We have ventured this year to the interior of Brazil, to a state called Minas Gerais, abbreviated from ‘Minas dos Matos Gerais’, which literally means ‘Mines of the General Woods’ and refers to two large geographical spaces dominant in this (very large) state: the Sertão - the dry Brazilian highlands - and what has now come to be called the Quadrilátero Ferrífero - a mineral-rich area that for centuries has seen urbanization activity in the form of mining towns, and cargo infrastructure. This is also the place that the city of Belo Horizonte is capital of - today the third most populous metropolitan region of Brazil, right after São Paulo and Rio de Janeiro, hosting twenty cities and 5.5 mil inhabitants. Compared to the extensive activities that have been happening on the land this metropolis is very young, founded in 1897, and stands on top of this land in a very complex series of relations to its surroundings, performing its metropolitan duty, but also in instances ambiguously autonomous, disconnected even. Our understanding of cities emerging and reigning over extensive physical domains - territories - seems to not apply here at all: an alluring case study to broaden our knowledge on contemporary forms on urbanization, and the ways in which cities relate back to their (hinter)land.

A crucial element of this research was a joint two-week expedition, in and around the city of Belo Horizonte, observing the different city expansions that appropriate the nearby landscape, and start to overlap with a series of activities that have permeated the land for centuries - the agriculture and livestock herding, and the mining. Each team operated individually covering a topic, seeking out sites where they could observe and understand these complex overlaps, and the new phenomena that the particular conditions create. This book is a repackaging of all the discoveries, curated to tell a tale of Contemporary Minas Gerais.

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Belo Horizonte
OPENING A TERRITORY AND MAKING A CAPITAL

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For a number of years we have studied the transformation of contemporary cities under globalization. It is from this context that we have, more recently, started to frame a wider area and query the impact of those same globalization processes on a greater geographical scale, one that extends beyond the clear gravitational fields of the metropolis. From the position that the city is not autonomous—but always rather embedded and in relation to a wider territorial logic, with human activity therein allowing for its accumulation—we have started to outline and investigate what comprises such contemporary territories in relation to the shifts we have observed in the contemporary city. Globalization processes seem to evolve from preexisting traditions and, ultimately, inspire different reactions in any given territorial milieu. Territories have begun to reconfigure themselves in the wake of globalization, to loosen and allow for increased mobility and metamorphosis. These processes require our professional inspection; they are as vital to understanding contemporary life as is the accumulated understanding we have in our field of the city.

This project continues ETH Studio Basel’s territorial researches in Switzerland (1999–2005), the Nile Valley (2009), Rome - The Adriatic (2010), Florida (2011), Vietnam (2012), and Muscat and Oman (2013). These projects demonstrate ways in which densely populated environments invent new types of space: traditional, natural or rural areas turn into urbanized territories characterized by a multilayered occupation of landscape, overlapping structures, and diverse meanings.

Minas Gerais, abbreviated from Minas dos Matos Gerais, or “Mines of the General Woods,” refers to two large geographical spaces dominant in the very large, landlocked Brazilian state of the same name. It refers to the Cerrado—the dry Brazilian savannah—and what has now come to be called the Quadrilátero Ferrífero (iron quadrangle)—a mineral-rich area that for centuries has seen urbanization in the form of mining towns and cargo infrastructure. If none of these names or places sound familiar, one might be familiar with Belo Horizonte, the capital of the state and Brazil’s third most populous metropolitan region after São Paulo and Rio de Janeiro. In comparison to the extensive activities that have been happening for so long on the land, the region’s metropolis is relatively young, only founded in 1897.

THE BRAZILIAN FRONTIER

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THE RED SOIL OF MINAS GERAIS

The first thing that strikes one about Minas Gerais is its bright red soil, which impregnates the entire landscape. In its original state this land was lush green during the season of heavy rainfall or timidly yellow during the four dry months of winter. The soil rests under a surface of vegetation and therefore when we perceive it—as today we do everywhere in this region—it is because the earth has been scratched: the land overturned, cut into, exploded, ploughed, or shifted. The red soil of Minas Gerais becomes an observational tool, a way to track the ongoing processes of man-made physical intervention begun over 400 years ago. What we see today is the “second nature” of Minas Gerais, the one of the Cerrado pastures, of eucalyptus plantations that anemically simulate the long disappeared original Atlantic forest; of iron ore, limestone, and precious metal mining; of new highways that make slits in the land; of artificial lakes created by retention dams; of “condominios” that re-sculpt the tops of hills almost as extensively as open pit mining does. This is the landscape of a rapidly developing society with a pragmatic and not too shy attitude toward the land.

