EXPERIENCING THE POST-MINING WONDER

Reclaiming a new purpose for post-mining landscapes in the Quadrilatero Ferrifero (MG), Brazil

Carlo Leonardi

Wageningen University and Research

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Carlo Leonardi
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Chairgroup Landscape Architecture
Phone: +31317484056
Fax: +31317482166
Email: office.lar@wur.nl / www.lar.wur.nl
Postal address: Postbus 47, 6700BP Wageningen, The Netherlands

WAGENINGEN
UNIVERSITY & RESEARCH

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Carlo Leonardi
Registration number: 901009513040
leonardicarlo@hotmail.it

1st Supervisor:

Ir. Paul A. Roncken
Assistant Professor Landscape Architecture Wageningen University

2nd Supervisor:

Dr. José Eustáquio Machado de Paiva
Professor at Federal University of Minas Gerais

Examiners:

Prof. Dr. Ir. Adri van den Brink
Chair Landscape Architecture Wageningen University

Ir. Daniel Jaslin
Docent Landscape Architecture Wageningen University

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Fig. I: Mud in a mining area. Source: Original picture


“The world will never starve for want of wonders, but only for want of wonder”
G. K. Chesterton
Tremendous Trifles (1909)

ABSTRACT

The technological developments of the last century left behind many abandoned industrial landscapes which constitute a threat to both the environment and to local. Post-mining landscapes are the result of this process and they are expected to grow in number worldwide, in the coming decades. Reclamation, as defined by Berger, is the practice of recovering these landscapes as a laboratory for new scripts; minimizing their negative impacts and maximizing their aesthetic and ecological functionality. Moreover, the author denounces the failure of landscape designers in looking at these landscapes through a purely technical or economic perspective. Integrating the aesthetic experience beyond its traditional connotations within the sustainability discourse, is an issue raised also by many other experts in different fields of knowledge. Although recently many good examples of reclamation projects are arising, there is a lack of literature on how the scenic aesthetic component of these landscapes should be taken into account together with ecological values, especially for such controversial places as post-mining landscapes. In my thesis, I have investigated upon this issue through a specific design challenge located in the Quadrilatero Ferrifero (MG), Brasil. To understand how reclamation can be achieved, I conducted qualitative research which analyzed the scenic aesthetic and the ecological components of the landscape separately. Finally, I used my design capacities to combine these two apparently divergent perspectives for the specific site and derived some guidelines that could be applied to other post-mining reclamation projects.

Fig. II: Mud in a mining area (2). Source: Original picture

“Lira Itabirana”

O Rio? È doce.
A Vale? Amarga.
Ai, antes fosse
Mais leve a carga.

Entre estatais
E multinacionais,
Quantos ais!

A dívida interna.
A divida externa
A divida eterna.

Quantas toneladas exportamos
De ferro?
Quantas lágrimas disfarçamos
Sem berro?

Carlos Drummond de Andrade, (1984)

Fig. III: Red soil. Source: Original picture

Fig. IV: Stone with high iron content. Source: Original picture

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INTRODUCING THE RESEARCH

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INTRODUCTION

Landscapes are changing entities; well-known is it that over the past centuries they have been increasingly influenced by the dynamic interaction between mankind and nature. Since the rise of industrialisation, the changes in the global environment have reached an unprecedented scale and magnitude. Often, the inter-actions brought to environmental degradation and related ecological problems in both developed and undeveloped countries. Abandoned mining landscapes are one product of this process; areas of untreated surface mining can produce extensive damages and disturbance to land and create negative safety and environmental impacts (2008). Reclamation of these sites consists on removing the "damaged landscape" (Berger 2002), enabling new land uses (Enis 1974) as a resource for new opportunities (Loures and Panagopoulos 2007). Such interventions aim to alleviate environmental degradation and also respond to social demands as enhancing the quality of life of local inhabitants and fostering local regeneration and sustainable development (Loures and Panagopoulos 2007, Milgrom 2008, Dong-dong, Yushan et al. 2009).

This research intends to address the more general challenge of landscape reclamation by focusing on a specific location, a tailings dam located inside the Quadrilatero Ferrifero (meaning *Iron Quadrangle*), in the mid-south portion of the State of Minas Gerais, Brazil. The region is historically relevant for the development of mining activities. Moreover, its geological and biological context makes it an area of wide interest expressed by the quantity of works and researches already developed in the region (Application Dossier 2010). As the potentials of the Q. F. for the comprehension of the Earth Sciences and the mining history is widely accepted, evaluation studies on the potential of this region to become a Geopark under the auspices of UNESCO have been performed since 2006 (Application Dossier 2010). Within the proposal for the development of the Geopark some old mining sites are in the process of environmental recovery with proposals for educational and leisure uses for tourists and locals.

Considering this topic from the position of a landscape architect, a research based on two different qualitative approaches has been adopted in view of creating a natural area of outstanding beauty and experiences. On the one hand, the analysis has been conducted in order to synthesize the scenic aesthetic properties of the landscape. On the other, a more conventional environmental analysis has been carried to find the ecological functions and characteristics of the site. This methodology has been developed considering the definition of reclamation stated by Alan Berger (Berger 2002), in which

Fig. 1: Belo Horizonte 2016, urban sprawl. Source: Original picture

natural and cultural values are combined. Moreover, since humans dispose of a great power in influencing the environment, in the literature is widely stressed the need to understand how humans interact with ecosystems, because this influences how they intentionally change landscapes in turn (Gobster, Nassauer et al. 2007). Particularly, landscapes that are perceived as more aesthetically pleasing are more likely to be appreciated and protected (Nassauer 1995, Gobster, Nassauer et al. 2007). Therefore, when aesthetic and ecological values are not aligned, it is more difficult to reach consensus among stakeholders toward reaching ecological goals (Nassauer 1997, Gobster, Nassauer et al. 2007).
Landscape design, as humans' interventions that can change the perceptible realm, can build a closer correspondence between aesthetically attractive landscapes and ecologically beneficial landscapes, moving towards greater sustainability (Koh 1988, Nassauer 1997, Meyer 2008). Currently, although there are many good examples of reclamation projects, there are no guidelines of how to create aesthetic experiences especially within post-mining landscapes that are so controversial. In this research, I will discuss and elaborate how the ability of landscape architects in constructing both a scientifically sound and aesthetic challenging landscape, can be applied to a specific case of post-mining reclamation project. Then, hypothetically, also to derive some general guidelines that could serve to future case studies.

Problem Statement

Alan Berger (2002) defines reclamation as an act of landscape recovery in which both the cultural and natural values are considered important. In parallel, literature stresses the need of combining ecological goals with aesthetical ones in landscape architecture intended as a work of art (van Etteger, Thompson et al. 2016). Especially challenging appears to be achievement of the right combination for post-mining landscapes where the aesthetic appreciation of the anthropic influence is often not aligned with ecological values. During the last twenty years many landscape projects have taken this challenge and addressed recovery without renouncing their peculiar aesthetic potential, given by the heavy presence of human activity. The investigation of the aesthetic alongside the environmental and ecological characteristics could help me to better understand how reclamation could be foreseen for post-mining landscapes.
In addition, and more broadly, this thesis addresses the issues raised by the mining activity, in particular the process of mining closure within the context of the Q. F. Here, mining has brought the destruction and degradation of important natural areas and many more are intended to be exploited in the next future (Carmo, Carmo et al. 2012). In environmental terms this would lead to catastrophic scenarios, resulting in the deterioration and loss of entire ecosystems and related services for the local populations (Carmo, Carmo et al. 2012). Therefore, the recovery of abandoned mining sites, in which both ecological and cultural values are considered, could be a fundamental showcase for the future of the Q.F., even more so, considering the prospect of becoming a UNESCO Geopark.

Knowledge gap

There is a consistent amount of literature regarding the necessity of integrating aesthetic and ecological values in landscape planning and design (Koh 1988, Nassauer 1997, Gobster, Nassauer et al. 2007) and the debate between scenic and ecological landscapes (Gobster, Nassauer et al. 2007, Hill and Daniel 2007). However, the primary focus of recovery of abandoned mining landscapes relies on its related technical and economic issues (Sklenička and Kašparová 2008), on ecological functionality and environmental adaptability, following a romanticised vision of nature (Cronon 1996, Ellison 2013). Particularly, there is not much written on how the scenic aesthetic component of post-mining landscapes should be integrated, on how the *performance of appearance* (Meyer 2008) in constructing new values and symbols, enters the sustainability discourse. Much of the difficulty depends on the fact that the aesthetic function of landscape is much more problematic to define, evaluate and protect than its ecological aspects (Sklenička and Kašparová 2008). In addition, while for agricultural, forest and urban landscapes much more is known about their perception (Hands and Brown 2002, Kaltenborn and Bjerke 2002, Van den Berg and Koole 2006), post-mining landscapes are more recent and exceptional cases. Evaluations of visual preferences in mining and post-mining landscapes with the aid of photographs are rarely found in the literature – so far, this approach has only been utilized by Sklenicka and Molnarova (2010) in a study of habitat types used in reclamation (Dentoni and Massacci 2013). In addition, there is no such investigation among former thesis work carried by Wageningen students. While Nijland and Goossens (2014) addressed the problem of integrating environmental and social issues in landscape recovery, my investigation will have a more specific goal by focusing on the integration of the aesthetic properties, pertaining the cultural sphere of reclamation as defined by Berger (2002).

Worldview and Philosophical Position

If the role of a landscape architect is to create constructed human experiences as much as ecosystems (Meyer 2008), my main concern has been to investigate how the two relate to each other and how I may align them. I also positioned myself within the debate of scenic and ecological aesthetics, and found what I believe to be the best approach to conduct my research as a landscape architect. I believe that my work is to create emotions towards a cognitive changing of people's environmental ethics, because "the experience of landscape can be a mode of learning and inculcate values" (Meyer 2008, p. 20). Therefore, in my thesis I have defend the landscape architect's ability to shape the *perceptual realm* (Gobster, Nassauer et al. 2007) as a trigger of people's imaginative power for an outstanding aesthetic experience of nature, leading to the creation of an ecologically beneficial landscape that is also culturally sustainable.
Creswell (2013) gives an account of different philosophical worldviews that can influence research in all its components: (post) positivism, constructivism, advocacy/participatory and pragmatism (Lenzholzer, Duchhart et al. 2013). In this research I started from a pragmatic worldview whereby multiple methods were used to understand the problem and to generate new knowledge. Within this perspective, as the human experience is a central topic of the research, the constructivist worldview has been be the most closely related worldview for this research. Indeed, pragmatism results as a combination of other knowledge claims, which are used depending on the context and the phenomena under study (Lenzholzer, Duchhart et al. 2013).

Objectives

The general objective corresponds with the proposal of a landscape design for the reclamation of a tailings dam, in order to create a centre for environmental research and education within the Ecological Station of Aredes (within the Q. F.). The objective can be better defined by addressing two fundamental aspects of the project:1) Landscape Design

1) Landscape design
A landscape is the product of both societal processes and natural events, culture and nature combined (Schama 1996, Stigliano, Ribeiro et al. 2011), that can be read like a text (Pandakovic and Dal Sasso 2009, Stigliano, Ribeiro et al. 2011). Reading a landscape, in all its complexity, is not for everyone; revealing the hidden messages that it carries is part of the job of the landscape architect, through his design ability. Therefore, my objective is to shape the aesthetic experience of the landscape in a way that the meaning and values of the related center of environmental research and education may be clearly expressed and communicated to its visitors.Purpose Statement

2) Intervention of reclamation
As defined by Berger (2002), reclamation seeks recovery by proposing a new utilization for the degraded site, without a real strict ecological compromise. Considering the case under study and the location in which it is inserted, I have regarded reclamation as a display of natural and cultural forces, where the following aspects have been taken into consideration:
a) Ecologic and functional characteristics
b) Perceptual and aesthetic characteristics
c) "Mining closure" process
d) Proposals addressing the demands and activities for environmental research and education (various structures and facilities).

Purpose Statement and Relevance

The purpose of the thesis is to investigate how landscape design can achieve reclamation by integrating aesthetic properties with ecological values. Subsequently how this can be applied through a specific design project of for research and educational uses in the context of the Q. F. in Minas Gerais, Brazil.
The significance of the study lies in the potential of the design to create environmental awareness, attachment and education through the use and combination of its aesthetic characteristics, considering in particular the more formal ones typical of the *scenic landscape*. I research terms, the thesis could be helpful to find new guidelines on how the aesthetic experience of post-mining landscapes can be integrated within an intervention of landscape recovery. Moreover, this work aims to clarify and address specific topical issues in the Q. F., and hopefully trigger further research.
In addition, in the present situation in which the area of competence of landscape architecture, as a relatively young discipline, seems undermined by other more consolidated fields of knowledge (van Etteger, Thompson et al. 2016), reclamation is presented as the occasion in which this condition may be sur-

passed. Indeed, according to Berger reclamation of mining sites "as a unique form of landscape production, offers designers a substantial opportunity to expand their intellectual concerns and scholarship in the areas of landscape disturbance, renewal, design, and of reoccupation of synthetic space and ecology. By learning from mining and reclamation, landscape architecture could redirect and expand its influence in the areas of sustainability, site evolutionary strategies, and new ecological thinking" (Berger 2007, p. xxi).

Research and Design Questions

The Research Question are:

1. What are the scenic aesthetic values of the selected post-mining landscape?
2. What are the ecological characteristics and functionalities of the selected landscape?
3. What kind of interventions are needed\required to recover the selected post-mining landscape?

The Design Question is:

1. How can landscape design combine scenic aesthetic and ecological goals within a project of reclamation for a post-mining landscape?

2. How the combination of scenic aesthetic and ecological goals can be generalize it into design guidelines for post-mining landscapes?

Methods and Methodology

This research has been conducted mainly through a qualitative approach (Creswell 2013); using largely descriptive strategies as explained by Deming and Swaffield (2011). In addition, classification schemes and descriptive modelling strategies helped me to synthetize my results. As the study focuses mainly on the human aesthetic experience of the landscape, and how this relate to ecological issues, qualitative methods have been adopted (Creswell 2013). This approach strongly requires the direct involvement of the researcher. It is important to get in close contact with the environment object of the research and reflect on it critically in order to build new knowledge that potrays the complexity of a situation. Furthermore, this research has made use of two research modalities: research for design and research through design. Research for design provides the knowledge to improve the reliability of the final design, while research through design, uses the same design as a tool of investigation and validation within the research process.

The first part of the research consists in a the literature review, which continued along with the development of the thesis. The research is divided in two different analyses. The first is about the investigation of the aesthetic experience of the landscape on the selected area (presented in the 3rd Chapter) . The objective is to understand the landscape's aesthetic properties through a landscape perceptual analysis. The outcome is a zoning map of the different types of aesthetic experiences evoked by the landscape under study. According to Zangwill's Aesthetic Theory (Zangwill 2007) aesthetic properties rely on non-aesthetic properties. For this reason the analysis was pursued with multiple methods in three distinct phases, passing from a more objective and sensorial experience of the landscape toward a more subjective and intellectual one. At first, collection of the sensorial experience is registered through a phenomenological approach (Zahavi and Gallagher 2008), followed by a picture reduction analysis in which the main non-aesthetic properties are derived and finally summarized in an archetypical element, that synthesize the overall aesthetic experience.

The second part of the research deals with the investigation on the ecological characteristics and functionalities (presented in the 4th Chapter), but also with the understanding of the interventions needed to recover the landscape under study (presented in the 5th Chapter). The results of this analysis are then represented through descriptive\synthetic modelling strategies (Deming and Swaffield 2011) in a zoning map of the area and a basic recovery plan as a base for the final design, each illustrated step by step. The environmental analysis was carried out through a layer approach (Deming and Swaffield 2011) together with the consultation of existing literature and secondary descriptions. The landscape will be analyzed considering different scales and layers (Kerkstra and Vrijlandt 1988). The ecological investigation covered geology and geomorphology, hydrology, flora and fauna and how do they interact in shaping the landscape. For the recovery plan, instead the consultancy of experts and the consultation of specific reports and documents played a fundamental role.

Finally, the results of the analyses are compared and brought together in a research through design, whose outcome allowed me to respond to the last Design Question. The intended result is be a landscape reclamation design in which aesthetic and ecological values are both enhanced. More detailed explication of the methods will be provided during the rest of the thesis and especially during the analysis chapters.

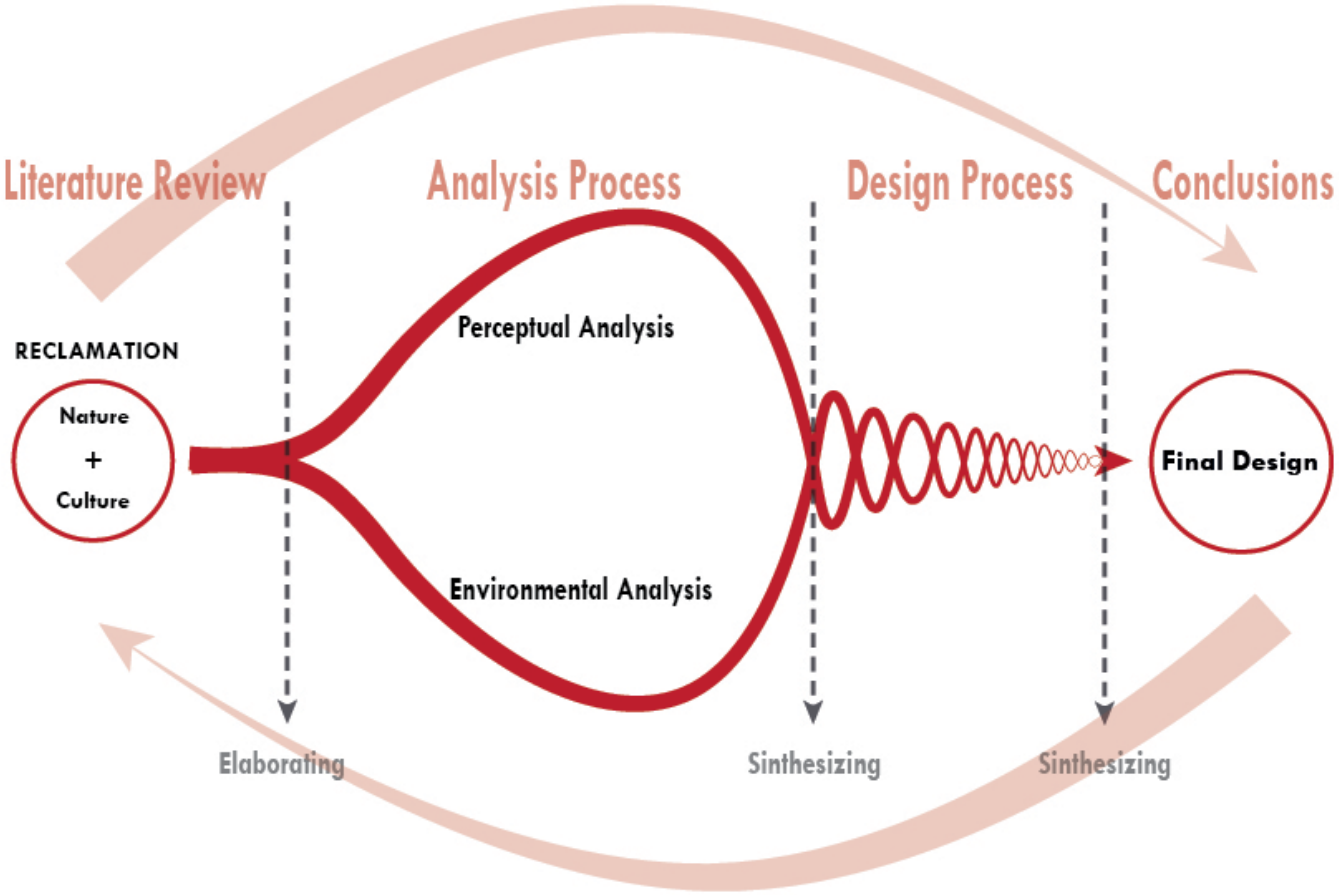
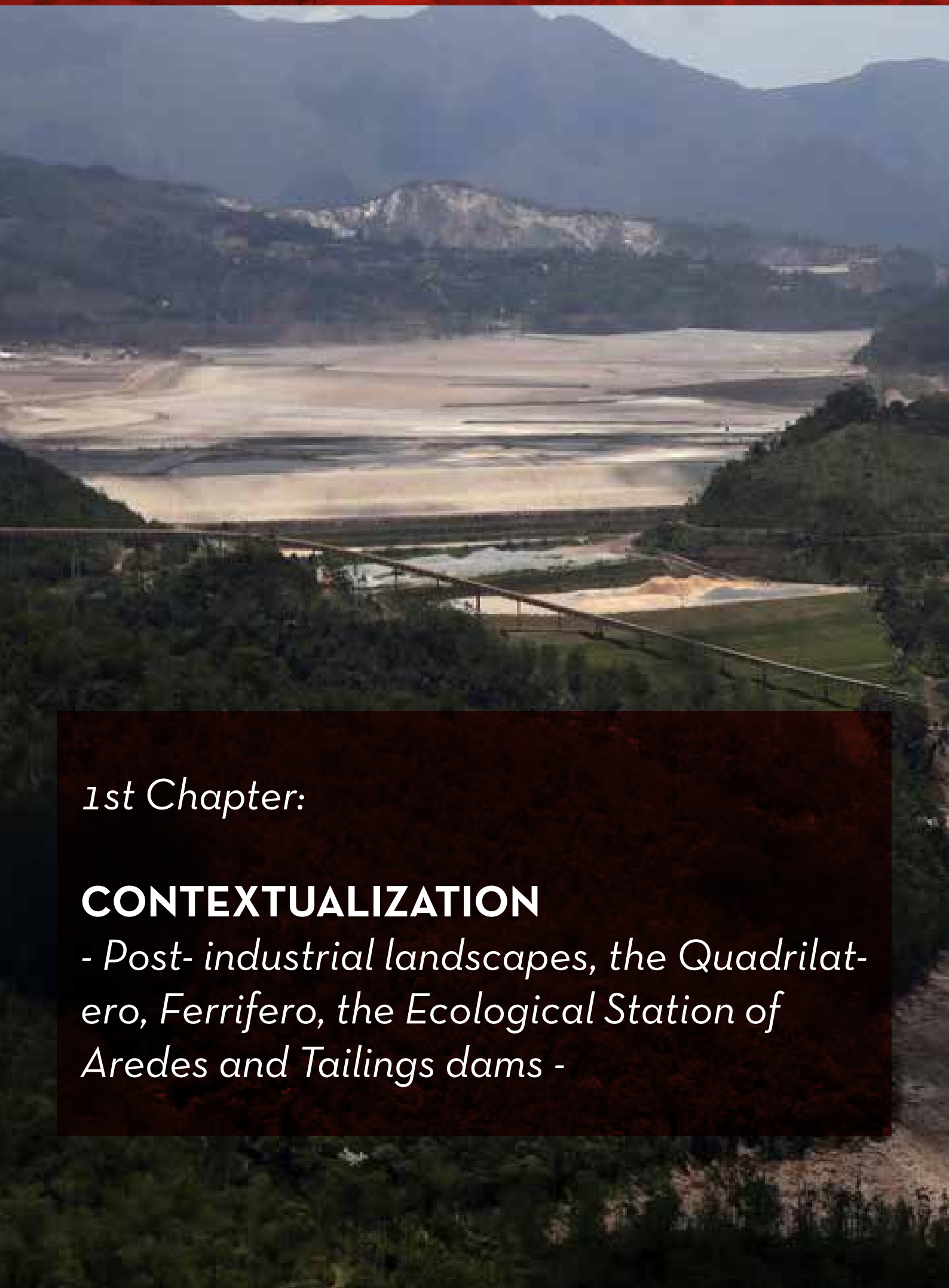


Figure 2: Flowchart of the research process. Source: Original image



1st Chapter:

CONTEXTUALIZATION

- Post- industrial landscapes, the Quadrilatero, Ferrifero, the Ecological Station of Aredes and Tailings dams -

Fig. 3: Accident of the tailings dam failure, Bento Rodrigues, 5th November 2017. Source: Internet

1.1 POST-INDUSTRIAL LANDSCAPES

At the end of the 20th century the industrial sector started a new phase changing its physical and geographical aspects. Some of the industrial products of the modernist period have become obsolete, leaving behind an abandoned industrial environments and infrastructures. This period is called "deindustrialization" and brought to new severe economic, social and ecological repercussions. Post-industrial abandoned landscapes are one of the results of this process (Dias, Panagopoulos et al. 2008, Loures, Viegas et al. 2008). These places nowadays represent a dramatic challenge both for current and new generations. In the literature is widely stressed how the consequence of industrialization brought to new ecological social and cultural challenges (Loures and Panagopoulos 2007).
Although frequently these landscapes have been left abandoned, this tendency is starting to change given the trends of the last decades (Dias, Panagopoulos et al. 2008, Loures, Viegas et al. 2008). Nowadays, there are many examples of interventions around the world that prove that these sites can constitute resources for urban regeneration and ecological rehabilitation (Loures, Viegas et al. 2008). Indeed, the recovery and development of these spaces is increasing as it has been acknowledged that these interventions can contribute to achieve sustainability goals (Dias, Panagopoulos et al. 2008) and an opportunity to develop multi-functional landscapes (Loures and Panagopoulos 2007). The challenge for landscape architects, urban planners, and other planning professionals resides on how to redevelop these post-industrial landscapes as generally their costs of recovery exceed the potential value generated by its re-development (Loures, Viegas et al. 2008).

1.1.1 Post-mining Landscapes

Especially mining sites, usually covering big (if not huge) portion of land, are considered to have a very strong socio-environmental impact during and after their activity (Berger 2002, Sklenicka and Molnarova 2010). Mining occurs since prehistoric times, nowadays has risen a globalized mining industry led by large multinational corporations. Furthermore, mining can take place almost everywhere (see Fig. 4), provides much of the world's wealth, as being fundamental for the economic development of many countries (Walser 2000). Alan Berger (2002) reports that just in the United States there are around 200,000 abandoned and active mines covering thousands of squares miles; he calculated that by the year 2250 there will be more than a hundred thousand square miles to reover. Extending the research to the rest of the world it would result the impressive magnitude of this phenomenon, consequently it would appear clear the fundamental urgency of recovering these landscapes for the sake of sustainability.
The negative impacts of mining activities are diverse and widely stressed by the literature. Mining entails the excavation and removal of top soil exposing the surface of bare rocks; this brings to consequential serious environmental problems widely listed in the literature (Milgrom 2008, Ge, Yi et al. 2010). The original habitat results seriously damaged, and not just the area directly involved, but also the surrounding ones (Nieman and Merkin 1995, Sklenicka and Charvatova 2003). In addition, the majority of these derelict landscapes are located close to urban environments (due to the expenses of transportation) and inhabitants that live nearby may be effected by air and noise pollution (McCandless 2013). Although mining can bring economic growth and be a catalyst for social regeneration (as employment and income generation), the related socio-cultural issues are also well known and often linked to the environmental ones (Kitula 2006, Es-

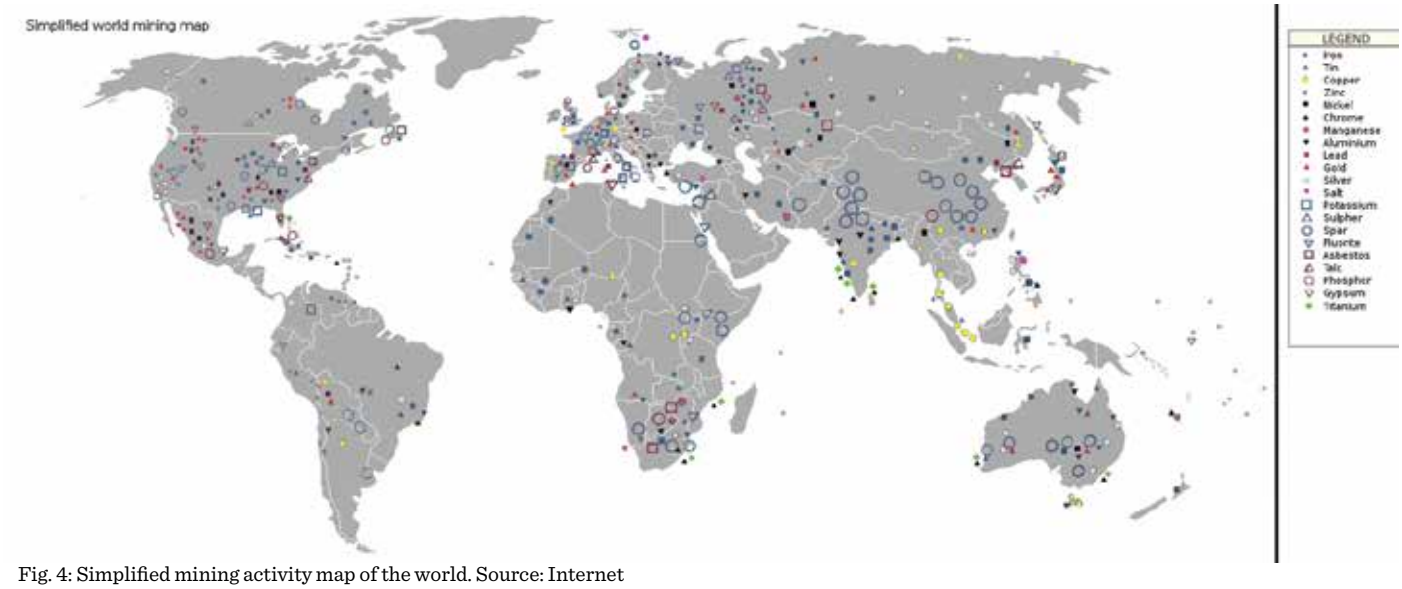


Fig. 4: Simplified mining activity map of the world. Source: Internet

teves 2008). Moreover, the literature reports also how mines and quarries cause the aesthetic depreciation of the landscape, studies have showed that their impact has a highly negative influence on the responds of the people (Kaliampakos and Mavrikos 2006, McCandless 2013). The damages linked to mining activities include also fatalities that sometimes occur everywhere in the world. Indeed, although the safety measures and the new technologies have brought to a decrease in the disaster records, mining is still one of the most hazardous practices worldwide (Saleh and Cummings 2011).

1.1. 2 Post-mining processes in Brazil

Nowadays, Brazil is a world leader in the production of iron ore, gold, bauxite, tin and manganese (Toy and Griffith). Especially for iron-ore, his position stands between the second and third biggest producer of the world, which accounts for the 85% of Brazil's mineral-commodity exports (Toy and Jackson Griffith 2001, Carmo, Carmo et al. 2012). Nevertheless, there are really few companies that detain the most of the mineral production of the country (Mineral 2005). Next to these there are hundreds of family businesses and cooperatives that compose the other face of the mining sector in Brazil (Fernandes 2007). On the one hand, the mining activity in Brazil can act as a catalyst for local development. This can be done not just through the provision of more jobs opportunities, but also through project of conservation, restoration and touristic use of the rich Brazilian mining heritage, which is not sufficiently valorized (Fernandes 2007). On the other hand, the mining activity brought all the threats already mentioned in the previous section, so that sustainability goals are still far from being accomplished (Toy and Jackson Griffith 2001, Fernandes 2007).

Although the mining tradition in Brazil stands now for more than 300 years, recovery start being required just since around 20 years ago (Toy and Jackson Griffith 2001, Fernandes 2007). The increase of national and international environmental awareness, together with accumulating of social and environmental problems, brought to the evolution of the Brazilian policy regarding environmental management and the consequential strengthening of the laws regarding environmental protection related to mining activities (Toy and Jackson Griffith 2001, Fernandes 2007). From 1988, the new Brazilian Constitution, requires all mines to recover their degraded areas, and from 1989 they are obliged to prepare a Plan for the Recovery of Degraded Areas (PRAD) (Toy and Jackson Griffith 2001). Nowadays the mining companies have to respect particular

environmental obligations, dispose of plans for recovery of the degraded areas and in case of breaking the law they are exposed to penal sanctions (Fernandes 2007). Moreover, environmental impacts studies and the diagnosis of several different researches, together with the implementation of new technologies, have been conducted for their improvement, to prevent environmental issues and to recover degraded or contaminated areas (Fernandes 2007). A sustainable deactivation project demands an integrated planning that takes into account the entire process of the mining activity and its related impacts, which is now virtually absent in the Brazilian mining sector (Fernandes 2007). In the meanwhile, during the last thirty years the mining sector saw a great expansion around the world due to an increasing demand of prime materials, consequentially is expected to continue playing a major role also in the Brazilian economy (Toy and Jackson Griffith 2001, Carmo, Carmo et al. 2012). Indeed, the Brazilian government planned to increase the mineral production of the country till 2030 (Carmo, Carmo et al. 2012). This means that the amount of waste produced and of land degraded will also dramatically increase, together with the necessity of building new infrastructures, inducing new activities of mineral transformation, which impacts will accumulate with the ones of the past (Fernandes 2007).

1.3 THE QUADRILATERO FERRIFERO

The Quadrilatero Ferrifero is located in the north of Southeastern Brazil, in the State of Minas Gerais (*General Mines*), one of the largest among the Brazilian states (see Fig. 7-8). Nowadays, within Brazil, most of the mining activity is located in Minas Gerais.

Fig. 5: Photograph by Sebastiao Salgado "Miners in Serra Pelada", 1980's. Source: Internet

Fig 6: Mining activity in the Quadrilatero Ferrifero, *Serra da Moeda*. Source: Original picture.

Particularly in the area of the Quadrilatero Ferrifero , are founded 75% of the measured iron-ore reserves, of which at least one-half is graded at 60% Fe content or better (Toy and Jackson Griffith 2001). This particular area is located south of the metropolitan area of Belo Horizonte, the state's capital. Belo Horizonte is one of the major finance and urban centers in Latin America, with its 5,500,000 inhabitants is the third metropolitan area of Brazil, after Rio de Janeiro and Sao Paulo (IBGE 2013). It could be stated that the Q. F. holds much of the importance of Minas Gerais within the Brazilian context, not just for its socio-economic aspects but also for its outstanding natural and cultural assets.

The Q.F. is an area of about 7.000 km2 that corresponds to a geological block from the Precambrian age[1] whose contours were revealed by differential erosions (Application Dossier 2010). The term "Quadrilatero" (Quadrangle) refers to the shape of this block, which is delimited by several mountainous ranges. While "Ferrifero" (Iron) refers to the deposits of iron ore that where founded here since the Portuguese colonization during the 16th century. As the potentials of the Q. F. for the comprehension of the Earth Sciences and the mining history is widely accepted, evaluation studies to become a Geopark from UNESCO have been performed since 2006 (Application Dossier 2010). The Quadrilatero Institute, in charge of the geopark management is a non-profit private entity which mission is "to develop and to promote actions related to the integrated territorial development of the Quadrilatero Ferrifero presenting sustainable social, economic, cultural, and environmental bases" (Application Dossier 2010). Indeed, the concept of the Geopark intends to combine science, culture, and education to diversify and complement touristic offers, and it may also be used as a strategy for local development (Piranha, Del Lama et al. 2011).

1 Corresponds with the earliest 4.567 billion years of the Earth until the Cambrian period when the first hard-shelled creatures appeared.

Fig. 7: Geo-localization. Source: Internet

1.3.1 Natural and Cultural Assets

The landscape of the Q. F. is characterized by hilly and mountainous areas which provide many resources (mainly mineral, forestall and agricultural), but at the same time constitute a rare and fragile environment exposed to soil erosion and loss of habitats. The peculiar geological formation and morphology, together with its particular sub-tropical climate, give rise to a high biological diversity (Formoso 2014). Indeed, the Q. F., is characterized by a biodiversity with a high concentration of endemic species that depend on the variety of habitats and ecosystems present in the region (Formoso 2014). Moreover, this landscape its characterized for its important hydrology, which provides underground reserves that are fundamental for recharging the springs that here starts (Augustin 2008). Witness of this situation, are the numerous caves and waterfalls that are found. This richness of ecosystems and related services for the local populations are jeopardized by the mining activity that in many cases is not yet portrayed with sustainable means (Toy and Jackson Griffith 2001, Carmo, Carmo et al. 2012). The mining tradition in Bra-

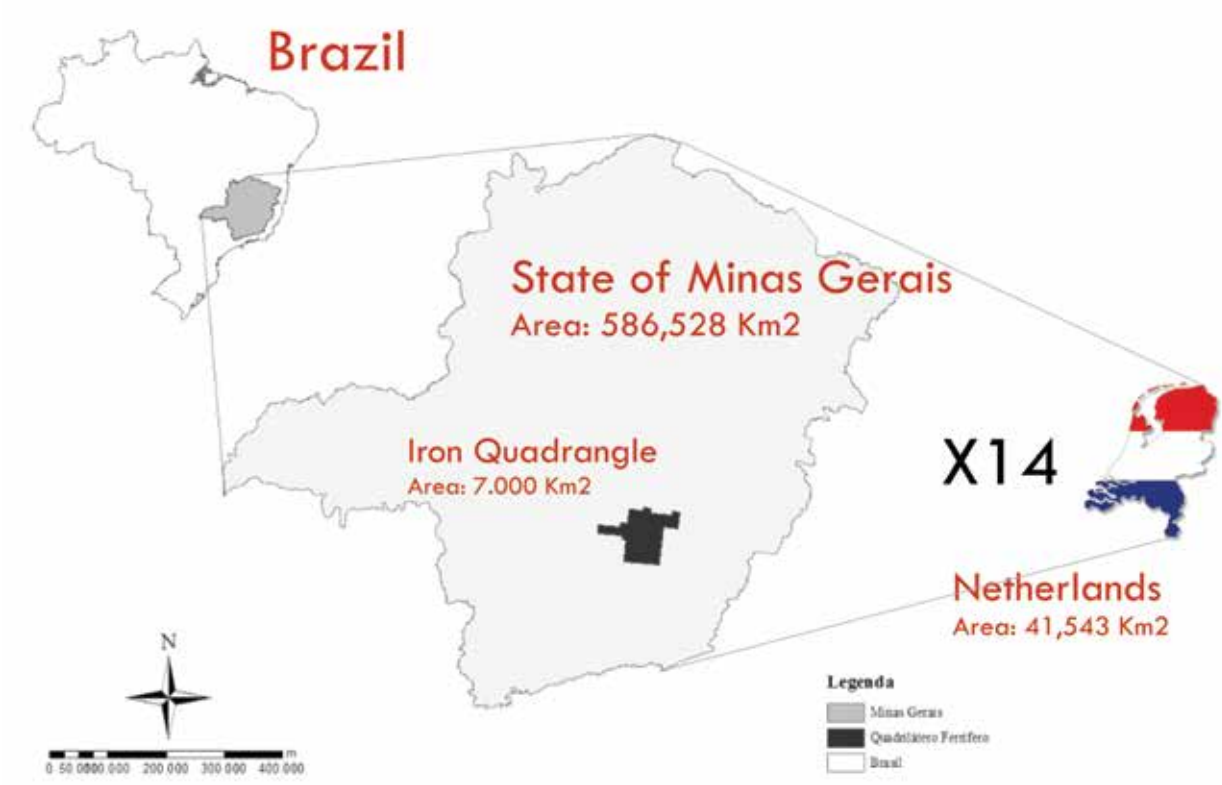


Fig. 8: Size and Location of Brazil, Minas Gerais, and the Iron Quadrangle. Source: Internet.

zil find its fulcrum in Minas Gerais, when between the 17th and 18th century, during the Portuguese colonization, reached its peak. Initially gold was discovered around this area around the end of the 17th century, and later also diamonds, on the northern part of the state. Over a half million of slaves were deported to work in the gold mines, the activity was so intense that Brazil reached almost the half of the world's gold production (Toy and Griffith). Witness of the gold rush that occurred in those times, are the many heritage sites and historical cities that were founded here, among them, the most famous are: Congonhas, Ouro Preto (both UNESCO heritage sites), Sao Joao del-Rei, Tiradentes, Diamantina and Mariana. Especially Ouro Preto (meaning Black Gold), was the focal point of the Brazilian "Golden Age", as during the 18th century was the most populous city in the New World, with 80,000 inhabitants (double the size of New York). Ouro Preto was also the focal point of the – so called – Estrada Real (Royal Road) or *Caminho do Ouro* (*Route of the Gold*), the path connecting Rio de Janeiro and Paraty with Diamantina where most of the mining products were transported and then shipped to Europe.

