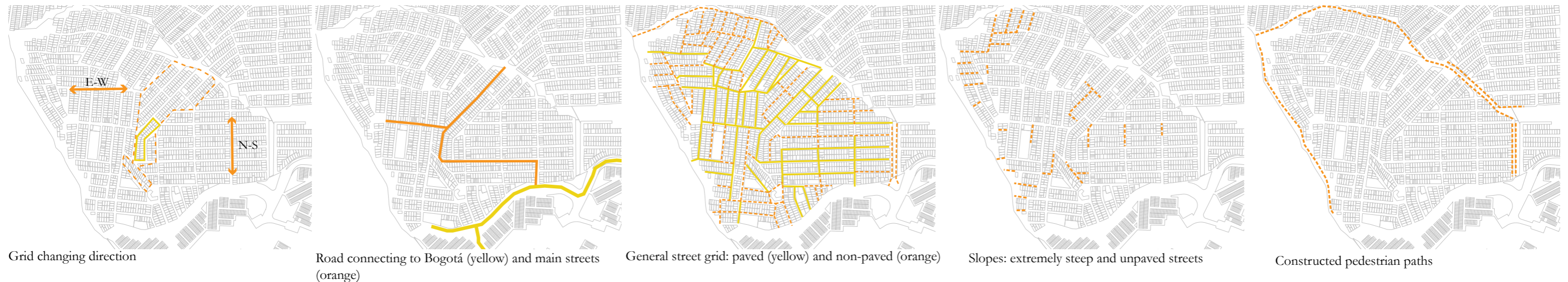
The system for managing storm water is, where present, open canals along the streets leading the storm water down to the bigger canals that constitute the lowest points and also the limits of the barrio in all directions but south. The canals are made out of concrete, hence do not infiltrate any water. Our field study coincided with a particularly dry year of the dry season and all canals were dried up during our stay. However, through conversations during our walking tours, we understood that the canals and the connecting area often gets flooded during wet seasons. Some of the paved streets and none of the unpaved streets are designed to manage storm water and we could see the impact of heavy rains in the erosion of the unpaved streets. This is an issue since walking can be problematic where it is very uneven but we consider the paving of roads without a system for handling the storm water an even bigger issue in this aspect since it increases the amount of water led to the unpaved streets and down the slopes of the barrio, thereby increasing the risk of erosion or potentially trigger landslide through saturation of the soil. It is important to improve the accessibility of the streets in the barrio but it has to be done with caution because of this risk.



Potosí is located on a hill. Between other hills.

Summary:

- There is a need for solutions that improves access and use of steep areas
- There is a need for a more effective solution for preventing occupation of the areas where there is a high risk for landslide
- There is a need for solutions to stabilize the soil in high risk places
- There is a need to incorporate more permeable surfaces when upgrading streets and the canal



Street grid from above. The image shows the neighboring barrio Caracoli but Potosí looks similar



Example of main street



Example of paved street



Example of unpaved street



Example of slope



Example of pedestrian path

Morphology and road network

The blocks and streets are organized into a symmetric grid as in the rest of Bogotá. With few exceptions the grid is laid out without consideration of the topography which results in very steep streets in many places. The blocks in the eastern part are organized with their long side in the direction north to south and the ones in the western part east to west resulting in a transition in the centre of the barrio where a lot of streets are cut off, creating a barrier. One block (marked in yellow) is especially problematic because of its length and position.

Road connecting to Bogotá

The road that connects Potosí with greater Bogotá has been adjusted to the topography, allowing bigger vehicles to access the south part of the barrio. The structure of the barrio with the more frequent occurrence of institutions, services and businesses in this part might be a result of this. By conversations during our walking tours we understood that this road normally also is used for transports of material from the mining area which is considered a safety issue in the barrio.

Main streets

Within the barrio there are three main streets meeting close to the geographical centre, one coming from the south that connects to the barrio Arborizadora Alta where the closest bus stop also is located, one from the west that ends at one of the schools and one from the northeast, connecting Potosí with the neighbouring barrio Caracoli. These are all paved and the most frequently used by motor vehicles. The main streets are vital for transport of goods and people to the different part of the barrio since the rest of the street grid is very inconsistent in quality and because of that not suitable to carry larger vehicles.

General street grid

From the main streets, a system of paved and unpaved roads provides access to people's homes. The width of the blocks is generally only the length of two lots together measuring around 30 meters, requiring a lot of streets to access all the houses. There is a big variation in quality between the streets, making the accessibility for motor vehicles and pedestrians inconsistent.

Slopes

The combination of the topography and the morphology result in many streets that are extremely steep. They mainly occur along the edges in the western part where the streets tilts down towards the canal but also in the transition between higher and lower Potosí.

Pedestrian path

There is a pedestrian path constructed along the canals that provides the possibility to move along the edges of the barrio. During our walking tours we experienced that it was not used by many even though the quality of the path is high. Our conclusion is that a combination of too few access points to it and the isolated location deter people from using it.

Pedestrian life

The main mode of transport within the barrio is walking and owning a car is generally an exception. During our walking tours we experienced the unpaved roads as one of the biggest issues in the outdoor environment, both because of difficulties to access all parts of the barrio with for example a car or a stroller and also because of the particles it generates in the air. This was also confirmed in the interviews with

people from the community. Another issue is that very few roads are equipped with sidewalks and the ones that exist are very narrow. This is a threat to the safety of the pedestrians mainly on the main streets which attracts both motor vehicles and pedestrians because of the high accessibility. Unfortunately the width of the main streets are not enough to provide all functions needed.

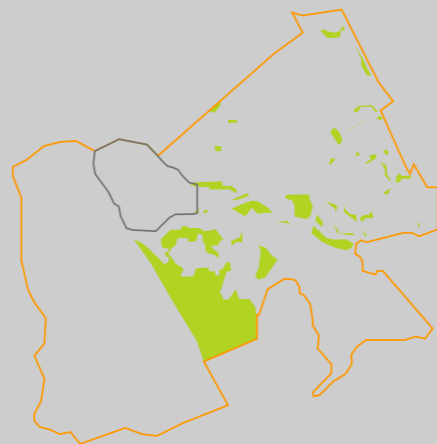
The municipality do have projects for upgrading the roads in the area but unfortunately, because of the narrow space available, sidewalks does not seem to be a priority. One of the recent renovations however, suggest that there are alternatives; to create a safer passage for the children going to and from the barrio kindergarten, a former narrow two-lane street has been converted into a one-lane street equipped with sidewalks on both sides. Considering the low amount of motor vehicles in the barrio this approach feels reasonable.

Summary:

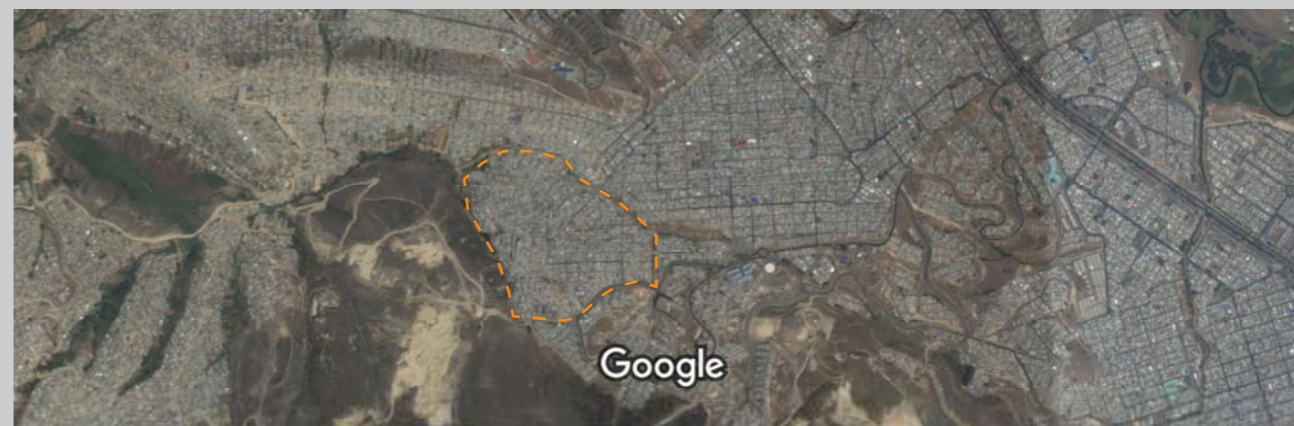
- There is a need to preserve the accessibility of motor vehicles on the main streets
- There is a need to provide a more accessible and safe street network for pedestrians
- There is a need to improve the access points to as well as the sense of security of the pedestrian path along the canal
- There is a need for a solution that increases the accessibility in the slopes

Greenery in Potosí

The Master Plan for Bogotá from 2005 declare that the aim for 2019 is to achieve 10m² of green public space per inhabitant, of which 6m² should constitute of parks, squares and plazas at all scales and 4m² should be reconstruction and protection of the main ecological structure (Alcalde Mayor de Bogotá 2013, p. 102). We have not had the possibility to acquire statistics specifically on Potosí but the statistics on the Jersusalén (UPZ) can provide an indication of the needs of Potosí. Jerusalén, with a population of 116113 inhabitants, has a shortage of green public space of 594344,27 m² or 5,12 m² per inhabitant. When studying the map of the distribution within Jerusalén, it is clear that Potosí is one of the barrios with the least amount of existing greenery today.



Existing green public space in Jerusalén
(Map constructed according to the Sentido Agosto)



Connection between the greenery of Potosí and surrounding landscape

Imagery ©2016 DigitalGlobe, Map data ©2016 Google 200 m

Classification of existing green spaces by accessibility

To propose a structure that also benefits the community in the social and recreational aspect we needed to separate the greenspaces that are accessible to the public from the ones that were not in order to determine which spaces that should be included in our proposal. Another prerequisite for doing this is that it is difficult to propose any type of change to be made on privately owned land. We complemented the inventory with observations and dialogue with the community to determine the landownership and categorized the different types of greenery. There were big differences in terms of quality and recreational functions; hence it was necessary to identify the following subclasses to be able to propose different types of design interventions for the different sites.

Public greenery

The greenery that was considered public had to be physically accessible by everyone and during all times of the day.

Parks

Green spaces that were designed with the main purpose to provide recreational functions for the community were considered parks.

Natural area

Green zones which are not designed and big enough to be perceived as an individual area. The zone can be affected by human activity but should not be characterized by it.

Edge zones

Zones of varying size with natural vegetation that are not designed and that constitute the transitions or border of surfaces or areas

Water bodies

Natural or manmade passage or storage for water.

Semi-public greenery

The greenery that was considered semi-public was either accessible to everyone but only at specific times, or only to some groups of people but at all times.

Institutional greenery

For example schools and community centers.

Private greenery

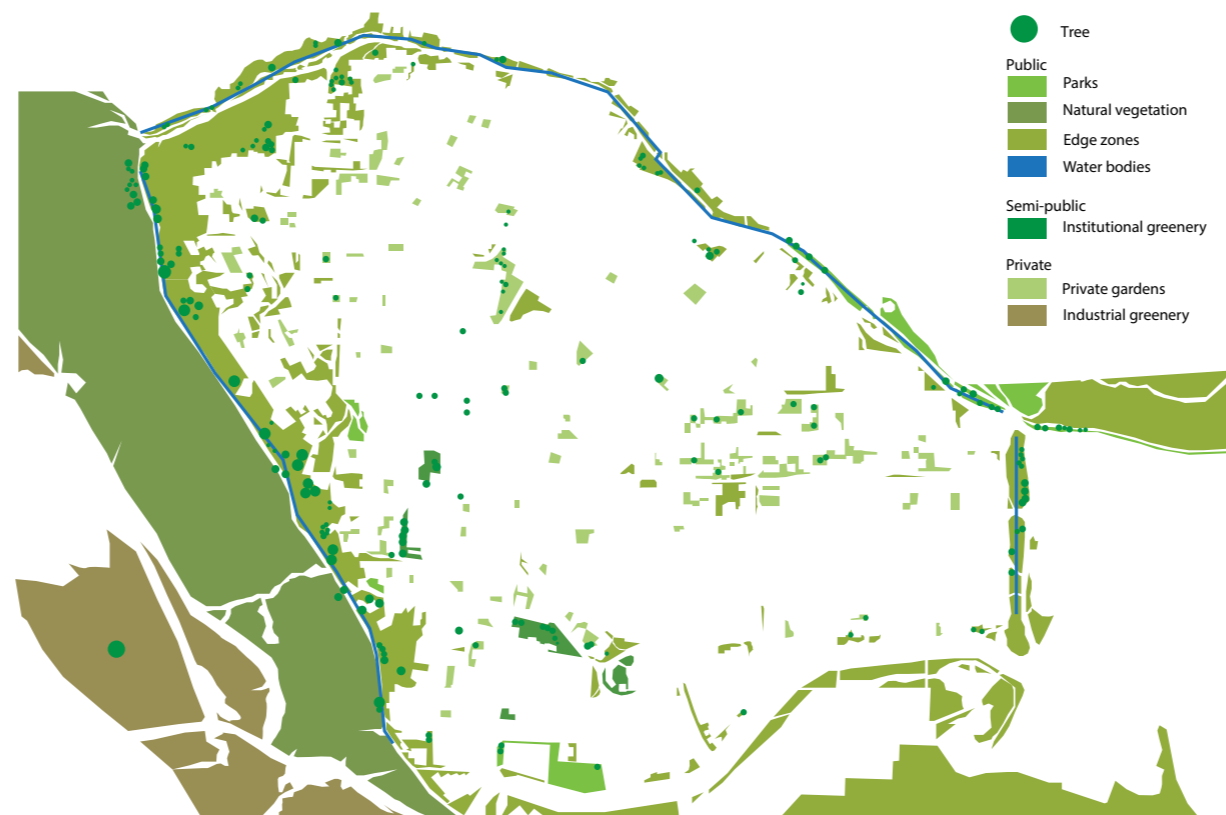
The greenery that was considered private was only accessible to whom the landowner gave his or her permission.

Private gardens

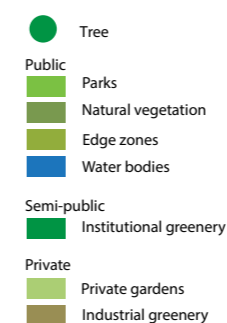
Home gardens or greenery in the public space but that are clearly belonging to the connecting house

Industrial greenery

Greenery in connection to industries or similar establishments.



Summarizing map of public, semipublic and private greenery



Public greenspaces

Semipublic and private greenspaces

Public parks Scale 1: 15000/A3

Analysis of accessibility & use

Accessibility depends on both legal and physical access to green spaces. The ownership of the land limits us in which development we can propose for the space. The use of a space depend on this but also on how attractive a place is to visit or in opposite, if there are mental barriers that deter people from use of it; perceived accessibility

Semi-public and private

The private green spaces are of value for the ecological network and its users but they do not offer access to the public. The semi-public greenspaces are in connection to the schools and community centre and are important for education and inspiration on environment and greenery by reaching out to many people.

Public

The public green spaces mainly consist of edge zones and of the slope of the cerro categorised as a natural zone. The public has legal access to these greenspaces but they are generally not easy to physically access since they coincide with the steepest areas of the barrio and there is a lack of connecting streets. Their location at the edges and lack of possibilities for activity also make them unattractive to visit.

Designed public parks

Out of the public greenspaces only a very small part is designed parks where there is an opportunity for people to interact with greenery through activity or recreation. The park that stretches along the northern canal is quite recently constructed but by observations and conversations we understood that few people spend time here. This is probably because of the combination of a location that is perceived as unsafe and lack of equipment and attractions.



Example of private greenspace



Example of a public park constructed by people from the community.



Examples of public greenspace (an edgezone meeting a natural zone)



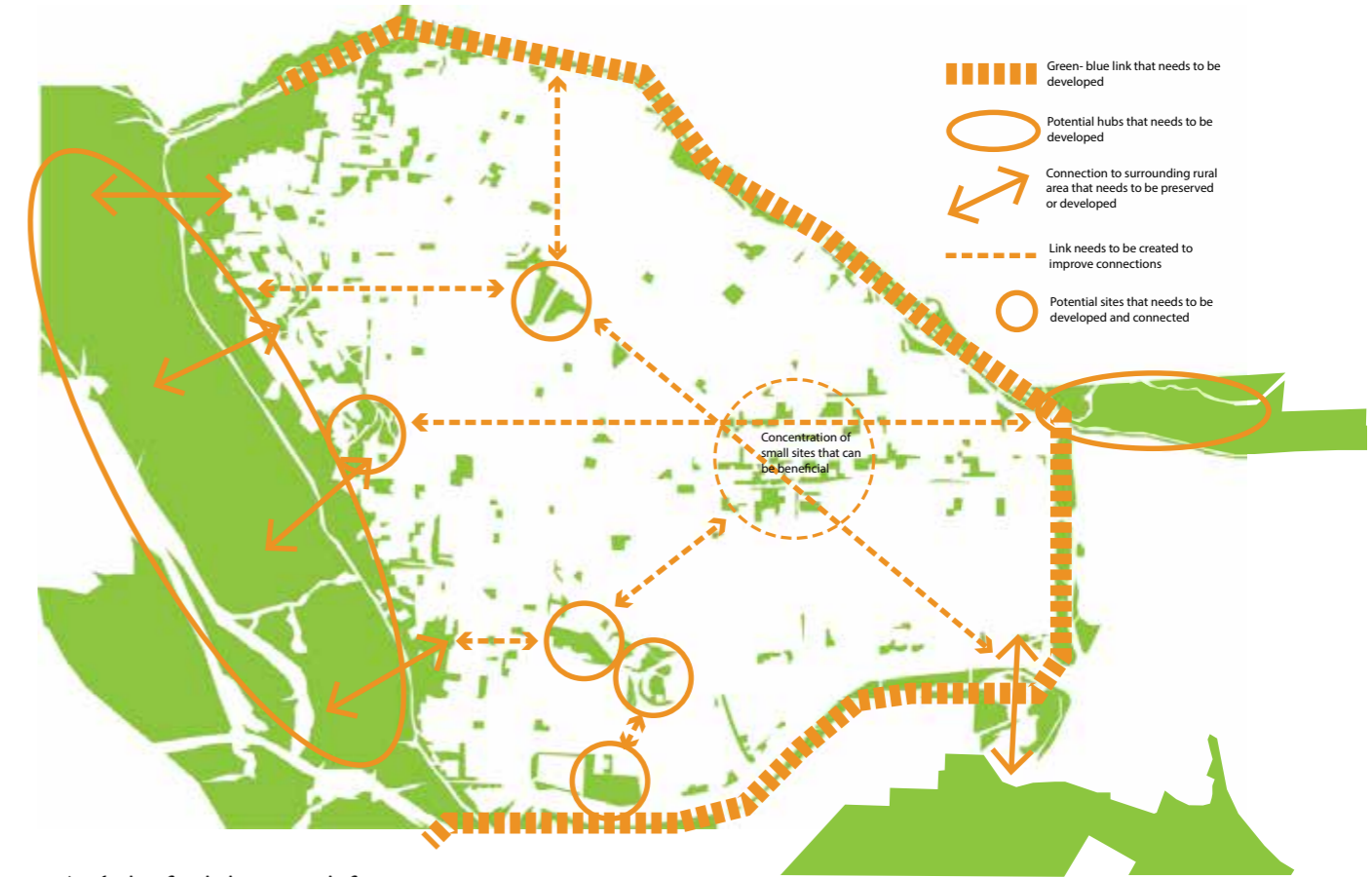
Example of semi-private greenspace (community center)



Examples of public greenspace (an edgezone)



Example of a public park constructed by the local government.