There are distinct ridges and underground “veins” where ore can be found and mining activities now focus. South of Belo Horizonte lies one of the largest iron ore deposits in the world, the Quadrilátero Ferrífero, where mining activity—initially gold mining—has characterized the land since its colonization. Because this entire region was suitable for mining, and due to the labor requirements and mobility of the time, the first human settlements formed a system of smaller towns and villages dispersed close to the mines themselves. These settlements are still inhabited, and have come to various fates, but as the technology of mining (and of mobility) has advanced, so has the organization of the industry. This densely populated landscape now also manifests itself as a network of towns filled with commuters who work in the newer mining regions and form a myriad of new relationships between the pieces that compose the landscape. Chapter VI Quadrilátero Ferrífero deconstructs the formation of this landscape and separates the different layers.

In other places vast pastures cover the land. The Cerrado has become synonymous with cow herding, milk and cheese production, and—in higher altitudes with more agreeable humidity levels—vegetable and coffee plantations. The very west of the state, the Triângulo Mineiro, marks the beginning of large-scale agricultural holdings and organized industrial production. It seems the farther away one ventures from Belo Horizonte, the more dominant the Cerrado becomes. Chapter V Cinturão Verde sheds light on the particular physical and economical interdependencies that this agricultural landscape has with the city of Belo Horizonte and looks, in particular, to farming that occurs in the peripheral regions of the metropolitan area. Here, the “family farm” prevails, and this almost minimal landscape is, in fact, a very loose, dynamic system of urban agriculture: even as people leave the land for cities, a number of urbanites simply abandon their professions to become farmers, partly for the lifestyle and partly because the activity is still vital. Recreation and enjoyment of landscape then also play into the energies the city projects into the “wild west,” and through these mutual exchanges the extended urban periphery becomes a lively “green belt” providing goods and relief for the city.
The second striking thing about Minas Gerais is its topography. Finding flat land here is a fool’s errand and Belo Horizonte’s founders didn’t bother looking for an ideal clearing. Instead, they placed the future city simply in the “center”: a strategic and administrative attempt to consolidate the state and centralize its functions. The city inserted its grid atop many hilly slopes. Its urban forms appeared slowly at first and, with the beginning of industrialization and iron ore mining, more and more rapidly. The city soon outgrew the plan manifold and its Centro is today just one neighborhood in an extensive urban field. The fate of this initial centrality is described in Chapter I Metropolitan Core. We investigate the ideas behind the plan and the vitality still embodied in this distinct urban space today.

An industrial city soon emerged based on production. The most significant was the automobile industry and the arrival of Fiat in Betim (a neighboring town since absorbed by urban growth and now very much a neighborhood of the city) eventually elevated Belo Horizonte to the global economic forum. Instances of how production and industry were implemented and organized at various times during the growth of the city, and as differing economic strategies are dealt with in Chapter II Betim & Contagem, and mostly describe the western extensions of the city in these two municipalities, both connected by the highway that leads to São Paulo. Nowadays, and with the city’s growth, the spaces of production and habitation are intertwined and industry remains a significant factor in the everyday life of the city.

HOW DO MINEIROS BUILD A CAPITAL?
Belo Horizonte is a vast metropolis. Beyond its initial center and the western expansion tied closely to industrial growth, the city has sprawled outward extensively and continues to do so. Due to very specific geographical conditions, the nature of the expansion of the city created very distinct entities. An upscale development to the south, on the slope of the Serra do Curral—a sharp mountain ridge that initially curbed growth but now represents an urban asset offering tranquility and nice views—has become a vital and consolidated part of the city, although its nature is entirely informal. Lying in a separate municipality, one also characterized by a lot of mining activity and in which most of the land in question is owned by mining giants, this area becomes an interesting example of “private urbanism,” dealt with in detail in Chapter VII Nova Lima.

Opposing this trend is the city’s tendency to develop northward, toward the international airport. These strategies, as well as what they produce, are described in Chapter III Vetor Norte. The city’s plans were never sufficient to accommodate the growth that followed economic development and it has rather been the trend, since the initial 1897 master plan, to work with the idea of “planned islands” placed at strategic spatial instances. In the case of the north this means along the highway leading to the airport. A friction of spaces emerges. The strategies of new growth assume tabula rasa situations but here one instead encounters entire informal neighborhoods of city commuters and ecologically protected lands.

Planned or, indeed, spontaneous, the consideration of water emerges as a contributing factor to urban growth or, at least, urban value. The idea of water as an urban asset saw its precedent (and it was only then that its consideration was seemingly intentional) in the first northern expansion of Belo Horizonte to Pampulha, where in the nineteen-forties Oscar Niemeyer and Burle Marx created an artificial lake with pavilions along the rim—a celebration of recreation and a new standard of urban living centered on a connection to nature. Chapter VIII The Water Cycle deals in detail with how Pampulha Lake became emblematic of a new lifestyle of living with water while, simultaneously, the planning and management of water as a resource, and threat, leave this abundantly present resource entirely unnoticed in most parts of the city save in moments of disaster and flooding.