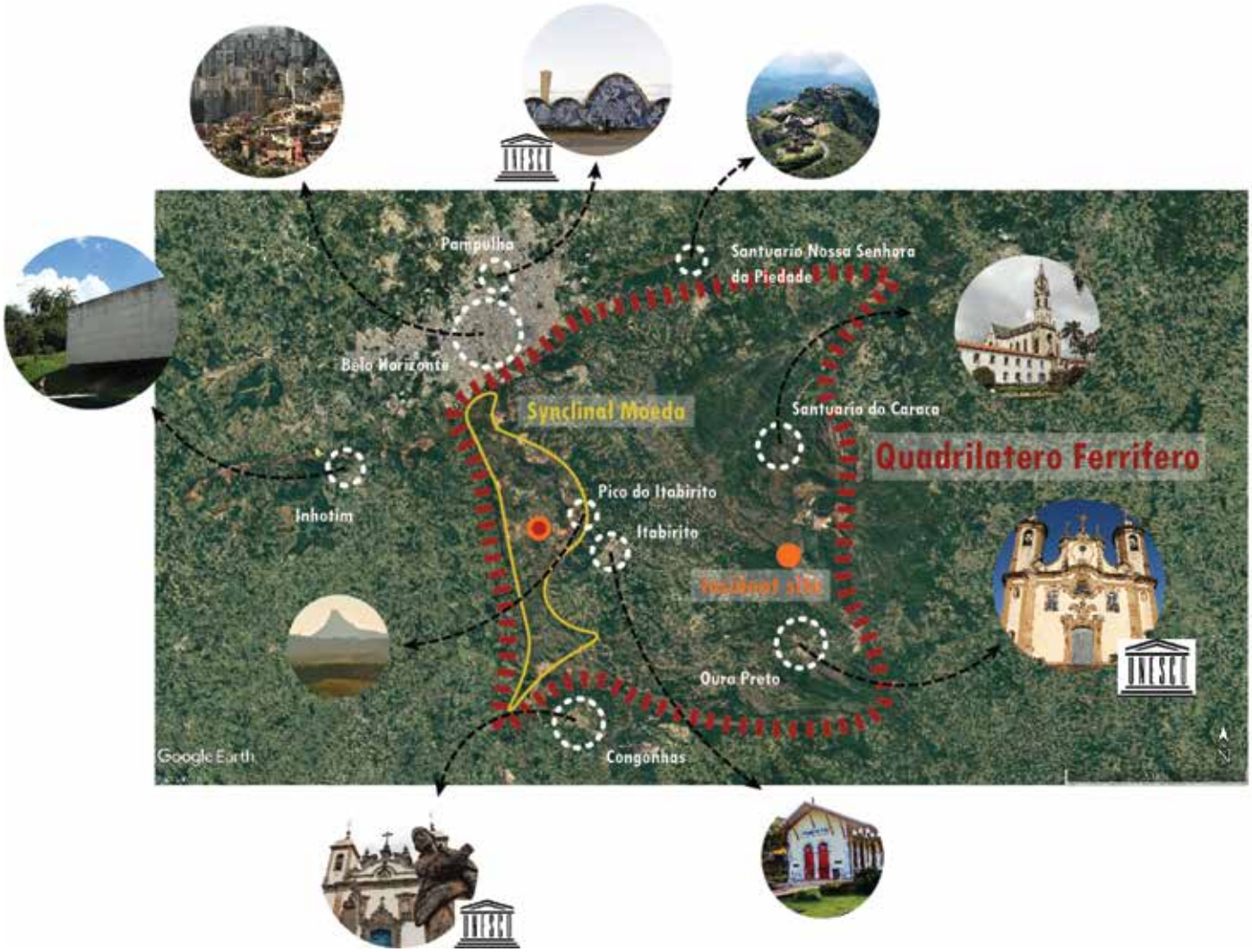


Fig 9: The Quadrilatero Ferrifero, areas and sites of interest. Source. Internet.

Fig. 10: *Inhotim,* is a famous centre of contemporary art, designed by Roberto Burle Marx. Source: Original picture

Fig. 11: *Ouro Preto*, historical city linked to the gold rush period, nowadays its a UNESCO heritage site. Source: Original picture

Fig. 12: *Igreja de Saõ Francisco de Assis da Pampulha*, UNESCO heritage site, example of Brazilian Modernist architecture. Source: Original picture

Fig. 13: Flower of *Quaresmeira,* the Quadrilatero Ferrifero is characterized by a particular biological richness, counting many endemic species. Source: Original picture

1.4 AREDES AND THE RESEARCH SITE

For the purpose of this research it has been chosen an area located inside the Ecological Station of Aredes (EEA), within the context of the Quadrilatero Ferrifero (see Fig. 14). Aredes started in 2010, it protects an important historical and archaeological complex, constituted by a large area where activities related to gold mining, agriculture and commerce were developed (Formoso 2013). Since ancient times till nowadays, this territory saw the influence of great anthropic modifications of the landscape.

The EEA is founded in the Syncline Moeda, a highland delimited by two mountain chains oriented in North-South direction. Aredes is located within a very distinct and interesting landscape; on one side, characterized by important natural features, on the other, suffering the pressure of old and new human developments. The Ecological Station can be considered like a little sample of this situation (more information would be given in the 4th Chapter). This proposal of landscape intervention, seeks to identify the area's peculiar conflicts and values and to narrate them within a project of landscape reclamation, considering the guidelines given in the Manajement Plan (Plano de Manejo). For this reason it has been selected an area which has been pointed to be in urgent needs of being recovered.

The area selected is an installation of the Herculano Mining Company, is the tailings dam B4, located on the North boarder of the Ecological Station (see Fig. 15). The selection has been made following criteria that were decided before hand, without any knowledge previously acquired except the visiting walks. The criteria adopted were:

Fig. 14: Localization of Aredes and the Herculano's Plateau. Source: Internet

- The landscape resembles more to the ones addressed in the literature when considering interventions of reclaimed mining landscape.
- Aesthetically speaking the characteristic of a post-mining landscape are more recognisable, making the aesthetic research upon them more feasible and explicit.
- Considering the context of the Ecological Station of Aredes, this area would be more suitable to be developed as a landscape intended for visitors' activities, considering position and accessibility.
- Personally, I found this landscape more complex and richer in terms of perceptual encounters.

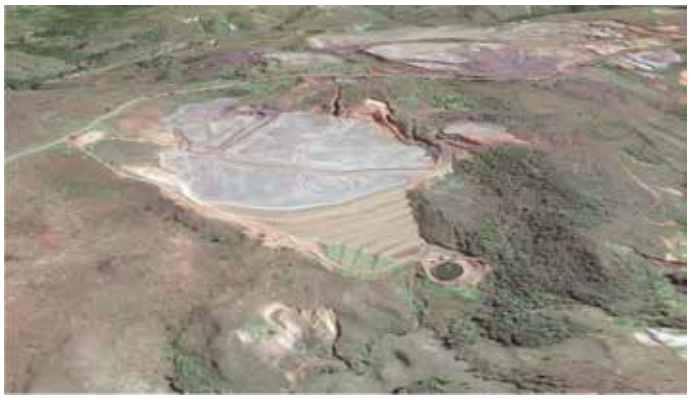


Fig. 15: Tailings dam B4. Source: Internet

The tailings dam B4 is part of a bigger area that was all formerly propriety of the Herculano Mining Company. This area is also known as the Herculano's Plateau (BRANDT 2015), for the fact that the complex dominates the higher part of the Plateau (see Fig. 15). Together with the dam B4 there are other interesting features mostly related with the mining activity on this plateau (see Fig). In the middle of the plateau, surrounded by a degraded landscape, there is the Tanque Seco, an ancient sinkhole of which significance would be explained further during the analisys.
Other important characteristics of the tailings dam are its dimensions. The area considered for the reclamation project is around 37 hectares, comprehending also part of the surroundings of the dam. This area is almost as large as long, ideally a square of 800x800m, with the dam inside that is high 42m (see Fig. 18). The main anthropic features in the area are the tailings dam, in which can be recognized by the part of the tailings,

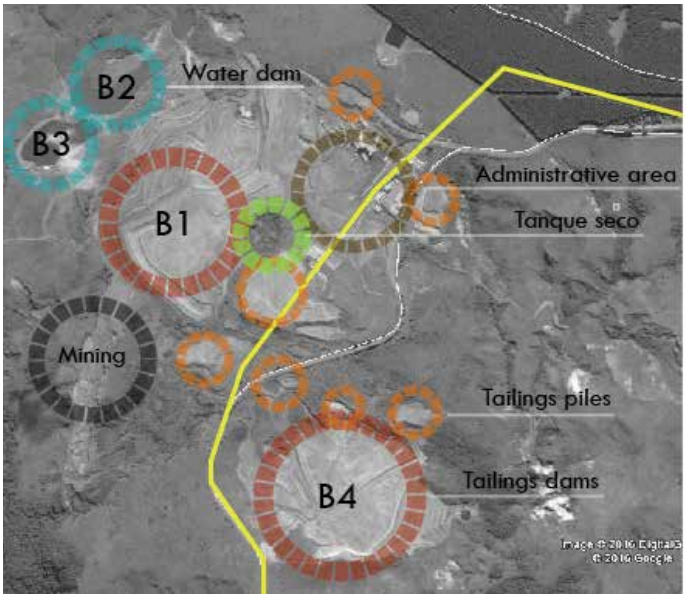


Fig. 16: Herculano's Plateau, traces of the antropic influence. Source: Internet

the deserted impoundment area, with the structure of the dam, typically organized in huge staircases made of compacted earth (see Fig. 19). In addition, is possible also to recognize the water collector, where some water of the Company is depurated on the lower part of the landscape and some tailings piles, casually left here and there. Finally, of course, the paths, the drainage system, tubes and pipes are also smaller sign of the anthropic activity on the landscape.

1.4.1 Tailings dams

Tailings dams are retention structures that rank among the biggest structures in the world and are designed as permanent containment (meaning to last forever) posing many environmental challenges (Gavett 2012). These dams are filled with the by-products of the mining operations: the material extracted from the mine is processed in a mill in which the ore is divided from the waste rock that has no commercial use. This material called tailings is presented as solid or liquid, typically is a muddy material, that is piled or ends stored in dams. There are many types of tailings dams, each type is chosen based upon the topographic, geological and climatic features of the landscape. The one under study is a tailings impoundment dam realized with an upstream design. This means that the structure has been constructed starting from the bottom to the top (from the toe to the crest), as the tailings are released, and that the content is a muddy-wet type of tailings, recognisable by a wet surface at the top. More specific details about the tailings dam will be presented along the thesis. What is important to note at this point is that the structure is no more operative, after the event of a serious accident occurred the 10 of September 2014.
Tailings dams failure is one of the most common causes of accidents: on average is estimated one big accident

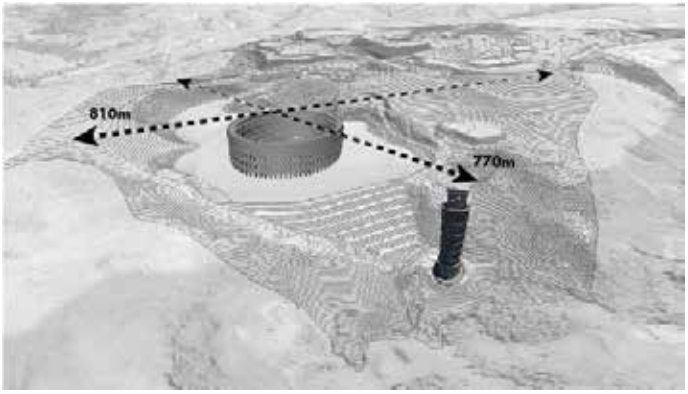


Fig. 18: Dimensions of the tailings dam B4. Source: Original image

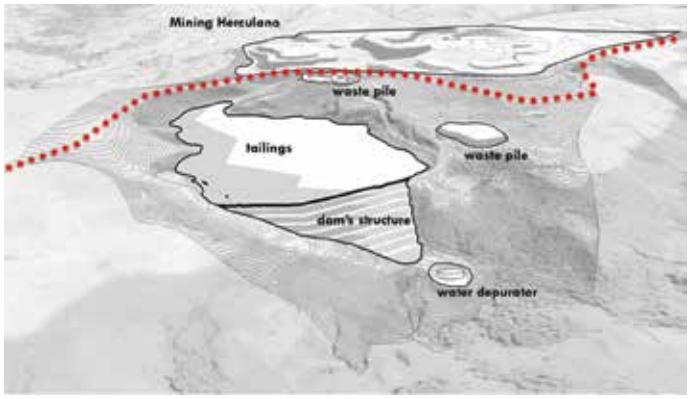


Fig. 19: Partition of the tailings dam B4. Source: Original image

Fig. 20: Distruction of a village along the Rio Doce after the collapse of the tailings dam. Source: Internet

Fig. 17: The research area, the Herculano's tailings dam B4. Source: Original picture

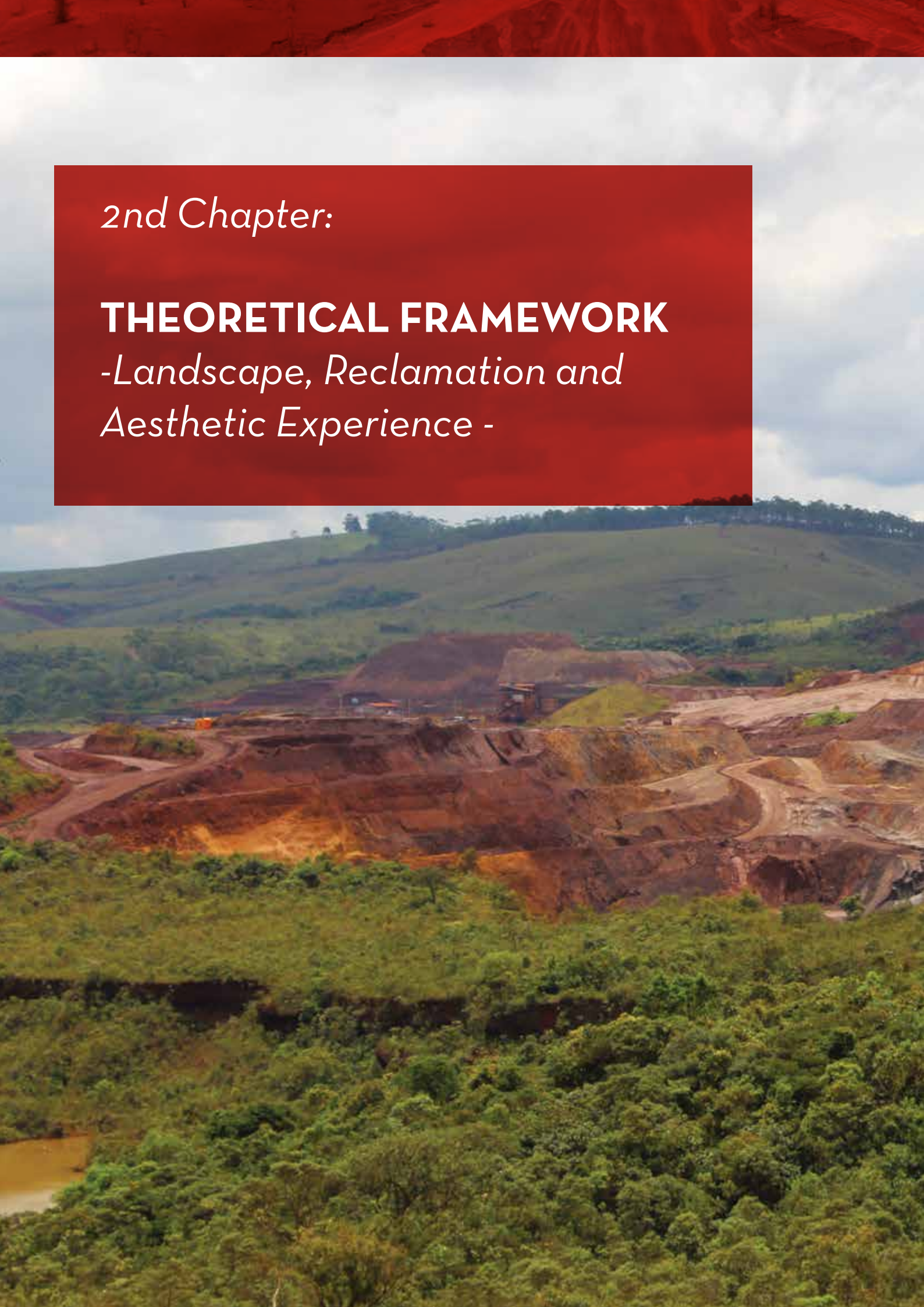
involving a tailings dam each year (Martin and Davies 2000, Diamond 2005), and failure rates might be higher due to probable unreported cases. Around the world are calculated around 3500 active tailings dams, 2000 of these experience 2 to 5 "major" failures annually (Martin and Davies 2000). The environmental damage caused by failures can be very high as the tailings can release toxic metals (as arsenic and mercury), produce acid drainage either pollute the clean water on which relies the aquatic wildlife (Franks, Boger et al. 2011). But the most severe failures have caused too many fatalities in different places around the world (Rico, Benito et al. 2008, Franks, Boger et al. 2011).
Right inside the Quadrilatero Ferrifero, around 50 km far from Aredes, the 5th of November 2015, the collapse of a tailings dam at the Samarco iron mine, closed to the village of Bento Rodrigues, provoked the death of at least 17 people (see Fig. 17). The environmental damages were so impressive, that the accident has been declared "the worst environmental disaster of the Brazilian history". It was estimated that 60 million cubic meters of mud broke through the dam, creating a large mudflow that propagated into the local river system (see Fig. 21) until the Atlantic Ocean, causing a large die-off of aquatic life (Mattex 2016). The environmental damage won't be recovered for decades and the life of many locals have been changed forever.

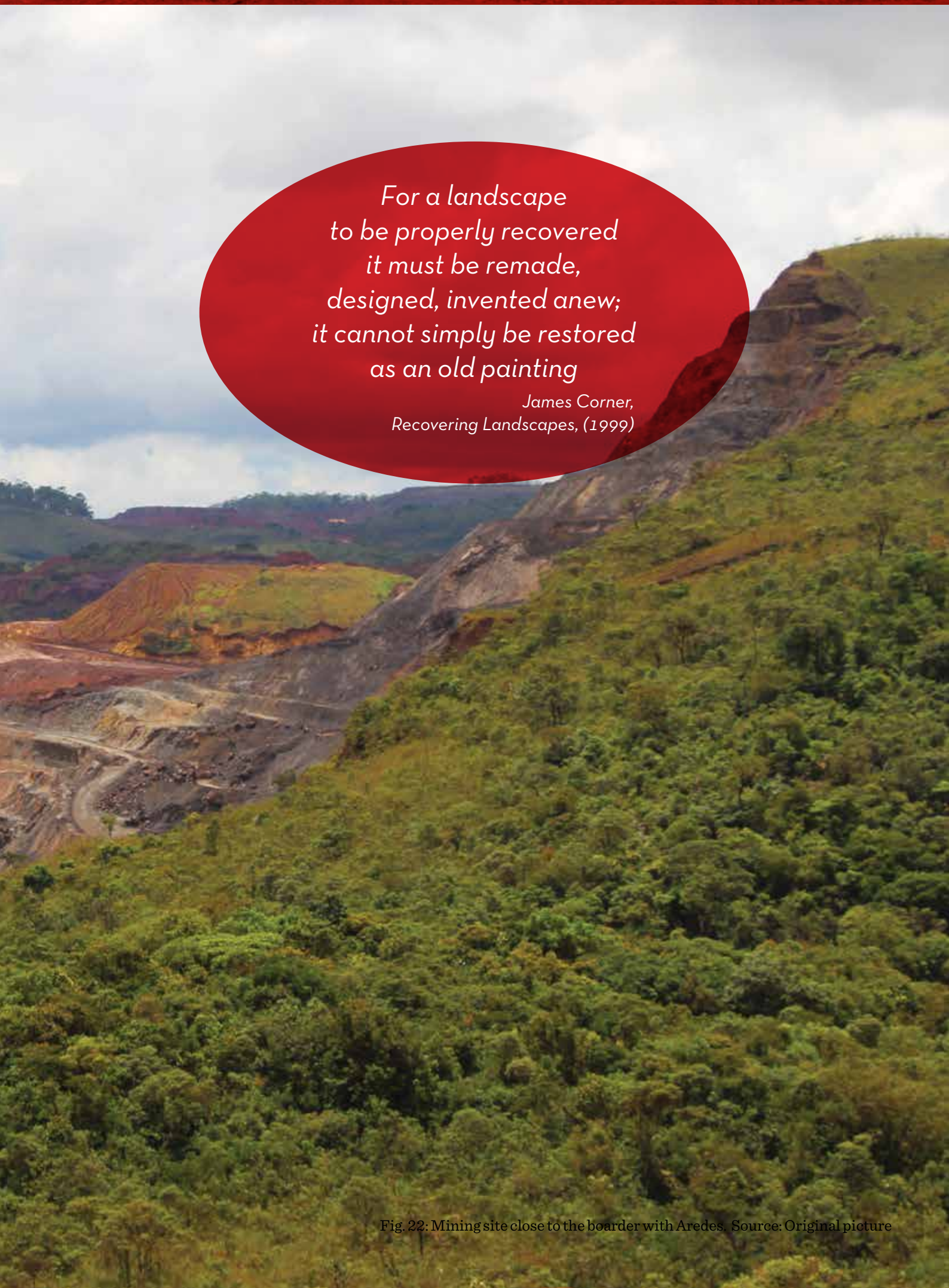
Fig. 21: Impact of the disaster along the Rio Doce. Source: Internet

2nd Chapter:

THEORETICAL FRAMEWORK

-Landscape, Reclamation and Aesthetic Experience -





For a landscape
to be properly recovered
it must be remade,
designed, invented anew;
it cannot simply be restored
as an old painting

James Corner,
Recovering Landscapes, (1999)

Fig. 22: Mining site close to the boarder with Aredes. Source: Original picture

2.1 LANDSCAPE: A DYNAMIC CONCEPT AND A CULTURAL PRODUCT

There are many definitions of landscape namely an agent for a change (Koh 2013, a field of potential (Koolhaas, Mau et al. 1995), mat and matrix (Forman 1995), a thick surface (Allen and McQuade 2011), a language (Spirn 1998), and most of all a body or embodied experience (Berleant 2011). All of these definitions are mostly instrumental and discipline centered, witnessing that landscape is an open concept that doesn't pertain just one scientific monopoly (Koh 2013). Moreover, this elusiveness of the term is also recognizable in different cultures and time periods (Stigliano, Ribeiro et al. 2011). For example, *parerga* was the Italian term for landscape, constituting the auxiliary scenarios for the common themes of mythology and Holy Scriptures, an idyllic and pastoral environment, image of the Garden of Eden. While in the Netherlands, *landschap* (from the German *landshaft*) assumed the meaning of the land shaped by the work of man and at the same time the delightful object of a painting (Schama 1996, Stigliano, Ribeiro et al. 2011).

Stating the different uses that the term landscape implies both through the course of history and nowadays, it would be important to find a common ground from which each different perspective derives. According to Milton Santos (2000) the general concept of landscape derives from the concept of space, which essence is social, constituted from the relation of material things (nature) with society (culture). Its physical and geographical characteristics are interrelated with all the social processes representative of a society in a given moment, the fundamental characteristic of space. All the social processes representative of a society are part of its culture, defined as "the customs, arts, social institutions, and achievements of a particular nation, people, or other social group" (Oxford Dictionary). In this sense it stands out the idea that landscape is a cultural product, built upon a rich repertoire of habits, myths and traditions (Schama 1996, Turri 1998, Stigliano, Ribeiro et al. 2011). Looking at the landscape as a product of culture, made both of material features and the work of the mind, it entails that the essence of landscape doesn't resides neither in the object nor in the subject, but the in relation between them.

Assuming again the fundamental relation of the landscape to the concepts of space (and time) as expressed by Milton Santos (Santos 2000) two fundamental characteristics of the idea of landscape are related to its elusive essence: dynamism and signification, through materialization of the social processes linked to it[1]. It appears clear in this perspective that the study of culture is essential to understand landscape, or, vice versa, that the study of the landscape is essential to understand culture, as a mirror of society (Turri 1998). Indeed, landscape displays evidence of knowledge, the habits and the needs for men to survive, in brief, their relation with nature (Stigliano, Ribeiro et al. 2011). In this sense, with cultural landscape, it is intended: "a concrete product and interaction characteristics of complex between a particular human community, covering certain preferences and cultural potentials, and a particular set of natural circumstances " (Stigliano, Ribeiro et al. 2011, p. 639).

1 Dynamism, as always in relation with the social processes influencing it both in form and content. Signification through embodiment of social process as product of the bilateral relation between form and action.

2.1.1 The Landscape as a Text

Landscape therefore is embodied with important (changing) values and symbols that can be red and interpreted by the observer. These messages tells us about the natural and social characteristics of a place and the relation between the two. Modern cultural geography developed the concept of landscape as a "text", the document that represent society (Pandakovic and Dal Sasso 2009, Stigliano, Ribeiro et al. 2011). Also, landscape is like a palimpsest that we can interpret adopting a regressive method and through the knowledge given by many different disciplines (Turri 1998). But what we can observe is just the last fragment of a history where not all the messages, formally expressed, are always visible and some are totally absent (Pandakovic and Dal Sasso 2009). Indeed, reading a landscape in all its complexity requires a certain amount of particular knowledge, a specific language (Cosgrove 2004), not accessible to everyone, so that its meanings are often hidden to the general public (Pandakovic and Dal Sasso 2009, Stigliano, Ribeiro et al. 2011). Revealing the hidden messages carried by a landscape is part of the work of a landscape architect (Cosgrove 2004), "re-presenting the landscape at a level in which its meanings are exposed and reflected" (Stigliano, Ribeiro et al. 2011, p. 640).

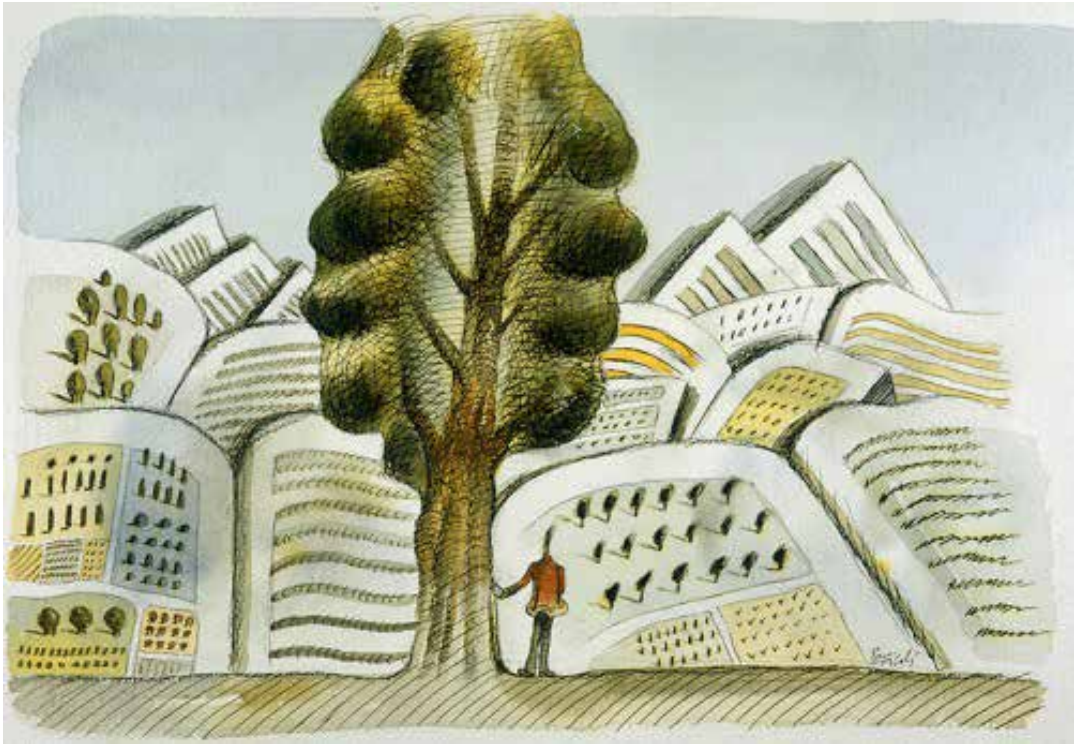


Fig. 23: Tullio Pericoli, "*Lettore*", 2000. Source: Internet

2.2 DEFINING RECLAMATION

The term reclamation is widely used in the literature by several different authors, nevertheless it seems that there is no clear shared definition among them. Sometimes reclamation is used in alternative to the terms restoration and rehabilitation without specifying any differences. The National Accademy of Science of the United States of America, in 1974, defined these three terms as expressing three different strategies for recovering degraded areas (Correa 2007):

- Restoration: entails the replacement of the exact conditions previous to the degradation of the area, the status quo ante. Restoration of an ecosystem is highly difficult, expensive and not always possible for cases in which the landscape is extremely degraded, as in the case for mining areas. In addition, restoration produces just simplified communities, if related with the originals, or communities that cannot be maintained.
- Rehabilitation: consists on the return to the productive activity of the earth, not of the entire ecosystem, through appropriate revegetation. Entails the recovery of at least some of the functions of the ecosystem and of the original species.
- Reclamation: is the stabilization of a degraded landscape, without a strict ecological compromise. The term also defines a generic process that embrace all the aspects of a project that sees a new utilization for a degraded site.

The author that is mostly interested in defining the term reclamation, especially in relation to recovery of mining sites, is Alan Berger. The author, considering the wide spectrum of possible meanings and given definitions, finds the core of reclamation in the idea that it consists on "*claiming or constructing new futures out of preexisting conditions*" (Berger 2002, p. 60). Reflecting upon the etymology of the word (from the Latin *re-clamare*, "to cry out against"), we reclaim in an attempt to return or recover something that has been previously lost. But, since it's not possible to return to the conditions previous to the mining activity, according to Berger, one concludes that the goal becomes to recover something else, not just the environment. Indeed, reclaimed landscapes never re-create the old or represent it.
They construct or assemble artificial conditions that accept alteration as the genesis of a new landscape structure. This results in the formation of a new ontological value from altered conditions. Reclaimed landscapes, a new category of environmental distinction, are post-technological landscapes[1] (Berger 2002, p. 71). Indeed, in the act of reclaiming and in the reasons that bring to reclamation, there is a consistent socio-political aspect, that makes these landscapes the interesting result of technological, scientific and socio-cultural situations. Therefore the act of reclaiming becomes an opportunity to rethink the future by reflecting on the past through the act of "*reordering physical entities (such as natural systems, programmatic experiences, sun and shade, wind and water) and nonphysical phenomena (such as perception, jurisdictions, and histories)*" (Berger 2002, p. 61).

1 Alan Berger defines post-technological to "describe landscape ecologies that have been created (reclaimed) by technological (human-in-duced or artificial) processes.

Reclamation VS Restoration

A way Alan Berger defines reclamation is in distinction to restoration, as two different ways of recovering a landscape (Berger 2002, Berger 2007). Reclamation is a much younger concept if compared with restoration; while landscape restoration took place around 1935, in the US, landscape reclamation did not begin until 1977 (Berger 2002). There are more than one aspect remarking the difference between the two terms, but the ontological difference is that reclamation seeks the creation of a new landscape and ecological situations (Berger 2002). While, the attempt of restoration is that to bring something to a former condition whatever that might be, erasing any sign of disturbance or disruption (Berger 2002, p.13). Reclamation, not necessarily take into consideration the site's preexisting condition and doesn't makes any effort to return to it, instead "its goals are to minimize the negative impacts that the site may have on the surrounding environment and to maximize its aesthetic and ecological functionality" (Berger 2007). The author also stresses how the attempts of restoration on mining sites are very improbable considering the magnitude of the intervention on completely reestablishing the former landscape on such a wide area.

This distinction between reclamation and restoration should not be taken too literally, because the distinction is not so clear especially in the professional context, but sometimes also because it is difficult to judge if a landscape has been restored rather than reclaimed. To better clarify this distinction I took two examples that are strikingly helpful to understand the difference. On one hand, an ideal restoration plan could look like the one implemented by the Terra Institute in Minas Gerais, Brazil (fig 001). The project took place on the farm of the

Fig. 24: Example of Restoration (before): Instituto Terra, MG, Brazil Source: Internet

Fig. 25: Example of Restoration (after): Instituto Terra, MG, Brasil. Source: internet

Fig 26: Example of Reclamation, Vall d'en Joan landfill site, Battle i Roig Architects, Catalunya, Spain. Source: Internet

famous Brazilian photographer Sebastiao Salgado, which returned what was formally a cattle ranch into a subtropical forest, considered its natural state. On the other hand, the project of the Vall d'en Joan in Catalonia, designed by Battle i Roig, represents a perfect example of reclaimed landscape. The project consists in recovery a waste dump by creating a new landscape that integrates landscape engineering with landscape architecture solutions. In the website of the firm the project is presented as an intervention of restoration, witnessing, ones again, the confusion around the term.

2.2.1 Reclamation and Landscape Architecture

The example of the new landscape created in the Vall d'en Joan is just one of the many reclamation projects made by landscape architects. The Alumnae Valley Restoration project in Wellesley (MA, United States) during 2001 and 2005, consists in reclaiming a toxic brownfield into a restored Campus by re-conceptualizing the natural and anthropic history of the area (Fig. 27). The design highlights a much undulated topography of the soil that emphasizes the forms generated during the glacial period in this area. Another intervention that calls the attention is the one still in development by James Corner's studio Field Operations, Freskills Park. It's a model of landfill reclamation transformed into a vast green space full of wildlife and very diverse activities close to Manhattan (Fig. 28). On one hand the landfill gas collection system is used to provide enough gas to heat 22.000 houses, on the other, the park serves as a beautiful cultural destination, demonstrating how landscape architecture can restore a harmonious balance.
The reason that makes reclamation so important for landscape architects resides in the necessity of considering and reshaping those social processes that are materialized in it, those dynamic and symbolic landscape aspects assumed so fundamental by Milton Santos and many other authors. Indeed, Berger argues how landscapes designers "*often failed to see landscape space as anything other than the context or setting for significant action to occur...This suggest that space is an externalized, neutral, passive, asocial thing*" (Berger 2002, p. 151). Berger is not alone in stressing how operations of reclamation require a holistic approach, often understood just as a technical or economic problem that does not take into account the formal, visual and cultural aesthetic expression of the landscape (Martiš, Zdražil et al. 2008, Sklenička and Kašparová 2008, Svobodova, Sklenicka et al. 2012). Therefore, as "reclamationists", landscape architects shouldn't forget that these landscapes are a dynamic product of both culture and nature, going beyond this apparent dualism eradicated by the modernist perspective (Berger 2002).
To conclude this section is important to mention a recent recovery project of a tailings dam that took place in Minas Gerais, close to the research area. This project consists

Fig. 27: The Alumnae Valley Restoration project in Wellesley (MA, United States), 2001-2005. Source: Internet

Fig. 28: Fresh Kills Park (NY, United States), by Field Operations. Source: Internet

of recovering three tailings dams located near Sao Joao Del Rei, and the design is made by Patricia Akinaga in collaboration with many other experts. The objective of the intervention, declared in the report (Akinaga, Namba et al. 2010), is to re-create (and not to re-produce) the natural characteristics of this place, by reconciling the natural landscape with the constructed landscape (Fig. 29). Although this could be considered a reclamation type of project, from the visuals its perceivable a quiet "naturalistic" type of design in which the aesthetic characters of the constructed landscape are hidden.

Fig. 29: Reclaimed tailings dams, *Mina da Cachoeira,* Sao Joao Del Rei. Source: Akinaga, Namba et al. 2010

2.2.2 Reclaimed landscapes as a laboratory for new scripts

The overlook upon these project was useful to understand how reclamation is important to experiment and negotiate new future scripts for the landscape. It is about creating new narratives that not only restore ecological processes but rethink the human relationship with nature (Potteiger and Purinton 1998). In this sense Alan Berger reflects considering in particular mined landscapes: "*Mined sites enable designers to speculate over a landscape that is not bound by, nor indebted to, historical filters, aesthetic traditions, or strict contextuality. Within this rubric reclamation is not solely a "landscape" or engineering issue. It is a large scale design issue that affects environmental systems and the life supported by them. Most importantly, reclamation can act as a laboratory for experimentation."* (Berger 2007, p. xviii).

Now, given the interpretation adopted of the landscape as a text, and reclamation as a field for experimentation of new scripts for landscape architect, reclamation could allegorically be envisioned as one of those epic stories in which the protagonist has to struggle through many asperities to reach a better condition from a negative situation in which he finds himself. It's the well-known narrative topic of the hero that starts from the ancient myths of our culture, passes through the romantic poets, and arrives nowadays gently hidden in many Disney movies. No doubt why walking through this landscape we feel as being characters of the epic novel The Lord of the Rings, with its infernal scenarios successfully represented in the homonymous film. The way through asperities, the struggle between the Good and the Evil, portrayed in *The Lord of the Rings* are topics that are strongly rooted in our culture and allegorically depicted in many ways. In this sense perhaps one good example of the heroes' journey is wonderfully described by Dante Alighieri in the *The Divine Commedy*. In his masterpiece, the protagonist, Dante himself, with the help of Virgilio and then of Beatrice, travels through Hell to Heaven (through Purgatory) to find again the way to salvation that was lost.

In our culture all the stories of redemption or salvation are like concentric circles with-

Fig. 30: *Pico do Itabirito.* Source: Violeta Andrada

Fig. 31: Image of the mountain of Doom, from the film "*Lords of the Rings*". Source: Internet

in the biblical story of Adam and Eve in the garden of heaven. The Italian philosopher Rosario Assunto starts from the idea of paradise, an ancient cross-cultural concept, as the ideal condition of being to which we struggle to come back, as the ultimate end at which every landscape project should aim. Paradise, from the Ancient Greek παράδεισος which means garden, it's that place where trees are "*enticing to look at and good to eat*" (Genesis 2, 9) and where in the middle "*the tree of life and the tree of the knowledge of good and evil*" is found (Genesis 2, 10). In other words, is that place where *firmitatis*, *utilitatis* and *venustatis*[2] are always present together (the pleasant and good for food trees) and where there is also space for the sacred, the mystery, that is not object of consumption but mere contemplation (the tree of life and death). In this sense it is a common expression among landscape architects to "make a garden out of Eden" of a given place. Therefore, paraphrasing John Milton, in every landscape that we aim to reclaim there is a lost paradise that needs to be found, a narrative of redemption that is waiting to be told through the help of a landscape architect.

2.3 AESTHETICS

Once presented the importance that cultural systems have in reclamation, Berger (2002) also briefly discuss how aesthetics should be rethought beyond its traditional connotations. In his view the aesthetic experience should be thought not just for its mere visual aspects, but more as a form of learning, unrevealing complex phenomena linked to cultural agents. Reflections on aesthetics finds strong agreement also from authors and different fields. Gobster et al. (2007) recognises the importance of aesthetics in motivating and directing landscape changes by influencing people's behavioural choices. In this article the authors convey that landscape designs could be mutually beneficial, aligning the immediate aesthetic experience of a landscape with its ecological processes. Also Meyer (2008) is interested in bringing aesthetics within the discourse of sustainability through the practice of landscape architecture. She argues for what she calls the *performance of appearance*; people tend to care much more about landscape that they can aesthetically appreciate, and therefore landscape architects should stand for the claim that "*design matters and beauty matters*".