Analysis of existing green infrastructure

Quality

Our first impression of the greenery was that it generally was degraded both in providing different types of habitats, creating biodiversity and in being aesthetically attractive. The green spaces also suffer from the lack of garbage management and there are issues with littering and disposal of masses.

Within the urban fabric the majority of greenery is what we refer to as edge zones. These spaces alter between being streets and green space; grass and low herbs take over in areas less used but gets worn down by tramp and drought in the more frequently used spots. The edge zones along the borders of the barrio are bigger and of more natural character with trees and shrubs. In these places there are also traces of former houses from where people have been relocated.

As identified in the classification, there are a few designed public parks but they also suffer from lack of diversity and quality. The greenery of the parks include trees and thereby providing an additional layer but the groundcover is exclusively lawn that because of the low level of maintenance and dry conditions are of the same character and status as the edge zones.

The urban farming initiatives and some private gardens differ from the greenery as a whole by being diverse in species and in good conditions.

There are trees scattered within the barrio and a concentration around the western border, They are fully grown and constitute an ecological and spatial value.

Analysis of green structure according to GI

In the analysis of the Green Infrastructure we identified which existing green spaces that has the potential to constitute a hub, a link or a site.

The existing greenery around the canal constitute a cohesive border around most of the barrio and we consider it to be an important link in connecting the largest green spaces within the barrio and also to the surrounding natural areas. This relation is considered by us to be the biggest value of the barrio. The western side of Potosí connects to what today is a mining area with relatively poor natural qualities but that has a potential to constitute a bridge between the urban fabric and nature if restored. There is also a potential for connecting the canal along the eastern border with a preserved or possible restored forest in the neighbouring barrio. This would have to include an intervention of a bigger area than what we cover but this possible scenario for development should be considered in our proposal.

Within the urban fabric the greenery is generally fragmented and the sites are poorly connected to each other and to the surrounding nature areas. We identified the sites that because of their size are most important to develop. We also determined where there are links missing in the existing network and that needs to be created.

Summary of site conditions:

- Increase the amount of designed public greenspace
- Utilize the semi-public greenspaces in connection to the schools and community centre to educate and inspire the community in greening their private space
- Increase biodiversity
- Additions of greenery should be aesthetically attractive and of low maintenance
- The locations for urban farming are both ecologically important and places attended by the community and should be preserved
- Create connection between green spaces within the barrio and also to surrounding green areas
- Strengthen the link constituted by the greenery along the canal
- A development of the ecological network should also improve the accessibility to the green spaces in the barrio.



Areas perceived as insecure by interviewed residents



Canal in the east



Slope going north from Cocinol



Canal in north-east



Canal in north-west

Security in Potosí

Through conversations during our walking tours and by the interviews made with people from the community, we understood that many people that live in Potosí experience the barrio as insecure. Especially areas along the west and east parts of the canal and one slope going north from Cocinol were pointed out and the interviewees explained that robberies and drug dealing were common here. When executing our walking tours, the guides were really firm in avoiding this street because they perceived it as a risk for us. One boy that we interviewed explained that he was afraid to go to the northeast parts of the barrio because there had been murders occurring there.

Along the canal there is also a lack of proper lightening which increase the sense of insecurity and people said that they were afraid that someone would hide behind a tree or a shrub. Because of these problems people avoid the areas around the canal, making them increasingly insecure.

In Potosí, the areas considered as unsafe by the community often coincide with green spaces, which we perceive as results in hesitant attitudes towards greenery in general. This connection between greenery and experience of insecurity is a problem also in other informal settlements according to our interviews with Colombian landscape architects.

Many of the residents said that they feel secure in their own block where they know their neighbours, and that they mainly spend time in their own block. Our main guide, Nini, explained that the trust between people has changed a lot during the last years. She told us that 20 years ago, everyone left the doors and windows open even if not at home, but now there is a lack of trust between the people in the barrio and people have even started fencing their lots. We believe that this is strongly connected to the security issue; people don't know each other and therefore they don't trust each other, which creates a feeling of insecurity. The schools and the park Puente del Indio in the neighboring barrio were mentioned in the interviews as areas where the residents feel particularly secure. These are both active areas that are well used during the entire day.

The security issue is also connected to the time of the day. During daytime we experienced Potosí as a calm and safe area but we were not recommended to visit the barrio by ourselves or after 4pm in the day. Probably the situation and experience of security changes in the evening and night-time. Through conversations with the students from Javeriana that live in central Bogotá, we understood also the image of Potosí, and similar barrios from the outside is that they generally are insecure and sometimes dangerous places.



Graffiti at the small Cancha



Painted tires used as fence



Decoratively painted landing



Decorated facades

Characteristics & aesthetics

There is a strong tradition of auto-construction of residential houses in the barrio and with limited resources, one result of this is a continuous and long going development and upgrading of the own house, both in number of floors and level of decoration.

The part of the house turning towards the street like the façade and the landing are very important parts of the house and these are often ambitiously decorated and in vivid colours. This dedication often also moves out on the street, enriching the public space with painted stairs and sidewalks, especially around holidays when motives celebrating the current holiday is painted in streets around the barrio. The decorative façades also contribute to the aesthetics of the public space and we believe that these contribute to that streets are experienced as populated

and looked out for and by that also more secure.

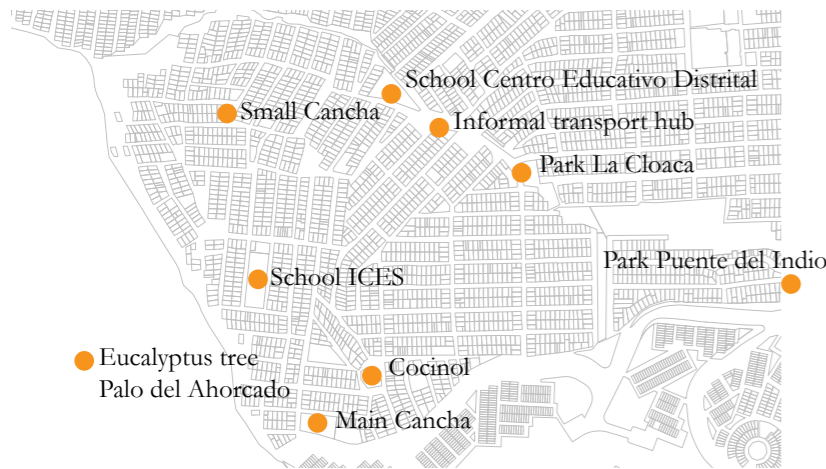
A commonly used building material is, as in the rest of Bogotá, brick.

The recycling of materials is important in the outdoor environments of the barrio and in private gardens. Playgrounds, stairs and fences are often made out of tyres, and plastic bottles or cans in different creative arrangements are used for cultivation. Initially, this might have been a solution that answered to lack of resources but it is also an aesthetic that is important for the identity of this barrio, and of other informal settlements we have visited.

Another characteristic is the tradition of public involvement in making decisions regarding development and design of the barrio making it necessary for us to consider this dynamism and design language in our proposal.

Summary:

- There is a need to improve the sense of security in the area
- There is a need to counteract the hesitant attitude towards green areas
- It is necessary to create green spaces in a way that doesn't limit sight and visibility
- There is a need to improve the trust and solidarity between people in the area
- There is a need to improve the lightning in the area
- The dynamism and tradition of continuous development needs to be considered
- Engagement for the outdoor environment should be utilized and stimulated
- There is a need to incorporate traditional aesthetics in the design to preserve the identity of the barrio



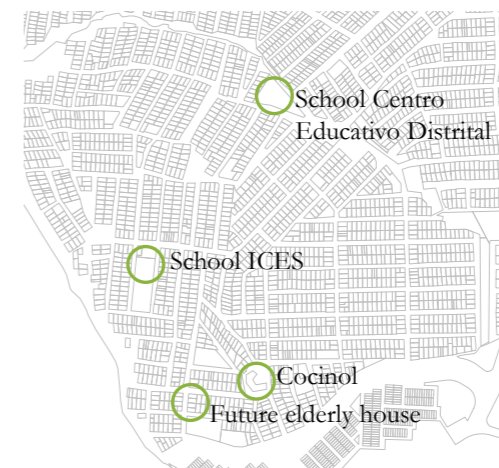
Valued and well-used places



Eucalyptus tree Palo del Ahorcado



The park Puente del Indio



Locations for urban agriculture initiative



Cultivating outside residence



Public school
Instituto Cerros del Sur (ICES)



Main Cancha in the south



Community center Cocinol



Informal transport hub



Cultivation in the school ICES



Collective cultivation at Cocinol

Places valued and well-used by the community

There are in total three schools in the barrio of which we have understood that two are considered to have a big value; Instituto Cerros del Sur (ICES) and Centro Educativo Distrital. These two are the ones referred to as “the schools” from now on. Through conversations with the community and the school staff during our walking tours and during our visits at ICES we have understood that the schools are very appreciated and important to people in the community, and even respected by individuals or crowds that usually cause issues in the barrio by intimidating people or dealing drugs. There are classes during the whole day and in the weekends there is also adult education in ICES.

The main Cancha in the south part of the barrio is a very popular place. During the whole day people are playing football and basketball and kids are playing around in the playgrounds. The schools are using the Cancha for physical education since the school yards in the area are very small. Besides being a place for activities, the Cancha and its surroundings are also important meeting places; here people gather on landings, talks to each other and watch the games. In the north part of the barrio there is a small cancha with field for basketball, some play equipment, seating and a graffiti wall. The park Puente del Indio is located in the neighbouring barrio Arborizadora Alta and is a big area with playgrounds, sport fields and a square. The park is mentioned by many of the residents in Potosí as an important place where they go to do sports, play, meet other people or to eat ice cream. There is a constructed park also in Potosí that includes a playground, paths and seating opportunities (la Cloaca) but this does not seem to be used by the community as extensive as Puente del Indio. We believe that this is because of its more isolated location.

Cocinol is the community and cultural centre of the barrio, and also the seat of the JAC-group. Here the community gathers for decision-making and social events like music or dancing nights. Cocinol is an active place in the barrio and holds the same

level of importance and respect as the schools.

The eucalyptus tree, Palo del Ahorcado, on the top of the Cerro is an important element for the barrio, with both historical and religious value and during Semana Santa (Easter) the people do processional walks to the tree. At the border between Potosí and Caracoli there is an informal transport hub which seem to be the natural place to drop people off or pick them up. There are also buses stopping here but these are not a part of the Transmilenio system. They might be schoolbuses or buses of private transport companies. At our first visit we arrived to this location with a chartered bus.

Activities in the outdoor environment

Every year there is a local rap festival and a cinema arranged in Potosí. Big feasts as Christmas and Semana Santa are very important and there are big public celebrations in the barrio during these times. We could still see traces from previous celebrations; paintings of Santa Claus on the streets and Christmas decorations still hanging on the facades of the houses.

Urban agriculture

Many of the people that have moved to Potosí have an agricultural background and in Potosí there is a big interest for urban agriculture. We could see different innovative solutions for growing plants for example in recycled cans and bottles on roofs and along the facades of residential houses. There are also initiatives for collective cultivation connected to the institutions and these places are well respected, protected and maintained due to their location and the organization behind it where a group of people are clearly responsible for each site. In the interview with Andrey, who is in charge of the initiative, he explained that in the current situation of Potosí it is necessary that there are individuals or groups responsible for the sites for it to be respected.

The two schools are two out of four locations for the collective urban farming in the barrio. The students get involved in the cultivation during school hours and workshops for the community is arranged in weekends and evenings. The other two sites for urban farming are Cocinol and at the site where an elderly activity house is being constructed. The last one is only temporary while waiting for the house to be completed, but this shows a need and wish for more opportunities for urban agriculture sites within the neighbourhood.

Summary:

- Utilise valued and well-used places in the development of a green infrastructure
- More opportunities for urban agriculture should be developed in Potosí
- It is important to connect and involve the residents in projects of urban agriculture to make them respected
- The structure should provide possibilities of implementing urban farming also in public space in the future

Interviews and Workshop with people from the community

To complement our own observations of peoples use of the outdoor environment and to gain a better understanding in peoples experiences and wishes for the outdoor environment as well as getting input on different green designs we conducted interviews with people living in the barrio. The interviews with people from the community were divided into two themes. The first part included questions about how they use their outdoor environment today and the second part focused on implementing greenery. The first part had seven respondents and the second part had four.

First part

In the first part the interviewees were asked about which places and features they appreciate, where they feel safe and unsafe as well as what would make them spend more time in the public spaces of Potosí. Below follows a conclusion of the answers:

Important places

The own house and block, the schools, the park Puente del Indio in Arborizadora Alta, the Cancha and the Community center were mentioned as important places. People spend time here, meet and also feel secure. The cerro with the eucalyptus is also an important place, but feels unsecure because of the low presence of people and police.

Spending time in neighboring barrios

Potosí is surrounded by the barrios Caracoli in the north, Las Brisas in the east and Arborizadora Alta in the south-east. From the interviews with people from the community we understood that the relationship with Caracoli is quite tense; people mentioned that they experienced it to be very separated from Potosí and that they do not spend time there, while the barrio Arborizadora Alta is an appreciated and well visited area, much because of the popular playground Puente del Indio. Almost no one did know where Las Brisas was located.

Popular outdoor activities

Sports like football, basketball and bicycling are the most common things to do in the outdoor environment among the interviewees, but also baby-sitting, playing in the kinder garden and meeting other people is common. In Arborizadora Alta they go to the park Puente del Indio where they do sports, play with the kids, ride bicycle, eat ice cream and meet people. One person answered that she doesn't spend time outdoors because she is working all the time.

Safety

People feel insecure primarily along the canals. Some say that they feel insecure in the whole area of Potosí, mainly because of drug dealing. The interviewees mentioned that they feel secure in their own block and close to their houses where they know everyone. Many also felt secure close to the institutions like the school, close to the police station or in the park Puente del Indio which is located next to the police station in Arborizadora Alta.

What is missing?

Many of the interviewed answered that more and better possibilities for doing sports would make them spend more time outdoors. Also more parks, activities in the weekends, activities for kids and places to meet people were mentioned. Almost every one of the interviewees said that they miss paved streets in the outdoor environment. Also safety is a big issue in Potosi; some of the interviewed said that they would like to have more presence by the police in the streets to feel safer. One person mentioned that she miss bicycle paths, slides, green spaces and trees in the outdoor environment.

For the last question we provided alternatives of functions and activities that are commonly used in the outdoor environment and that we, through inventory and conversations had concluded to be missing or insufficient in the barrio. The interviewees got to mark which functions and activities they would prefer in Potosí. The result of this question is presented below.

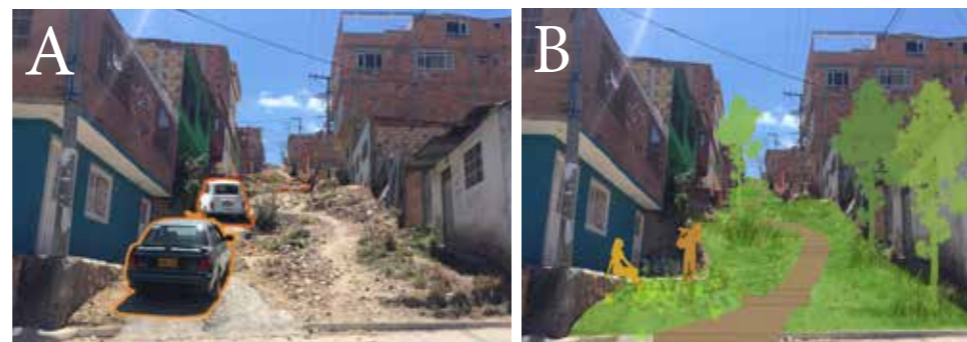
	1	2	3	4	5	6	7
Playgrounds	x	x	x	x			x
Sport field	x	x	x		x	x	
Farming	x	x	x		x	x	
Opportunities to sit down and relax	x	x	x				x
Outdoor gym	x		x	x	x	x	x
BBQ area	x	x					
Stage for different performances	x		x	x		x	
Recreational park	x	x					
Other: cinema	x	x					

Result of last interview question. Number 1-7 represents the seven interviewees and the letter x marks out which functions and activities the interviewees would like to have in Potosí.

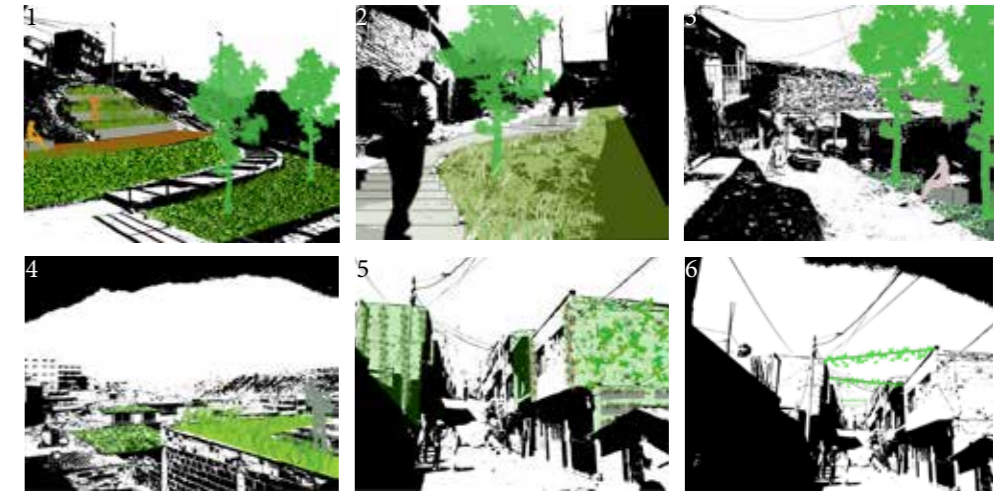
Second part

In the second part illustrations of alternative design principles constructed by us were presented to the interviewees with the purpose to get their reactions on them.

To get a picture of the attitudes towards pedestrian paths as a solution to some of the steep streets, we presented two images for the interviewees and asked them which one they preferred. No one except one of the interviewed owned a car. The persons who didn't own a car preferred option B; one person said that she selected alternative B partly because she doesn't own a car but also because she think that pedestrian paths would gain more people since many that live here don't own a car. Another argued that plants are good because they produce oxygen and mitigate pollution and also note that there are few green spaces and spaces for walking in the area. The person that owns a car preferred option A because he thinks that accessibility with the car to the house is very important.