An exceptional site in our study, covered in Chapter III Inhôtim, is a contemporary art compound located in a neighboring, predominantly rural municipality southwest of the capital. An eccentric mining tycoon has managed to inaugurate, in this “hinterland” of Belo Horizonte, a park that seemingly bypasses the land, and the city, and connects to the global art circuit. It has no connection at all with any of the aforementioned dominant geographic spaces, nor the city of Belo Horizonte. Instead, it is discussed in cosmopolitan centers like New York, connecting to the dialogues and communities there, and, in São Paulo, it forms part of the city’s Art Biannual.
On the ground, Belo Horizonte, along with its outlying leisure “islands” reads as simply another “surface” with its internal logics and seems not to influence the land nor the activities outside of it. We did not discover many dependencies of the agricultural or mining regions with regard to the capital. The legal structure orients toward the smaller, municipal level or to the federal, reducing the “power” of the capital over the region. Nevertheless, the city has taken on a significant role for Minas Gerais: it concentrates public functions and is an emerged business center for the region due to its provision of services and concentration of infrastructure. Moreover, federal investments have connected it effectively via highways and the airport to other Brazilian metropolises and this has allowed for an integration into a wider urban constellation, one that tenuously “covers” the whole Brazilian carpet of soil exploitation. This constellation is calculated and planned, its logic derives from federal management decisions that have little to do with the nature of the soil, just as Belo Horizonte was simply sited in the geographic center of the state and developed into a centrality by multiple strategies of concentrated investment.

Apart from the highways that lead in all directions from Belo Horizonte to Brasília, Uberlândia, to the coastal centers of Rio de Janeiro, São Paulo, Vitoria, et cetera, Minas Gerais itself remains a sparsely populated region where moving around is slower, and closely embedded with the logic of the shifting activities of the soil. The urban network, then, forms a kind of complimentary strategy of urbanizing the territory and pinning this moving carpet with fixed points of exchange. And, even though it was founded very recently, the city emanates a kind of permanence over the landscape. The reason for this is the constant physical transformation of the landscape itself. Even as its image is at times idyllic, slow, and seemingly stable, the only reliable characteristic of this landscape is its continuity of transformation. This in itself is not a cause of instability in a country that possesses such a rich surface crust. Indeed, the question of the exhaustion of resources is not really on the horizon at all. We can only anticipate that ameliorations, the implementation of adaptive and more efficient technologies, and the appeasement of certain ecological concerns are the matter of the day.

A STABLE URBAN GRID IN AN EVER TRANSFORMING LANDSCAPE
RESEARCH TOPICS

Each research topic was developed by an individual team of student-researchers and tested through case studies. Each case study relates to a specific physical location, in which the recent tendencies are best visible.
The Water Cycle

Nova Nova
Nova Ceres
Metropolitan Core
Vetor Norte
Betim & Contagem
Inhôtim
Cerrado
Quadrilátero Ferrífero
I Metropolitan Core CENTRALITY, MOBILITY AND REAL ESTATE

In 1985 with the plan for the new state capital ‘Cidade de Minas’, a metropolitan form was stamped on a then still virtually untouched land. This urban form – today the Centro of Belo Horizonte – contains the entire program of a metropolitan downtown: wide avenues, monumental squares with obelisks, high-rise buildings, museums, libraries, theaters, government palaces, a central train station, a large central park etc.

For reasons that remain to be investigated (safety, traffic etc.), it has in recent decades been increasingly deserted by both upper class dwellers and businesses, many of which have moved to the southern tip of the Centro or even beyond the Avenida Contorno, the ring road defining it. At the same time the high real estate prices keep away more modest users. As a result the very center of the growing metropolitan region has become partially abandoned and exists today in a strange mélange between pressure and neglect. Why is the very entry point of the city into the territory slowly losing its role as center? And where are those central functions going?

A city center can be a nucleus for many different networks and systems: politics, culture, commerce, transport etc. Start by looking at different such hubs (central market, train station etc.) and observe how they work within the city. Who owns them? Who owns the land they’re on? Who works there? But do not look at them isolated; always ask yourself how these central functions are connected to the larger territory. How far into the territory do the flows reach, that come together in the center? And has this structure changed? Are there maybe new hubs outside the Centro?

Find such examples and investigate them. By looking at several institutions try to develop a clear picture of the changes and movements that are currently affecting Belo Horizonte’s centralities!

Site(s)
Centro
New hubs
Traffic network

Atlas
Try to trace the history of the “metropolitan project” of Belo Horizonte. Which plans and visions have shaped the city? Learn as much as possible about the city’s history in general and try to visualize – in a timeline – important steps and shifts in life, politics and planning! Investigate the current situation of the Centro! Who are the actors involved? Who owns the land? What conflicts are discussed in newspapers and such?