> "Many professions and disciplines will contribute to our understanding of sustainability. Landscape architects who are designers do so by making places that are constructed performing ecosystems and constructed aesthetic experiences."
> Meyer (2008, p.21)

2 These are three main principle of architecture according to the Latin writer Marco Vitruvio Pollione in the *De Architectura*

Moreover, the reflection upon aesthetics in landscape architecture is brought forward by Van Etteger et al. (2016) who address the imbalance within nowadays practice due to the mayor focus that is portrayed toward functional and sustainable design. They argue that by adopting Zangwill's Aesthetic Creation theory (2007), landscape architecture can entirely be considered as an art. Leaving the traditional aspiration of *art for art's sake*, works of art can also have non-aesthetic functions, such as ecological ones, together with their essential core. The same urgency is expressed by Brady (Brady 2006, Brady 2007) for whom artworks can act as catalysts for aesthetic-moral interactions between man and nature. Finally, it's clear how Berger's reclaimed landscapes find the new perfect battleground for the current debate in landscape architecture in which the traditional conceptions of culture and nature, art and science are challenged.

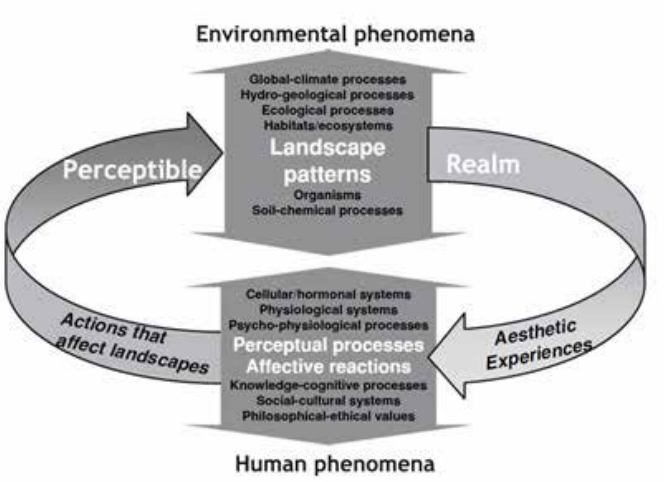


Fig. 32: Model of Human Environmental Interactions in the landscape. Source: Gobster, 2007.

2.3.1 The Aesthetic Experience and the Aesthetic Message

In order to design an aesthetic experience of nature I had to investigate what actually this means and what are the different positions within the literature. The word "aesthetics" was introduced in the philosophical lexicon during the 18th century, but the origin of the word aesthetics comes from the Ancient Greek αίσθησις, which means "sensation", and nowadays it consists in the study upon beauty and taste. Indeed, every experience of landscape, whether ecological or aesthetic, starts at a certain scale from what humans perceive as landscape, the *perceptible realm* (Gobster, Nassauer et al. 2007). But the sensuous encounter with the perceptible real is just the first step of the aesthetic experience. Indeed also our cognition, our values and other historically cultural factors that are referred as "*the totality of human experience of the object*" (Koh 1998, p. 177) can play a determinant role in the way we finally judge the world (Nassauer 1995). Therefore, once again, landscape aesthetic experience can have an impact on influencing actions that affect the landscape. A clear schematization of this concept is given by Gobster et al. (2007).

According to Umberto Eco the message have an aesthetic function "*when it presents itself structured in an ambiguous way and appears self-reflective, therefore when intends to attract the attention of the addressee above all upon its form*" (Eco 1968, p. 110). Indeed, he argues that ambiguity rises the attention and demands for an extra interpretative effort in which the apparent disorder, of the object under investigation is finally decoded, and a non-obvious order is found. Eco explains this concept by referring to Aristoteles' *Poetica*, in which the ancient philosopher argues that the tragic narration to be effective has to go beyond our expectations, but this to be accepted always has to appear somehow credible, within a recognizable script. This dialogue between our inner self and the surrounding world constitutes the essence of the aesthetic experience for every situation whether these are artistic representations or everyday situations.

Therefore, the essence of the aesthetic experience, resides in creating ambiguous signs, narratives or metaphors, as bridges through our inner world and the outside world, transmitted through the means of perception. As Emily Brady says "*My appreciation of aesthetic qualities is directed by what I perceive, but what I pick out for appreciation depends to some extent on the effort I make with respect to engaging my perceptual ca-*

pacities" (Brady 1998, p.143). The effort addressed is the one already addressed by Eco. According to Brady, imagination, inherent to the subject that experiences it, is responsible for creating these metaphors that binds us in stronger relation with the world. Consequently, the aesthetic properties of a landscape are those that enables the observer to "*recognize that certain common forms have a more or less sacralised or withdrawal of the course of everyday life. In this sense, they are the object of admiration and contemplation for the exemplary idea of which they are loaded and for the exceptionality that introduce.*" (Gomes 2007, p. 242).

2.3.2 The debate on Environmental Aesthetics

The aesthetic appreciation of nature as we intend it today, in the West, is a relatively young concept. Indeed, it is a cultural product of the 18th and 19th century, born with the new aesthetic theories of nature developed by mainly two philosophers, Edmund Burke and Immanuel Kant (Cronon 1996). While before the concept of aesthetic regarded just the sphere of fine arts, the aesthetic dimension starts embracing also the natural environment no more just trapped into paintings.
According to Carlson (2010) the Traditional Aesthetics of Nature has its roots in the idea of the *Picturesque* that stands between those of the *Beautiful* and the *Sublime*[3]. Therefore a middle ground between the traditional idea of the beautiful and the threatening wild nature of the sublime. This concept continued to shape a popular way of appreciating nature till nowadays, in which scenic images of nature are used to attract tourists.
A related approach is the formalist theory of art, for which "*aesthetic appreciation in general was constructed as the detached contemplation of the formal structure of any isolated object of appreciation*" (Carlson 2010, p.5). Consequently also nature can provide

3 While Beauty was a concept already categorized during Neoclassicism, the Sublime and the Picturesque have been defined after, during romanticism, by Burke, Kant and Price.

Fig. 33: Thomas Moran (Hudson School), "*The Grand Canyon of the Yellowstone*", 1901. Source: Internet

aesthetic values as long as it formally resembles to arts, experienced as "*a pure formal combination of lines and colours*" as Clive Bell, the main exponent of formalism, wrote (Bell 1958).

Nowadays the aesthetics of nature is integrated in what is called environmental aesthetics, a new area of aesthetics emerged at the end of 20th century. The study of this discipline considers the appreciation of the world at large and not just the one of the natural environment (Carlson 2010). Within environmental aesthetics different positions can be traced, these can be conventionally divided into cognitivist and non-cognitivists theories. The cognitive account (or scientific cognitivism), such as the one proposed by Carlson and Saito, argues that knowledge is necessary to correctly determine, as categories in arts, the aesthetic value of nature (Matthews 2002). Rejecting the tradition of landscape picturesque appreciation and formalism, cognitivism follows another tradition of nature appreciation developed by Aldo Leopold at the half of last century, and known as "*ecological aesthetics*". On the other hand, the non-cognitive approach declares that appreciation of nature doesn't necessarily need scientific knowledge and that it is a more intuitive and visceral experience (Carlson 2010). This view is closer to the traditional one but does not have to be considered as primarily emotive and extremely formalistic (Parsons and Carlson 2004).

These philosophical standpoints highly influenced the current scientific research in landscape aesthetics. Landscape preference and perception theories, routed in environmental psychology, dominated the empirical work in the field of landscape aesthetics since the 1960's till the end of the 20th century (Jorgensen 2011). These theories can be divided into evolutionary theories and cultural preference theories (Sklenicka and Molnarova 2010) . These types of theories are based on a wide number of multidisciplinary scientific researches (in the field of environmental psychology, neurobiology and cognitive science) and are grouped under the term "*scenic aesthetics*" (Parsons and Daniel 2002). These researches implicitly claim that preference is relatively permanent across human perception of nature and that, therefore, scenic aesthetics results from an idea of aesthetics not easily malleable because profoundly inherent to humans. This vision seems to follow the non-cognitive philosophical approach, derived from the more traditional theories of aesthetics of nature in which there is a focus on the formal properties of the object instinctively recognized by the human mind. Indeed, it is not a case that scenic aesthetics has become associated with popular preferences for spectacular romanticized landscapes as the ones represented by the artists of the Hudson River School (Ellison 2013).

In contrast to this apparent fixity portrayed by the sce-

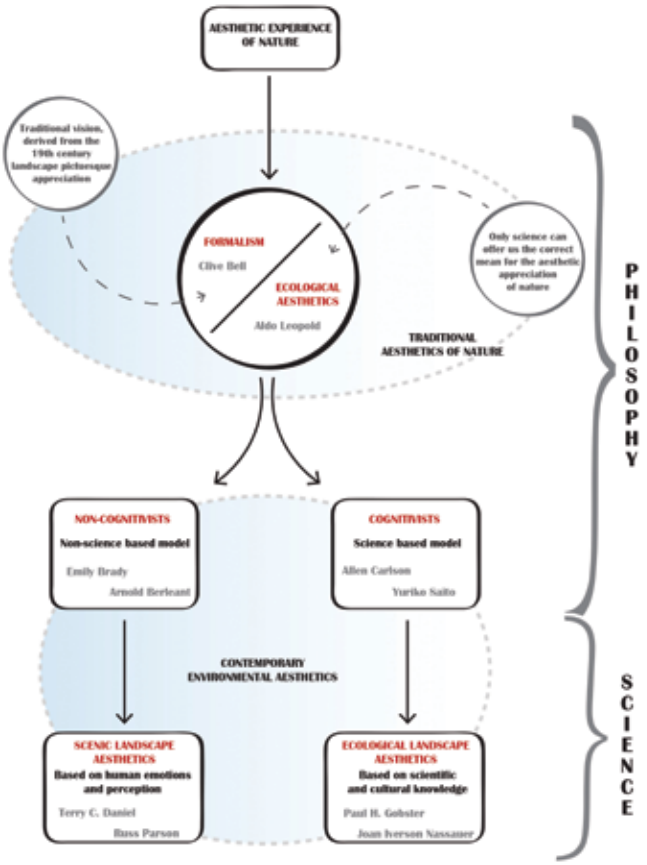


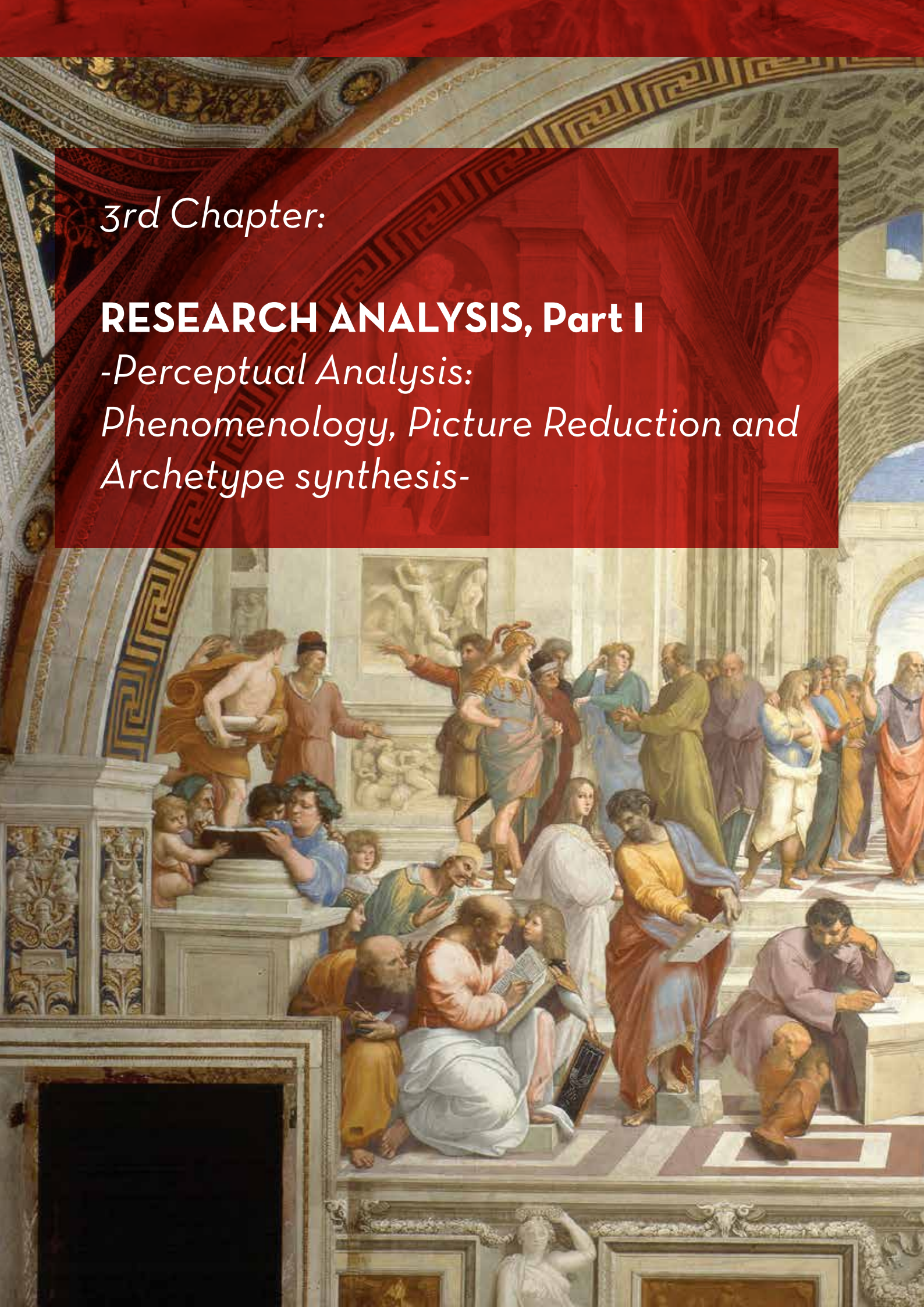
FIgure 34: Theoretical flowchart. Source: Original image

nic aesthetics, more recently, advocates that rely on the shoulders of Aldo Leopold's ecological aesthetics theory, assert that appropriate appreciation should not be found in immediate sensory involvement but on a more cerebral and information-based perspective (Gobster, Nassauer et al. 2007, Jorgensen 2011). According to ecological aestheticians "*the scenic aesthetics has taught us to view landscape passively, limited the benefit we gain from such encounters to short-lived changes in mood (Gobster 1999), and led designers to manage the land for the "lowest common denominator" in aesthetic taste*" (Carlson 1977). Therefore they criticize scenic aesthetics for being superficial, human-centric and responsible for leading the practice of design, preservation and management (especially in the U.S.) at the expenses of those landscapes that do not accomplish its popular and socio-cultural parameters. As a reply, the advocates of the scenic aesthetics contest the so called superficiality and shallowness of their theories because based on scientific evidence, a consistent body of research (Parsons and Daniel 2002).
Summarizing, the debate is between two ideas about aesthetics, one more human-centred and the other more environment-centred. Philosophically speaking it is about whether knowledge is central or not regarding the aesthetic experience, while scientifically the question is how knowledge influences aesthetic appreciation of nature. If on one side these two visions have not found yet an agreement upon the ontological definition of what constitutes the aesthetic experience of nature, they both agree that, due to the increased concern on environmental issues, it would be important to align aesthetics with ecology, since "l*andscapes that produce important ecological benefits are unlikely to last in human dominated landscapes if they are undistinguished or aesthetically unattractive*" (Gobster, Nassauer et al. 2007, p. 97).

2.3.3 Concluding remarks on Aesthetics

As a landscape architect I'm not interested in finding the answer whether aesthetics is ontologically based on knowledge or some more basic instinct. Rather, I recognize that "*cultural expectations and human pleasure will continue to be measures of ecological function*" (Nassauer 1995, p. 9), as the supporter of the scenic landscape position mainly suggests. So to say that both cognitive and sensory inputs are important for landscape perception and consequently landscape aesthetic appreciation (Svobodova, Sklenicka et al. 2012). Therefore, on the one hand, landscape architecture can be intended as an art that finds its scope in creating attractive aesthetic experiences, evoked by modelling the formal and sensorial qualities of the landscape. On the other hand, as Zangwill's theory suggests[4], nowadays there is a call for expanding the scope of aesthetics to include also non-aesthetic values and therefore orienting it toward "more functional" purposes as environmental issues. Therefore, the *performance of appearance* (Meyer 2008) addresses the challenge that landscape architect should carry, portraying the scenic aesthetic position into the sustainability discourse. Finally, referring back to the statements made at the beginning of this chapter in which aesthetic in reclamation should be considered as a form of learning, mutually addressing the cultural structures and the natural processes within the aesthetic experience.

4In the Analysis chapter, the basic principles of this theory and the use that I would make of it would be further explained



3rd Chapter:

RESEARCH ANALYSIS, Part I

-Perceptual Analysis: Phenomenology, Picture Reduction and Archetype synthesis-

Fig. 35: "*The School of Athens*", Raffaello Sanzio, 1509-1511. Source: Internet

INTRODUCTION:
between Plato and Aristoteles

In the theoretical chapter it has been discussed how the work of the landscape architect (especially in reclamation projects) is challenging for the difficulty of combining two apparently opposite perspectives, the ones of nature and culture, the *sky* and the *earth*, as depicted by Tullio Pericoli (Fig. 36). This be-parted view of the world could be traced in the history on western philosophy; we find that these perspectives can be defined in two currents that influenced our way of thinking since the Ancient Greece. One corresponds to the figure of Plato and is known as Platonism, the other corresponds to the figure of Aristoteles, (Plato's disciple) and is known as Aristotelianism. Although, their philosophical thought has been reviewed and reinterpreted various times through history, some unchanging characteristics can be traced. A Platonist perspective can be defined for its transcendent aspect a vertical movement between the sensuous reality and the, so called, "*world of the ideas*" (as Plato defines it). On the other hand, a Aristotelianism is characterized by its immanent view onto the world, an horizontal perspective to the only existing world, in which the Truth can be found through the use of syllogism, the λογος (logos = rational thinking). In this philosophy we can trace the bases of the scientific thinking that passed through Galileo, Descartes till nowadays.

The masterpiece of Raffaello Sanzio "*The School of Athens*" made for Pope Giulio II, during 1509-1511, illustrate philosophers and personalities of the Classical world. No wonder why at the focal center of the painting are standing Plato and Aristoteles, easily recognizable for their gestures; one (Plato) is pointing upwards towards the *Hyperuranion*, while the other (Aristoteles) is pointing downwards, towards the mere earth. During those times these two perspectives, reinterpreted under the light of Christianism, were read together as one completing the other. This is why, according to the critics, they are so closed together, even overlapping. The world's knowledge is both the knowledge of the terrestrial things and the celestial things, bounded together.

In my vision the final work of the landscape architect is to build the bridge and play on the connection between these two worlds: the sky and the earth, the view of culture and the view of nature as Berger says (Berger 2002), engaging with both of them at the same time. Acknowledging the consideration that these two dimensions are not always easily distinguishable from one another this worldview can be applied to schematically simplify the vision of reality. Therefore, I decided to divide the analysis chapter into two parts; one that tries to

draw out the scenic aesthetic, and more intellectually the transcendental aspects of the landscape, and the other that tries to extracts the ecological, and more immanently scientific aspects of the same landscape. Indeed, the landscape as a text, can have different interpretations. My scope of the analysis will be to investigate both of them.

Fig. 36: Tullio Pericoli, "*Cielo e Terra*", 1985. Source: Internet

3.1 PERCEPTUAL ANALYSIS

The theory on which stands the perceptual analysis is derived from Zangwill's Aesthetic Creation Theory (Zangwill 2007, van Etteger, Thompson et al. 2016). One of the statements of this theory is the "supervinience" of aesthetic properties, which states that **aesthetic properties** depend on certain **non-aesthetic properties** (Fig. 37). To better understand, aesthetic properties are those *verdictive and evaluative properties* such as beauty or ugliness, while non-aesthetic properties are physical properties or qualities of the object such as shape, colours and sounds. This theory is the extension of the *weak dependence Theory* (Zangwill 1998) in which Zangwill explains how without the sensory (non-aesthetic) properties there would be no aesthetic appreciation. However, the aesthetic properties don't respond to a specific set of non-aesthetic properties, although certain non-aesthetic properties seem to exclude certain aesthetic ones. For example, "*a garden consisting entirely of straight lines and geometrical shapes (as non-aesthetic properties) could not be naturalistic (as a substantive aesthetic property), but conversely, not all irregular plantings are necessary naturalistic"* (van Etteger, Thompson et al. 2016, p. 84).

Having Zangwill's theory as a basis the qualitative method used to find the aesthetic properties of the research area was divided into three distinct phases. The first phase concerns the **phenomenological analysis**, which entails the collection of data from the perceptible realm, "*as the aesthetic response to natural objects begins with the perceptual exploration of the aesthetic object*" (Brady, 1998, p. 142). From this analysis, some of the non-aesthetic properties, necessary to define the aesthetic ones, will be found. Although, to make this reasoning more explicit, reliable and synthetic, I passed the re-

sults of my perceptual analysis through the filters of the **picture reduction** method in order to derive the landscape's essential structural and formal qualities. Than the third phase consists in the "creative jump", the passage from the non-aesthetic properties to the aesthetic properties of the given landscape. In this last phase, the reflections upon the non-aesthetic properties of the landscape is used to synthetize these aesthetic ones in **iconic archetypes** that holds the final essence of the aesthetic experience. In the next sections the entire analysis process and how the fieldwork was conducted will be explained more thoroughly.

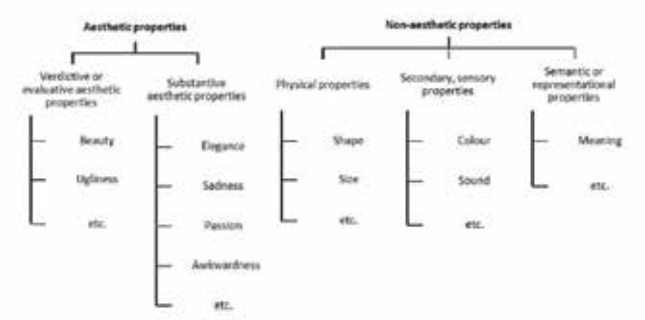


Fig. 37: Aesthetic and non-aesthetic properties according to Aesthetic Creation Theory. Source: Zangwill 2007.

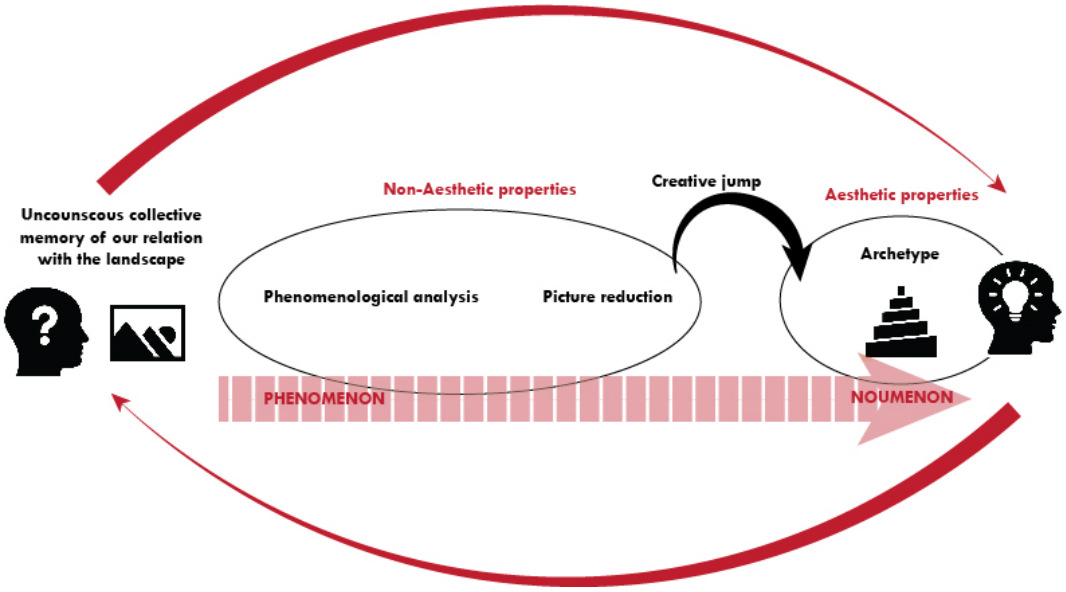


Fig. 38: Flowchart of the perceptual analysis process. Source: Original image

3.1.1 Phase 1: Phenomenology

Phenomenology is the *return to things themselves* (Husserl 2012) whose goal is to "*understand the complex world of lived experience from the point of view of those who live it*" (Schwandt 1999, p.221). This approach will allow me to engage a first contact with the perceptual world, as this is manifesting itself through my senses, and to collect multiple non-aesthetic qualities. Indeed, it's a philosophical approach that brings me to the collection of the *phenomena*, how things are given, rather than *noumena*, what things are, their meaning that the senses cannot grasp[1]. As it has been discussed before, the essence of landscape resides in the relation between man and the surrounding environment. Phenomenology is intended as the entry point of this relation, the report of the sensuous encounter with reality, the so called *perceptible realm* (Gobster, Nassauer et al. 2007). In the Appendix are reported some of the main concepts applied with the phenomenological method as described by Van Etteger (2016).
For the phenomenological part of the analysis **two fieldworks** have been conducted; the first consisted in an uninterrupted and unbiased exploratory walk, while the second in a more systematic walk (van Etteger and Verhoeven 2016). In the next sections it will be explained how these have been conducted and which criteria have been considered.

1 This terms first appeared in philosophy in Plato's distinction between senses (phenomena) and forms or ideas (noumena), than reused in modern times especially starting from Immanuel Kant.

Fieldwork 1

The data acquired from the first visit consisted in the descriptions of the flux of experiences made after the fieldwork, applying the phenomenological approach. First, on the field, the work consisted in an uninterrupted and unbiased exploratory walk applying *epochè* and *phenomenological reduction* (see Appendix). Afterwards, at home, I wrote the description of the flux of the experiences perceived in the landscape. A discourse analysis of these experiences then allowed me to identify different areas of the landscape that have distinct perceptual qualities. Of course this distinction was still approximate, but enabled me to set the work for my second phase by creating a **perceptual zooning map** where the different experiences were grouped in different areas.
Also important has been **the decision of the path** that I had to plan before the walk. There are no maps of the paths of the site and so I had to make my own map for the second phase. In addition, since the site is not a linear route, but an extended area, the possibilities of paths were multiples. Therefore, the beforehand planning of the path that had to be undertaken was based mainly on my arbitrary decision, obstacles and physical characteristics of the place. The criteria that ordered the arbitrary decision of the path were:

1) The one of covering the most surface of the landscape, in order to have the most complete overview of it.
2) Try to make the most rational "visitor path", as a sort of ring circuit, so to experience the changing of perceptual experiences in different sequences, one after the other.
3) More importantly, to pass over the all perceptual areas identified in the first exploratory walk.

After, once the path was settle it was important to state beforehand which criteria to adopt for deciding the points where I would stop to record data:

1) Take records in each of the previously determined areas.
2) Take record of the experience in the most valuable locations. The method used by previous research consists on stopping each 500m or each 7 minutes (Dings 2015). For this research I found it not appropriate, because in this type of landscape the experiences can change very suddenly and last less than 500m or seven minutes.
3) Since, the objective will be to set the aesthetic properties of each area, and the ones of each area in relation to one another (the aesthetic experience of a place is a whole of experiences tightly related and determining one another in space and time) the expe-

Fig. 39: Phenomenological Path. Source: Original image

riences have been recorded in locations placed inside the "perceptual area" and at the margin of it with other areas.
Finally, this first visit resulted in a map in which 5 different perceptual areas were drawn, connected by one unique circular path and 18 points selected for documenting the phenomenological experience (Fig. 39).

Fieldwork 2

The second fieldwork produced the collection of the multisensory experience on different locations of the landscape. The data acquired from this fieldwork were: detailed descriptions of the multisensory experience, sounds recordings, gps tracking, photographs and eventually videos. All this documentation was acquired through a systematic walking performed in one day as previously planned after the first fieldwork. Therefore, following the prescribed path and stopping at each pre-decided point to record data. The descriptions were taken following the suggestions of the previous research (van Etteger and Verhoeven 2016): they were all of equal length and consisted in descriptions of the flow of experience and a description of the details. The recordings were taken for 5 minutes at each point, sitting still in silence. The photographs were also taken at each point with a Reflex Canon EOS 650D; I took pictures of details, things that caught my attention and panoramic views of the surrounding. More detailed information about the organization, the observations and the limitations of this fieldwork are given in the Appendix.
The result of this second visit consisted in a new and more precise map enriched with a systematic phenomenological analysis conducted as previously described. In total I had 18 sound registrations and descriptions and many more photographs that documented the phenomenological experience on each of the 5 areas. To organize this material, for each point, I gathered all the related documentation that served as a starting point for the second phase of my perceptual analysis: the picture reduction analysis.
To facilitate the synthesis effort of the second phase, I prepared for each of the 18 multisensory experience, a panoramic picture and a discourse analysis on the descriptions. This has been done in order to find, and present, the elements or features responsible for the experience. Finally, the overall multisensory experience of each point resulted in a first basic sketch enriched with small descriptions that resumed the overall experience at once, following the examples made by Van Etteger and Dings (Dings 2015, van Etteger and Verhoeven 2016). To better explain the analysis I chose, as an example, the work inside the yellow area for point 4.

Fig. 40: First Exploratory walk in Aredes. Source: Original picture

Fig. 41: Documentation of the Phenomenological Analysis. Source: Original picture

Fig. 42: Documentation of the Phenomenological Analysis. Source: Original picture

Fig. 43: Fieldwork 2. Source: Original picture

Fig. 44: Documentation of the Phenomenological Analysis. Source: Original picture

Yellow area: *Point 4*

Photo:

Fig. 45: Panoramic photo, point 4. Source: Original picture

Description:

Terraces: on one side, towards the landscape, there are two terraces, on the other, very big and regular terraces with grass on the steep slope and earth on them (6-7 meters). The road goes down steep, always with traces of pneumatics, near the staircases there is a gut made of concrete that seems like earth. I can see the landscape around, groups of trees, valleys, canyons. Sounds of insects, wind, birds and cars far away. I still cannot see the end of the road that is hidden behind the bushes in front, and the deserted landscape is no more visible.

Elements:

-Very big and regular staircases with grass on the steep slopes and earth on them
- The road continues down steep, but cannot see where it goes
- There is a gut made of concrete on the side of the road
- The landscape around: woods, valleys and canyons
- Sounds of insects, wind, birds and car far away
- On one side, toward the landscape, there are two build-up terraces

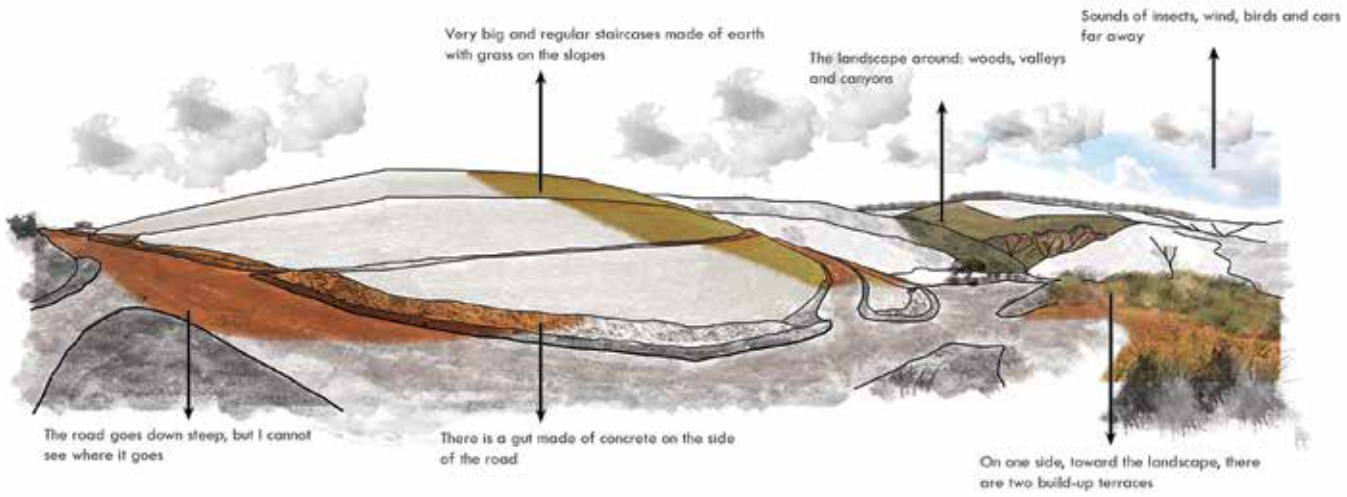


Fig. 46: Phenomenological analysis. Source: Original image

3.1.2 Phase 2: Picture reduction

Picture reduction is a qualitative method used to reflect more systematically upon the formal and structural perceptual (non-aesthetic) qualities of the landscape. The specific method adopted has been inspired by former thesis works as the one of Zuzana Jancovicova (2014). The method is already useful as a tool for a general understanding of the landscape, as design can be intended as a way of thinking involving more or less conscious critical decisions (Dee 2012). Indeed, it involves much of the intuitive capacity of critical selection of the designer together with its design skills. In this thesis the method is used to capture mainly four fundamental aspects of the landscape: **textures, forms**, **structures** and **volumes**. While forms, structures and volumes are considered in literature as the basic concept founding architecture (Jacob), I thought that texture would have been another important aspect to consider in the context of landscape architecture. These categories have been applied as filters to the landscape; like artists try to represent their way of looking the world selecting, modifying or erasing certain aspects of reality, this technique would be helpful to read the presence of certain main non-aesthetic characteristics for each perceptual area.

When considering **textures** the main goal was to understand the tactile characteristics of the given location. The picture is reduced to essential colours on a greyscale, highlighting the intensity of the shadows on the surfaces, which determines the way light is reflected by the different materials. These characteristics are especially important to investigate the presence of natural elements over cultural ones. Indeed, the natural patterns are softer looking like surfaces and complex irregular textures, while the more artificial ones are usually harder and coarse surfaces with regular textures. Textures seems to be applied by Tullio Pericoli as a way of interpreting the landscape in some of his paintings, where the forms are defined by its internal patterns, and the painting seems to be made for being touched (Fig. 47).

Regarding **forms** the picture is reduced to essential lines on the white canvas on which just the shapes of the landscape elements emerge. This filter allows to recognize the presence of organic or more linear and regular forms which enables to recognize a certain order or disorder of the composition. This characteristic can lead to reflections over the presence of natural and cultural elements and suggest more abstract sensations related to the communicative charge of curved and straight features. The abstract works of art like the ones of Gustav Klimt and Wassily Kandisky are emblematic of the studies made by modern painters on forms and shapes (Fig. 48).

Instead, for **structures** an additional interpretative effort has been made starting from the resulted picture of forms. The effort consists in finding the balance and essential

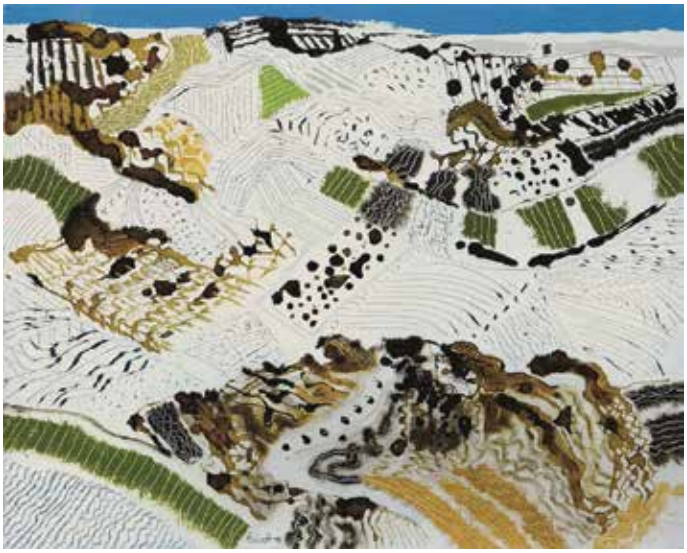


Fig. 47: Tullio Pericoli, no title, 2014. Source: Internet

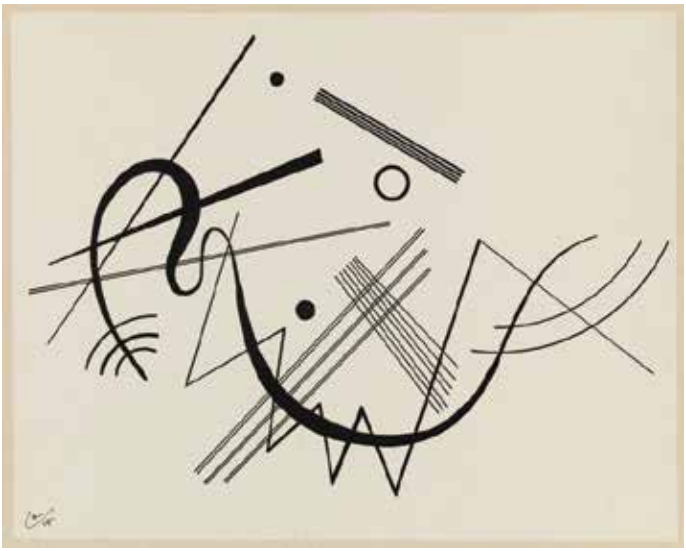


Fig. 48: Wassily Kandisky, "Diagram 17", 1925. Source: Internet

composition of the picture. Therefore, terms as back ground and foreground, symmetry and partition and others filled the descriptions. This filter allowed me to understand which and how the elements of the landscape play a role in the overall perceptual experience. For example, if an element is always present in the same condition or it changes its role during the experience (like passing from background to fore- ground). Someone that has been an innovator in terms of structuring his landscape views was Leonardo da Vinci, who introduced the technique of the "Sfumato" (meaning blurred or vague) used to gradually give depth to his open views (Fig. 49).

Volumes is the last filter and is used to minimize at the very end the perceptual reality, giving no more information than the spatial configuration of the picture and the possibility to move in it. What emerges from the picture is a sensation of spatiality from our human perspective which is given both by the relation in scale that we engage with our surroundings, and both by the capacity of discovering the space through the projection of the affordable movements in the landscape. Playing with Volumes is certainly the approach toward reality established by the poetry of Pablo Picasso (Fig. 50).

The basic image considered for the reduction was a panoramic picture (and therefore larger than the normal format) taken for each point. Then for each reduction a small description was made reporting on the main properties and characteristics highlighted by the filter applied. For each type of description a certain range of adjective was used to enable me to compare the images and find differences and similarities for each point and, overall, for each area. Once all categories have been applied to all the point of each area I was then able to trace the main perceptual properties and perform the "creative jump" towards the identification of the aesthetic properties. To better understand this analysis process, again I will report here the analysis made on Yellow area, taking as example the ketches realized for the fourth point (see Fig. 51).