The sketches used to visualise solutions for steep streets (A and B)



The sketches used to visualise the designprinciples 1-6.



A photo collage was used to visualize design principle 7.

We also asked the interviewees opinion on the following seven design principles for including more greenery. The designs were visualized in a sketch and the questions to the interviewees were:

- What are your thoughts on this idea?
- Do you think that this idea would be good to implement in Potosí?
- Do you see any problems with this idea in Potosí? Which problems?

1) Public green area or park with space for different activities and recreation

All of the interviewed liked the idea of a bigger park in the barrio and also that it was possible for Potosí. One of the interviewees stated that people would probably appreciate it and take care of it. Possible problems pointed out were the importance of not interrupting the mobility of cars and rescue vehicles when choosing a location and also that it might attract drug consuming. The person bringing up the drugs also mentioned that lightening would probably not help since they usually don't hide their business. One of the interviewees recommended keeping flower plantings and edible crops separate.

2) Creating green pedestrian paths in steep and unpaved roads in the neighborhood

Three of the interviewees liked the idea and one person felt that it would improve the general condition of the barrio and also thought it would be appreciated and maintained by the community. Possible problems mentioned were difficulties cleaning up in general and especially after stray dogs. One person did not like the idea because it would interfere with the accessibility for both pedestrians and vehicles.

3) More greenery in the street such as street trees or small greenspaces with seating beside the streets.

Two of the interviewees clearly expressed that this was a bad idea and not appropriate in Potosí. Possible problems identified were that drug dealing and consuming would take place in the pockets and that it would be a place of insecurity and perhaps for robbery. The other two said that there is not enough space and that the design would be an obstacle for pedestrians on the narrow streets.

4) Greenery on roofs that also could be used for urban farming.

One of the interviewees did not like the idea but the others were positive. One pointed out that it would be good for the environment and another one told us

Interviews and Workshop with people from the community

that he is the son of a farmer and would love to have a roof like that. All but one thought it would be possible to implement in the barrio but pointed out that since its on people private houses it depends on if the individual that owns the house has an interest in taking care of plants. One of them complemented this by saying that many people in the barrio are former farmers from the rural side of Colombia and like to work with plants. One of the interviewees preferred greenery in front of the houses instead.

5) Greenery on walls

All but one of the interviewees were positive to the idea and one of them was kind of ecstatic saying that if someone just told him how it was done he would very much like to do it to his wall. The last person was hesitant about the impact that humidity and soil close to the walls might have on the house and also pointed out that people in the barrio generally are very fond of their houses and value their facades so it has to be a personal decision. The same person was also worried that it might be difficult to maintain.

6) Wire-constructions above the streets which also would provide shade

All but one reacted positive to the idea; they thought it was pretty and that it could work in the barrio. The last person did not think it was beautiful and would not like to see it in the barrio. When asked about potential problems it appeared quite a lot of issues, especially concerning the fact that it had to be shared by two houses. It was pointed out that this could cause a conflict between the neighbors sharing it and also that it could be problematic that it does not clearly belong to one person and therefore might not be taken care of. The potential interaction between the wire and the above-ground electrical wires was also brought up.

7) Mobile constructions for farming possible to move around the house and outside

All of the interviewees thought this was a good idea in general and also to implement in Potosí. One person suggested that it could be done in a collaborate way by sharing plants with each other in the barrio. One person said that they have a lot of materials in the barrio that are possible to recycle and that it by using those, it would be economically possible to implement in Potosí. One problem that was mentioned was the risk of someone stealing them.

Interview with Wilder Andrey Tellez Gonzalez, Potosí

We also conducted an interview with Andrey, who is involved in projects of urban agriculture in the barrio. This interview gave us insights in the benefits and issues of the initiatives.

When meeting with Andrey we talked about the importance of urban agriculture from different aspects. Andrey started by talking about the ideology of the project. He means that the city is dependent of agriculture and that there is a need to bridge the gap between the urban and rural areas. For him, urban agriculture also has political aspects; fighting the multinational food production by producing more locally and to give people the knowledge and power to choose alternatives. Andrey mentions the importance of using traditional crops and methods to connect to the cultural heritage.

Cultivation has a long tradition in Potosí and it is an important character of the barrio. Andrey says that many people in Potosí come from the countryside and that urban agriculture is a way to reconnect people to their background and to show that it is possible to do small-scale farming in the city as well.

Today, they do urban agriculture in four different locations in Potosí. Andrey is convinced that this solution, with a few specific places, is the best one today. This

both because of the soil improvements that needs to be done and also because he thinks that it is necessary to have individuals responsible for the sites in order for people to respect it and take good care of it. Andrey says that most people of the community support the initiative, but not everyone is engaged. Many people work long days and don't have time and some already have cultivation projects of their own. Mainly children, young adults and retired people are actively engaged, because they spend more time in the neighborhood.

Workshops are organized in the schools together with the JAC-group with the purpose to educate people on urban farming so that they can do the same at home and also teach each other, to strengthen the tradition. Andrey tells us that it is a pedagogical process in two parts; practical and theoretical. For the practical experience, the strategy is learning by doing which often also results in a sentimental connection to the nature. The theoretical part focuses on spreading knowledge of the ideology and of sustainable use of natural resources.

Andrey says that he sees many positive effects of the urban agriculture in Potosí; He finds that the cultivation reconnect people with nature and help them appreciate both nature and life, making people take better care of their outdoor environment. He also says that it builds a more general environmental consciousness. The people involved tend to consider and engage also in other environmental issues of the neighborhood, for example mining and littering.

Andrey tells us that many of the difficulties and problems that they have with the project is related to the climate and soil conditions. The combination of sandy soil, dry climate and the strong sun demands a lot of watering but they are missing the adequate infrastructure to cultivate successfully in some of their sites. They also have problem getting the right seeds. The certified seeds, which are often genetically modified, need other products such as specific pesticides that most people in Potosí cannot afford. He would prefer if they primarily could use native and local seeds which also would be valuable in preserving the culture and natural history.



“Many people in Potosí come from the countryside and urban farming is a way to reconnect people to their background”

(Andrey)

Summary:

- There is a need to create possibilities of strengthened relationship to surrounding barrios
- The connection to the park Puente del Indio is important and need to be improved
- The urban agriculture should be arranged in specific locations and with someone clearly responsible in order to be respected as the conditions look like today
- Possibilities of collecting rain water in connection to the locations for urban farming should be provided

Workshop in Potosí 18th-19th of February

During two days in February we took part in a workshop in Potosí that allowed us to experience both the strong engagement and commitment to common cause and projects that exist in the barrio as well as see how it is possible to, with what for us seemed like very scarce resources, generate a lot of joy and appreciation. We also got to encounter the worry of “wrong people” appropriating public space up-close. We have learned a lot about the dynamics and sentiment of the barrio during our site study that does not transcend into other parts of our site description enough and we feel that the story of these two days helps to convey a holistic picture of Potosí.

The workshop was arranged by Pontificia Universidad Javeriana in Bogota for a group of students from the architect program and we had the pleasure to join them. An empty space in Potosí had been identified and the plan was to convert this place into a playground made of reused tires. The students had already made a plan for the playground, and the first day we took measurements and started with some of the construction. One important aim with their plan was to inspire the community to continue developing this or other playgrounds and for that reason it was important that it was constructed with materials and tools that are accessible to the community. When we were just about to start a woman living in one of the houses close to the place confronted us. She was upset and critical to the work because she thought that the playground could attract also teenagers and criminal people that would disturb the block and damage her house during evenings and nights. While we were working other people in the neighborhood joined us, they helped us with digging, played music, served us panela (a sweet drink typical for Colombia) and kids were already playing around.

The next day we finished the construction and after that we started to paint the tires and plant flowers in the pots made of tires. Every pot got a sign with the name of the family that had promised to take care of and water the plants. During our work the people in the neighborhood collected some food together and a woman started to cook us soup over an open fire. We worked the whole day, and in the afternoon the playground was finished. When we were almost finished the woman that had confronted us the first day came back. She apologized for being skeptical to the work and said that she now thought it was a good project and that the result was very pretty.

During our last visit in Potosí, two weeks after the workshop, we returned to the playground. The playground was in very good condition and people took care of it; an old man was sweeping the area and the flowers were recently watered. We were told that it was well used and appreciated by the children in the area.



The playground constructed during the workshop in Potosí

Analysis based on Lynch

To better comprehend the physical and experienced structure of Potosí, the results from the inventory and analysis together with the results from the interviews with the community, are summarized in a map according to Lynch's model for analysing.



Districts

The identified districts are higher and lower Potosí and also a couple of blocks in the northwest where conditions are especially poor and that many people refer to as unsecure.

Landmarks

The identified landmarks are a school on the top of the hill in the neighboring barrio Caracoli and Palo del Ahorcado on the cerro west of the barrio.

Node

We have identified the bus stop, the main cancha, community center Cocinol, kindergarden, the transport hub and the school ISEC as the most important nodes of the barrio. The park Puente del Indio and the bus stop for public transport are also included even though they are not situated in the barrio because of their importance for people in the barrio. Other nodes identified are the other schools, the small cancha, the church and the healthcare facility.

Paths

The paths marked in the map are the ones most frequently used by pedestrians.

Edge

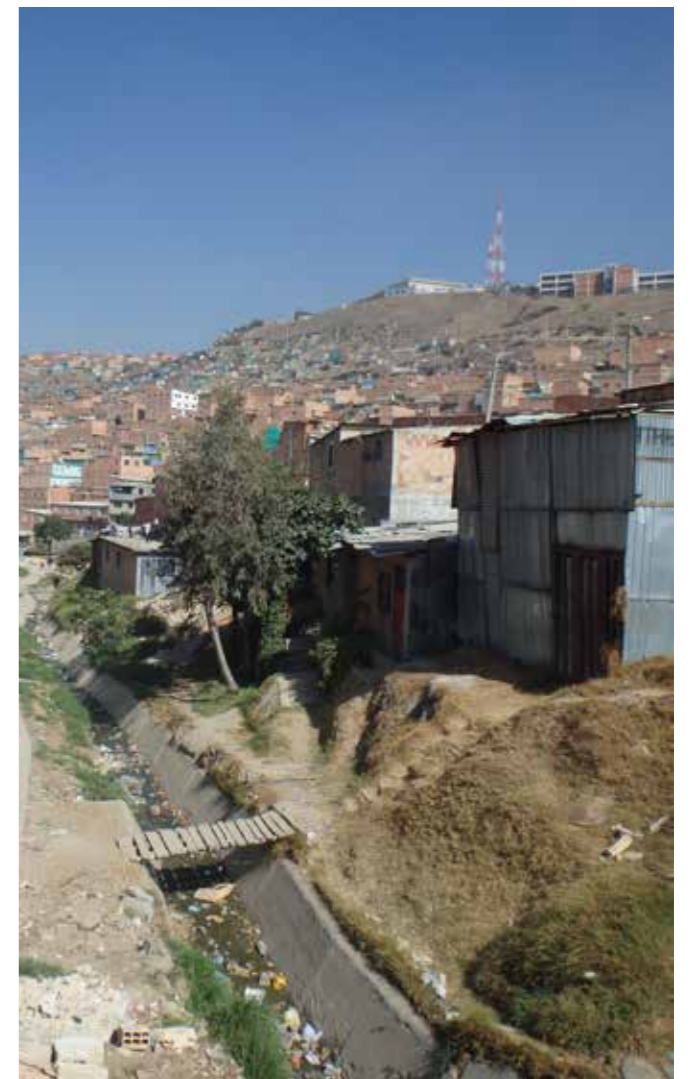
The canals and the big road are identified as edges; they constitute a barrier that divides Potosí from neighboring barrios. The long blocks that cut off the passage in the middle of the barrio and one of the slopes where drug dealing is concentrated are also considered edges that interfere with how people move in the barrio.



The identified node playground la Cloaca



The identified landmark Palo del Ahorcado



Identified landmark; school in Caracoli and the canal that we perceive to constitute a barrier

Compilation of site conditions

Below follows a compilation of the summaries presented in each section of Inventory & analysis, interviews and workshop with the community.

Land use

- There is a need to work with a strategy for the development of the barrio and Cerro in a future without mining activity
- There is a need to implement greenery in combination with other needed improvements in the barrio to solve several issues at once
- The streets should be utilized in the proposal since they constitute the majority of the public space within the barrio.
- Primarily vacant areas should be used in the proposal

Topography, landslide and water management

- There is a need for solutions that improves access and use of steep areas
- There is a need for a more effective solution for preventing occupation of the areas where there is a high risk for landslide
- There is a need for solutions to stabilize the soil in high risk places
- There is a need to incorporate more permeable surfaces when upgrading streets and the canal

Morphology and road network

- There is a need to preserve the accessibility of motor vehicles on the main streets
- There is a need to provide a more accessible and safe street network for pedestrians
- There is a need to improve the access points to as well as the sense of security of the pedestrian path along the canal
- There is a need for a solution that increases the accessibility in the slopes

Green structure

- Increase the amount of designed public greenspace
- Utilize the semi-public greenspaces in connection to the schools and community centre to educate and inspire the community in greening their private space
- Increase biodiversity
- Additions of greenery should be aesthetically attractive and of low maintenance
- The locations for urban farming are both ecologically important and places attended by the community and should be preserved
- Create connection between green spaces within the barrio and also to surrounding green areas
- Strengthen the link constituted by the greenery along the canal
- A development of the ecological network should also improve the accessibility to the green spaces of the barrio.

Security

- **There is a need to improve the sense of security in the area**
- There is a need to counteract the hesitant attitude towards green areas
- It is necessary to create green spaces in a way that doesn't limit sight and visibility
- **There is a need to improve the trust and solidarity between people in the area**
- There is a need to improve the lightning in the area

Character & Aesthetics

- **The dynamism and tradition of continuous development needs to be considered**
- **Engagement for the outdoor environment should be utilized and stimulated**
- There is a need to incorporate traditional aesthetics in the design to preserve the identity of the barrio

Valued and well-used places

- Utilise valued and well-used places in the development of a green infrastructure

Activities

- Improve possibilities to perform activities

Urban agriculture

- More opportunities for urban agriculture should be developed in Potosí
- It is important to connect and involve the residents in projects of urban agriculture to make them respected
- The structure should provide possibilities of implementing urban farming also in public space in the future

Interviews

- There is a need to create possibilities of strengthened relationship to surrounding barrios
- The connection to the park Puente del Indio is important and need to be improved
- The urban agriculture should be arranged in specific locations and with someone clearly responsible in order to be respected as the conditions look like today
- Possibilities of collecting rain water in connection to the locations for urban farming should be provided

From the summary of site conditions, four aspects were identified as not possible to concretely or solely solve in a design, but that are fundamental to consider when creating a Green Infrastructure in Potosí.

Create Security

The sense of security affects how people experience and use their outdoor environment and is therefore fundamental to consider in creating a green structure in the area that will be appreciated.

Build solidarity and trust

If there is a low level of solidarity and trust in the community, the use of the outdoor environment decreases which increases the sense of insecurity. The outdoor environment should offer places where all people can interact and build relationships.

Utilize initiatives and engagements

Within the area we can see different initiatives and engagements in the outdoor environment. This character is very important to take care of and further encourage to create a stronger contact between people and their environment as well as a feeling of responsibility and concern.

Allow for continuous development

The environment has grown and been formed by the needs and wishes of its residents, and this is also how the development is going to continue in the site. It is therefore fundamental to create a structure that that is flexible for, enables and initiates further development depending on future needs and wishes, but also to allow people be a part of the creation of their environment.

Theories & Concepts
Potosí in a larger context

Site conditions			
Create Security	Build solidarity and trust	Utilise Initiative and engagement	Allow Continous development

Proposal



6. Proposal for Green Infrastructure in Potosí

This chapter presents our design proposal for a Green Infrastructure in Potosí, anchored in previous information from the theories & concepts studied and the inventory, analysis and interviews conducted in the case study. First, the vision for the site is stated, followed by the program and the concept that will help us achieve the vision. In the following section the base and content for the structure will be described introducing the final proposal of the Green Infrastructure. This is followed by more detailed descriptions of the proposal through different design principles.

Vision

Our vision for Potosí is a green neighborhood where people interact with each other and nature. The green structure is resilient and promotes ecological and social sustainability. People value the greenery and this attachment motivates concern and stewardship of the green spaces and the ecological systems. The outdoor environment stimulates engagement and initiatives from the community and allows creativity and continues development according to these. There is a strong trust within the community and people feel safe when moving in the whole neighborhood regardless of time in the day. There is a constant movement of people between the attractions of the neighborhood and everyone has good access to greenery.

Program and Guidelines for Potosí

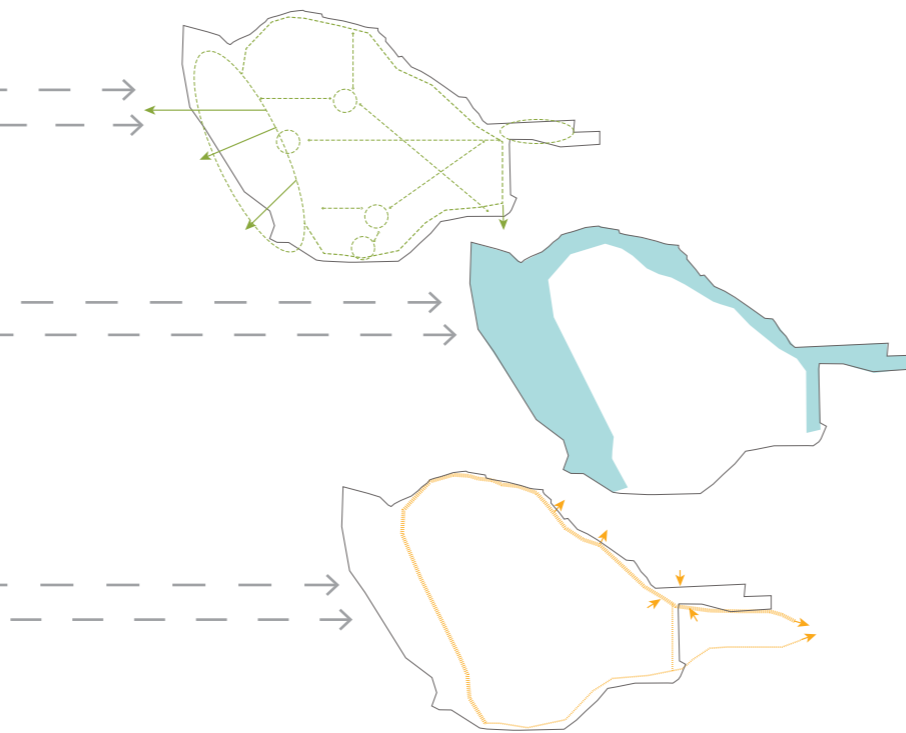
To propose a green infrastructure that promotes ecological, social and recreational benefits in Potosí we have formulated a program and guidelines. The program contains the aspects possible to handle within the field of landscape architecture and will serve as the base for a development that can achieve the vision. The program points that are site specific are complemented with illustrations that describes where they should be implemented. The guidelines are aspects that cannot be solved solely through design of the green infrastructure but points out the direction for the proposal.