An important indicator for the relation of an urban core and its territory is traffic. Map the networks of private and public transport and try to find data on traffic flows! Which are the most important hubs in the transport of goods and people and where are they located?

Contacts
Professor Radamés (via UFMG)
Fundação João Pinheiro (statistics)
II Betim & Contagem PRODUCTION AND LOCATION

Belo Horizonte is economically the third biggest city in Brazil and the one with the highest growth rate. Traditionally the region was devoted to mining, and the city emerged as an important industrial center. Today the production industry only contributes around 15% of the city’s GDP but its presence in the city is still vivid. Belo Horizonte was in a way deliberately created as a center for alternative economical activities not (only) directly dependent on the mining industry that had evolved and dominated the surrounding area and the state of Minas Gerais during the last centuries.

After the creation and realization of the first city plan with its orthogonal urban blocks, the ‘suburban belt’ and supporting agricultural areas of the city soon failed in hosting the growing population and managing its legal land use or land occupation (partly due to land prices). With the intention to support the economical and industrial development urban areas like the hexagonal plan of the Industrial City in Contagem (1940’s) were implemented offering at the time a modern and effective infrastructure, including a power plant and extensive road networks. In a later stage and in direct proximity the housing district Eldorado was build. Around the steel-tube industry of Mannesmann (V&M Group) an industrial area of Bahreiro evolved in the 1960’s. The implementation of designated ‘industrial cities’ continued and in 1970 Fiat established itself in the neighboring city of Betim. As a support for the local industries and as a reinforcement of the industrial attractiveness of the area, other major industries like Petrobras (oil refinery) located activities in Betim. In the case of Fiat their policy to demand a ‘just in time’ system of subcontractors consequentially led to a whole production network of support industries to the car industry developing in and around Belo Horizonte. Driving out of the city along the westbound road of BR-381 the Contagem Industrial City, Petrobras, and Fiat dominate the landscape, but it’s also clear that the use of the land has partly been changed and one reads instead of several dispersed entities one continuous urban fabric, as the housing (of the workers?) has consolidated all the separate pieces together. The refinery, with its immense size and pollution level, creates the exception, as it still to this day requires natural green buffers around it.

Important questions to seek the answers to are how this ‘second economic surge’, and leaving the mining aside (although its interrelations to production should not be ignored), has changed and organized the territory in and around the city? How was it planned? What was actually realized and why? What is the relationship of the industry to the city today? And – looking wider – how has the specific location within the territory supported and enabled the industry (proximity to resources, support industries, the formation of industrial concentrations, infrastructure, etc.)? Investigate what kind of urban ‘spin-offs’, legal or ill-legal land occupations (housing neighborhoods etc.) these industrial areas generated and generate. Infrastructure, such as roads and railways, for example, have a history of forming around, and being enhanced in accordance to, the needs of economically important sectors (financed by private or public means). Identify and describe the distribution systems of these industrial sites. Who initiated and executed the infrastructure (paid and planned)? With the tendency today being an economical orientation towards the service sector, information technology and biotechnology, one also wonders if and how these older areas are changing, i.e. what their vitality is to the city today.

Sites(s)

Industrial areas west and southwest of the city
Contagem
Bahreiro
Betim

Atlas
Economic of Minas Gerais and Belo Horizonte
III Vetor Norte URBAN PLANNING, MINING AND ECOLOGY

The “Northern Vector,” the whole stretch of land north of the city center towards and beyond the international airport in Confins, has for long been advanced by official planning authorities as the area for the future city expansion. Since a couple of years Belo Horizonte has a regional planning agency in charge of coordinating all work done on developing a plan for the Metropolitan Region of Belo Horizonte (RMBH), which includes 37 municipalities.

ture preservation, mining and the urban pressure. These are relations that at times appear as astonishing and ‘violent’ clashes which one can visually read in the landscape. What do the newly planned areas within this region look like? Like in the south, certain high-end industries (garment and SEMI-conductors) and centers (like the Cidade Administrativa) are being built with the outlook of creating an urban enhancement, paving the way for a planned metropolitan expansion. What considerations and measures are taken whilst implementing the new?