Fig. 49: Leonardo da Vinci, "*Landscape with river*", 1473. Source: Internet

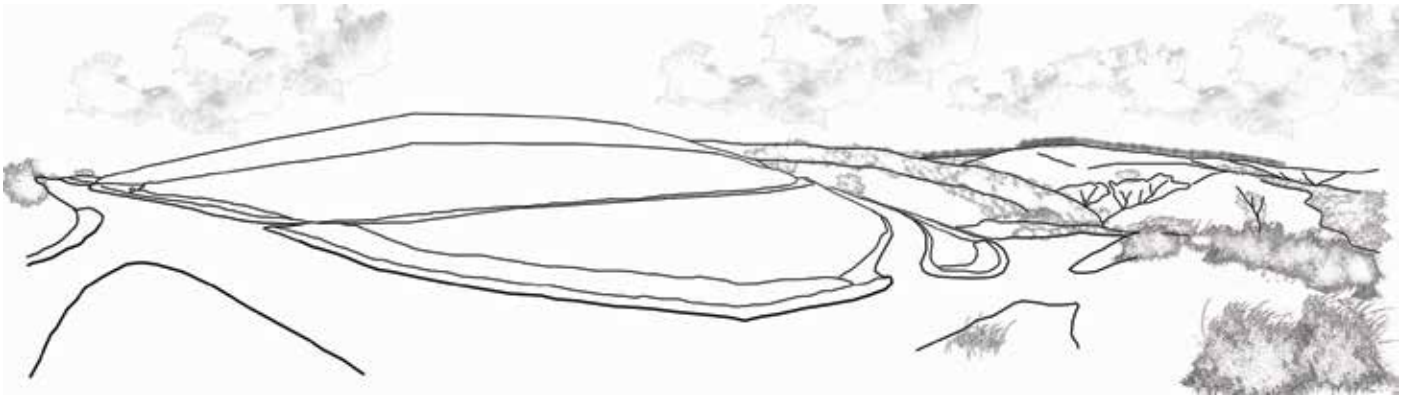
Fig. 50: Pablo Picasso, "*Figures on the Beach*", 1931. Source: Internet

Perceptual Properties: Yellow Area

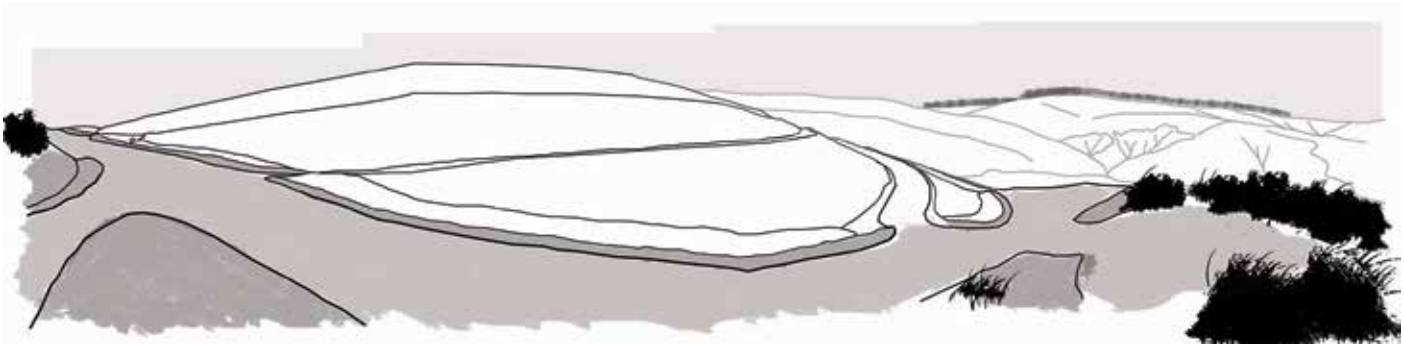
Point 4

Textures: there is a prevalence of hard surfaces and mainly rough and smooth textures, revealing the prevalence of artificial elements over the natural ones just present on the edges.

Forms: neat linearity especially in the foreground, wide and curved lines and shapes.



Structure: three main elements compose the view; the descending road in the foreground, the big staircases upon it and the landscape at the side in the background.



Volumes: quite a complex organization of space with different possibilities to move, massive over scale presence of the staircases.

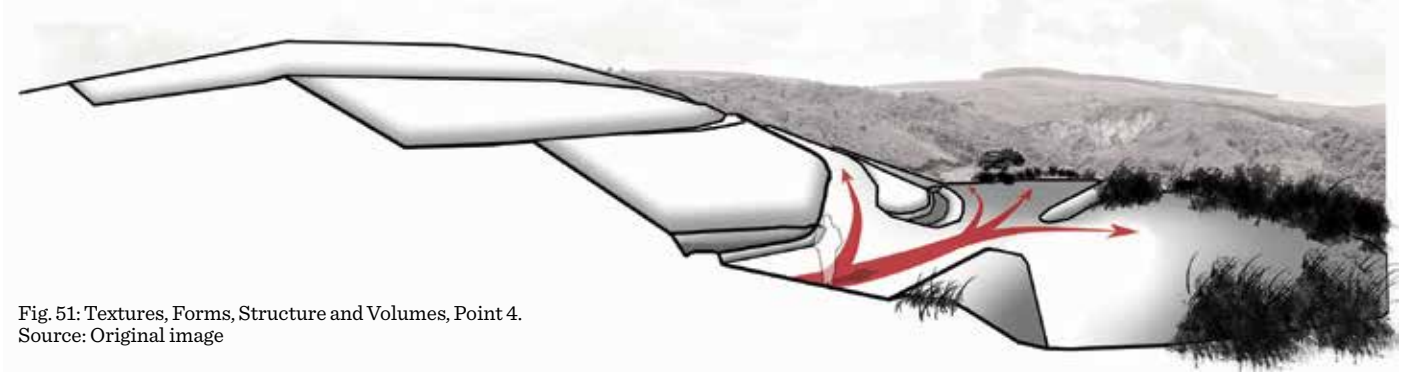
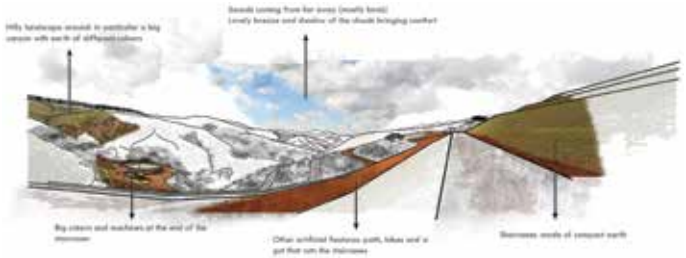


Fig. 51: Textures, Forms, Structure and Volumes, Point 4.
Source: Original image

Point 5

Panoramic photo

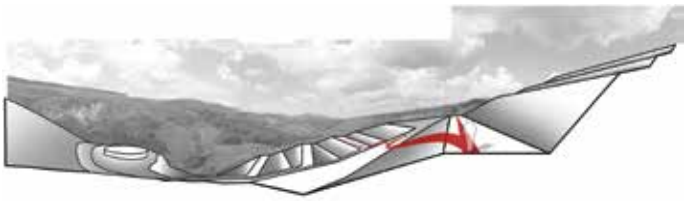


Phenomenological analysis

Textures

Forms

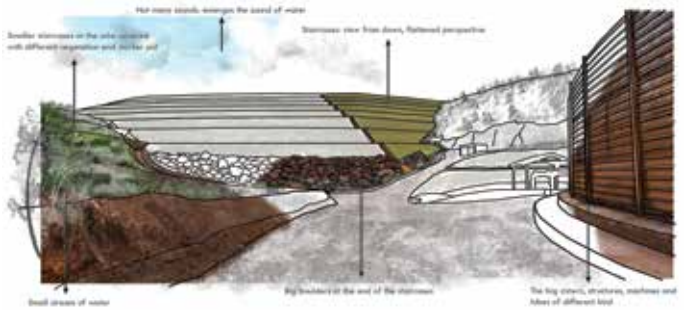
Structures



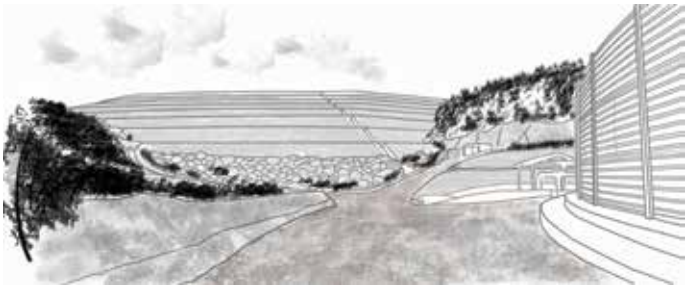
Volumes

Point 6

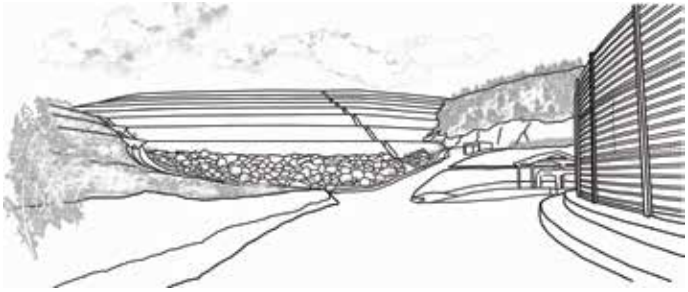
Panoramic photo



Phenomenological analysis



Textures



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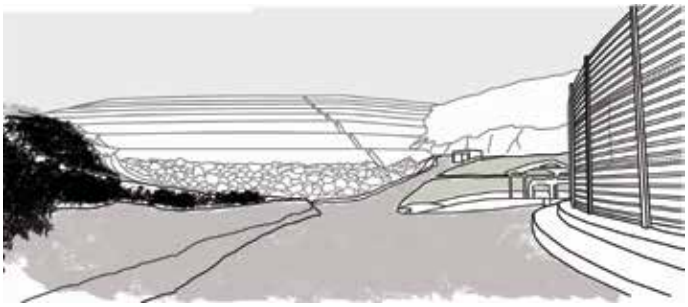
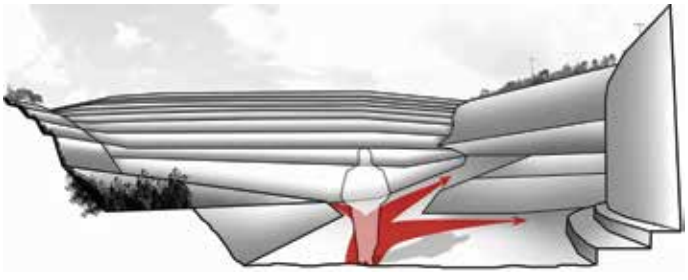


Structure



Volumes

Fig. 52 - 53: Phenomenological analysis and Picture reduction, Point 5. Source: Original image

3.1.3 Phase 3: Archetype synthesis

Once the non-aesthetic properties have been collected from the landscape, the object of the last phase of the analysis was to acquire the aesthetic properties linked to them. The method used for this phase relies totally on a subjective interpretation of the non-aesthetic qualities, this is why it is described as the *creative jump* (see Fig. 39). Although, this method cannot be considered totally arbitrary; the aesthetic "vocation" of each area relies on reflections supported with reference and examples of places with similar characteristics as if they would all refer to one unique symbolic archetype.
The term archetype is used by Carl Yung (Jung, Freeman et al. 1991) referring to those spiritual symbols that are related to a collective primordial memory, which subconsciously influence our way of interacting with the world. According to Yung "*a word an image are symbolic when they imply something that goes beyond their immediate and obvious meaning. It has a wider aspect, subconscious, that is never defined with precision or completely explained.*" (Jung, Freeman et al. 1991, p. 11). Therefore, so intended, a symbol is charged with an aesthetic message (see 3.3) that we cannot always completely understand, but perhaps we can appreciate as far as it gradually and subconsciously builds a dialogue with our internal archetype.

Aesthetic Experience: Yellow area

The presence of the huge staircases is certainly the main feature that constitutes the aesthetic experience of this area. The contrast between this impressive structure and the surrounding natural landscape plays an important role. The use of natural materials facilitates the integration of it in the landscape, but the neat maintenance of it and defined structure mark the distinction between mankind and nature.
Its out-of-scale size communicates a sense of powerless and smallness, which is augmented by its hard geometrical lines and rhythmic structure, remembering some awe-inspiring construction of an ancient society. The Tower of Babel, narrated in the Bible, is the metaphor of the catastrophic destiny that mankind encounters every time that aims to challenge God with immense constructions. It symbolizes the man-will to reach the sky (meaning God) with its own hands, and so to put itself in confront with him, and fail. The same concept was also expressed by the ancient Greeks, they used the term *hibris* to describe the arrogant challenge of a man to the gods, as did Prometeus when he stole the fire.
Structures resembling the Babel Tower are part of different cultures and different ages through all history. Indeed, the Babel Tower story was probably inspired by one of the colossal constructions made by the ancient societies that were surrounding and threatening the "chosen People" (the Jewish). Indeed, on one side there were the pyramids of the Ancient Egypt and on the other the ziggurat of the Mesopotamic populations. Moreover, reinforcing the idea of the Babel Tower as a collective archetype are the presence of incredibly similar structures all around the world, as the pyramids of Teotihuacán in Mesoamerica (Mexico). Therefore, since the beginning of the civilization, mankind always challenged with its technical knowledge his limits and the limits of nature, creating structures always higher, bigger and complicated. The acme of this process are the skyscrapers of nowadays metropolitan society, cities as Dubai are like the utopic (or perhaps dystopic) dream of those populations that thousands of years ago were building the ziggurat not far from that same desert.

Finally, the aesthetic experience, taken from the perceptual analysis is synthesized in a unique zoning map in which all the archetypes are fantastically represented at once (Fig. 56). Four are the archetypes found for the five areas, indeed one of the outcomes of the perceptual analysis was that two areas (the Red and Green one) had very similar non-aesthetic properties, which brought to the same architype, the *Labyrinth*. This

archetype has been chosen for the difficulty of orientating and understanding the landscape covered by the closed by vegetation. The doubts dissipate as we get closer to the tailings impoundment, the centre, where the Minotaur is found. For obvious reasons the *Desert* has been decided for this part for the absence of vegetation, the immense

Fig. 54: The four archetypes: the *Tower*, the *Labirynth*, the *Desert* and the *Mountain*. Source: Internet

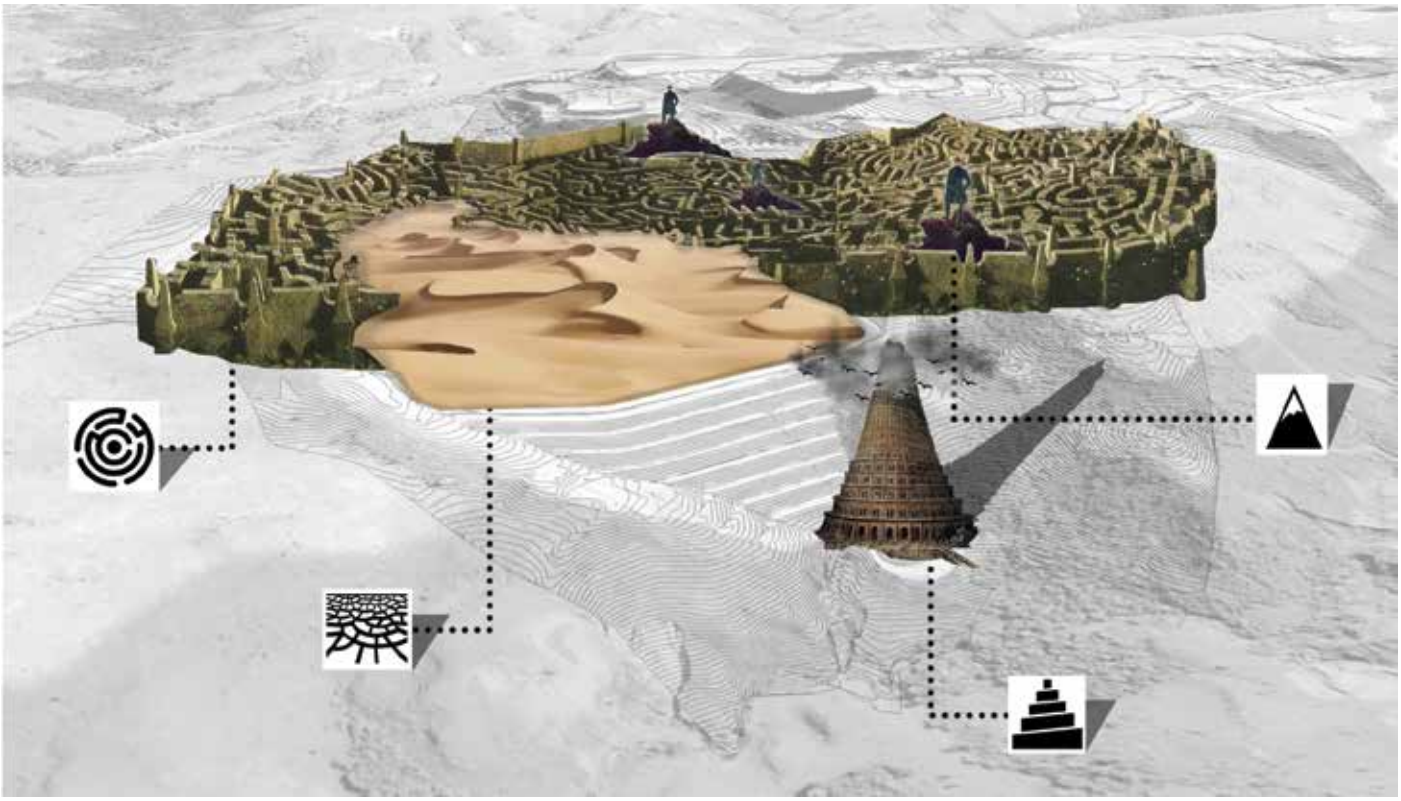


Fig. 55: Archetype Zoning map. Source: Original image

plane where distances are difficult to measure intuitively. The *Mountain*, on the other hand, has given to these areas as they are clearly among the higher parts of the landscape and from them is always possible a clear overview of the landscape all around. This map would be fundamental for the final design process in which it would be confronted with the results of the second part of the research analysis, the landscape environmental analysis.

For each of the five areas an archetype has been found. The scheme (see Fig. 56) represents the overall process of the perceptual analysis in which the final archetypes are represented as the image that holds the entire aesthetic experience. Of course many non-aesthetic properties of the landscape (gathered during the phenomenological analysis) have been lost during this extreme process of synthesis, though they won't be necessarily lost in the final design process as many will be used as design "ingredients". In the next section, the example of one archetype synthesis will be explained more in detail.

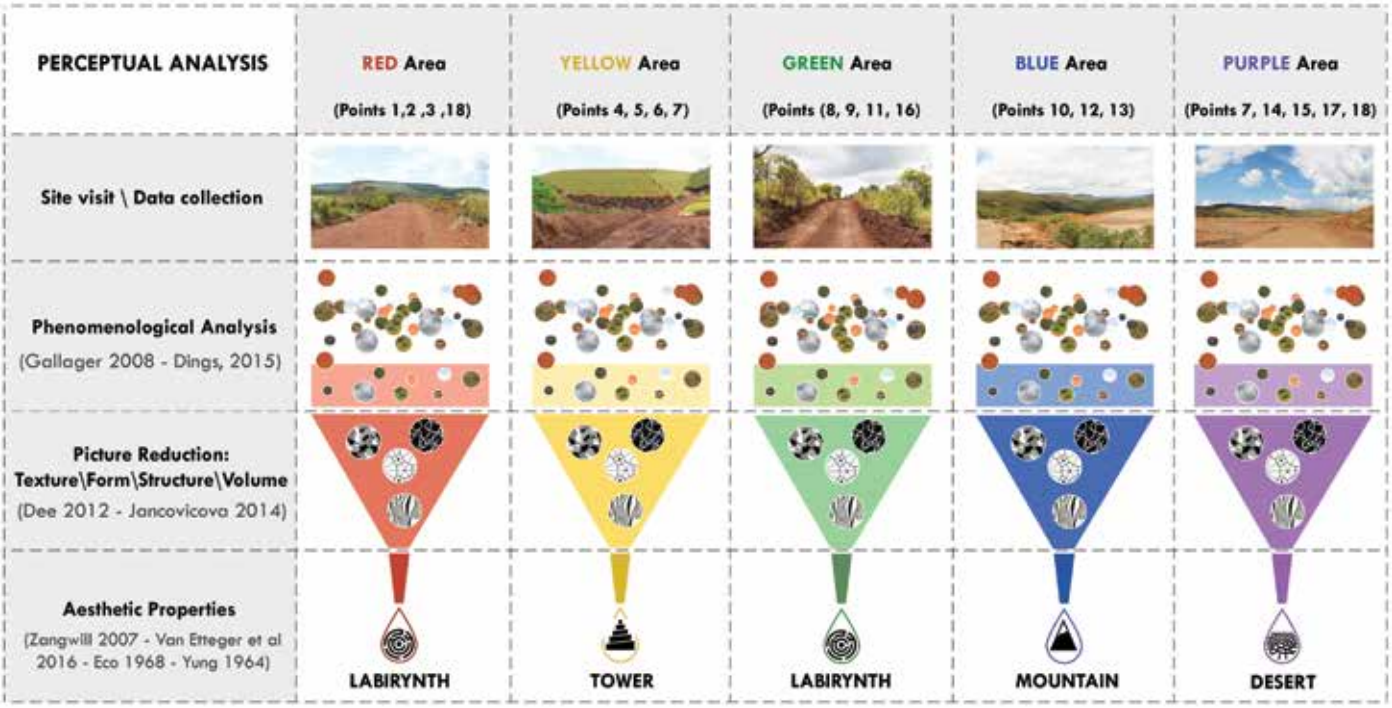


Figure 56: Schematization of the Perceptual Analysis. Source: Original image

4th Chapter:

RESEARCH ANALYSIS, Part II

-Environmental Analysis:
Geology, Hydrology, Flora and Fauna-

INTRODUCTION

The second part of the analysis consists in answering to the second Research Question upon the physical environmental characteristics of the area. A landscape can also be described as the result of the action of multiple natural and human forces that interact throughout time with different intensities. Therefore, it will be adopted a view of the landscape as made of different layers as inspired on the regional landscape analysis made by Kerkstra and Vrijlandt (1988), starting with a large view on the landscape towards a more detailed perspective on the study area. This approach will be useful to understand how the site works in terms of abiotic and biotic interactions and which main ecological values and threats should be considered. The information acquired on the landscape, besides my personal experience and conversations with local experts, is given through two main sources: the Master thesis work of Denise Formoso (2013) and the environmental report made after the disaster of the Herculano tailings dam by the "BRANDT *meio ambiente"* Company (2015).

Fig. 57: "*Cachoeira do Tabuleiro*, waterfall located close to Belo Horizonte, with its 273m is the third major fall of Brasil. Source: Original picture

4.1 GEOLOGY AND GEOMORFOLOGY

This section is intended to briefly understand the geological and geomorphological structures of the research area, more detailed information can be found in the environmental report made by "BRANDT meio ambiente" (2015).

As introduced in the beginning, the site is located in the Syncline Moeda, and finds itself on a higher position of the landscape of the Quadrilatero Ferrifero (Fig. 58). A syncline is a folded geological structure characterized by a sequence of rock layers which are usually younger in the middle and older at the edge. This formation is the result of compressing forces that are caused by orogenic movements. Indeed, the Syncline Moeda is delimited by two mountain ranges, the external flaps: the *Serra da Moeda*, a straight mountain chain going North-South, and the *Serra das Serrinhas,* following the same direction but with a much more winding structure. The other unit that characterizes the Syncline is the inner plateau, where the research site is located. While the external flaps reach altitudes between 1500 and 1600 m, the inner plateau is located between 1200 and 1300m. The geomorphological form of the Syncline Moeda orientates the hydrological system, which flows deeply docked in the faulting system going North-South.

The altimetry dislocation of the different geomorphological structures of the Syncline Moeda, as for the entire area of the Quadrilatero Ferrifero, is directly conditioned by different lithological compositions (Fig. 59). The lateral mountain chains are constituted by more ancient and resistant types of rocks layers, these are quartzites rocks (Moeda Formation) and itabirites rocks (Cauê Formation), which are important types of rocks for iron mining. The top of this mountains are covered with *canga*, outcrop of ferruginous rocks, which constitutes an unique geo-environment, hosting many endemic species and functioning as recharge area for rivers (Carmo, Carmo et al. 2012). The internal part of the Syncline Moeda is constituted by phyllites and schists (of the *Piracacicaba* group), which are also metamorphic rocks, but much less resistant and sensible to erosion. In the study area (Herculano Mineração) dissecting, transition and depositional relief can be still identified. The dissecting relief corresponds to the unit of elongated hills and hills with rounded tops, while the transition relief corresponds to the unit of escarpments and the depositional relief to the colluvium ramps.

The research area is located in the middle portion of the syncline, on what has been called the Herculano's

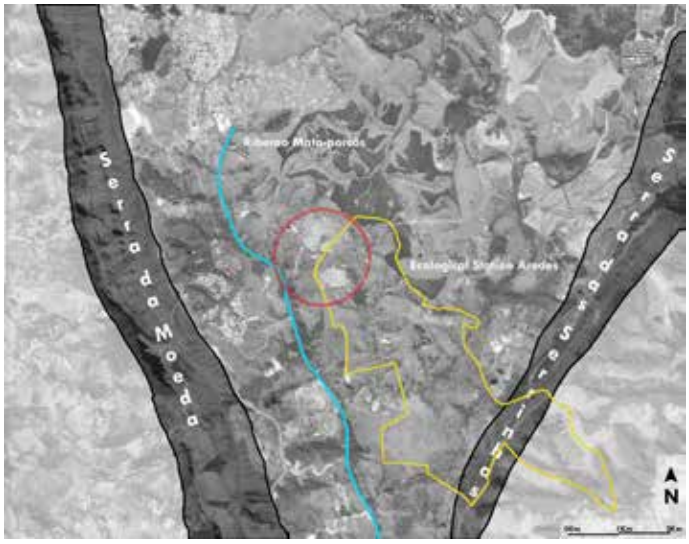


Fig. 58: Localization Plateau Herculano. Source: Original image

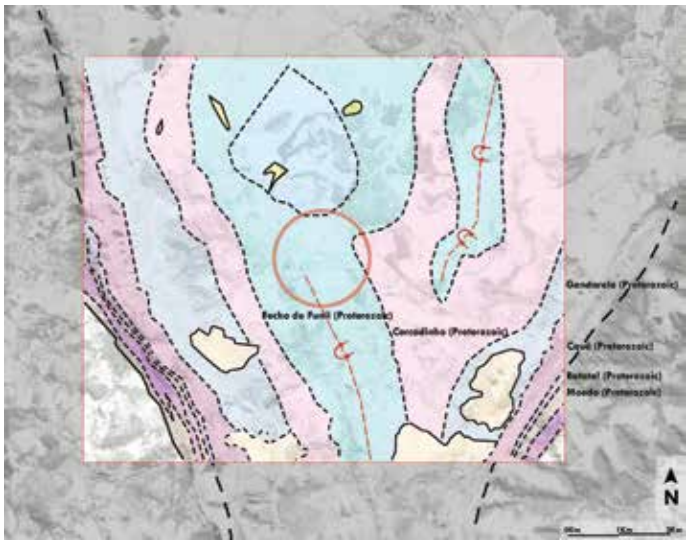


Fig. 59: Geological map of the Synclinal Moeda. Source:BRANDT 2015

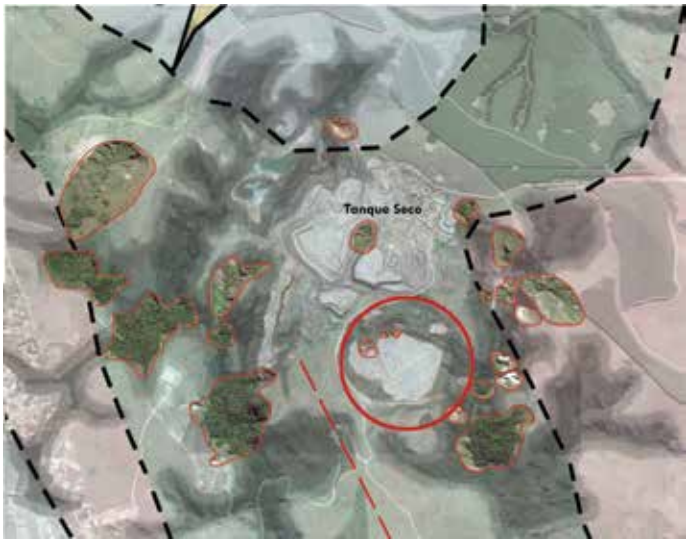


Fig. 60: Geomorphological map of the Plateau Herculano. Source: BRANDT 2015

Plateau (BRANDT 2015). Here, the tailings dam is found on the southern side of an elongated hill that reaches altitudes above 1200m. Around it are two valleys strongly carved, where the drains of two streams, the *do Silva* and *Benevides* are flowing The area is found inside the geological formation called *Fecho do Funil*, constituted of *dolomitic phyllites* and *dolomitic lenses*, interspersed with high concentration of oxides and hydroxides of manganese. The geological map shows also the presence of a longitudinal fault where the *do Silva* River flows and in the report are described some other smaller faults in the same direction and other smaller ones perpendicular to them. This landscape is characterized by canyons and dissolution stone bridges endorsing typical karst-like features[1] (Fig. 61).

Indeed, a very important aspect of the dolomitic rocks is that they are susceptible to hydro-chemical dissolution phenomena, which can bring to natural erosive processes as sinkholes or underground channels. Visible erosion patterns, as gullies, can be spotted all around the research area, while in the middle of the Mining Herculano's facilities, on the top of the hill there is a big sinkhole where the water is collected and released through underground drainage. This sinkhole is historically known as *Tanque seco* (meaning, dry tank) and its position (Fig. 60), on the higher part of the landscape, reveals evidence of a former process of relief inversion[2] (Fig. 69). This phenomena took place throughout different geological periods, as explained in detail in the report (BRANDT 2015). The result of this process was that the *Tanque seco* and an entire local system of caves and underground channels that have been deactivated by moving at a higher position of the landscape, and generally cluttered with powdery materials (oxides and hydro-oxides of manganese plus other particles).

Another local geologic feature to be mentioned is a volcanic dike that crosses the tailings dam South-North. According to the experts this dike created a solid structure, like a wall, that prevented the dam structure to collapse, considering the fragile characteris-

1 Karst topography is a landscape formed from the dissolution of soluble rocks such as limestone, dolomite, and gypsum. It is characterized by underground drainage systems with sinkholes and caves. (Wikipedia)

2 Inverted relief, inverted topography, or topographic inversion refers to landscape features that have reversed their elevation relative to other features. It most often occurs when low areas of a landscape become filled with (...) material that is more resistant to erosion than the material that surrounds it. Differential erosion then removes the less resistant surrounding material, leaving behind the younger resistant material which may then appear as a ridge where previously there was a valley. (Wikipedia)

Fig. 61: Sinkhole, visible from the project area. Source: Original picture

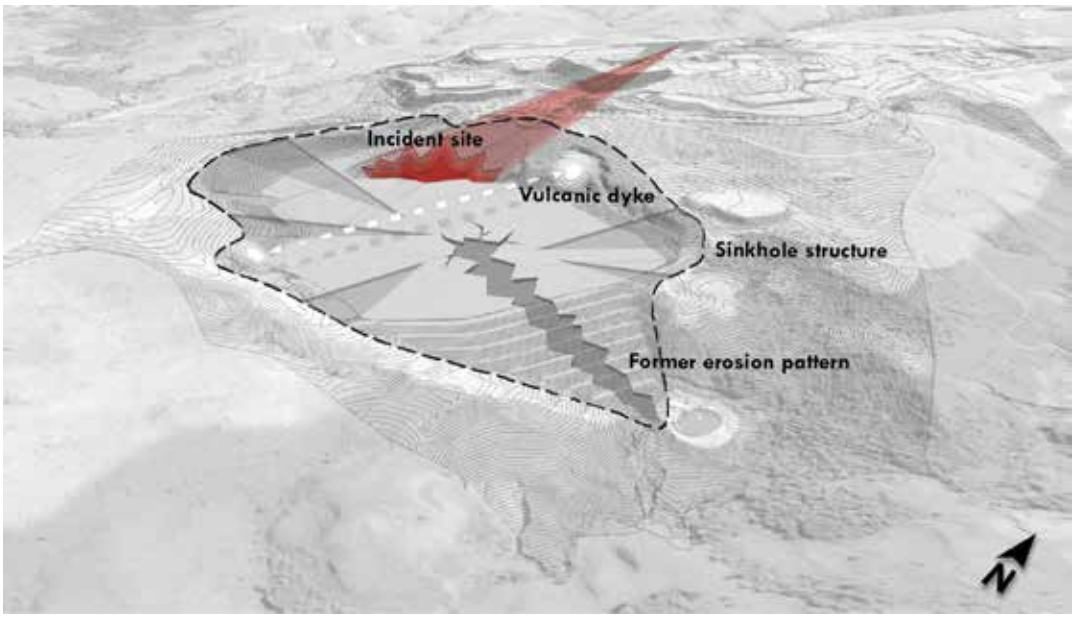


Fig. 62: Geological and geomorphological characteristics of the research area. Source: Original image.

tic of the landscape. Moreover, the presence of this dike explains the fracturing patterns of the soil and the consequent process of relief inversion happening here. Indeed, on the upstream side of the dike the soil uplifted and on the other side the soil subsided while the magma was coming up from the fracture. Nowadays the weathered magma results with a whitish color, which is indeed visible on the exposed rocks at the two sides of the tailings dam where once was crossing the area. In general there are several areas on this landscape in which the rocks are found exposed. This aspect could be considered to be quite interesting for the study of the variety of geological phenomena and characteristics of the area. More of the geomorphology of this landscape will be explained in the next section, especially in relation to water flows.

4.1.1 Report of the incident

According to the report (BRANDT 2015), this underground channel system would have been the cause of the incident occurred on the 10th of September 2010, reported as "*one of the most curious phenomena ever occurred in an iron tailings dam of the country*" (BRANDT 2014, p. 21). In this section, the facts of the incident would be further explained, being directly related with the geological characteristics of the research site. Some months before the accident, an event was reported by the officers of the Herculano; they heard a bang while the waters of the B4 where creating a great vortex, curiously entering the soil on the portion of tailings located upstream (opposite where it would be expected to flow). The water in the vortex was described to turn very rapidly, and after some hours all the water of the dam was disappeared in the vortex (Fig. 63). The event was accompanied with local earthquakes and soil breakdowns in direction of the top of the hill, where the *Tanque seco* is located. After this event, the company stopped with the release of tailings in the dam and started with studies to analyse the stability of the surrounding area, and especially of the dam, which structure resulted intact.

The outcome of the investigations made by "BRANDT *meio ambiente*" states that the vortex was the result of the opening, after millions of years, of the underground channels going in direction North-South (following the Sinclinal Moeda's central faulting system). As the tailings dam brought the water again to that level, the combined pressure of tailings and water caused the reactivation of the channels. The accumulation of water led to a process of dissolution and reactivation of the channels, which were filled with friable magnesium and directed toward the area of the *Tanque seco* (Fig. 64). The

incident of the 10th of September 2014 was provoked by the exit of this water, in the form of "gushing mud", from the side of the relief where the dam B1 was located. Suddenly, an incredible flush of mud broke through the other side of the mountain, located almost at the same level of the vortex occurred in the B4 some months before. A more detailed description of the event is given in the report made by "BRANDT *meio ambiente"* (2015). The incident provoked the partial collapse of the dam B3 and the flowing of the mud in the local river valley into the do Silva River. Luckily, the effect on the local vegetation has been reported to be relatively low, but three people died from the event. Finally, is important to note that the presence of the vortex and the speed at which the water was swallowed, indicates a channel system of notable volume. Therefore, considering its magnitude, the evaluations of the report (BRANDT 2015) states that this event can be considered an uncommon happening that has no previous records engineering in this region.

Fig. 63: Pictures of the *Vortex area.* Source: BRANDT 2015

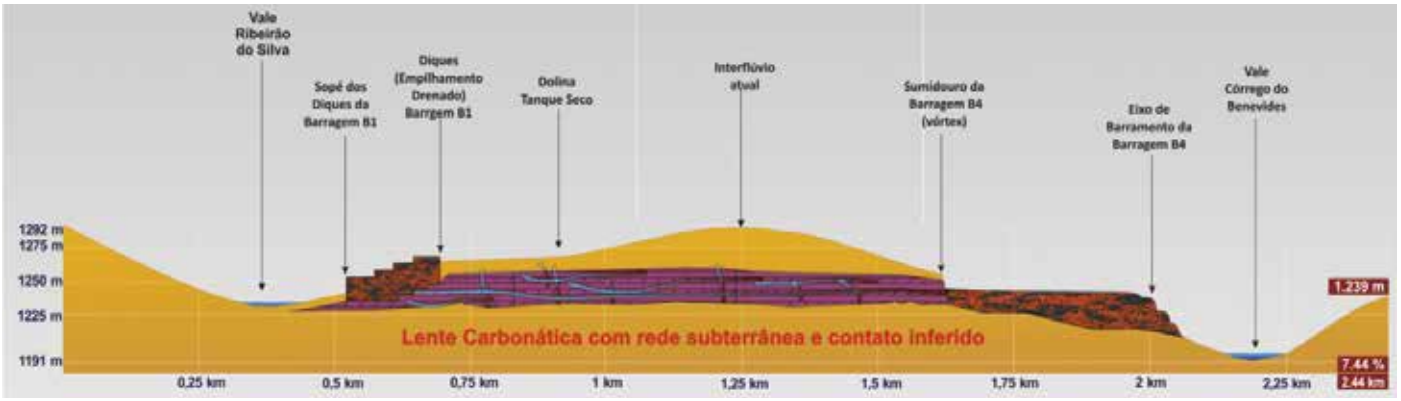


Fig. 64: Schematic section of the channel system under the Herculano's Plateau. Source: BRANDT 2015

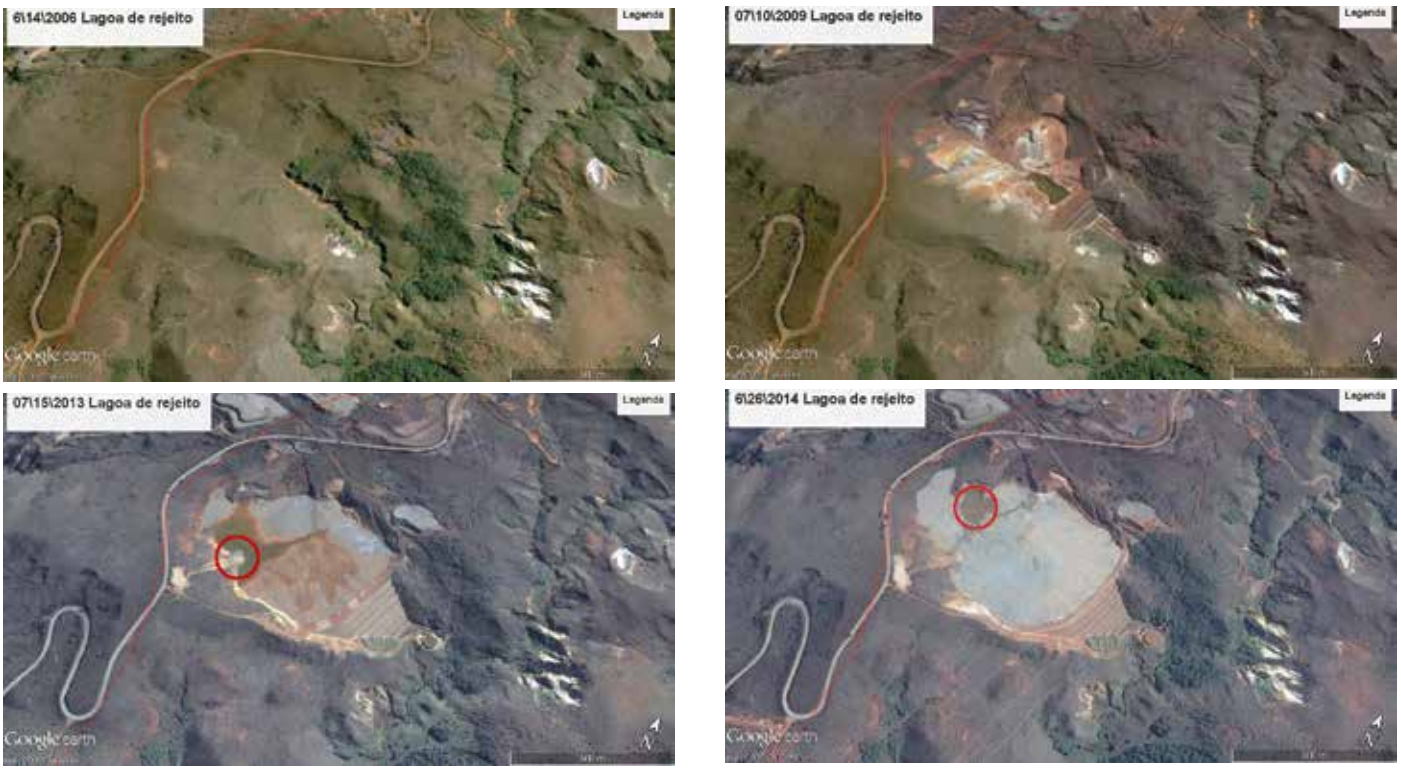


Fig. 65: Chronology of the tailings dam B4: 2006) when the dam was not yet constructed, 2009) when the construction started, 2013) when almost at its maximum height the water started moving from the overflow towards the karstic formation and 2014) when the water had entirely moved upstream. Source: Internet

4.2 HYDROLOGY

Also very important for the environmental context of the Sinclinal da Moeda are the hydrological aspects. The Serra da Moeda is located in a region of springs that drains into two rivers: the *Rio Paraobeba* and the *Rio das Velhas*. At the same time, the mountain chain, is the divisor of drainage basins of these same rivers which farther join in the Rio Itabira. Continuing, the waters reach the *Rio San Francisco*, the fourth longest river in Brazil; starting in Minas Gerais, crossing Bahia before turning east and forming the border between Pernambuco and Alagoas. The hydrographic basin of the river *das Velhas* is located inside the Syncline Moeda; the streams of *Benevides* and *do Silva*, located around the research area, are part of this system. The river *do Silva* flows inside the geological fault of the Synclinal Moeda, going North-South. Its tributaries have the same characteristics having a sinuous shape in the middle of deep and embedded valleys (Fig. 66).