Programme

- Create a green structure that contain hubs and sites connected with links
- Strengthen the connection between the greenery in Potosí with the surrounding nature
- Increase the quality of the green spaces
- Promote biodiversity in the area
- Use native plant material suitable for the site conditions
- Retain people from residing in hazardous zones
- Improve soil stability
- Promote movement and activity to improve sense of security
- Increase accessibility and attraction of the green spaces
- Create a range of public places that provide recreation and meeting places for different target groups
- Enhance the accessibility for pedestrians
- Provide possibilities of improved connections and accessibility to the surrounding barrios
- Activate the edges of the barrio
- Create a structure with potential for continuous development
- Utilise existing resources and values of the built and natural environment as well as of the community.
- Apply low-maintenance solutions where possible

Guidelines

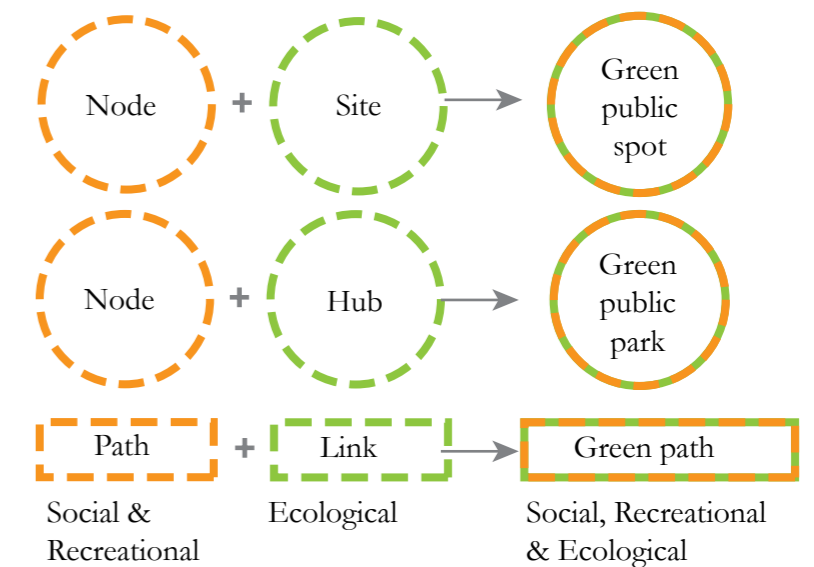
- Create Security
- Build solidarity and trust
- Utilize initiatives and engagements
- Allow for continuous development



Concept: More eyes on the greenery

To help us implement the program and achieve the stated vision we created a concept for the design proposal. The strategy is to create a green network of hubs, sites and links that coincide with a network of well used paths and nodes. In this way active spaces go green and green spaces go active, to improve sense of security through *more eyes on the greenery*.

To create this, hubs will be combined with nodes into Green public parks, sites combined with nodes into Green public spots and links will coincide with well used paths to create Green paths.



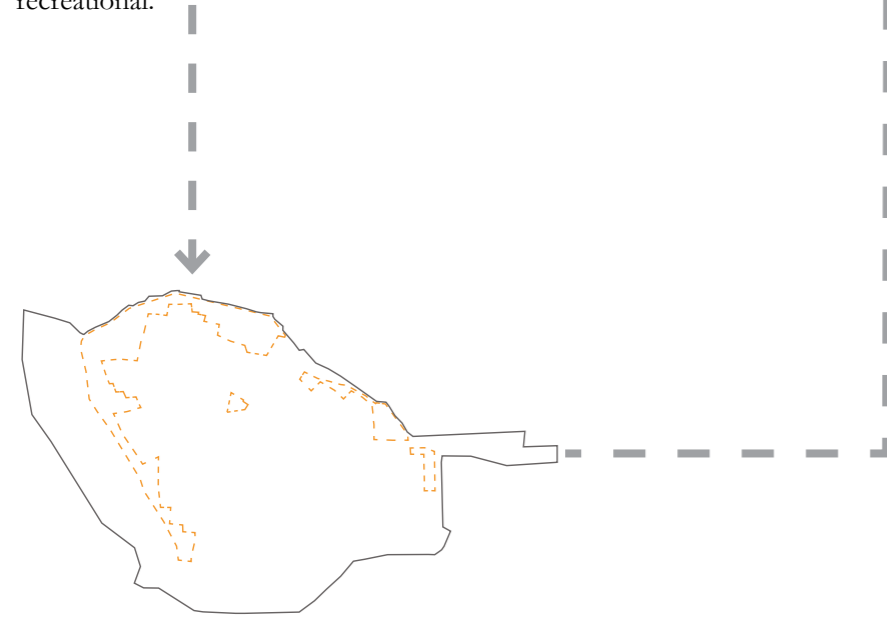
Spaces to use

This section describes which areas that are included in our design proposal and states how our concept will be applied to them.



Existing green spaces

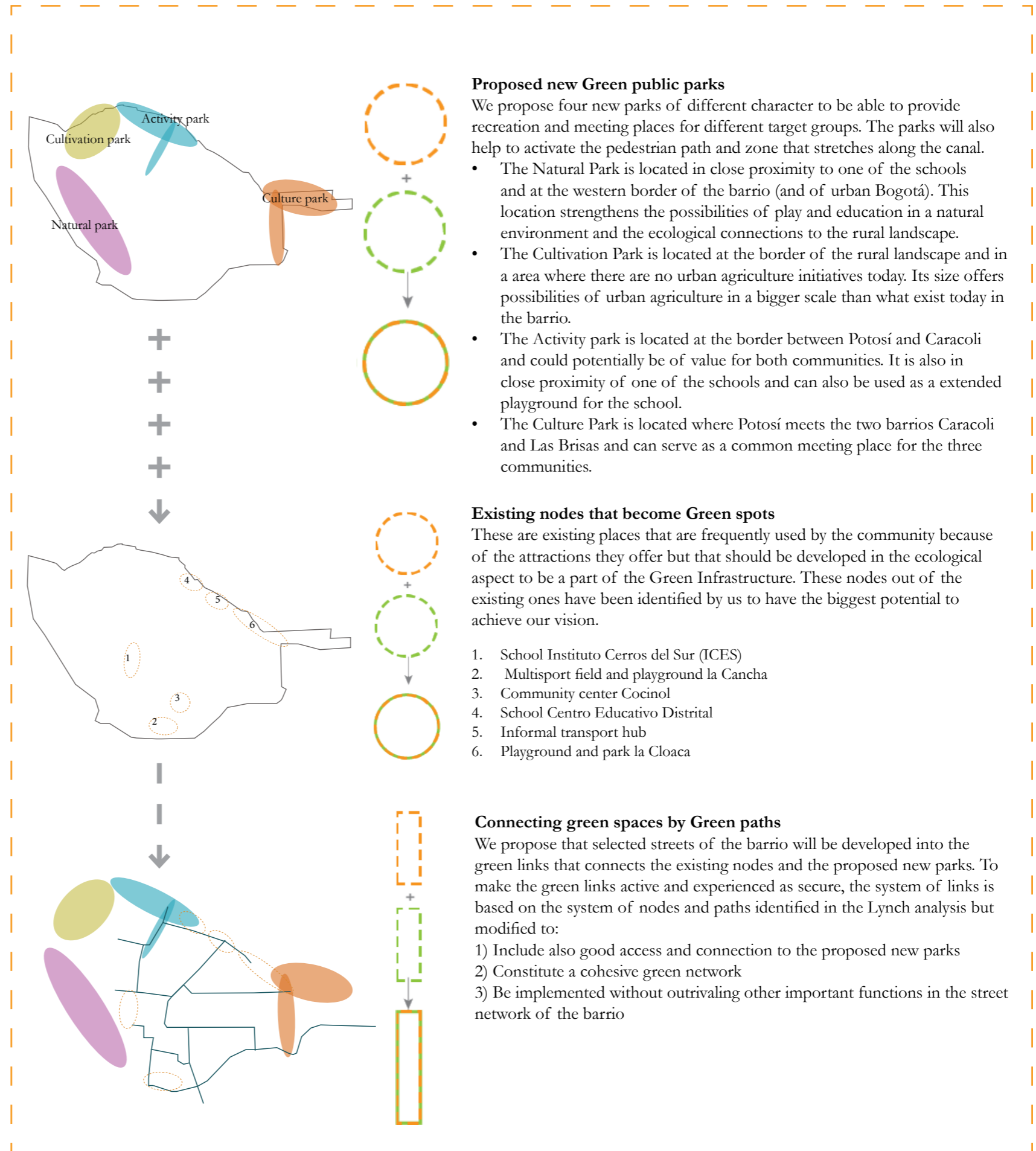
These are the existing green spaces of the barrio. Regardless of legal ownership or quality they are all a part of the Green Infrastructure of Potosí. We will however focus on selected parts to develop in our proposal. The parts selected are the ones estimated by us to have the greatest potential to benefit the barrio both ecologically, social and recreational.



Extension of existing green spaces

The marked areas are constituted partly of public greenery that today do not offer any function or attract users, and partly by residential houses. We propose that residents living in houses within marked areas are relocated and that the greenery is extended to cover the whole areas marked in the illustration. We motivate this by the fact that:

- 1) these areas are in high risk of landslide and people should not reside here in the long term and
- 2) these areas will be an important complement to the existing green infrastructure. Creating valued parks in these locations could prevent settling, resettling and generate benefits for the whole community.





Content of structure

This section describes the content of the Green Infrastructure, broken down in two parts; attractions for social and recreational benefits and tools for achieving ecological benefits. The attractions and tools are going to be used in specific places inside the structure, showed in the next section.












Attractions

Through the information gathered through the case study and visited reference projects, we have selected attractions that respond to desires and needs in the barrio and that we consider to be executable in the site. The purpose with the attractions is to create meeting places with social and recreational benefits.

- | | | | |
|--|---|---|--------------------------------|
|  | Playground |  | Sculpture gallery |
|  | Farming |  | Environmental education |
|  | Outdoor gym |  | Skate |
|  | Sport fields | | |
|  | Stage for different performances | | |
|  | BBQ area | | |
|  | Outdoor cinema | | |
|  | Center ex. Library | | |
|  | Food hub | | |
|  | Grafitti gallery | | |

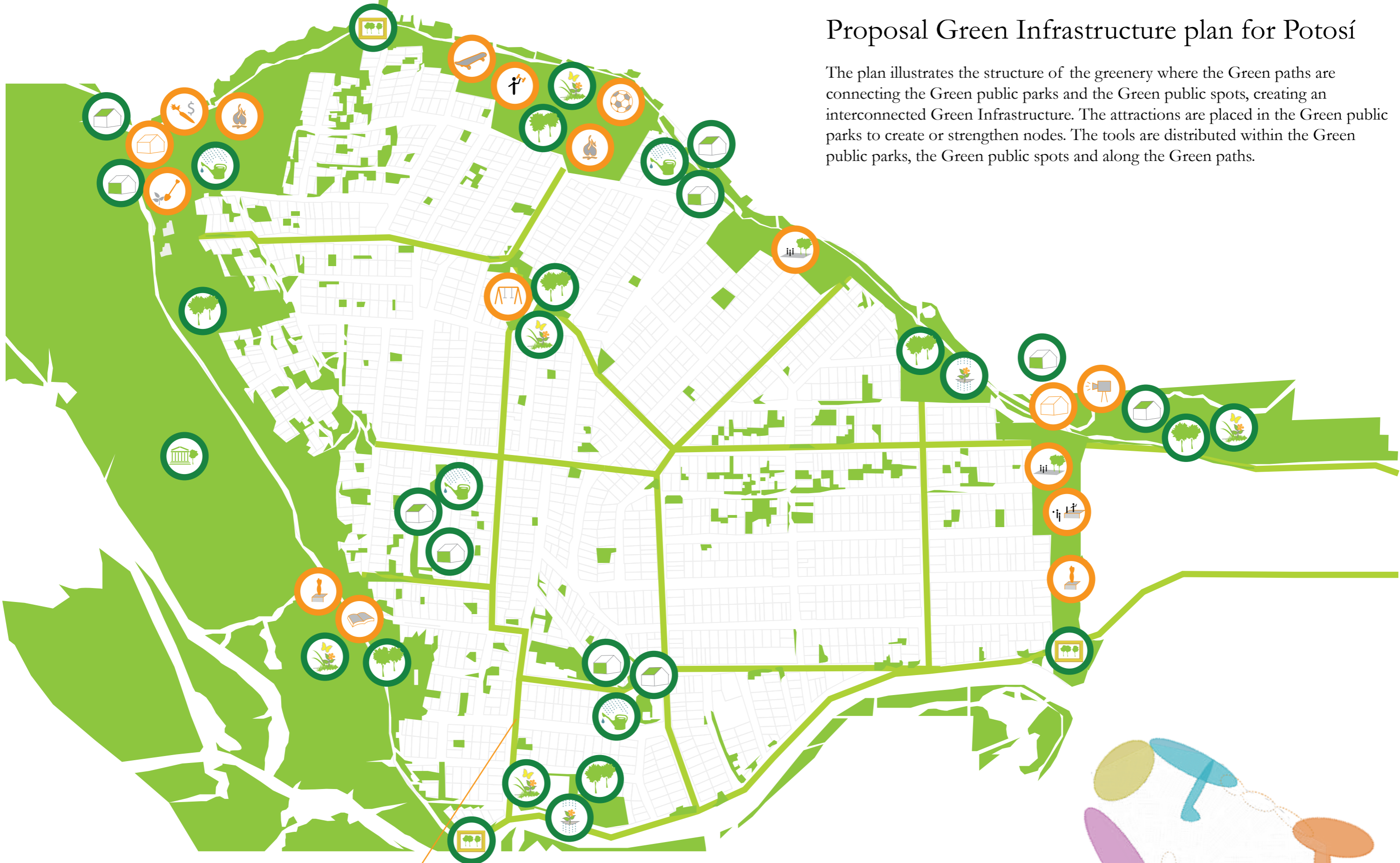
Tools

Through the site survey and the literature study of Ecological Design we have identified tools that can be used for achieving ecological benefits and are applicable in Potosí. The tools and a description of which values they can have for Potosí is described below.

- | | | | |
|---|--|---|--|
|  | Street trees
Benefits include providing habitat for birds and insects, produce shade and regulate temperature. They can also be important in visual and physical distinction of different areas and paths (Rottle & Yocom 2010, p. 163-164). |  | Swales
These are applicable along the canals. Should be designed to be able to store big volumes of water when needed but that during the dry period could be used for other purposes |
|  | Trees or shrubs in groups or solitary
Benefits as above. |  | Rain gardens
These are applicable along streets, in parks or other green spaces to take care of run-off water. Should be designed with plant material that can handle both drought and flooding |
|  | Planting strips
Provide habitat for insects and birds, create distinction between areas and functions and can be designed to collect, detain and treat storm water (Rottle & Yocom 2010, p. 163-164). They can be combined with street trees to create multi layered plantings along streets. |  | Interventions to show landscape
These can be used in different ways depending on site. The connection to the rural landscape can be highlighted through both improved access and through elements that enhance sightlines |
|  | Green roofs
Provide habitat for insects and detain precipitation. In roof terraces they can also be designed for cultivation and for collection and reuse of precipitation. Considering the density of the barrio, green roofs has a potential to contribute a lot to the Green Infrastructure if implemented by many. The majority of the houses are privately owned and the decision of implementing has to be the house owners. However, implementing green roofs on the institutional buildings of the barrio could serve as an inspiring example and model for the community. |  | Restoration of native and historical functions
The functions present for using this tool in Potosí could be restoring vegetation or restore the historical use of the eucalyptus. To provide possibilities for urban agriculture can also be incorporated in this tool because of the long going tradition in the barrio and also in some way because of agriculture being a vital part of many residents lives. |
|  | Green walls
Green walls can provide greenery where there is a lack of horizontal space. Implementing green walls on the institutional buildings of the barrio could serve as an inspiring example and model for the community. |  | Biodiverse flowerplantings
Should be composed with native plant material and used in places where aesthetic impressions are especially important, for example strengthening entrances. |
|  | Collect rainwater (to reuse)
Collecting precipitation can be one of the solutions to mitigate the negative effects of storm water. It is especially beneficial to include in locations of urban farming. | | |

Proposal Green Infrastructure plan for Potosí

The plan illustrates the structure of the greenery where the Green paths are connecting the Green public parks and the Green public spots, creating an interconnected Green Infrastructure. The attractions are placed in the Green public parks to create or strengthen nodes. The tools are distributed within the Green public parks, the Green public spots and along the Green paths.



Tools used for green paths, see following section for details



Green public parks Parks and green spots

Proposal Green paths

The system of green paths consist of selected parts of the street network in the barrio, the main road and of the Canal path along the border of the barrio.

Street network

The network of green paths consist of existing streets in the barrio that are developed ecologically. These are complemented with three new green paths to create a more cohesive and logical structure to orientate oneself within. Rain gardens, street trees and street greenery are the tools used in the street network inside the barrio to increase biodiversity and to take care of run-off water.

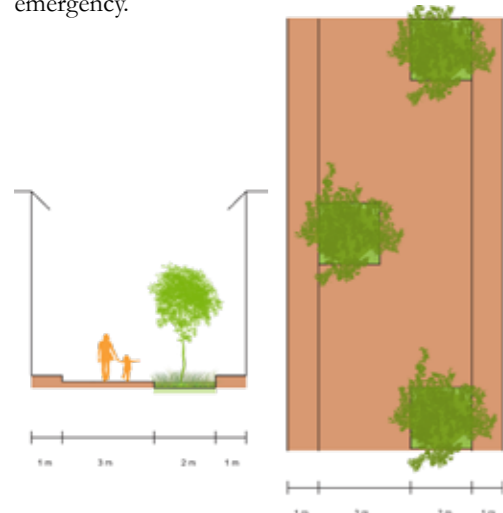
To be experienced as green links, the planting beds have a minimum width of 1.5 meters, but where there is more space, they are wider. The plant material consist of low and transparent vegetation to not limit visibility. Inside the barrio, the planting beds are designed as rain gardens that can infiltrate and detain run-off water, and the selected plants tolerate both dry and wet conditions. Where there is enough space, the rain gardens are complemented with street trees, which require beds of minimum 2 meters. The trees have a narrow or high canopy to keep a distance to the façades and to not disturb the visibility. They are distributed to not create blind corners or block the sight in junctions. Along the main road, wide planting strips are implemented in combination with trees that are high enough to allow large vehicles such as buses to pass underneath. The greenery creates a distinction between the walking path and the main road to increase the safety for pedestrians and to lower the impression of the traffic. The planting strips consist of species that require low maintenance, but can be developed with other species if desired.

Principles for street greenery

There is a high complexity in the street network, with great variations in topography and width of the streets. The five principals are designed to suit different situations according to requirements of use, width and steepness of the street. The principles are not site specific, and it is the conditions of each specific street that determine which principle that can be used. Therefore the principles will vary along the street network. The principle for the main road is the only principle that is site specific, this was possible since the main road has a consistent width. This width is not found anywhere else in the barrio and therefore this principle cannot be used in other situations. The principles are shown in their narrowest scenario. If the street where a specific principle is going to be implemented is wider than illustrated in the principle, the width of the greenery is extended. In all the principles, respect is paid to the landings along the façades and their function as transition between the private and public space.