Site(s)
Pampulha
The Technology Park of Belo Horizonte
Cidade Administrativa
Neves (poor neighborhood)
Santa Luzia
Vespasiano
Confins
Lagoa Santa
São José da Lapa
Pedro Leopoldo (Sete Lagoas)

Atlas
-Causing the urban pressure are the demographic changes and increase in population. Describe the demography of Belo Horizonte
-In order to understand the power play behind the current situation and the urban changes it can be good to have a general understanding of the traditions and laws of Brazilian (MG) land ownership and land use (e.g. big mining companies vs. farmers/house owners, illegal settlements, land-grabbing movements)

The extension towards the north and the slow incorporation of neighboring towns started already with the Pampulha (sport and recreation) complex designed by Oscar Niemeyer in the 1940’s. With the inauguration of the ‘Cidade Administrativa’ in 2010 a decisive step towards emphasizing the cities’ growth in this direction was undertaken. The international airport in Confins is also viewed as an important element in the configuration of the ‘Northern Vector’. It is the biggest airport in Belo Horizonte and is being extended in order to handle even more traffic and cargo (recently it has become an international airport). These two entities are the biggest inserted artifacts along the northern stretch otherwise composed by smaller towns and cities, which have clustered around the old stretch of the railway and the mining in the area (limestone/cement). Many of these settlements are very poor and with an insufficient infrastructure. The natural geology and habitat is that of the Cerrado, with poor soil qualities but with rich and sensitive natural bush, grass and forest ecosystems. In addition the area is rich in historical remains from earlier civilizations. This precarious setting is now the scene for urban change.

Look at what has traditionally given shape to the occupation of this landscape - the mining and its aggregated urban sprawl (plus the agriculture) and how these formations are changing. Describe the conflicts concerning nature and cul-
The collection comprises works – many of which are site-specific installations – of both the Brazilian and international art ‘elite’. In 2011, it attracted nearly 250,000 visitors from all over the world. Inhôtim now sprawls over 5,000 acres and employs 1,000 people, costing Bernardo Paz $60 million to $70 million for operations each year. In order to make the project financially self-sustaining he plans to expand Inhôtim with 10 or more new hotels, a 15,000-capacity amphitheater, and even a complex of ‘lofts’ for those who want to live amid the collection. “I want to create a place where people can come and work without being in a hurry, where they can live surrounded by birds, have fun, a place they can bring their lives to,” Paz told O Globo newspaper. “It’s like Disney, which began life as a park and expanded. Only here it is something serious.”

Brumadinho is a rural settlement of 18,000 inhabitants, which has more or less over night become part of global streams and forces due to its immediate proximity to the Inhôtim project. Its modest economy and infrastructure is now confronted with the needs and means of international art tourism. A close – but arguably uneven – relationship has developed between Brumadinho and Inhôtim. Inhôtim has become a major employer and claims to actively engage the local community in its activities. Some see Brumadinho as the lucky beneficiary of an unexpected ‘gold mine’ while others feel it has been forced into the service of a venture as megalomaniac as the Manaus Opera House.

Examining the relationship between Inhôtim and Brumadinho, the conflicts, synergies and potentials, might give important insights into contemporary processes of urbanization. How does a powerful urban institution, such as Inhôtim, occupy the landscape and what is the territory’s reaction to such an ‘invasion’?

First map the physical relationship of Inhôtim and Brumadinho! What kind of infrastructure do they each have? Which parts only work for themselves and which relate to the other?

Then try to unravel all the different relations and conflicts between the two entities. Opinion on the value of this relationship may greatly vary so try to find as many different perspectives as possible! The presence of an international art-tourist destination might affect the entire region, especially along its access path (road Inhôtim – airport). What can you observe there? Are there other tourist / resort projects in the hinterland of Belo Horizonte?

Site(s)
Inhôtim Art Park
Brumadinho (Municipality)

Atlas
Try mapping out a history of tourism in Brazil (timeline). What is the economic importance of tourism today? What different forms of tourism are present and where are they centered? What spatial models (resort, hotel etc.) do they apply?

Contacts
Patrícia Capanema
Minas Gerais was once known for milk and cheese production. Today Brazil is a major importer of dairy products to supply the domestic demand. At the same time the advent of large monocultures, such as eucalyptus plantations, raise the question of ecology.

It is at first glance unclear to what degree rural settlements such as Mateus Leme or Bom Despacho are still based on agriculture and how productive this quiet landscape still is. How is agriculture affected by the city’s proximity? Is dairy farming still a lucrative industry? What are alternative products? Who does it supply and who lives of it? How does all this relate to the important questions of food quality, food security and nutrition in booming Brazil?

Start by visiting several farming operations along BR-262. Map the physical relationship of the farm infrastructure and the cultivated area. How is the landscape cultivated for farming? How do people live and work on these farms? Is farming their only income or do they work additionally in other sectors? If yes, where do they work? What are their traditional crops and animals, what are new ones? Do they produce only for themselves or for the market? Where do they sell their products? Try to identify different types of farmers and develop their specific profiles!

Another direction to approach the subject is to start with the points of sale (highway stops, markets etc.) and trace back the products to their origins. How close or far away from the city are these products produced?

Parallel to this find experts to tell you about the current agricultural politics. What role does agriculture play for this territory and the city of Belo Horizonte? How do people envision the future of agriculture?

Maybe a trip to Uberaba or Uberlândia – both centers of industrial agriculture – will put the agriculture around Belo Horizonte into a wider perspective.