The hydrographic importance of the region is given by the amount of related ecosystem services that it provides beyond the regional limits. Indeed this is a very important area of water production, flow regulation and recharge (Formoso 2013). The high amount of cavities, caves and channels in the soil, that characterizes this region, acts like a sponge efficiently transferring the rainwater inside the mountain[3] (Carmo, Carmo et al. 2012). The storage of water is very important in this region and in all Minas Gerais, as this region provides water to many other region in Brazil, mainly through the course of the *Rio S. Francisco*. Furthermore, the quality of the water is another important factor to consider, not just for the wellbeing of the populations that relies on it, but also because of the preservation of many endemic species and habitats linked to it (Formoso 2013). Finally, it has been previously described how the water system worked in shaping the landscape of the Syncline Moeda and is presently rapidly accelerating the erosive processes all around the area.

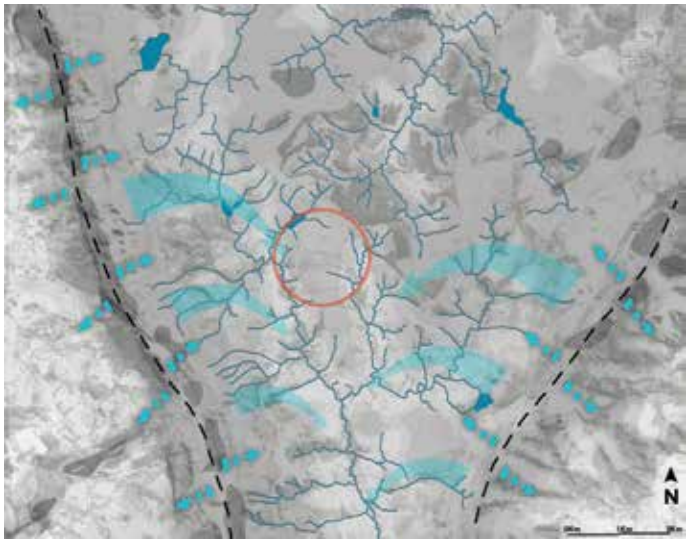


Fig. 66: Water system map of the Synclinal Moeda. Source: Original image

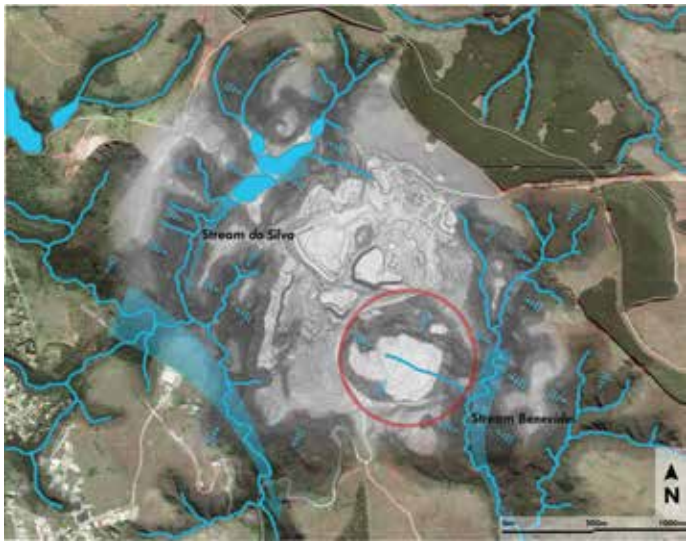


Fig. 67: Water system map Plateau Herculano. Source: Original image

Aredes and the research area

The Ecological Station of Aredes is representative of the hydrological characteristics of the Syncline Moeda. One singular aspect to mention is the presence of a thermal spring close to its boarders, manifesting the presence of recent tectonic activity (Quaternary geological age, the one we are living nowadays). This is one of the most valuable areas for preservation. The Herculano's Plateua is surrounded by two main streams where the springs join: the stream *Benevides*, located on the side

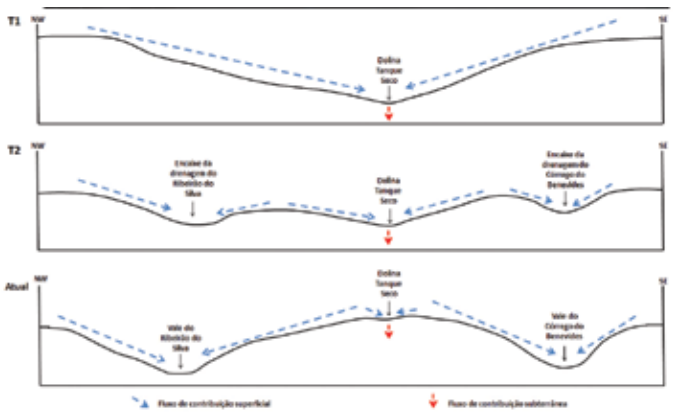


Fig. 68: Schematization of the process of relief invertion. Source: BRANDT 20015

3 This is mainly due because of the presence of cangas, a particular geologic formation with high concentrations of iron, that appears as a shell the surface of the reliefs (Fonseca do Carmo, 2012)

of the dam B4 and the stream *do Silva*, flowing in the opposite valley, where is the dam B1 (Fig. 67). The water that is flowing is partly collected in underground channels, as it happens for the area of the *Tanque seco*, on the top of the hill. The rest is recognizable on surface carving the valleys, the hillslopes and manifesting its presence through many on-going erosive processes. Very recognizable, also from satellite pictures, are the erosion gullies that form this peculiar semicircular patterns as water catchment-like areas. These areas were created after a first physical process of landslides, followed by a hydro-chemical dissolution process that led to the erosion of the hill side.
The region where the tailings dam is located has also a peculiar amphitheatric shape. From a satellite picture previous to the construction of the dam is clearly recognizable the contours of an erosion gully in development (see Fig. 65). In this catchment area the water was collected as a basin and a stream formed at its base. The stream is recognizable for the presence of a erosive pattern, starting after the magmatic dike previously described. The magmatic dike used to oppose resistance at the erosive potential of water accumulated through gravity, as the magmatic dike finishes the water could release this energy eroding the soil. From the image its clearly visible how the erosive pattern starts suddenly to erode the ground.
When the dam was built the water flow changed radically being regimented in tubes and artificial guts. Part of the water is brought laterally to the dam, flowing at the boarder of the staircases structures. Another small part is drained from the central part of the structure through and artificial gut that cuts the staircases. The rest of the water (which is the majority of the one collected) flows inside the tailings area; this is partly drained in the soil and partly is collected through an overflow system that, through pipes, reaches the old stream paths until joining the Benevides in the valley with the rest of the waters (Fig. 69). Walking through this landscape, is always striking to see how the water carves the soil and creates small natural guts here and there especially at the boarders of the paths, manifesting, even when absent, its strong trace in this region.

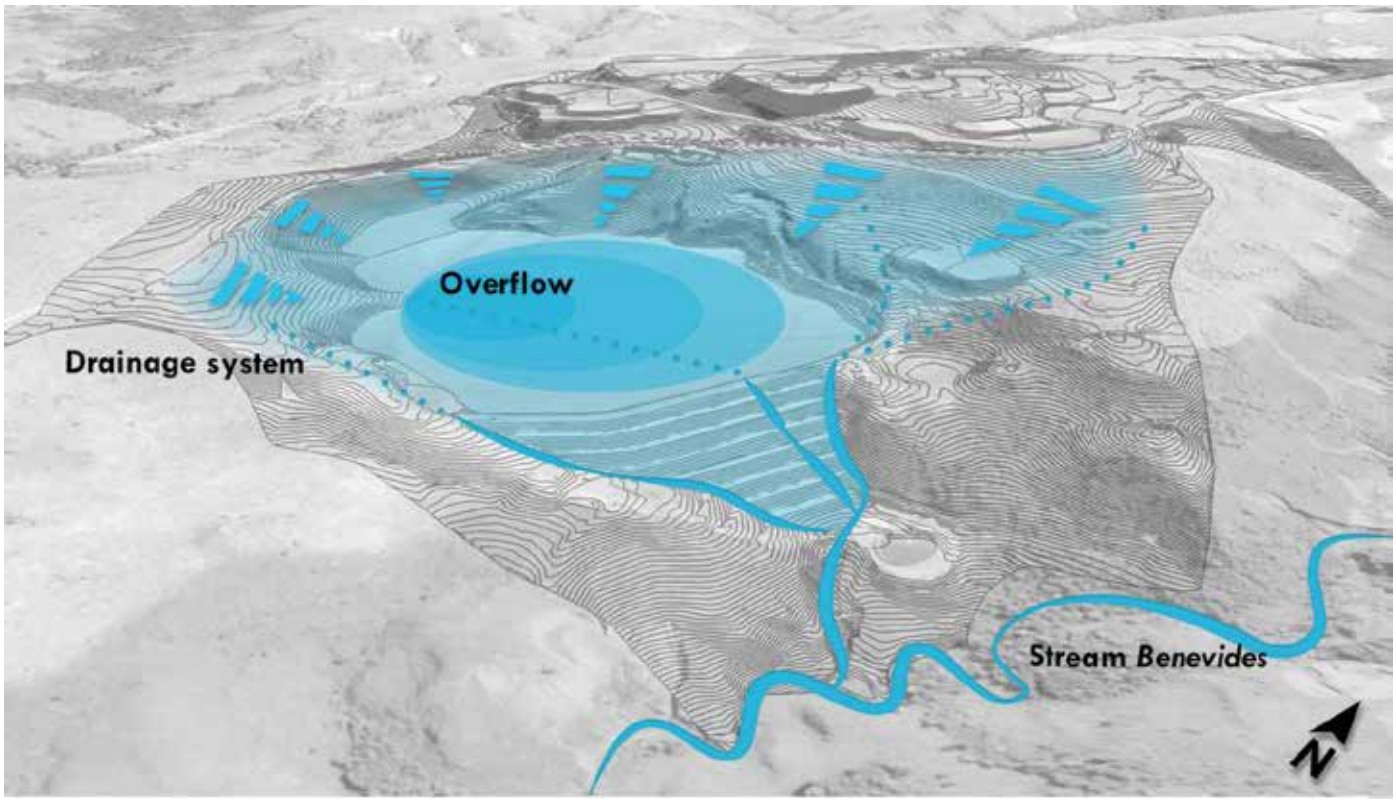


Fig. 69: Water system map in the research site. Source: Original image

Fig. 70: View of the Stream *Benevides* from the research site. Source: Original picture

4.3 FLORA AND FAUNA

The Q. F. within its 7.200 km2 is located within one of the regions of major floristic diversity of South America (Rapini, Ribeiro et al. 2008) and more than 30% of endemism regarding its flora (GIULIETTI, DE MENEZES et al. 1987). Indeed, this is considered an area of special biological importance, especially due to its ferruginous fields (as the cangas previously described) that constitute an unique environment full of endemic species (BRANDT 2015). Within Minas Gerais the *Serra da Moeda* and of *Itabirito* contain 22% of the species of amphibians and of birds, 13% of the mammals and 8% of the plants species (of which 53 of them are under threat of extinction in the state). Generally is reported that the level of bio-diversity is so high in the Sinclyne Moeda region, that is possible to find, in less than 2km2, many different biotopes (Jacobi, Do Carmo et al. 2007, Formoso 2013).

Aredes vegetation's reflect the ones that characterize the Sinclinal Moeda in which is inserted (Fig. 71): a transition area between *Cerrado* and *Mata Atlantica* (Formoso 2013). The Cerrado can be found above altitudes of 1000 meters, it's characterized by cross-country vegetation and it's predominant on the area. This type of ecosystem it's a type of savannah with a very high index of endemism and elevated biodiversity, even though it grows on soils with low fertility, in conditions of extreme temperatures and low availability of water (Viana and Lombardi 2007, Formoso 2013). The *Mata Atlantica* (Atlantic Forest) here is found as a deciduous semi-deciduous mountain forest that on this landscape

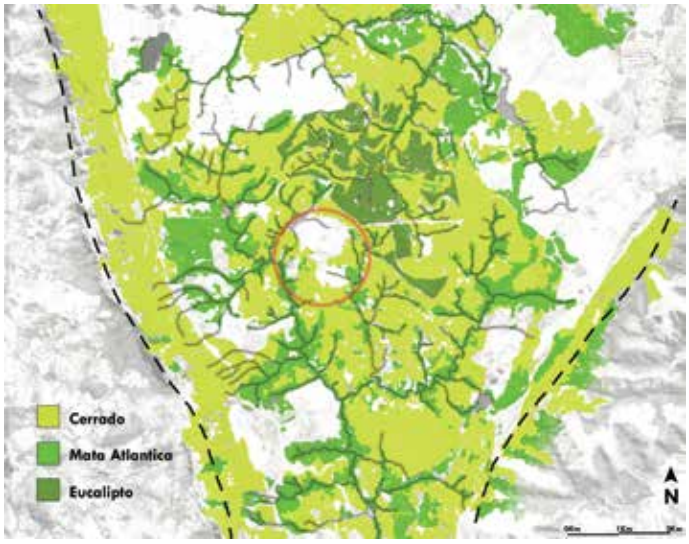


Fig. 71: Biological map Synclinal Moeda. Source: Original image

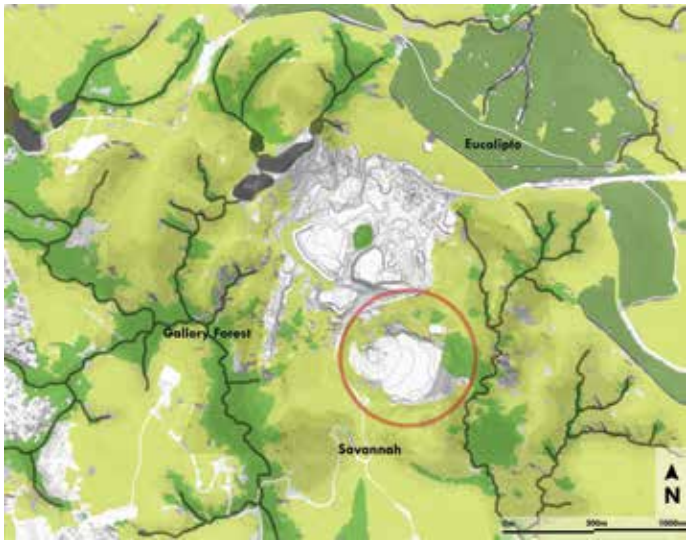


Fig. 72: Biological map Plateau Herculano. Source: Original Image

is settled along watercourses, on the slopes and isolated in the middle of cross-country vegetation. Also the Atlantic Forest is characterized by a very high grade of endemism and biodiversity of animal and vegetation species that is nowadays under risk because of deforestation. Furthermore, in Aredes there are also eucalypt plantation, which are concentrated all around this area in the higher part of the inner Plateau.

The area concerning the Herculano's Plateau comprehends parts of landscape that are located inside and outside Aredes and its characterized by this same transition between *Mata Atlantica* and *Cerrado* (Fig. 72). Indeed, the higher parts are characterized by savannah like vegetation, while starting from the hillsides the forest occurs till the lower parts of the landscape. In the valleys around, along the streams, there is mainly a gallery forest at the middle stage of natural regeneration. Generally the understory of the forest are very dense and rich, under canopies that can reach 10 meters of height. From the Plateau, around are visible some eucalyptus plantations, clearly recognizable for their regular and compact appearance on the higher part of the landscape. The rest of the landscape is determined by the industrial installations of the Herculano Mining Company, part of which is already undergoing the process of landscape recovery.

Fig. 73: Grassland, *Cerrado*. Source: Original image

Fig. 74: Forest, *Mata Atlantica.* Source: Original image

Fig. 75: Plantation of Eucalipto. Source: Original image

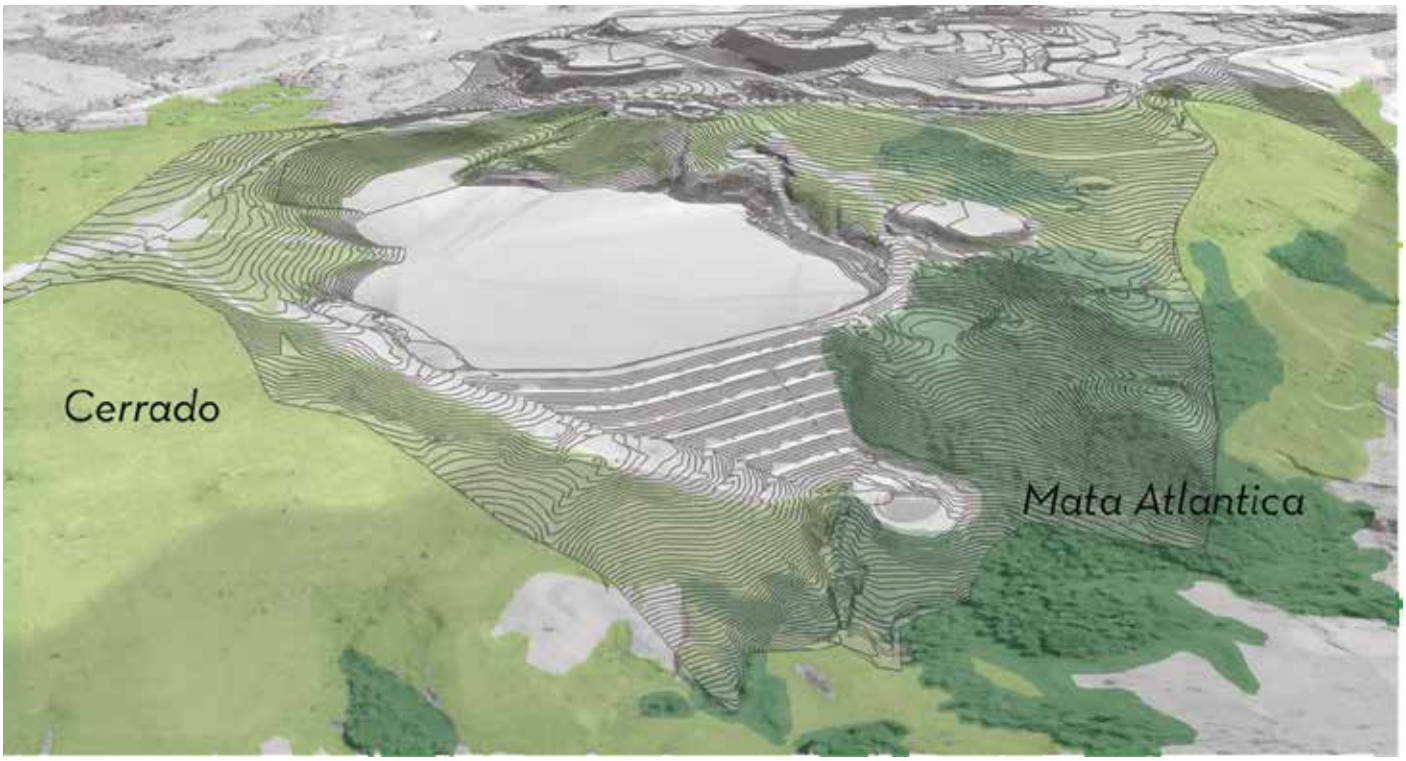


Fig. 76: Biological map research site. Source: Original image

4.4 ANTHROPIC INFLUENCE

The anthropic influence in the Syncline Moeda has a very significant impact especially for the intensity of the mining activity, easily recognizable from satellite images. Moreover, the Syncline is crossed by the highway system that connects Belo Horizonte with Ouro Preto and Rio de Janeiro located south. There are also some industrial areas, as a result of the expansion of the metropolitan area of Belo Horizonte, and countryside residences. For this reasons, during the years, many preservation areas with different particular objectives like Aredes have been established. In the report these are all listed considering their typology and their distance from Aredes (BRANDT 2015). The research area has a high anthropic influence due to the installations of the Herculano Mining Company as shown in the first Chapter.

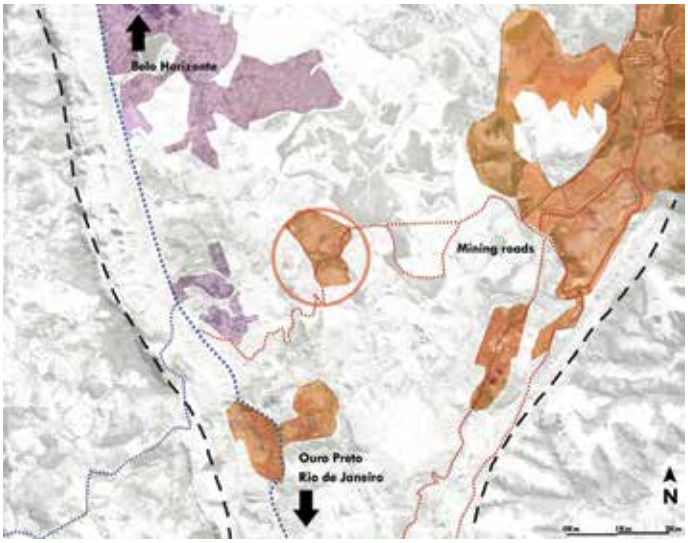


Fig. 77: Anthropic influence map Synclinal Moeda. Source: Original image

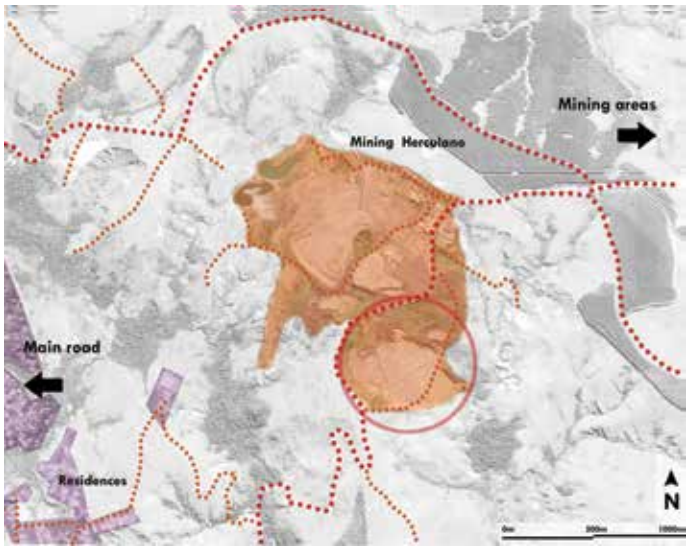


Fig. 78: Antropic influence map Herculano's Plateau. Source: Original image

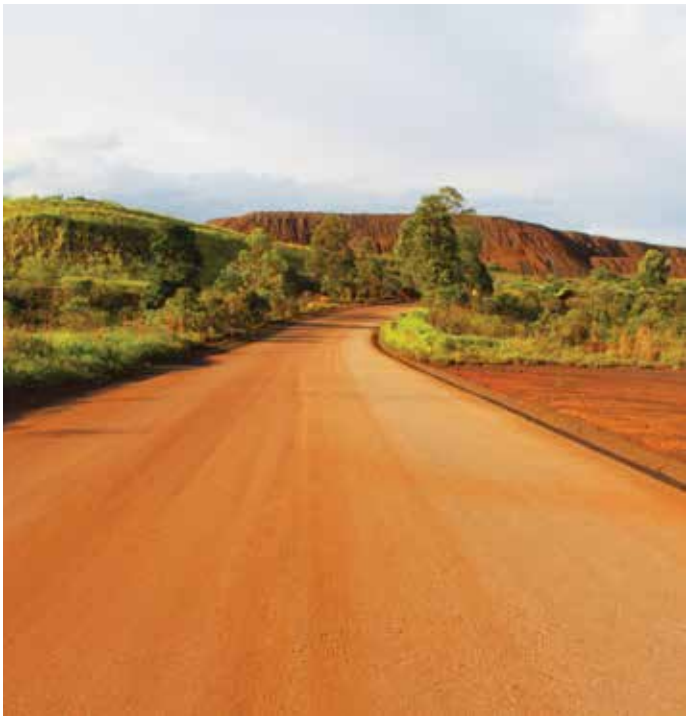


Fig. 79: Mining road and tailings pile. Source: Original picture

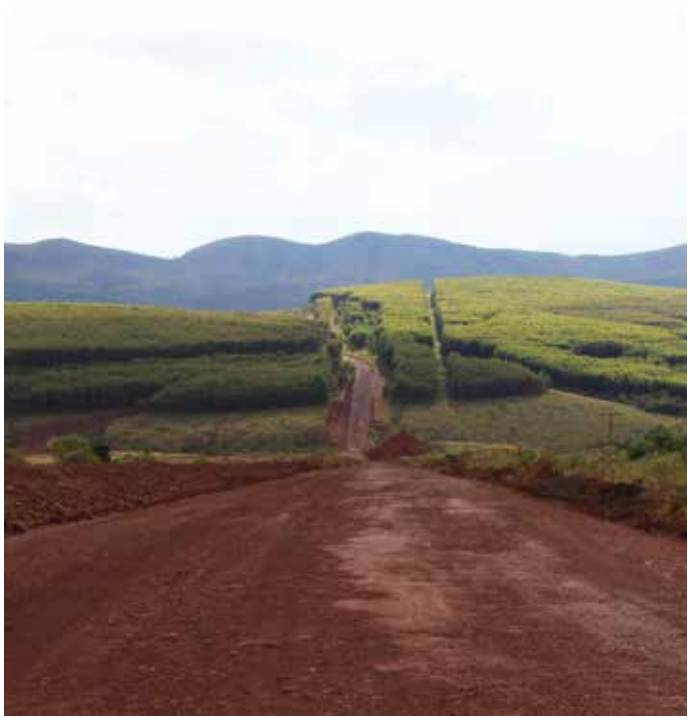


Fig. 80: Mining road and euclipt plantations. Source: Original image

The final zoning map cannot contain all the information acquired during the environmental analysis. Although it shows that all the main ecological characteristic and functionalities can be traced in the project are, together with the consistent presence of the anthropic influence.

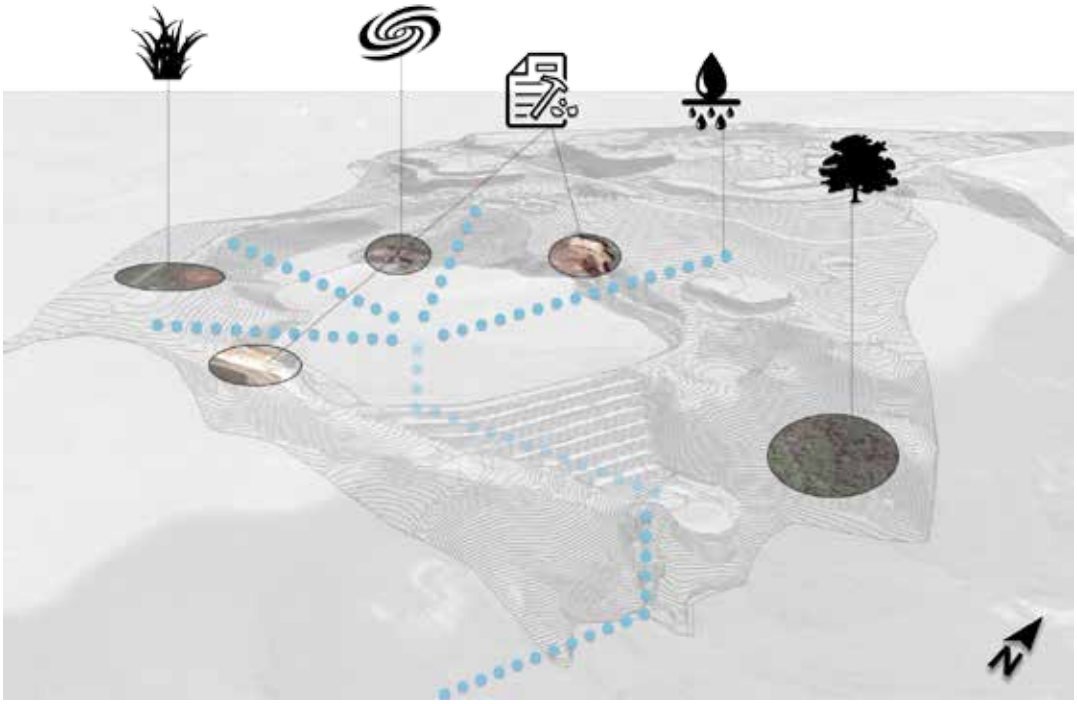


Fig: 81: Environmental analysis zoning map. Source: Original image

5th Chapter:

THE RECOVERY PLAN (PRAD)

-Physical measures and Biological measures -

INTRODUCTION

This chapter is intended to give answer to the last research question: What kind of interventions are needed to recover mining landscapes, and especially, for the area under study? Once again the report made by BRANT (2015) resulted very precious, as it contains a plan for the closing process of the mining activity in this area. This plan is called PRAD (Plano Recuperaçao Areas Degradadas) and since 1989 is requested by law to every mining company in Brazil (see Chapter 2.2). In this Chapter the main passages requested by the PRAD are further explained, while in the next chapter it will be shown how these have been interpreted during the overall design process.

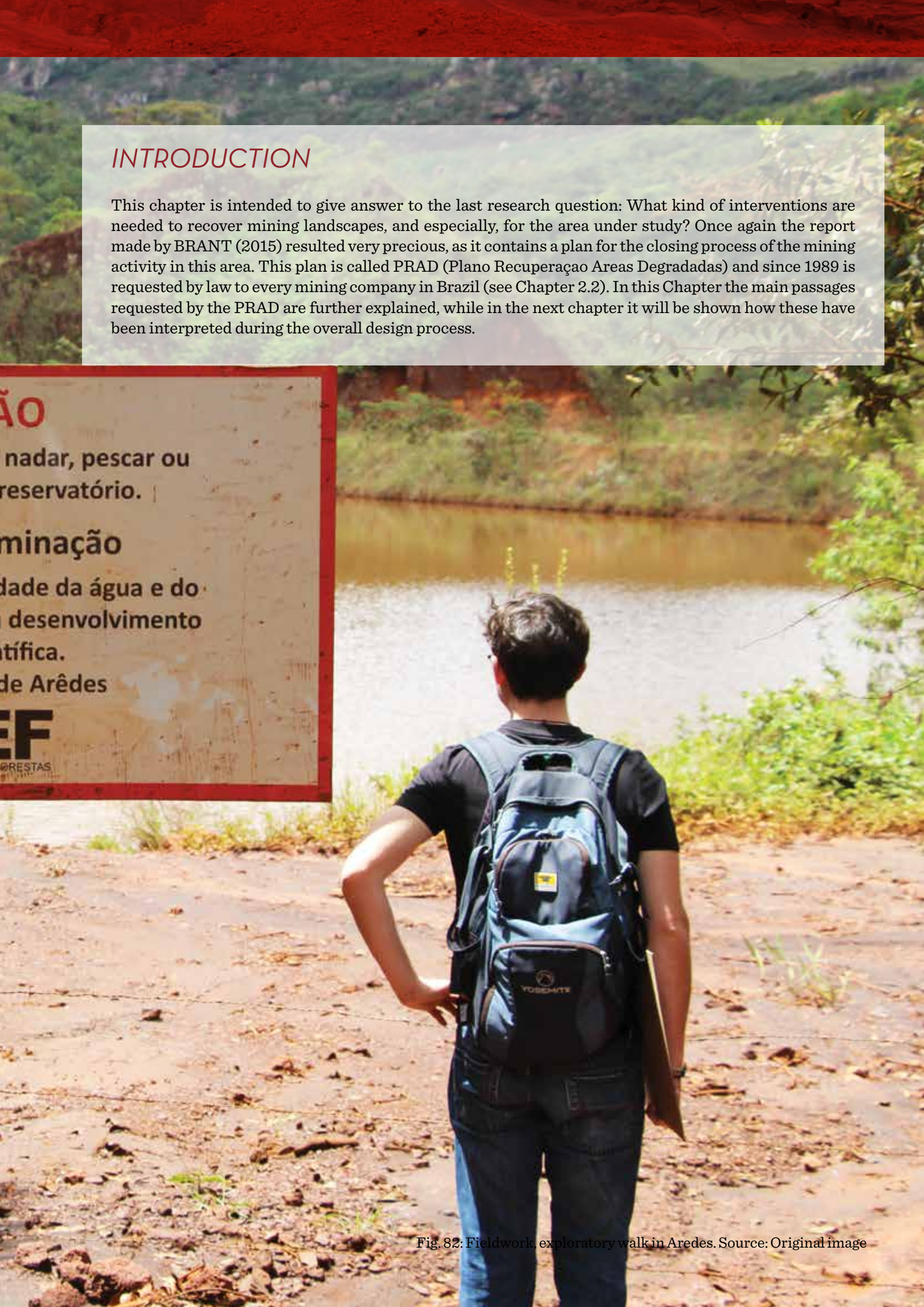


Fig. 82: Fieldwork, exploratory walk in Aredes. Source: Original image

The PRAD (BRANDT 2015) is presented as a preliminary study toward the mining closure process for the socio-environmental balance in the short, medium and long terms. Meaning that further investigations and measurements should be undertaken in order to practically recover the area. The general objective is to "*allow the environmental recovery and ecologic restoration, by means of indicating feasible measures...*" (BRANDT 2015, p. 217). More specifically the intervention suggested for the tailings dam B4 is intended as "*ecological restoration and reintegration of the area into the ecological context of ESEC (Aredes)*" (BRANDT 2015, p. 219). Although the PRAD speaks about ecological restoration, during the interview with Wilfred Brandt, it emerged that the actual action would be to "rehabilitate" the area, meaning a less radical intervention, something in between the definitions of restauration and reclamation (see Chapter 3).
The steps described in the PRAD for the decommission of the area are the following:

1. Preliminar measures
2. Physical mesures
3. Biologic measures
4. Maintenance and cultivating systems

Of these four operations just the second and the third operations will be reported as the others are not considered to be of particular relevance for the scope of the thesis. The next sections will explain in detail the actions to be undertaken when considering the physical and biological measures.

5.1 PHYSICAL MEASURES

For Physical measures are intended:

- The removal of the tailings from the dam and from the piles
- The containment of the erosive processes
- Decontamination where necessary
- Topographical reconfiguration and unpacking of flat surfaces
- Guarantee of geotechnical stability on the surface to be worked

5.1.1 Tailings removal

Considering the fragile characteristics of the landscape, the presence of the tailings could result in other harming events in the near or far future. Therefore, the PRAD envisions the decommission of the entire structure of the tailing dam and of the remaining piles left around and the consequent return to the original soil profile. This action is intended for the structural stability and further revegetation of the area. In addition, in the report is mentioned how the tailings could be processed and reused for industrial purposes. Finally, it is expected a period of seven years to extract all the tailings and

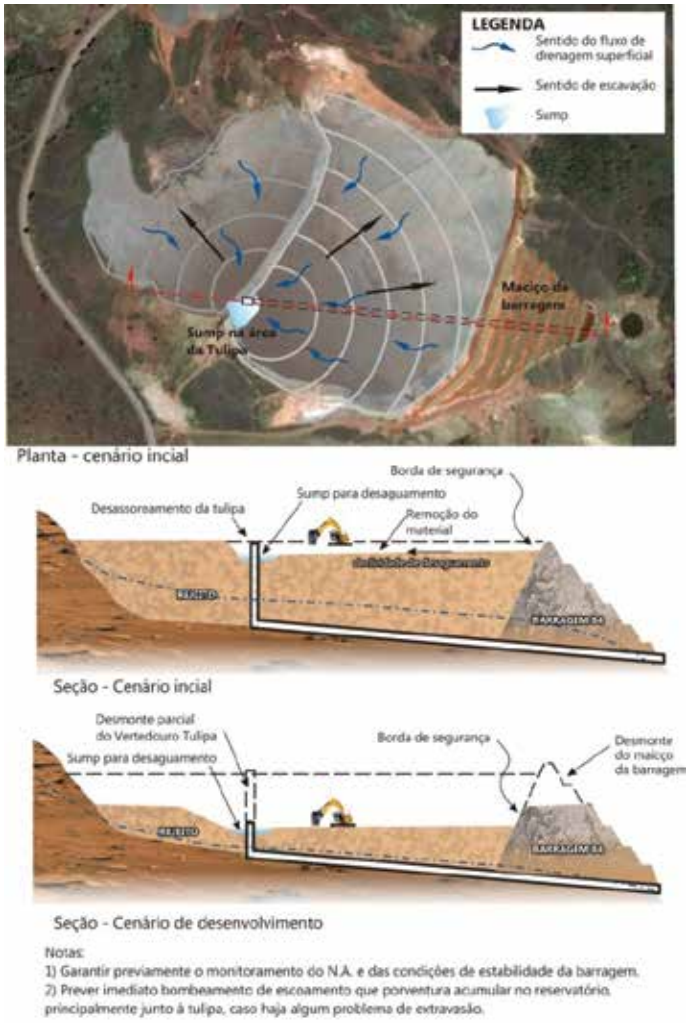


Fig. 83: represetations of the procedure for tailings removal. Source: BRANDT (2015)

process them.
The operations of excavation of the tailings are represented in the following images (Fig. 83). The excavation should start from where the overflow is located towards the boarders of the dam, so that the water could easily converge in it and be expelled. Also the structure of the dam should then be gradually removed as the reservoir decreases, in accordance with the hydraulic safety analysis. More detailed information about the technical pre-cautions to be observed during the excavation works are explained in the report (BRANDT 2015).