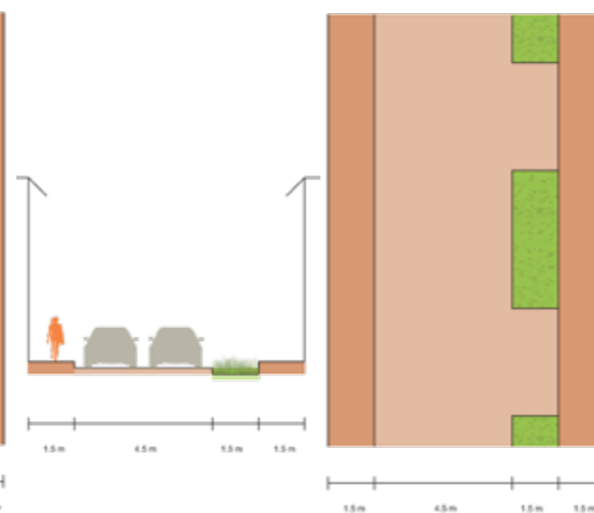
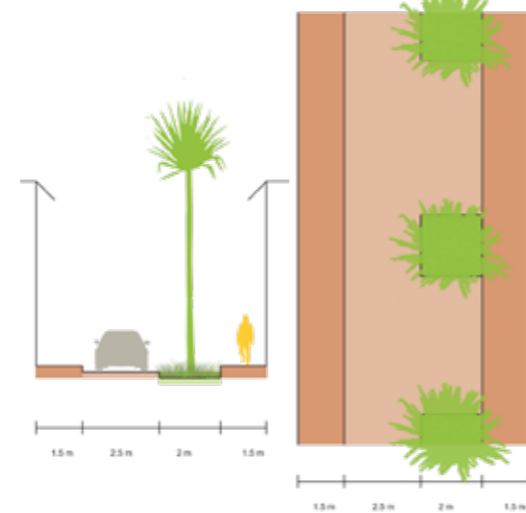
Pedestrian streets

Motor vehicles are forbidden, but there is enough space to drive a car in case of emergency.



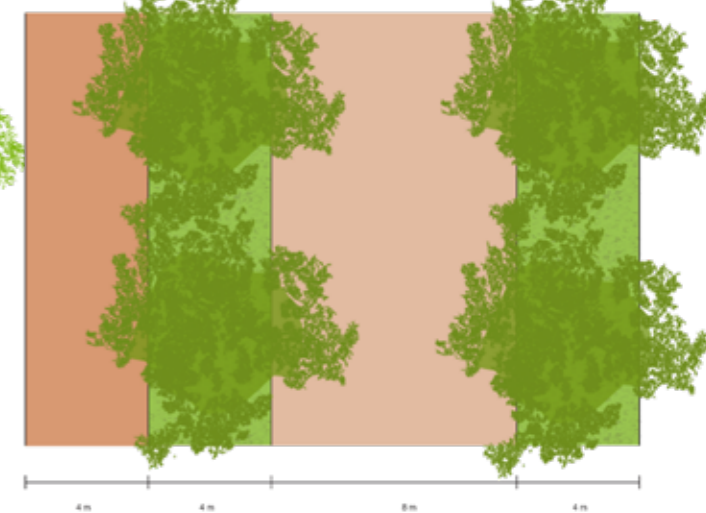
Streets with vehicles

When there is space enough or specific requirements of accessibility by car, space for one or two way car lanes is left over, but always complemented with sidewalks

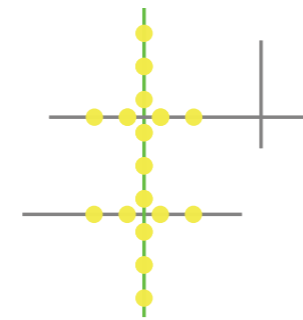


Main road

Along the main road in the south a wide sidewalk is constructed to increase the accessibility for pedestrians and to strengthen the connection to Arborizadora Alta and Puente del Indio.

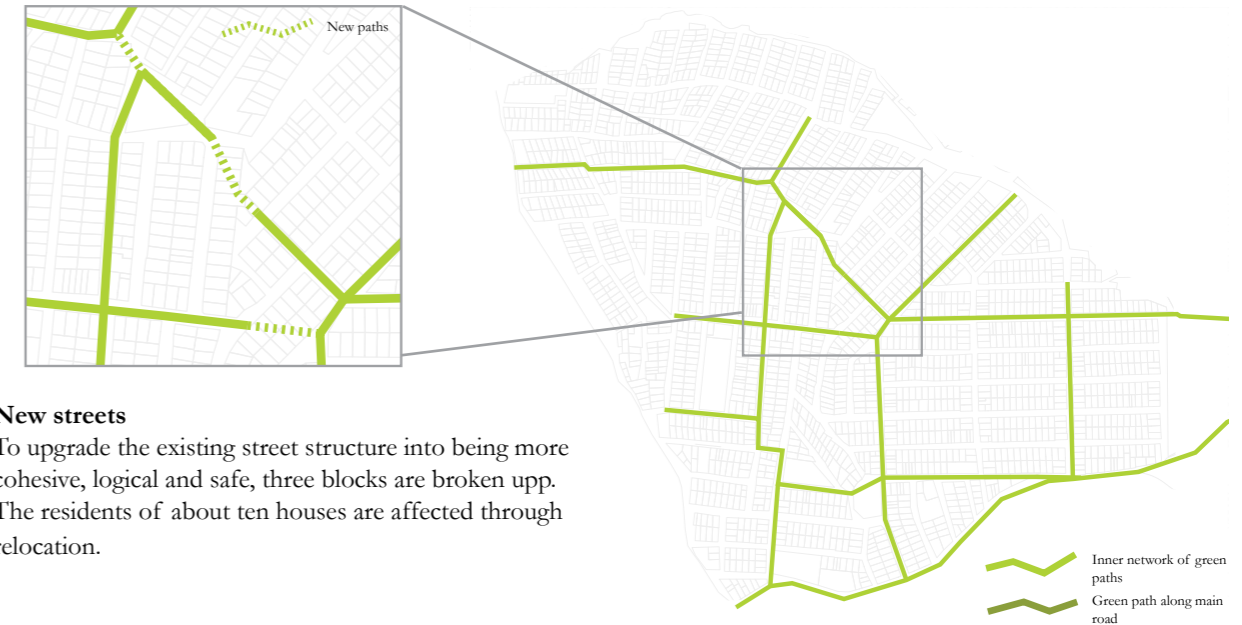
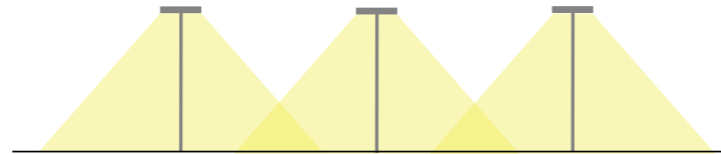


Tools used for the street greenery



Lightning

The lightning is arranged to spread evenly along the street without leaving dark transitions between the light cones. The street lightning stretches out from the green paths on crossing streets increasing the visibility in the junctions.

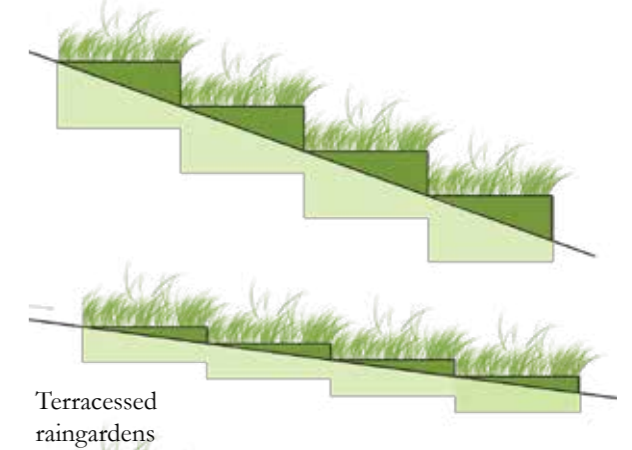
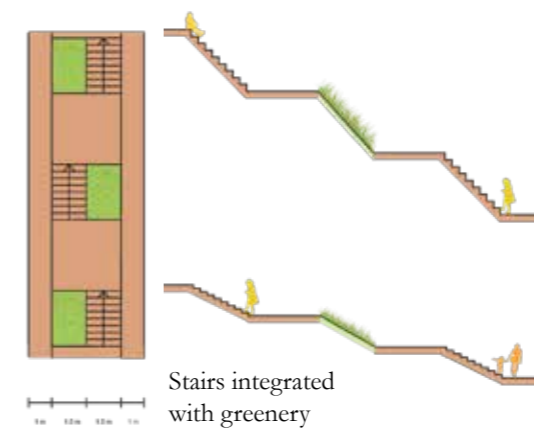


New streets

To upgrade the existing street structure into being more cohesive, logical and safe, three blocks are broken up. The residents of about ten houses are affected through relocation.

Slopes

Some of the streets are so steep that accessibility with car is impossible. Here, stair-parks increase the accessibility for pedestrians. Along roads with very steep topography, the raingardens are designed in terraces that help prevent erosion of soil and flooding during heavy rains.



Proposal Green Paths

The Canal path

The areas around the canal constitute of three different components that are integrated; the waterbody, its vegetation and the pedestrian path that stretches along it. The three parts answer to different parts of the program and therefore we approach them using different tools. There is a change of character from natural to urban along the canal which is also reflected in the design principles for the canal.

Waterbody

The canal can handle both high and low flows of precipitation and the design is attractive both during wet and dry periods. The existing canal out of concrete is developed into a infiltrating swale along the entire barrio. The swale is complemented with flooding surfaces that can detain big volumes of water when needed. There are two design principles for the flooding surfaces, one for urban and one for natural character.

Vegetation

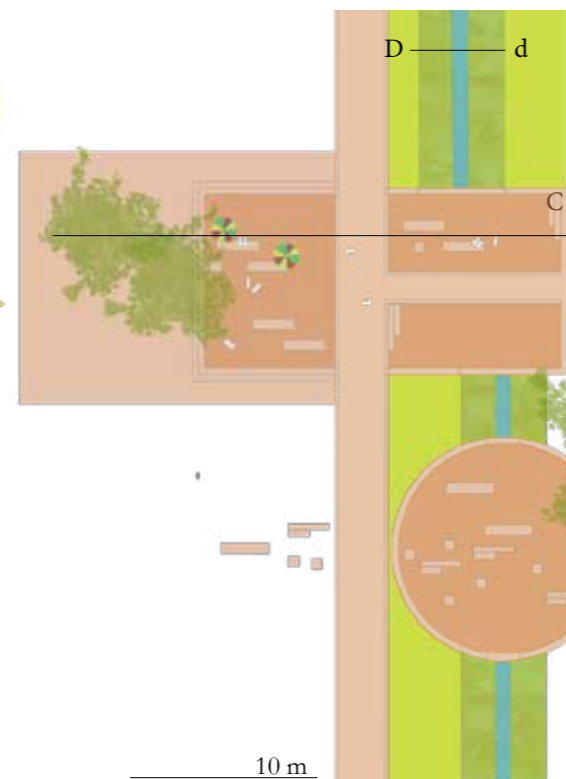
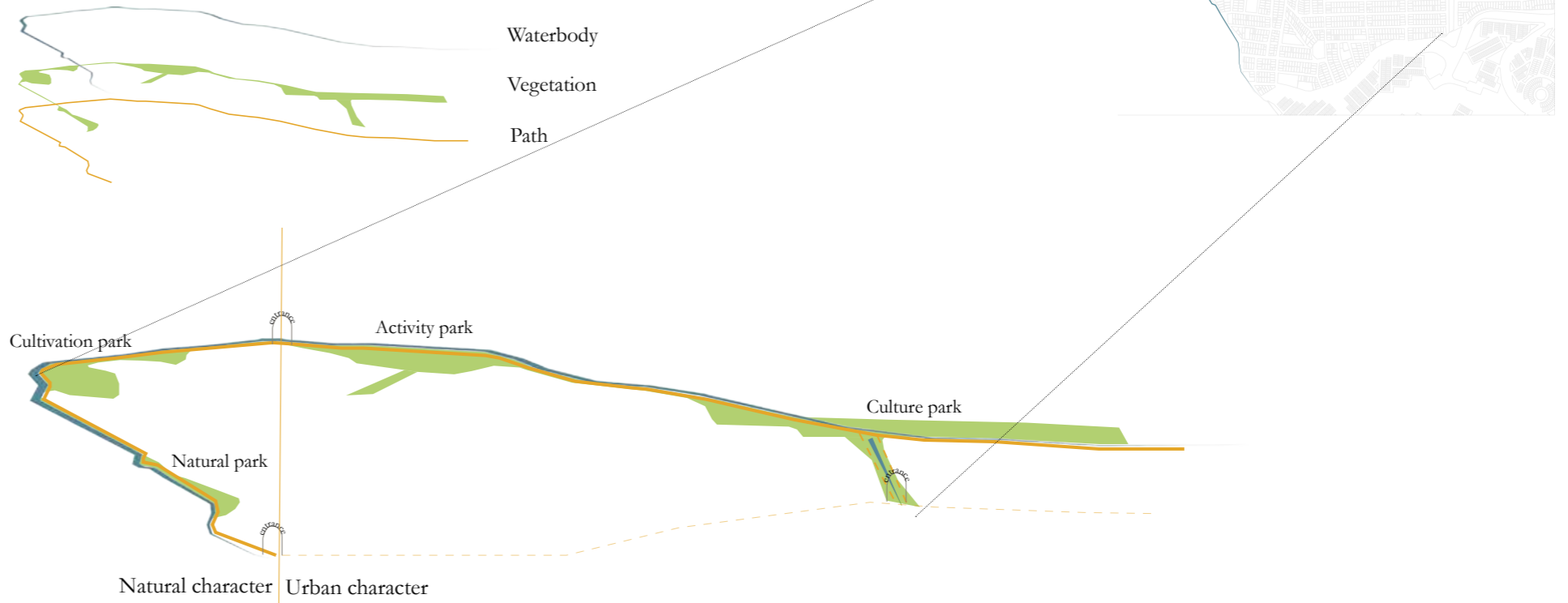
The vegetation stretches along the entire canal and provides habitat and transport corridor for flora and fauna between the different sites and hubs along the canal as well as to surrounding nature. The plants can handle both drought and flooding and helps to protect the soil along the canal against erosion. The plant composition is diverse both to be aesthetically interesting and to promote biodiversity. To increase the sense of security, the vegetation is transparent and the placement of plants is done to not block visibility.

Path

The path is important in providing the community possibilities to spend time in, and connect to natural environments as well as to provide possibilities of improved connections with the neighbouring barrios. To show the landscape and to increase the perceived accessibility, the path is equipped with inviting entrance situations in both ends and in the transition between urban and natural character.

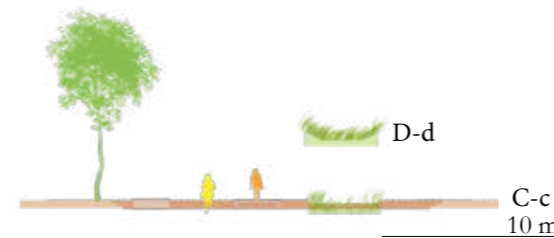


Tools used for the Canal path



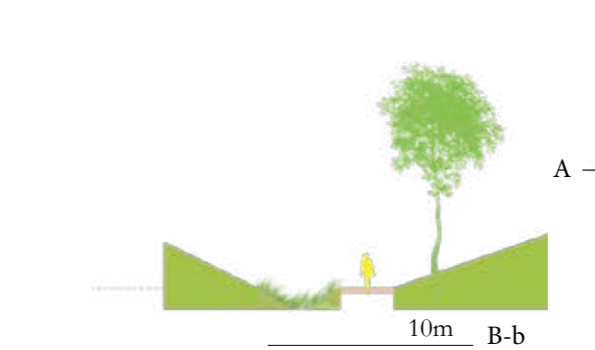
Principal for Canal, Urban charcter

The swales are complemented with hard surfaced flooding areas that can be used in other ways during dry periods, for example skate or market square.



Principal for Canal, Natural charcter

The Swales are complemented with flooding surfaces planted with vegetation that can handle both drought and flooding.



Principal for lightening

Lightning is distributed along the entire path and trees close to the paths are illuminated from the ground to improve sense of security during evenings. Extra lightening is provided by the main entrances and to highlight the parks. To avoid above ground electrical wires that disturb the natural character, light poles with solar panels are used in this part of the path.

Proposal Natural park



Attractions used for green public park



Tools used for green public park



The Natural Park is situated in the southwest part of the barrio to increase the accessibility and connection between the community and the surrounding nature. The park consist of the slopes west of the barrio and the learn-and-play park is situated by the canal where the terrain flattens out, in close distance to the school ICES and the kindergarten and can be used as playground or for outdoor educations by these institutions. The slope is replanted with trees and the natural heritage is enhanced by the use of native and existing plant species. The park is formed to show nature by a learn-and-play path passing by different types of biotopes, creating opportunities for natural play and education or just to enjoy nature.

Butterfly garden

In the learn-and-play garden, flowering plants that attract different species of butterflies welcomes you. A labyrinth of natural material invites to play combined with natural experience. Knowledge of the flora and fauna is provided by information signs, but also by different types of installations and statues showing examples of natural elements.

Water-play

Small foot bridges crossing the canal increases the connection to the water. Jumping stones are integrated in the flooding surface along the Canal path to create a place for play during dry or flooded conditions. On information signs you can learn about the function of the flooding surface and the flora and fauna.



Strategy for vegetation



Replanting in slope

Vegetation

Closest to the paths, low and transparent grass, shrubs and trees with high or transparent canopies are used to not disturb the visibility which increases the sense of security. Further away from the paths, the density of vegetation and height of shrubs increases. The slope west of the barrio is replanted with native trees to restore historical vegetation as well as prevent settling in the area. The trees are strategically placed not to interfere with the sightlines towards Palo del Ahorcado tree from the Green paths of the barrio. The density of trees increases up the hill.



Jumping stones and foot paths



Butterfly garden along learn-and-play path



Different uses of the amphitheatre

Amphitheatre

The learn-and-play path leads to an amphitheatre integrated in the slope. The theatre can be used for outdoor lectures, performances or exhibitions. The stairs provide opportunities for relaxing as well as for play and activity. Native and soil-fixating species of grass, shrubs and trees increase the stability of the slope.