Site(s)
BR-262
Mateus Leme
Nova Serrana
Bom Despacho, etc.

Atlas
Learn about the agricultural heritage of Minas Gerais and Brazil. How did agriculture traditionally work here and what settlement patterns has it produced?
Then investigate the role of agriculture today both at the scale of Minas Gerais and Brazil. What is produced and where is it consumed? What is exported and what (if anything) imported? What is the share of agriculture in Brazil’s economy (numbers of employees, GDP)? Try to map the different production zones within Brazil! For this you will have to go back a step to investigate the different premises for agriculture, mainly climate and soil quality.

Also try to find out which political policies, subsidies, supports and strategies are in action. Sketch the different actors and their relations in order to have as much background knowledge as possible for the case studies during the field trip.

Contacts
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Adriana Aranha, PUC

Cinturão Verde CULTIVATION AND URBANIZATION

Along the western exit road BR-262, towards the “Triangulo Mineiro,” the city comes in direct contact with rather extensive forms of agriculture. The hilly landscape is occupied by scrubs, termites and detached herds of Zebu and Holstein cattle. Dairy farming – next to mining, the traditional industry of Minas Gerais – consumes large plots of land and demands very little ‘cultivative’ measures. How does such a land occupation react to the pressures of urbanization?
Over centuries of man made changes, it is very hard to know what untouched nature here once looked like, as the extent of the transformation has been widespread and continuous. An interesting question to us is how is this seemingly infinite process impacting the current reality, and what different pieces make up this complex landscape puzzle. This study will focus on a stretch of the Quadrilátero Ferrífero that seems to collect several of these puzzle pieces, that are exemplifying what kind of transformation the practice of continuous ore extraction can and has had on settled and on virgin land, focusing closely on the relationship between settlement and mining.

One starts from the historic colonial towns of Ouro Preto and Mariana, both settled upon very steep topography close to riches of gold ore, both boasting a long colonial history and Portuguese architectural heritage, and both currently living off of services and tourism, and then continues on the road northwards towards Itabira, a very important town, and also the name of a very important mine, the first large scale, open-surface mining operation of the Brazilian mining giant Vale, its functioning has already for decades defined the everyday of the citizens, and the everyday of the physical reality. This place is half-mine, half-city, and will become an interesting case study into the growth and urban impacts that such a seemingly hostile extraction activity has had.

However, contemporary mining practice does not at all anymore require human settlement for its functioning, the existence of the village of Itabira happened to be pure accident (people even had to be ‘moved’ slightly to get at the ore), therefore, last but not least, and dealing with very much the contemporary mode of conduct, along this same road, between Mariana and Itabira, there are segments of immense nature, mountain ridges and water springs, and it is here that we find the largest scale of human physical transformation taking place due to mining, an immense operation named Mina Alegria, reveals itself as a mountain re-carving, of such a scale that one can read the age of the mine, and feel the process of extraction cutting down the mountain (once depleted, a kind of green grassed ziggurat remains, as if to resemble an Incan temple, confusing our interpretation of this grand nature we are seeing, while the meticulous operation moves onto the next ridge, creating dark grey terraces mixed up with the reddish Minas Gerais soil).

1) Old mining towns that struggle in their existence forms the question of the first case study; 2) A seemingly rampant human intervention within hidden and unsettled nature forms the second case study; 3) and the interlinked realities of living in an active mining town form the third case study. Through it, one begins to understand the complexity that this long process can have on the land, and the consequences that it has on human settlement, also opening up questions about the heritage of the mining, preservation of the landscape and economy. A large part of the Quadrilátero Ferrífero lies within a proposed UNESCO Geoparks area, an area that is supposed to exemplify one day landscape preservation, allow the study of mining landscape as a heritage, as well as continue to allow mining as an active economic activity, all together forming one happy family.

VI Quadrilátero Ferrífero THE MINING LANDSCAPE

The territory of the Quadrilátero Ferrífero is mainly characterized by extraction, a principle that has historic roots in Brazil that go back to its discovery by the Europeans. These ‘rushes’, first of gold and diamonds, now of iron and steel have permanently reconfigured nature into artifact. Minas Gerais is one of the biggest iron ore deposits in the world, when one looks at an untouched hilltop in this region, one knows that it could only be a matter of time before it is shrunk over a process of several decades, and depleted, with a very awkward crator left behind in the process.
Why? Apparently this entire area is a case of ‘private urbanism’ and its roots can be traced back already to the 70’s, when developers started to make areas with second homes in the outskirts of the city, in the neighboring municipality of Nova Lima. Nova Lima is mostly owned by the mining agglomerations, nowadays, and it was already the case in the last century. As the iron mining drew to an economic slump mid-last century, an upscale urbanization phenomena started to occur, and the miners were converting land spotted initially to have iron, and developing it for a profit.