Containment of the erosive processes and decontamination

The erosive process would have to be constantly mapped and monitored, so that actions of adjustment of the project could be undertaken in time. The activity of restraint should be carried out during the dry season and different methods of erosion control will be specifically defined for each area. These methods are:

- Containment of lateral slope stability
- Landscape adjustments for insertion in the scenic context
- Drainage system appropriate to the situation
- Power Sinks and Gut Stabilization
- Revegetation of coverage and control
- Final monitoring for closure

Evaluation upon the eventual contaminations in the soil should be hold by an expert all around the area. In case of any contaminations detected the area would have to undergo decontamination treatments to allow revegetation. The report doesn't go further in explaining these operations, but they are reported for the sake of further investigations by the professionals that will deal with them during the closing process.

5.1.2 Topographical reconfiguration and unzipping of flat surfaces

Before the revegetation processes, all the new surface would have to undergo the reconfiguration and levelling of the terrain. In addition, the flat surfaces would have to be unzipped, when considered necessary; the high pressure exerted by the tailings on the soil could have provoked areas of high compression. The unzipping would then be useful to improve the physical structure of the soil, encouraging the development of the root system essential for revegetation, besides enhancing the infiltration of water in the soil.
The following pictures show the topographical reconfiguration of the soil as intended in the PRAD (Fig. 84-85), a smooth geometry is intended to follow the original topography. Specific parameters for the stability of the soil where followed:

- Height of the terraces: 5m
- Slope inclination: 2H : 1V
- Minimum edge size: 6m

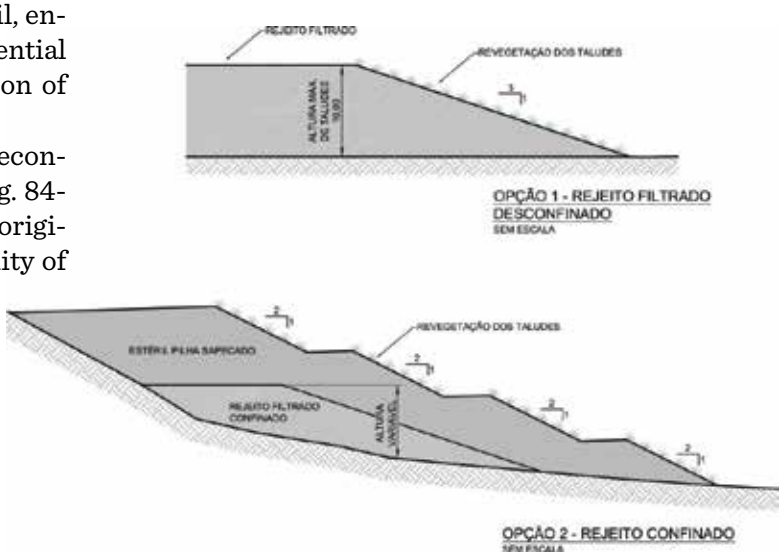


Fig. 84: Staircases reconfiguration. Source: BRANDT (2015)

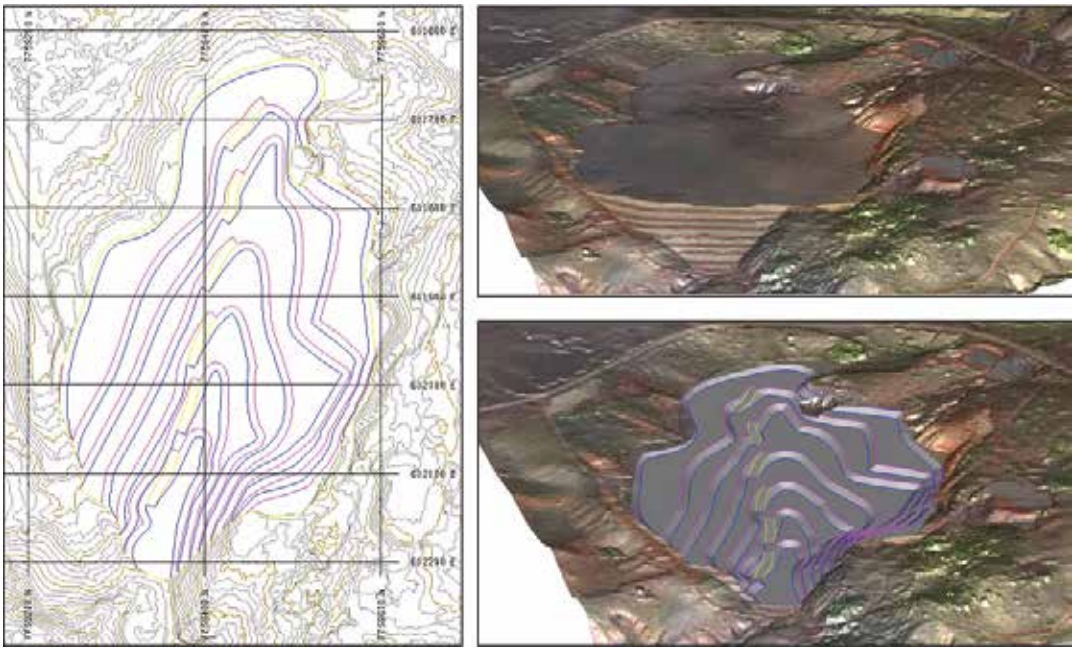


Fig. 85: Model of the topographical reconfiguration. Source: BRANDT (2015)

5.2 BIOLOGICAL MEASURES

The biological measures can be summarized in two main operations: revegetation and attractions for fauna and avifauna.

5.2.1 Revegetation

The method suggested in the report (BRANDT 2015) is the Green manure one, which consists in the application of cover crops that quickly can cover the altered soil after the revegetation. The primary vegetation will be applied everywhere while new revegetation stages can take over in certain areas with secondary revegetation. The choice of the plant species will be directed toward native ones and to those species suitable for the environmental conditions of the region. Further indications on the seeding process are given in the report (BRANDT 2015). The species recommended for the primary revegetation process are the ones found in the list (Fig. 86).
Particularly for the area inside Aredes (therefore the project area) the report states that the goal is not to restore the same vegetation as the one that there was before the construction of the dam, but rather to "*Incorporate peculiarities of the landscape unit to restore important ecological processes in the reconstruction of a functional community. As a way of establishing a new dynamic of ecological succession, where there are intense levels of interaction between producers, consumers and decomposers, in a continuous cycle of deaths and births.*" (BRANDT 2015, p. 224). For this to take place, the nucleation technique will be used. This technique makes use of the capacity of a species of improving the local environment, facilitating the occupation of a certain area from other species. Therefore, starting from vegetating some scattered parts, secondary vegetation develops around accelerating the natural processes all around the degraded area (Martins 2007).

Revegetation of savannah (Cerrado)

The planting for the primary succession will have to be realized as indicated at the beginning of this section. The report suggests that on the more convex areas on the landscape (therefore also the higher ones), where less water is available, it would have to be planted nucleus of species taken from the types of the woodland and grassland savannah (*Cerrado*). To do so the revegetation implanted for the primary succession would have to be totally removed. More detailed information upon the planting technique of these species is reported in the PRAD (BRANDT 2015, p. 224), while the following table reports the main principal species that could be used for this type of revegetation.

Revegetation of forest (Mata Atlantica)

Also for the revegetation of forest like areas it will be foreseen the nucleation technique combined with planting techniques based on successional models. According to the report this method would be the more successful one to create a rich forest as quick as possible by combining different plants and different successional stages in the same nucleus. As well the choice of the species would be preferably of native species from the semi deciduous seasonal forest (*Mata Atlantica*), which generally occupies the lower parts of the landscape and especially grows along the drainage as gallery forest. Also for this particular revegetation a more detailed description of the planting technique suggested is given in the PRAD (BRANDT 2015, p. 225). A list of possible species is given in the report (BRANDT 2015).

Species	Vernacular name	Re-colonization	Inhibition of succession	Biomass	Seeds\meter
Cajanus cajan	*Feijão-guandu*	high	low	high	**20**
Crotalaria juncea	*Chocalho-de-cascavel*	low	low	high	**40**
Canavalia ensiformis	*Feijão-de-porco*	high	low	high	**3**
Crotalaria brevifolia	*Chocalho de cascavel*	high	low	high	**25**
Crotalaria mucronata	*Chocalho de cascavel*	high	low	high	**30**
Crotalaria ochroleuca	*Chocalho de cascavel*	high	low	high	**30**
Crotalaria spectabilis	*Chocalho de cascavel*	high	low	low	**30**
Helianthus annuus	*Girassol*	low	low	high	**7**
Mucuna aterrima	*Mucuna preta*	high	high	high	**
Mucuna deeringiana	*Mucuna anã*	high	high	high	**
Pennisetum glaucum	*Milheto*	low	low	high	**50**
*Centrosema coriaceum	*Jequitirana*	low	N.G.	low	**40**
*Stylosanthes gracilis	*Alfafa do mato*	medium	N.G.	low	**40**
*Periandra mediterranea	*Alcaçus do cerrado*	medium	N.G.	medium	**40**
*Mimosa pogocephala	*Mimosa*	high	N.G.	high	**15**
*Senna multijuga	*Pau-cigarra*	high	N.G.	high	**7**
Andropogon bicornis	*Capim*	high	N.G.	high	**50**
*Axonopus siccus	*Capim*	medium	N.G.	low	**50**
*Bulbostylis capilaries	*Capim*	low	N.G.	low	**50**
*Echinolaena inflexa	*Capim flechinha*	high	N.G.	low	**50**

* Native species

** Invasive species to be applied just in areas with difficulties of revegetation

Fig. 86: Species for primary revegetation. Source: BRANDT (2015)

Cerrado

Family	Species	Venacular name	Type
1. Solanaceae	*Solanum lycocarpum*	--	Arboreal
2. Malpighiaceae	*Byrsonima lancifolia*	Murici	Shrub
3. Erythroxylaceae	*Erythroxylum suberosum*	--	Shrub
4. Bignoniaceae	*Jacaranda caroba*	Caroba	Shrub
5. Melastomataceae	*Tibouchina heteromalla*	Quaresmeira	Shrub
6. Asteraceae	*Vernonia westiniana*	--	Shrub
7. Bromeliaceae	*Aechmea bromeliifolia*	bromélia	Shrub
8. Malpighiaceae	*Byrsonima intermedia*	Murici	Shrub
9. Myrtaceae	*Eugenia sonderiana*	--	Shrub
10. Poaceae	*Andropogon bicornis*	capim	Herbaceous
11. Poaceae	*Axonopus siccus*	capim	Herbaceous
12. Cyperaceae	*Bulbostylis capilaries*	capim	Herbaceous
13. Poaceae	*Echinolaena inflexa*	capim	Herbaceous
14. Poaceae	*Paspalum plicatulum*	capim	Herbaceous
15. Anemiaceae	*Anemia ferruginea*	macela	Herbaceous
16. Asteraceae	*Aspilia foliacea*	maragarida do mato	Herbaceous
17. Blechnaceae	*Blechnum occidentale*	--	Herbaceous
18. Acanthaceae	*Ruellia macrantha*	--	Herbaceous
19. Asteraceae	*Achyrocline satureioides*	assa-peixe	Climber
20. Passifloraceae	*Passiflora amethystina*	Maracujá do mato	Climber

Fig. 87: Species for second revegetation, *Cerrado*. Sorce: BRANDT (2015)

Fig. 88: *Cerrado* landscape. Source: Original image

Mata Atlantica

Family	Species	Venacular name	Type
1. Anacardiacea	*Schinus terebinthifolius*	pimenta-rosa, aroeira-pimenteira, aroeira-mansa, aroeirinha	Pioneer
2. Myrsinaceae	*Myrsine coriacea*	Capororoca	Pioneer
3. Myrsinaceae	*Myrsine umbellata*	Capororoca	Pioneer
4. Siparunaceae	*Siparuna guianensis*	Capitiú	Pioneer
5. Anacardiacea	*Lithraea molleoides*	Aroeirinha	Pioneer
6. Anacardiacea	*Protium heptaphyllum*	Breu	Initial secondary
7. Anacardiacea	*Tapirira guianensis*	Tapiriri	Initial secondary
8. Araliaceae	*Dendropanax cuneatus*	Maria-mole	Initial Secondary
9. Arecaceae	*Acrocomia aculeata*	Macaúba, palmeira-macaúba	Initial Secondary
10. Bignoniaceae	*Handroanthus ochraceus*	Ipê-amarelo-do-cerrado	Initial Secondary
11. Annonaceae	*Annona sylvatica*	Araticum	Initial Secondary
12. Arecaceae	*Geonoma schottiana*	--	Initial Secondary
13. Fabaceae	*Copaifera langsdorffii*	Copaíba	Initial Secondary
14. Lauraceae	*Aniba firmula*	Canela	Initial Secondary
15. Sapotaceae	*Chrysophyllum marginatum*	Aguaí	Initial Secondary

Fig. 89: Species for second revegetation, *Atlantic Forest*. Sorce: BRANDT (2015)

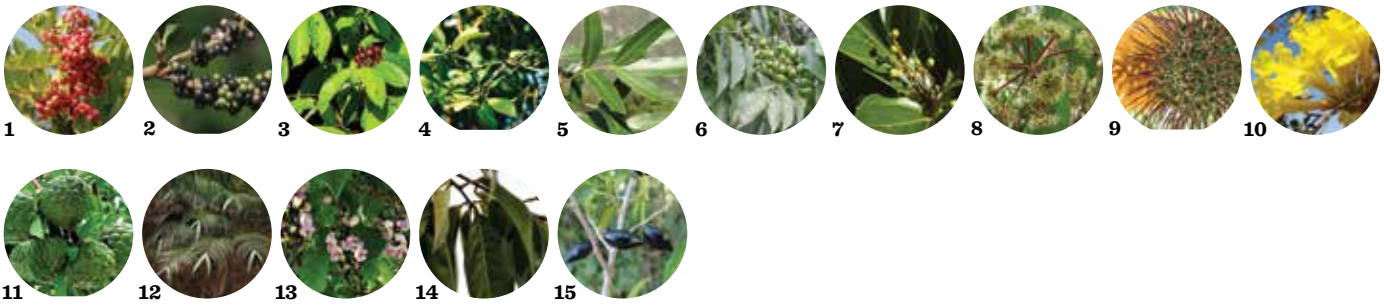


Fig. 90: *Mata Atlantica* landscape. Source: Original image

5.2.2 Attractions for fauna and avifauna

The PRAD suggests the formation of piles (*galharias*) made with forest local residue, such as twigs, stumps and stems which are considered to stimulate the attraction of the fauna. The species expected to colonize this piles are of small size: animals like amphibians, rodents, lizards, birds and insects pollinators. After a while the piles decompose attracting animal of different trophic levels. Would be important to place them especially in those locations where the process of revegetation had been more difficult, in order to avoid the proliferation of invasive exotic species.

For the attraction of the avifauna a similar method is used. Artificial perches could be used to attract the local birds, which have been observed of being in great number around the area. The attraction of birds would be important also for their contribution in spreading seeds around during their movements. In the report is reported that five perches for hectare to be placed during the process of revegetation, are already sufficient. These can be made with natural materials like wood of eucalyptus or bamboo, and reach heights up to 10 meters.

Finally, other suggested structures are the, so called, *torres de trepadeiras* around which the planting of lianas and herbs together with natural man-made structures is thought to attract animals.

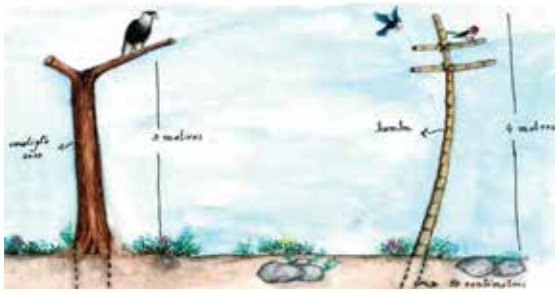


Fig. 91: Artificial perches for attraction of avifauna: Source: BRANDT (2015)

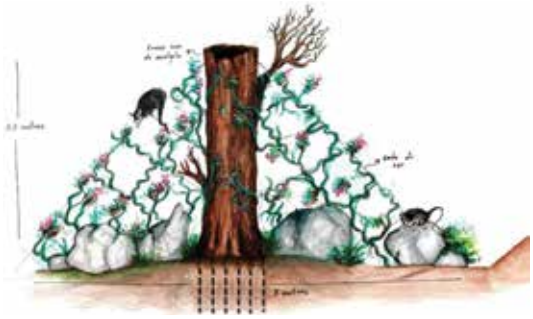


Fig. 92: *Torres de tropadeiras.* Source: BRANDT (2015)

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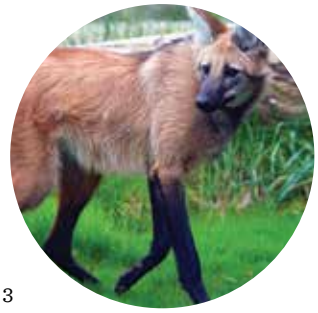

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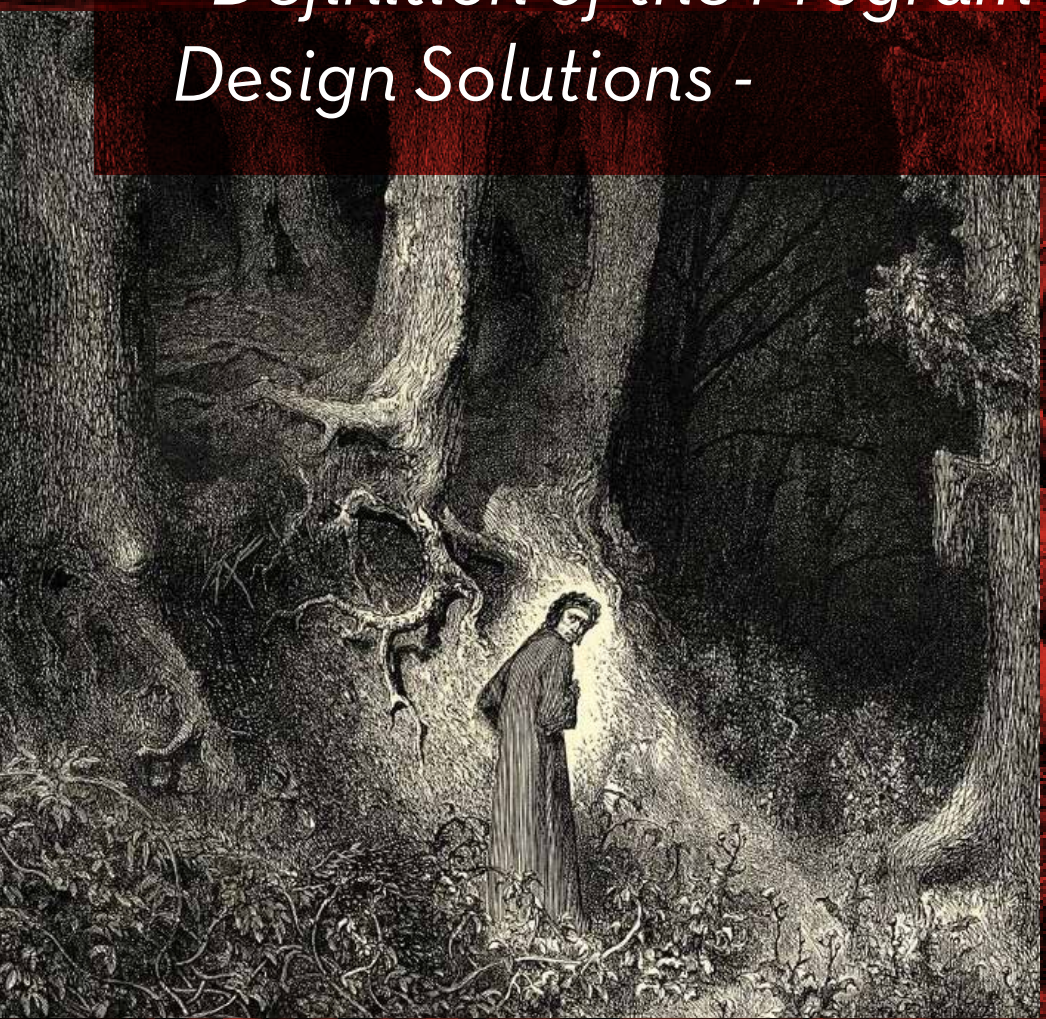
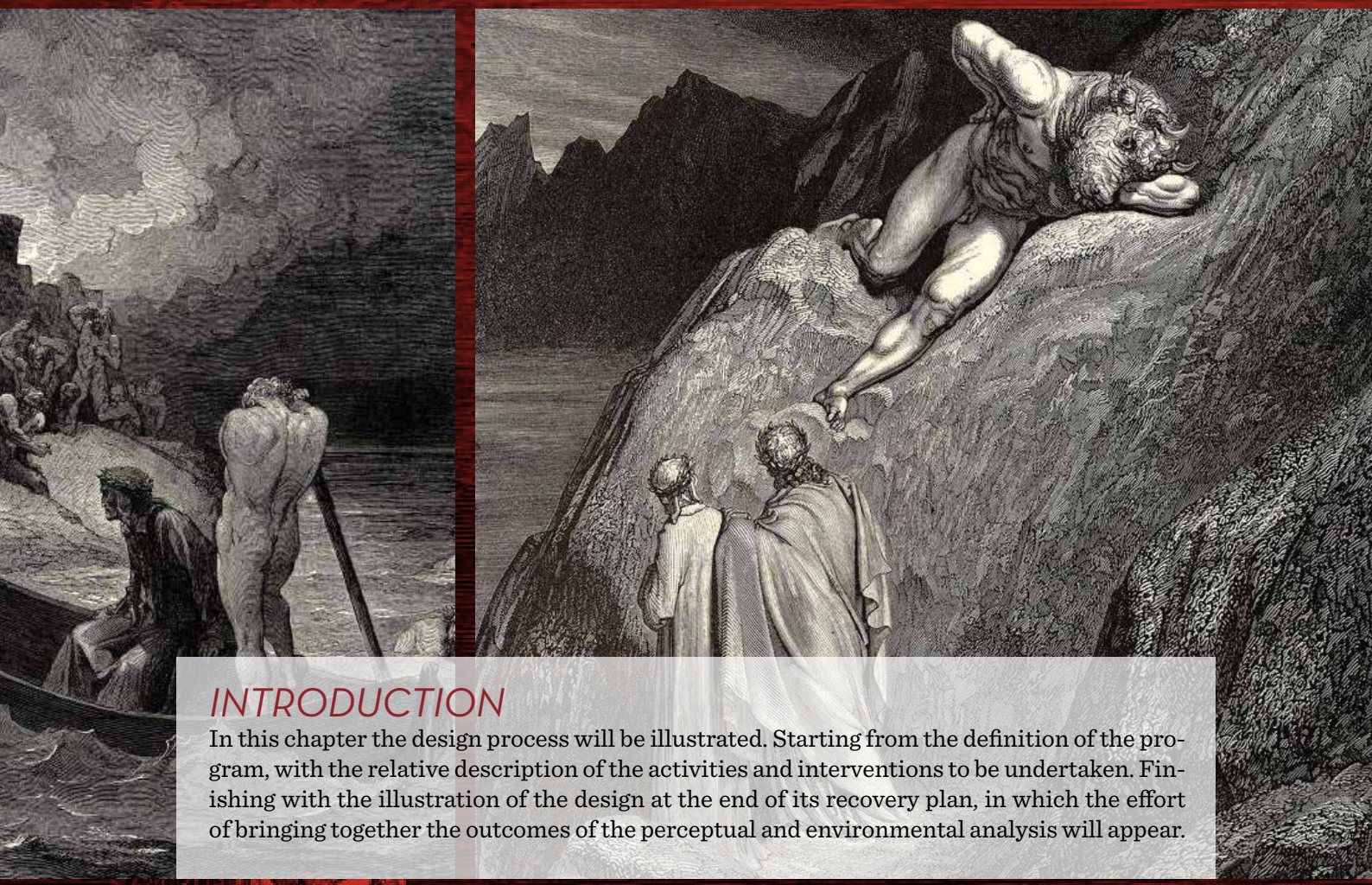
Fig. 93: 1) Beija flor de gravata (*Augastes scutatus*). 2) Tamanduá (*Tamandua tetradactyla*). 3) Lobo-guará (*Chrysocyon brachyurus*). 4) Gato-do-mato (*Leopardus tigrinus*). Source: Internet. 5) Urubù de cabeça vermelha (*Cathartes aura*). Source: Original picture

6th Chapter:

THE DESIGN PROCESS

- Definition of the Program and Design Solutions -





INTRODUCTION

In this chapter the design process will be illustrated. Starting from the definition of the program, with the relative description of the activities and interventions to be undertaken. Finishing with the illustration of the design at the end of its recovery plan, in which the effort of bringing together the outcomes of the perceptual and environmental analysis will appear.

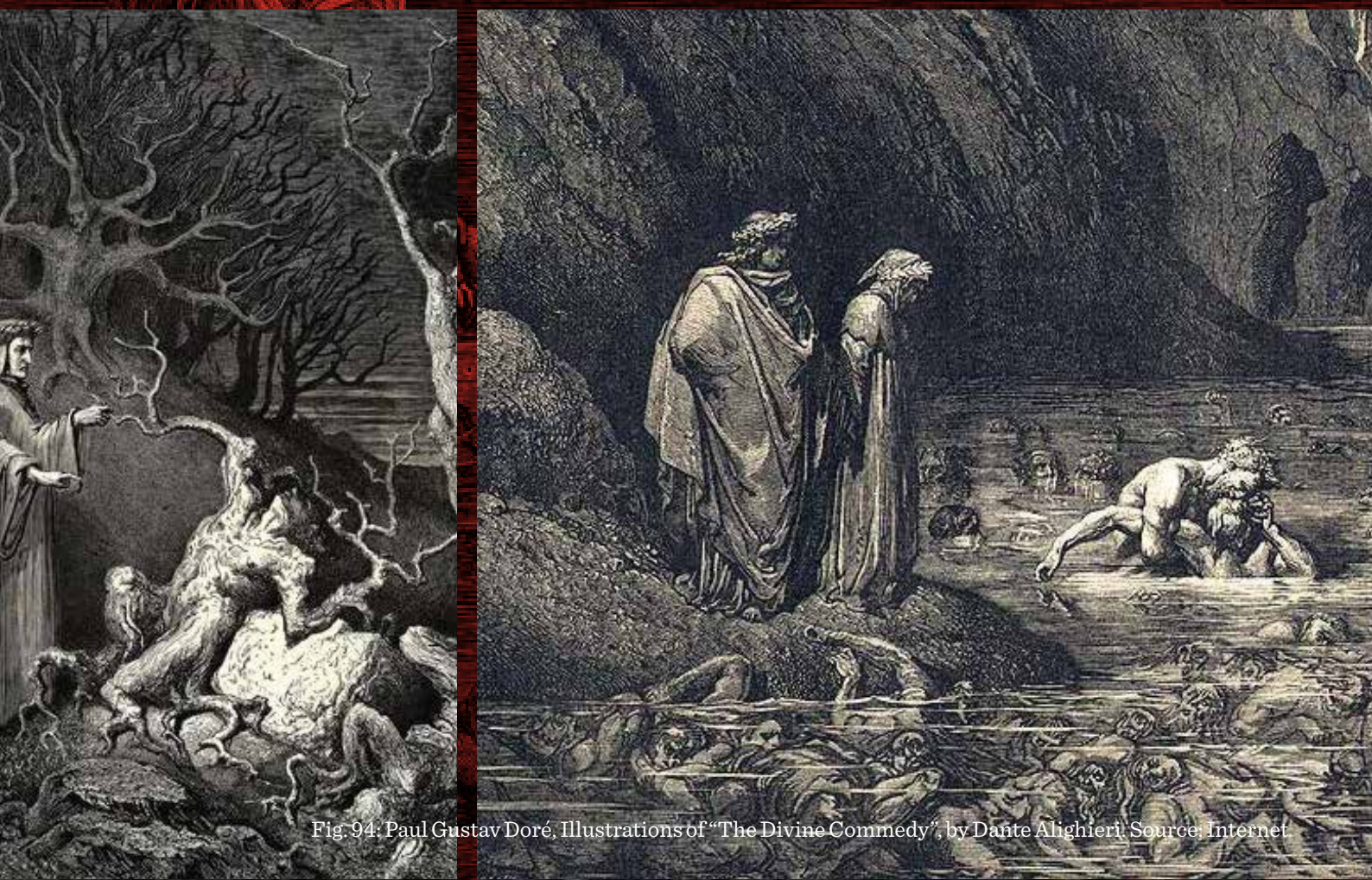


Fig. 94: Paul Gustav Doré, Illustrations of "The Divine Commedy", by Dante Alighieri. Source: Internet

6.1 DEFINITION OF THE PROGRAM

The program of the area has been defined during the period of the fieldwork in Brazil. Of special importance have been the interviews with Luiz Fernando (the administrator of Aredes) and his team, together with the opinions shared with some other experts and my supervisor (José Eustaquio Machado de Paiva). The first consideration to be made is that the site is located inside an Ecological Station, and therefore, any program should follow the terms described by the relative jurisdiction. In the specific, the Brazilian federal law n° 9.985, defines the dispositions to be respected for the unities of conservation of natural values. Another consideration emerged during the talks and the research process is that the area where the site is located has a full range of interesting environmental characteristics, the ones of the inner plateau of the Syncline Moeda (as described in the fourth Chapter). Finally, from a more practical perspective, the location of the site, at the boarders of the Ecological Station, makes it a convenient place for the coming of people.

Based on these main observations, the idea of transforming the area into a site dedicated to environmental research and education, seemed the more suitable one. The concept on which the entire plan will stand is a landscape design that will allow people to understand and study what happened in this place and how natural and human forces have been interacting through time and are still doing. Considering the definition of reclamation (see second Chapter), this means displaying the role of natural together with socio-cultural forces in shaping the landscape, expressed through the narrative of construction and decommission of the tailings dam.

As already mentioned, the area to be reclaimed comprehends also a portion of the land over the street, part of the former Herculano Mining Company settlements. Acknowledging the limits drawn for this thesis, the project will consider just the dam B4, but the entire reclamation process should involve also the other part of the site. For this reason a program for this area has been suggested as well, as a unique complex together with

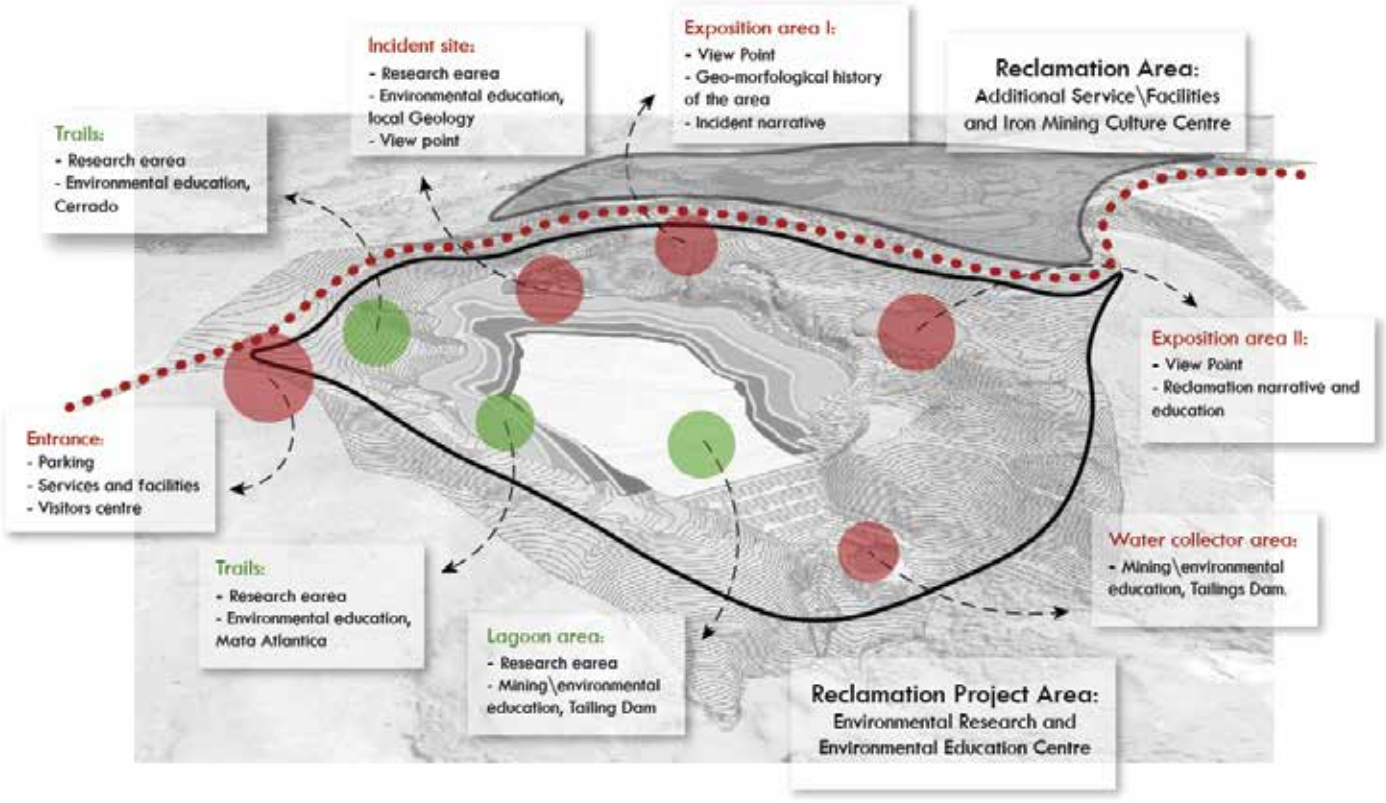


Fig. 95: new reclamation program. Source: Original image

the B4 area. Indeed, considering the structures that this place already dispones, it could be transformed into an area where additional facilities are concentrated and an iron-ore mining culture center implemented. This could entail additional spaces to host the visitors, as dormitories for the researchers, working and studying spaces, restaurants, cafes and conference rooms. Also a museum could be planned here, in which the evidence of the mining culture on the area would be exposed, and memories and stories of local people gathered, the so called "*heritage from below*" (Robertson 2008).
While on the other side of the road, the project area will focus on showing how the mining tradition brought some serious environmental consequences, and how these could be resolved in the future. Therefore, the activities that have been suggested are very diverse. The site has been divided in three main areas, located at three different altitudes of the landscape: the "*Cerrado area*", the "*Mata Atlantica area*" and the "*Tailings area*". The activities suggested are: outdoor laboratories for schools and universities, guided walks with recognition of the different landscape's features (types of plants, types of soils ecc...), visits of the accident site, view and observation points and more. Either some parts could be temporally closed to the public for research purposes (for example, there is one area at the North-West side of the site that has some archeological remnants). Moreover, several facilities and structures will be placed in certain specific spots, also to enhance and facilitate the experience of the landscape. Many of these aspects will be described more thoroughly during the presentation of the design.
Finally, is important to mention that the program will be intended to evolve with the reclamation process of the area. As soon as the area would be put on safe, with the tailings brought away and the topography reshaped and stabilized, research and educational activities could start taking place. These could also take part to the same reclamation process. For example, the revegetation process could become a workshop for school and universities, and moreover, the collection of data and studies upon the erosive processes, a matter of academic research that could also attract attention from abroad. A more detailed definition of this plan will not be displayed further as it would need additional research that, for the limit of this work, can be just foreseen. Concluding, what is important to note is the dynamic character of this program that follows the dynamic character of the landscape to which planners and landscape architect will have to adapt step by step.

6.1.1 Preliminary interventions

Before presenting the design, I will briefly introduce some basic preliminary interventions that have been envisioned based on the investigations on the recovery plan previously explained. As already mentioned, the main intervention that will state the difference from the PRAD, is the conservation of half of the tailings already present. This decision has been taken after consultation of the experts and for reasons that would be further explained during the design process. Alternatively, the tailings piles will be totally removed for their unstable condition. The topography of the slope, cleared from the tailings, will be organically reconfigured, following the basic rules mentioned in the PRAD, gently descending towards the tailings area (Fig. 97). This new part of the landscape will result as a negative of the former terraces of the dam, and additionally subdivided in smaller slopes connecting the different levels, in order to facilitate the propagation of water flows and consequently enhancing revegetation and soil erosion control (Fig. 98). Finally, the subdivision of the three different revegetation areas has been partly envisioned considering the two types of secondary revegetation suggested in the PRAD, with the difference that their location in the new landscape is clearly defined and that the tailings are still present (Fig. 99).