Proposal Cultivation park



Attractions used for green public park



Tools used for green public park

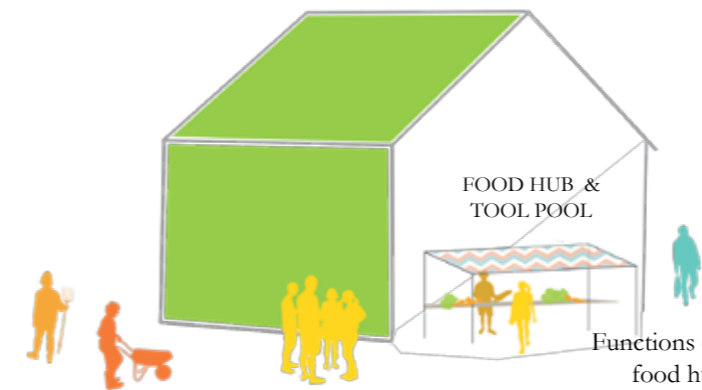


Cultivation gardens

Where the terraces can be made flat and big enough, the space is provided for cultivation gardens for the community. In collective and private lots vegetables, fruits, herbs or ornamental plants can be grown. At some places, high walls are needed to compensate for the steep terrain and they are used for vertical cultivation. The gardens have a system for collection and reuse of rain water and for composting. The Cultivation gardens is a place where different people from the community can meet and share knowledge on cultivation. Terraces for cultivation are integrated according to the demand for lots today but more terraces are prepared with soil improvements in case of an increasing demand in the future. These are planted with species fixates nitrogen during the wait.

Planted slopes

Where the terrain is too steep to create terraces for cultivating, plants and shrubs that fixate soil are planted. The plantings are low and transparent, tolerant to drought and of diverse material. Illuminated walking paths along the slope increase the accessibility to the canal.



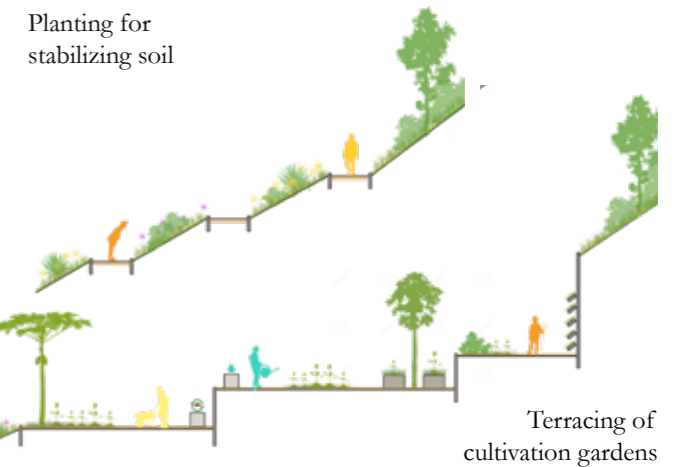
FOOD HUB & TOOL POOL

Functions of food hub

BBQ area

At the BBQ area people can cook food harvested in the gardens and also arrange celebrations or parties, which activates the park also during evenings. The place is well illuminated to increase the sense of security and to make it experienced as inviting during the dark hours, both for people inside the park and for people passing by on the Canal path.

The Cultivation Park is situated in the north-west corner of the barrio, stretching down the slope to the Canal path. The park partly consist of space from where houses have been relocated because of the high risk of landslide, and the new Cultivation park contribute with functions that benefits the whole barrio and by that retains resettling as well as astrengthens the connection to surrounding nature. Terraces and stairs are integrated to stabilize the soil and toincrease the accessibility to the park. The terraces provide opportunities for urban agriculture. By the entrance to the Cultivation park along the Canal path, a food court and a BBQ area create a meeting place.

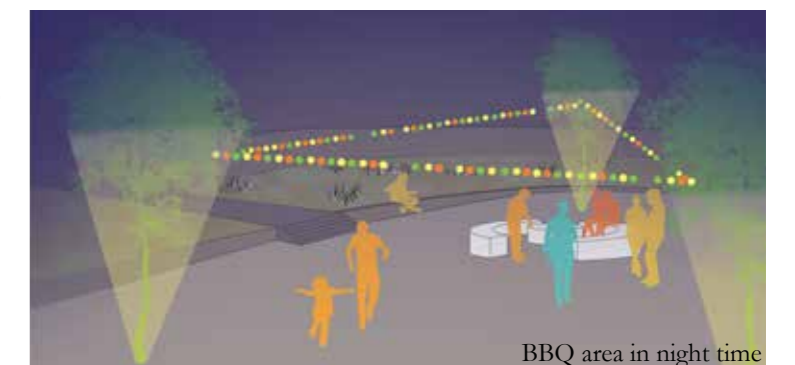


Planting for stabilizing soil

Terracing of cultivation gardens

Food hub & Tool-pool

At the food hub, markets where people can sell and buy the locally grown food can be arranged. This stimulates local business and creates an active meeting place. The house can also be used for storage of gardening tools and provide a collection of tools for people to borrow. Additional uses for the house might be place for meetings, workshops or education connected to urban agriculture. The green roof and green walls of the food hub acts as inspiring example for people in the community.



BBQ area in night time

Proposal Activity park



Attractions used for green public park



Tools used for green public park



The Activity Park constitute of three parts; the playground inside the urban structure, the main activity park at the border to Caracoli and the green path connecting the two. The park slopes down towards the canal but not as steep as in the other park locations which makes it the most suitable for sports facilities. The topography is taken up by wide terraces connected by ramps that provide rather flat surfaces in between.

Active play

The playground is situated in a location of the barrio where opportunities for play are scarce today. It has a short distance to many blocks and is by that suitable for small children living in this part of Potosí. Transparent trees are used to provide shade on kids playing. The playground works as a entrance to the main park and by that also activates the green path connecting the two. In addition to the earlier mentioned principles for the green paths, this one also contains small spaces along it for pop-up businesses and seating.

Main activity park

The main park is equipped with attractions for many different target groups but has a focus on exercise. It contains multisport canchas, gym, open space with lawn and also playing opportunities. The park borders to one of the schools and can be used as an extended playground and for physical education during school hours.



The attractions of the park are arranged along the activity path to promote movement.

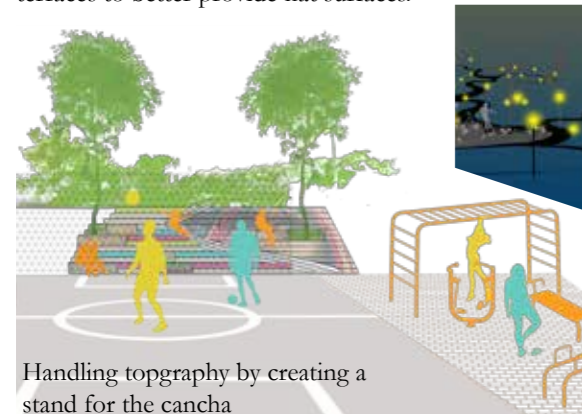


The playground

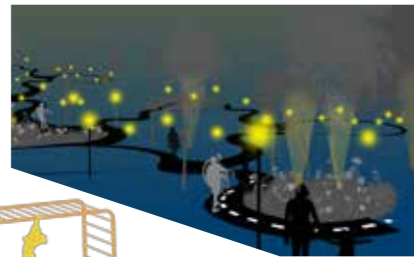
Activity path

A winding path system that also can be used as running track and for bicycling stretches through the entire park. The attractions of the park are distributed along these paths to promote movement inside the park. The different parts are defined by low maintenance flower plantings in the proximity of the path that transitions into tree plantings further away from it to benefit visibility and sense of security while providing a diverse range of plants.

The activity park stretches along terraces to better provide flat surfaces.



Handling topography by creating a stand for the cancha



Path by night



Transition between chill and skate area

Proposal Culture park



Attractions used for green public park



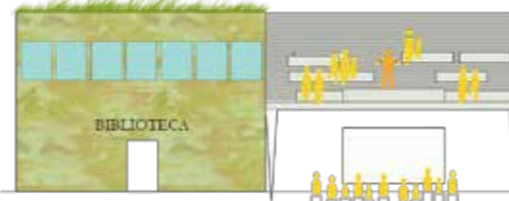
Tools used for green public park



The Culture Park is situated where three barrios meet and by that has a big potential to constitute a value for many and being an important meeting place for the three communities. The conditions of this site are very steep and all design principles are adjusted to utilize also the vertical surfaces of public space. In the centre of the park, a library is located and starting from the building itself, public space and the garden stretches out and connects with the main road, Puente del Indio in the neighbouring barrio and with the bigger ecological structure.

The library

The library is a merge of building and public space. The public roof terrace is accessed by stairs from the park and there is a stage for different performances or events. Benches integrated in the stairs constitute stands for the audience and take up the topography. The terrace and stage can also be used for other purposes like reading a book or playing games. The terrace juts out providing roofed space underneath where movies can be displayed on the white wall. Roof and wall greenery is used to improve the ecological qualities in the park and to inspire people in the community.



The leaning garden

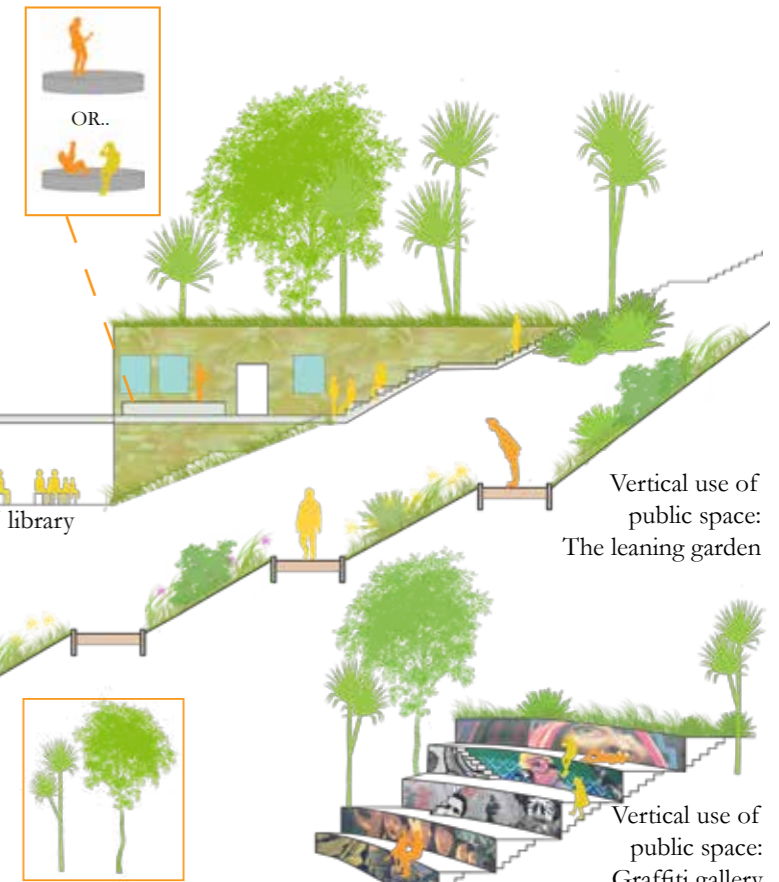
Flower and shrub planting with walking paths are constructed along the slope. The flower plantings are diverse in species but are selected to be transparent or low and tolerant to drought. Species specialized in fixating soil will constitute the base of the planting.

Graffiti gallery

The leaning garden opens up in terraced areas that provides space to paint graffiti and murals. Displayed in one place the paintings constitute a gallery where strolling around watching them is also an attraction. The gallery is illuminated for use also in evenings. The terraces can be developed to incorporate more functions depending on future scenarios and demands, maybe an additional outdoor gym or cultivating in planting boxes?

The Sculpture gallery

To activate the stretch along the canal and to highlight the entrance to the library and its garden the green path along the canal going south is complemented with cubes that can be used for display of for example artwork or school projects or for sitting down and relax. To highlight the displays and the entrance, as well as to increase the sense of security, lightning is frequently distributed along the canal.



Side of library

Vertical use of public space: The leaning garden

Vertical use of public space: Graffiti gallery

Trees

Trees are placed strategically to not block visibility or decrease the sense of security. They are grouped in spaces where human activity is concentrated and planted as solitaires in the rest of the park. The selected tree species have a high or transparent canopy.



The sculpture gallery

Proposal Green spots

These are existing places that are frequently used by the community because of the attractions they offer but that are developed in the ecological aspect. The designs have to reflect the existing character and use of the places in order to strengthen them. Descriptions of design interventions of existing nodes follow below.

Schools ICES and Centro Educativo Distrital

The schools are developed into Green public spots by the addition of green roofs, green walls and collection of rainwater. The green roofs and walls take care of precipitation and state an example on how greening of buildings can be done to contribute to the green infrastructure where open space is scarce. By being implemented in important nodes like these they can serve as inspiration for the residents of the barrio. The collection of rain water is a addition that can aid the urban agriculture initiatives that take place in the two schools.

Multi-sport field and playground la Cancha

The Cancha and its connecting playground are upgraded with street trees that provide shade for its users. It is complemented with flower and shrub plantings to add an additional layer that constitutes a habitat as well as aesthetically highlights the space. The street is designed to indicate shared space by the use of the same ground material as pavements and pedestrian paths proposed in the barrio.

Community centre Cocinol

Green roofs, green walls and collection of rain water are added to Cocinol with the same purpose as at the schools. Cocinol is an important junction of green paths and the existing space today consist of unnecessary wide streets flanked with edge zones. These are used for raingardens with street trees that take care of run-off water and strengthens the spot where the green paths meet. The same principal for shared space is used around the community center as by the Cancha.

Informal transport hub

The transport hub is divided into three parts by the use of different ground materials. The station part where buses stop is designed with permeable ground material and that because of its texture also limits the speed of motor vehicles turning and reversing. The space in connection to the canal is designed as a pedestrian path where there is also space for vendors. Between these two the street is paved and mainly for passing motor vehicles. The pedestrian path is flanked by tree plantings where low and transparent trees are selected to not interfere with the above ground electrical wires.

Playground la Cloaca

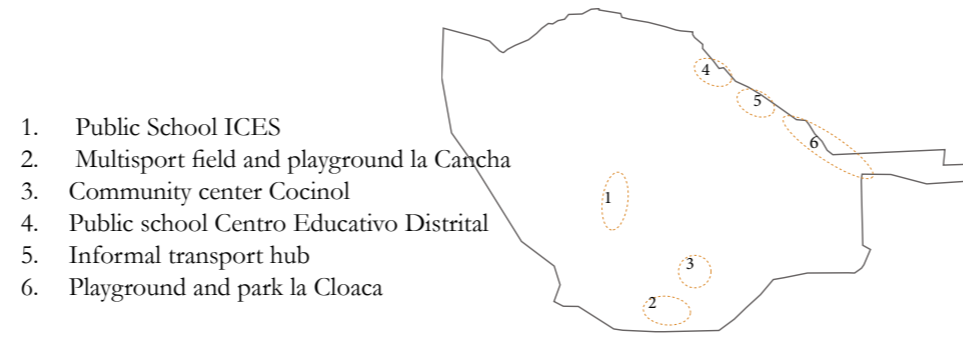
The playground is complemented with trees that provide shade for playing children. The trees are transparent and have a high canopy to not interfere with the visibility and sense of security. The placement of trees is done to not interfere with above ground electrical wires.

Lightning

The illumination is improved in all these places by addition of more frequently distributed lightning. The type of lightning depending on the specific site.



Tools used for developing existing nodes into Green public spot



Public school ICES



Public school Centro educativo Distral



Multi sportfield and playground La Cancha



Community center Cocinol



Informal transport hub



Playground la Cloaca

Plant material

The selection of plant material is done to be transparent or low to not block visibility, diverse in species to promote ecological values and native to Colombia or Latin America to connect to the culture and natural history and suitable in dry conditions. A plant specie that is not native but commonly and successfully used in Potosí is an exception since the local character also is important to consider. In addition, plants that are successful in the site today are likely to demand a lower level of maintenance. Plants with edible parts are considered desirable but not necessary. The plantings should be multi layered to provide different types of habitat and to be aesthetically interesting and attractive. This proposal does not include detailed planting design but will provide examples of plants that fulfill the above stated demands.

We have studied the plant material on the site, in the botanical garden of Bogotá and in reference projects of Bogotá in order to get references on what species to use. For tree species we have also used the Urban forestry manual for Bogotá provided to us by the botanical garden.

Example of tree species for top layer



Yucca arborescens
Narrow

Senna Alata
Ornamental

Sambucus Nigra
Edible berries

Myrsine guianensis
Soilfixating and transparent
Image used with permission from Petrus

Example of shrub species for middle layer



Opuntia ficus-indica
Has edible fruits and is difficult to hide in.

Agave Americana
Transparent

Bougainvillea spectabilis
Ornamental

Example of plant species for ground layer



Bergenia cordifolia
Ornamental

Salvia leucantha
Ornamental

Aster
Ornamental

Arachis pintoi
Fixates nitrogen



7. Discussion

This chapter will provide a discussion and reflection on firstly, our proposal in relation to our main results and to other projects and research which will be followed by a discussion and reflection on our methods used. The chapter will be concluded with a reflection of our working process and ideas on further research on the subject.

Discussion

The purpose with this thesis was to investigate how the Green Infrastructure of Potosí; an informal settlements of Bogota best could be developed to improve the dense urban environment through providing ecological, social and recreational benefits for the community.

The research question that helped us to meet this purpose was:

What are the preconditions and potentials for developing a green infrastructure in Potosí and how can this be done to promote ecological, social and recreational benefits?

To be answered, the research question needs to be broken down in parts. To identify the preconditions and potentials for developing a Green Infrastructure we performed a case study of Potosí that included inventory, analysis and observations during walking tours and during our participation in a workshop and interviews with people from the community. This included getting to know the details of the existing structures, conditions and values of Potosí, both in the ecological, social and recreational aspect. To identify what could be done to promote ecological, social and recreational benefits we turned to literature, reference projects and interviews with Colombian landscape architects.

Compromising

The insight that probably had the greatest impact on our thesis was how the density of the barrio creates a conflict of land use between many important functions, including the ecological network. This led us to the conclusion that the green infrastructure should be co-developed with a structure that take also other identified needs into account such as inadequate space and conditions for pedestrians, small schoolyards or for providing space for ongoing initiatives like urban farming, in order to be justified in the context as well as solving several issues at once. This resulted in a proposal that is characterized by compromises. The first and most central being the research question; *..promote ecological social and recreational benefits* might not always constitute a compromise but when located in Potosí with its preconditions and potentials, it was. Rouse and Bunster-Ossa means that the Green Infrastructure can create places where people can gather, socialize, express art and culture, which can strengthen the community spirit and connection to the place, and not least has a big aesthetic quality for urban areas (Rouse and Bunster-Ossa 2013, p. 12-13). For the Green Infrastructure of Potosí to do this, many compromises had to be done. Compromises between ecology and sense of security, between need for urgent improvements and will to allow for continuous development, between topography and accessibility and between ecology and the needs and wishes of the community to mention a few. This discussion will be based on the compromises that have been done when applying the theories and concepts to the site.