The trend has continued up to today, although nowadays the mining activity has once more become very lucrative. With the growth of Belo Horizonte creating a land value increase on its outskirts, this has meant that the perimeters of Nova Lima have become new city parts of Belo Horizonte. On-going mining activity, ongoing condominium and high-rise development, along with some pieces of leftover nature, now define what one sees when one climbs up from the center to the ‘Belvedere’. This topics deals with the question of private urbanism, in a very particular context of a ridge, which used to be the former natural barrier of the growth of the city, and inevitably deals with the mining giants, albeit in another role here, in the role of land developers.

1) Nova Lima in particular has been the source of the second home of the Belorizontino for a long time, the first case study should include older condominium developments; 2) the Belvedere is the obvious pinnacle of the city, and represents the second case study; 3) the mines are not really to be forgotten here, being so close to the urban reality of Belo Horizonte, there is a lot of myth and criticism about the activities that are (or are not) happening in the area. It would be important to get an understanding of what is happening to old ‘hotspots’ of the mining, which are supposed to be converted into natural parks, or developed in some other way.

Site(s)
Condominiums from the 70s
Belvedere
Belvedere Old Mine

Atlas
- Historic development of the city, in particular of what was happening in the area in question
- Economic historic timeline of impacts on mining, and on real-estate (or rather the link between the two) in Nova Lima in particular
- Understanding the Geoparks UNESCO proposal for the greater Quadrilatero Ferrifero region, or what the current debate is on remnant-mining landscapes, and current mining landscapes

Note: Diploma topic
VIII  New Betim  WATER AND URBAN GROWTH

Minas Gerais is rich in water resources both for portable water and for hydropower production. With its absolute abundance of fresh water and with its relatively good distribution system the state has one of the highest and best water supply levels in the country.

What are the dependencies and economical powers and concerns behind the decisions concerning how the water and the nature questions are being dealt with? This raises the general question under what condition can ‘nature’ become part of the metropolis and its territorial activities.

Site(s)
Lagoa Várzea das Flores, Betim
Area around ‘dried out lake’ in Ibirité
Reservatório Serra Azul
Represa Rio Manso
(Lagoa Santa?)
Ref: COPASA (Water Company of Belo Horizonte)

Atlas
-Ecology/nature Preservation in Minas Gerais (an overview of water policies and nature protection)
-Survey of hydropower production in MG and its role and importance

The fresh water sources of Belo Horizonte, the rivers and lakes in the closest surroundings, all used to lie outside the agglomeration but are today taken over by the cities growth and embedded in urban fabric. This directly illustrates the paradox the city is in, where fresh water is available but due to urbanization pressure it has gotten a poorer and poorer quality. The city is now seeking for more remote sources in order to meet the needs. The endeavor to protect the current water sources and the current process of naming new, have had consequences for the formation of the urban sprawl in the adjacent areas.

Describing and understanding these consequences will allow us to have an understanding of the specific role the water has in the formation of the metropolis. Early on COPASA (the water company of BH/MG) have had a strong role and they are still effectively executing and implementing their programs in the region. But how much influence do they have over the actual urban configuration – over the legal and illegal developments? Are their distribution systems, cleaning plants and reservoirs ordering the territory? Or is it the other way around? Look at the case study of Lagoa Várzea das Flores and the neighboring area of ‘New Betim’. Water (the fluctuation of lake levels, quality and access) are also often mentioned as points of conflicts in relation to mining activities throughout the area. Are there parallels to be drawn?
I have learned an impressive amount of things - that sums up my impression of the work the students of the ETH studio Basel have done in and around Belo Horizonte.

What stands out is the effort of all the teams to draw a rich picture of their area of study. Not just architecture, or urban development, or the strategy for an art collection, they went out and collected information from a lot of sources and people. In that way, I get an idea of how the Inhôtim art park came into being, what it depends on, how it changes the landscape but also the social and economic realities in its surroundings.

And another example: the pictures and the analysis of the peculiar high rises in the city, with their private spaces on the upper level above the streets, give an intriguing glimpse into the social fabric of the city and, even, into the minds of the people: they perceive their city obviously as insecure. If that is justified must remain an open point. However, intriguing as well, is how the building code of the city has helped to create these spaces.

It is impressive how the students have collected this information. Because it is not to be found in scholarly books in the university library nor is it plainly visible in the city for everyone to see. It has to be pieced together, from talking to administrators, scholars, professionals, people on the street. It has to be formed into a hypothesis and then tested, refined. In short, these projects of the ETH studio have created an image of a reality that helps to explain how this reality came to be, how it works, what it depends on, what it influences.

Many times during the presentations, these images rang true for me and what I have learnt in Brazil myself. Many times, I recognized a familiar pattern, an impression from Belo Horizonte that I knew from Brasilia or São Paulo - this, I think, makes it very likely, that the students have uncovered many an essence of what contemporary Brazil is like.