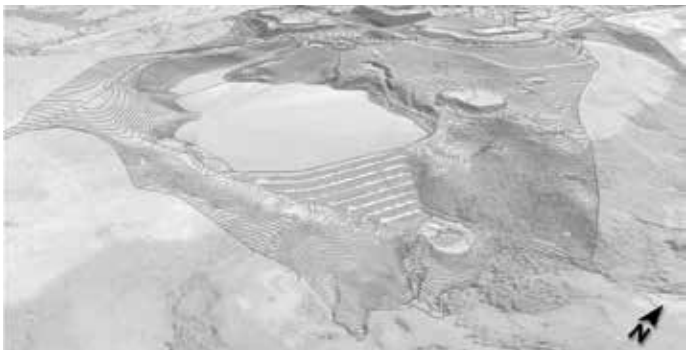


Fig. 96: Tailings dam B4, present situation. Source: Original image

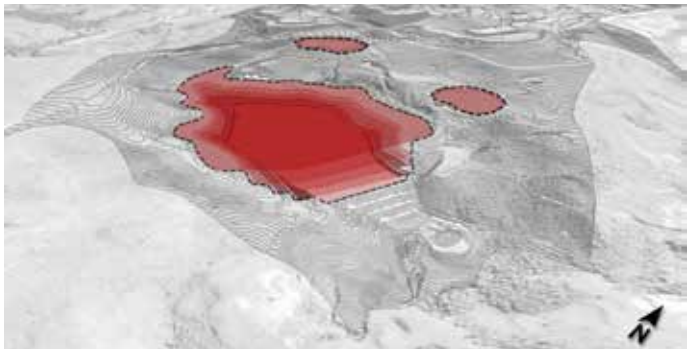


Fig. 97: Tailings dam B4, tailings removal. Source: Original image

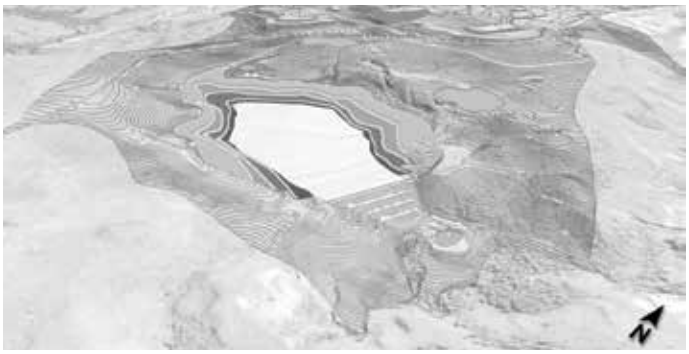


Fig. 98: Tailings dam B4, slope reconfiguration. Source: Original image

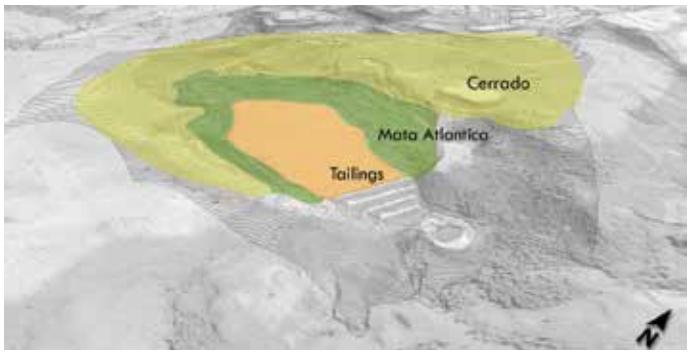


Fig. 99: Tailings dam B4, revegetation areas. Source: Original image

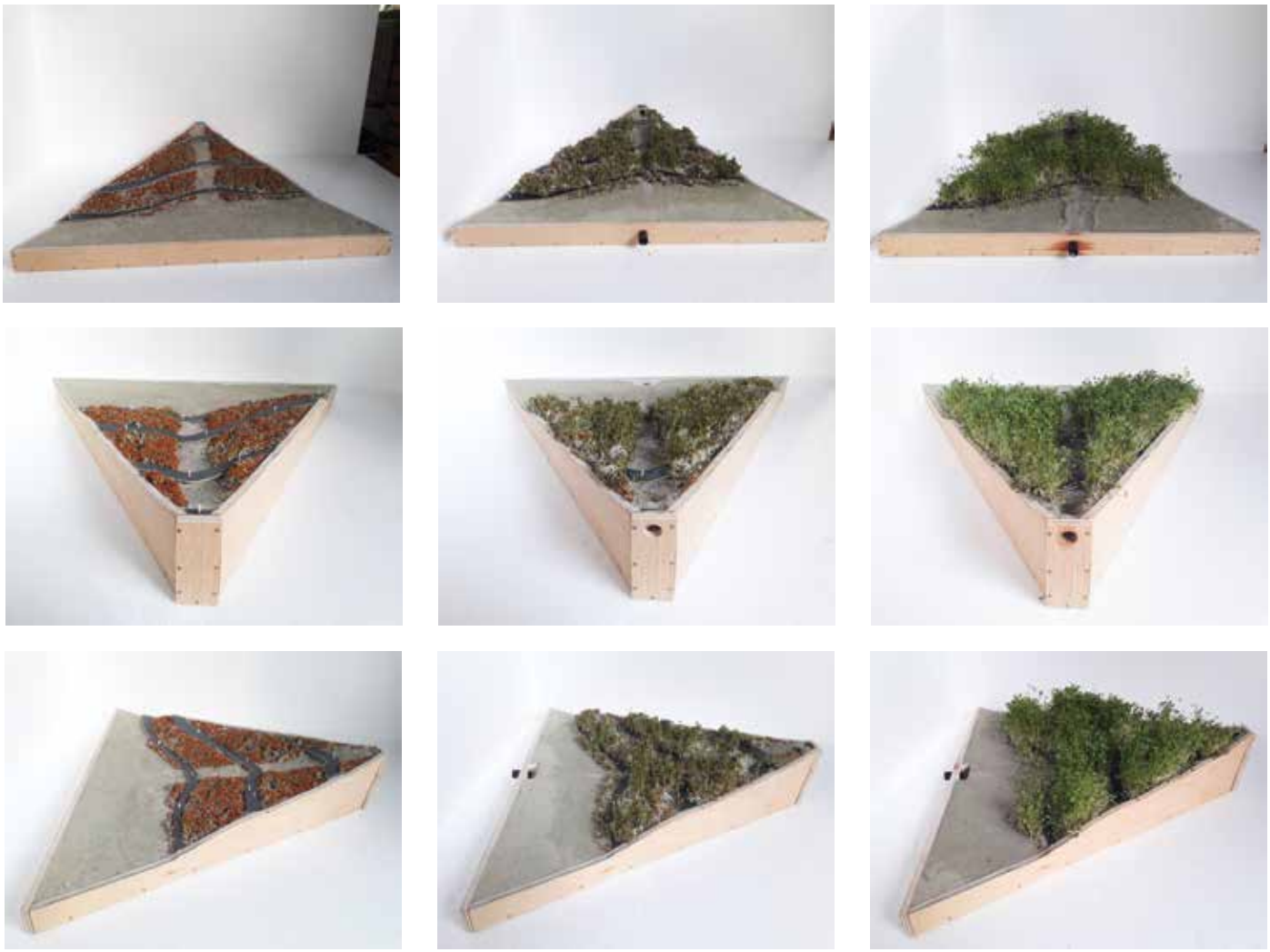


Fig 100: Studying revegetation patterns in the *Mata Atlantica* area with the help of the model. Source: de Jong (2016)

6.2 DESIGN SOLUTIONS

In this section the design will be revealed step by step. Just like the travel of Dante with Virgilio, the explanation will be carried simulating a walk in which there are two voices speaking and commenting upon each different location of the area where they find themselves. One is the voice of the totally uninformed visitor that describes the phenomenological experience of the landscape at different stops (Fig. 101), just as I did for the first part of the perceptual analysis. While the second would be the voice of someone totally acknowledged and able to read the landscape, maybe one of the guides of Aredes (or maybe the designer itself). Before getting into the narration of the site, some more information will be given upon the entrance to the area.
The entrance has been thought right at the first point available where the boarder of the area meets the main street. This location seemed the more suitable one as there is already a gate and sufficient space to have a parking area and an entrance. The parking will be big enough to host around eighty parking spots with also the place for hosting buses for school trips. This is intended to be embedded in the slope of the hill, gently blended in the landscape, not impacting the view from the surroundings. The entrance as well is not intended to be a landmark; it will be made of some low buildings covered with a roof garden, as well inserted in the slope of the landscape. Here there would be a visitor centre, with a conference room, a small gift shop and eventually also a bar together with other requested facilities.

Fig. 101: Path of the simulated walk across the new landscape. Source: Original image

6.2.1 First stop: Lost in the grassland

From the entrance we ascend few steps and we find ourselves on the higher part of the landscape, the Cerrado area.

> *"The terrain under our feet is hard and of reddish colours, we are on a road that becomes hollow, with sloping and irregular sides. There is also a small channel contained with steel, running aside. Above the slope there is a dense grassland, there are no indications and no visibility of the landscape around, we just keep on descending hoping to discover more. Around there are many different plants, there are even some flowers. Sometimes the noises of the insects are really loud, but there are lovely birds singing and flying, there is a bigger one standing on a brunch without leaves, it looks burnt. Now it's really hot, the sun is high so we find shelter under the shadow of a big bush that seems made artificially. We find ourselves at a crossroads, on one side there is a dark gateway on the other the road that continues descending, we will go down it seems safer." (Fig. 102)*

The *Cerrado* area is all intended to make the visitor wonder "where am I going?" as if he would move in a labyrinth-like situation. These paths are designed so that there are always multiple choices that can be taken, without having a clear idea on where would they lead as the landscape around is hidden by the lower position in which we find ourselves. The paths are not designed only to communicate this specific aesthetic experience, these forms are simulating the ones of the erosion patterns found on the boarders of many walks around this area, where the red earth is carved like in small channels (Fig. 103). The design of the paths at this altitude is inspired by the typical forms of drainage dendritic patterns on the hillsides (Fig. 104). In addition, is intended to direct the waters that are not absorbed by the soil (especially during heavy run-offs) in the

Fig. 102: First stop, experience of the paths of the grasslands. Source: Original im-

desired parts of the landscape, just as the systems of artificial gullies and pipes that was working for the former tailings dam.

Moreover, there are many other details that tells other characteristics of this landscape. The neat division between the path and the savannah area above, the hard and soft surfaces, the red and green colours, the artificial and the natural, are all traces of the former relation between man and nature registered during the phenomenological walk. The changing height of the slope around allows to experience the savannah at different levels, sometimes as if you would be smaller and inside of it. It allows also to look at the plants from a different perspective, like if you would study them, and of course there it would be always the possibility to leave the path and explore the grassland from inside.

Other, interesting aspects to mention are the *torres de tropadeiras*, structures made with natural elements to attract the local fauna, in this case used as protection against the sun by our imaginary visitors. Also, one of the burnt small trees on which a *carcará* (raptor bird) is hanging in search for a pray, is a heritage of the last fires that are part of the natural cycles of savannahs. Finally, the "dark gateway" is a reminder of the mining tradition of the beginning, during the Portuguese colonisation, here found like a first hint describing which type of human intervention took place[1] (Fig. 105).

Fig. 103: Erosion patterns in Aredes. Source: Original picture

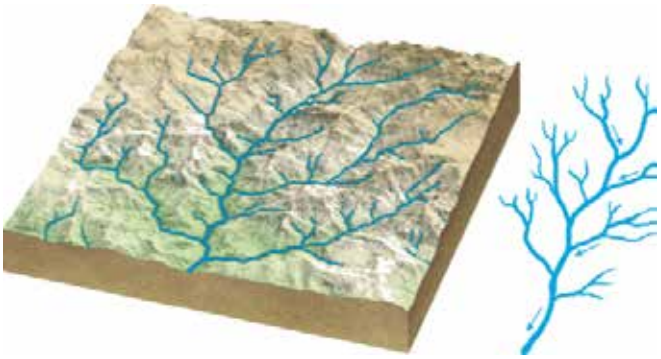


Fig. 104: Drainage dentritic pattern. Source Internet

Fig. 105: *Mina da Passagem*, Ouro Preto. Source: Internet

1 In those days, sometimes mines where recognizable just from a simple entrance into the soil, like a cave, and behind you could find deep channels in the mountain excavated by slaves. Witness of this tradition is the city of Ouro Preto, which has hidden hundreds of little mines that the people were starting here and there in search for gold.

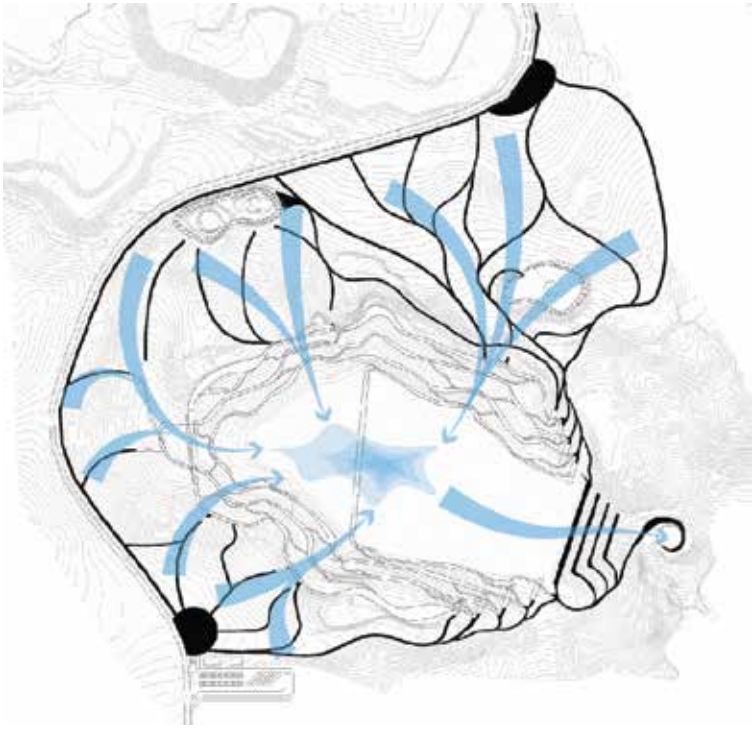


Fig. 107: Drainage system scheme. Source: Original image

6.2.2 Second Stop: An unexpected sight

The *Cerrado* experience is now behind, the landscape around starts appearing from the vegetation that is gradually changing. Suddenly, we are in front of what remains of the tailings dam.

> *"We are at a lower position of the landscape, but we have a better overview of the surroundings. On one side there is a hill with an evident part of soil exposed, showing the many different colours, and below, a steep valley descending. There is a big cistern, full of water and some staircases at which top starts the unexpected vision of a deserted landscape. On the other side, and here now closed to us, there is a rich forest, from which some strange terraces emerge like derelict structures, degrading till almost the top of the slope. I feel that is more humid, I can hear some water running. I can still hear a lot of noises, also of different animals, there are some footprints on the ground. The sky is also cloudier now, and some birds with wide wings are twirling above."(Fig. 108)*

The solution of the labyrinth is now clear, the path was hiding a former tailings dam. On one side, the lower part of the landscape of the inner plateau of the Syncline Moeda is clearly visible. The signs of the fragility of this landscape are manifest on the hillslope, a trace of what we would see better later. Also the local water system now is recognisable, or at least listenable as we descend. The water collector for purification is intended to remain there; a clean and still body of water that mirrors the sky, reminding its old usage just for its neglected ferruginous aspect.
The sight switch towards the staircases; some of them are still left intact, maintaining their original function of containment of the tailings. While the rest of them is clear-

Fig. 108: Second stop, experience of the terraces. Source: Original image

ly disappeared, leaving a huge void that is still not entirely understandable from here. Above there are four terraces-like structures sticking out from the hill side they remind the four staircases missing, starting just were these were beginning. These are made of weathering steel (corten) that with its rust-like appearance and its decadent form, are intended to leave a melancholic sense, evoking the fall of the *Babel Tower* (the archetype chosen for the dam's structure) (Fig. 109-110-111). By the presence of the new terraces we can grasp the absence of the former structure, "collapsed under the forces of nature".

At this level of the landscape a new habitat is found, indeed, here is meant to be planted the *Mata Atlantica.* In the Syncline Moeda this is especially present in the lower parts of the landscape under the form of gallery forest at the sides of the streams. These are also more humid and less ventilated locations in which a different type of biotic life takes place, especially considering insects and amphibians. Another characteristic factor registered in this mountainous area, is that the weather can change rapidly during the same day. As the view gets open is possible to spot raptors of big sizes such as the *Urubú de cabeça vermelha* (condor red head).

Fig. 109: Abandoned bridge made of iron sheets. Source: Internet

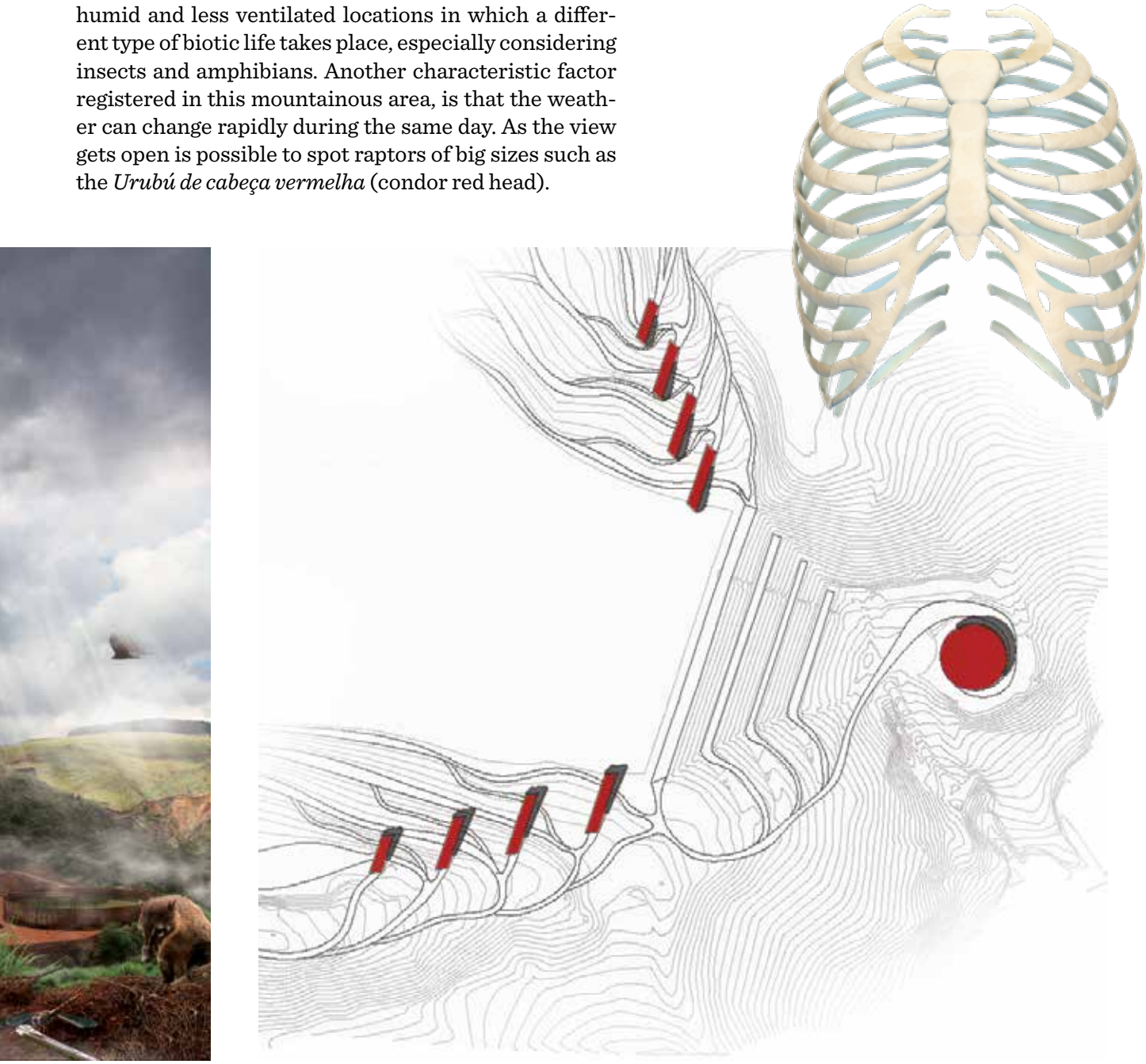


Fig. 110: Structures recall the presence of the dam like the ribs of a skeleton. Source: Original image

Fig 111: Vista of the terraces. Source :Original image.

6.2.3 Third stop: A walk in the forest

Once crossed the dam, on the other side, we get into the forest where a totally different environment is waiting to be explored.

> *"Inside this forest, is much shadier. We are standing on a sort of suspended path, a winding metallic footboard, illuminated by a sun ray that glimpse through the trees, of an orange vivid colour that contrasts with the surrounding forest. Again is not clear where exactly we are going, sometimes the path splits and you can continue going up or down. Suddenly there is a small bridge, we are above a channel and down we can distinguish some other bridges like this one in sequence, right until the deserted area. Here is really nice to stay we decide to stop and have a break; under us, flows some water, the wind shakes the top of the canopies and there is lighter. It's also full of life, we spotted some monkeys, strange birds, we even thought of seeing a big mammal hiding under the rich understory and a big blue butterfly landed on my shoulders." (Fig. 114)*

We left a labyrinth and we entered another one, even more dense and mysterious, just like in the paintings of Russeau (Fig. 112). This is the area of the forest that, like a theatre, embraces the desert (Fig. 113). It is a completely new area, covering the part of the landscape in which there were the tailings before. Instead of the tailings the topography of the landscape has been shaped following the negative of the dam's structure. The slopes result divided as well in four big staircases, modelled respecting the guidelines presented in the PRAD (see Chapter 7). In addition, the soil will be reconfigured in more organic, winding shapes, and additional slopes, in order to add some more mystery to the walk. This intervention will be revealed by an elevated path that enlarges and narrows following the profile of the topography. This footstep will be made of a light coloured type of corten, again used to play on the contrast between natural and cultural element.
The decision of placing this kind of path has been made also for other practical reasons that have been raised by studying the model made by Jolanda de Jong (2016) on this part of the project. The model was made to help me visualize and understand better my design, especially in terms of aesthetic experience. Although I also came to consider some more practical issues. A very important reflection consisted on the

Fig. 112: " The Dream", Henri Russeau, 1910. Source: Internet

elevation of this path not intended to interfere with the water distribution system envisioned for this part of the landscape. The presence of the forest and the design of the topography is organise so to slow the local run-off, to control erosion, and to distribute the water for accelerate revegetation. The system that I'm about to explain would need some extra measurements to be defined totally reliable, but I will offer a solution based on the observations of the model and the available literature (Norman 1997, Correa 2007, Wang, Burley et al. 2013). Indeed, the best strategy stressed by the literature consists on diverting the streams and overland flows not directly on the mining site, has shown in the diagram of

Fig. 113: Vegetation map, *Mata Atlantica*. Source: Original image

Fig. 114: Third stop, experience of the forest. Source: Original image

Norman (Norman 1997, p.96) (Fig. 115). Similarly the flow of the main streams would be slowed down and directed in different directions, while passing through the terraces, until part of it will reach the Lagoon. The areas where the main flows will pass will be bridged, highlighting the passage of water and its distribution after heavy rainfalls. While probably it would remain dry most of the time, these guts will manifest the importance and the force of rainfalls (and water in general). The schemes made on Jolanda's model illustrates this process (Fig. 116- 117).

Finally, here, more than ever the richness of the local nature will be appreciated by the visitors, especially looking from the bridge, where from the sides of the gut a great variety of local species will emerge. Together with plants, also many animals; starting with the *mico estrela* (the star monkey), to colourful birds and insects, as well more rare big mammals as the *tamanduá* (giant anteater) and many others.

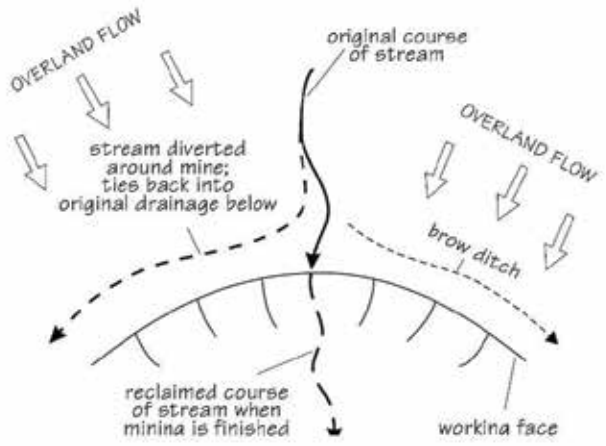


Fig. 115: Storm water diversion scheme. Source: Norman (1997)

Fig. 116: Storm water diversion scheme applied to Jolanda de Jong's model (perspective view). Source: de Jong (2016)

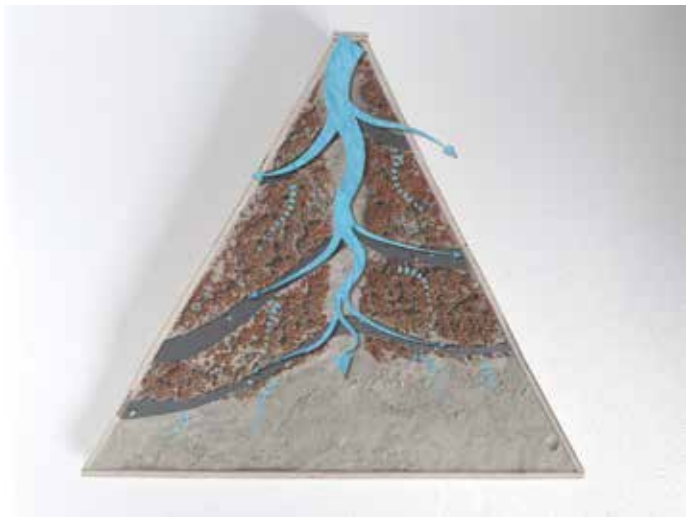


Fig. 117: Storm water diversion scheme applied to Jolanda de Jong's model (plan view). Source: de Jong (2016)

Fig. 118: Research through design, searching for ideas by interacting with the model. Source: de Jong (2016)

6.2.4 Fourth stop: Above the tailings

After finding the way-out from the forest we reached the tailings dam and a straight path that crosses it.

> *"The path now is straight and wide and is leading us across the deserted landscape, again on the other side of the hill-slope. Below me, the same footboard but this time around nothing but some small bushes of plants, clearly planted one after the other and then a wide sandy area, with signs of water erosion, different textures and colours and there is an area in the middle with a bit of water. Around me, a green slope, the forest that surrounds me like a theatre. Then, I distinguish the grassland area above and I can see two steep walls of red soil exposed with some lighter spots. Above me, a heavy dark sky, its windy and the sand of the desert its rising while is also starting to rain, we should find shelter fast, before a storm starts. As I reach the middle of the desert, right here there is some water on the tailings under the path, I feel that the path becomes less stable, suddenly it responds to our weight, shaking a bit, why is this?"(Fig. 119)*

Now we are passing through one of the most controversial areas of the new landscape. According to the PRAD (BRANDT 2015) the tailings dam should be totally dismissed for security reasons. Although, during a talk with Wilfred Brandt emerged that this intervention could be rethought by just diminishing the quantity of tailings until a safety level (like the half). The scope of the reclamation project is to show as much as possible all the natural and cultural component that are involved in shaping the landscape and therefore also the tailings are an important part of it. The experience of the *Desert* (the archetype chosen for this area), emulates the same I had when walking on the embankments currently built on the tailings (Fig. 121). This walk will represent a totally new

Fig. 119: Fourth stop, experience above the tailings. Source: Original image

experience, the one of crossing a mining landscape that is generally something not accessible and hidden to the public.
After searching our way through narrow streets, we can now see the open space of the main square and orientate better. The stark contrast between the deserted landscape and the green forest that embrace it will act like a catalyst of deeper reflections. Indeed, this experience doesn't have to be necessary "pleasant" but rather is intended to make people reflect, imagine or wonder some of the impacts of mining activity. Consequently, bringing them to understand, acknowledge and therefore feel more responsible for their actions and impact on the natural environment.
But this area is not just intended as an aesthetic metaphor, is also intended to inform the visitors about tailings dam, what they are and how they function. For example, the tailings have a small slope directed toward the middle where the water is collected around the area of the system of the tulipa (the overfull) that will be visible from the path. In addition, the small plantings found on the sides are part of the experiments that could be launched to investigate upon the species of plants that would adapt better to grow on this types of soils. Also, to see which species would be more useful to compact the ground in order to avoid movements or subsidence of the tailings and the embankments (and therefore keep it more safe) (Peters 1984).
For this purpose, also the available technical knowledge would help to identify the best techniques to realize this type of path, which trace much of the inspiration from the Floating Piers of Christo in Lago Maggiore, Italy (Fig. 122). The literature gives some information on the construction of embankments on tailings dams (Norman 1997, Davies, Lighthall et al. 2002, bhpbilliton 2009, Commission 2009). Furthermore, a similar structure for a tailings dam has been conceived for another recovery project as well in Minas Gerais (Akinaga, Namba et al. 2010). To know more about the possibility of its construction I also asked consultancy to a structural engineer, although in reality, every consideration upon its feasibility should be taken after the consultation of the experts and measurements on field, which is something beyond the scope of this thesis.
The literature states that most of the time the tailings become more and more resistant as the time passes (Szymanski, Eng et al.). In the design I tried to conceive an optimistic scenario in which the structure will partly stands on the embankments reinforced with vegetation and closer to the sides (where the sand is supposed to remain dryer). The middle part will stand as a bridge on pillars, directly in contact with the stable surface of the hill under the tailings. In this central segment the pillars will be connected to the path on springs located inside the core of the pillars just as shock absorbers. This element will make the bridge respond to the steps of the people with small vibrations, in this way communicating the instability of the place.
Another relevant aspect of the design of this path resides on its form and direction which is not casual. Indeed, the path reminds the volcanic dike that once was emerging from here, conditioning the erosion patterns and documenting the exact location of the relief inversion process that took place on this area (see Chapter 4) (Fig. 120). The remnants of this dike are still visible on the landscape through the whitish spots on two exposed parts of the soil located above the

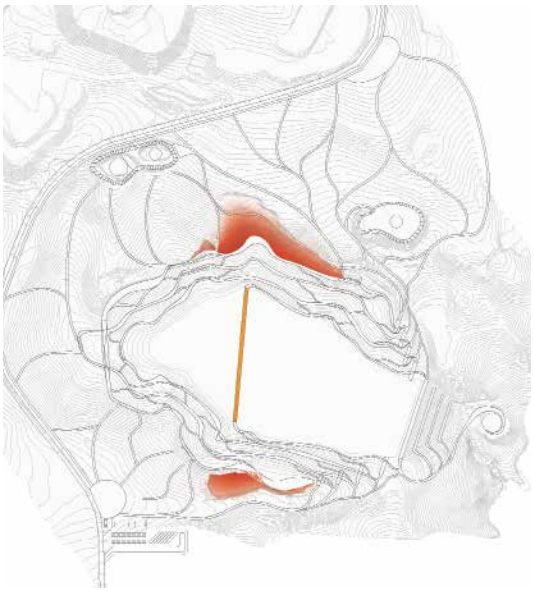


Fig. 120: The path as the vulcanic dyke. Source: Original image

forest opposite one another. The path follows the direction of the dike, visually connecting the two spots that would be left uncovered of vegetation to be recognized.

Fig. 121: Walking paths built on the tailings. Source: Original picture

Fig. 122: Christo's "*Floating Piers*", Lago Maggiore, Italy. Source: Internet

Fig. 123: Vista of the tailings path. Source: Original image

6.2.5 *Fifth stop: The vortex area*

Once left the deserted landscape, the route continuous again through the forest until an unexpected sight captures our attention.

> *"We are on a bridge that comes out from the forest, we have a very nice view from here. Our sight is captured by a big structure, like a viewpoint, sticking above the forest. There are some people down and above it looking in all the directions. Closed to it there is a big part of the hillslope's soil exposed, it has a really dramatic look as it has been brutally excavated. There is a different smell up here and the wind blows carrying the clouds that move rapidly. The forest continues all around, perfectly separated from the grassland area. We can see the canopies of the trees of different shapes and colours, especially there are some really nice red and violet ones. A bird with a big beak left his brunch and now flies on our direction. Below us, the orange paths winding in the dark of the forest and the deserted area at the very bottom." (Fig. 126)*

This is the "accident site", located right where the savannah finishes and the forest starts. It is announced from far by a viewpoint, a curved and elevated path with steps sticking out toward the landscape. From above this structure the view will allow to grasp the totality of the site. Although this area is mainly intended to watch and study the area of the vortex from a privileged perspective. A closure look then will be allowed through a footboard at its bottom, simply consisting on the enlargement of the normal path. This view point will be fixed on a structure that will stand on the more resistant terrains located around the "accident site". The pavement of the view point is intended made of a glass transparent surface that will inspire the sublime experience of instability that characterize the place together with its extruding shape.

From this position on the landscape many other important details can lead to further considerations. First, the evident transition between *Cerrado* and *Mata Atlantica* which is, one of the main characteristics of the landscape of the Syncline Moeda. It has been already discussed (see Chapter 4), how usually the forest is located in the lower parts of the landscape, while the savannah on the highest. This transition can happen really abruptly as here it would appear in the project. Moreover, the altitude in which this is intended to take place, corresponds with the level in which, formally, the tailings dam was occupying this area. This is also meant to remark that this is the level of the landscape where the underground channels system runs.

From here will be also possible to experience the forest at a different level. It's clearly visible the canopies the trees typical of the *Mata Atlantica* in this areas. There are some pioneers trees recognizable for their colours, like the *Embaúba* (Cecropia) with its peculiar whitish leaves and the *Quaresmeira*[1](Tibouchinha granulosa), called in this way for its violet flowers visible during Easter time . The high position will also offer a different overview of the animal species that usually stays more on trees, mainly birds, of course, (like the Tucano) but also other rare mammals as the *Gato-do-mato* (Oncilla).

Concluding, the view will allow to better understand the composition of the landscape of the staircases, recognisable through the winding orange paths, organized at different levels. This composition draws its inspiration from the concentric structures of the land art of Smithson, designed for a mining site, but never realized. Personally this structure also reminds me the way in which Dante Alighieri organizes the Rounds of its *Inferno*, in the *Divine Comedy* (Fig. 124-125). It will be especially during the initial period, with less vegetation, that this aspect would appear more evident. After some years, the forest will cover the smooth shapes of the terraced landscape and the slopes will tend to gain a more natural profile. The orange path is intended to recall the original shape of the slope, that otherwise would be lost through time.

1 Quaresma in Portuguese it means the Lent period

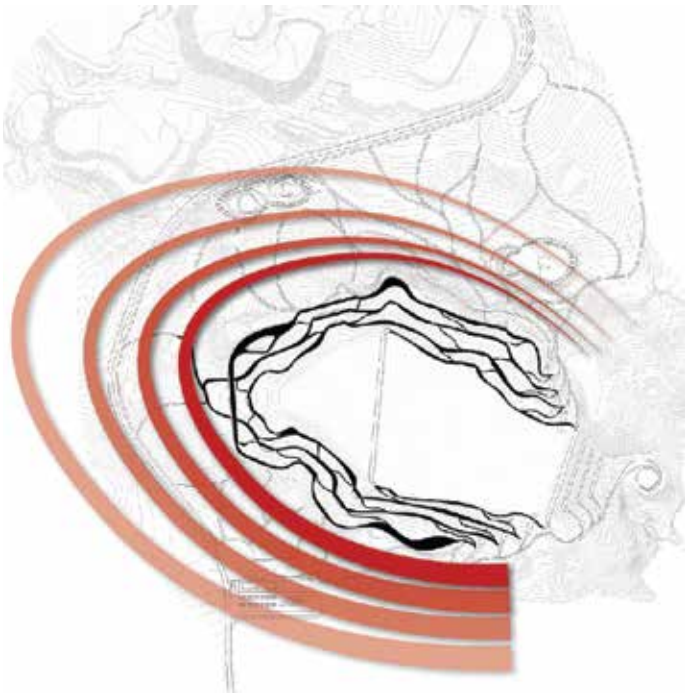


Fig. 124: Forest paths configuration. Source: Original image

Fig. 125: Dante's Inferno configuration, illustration by Stradanus, 1587. Source: Internet

Fig. 126: Fifth stop, experience around the vortex area. Source: Original image

Fig. 127: Vista of the accident site. Source: Original image

6.2.6 Sixth stop: The overlook from the pavilion

The walk continues ascending towards the higher part of the landscape, we are again in the grassland area.

> *"We find again the reddish terrain under our feet. Looking up there is a strange sculpture dominating the landscape. Coming closer we realize it's made of impressive rusty metal sheets, standing one next to the other and bending inside like a shell. We go inside, there are many maps, pictures and drawings exposed in panels and at the middle a spiral staircase, we decide to go up. We find ourselves on a platform surrounded by this threatening metal sheets. From up here the wind is stronger, we can overlook far beyond the hills around. A heterogenic landscape unfolds with carved valleys, canyons, woods, grasslands, but also some buildings. We can also hear the passing of cars along the highway. Looking further, we can distinguish a long monumental mountain range running straight, we can also see that some parts of the landscape have been clearly degraded." (Fig. 130)*

This is the place where once where left the tailings piles, these had to be removed as described in the PRAD. At their place stands some type of structures that will evoke the curious aspect of this piles. These are also intended to evoke the sublime aspect of the nearby Pico de Itabirito, natural heritage, landmark of the Syncline Moeda. The result is a very expressive sculptural element which needs some exploration to be fully understood. The standing metal sheets holding the structure emulate the dramatic erosion patterns of the previous tailings piles (Fig. 128), while the steel and their converging pointy forms remind the block of hematite of which is made the *Pico* (Fig. 129).
This structure is meant as a sort of pavilion with one floor. The ground floor will be accessible from every side, passing through the metal sheets. The inside will be intended for showing, panels with pictures and graphs explaining the meaning of the area and the natural and cultural events that occurred here. As there are two main piles dominating the landscape, two similar pavilions are intended to take their place. One, located more on the west side of the area could host the narration of the geo-morphological history of the site, linked to the event of the accident. The other, placed on the northern part, could display the story of reclamation and its documentation through time.
Concluding, these pavilions are not just made for reading the landscape through indirect and more abstract means (like maps). Indeed, they serve also as precious viewpoints, because these are the places from which we can read the landscape in its totality. Close by, the site appears with all its main features visible at once. Further, the sight reaches the inner Plateau of the Syncline Moeda with its peculiar landscape, where also the anthropic influence is recognizable. Further, on the sides, the mountain ranges of the *Serra da Moeda* and the *Serra das Serrinhas* are clearly recognisable, where the soil, rich of precious minerals, attracts the interests of the mining companies since centuries.