Structure

The main result of the inventory and analysis of the existing green structures of Potosí was that it is generally fragmented, of low quality and in most cases, inaccessible in the legal, physical or perceived sense. We identified the green spaces along the canals and the cerro bordering the barrio in the west as the locations with the greatest potential to anchor and link the green structures within the urban fabric to each other and to the surrounding nature in the ecological aspect, because of their cohesion and size. These are located at the edges of the barrio and constitute the main part of the existing green structure, much because of the steep conditions that make them impossible or at least the last option for settling in.

The statement that a developed Green Infrastructure makes green areas and nature more accessible and connected to people, and thereby strengthens the interaction between humans and the landscape they live and act in (Rouse and Bunster-Ossa

2013, p. 12-13) was an ideal that we strived for but that was challenged by the remote and inaccessible location of the existing green spaces that had the greatest potential to benefit the ecology. We identified a few public places within the urban fabric that with modifications could constitute sites but there was no space for bigger green areas that could constitute hubs. Therefore our main strategy became to improve both the physical and perceived accessibility through interventions of the edge zones identified as potential hubs in order to achieve the above mentioned ideal.

The greatest challenge of improving the physical accessibility was the topography, since the steepest parts of the barrio are also the existing green spaces at the edges. However, desperation for places to reside in puts these spaces at risk of being built and the steep conditions and risk for landslide puts the potential resident at risk. It became clear during the case study that these green spaces needs to be occupied by something that deter people from settling here, which strengthened us in our strategy to work with interventions in these areas.

The perceived accessibility was defined by us as to having a reason of accessing a place and to not be hindered by perceived barriers, for example insecurity. From conversations during our walking tours we understood that lack of safety and security was considered a serious issue in the barrio and quite early the uncomfortable problematic of the locations pointed out as the ones feeling especially insecure coincided with the few existing green spaces occurred to us. This potential conflict between greenery and sense of security was also discussed during our interviews with Colombian landscape architects who confirmed that this issue was not specific for Potosí. As mentioned, the existing green spaces are mostly located in steep parts at the edges of the barrio and the hesitations about these places might be a result more of their remote location than being green, but we still felt that it was necessary to have a strategy in the proposal to prevent greenery from being associated with danger.

With our studies on theories and concepts concerning safety and security as a background we decided to locate a stretch of themed parks equipped with different attractions along the edges of the barrio in order to populate it and by that increase the activity and sense of security.

Making Parks out of hubs

The visited reference project *Jardin Circunvalar* was partly constructed with the purpose of limiting expansion into risk areas through creating an appreciated public park that in addition to providing needed social and recreational functions would be relieved from settling because of its new value. This visit was a important input when working with the park stretch.

Jane Jacobs means that there should be a big variation in type of attractions to make people crisscross and by that create continuous circulations (1992, p. 32-36) which confirmed our idea on themed parks that each could attract different people but by being connected by the Canal path, still connects to each other. In one way the thematic parks contradicts our ambition to promote meetings between people with different interests but we considered the promotion of movement, that we believe this solution does, of greater importance. We also believe that concentrating and channeling engagement and commitment is a way of strengthening it which benefits the people involved and also the place itself by further initiatives and maintenance. The argument that public engagement contributes to achieve long-term protection and stewardship is confirmed by Rottle & Yocom (2010, p. 78-79). This engagement to projects and causes within the community was the biggest potential identified during the case study. This was exemplified in the big interest of

and engagement in urban agriculture of different forms, both private and collectively organized, the concern for the own house and connecting street, the generosity of both time and appreciation shown by the community during the workshop we participated in and in the initiatives connected to the community center. The concern for the own house might have other motifs than enriching public space but it is still a concern that we for example through the workshop saw could be transferred also into public places. The matter of utilizing this type of engagement came up also in the interviews with Colombian landscape architects. An advice from them was that inclusion of the community in interventions do not only contribute to better and more appreciated environments but also creates a relation between people and the physical place that benefits the people and when done right, also the place since it will be better taken care of. This conveyed vision of a dualistic relationship between people and their public space was exemplified in some of our visits to reference projects in similar settings. *Barrio Santo Domingo, Jardin Circunvalar,* and *Escaleras electricas* were all projects that seemed to generate engagement and initiatives in the local area, multiplying the initial effect of the project on the outdoor environment. During these visits, and to the barrio *Patío Bonito* we also found that this concern of a public space in some sense also increases the sense of security in it by signaling that it is looked out for, which strengthens the feeling of that you, who are moving through the space, is also looked out for.

However, the remote locations of the parks combined with today's low level of trust within the community suggested that the strategy of social control by association might not be enough in the parks. In several reference projects we were introduced to more or less staffed parks, often through multiple use of space where staffed institutions, for example libraries, were located inside parks. We found that this multi-use can be a solution for both increasing the sense of security in remote locations, create connections between different people that does not naturally meet and to use land more efficiently. That multi-use of urban spaces provides opportunities for diverse activities and attracts different people and that a multi-use invites to a regular local use over during different times of the day which fostering a sense of community, vibrancy and safety is also argued by Rottle & Yocom (2010, p. 158).

With this as a background we proposed that staffed centers should be incorporated in two of our parks to strengthen the use and security. The Cultivation Park which has the most remote location is provided with a small building and food hub where different events can be arranged. The Culture Park is situated centrally and where Potosí meet two other barrios. The study of reference projects showed that libraries can constitute an enormous value and attraction and we think that this really could help connecting the people from the three barrios in addition of improving the sense of security in an area perceived as unsafe today. It might be seen as contradictive to locate buildings in the rare green spaces but in order to really create social and recreational benefits for the community we consider it necessary. The principals for the design of the buildings incorporates green roofs, walls and also has a clear focus on life in the public space that surrounds the buildings.

The different themes within the park stretch are located to create a smooth transition between rural and urban character where the design of the Natural Park and Cultivation Park is of more natural character and the Activity Park and Culture Park of more urban character. Attractions derived from the case study and reference projects were accompanied with tools for promotion of ecological benefits. Through all parks, water is taken care of in swales and flooding surfaces that can handle run-off water in an integrative way that improves the ecological conditions. The Cultivation Park also provides a system for reuse and recycling of rain water and compost which increase the sustainability by utilizing existing resources. An important feature in the design of the parks has been to create surfaces and elements

that are flexible. Flexibility can be expressed through either possibility of multi-use or possibility of further development by its users to work in accordance of changing needs, both during the day and for different future scenarios. For example, plantings consist of species requiring low maintenance, but can easily be developed with other species or to gardens for cultivating if desired by the community.

The topography posed a challenge for proposing any kind of construction in the parks but the study of how steep slopes were handled in the different reference projects expanded our view on what we first mainly saw as a big issue. We found that more or less vertical spaces can constitute or at least complement a public space in a very meaningful way, contributing with functional, spatial and aesthetic values. The topography is used for different functions in the parks; for seating, graffiti gallery, vertical cultivation and in the slopes east and west of the canal, replantation of forest to restore the former ecosystem and to fixate soil. Multi-layered planting and selection of different native species was proposed to increase the biodiversity. In areas close the canal path stretching through the parks and connecting paths the planting of trees and shrubs are more restrictive to not decrease the visibility for people moving on the paths.

Making Green spots out of nodes

The nodes selected were already accessible, used and appreciated and the main focus was to develop them ecologically through the use of the same tools as the parks. By this, they become a part of the Green Infrastructure and their popularity helps to increase the activity and thereby security in the barrio. The developments of existing nodes are small additions rather than changes out of respect for the places much created by the community by their use of the place. Hence, the additions were done to enhance the existing value of the places and to ease the use of them. Because of the central and dense location, multi-use was important in the design principals for the existing nodes, for example green walls, green roofs and permeable ground material that made it possible to combine greenery with ecological benefits and other functions, such as buildings or parking lots. We have seen examples among the reference projects where the combination of institutions and public space had a big value in reaching out to many people with education and inspiration. Both the need for education on nature and its benefits as well as the use of public green space as a tool for education and inspiration was also mentioned in the interviews with landscape architects and this was an important feature when greening the existing nodes. An example of this is constructing green walls and roofs on the school buildings and community center and in connection provide education on how it is done to encourage residents to do the same on their private houses. Considering the density of residential houses in the barrio, a development in that direction has a big potential of contributing to the ecological network. Of course, the use of institutions depend on the will and interest from the institutions themselves, but as seen in the case study there is already an interest for urban agriculture at these places and therefore we think that this development of their green profile could be a realistic intention.

Linking by green paths

To create a Green Infrastructure, hubs and sites should connect to each other with links (Benedict & McMahon 2006, p. 13-14) since the less connected the network is, the greater are the losses of ecological functions (Benedict & McMahon 2006, p.111-112). The inventory of public space made it clear that the dense network of streets constitute the majority of public space within the urban fabric and that it was virtually the only type of space that could be utilized to link the fragmented greenery within the barrio together and to the bigger green areas at the edges.

Jane Jacobs means that there is a clear connection between the presence of people and the sense of security, a well-used street is perceived as a safe street but a deserted one is perceived as unsafe (Jacobs, J. 1992 p. 30-34). Street trees can be a

big contributor to the ecological values in the urban environment but at the same time they can limit visibility and provide hide-outs and by that decrease the sense of security. In one of our interview questions on design principles, two of the interviewees were skeptical to the principle of “more greenery in the streets such as street trees or small greenspaces with seating along the streets” because of insecurity. Considering the benefits that can be obtained from trees we had to find a strategy where street trees could be integrated without decreasing the sense of security. We turned the thoughts of Jacobs around and decided to create the network of links by greening the most frequently used paths with the addition of the most probable paths to use for the new parks. By being well-used and feeling safe already, we considered them to not be as sensitive as more remote streets might be when adding trees. Also, selecting trees with a shape and density that does not block visibility was proposed.

The network of green paths does not exactly follow the paths identified in the Lynch analysis, though. The possibility of transport in both directions on the main roads was identified as important to preserve. Considering their limited width we found no way of incorporating either greenery or sidewalks which was important to do in the design of the green paths. This resulted in us using parallel and crossing streets that were logical to use when moving between the existing nodes and new parks of the barrio. This network of streets where pedestrians are prioritized expands the number of well-used streets if used. The choice to use them cannot be controlled by us, which is unfortunate since if used, it could also stimulate retail sales and economic activity for local business (Rouse and Bunster-Ossa 2013, p. 12-13) which through attracting even more people to the streets could lead people along connecting streets and past places without attractions that will become populated by serving as routs (Jacobs 1992, p. 32-36) and by that create the circulation of people that we believe is vital for creating security as well as building solidarity and trust within the community. We have proposed a network that is logical and distinctive in the design which simplifies orientation, and that improves safety and accessibility for pedestrians. It is a foundation for a continuous development that best answer to our vision for Potosí and that we believe encourages the use of it.

All streets of the barrio are narrow but also important for several functions; access to people’s homes and to services, passage for pedestrians and sometimes motor vehicles as well as constituting an extension of the own home, making it important to reserve space that is of more private character. This resulted in principles that are not optimized ecological links but constitute a compromise between ecology and the other needs identified. The narrow space is partly compensated by using several layers of plants since multi-layered planting design that provides different types of habitats and also increases the biodiversity (Rottle & Yocom 2010, p. 163-164) but this concept could not be optimized either since a middle layer of shrubs would interfere with the sense of security in the streets.

Implementing the project

The issue of funding the project was not a part of this thesis but we have had the scarcity of resources for investment and for maintenance present in the barrio in mind when creating the design proposal. The project in its full extent might not be realistic to finance at once or today but since it is in line with current ambitions of the city of Bogotá concerning development of vegetated infrastructure and improved accessibility and use of public space, we feel that it is not unrealistic in the long term. What we have understood, the local government are not obligated to invest in improvements of this barrio since it is not officially included in the city but the investments that they have already done through undertaking several projects suggests that there is a will to improve the environment of the informal settlements. Our visits to Medellín also showed that if there is political will, major improvements can be done even though costly.

The implementation of this project has to start with an investment that concretely answers to needs of the community and by that has the ability to generate attachment and initiate further engagement. If we were to prioritize within our proposal, we would suggest that the program points *Create a range of public places that provide recreation and meeting places for different target groups* and *Enhance the accessibility for pedestrians* should be a starting point for the implementation of the Green Infrastructure plan since we consider the movement of people and use of public space crucial in order to improve the security. Within this, we would propose that the construction of the Cultivation Park initiates the projects. This because of the already strong engagement in cultivation and because of its location in a part of the barrio where any form of attractions are scarce today and where high risk of landslide coincide with re-occurring settling. Improvements of the green paths leading to the Cultivation Park will also dramatically improve the accessibility for the people that reside in this part of Potosí where the conditions are identified to be the worst of the barrio today. It is vital that the community is a part of the construction in order to create a structure that engages people to preserve, maintain and further develop it. It is also important because of the potential to strengthen the relationships within the community that a common project like this has. This is a big project where many hands are needed and by employing local people, the constructions could also help to solve the issue of unemployment that exist in the barrio. During our visits we have seen a lot of driving spirit from both the JAC-group and the Urban farming initiative that could be used also to direct the work with this project and in acting a middle hand between the government that would have to contribute with some know-how and financing and the community who would have to contribute with engagement and manpower.

To conclude,

For a Green Infrastructure to promote ecological, social and recreational benefits in Potosí, the final structure could not be optimized for any of the aspects, but instead be a compromise crucial to make in order for the greenery to be appreciated and used, which in turn could foster maintenance and preservation of it. Since informal settlements are growing from bottom-up they are continuously changing and developing. To be able to make a proposal adaptable to this character the proposal is designed as a base that answers to our purpose, but which can be further developed through the community, rather than a finished product.

The four guidelines that were identified in our case study are not aspects that are possible to solve with a specific design solution or even in a green infrastructure plan but nonetheless they constituted the core of what a development of Potosí had to be based in, according to our case study. They are intimately connected to each other; *building solidarity and trust* is a prerequisite in both *creating security* and in *utilising initiative and engagement* which in turn is vital for a sustainable *continuous development*. We feel a need to clarify that these aspects depend on much more than the physical environment and cannot be decided on in a proposal, but also to point out that we believe that a design of the physical environment can provide a foundation and direction towards a development in accordance with these aspects.

This thesis has contributed with a thorough mapping of the barrio of Potosí, making both issues and values visible. The prerequisites identified might also be valid in other places or situations and can potentially serve as a starting point for investigation of other informal settlements, especially in Bogotá and Latin America. Since many of the conditions identified are mentioned in general literature on informal settlements, some principles, ideas and solutions used in this project could be useful also in other projects globally.

Discussion of methods

Below we will discuss the issues and challenges that was connected to the used methods.

Literature studies

We had difficulties finding literature and research concerning Green Infrastructure and Ecological Design that was adjusted to this type of context and one of the main challenges throughout the work was to put the concepts of Green Infrastructure and Ecological Design into the context of an informal settlement, characterized by bottom-up planning and without organized maintenance. The adaption of the collected information based in more formal contexts to suit this dynamic city structure posed a big challenge, not only because of the conditions on site but also because of our own perceptions of what kind of proposal the concepts should result in, that is grounded in a very different context than the one we found ourselves working in. Even though the both concepts are designed to be dynamic and adjustable to different contexts it was difficult to shake of western ideals and references. It was also difficult to find literature and statistics specifically on Potosí since most information in Bogotá is organized according to the UPZ's (zonal planning units). Potosí is only a small part of the bigger administrative unit Jerusalén which made it difficult to draw valid conclusions based on this material. One issue with some of our sources of literature was that they were published only in Spanish. We complemented our basic understanding of Spanish with translating services online and after that, discussed our perception of these texts with our local supervisor to minimize mistakes in our translation of them.

Interviews

The interviews with professionals was time consuming, both in preparation of questions and in the compilation of the answers. Because of the time factor we chosed to compile the material from the interviews by summarizing it instead of transcribing the exact words which inevitable means that the summary partly is our interpretation of what was said in the interviews. The two of us took separate notes and compared in order to compensate for deviation in individual interpretations, but the summaries might still be under the impact of our common research question and similar background as Swedish landscape architect students. The aim with the interviews with people from the community was to validate our own observations and the result of them was used in combination, and with consideration of also other sources. The low number of interviews conducted cannot be seen as representative for the entire community but we assess that it is enough to suit its purpose. An issue with the above mentioned purpose could be that issues that affect the interviewee's use of the outdoor environment might not come up, as a result of us not having identified it. To compensate for this, the opening questions of the interviews were constructed to be very open, providing the interviewees the chance to bring up issues not identified by us. In the interviews with people from the community, translators were used which is connected with some risks, including the above stated issue of interpretations which in the case with a translator constitutes a even higher risks of misinterpretations since more people are involved. Even though we are not anywhere near fluent in Spanish and could conduct the interviews on our own, both of us have a decent understanding of Spanish in speech and could understand the essentials of the interviewee's answers since we were present during the interviews, minimizing the risk of the translator leaving something out.

Reference projects

We visited eleven projects which provided us with inspiration on solutions and design to take with us for the proposal. We had selected aspects that were identified as important according to existing issues and potentials in Potosí and that we had in mind during all the visits, but the different aspects were many times represented in different reference projects. The fact that we visited this many projects resulted in that the study of each project could not be done in-depth but seeing this many

projects also allowed us to find patterns in the use and to analyze results of different interventions. This was a more important asset to us considering the conceptual level of the proposal.

Observations

The observations made were of informal character and no protocol was followed enabling us to get a wider perspective on daily life in the barrio than if we would have followed criteria stated beforehand. Observations, as interviews include a subjective interpretation which includes a risk of misinterpretation but as with the interviews we performed our observational walks together in order to compensate at least deviation between our individual interpretations.

Own reflections

Neither of us had been in South America before, and doing a MFS in Bogotá put us in a totally new context concerning history, culture and planning traditions. During our field study we met many challenges and insights that affected the process and direction of our project.

Before leaving we made literature and map studies to get familiar with the context of informal settlements in Bogotá and with our specific site Potosí, and from these we formulated a problem statement. We left Sweden with an idea of a design proposal in two scales; a Green Infrastructure plan for the whole of Potosí with a clear focus on ecological benefits and a detailed design of one specific site within this structure. Easy! That plan lasted all the way until our first field visit when it was crushed; the barrio was extremely dense with many social and recreational functions missing, many people were skeptical towards the existing green spaces and the specific area we had selected for our small scale design with the help of google earth was perceived as especially unsecure and avoided by people. Especially the issue of green spaces to some extent being considered unsecure made us realize that we needed to address the entire barrio covering not only ecological but equally much social and recreational aspects. Even though we kept our main purpose of creating a Green Infrastructure-plan during the entire study, twists and turns similar to this made our working process anything but linear. Sometimes it had great similarities with a labyrinth. Joke aside, we were kind of prepared for our original plans to be challenged or even shattered and to be caught unprepared for many aspects on the site that we have not been confronted with earlier in our education. What we were not prepared for however, was the accumulating affection and care for the site and its residents resulting in some difficulties to limit our work that sometimes led us too deep into dead ends of the labyrinth.

We have been working as a pair in all parts of the work with the thesis. It was a real asset to be working in a pair in this new context since we always had the opportunity to discuss questions and issues as they appeared during the field study. Back home, especially when working with the proposal it was really a big value to be able to discuss how ideas could take form in the site with someone that possessed equal knowledge on the site, this part would have been difficult doing alone. There are also difficulties working as a pair; explaining your thoughts to someone else is sometimes difficult and time consuming but we believe that it, in the end contributes to a more well-grounded work since you always have to motivate and discuss decisions and ideas.

The traditions of bottom-up processes and (un-)planning in informal settlements in general, and in Potosí was something that we put a lot of thought into during the whole process. We realize that it is an important character that has both positive and negative effects. Examples of positive effects are that when resources (human engagement and financing) are gathered, meaningful environments are created since places that are created by its users will probably constitute what is desired as well as being strengthen by the common effort that was put into it. A negative aspect is that

often the resources available are insufficient to realise what is desired, among others.

The clash between formal and informal is a big questions that we have not had the opportunity to fully immerse ourselves in during the work with this thesis but what we understand it is vital to include the community in development of informal settlement for it to be sustainable. In our work, we did not have the possibility to fully include the community in dialogues or workshops arranged from our part because of time limits and language barriers. Our approach during the field study was to watch, converse, listen and ask to be able to do a design proposal that still was inclusive of the community. The desicion that the designproposal should be rather open-ended was also an adjustment to this character.

One crucial decision made during our work that might not show much in the proposal but for us was a real dilemma was the decision to propose that some of the barrio residents should be relocated and that their lots should be used for public space. On one side of the dilemma was our background in landscape architecture, the literature study and the study of reference projects with this type of intervention with successful results. On the other side was the background on bottom-up processes where people shape their own living environments and our personal attachment to the site. In the middle was our research question that strives to compromise between ecological, social and recreational aspects and also with the site conditions in order to get to the solution that is the most beneficial through all aspects. The decision to relocate people living in zones with high risk of landslide felt easy in one way since residing there is connected to risks in the long term. When studying what the result of relocation of all houses in the high risk area would be, we found that the shape of the remaining structure would create a barrio with divisions that could not work with our vision and program. We tried alternatives and discussed pros and cons before we settled on relocating people at the far edges where the conditions of the barrio and of the residences are the poorest. This, partly because these locations could contribute a lot by strengthening the link constituted by the canal and its greenery and partly by thinking that the people living here would have the most to gain in a relocation. We also decided to break up existing blocks in three places without them being at high risk for landslide. This was motivated by the big importance these passages had in creating a cohesive, logical and safe street network in the barrio. The matter of where people should be relocated and how it would be organized and financed could not be a part of this thesis.

Further research

- The matter of where people should be relocated to, needs to be further investigated. In connection to that there should also be a long term strategy for the areas with high risk of landslide that was not handled in this thesis
- Which species and compositions of plant material that are suitable for rain gardens, green roofs and green walls needs to be be further investigated
- There is a need to investigate how formal planning can be integretad in informal settlements in a considerate way
- More thorough investigations on how the different principles can be implemented is necessary. For example, the amount of percipitation needs to be determined in order to calculate the appropriate dimensions of swales and flooding surfaces and the hight data and flows of traffic needs to be further mapped in order to determine which principles for the street network that are applicable in each street.
- The economical benefits of developing a Green Infrastructure in Potosí and in other informal settlements can be further researched in order to further motivate implementations.

6. References

Alcalde Mayor de Bogotá, Departamento Administrativo de la Defensoría del Espacio Público (2013). *Sentido Urbano – Una Mirada al Espacio Público en Bogotá (ISSN 2346-0350)*. Bogotá: Alcalde Mayor de Bogotá

Alcalde Mayor de Bogotá, Jardín botánico de Bogotá (w.y) *Manual de silvicultura urbana para Bogotá*. Bogotá: Alcalde Mayor de Bogotá,

Barrios, R. A. & Lazarevski, S. (2009). *Bogotá: social housing versus Actors*. Medellín: Universidad Nacional de Colombia <http://www.redalyc.org/articulo.oa?id=169414454008>

Behrens, S. (2016). Terrängformer och berggrund. *Nationalencyklopedin*. <http://www.ne.se/uppslagsverk/encyklopedi/lång/colombia> [2016-04-09]

Benedict, M. & McMahon, E. T. (2006). *Green Infrastructure: Linking Landscapes and Communities*. Washington, DC, USA: Island Press

Beza, B. B. & Hernández-García, J.(w.y). *Placemaking in Informal Settlements*. Bogotá: Pontificia Universidad Javeriana

Brown, M. (2012) *The Bogotá Green Divide*. Amsterdam: CitiNature http://www.citnature.org/uploads/4/7/4/0/4740372/citnature_report_bogota_green_divide.pdf

Bryman, A. (2012). *Social research methods*. 4th ed. New York: Oxford university press

Carmona, M., Tiesdell, S., Heath, T. & Oc, T. (2010). *Public Places Urban Spaces – the Dimensions of Urban Design*. 2nd ed. Oxford, UK: Architectural Press

Claghorn, J. & Werthman, C. (2015) Non-formal growth and landslide risk. *Topos 90*, p. 50-56

Climate-Data.org (2016). *Climate: Bogota*. <http://en.climate-data.org/location/5115/> [2016-06-05]

Czechowski, D., Hauck, T. & Hausladen, G. (2015) *Revising Green Infrastructure – Concepts Between Nature and Design*. CRC Press: 71-90.

Digital Globe (2016) *Google maps* <https://www.google.se/maps/@4.5744783,-74.1663049,2688m/data=!3m1!1e3> [2016-06-06]

Gehl, J. (2010). *Cities for people*. Washington: Island Press

Gillham, B. (2010). *Continuum Research Methods: Case Study Research Methods (1)*. Continuum International Publishing Group Ltd

Gutiérrez, A. I. (2011). *Pioneering Vegetated Architecture in Colombia: From Research to Regulations*. <http://www.greenroofs.com/content/Pioneering-Vegetated-Architecture-in-Colombia.html> [2016-06-05]

Hagan, S. (2015). *Ecological urbanism: the nature of the city*. New York, Routledge, Taylor and Francis Group.

Hernández-García, J. (2001). *Setting environmental planning management processes in urban poor areas in Colombia, the case of Bosa district in Bogota*. Rotterdam: Institute of Housing and Urban Development Studies – IHS

Hernández-García, J. (w.y.a). *Open Spaces in Informal Settlements in Bogotá, Expressions of Attachment and Identity*. Bogota: Pontificia Universidad Javeriana

Hernández-García, J. (w.y.b). *Placemaking in Informal Settlements*. Bogota: Pontificia Universidad Javeriana

Hernández-García, J. (w.y.c). *Informal sustainability citizenship*. Bogota: Pontificia Universidad Javeriana

Hernández-García, J. (w.y.d). *Underlying language and meaning of informality*. Bogota: Pontificia Universidad Javeriana

Hernandez-Gracia, J. (2010). *El Parque de mi Barrio: Production and Consumption of Open Spaces in Popular Settlements in Bogotá*. Newcastle upon Tyne: School of Architecture, Planning and Landscape University of Newcastle upon Tyne

Jacobs, Jane (1992). *The death and life of great American cities*. Vintage books ed. New York: Vintage

Jonsson, M. & Århe, K. (2016). Befolkning och etnografi. *Nationalencyklopedin*. <http://www.ne.se/uppslagsverk/encyklopedi/lång/colombia> [2016-04-09]

Lafortezza, R., et al. (2013). *Green infrastructure as a tool to support spatial planning in European urban regions*. Bari: Università di Bari

Landguiden (2016a). Äldre historia. <https://www.landguiden.se/Lander/Sydamerika/Colombia/Aldre-Historia> [2016-04-09]

Landguiden (2016b). Modern historia. <https://www.landguiden.se/Lander/Sydamerika/Colombia/Aldre-Historia> [2016-04-09]

Landscape Institute (2013). *Green Infrastructure - An integrated approach to land use*. London: Landscape Institute

Lynch, K. (1960). *The image of the city*. Cambridge, Mass.: M.I.T. Press

mapas.bogota.gov.co (2016). *Mapas de Bogotá*. <http://mapas.bogota.gov.co/> [2016-06-06]

Nationalencyklopedin (2016). Colombia: Landsfakta [http://www.ne.se/uppslagsverk/figur/textruta/colombia-landsfakta-\(1\)](http://www.ne.se/uppslagsverk/figur/textruta/colombia-landsfakta-(1)) [2016-04-09]

Nationalencyklopedin (2016b). Bogotá <http://www.ne.se/uppslagsverk/encyklopedi/lång/bogota> [2016-06-05]

Retsö, D., Schmidt, J., Rojas, M. & Horna, H. (2016). Historia. *Nationalencyklopedin*. <http://www.ne.se/uppslagsverk/encyklopedi/lång/colombia> [2016-04-09]

Rottle, N. & Yocom, K. (2010) *Ecological Design*. AVA Publishing SA: Switzerland

Rouse, D. C. and Bunster-Ossa I. F. (2013). *Green infrastructure: A Landscape Approach*. American Planning Association: Chicago

RUAF Foundation (2016). *Urban agriculture: what and why?* <http://www.ruaf.org/urban-agriculture-what-and-why> [2016-06-05]

SIDA, Avdelningen för Europa och Latinamerika (2015). *Utvecklingen i Colombia*. <http://www.sida.se/Svenska/Har-arbetar-vi/Latinamerika/Colombia/Utvecklingen-i-Colombia/> [2016-04-09]

The World Bank (w.y.) Cities Alliance for Cities Without Slums – Action Plan for Moving Slum Upgrading to Scale. Washington: The World Bank & UNCHS (Habitat UN-Habitat) (2003). *The Challenge of Slums*. UK: Earthscan Publications Ltd [http://www.aq.upm.es/habitabilidadbasica/docs/recursos/monografias/the_challenge_of_slums-\(2003\).pdf](http://www.aq.upm.es/habitabilidadbasica/docs/recursos/monografias/the_challenge_of_slums-(2003).pdf)

UN-Habitat (2015) *Habitat III Issue paper 22, Informal settlements*. New York: Habitat III http://www.google.se/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwiBwuXWtpHNAhVrSZoKHWpIDYgQFggBMAA&url=http%3A%2F%2Ffunhabitat.org%2Fwp-content%2Fuploads%2F2015%2F04%2FHabitat-III-Issue-Paper-22_Informal-Settlements-2.0.pdf&usq=AFQjCNEpKDr9DZMV30FRb-GDsu4VjDrClPg&bv=bv.123664746,d.bGs

United Nations (2014). *World Urbanization Prospects The 2014 Revision Highlights*. New York: United Nations <http://esa.un.org/unpd/wup/Highlights/WUP2014-Highlights.pdf>

Van den Ryn, S. & Cowan, S. (1996). *Ecological Design*. Island Press: London
WPR (2015). *Bogota Population 2015*. <http://worldpopulationreview.com/world-cities/bogota-population/> [2016-06-05]

Wright, L. & Montezuma, R. (2004). *Reclaiming public space: The economic, environmental, and social impacts of Bogotá's transformation*. http://www.google.se/url?sa=t&rct=-j&q=&esrc=s&source=web&cd=2&ved=0ahUKEwiWvuyLmZHNhXmQZoK-HeyLB4kQFggQMAE&url=http%3A%2F%2Fprints.ucl.ac.uk%2F110%2F1%2F-Wright_and_Montezuma%2C_Walk21_V%2C_Copenhagen%2C_Jun_2004.pdf&usq=AFQjCNERAWyDKzNBZcRv06tU5GVCJsnEw [2016-06-05]

Appendix Interviews questions

Interviews with professionals

Interview with Landscape architects Martha Fajardo and Noboru Kawashima

1. How do you use to plan with Green Infrastructure in Colombia and Bogotá?
2. Are there any principles of how to plan with Green Infrastructure in informal settlements?
3. Do you experience that there is a conflict between green spaces and security/sense of security?
4. If yes, do you have any principles to handle this issue?

Interview with Landscape architect Gloria Aponte

1. Have you taking part in any green infrastructure project in informal settlements?
2. How do you handle the issue with land-use; when green spaces could conflict with for example lot for building houses or other important functions (accessibility by car, sport-fields etc.)?
3. Do you experience that there is a conflict between green spaces and security/sense of security?
4. Which strategies are common to work with in informal settlements when it comes to security/sense of security?
5. In our site, Potosi, we have noticed that people live in a sustainable way, especially when it comes to transportation, and we want our proposal to encourage this to continue (sustainable transportation-mode must be common in many more places). However the car is a strong symbol of status and also in many places convenient. How do you work with this issue? How do you plan for a sustainable future for informal settlements?

Interview with Wilder Andrey Tellez Gonzalez

1. What is your position in project of urban farming in potosi?
2. What is the main purpose with urban farming in Potosi?
3. How do you implement Urban farming in potosi?
4. How do the community respond to the initiative?
5. How is the community involved in the urban farming in Potosi?
6. When did the project start?
7. What positive effects has the project generated in Potosi?
8. Has there been any difficulties or problems with the project?
9. Do you think that urban farming could also be implemented in more open public spaces in Potosi?
10. How do you to educate people about Urban Framing?
11. Is the dry climate in Potosi a big issue for the project? What solutions do you have?

Interviews with the community

Questions

1. Do you use to spend time outdoors in Potosi?

Yes

- Where?

- What do you do then?

No

- Why not?

2. What would make you spend more time outdoors?

3. Which places in Potosi are important to you and why?

4. Is there any place in Potosi where people use to meet? Where?

5. Do you use to spend time in the neighbouring areas; Caracoli, Las Brisas and Arborizadora Alta?

Yes

- What do you do then?

No

-Why not?

6. Are there paths, roads or places where you feel insecure? Why?

7. On which paths, roads or places do you feel especially secure?

8. What do you think is missing in the outdoor environment?

9. Which three of following options would you prioritize to be developed in the outdoor environment in Potosi:

Playgrounds

Sport field

Farming

Opportunities to sit down and relax

Outdoor gym

BBQ area

Stage for different performances

Recreational park

Other: _____

Other: _____

Other: _____

10. Do you own a car?

Yes

No

11. Which option would you prefer, A or B?

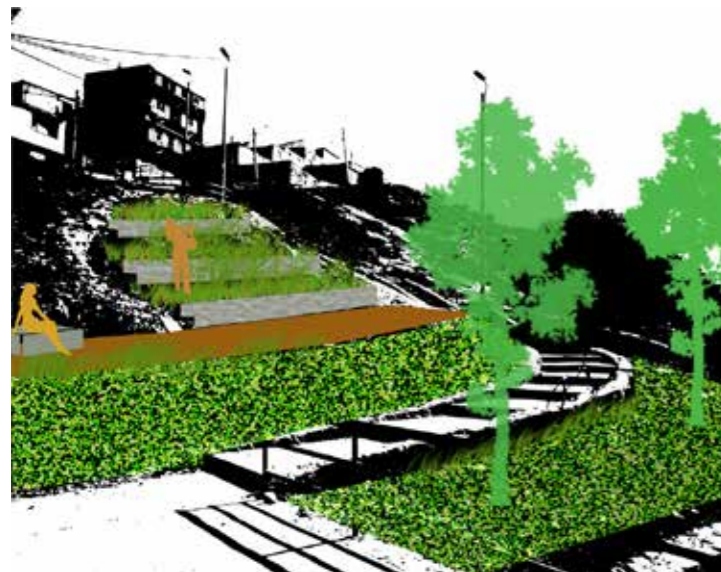
Roads accessible by car that connects to the houses

Green pedestrian paths



Interviews with the community

¿Qué opinas de las siguientes ideas para hacer de Potosí un barrio más verde?



1 Zona verde pública como un parque con espacio para diferentes actividades y recreación

¿Que opinas sobre esta idea?

¿Crees que esta idea sería buena para poner en práctica en Potosí?

¿Ves algún problema con esta idea en Potosí?
¿Qué problemas?



2 La creación de caminos peatonales verdes en las calles empinadas y sin pavimentar en el barrio

¿Que opinas sobre esta idea?

¿Crees que esta idea sería buena para poner en práctica en Potosí?

¿Ves algún problema con esta idea en Potosí?
¿Qué problemas?



3 Más zonas verdes en la calle, como árboles o pequeños espacios verdes con bancas al lado de las calles.

¿Que opinas sobre esta idea?

¿Crees que esta idea sería buena para poner en práctica en Potosí?

¿Ves algún problema con esta idea en Potosí?
¿Qué problemas?



4 Techos verdes que podrían ser utilizados para agricultura urbana.

¿Que opinas sobre esta idea?

¿Crees que esta idea sería buena para poner en práctica en Potosí?

¿Ves algún problema con esta idea en Potosí? ¿Qué problemas?

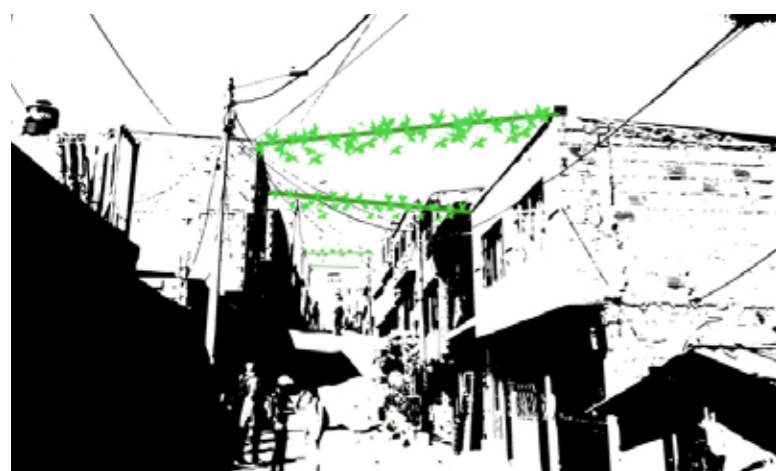


5 Vegetación en las paredes

¿Que opinas sobre esta idea?

¿Crees que esta idea sería buena para poner en práctica en Potosí?

¿Ves algún problema con esta idea en Potosí? ¿Qué problemas?



6 Pergolas (Construcciones de alambre) sobre las calles, que proporcionarían sombra

¿Que opinas sobre esta idea?

¿Crees que esta idea sería buena para poner en práctica en Potosí?

¿Ves algún problema con esta idea en Potosí? ¿Qué problemas?

Interviews with the community



7 Construcciones móviles para cultivar, como posibilidad para cambiar su posición en la casa y fuera de ella

¿Que opinas sobre esta idea?

¿Crees que esta idea sería buena para poner en práctica en Potosí?

¿Ves algún problema con esta idea en Potosí? ¿Qué problemas?

Interview questions on design principles in english

- 1) Public green area or park with space for different activities and recreation
- 2) More greenery in the street such as street trees or small greenspaces with seating beside the streets.
- 3) Creating green pedestrian paths in steep and unpaved roads in the neighbourhood
- 4) Greenery on roofs that also could be used for urban farming.
- 5) Greenery on walls
- 6) Wire-constructions above the streets which also would provide shade
- 7) Mobile constructions for farming possible to move around the house and outside

What are your thoughts on this idea?

Do you think that this idea would be good to implement in Potosí?

Do you see any problems with this idea in Potosí? Which problems?