Fig. 128: Erosive patterns of the tailings piles. Source: Original picture

Fig. 129: *Pico do Itabirito*. Source: Original picture

Fig. 130: Sixth stop, experience of the Pavilions. Source: Original image

Fig. 131: Vista from the pavilion. Source: Original image

Fig. 131: Some sketches. Source: Original image

MASTERPLAN

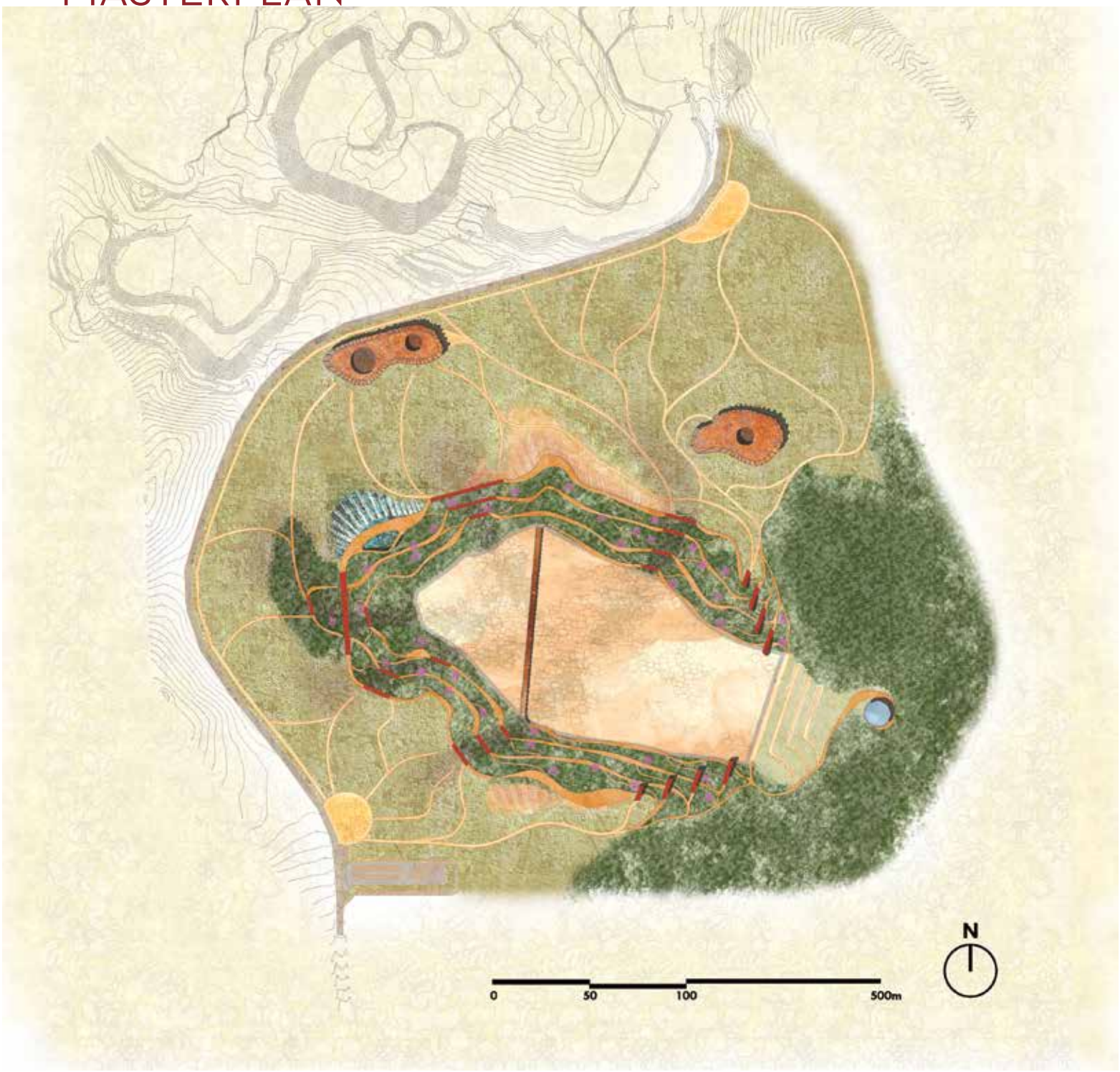
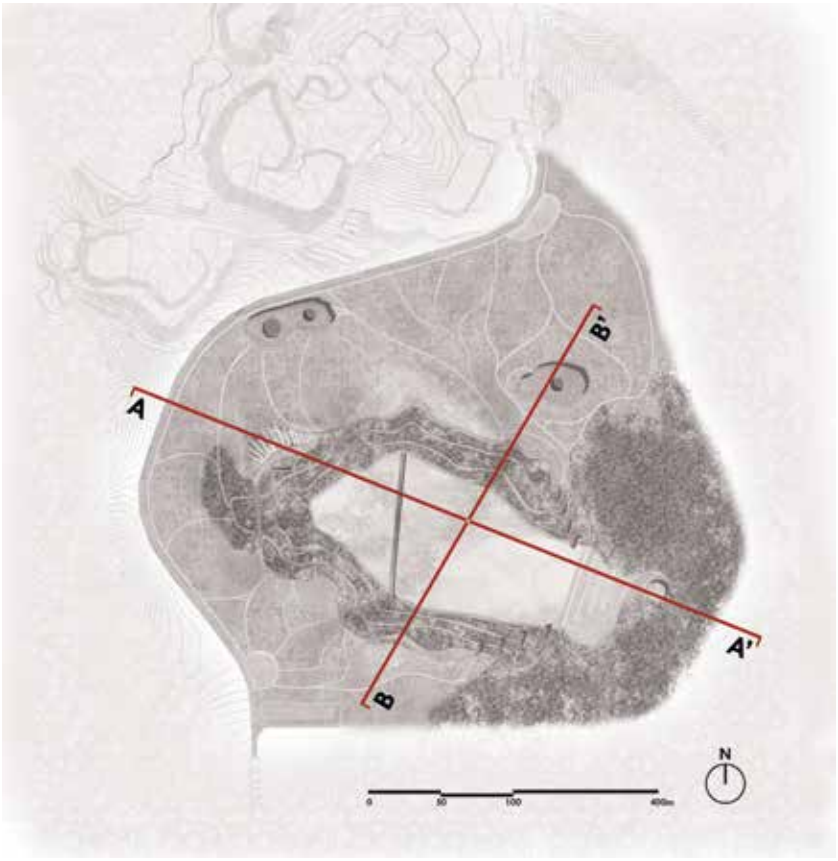


Fig. 132: Masterplan. Source: Original image

SECTIONS



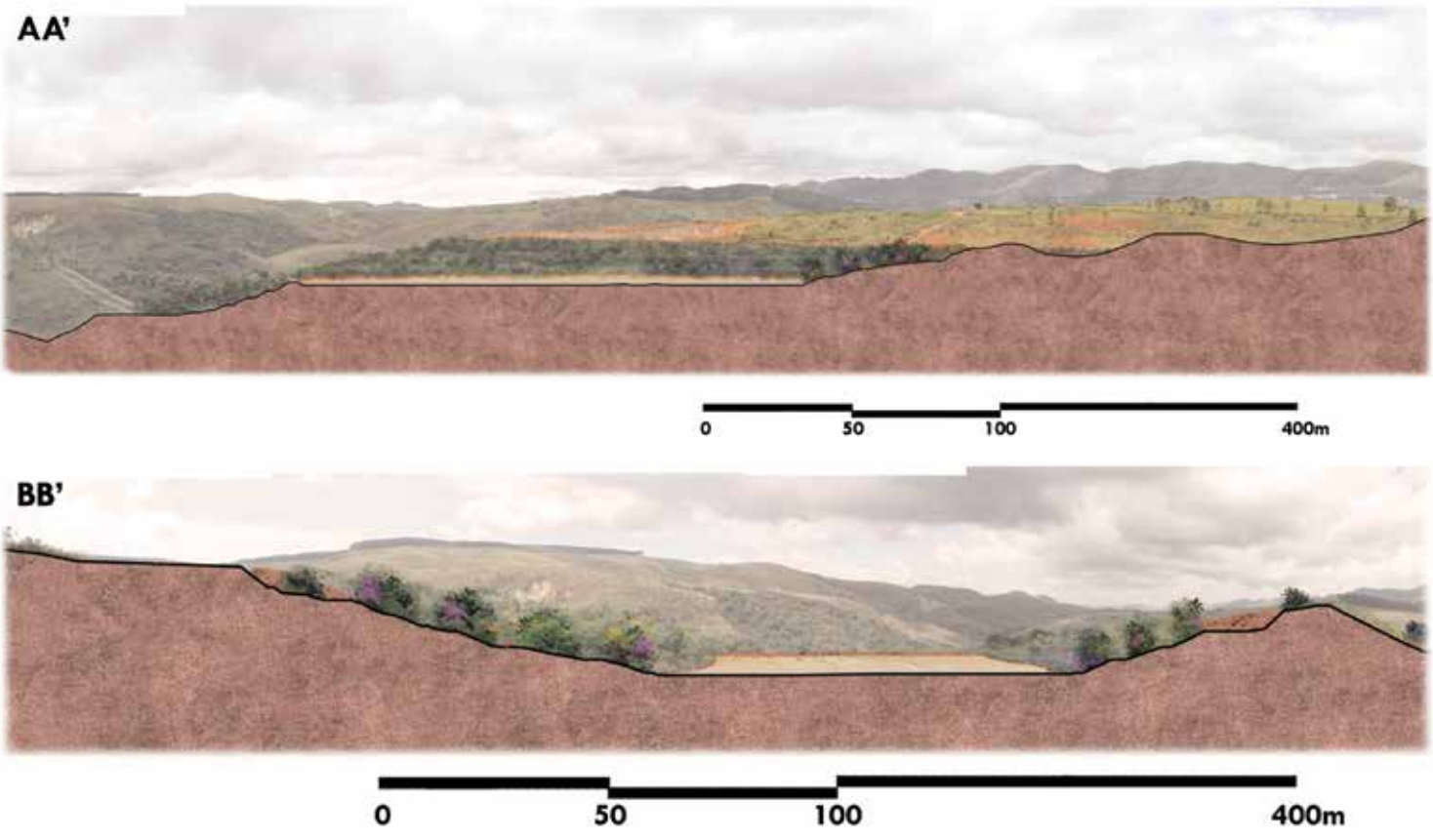


Fig. 133: Section BB'. Source: Original im-

7th Chapter:

DISCUSSION AND CONCLUSIONS

- Guidelines for the Post-mining Wonder experience, Limitations and further Reflections -

"...aesthetic truths are revealed through a heightened aesthetic experience, where perceptualand imaginative engagement with nature facilitate the kind of close attention that leads to revelation."

Emily Brady, Imagination and the Aesthetic appreciation of Nature, (1998)

7.1 THE POST-MINING WONDER EXPERIENCE

It has been discussed how, on the one hand, examples of recovery of mining landscapes have taken the way of natural restoration, totally erasing the aesthetic experience linked to the mining heritage and leaving behind a completely natural-looking landscape, as if nothing ever happened before. On the other hand, projects that are closer to the definition of reclamation (see Chapter 3.2), have gained their notoriety for engaging in a more dialectical way with their post-industrial aspect, even by leaving or re-interpreting some of its aesthetic and iconic features. This thesis follows the second approach applied to post-mining landscapes.
Therefore, to design for a post-mining landscape I developed a twofold approach in which three main Research Questions need to be answered:

1. What are the scenic aesthetic values of the selected post-mining landscape?
2. What are the ecological characteristics and functionalities of the selected landscape?
3. What kind of interventions are needed\required to recover the selected post-mining landscape?

Afterwards, applying the results to the design process helped me to link the results and answer to my final Design Question:

1. How can landscape design combine scenic aesthetic and ecological goals within a project of reclamation for a post-mining landscape?

I found that, in some cases, as stressed in the literature (Gobster, Nassauer et al. 2007), scenic and ecological values can be easily aligned. This is evident as it appears difficult to trace the boundaries between the scenic aesthetic and ecological characteristics in some parts of the design. Moreover, the design process brought me to the conclusion that this alignment can happen in two ways. On the one hand, the design solution for the aesthetic experience is already inherent to the natural environment and the effort of the designer consists in just making it accessible. On the other hand, the design solution can come from a creative thought built upon some aesthetic considerations that match with technical solutions. Indeed, we recognize how for these situations, the designer alternates between aesthetic and ecological reflections in different ways until their distinction is no longer recognisable. Therefore, a successful design can be the product of the spark between the friction of these two perspectives harmoniously melting together. This has been especially clear to for me, when I realized that knowing more allowed me to be more creative, finding solutions that I would not have come up with myself. Following Zangwill's Aesthetic Creation Theory (2007), this is a very good example in which landscape architecture, intended as an art, carries also non-aesthetic values such as the ecological ones.
However the ideal position of harmony of the landscape architect, between culture and nature, Plato and Aristoteles (see Chapter 5) is not always achievable, especially in the context of a mining landscape. The designer finds himself in a position in which he is not able to find a perfect balance between scenic aesthetic and ecological values. He is confronted with critical decision-makings. It cannot be claimed that the position of restorative experts is wrong. Although, if the objective of this thesis was about investigating the opportunity of making mining landscapes a *laboratory for experimentation* for rethinking the human-nature relation (Berger 2002), the content would perhaps be

to limited to address this discussion.
In the proposed design the *performance of appearance* (Meyer 2008), of the scenic components of the landscape, has been used in some cases, without a specific ecological return. These are the art-like features, such as the path above the tailings seemingly self-referential elements which (especially in this case) not only are not linked to ecological values, but they risk to jeopardize them. Therefore, what is that constitutes the *performance of appearance* for these design solutions?
My reflection is that the aesthetic experiences of the newly created landscape should not all be intended in the same way. Indeed, while the aesthetic experiences in some parts of the project are connected to important environmental characteristic of the area, fostering knowledge and cognitive processes, some others, instead, are the real surprising element of the script (see the definition of the aesthetic message by Umberto Eco Chapter 3.3) in which their contemplation triggers the personal interpretative effort, that touches deeper philosophical thoughts about our role of humans as actors in the landscape (Turri 1998). This dialectic relation between our inner self and the landscape was one of the pillars driving factors of landscape design since the very first gardens have been realized (Pandakovic and Dal Sasso 2009).
The new reclamation project enables the visitor to read both the cultural and natural characteristics of the Syncline Moeda's landscape, catalysed within the area of the tailings dam B4 and formalized through their aesthetic experience. "*This wouldn't have happened if the people who built the dam would have been able to read the landscape*" said Wilfred Brandt, commenting the incident that occurred in the tailings dam B4 the 14th of September 2014. Here stands the reason why it is important not to hide the heritage left by the tailings dam, so that it won't happen again. Indeed, visibility of environmental destruction makes it less acceptable (Sklenicka and Molnarova 2010). This is why reclamation should be pursued more often in implementing the potential of the aesthetic experience and carrying also non-aesthetic values as expressed in the literature (Zangwill 2007, van Etteger and Verhoeven 2016). In all their different configurations the adopted design interventions, as the bridge above the tailings, the terraces, the pavilions and others, are all intended to recall a mining heritage and make it visible in its controversial relation with the landscape.
I would recall the metaphor proposed by Rosario Assunto (1995) of the landscape intervention as the landscape of the Garden of Eden, in which the trees around are nice to see and always full of fruits, and where in the middle, the tree of good and evil stands, made for mere contemplation. Now I ask myself: How many occasions do we have, in society nowadays, to stop for a moment and become spectators, contemplating our own acts, new stories left on the pages of the landscape? My claim is that we have been actors for too long without being able to be spectators at the same time, and now we face the consequences contemplating our derelict landscapes. At the same time, we reduced the value of a landscape to its material return, leaving no space for the unaccountable value of the impact left by experiences and emotions linked to it (Sklenička and Kašparová 2008, Ellison 2013).
Overall, I define the *performance of appearance* of post-mining landscapes as the power of wonder, intended as the role of the aesthetic experience (in all its forms) "t*o ask yourself questions or express a wish to know about something*" (first definition of "wonder" under the Cambridge Dictionary), effecting the actions and the values that would shape the landscapes for the new generations. The experience of the post-mining wonder can be used to transform the wasteland into a sacred landscape (like the tree in the middle of the Garden of Eden) "*that has learned to live with ritual pollutions and cleanse itself with them*"(Berger 2002, p. 12). Perhaps, this would be the only way to fully "redeem" a narrative of shame, "n*ot by denying it but by lifting the cordons of fear and shame and engaging it*"(Engler 1995, Potteiger and Purinton 1998, p.235), into a narrative of hope for the future.

7.2 GUIDELINES FOR THE POST-MINING WONDER EXPERIENCE

In this section I will further explain the design guidelines derived from my case study of post-mining landscape. Consequently I will answer to my last Design Question.

2. 2. How can the combination of scenic aesthetic and ecological goals can be generalized into design guidelines for post-mining landscapes?

As these guidelines derive from a very particular type of post-mining landscape, it is desirable that further research be made on other types of post-mining sites that could add new ones to the list. The two main design guidelines taken from a more accommodating perspective in which ecology and aesthetics are convergent.

1) *Playing with water*

The flowing of water has a determinant role in shaping the landscape of the Syncline Moeda. The drainage system is harmoniously linked with the paths, responding to certain ecological functions, as ecologists would like, but also to create different experiences when crossing the landscape. By the means explained in the design section, the design communicates the importance of water and the power of its action (even when not present) in different ways and by different means as we descend towards the tailings.

2) *Experiencing vegetation*

Also the high biological diversity found in the transition between Mata Atlantica and Cerrado is a design aspect in line with ecological principles. Although, most probably, a normal recovery plan wouldn't pursue it as an aesthetic experiential element. The labyrinthine configuration of these areas are intended to make the visitor wonder into a unique habitat experience, where the concentration is focused on the details and the nearby happenings: a flower, an insect, a sound, a smell. But the opportunity of having a wider perspective is also made available through the strategic position of viewpoints and open views. In addition, re-vegetation is also used as a signal, clearly remarking the different zones in which the site has been intentionally configured.

On the other hand, by dealing with the scenic aesthetic properties of the landscape, four more design lessons have been derived. These four are all linked together throughout design means such as colours, textures, forms, and volumes, which strongly recall the mining heritage and expressivity.

3) *The dissonant scale*

The tailings left in the middle of the landscape, constitute the design element responsible for transmitting the dissonant vibrancies of the tailings dam through the experience of its scale. After walking around and experiencing mostly a natural looking landscape, the visitor will find himself confronted with the anti-ecological, artificial scale of the deserted tailings. Here is where the drama of the site reaches its apex, the result of the ancestral battle between human and nature is revealed in the middle, where a plane of desolation meets abruptly an embracing hillslope of life in abundance (the forest). The straight technological path crossing the tailings in the middle like a red carpet, allows this experience of dissonant features and spaces through an unexpected disposal of

what is generally hidden to the public.

4) *Symbolic reconstruction*

What is left of part of the dam has gone, although the fall of the "Tower of Babel" left behind a trace of its presence. The terraces sticking out from the hillslope, like neglected ruins, remind us about of this absence through their decadent aspect. The same operation is done for the winding path inside the forest. The terraced re-configuration remains recognisable, even after the revegetation process, by the slightly elevated orange path in stark contrast with the surrounding dense vegetation. Like ghostaken reconstructions, playing with the imagination of the visitor, are design solutions evoking past aspects of the landscape, fixed by evocative features of the former the tailings dam.

5) *Inside-outside overview*

Considering the peculiar configuration of the newly created landscape, some parts have been strategically selected to allow privileged viewpoints to facilitate orientation and to understand the spatial configuration of the different features. From these special areas the project site is confrontable with its surrounding landscape. Multiple reflections are possible as much as the sight can go far; the site in itself all at once, the surrounding landscape of the Syncline Moeda and finally the dialogue between the two. The design is responsible for building this communication through aesthetic reinterpretation and formalization of the surrounding landscape, so that the site becomes the whole landscape and the landscape the whole site.

6) *Dramatizing artificial stability*

One of the characteristics of this landscape is its variability also due to its instability; the sinkholes, canyons and erosive patterns are geologically recent and easily recognisable features witnessing this aspect. While in a normal recovery plan ecologists would tend to cover these elements, safely camouflaging them in the landscape, in my proposal these are left open to sight and to weathering. This aspect is expressed by leaving parts of the soil left exposed, which could prove useful in reading also the lithology of the landscape. Instability is also pursued through structural elements transmitting some kind of thrilling experience. These elements are the bridges along the paths in the forest, but more explicitly the middle of the path that crosses the tailings sustained on springs and the accident site overview point with its vertigo-inspiring transparent steps.

7.3 LIMITATIONS AND FURTHER REFLECTIONS

The limitations of these works are linked to its very specific scientific context and availability of time and resources.
Reflecting on the methodology, I found very useful the combination of two different and distinct lines of analysis very useful as a source of design inspiration, which allowed me to reflect better upon my own design solutions. Although, this process has been very time consuming, not allowing me to define better my final design intentions, which, I think, still leaves some space for improvement. Especially in terms of feasibility of certain aspects, more research should be carried out, acknowledging that further investigation in this sense would have led me beyond the scientific boundaries stated at the beginning of the research.
The limitations concerning the perceptual analysis were related with its a highly subjective character, entailing many personal reflections and arbitrary decisions, based on my personal experience. This subjective character was less present in the phenomenological analysis, that for definition has to be as objective as possible, but more present during the picture reduction phase, and even more for the archetype zoning. In this regard, would be interesting to see which type of outcome would result from the same analysis made on the same landscape, by different individuals, belonging from different cultures. This method could be also used in other context and situations, I believe that further research could improve it and make it more systematic, even though its subjective character would always remain linked to the designer's creative interpretation as a fundamental element. However, this analysis is legitimated by the constructivist knowledge claim, in which landscape architecture can derive its methodological body from the arts (Lenzholzer, Duchhart et al. 2013).
Concerning the environmental analysis I based my results on the outcome of the interviews with experts and detailed reports. However, I missed a walking interview with an expert to fully understand the site and be more precise during the analysis. Though I evaluate sufficiently my knowledge of the Portuguese language, instead, bigger limitations arose with the lack of specific knowledge in the fields of hydrology, geology and biology which brought me to simplify some more complicated concepts and aspects of this analysis. Considering the environment holistically, the research didn't go deeper into local social and economic issues, which have been briefly mentioned, just for justifying the program that would be developed by the reclamation project. Within this context, the major limitation has been the lack of consideration of the Herculano Mining Company, which has not been involved in the discussion of the plan.
Finally, this thesis aims to foster further research and discussion on landscape reclamation in landscape architecture. I foresee that the outcome of this work could be corrected, revised or expanded both in terms of methodology adopted and in final design solutions. Another hope is to bring experts and mining companies to see reclamation as an opportunity for multiple returns; not just simply in natural terms or economic ones, but also more fundamental cultural ones toward a more complete definition of sustainability.

8 REFERENCES

Akinaga, P., M. Namba, I. Cunha, G. Vinueza, G. L. Fontes and A. N. Júnior (2010). "Paisagem recriada: Projeto de descaracterização das barragens da mina da cachoeira." Revista LABVERDE(1): 117-133.

Allen, S. and M. McQuade (2011). Landform building: architecture's new terrain, Lars Müller Publishers.

Assunto, R. (1995). Ontologia e teleologia del giardino, Guerini.

Augustin, M. (2008). "Sinclinal de Moeda: um patrimonio geologico e geomorfologico."

Bell, C. (1958). "Art. 1913." Putnam, New York: 30-45.

Berger, A. (2002). Reclaiming the American West, Princeton Architectural Press.

Berger, A. (2007). Designing the reclaimed landscape, Routledge.

Berleant, A. (2011). "The changing Meaning of Landscape". Lecture to Lisbon Symposium of Landscape and Philosophy. Lisbon.

bhpbilliton (2009). Tailings storage facilities design report.

Brady, E. (1998). "Imagination and the aesthetic appreciation of nature." The Journal of Aesthetics and Art Criticism 56(2): 139-147.

Brady, E. (2006). "Aesthetics in practice: Valuing the natural world." Environmental Values 15(3): 277-291.

Brady, E. (2007). "Aesthetic regard for nature in environmental and land art." Ethics Place and Environment (Ethics, Place & Environment (Merged with Philosophy and Geography)) 10(3): 287-300.

BRANDT (2014). Relatorio preliminar: contextualizacao geoambiental da area do empreendimento e avaliacao ambiental preliminar dos impactos provenientes do acidente na barragem B1. Nova Lima, BRANDT meio ambiente.

BRANDT (2015). Herculano Mineracao: estudo ambiental, plano diretor. Nova Lima, MG, Brazil, Brandt meio ambiente. I,II.

Carlson, A. (2010). "Contemporary environmental aesthetics and the requirements of environmentalism." Environmental Values 19(3): 289-314.

Carlson, A. A. (1977). "On the possibility of quantifying scenic beauty." Landscape planning 4: 131-172.

Carmo, F., F. Carmo, I. Campos and C. Jacobi (2012). "Cangas: ilhas de ferro estratégicas para a conservação." Ciência Hoje 295: 48-53.

Commission, E. (2009). Reference Document on Best Available Techniques for Management of Tailings and Waste-Rock in Mining Activities.

Correa (2007). Recuperacao de areas degradadas pela mineracao no Cerrado, Manual para preservacao.

Cosgrove, D. (2004). Landscape and landschaft. 35: 57-71.

Creswell, J. W. (2013). Research design: Qualitative, quantitative, and mixed methods approaches, Sage publications.

Cronon, W. (1996). "The trouble with wilderness: or, getting back to the wrong nature." Environmental History 1(1): 7-28.

Davies, M., P. Lighthall, S. Rice and T. Martin (2002). "Design of tailings dams and impoundments." Keynote address, Tailings and Mine Waste Practices SME, AGM Phoenix.

Dee, C. (2012). To Design Landscape: Art, Nature and Utility, Routledge.

Deming, M. E. and S. Swaffield (2011). Landscape architectural research: Inquiry, strategy, design, John Wiley & Sons.

Dentoni, V. and G. Massacci (2013). "Assessment of visual impact induced by surface mining with reference to a case study located in Sardinia (Italy)." Environmental earth sciences 68(5): 1485-1493.

Diamond, J. M. (2005). Collapse: How Societies Choose to Fail or Succeed. New York, Viking.

Dias, S., T. Panagopoulos and L. Loures (2008). "Post-mining Landscape Reclamation: A Comparison between Portugal and Estonia." New Aspects of Energy, Environment, Ecosystems and Sustainable Development. WSEAS Press Athens: 440-445.

Dings (2015). The phenomenology of Dutch nature, Wageningen University and Research.

Dong-dong, Z., S. Yu-shan and L. Le (2009). "Study on sustainable landscape design of abandoned quarries: An example: Zhushan ecological park in Xuzhou." Procedia Earth and Planetary Science 1(1): 1107-1113.

Eco (1968). La struttura assente. Milano, Bompiani.

Ellison, A. M. (2013). "The suffocating embrace of landscape and the picturesque conditioning of ecology." Landscape Journal 32(1): 79-94.

Engler, M. (1995). "Waste landscapes: permissible metaphors in landscape architecture." Landscape Journal 14(1): 11-25.

Enis, R. (1974). "Determining Land-uses for Abandoned Quarries: Criteria and Planning Process." Technion (Hebrew), Haifa.

Esteves, A. M. (2008). "Mining and social development: Refocusing community investment using multi-criteria decision analysis." Resources Policy 33(1): 39-47.

Fernandes, F. R. C. (2007). Tendências tecnológicas Brasil 2015: geociências e tecnologia mineral, Sgb/Cprm Servico Geologico Do Brasil.

Forman, R. T. (1995). "Some general principles of landscape and regional ecology." Landscape ecology 10(3): 133-142.

Formoso, D. (2014). "Identificação e estudo das áreas prioritárias para conservação da biodiversidade no sinclinal Moeda (MG) com base nos serviços ecossistemicos ": 1 - 102.

Formoso, D. M. L. (2013). "Identificação e estudo das áreas prioritárias para conservação da biodiversidade no Sinclinal Moeda (MG) com base nos serviços ecossistêmicos."

Franks, D. M., D. V. Boger, C. M. Côte and D. R. Mulligan (2011). "Sustainable development principles for the disposal of mining and mineral processing wastes." Resources policy 36(2): 114-122.

Gavett (2012) "Tailigns Dams: Where Mining Waste is Stored Forever."

Ge, H., Y. Yi, X. Yang, L. Yang, D. Su and L. Ma (2010). "Study on ecological characteristic and reclamation in Xiangshui coal mining area, Guizhou, China." International Journal of Mining, Reclamation and Environment 24(1): 18-33.

Gerais, G. o. t. S. o. M. (2010). "Application Dossier, Geopark Quadrilatero Ferrifero." 87.

GIULIETTI, A. M., N. L. DE MENEZES, J. R. PIRANI, M. MEGURO and M. D. G. L. WANDERLEY (1987). "Flora da Serra do Cipó, Minas Gerais: caracterização e lista das espécies." Boletim de Botânica da Universidade de São Paulo: 1-151.

Gobster, P. H. (1999). "An ecological aesthetic for forest landscape management." Landscape journal 18(1): 54-64.

Gobster, P. H., J. I. Nassauer, T. C. Daniel and G. Fry (2007). "The shared landscape: what does aesthetics have to do with ecology?" Landscape ecology 22(7): 959-972.

Gomes, A. (2007). "The Role of Aesthetic Experience." Postgraduate Journal of Aesthetics 4(1): 1-17.

Gossens, N. a. (2014). Oil Sands 2.0, Wageningen University and Research.

Hands, D. E. and R. D. Brown (2002). "Enhancing visual preference of ecological rehabilitation sites." Landscape and Urban Planning 58(1): 57-70.

Hill, D. and T. C. Daniel (2007). "Foundations for an ecological aesthetic: Can information alter landscape preferences?" Society & Natural Resources 21(1): 34-49.

Husserl, E. (2012). Ideas: General introduction to pure phenomenology, Routledge.

IBGE. (2013). "Sala de Imprensa | noticias | IBGE divulga as estimativas populacionais dos municipios em 2012." from http://saladeimprensa.ibge.gov.br/noticias?view=noticia&redirecionado=1&id=1&busca=1&idnoticia=.

Jacob, M. "'On Mountains: Scalable and Unscalable." Landform Building: Architecture's New Terrain: 136-164.

Jacobi, C. M., F. F. Do Carmo, R. C. Vincent and J. R. Stehmann (2007). "Plant communities on ironstone outcrops: a diverse and endangered Brazilian ecosystem." Biodiversity and Conservation 16(7): 2185-2200.

Jancovicova (2014). Sublime flooding of the Maniny brownfield: Awaking a sublime sensation by sustainable brownfield re-development. Master, Wageningen University and Research.

Jong, d. (2016). Physical modelling in landscape architecture, exploring a design tool for the explorative phases in dynamic landscape design (Master Thesis). Wageningen University.

Jorgensen, A. (2011). "Beyond the view: future directions in landscape aesthetics research." Landscape and Urban Planning 100(4): 353-355.

Jung, C. G., J. Freeman, M.-L. von Franz, M.-L. von Franz and M.-L. von Franz (1991). L'uomo ei suoi simboli, Tea.

Kaliampakos, D. and A. Mavrikos (2006). "Introducing a new aspect in marble quarry rehabilitation in Greece." Environmental Geology 50(3): 353-359.

Kaltenborn, B. P. and T. Bjerke (2002). "Associations between environmental value orientations and landscape preferences." Landscape and urban planning 59(1): 1-11.

Kerkstra, K. and P. Vrijlandt (1988). Het landschap van de zandgebieden; Probleemverkenning en oplossingsrichting, Directie Bos-en Landschapsbouw.

Kitula, A. (2006). "The environmental and socio-economic impacts of mining on local livelihoods in Tanzania: A case study of Geita District." Journal of cleaner production 14(3): 405-414.

Koh (1998). "An Ecological Aesthetic." Landscape Journal.

Koh (2013). On a Landscape Approach to Design, an eco-poetic interpretation of landscape.

Koh, J. (1988). "An ecological aesthetic." Landscape Journal 7(2): 177-191.

Koolhaas, R., B. Mau and J. Sigler (1995). Small, medium, large, extra-large: office for metropolitan architecture, Monacelli Press New York.

Lenzholzer, S., I. Duchhart and J. Koh (2013). "'Research through designing'in landscape architecture." Landscape and Urban Planning 113: 120-127.

Loures, L. and T. Panagopoulos (2007). "From derelict industrial areas towards multifunctional landscapes and urban renaissance." WSEAS Transactions on Environment and Development 3(10): 181-188.

Loures, L., A. Viegas, T. Ramos and S. Silva (2008). "Reinventing Landscape in Postindustrial Sites: Three Sites Revised." Advances in urban rehabilitation and sustainability. pp165-170.

Martin, T. and M. Davies (2000). "'Trends in the stewardship of tailings dams." Tailings and Waste.

Martins, S. V. (2007). Recuperação de matas ciliares, Aprenda Fácil Editora.

Martiš, M., V. Zdražil, I. Kašparová, I. Svoboda and E. Pecharová (2008). "Strategy for reconstructing the ecological and aesthetic functions of the Kladno region landscape disturbed by hard coal mining." Journal of Landscape studies 1: 103-111.

Mattex, B., McKittrick. (2016). "Understanding mine failure."

Matthews, P. (2002). "Scientific knowledge and the aesthetic appreciation of nature." The Journal of aesthetics and art criticism 60(1): 37-48.

McCandless, C. (2013). "No more just a hole in the ground." 1-19.

Meyer, E. K. (2008). "Sustaining beauty. The performance of appearance: A manifesto in three parts." Journal of Landscape Architecture 3(1): 6-23.

Milgrom, T. (2008). "Environmental aspects of rehabilitating abandoned quarries: Israel as a case study." Landscape and Urban Planning 87(3): 172-179.

Mineral, B. (2005). "As 100 maiores empresas brasileiras de mineração." Brasil Mineral, junho 240: 44-160.

Moustakas, C. (1994). Phenomenological research methods, Sage Publications.

Nassauer, J. I. (1995). "Messy ecosystems, orderly frames." Landscape journal 14(2): 161-170.

Nassauer, J. I. (1997). "Cultural sustainability: aligning aesthetics and ecology."

Nieman, T. J. and Z. R. Merkin (1995). "Wildlife management, surface mining, and regional planning." Growth and Change 26(3): 405-424.

Norman, W., Throop, Schnitzer, Roloff (1997). Best Management Practices for Reclaiming Surface Mines in Washington and Oregon. O. D. o. G. a. M. Industries. Portland, Oregon, Washington Department of Natural Resources.

Pandakovic, D. and A. Dal Sasso (2009). Saper vedere il paesaggio, Città studi.

Parsons, G. and A. Carlson (2004). "New formalism and the aesthetic appreciation of nature." The Journal of aesthetics and art criticism 62(4): 363-376.

Parsons, R. and T. C. Daniel (2002). "Good looking: in defense of scenic landscape aesthetics." Landscape and Urban Planning 60(1): 43-56.

Peters, T. (1984). "Rehabilitation of mine tailings: A case of complete ecosystem reconstruction and revegetation of industrially stressed lands in the Sudbury Area, Ontario, Canada." Effects of Pollutants at the Ecosystem Level. Wiley, New York: 403-421.

Piranha, J. M., E. A. Del Lama and D. d. L. C. Bacci (2011). "Geoparks in Brazil—strategy of geoconservation and development." Geoheritage 3(4): 289-298.

Potteiger, M. and J. Purinton (1998). Landscape narratives: Design practices for telling stories, John Wiley & Sons.

Rapini, A., P. Ribeiro, S. Lambert and J. R. Pirani (2008). "A flora dos campos rupestres da Cadeia do Espinhaço." Megadiversidade 4(1-2): 16-24.

Rico, M., G. Benito, A. Salgueiro, A. Díez-Herrero and H. Pereira (2008). "Reported tailings dam failures: a review of the European incidents in the worldwide context." Journal of Hazardous Materials 152(2): 846-852.

Robertson, I. J. (2008). "Heritage from below: class, social protest and resistance." The Ashgate research companion to heritage and identity: 143-158.

Saleh, J. H. and A. M. Cummings (2011). "Safety in the mining industry and the unfinished legacy of mining accidents: Safety levers and defense-in-depth for addressing mining hazards." Safety science 49(6): 764-777.

Santos, M. (2000). La Natureza del Espacio: Tecnica y Tiempo. Razon y Emocion. Spain, Ariel.

Schama, S. (1996). Paisagem e memória, Companhia das Letras São Paulo.

Schwandt, T. A. (1999). "On understanding understanding." Qualitative inquiry 5(4): 451-464.

Sklenicka, P. and E. Charvatova (2003). "Stand continuity—a useful parameter for ecological networks in post-mining landscapes." Ecological Engineering 20(4): 287-296.

Sklenička, P. and I. Kašparová (2008). "Restoration of visual values in a post-mining landscape." Journal of Landscape studies 1: 1-10.

Sklenicka, P. and K. Molnarova (2010). "Visual perception of habitats adopted for post-mining landscape rehabilitation." Environmental management 46(3): 424-435.

Spirn, A. W. (1998). The language of landscape, Yale University Press.

Stigliano, B. V., H. Ribeiro and P. d. A. B. César (2011). "Paisagem Cultural e Sustentabilidade: possíveis conexões e subsídios para políticas públicas e planejamento do turismo." Revista Turismo em Análise 22(3): 632-650.

Svobodova, K., P. Sklenicka, K. Molnarova and M. Salek (2012). "Visual preferences for physical attributes of mining and post-mining landscapes with respect to the sociodemographic characteristics of respondents." Ecological Engineering 43: 34-44.

Szymanski, M., P. Eng and M. Davies "DESIGN CRITERIA AND SAFETY EVALUATIONS AT CLOSURE."

Toy, T. J. and J. J. Griffith "RECLAMATION REVISITED: MINAS GERAIS, BRAZIL1."

Toy, T. J. and J. Jackson Griffith (2001). "Changing surface-mine reclamation practices in Minas Gerais, Brazil." International Journal of Surface Mining, Reclamation and Environment 15(1): 33-51.

Turri, E. (1998). Il paesaggio come teatro: dal territorio vissuto al territorio rappresentato, Marsilio Venezia.

Van den Berg, A. E. and S. L. Koole (2006). "New wilderness in the Netherlands: An investigation of visual preferences for nature development landscapes." Landscape and Urban Planning 78(4): 362-372.

van Etteger, R., I. H. Thompson and V. Vicenzotti (2016). "Aesthetic creation theory and landscape architecture." Journal of Landscape Architecture 11(1): 80-91.

van Etteger, R. and M. Verhoeven (2016). Beyond the visible: prolegomenon to an aesthetics of designed landscapes, Wageningen University.

Viana, P. L. and J. A. Lombardi (2007). "Florística e caracterização dos campos rupestres sobre canga na Serra da Calçada, Minas Gerais, Brasil." Rodriguésia: 159-177.

Walser, G. (2000). "Economic impact of world mining." The Uranium Production Cycle and the Environment 2: 86.

Wang, Y., J. B. Burley and S. Partin (2013). "CASE STUDY: POST-MINING LAND-USE PLANNING AND DESIGN: AN OVERVIEW AND MICHIGAN." Journal American Society of Mining and Reclamation 2(2): 175-194.

Zahavi, D. and S. Gallagher (2008). The phenomenological mind, Londres, Routhledge.

Zangwill, N. (1998). "Aesthetic/sensory dependence." The British Journal of Aesthetics 38(1): 66-81.

Zangwill, N. (2007). Aesthetic creation, Oxford University Press.

Web-sites:

BATTLE I ROIG Arquitectes: http://www.batlleiroig.com/en/ (Accessed November 2016)

INHABITAT: http://inhabitat.com/10-landscape-design-projects-that-turn-damaged-and-neglected-spaces-into-healthy-beautiful-environments/ (Accessed November 2016)

INSTITUTO TERRA: http://www.institutoterra.org/eng/#.WL0apm81-00 (Accessed November 2016)

WIKIPEDIA (2017): https://en.wikipedia.org/wiki/Karst (Accessed January 2017)

WIKIPEDIA (2017): https://en.wikipedia.org/wiki/Inverted_relief (Accessed January 2017)

FIGURES

APPENDIX

Main concepts applied for the phenomenological analysis

• **Epochè** (scepticism Husserl):
Suspending all judgements about the external world, no prejudgements, biases, and preconceived ideas. Is really experiencing what it is that you are experiencing.
Therefore describe, do not explain and seek for invariant structural features.

• **Phenomenological reduction**:
The phenomenological reduction is at once a description and prescription of a technique that allows one to voluntarily sustain the awakening force of astonishment so that conceptual cognition can be carried throughout intentional analysis, thus bringing the "knowing" of astonishment into our everyday experience. Therefore, describe, reflect of the experience.

• **Imaginative variation**:
"The task of imaginative Variation is to seek possible meanings through the utilization of imagination, varying the frames of references, employing polarities and reversals, and approaching the phenomenon from divergent perspectives, different positions, roles, or functions. (...) Describing the essential structures of a phenomenon (...) in this there is a free play of fancy; any perspective is a possibility and is permitted to enter into consciousness." (Moustakas 1994, p. 97-98).

Report of the fieldwork

Organisation:
The fieldwork took place Sunday 3 of April (2016), starting from 09.50 (a. m.) to 15.20 (p. m.) with a small lunch break in the middle. Along with me, four other people took part of the walk, Filipe Soares, Julia Andrada Machado de Paiva and Violeta Andrada Machado de Paiva, their presence was firstly important for security reasons, as the area is not considered safe and they also helped me in conducting my research. A part from the logistics, these persons gave an important contribution to my work; Felipe and Julia are both botanists, so while they made an inventory of the plants surrounding the area, they also took pictures and kept track of the path with the gps. Violeta, is an industrial designer and she likes birds and photography, so she took nice pictures informed me about the birds present there and helped me with the sound recording.
Even though we were together, a part from Violeta helping me with the sound recording, we conducted our work separately, they had a second copy of the map with the path signed so that they could follow their own walking rhythm. I was making my descriptions and taking photographs alone in a silent atmosphere. I stopped at each point as decided in advance, but after some time I figured out that there were too many of points, so I decided to take out two. Therefore, instead of twenty points I reduced the research to eighteen points. Another change decided during the fieldwork has been the length of the recordings, indeed instead of 8 minutes as planned in advance, I recorded 5 minutes for each point. I realized from the beginning that the sounds where not changing that much within the same point, and that some different sounds would appeared within the time-frame of 2-3 minutes.

Observations and limitations:

Considering the climate the fieldwork took place under different conditions, with the temperatures fluctuating between 23° and 30°. This enlarged my phenomenological spectrum of experiences and acknowledged me about possible different scenarios taking place on the research area. Indeed, while the morning was characterized by mostly a sunny weather with some clouds covers each now and the. The afternoon was characterized by a more cloudy

sky, with some rain falling for some minutes in a stormier atmosphere. In some moments the weather changed very quickly altering sun, clouds and rain, I recorded this alternations with a video. I also realized how the weather can tire the body, especially the sun that in the middle of the day is very high and strong. While the rain can be a big obstacle for writing down descriptions (if there is no shelter) and recording other sounds, I have been lucky in this sense that I experience it just for a small period to realize about it.
Another observation can be made upon the flow of experiences that is constantly interrupted by the various activities of recording, taking pictures, annotating and carrying stuff. In this sense the presence of other people helping me made things easier than what would have been without them. Then, the fact that the points have been critically decided in advance, without a defined time spam or a precisedistance space between them (as stressed by the literature) has been another controversial aspect of the research because sometimes they were too close together. Is also for this reason that I reduced the number of points, but for other situations I founded necessary to brake this rule for the reasons that I explained before (Phase 1).
The data collection on the last point has suffered the interruption of the activity by the security of the mining company of Ercolano, still responsible for the security in this area. A man stopped our research as he wasn't informed about our presence, so even with our authorization we had to abandon the area. However, this was in any case the last point of the research and I managed to make a shirt description and take enough photos to conduct a phenomenological analysis also here. Finally, one more consideration has to be made with the fact that we were there on a Sunday, I remember from my first walk the noise of the tracks passing passing on the road just aside the area, in this second walk this noise was absent as nobody passed here.


"Nothing is known,
everything is imagined"
Federico Fellini
March 2017