I do think that this approach will help the students become architects that are especially aware of how the houses they will plan fit into a given space, into a city and its people. They will, perhaps, think more about what they will influence in a city, and in its society, by building what they are planning.

As an afterthought, I think it might be very valuable to share and discuss the research results with people in Belo Horizonte. They might gain a lot of insights which they probably had sensed somehow, but which viewed from sharp minds from the outside will still hold some surprises. Conversely, the students will get valuable feedback about their hypotheses - where are they spot on, where might their ideas be a bit out of tune with reality?

Thomas Häuser, reporter for Radio SRF 2 Kultur, Basel/Zürich, 2014
NÚCLEO METROPOLITANO
I
METROPOLITAN CORE
OLD AND NEW CENTRALITIES

AN OUTGROWN PLAN
The Idea of a New Capital
Expansion and Verticalization

CENTRO: A DUSTY DOWN TOWN
The Compact Quadra
Urban Equipment for Diverse Activities
A Large-Scale Street Event
Linchpin of Movement
Remaining Only a Passage Way?

SUL: A NEW LIFE STYLE
The Fragmented Quadra
Formally Programmed Environments
Large-Scale Leisure Enclave
Shift of Qualities?

CENTRO VIVO
Official Strategies
To Keep or to Tear?
AN OUTGROWN PLAN

In 1887, Brazil became a republic and with that the search for a new capital for Minas Gerais began. The first planned city of Brazil would have to be a symbol of modernity; a breakaway from the memories of colonization and slavery. In 1893, the village of Curral del Rey was chosen to become the new economical, administrative and cultural center replacing the old colonial capital of Ouro Preto. The site possessed, in addition to favorable climatic and topographic conditions, a good connectivity to other state capitals. This plan today represents only the central core of the city.
## Master Plan vs. Urban Growth

Several occurrences in the history of Belo Horizonte led to its current morphology and its urban growth. The city grew at extreme rates from the 50s on and demographic rates are still rising. The center has however experienced a period of stagnation and even a temporary recession in the 1980s - 1990s.

### Population of Central Area of BH

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## Belo Horizonte: From Masterplan to Urbanization

- **1950**: Planning and construction for the new capital, by Aarão Reis and Francisco Bicalho. Planned for 250,000 inhabitants.
- **1953**: Inauguration of Cidade de Minas, new Capitol of Minas Gerais: New economical, administrative, and cultural centre.
- **1960**: Brazilian Masterplanned City: Goiânia.
- **1962**: Brazilian Masterplanned City: Fordlândia.
- **1963**: Mercado Central inaugurated, 400 stores.
- **1965**: Minas Tênis Clube inaugurated.
- **1966**: Oscar Niemeyer designs Pampulha.
- **1967**: Minas Tênis Club is inaugurated.
- **1967**: Brazilian Masterplanned City: Brasília.
- **1968**: Economical industrialisation, BH becomes one of the leading industrialisation centres.
- **1969**: Concentration of service, commerce and finance.
- **1970**: Mobility increases because of the availability of automobiles.
- **1971**: Creation of RMBH. Union and Fundação João Pinheiro think thank.
- **1972**: Planejamento da Região Metropolitana (Plambel).
- **1973**: ‘Piloti’ law: Lei 2662, Normas de uso e ocupação do solo.
- **1974**: Law of urban land parcelling; no sale of unregistered parcels anymore.
- **1975**: Implementation of Metro: Companhia Brasileira de Trens Urbanos (CBTU).
- **1976**: Social Housing Program Orçamento Participativo. More than 1,000 projects realized.
- **1977**: Lei 7166, Normas e condições para parcelamento, ocupação e uso do solo urbano no município. Replaces the ‘Piloti’ Law.
- **1978**: ‘Centro Vivo’ Plan for Revitalizing the Central Area of Belo Horizonte, by Prefeitura Planejamento do Hipercentro de Belo Horizonte (Centro Vivo).
- **1979**: Law of urban land parcelling; no sale of unregistered parcels anymore.
- **1982**: Fiscal: Brazil becomes a Democracy.
- **1983**: Law of urban land parcelling; no sale of unregistered parcels anymore.
- **1984**: Implementation of Metro: Companhia Brasileira de Trens Urbanos (CBTU).
- **1985**: Social Housing Program Orçamento Participativo. More than 1,000 projects realized.
- **1986**: Law of urban land parcelling; no sale of unregistered parcels anymore.
- **1987**: Political: Brazil becomes a Democracy.
- **1988**: Fiscal: Brazil becomes a Democracy.
- **1989**: Fiscal: Brazil becomes a Democracy.
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- **2049**: Fiscal: Brazil becomes a Democracy.
- **2050**: Fiscal: Brazil becomes a Democracy.
The Idea of a New Capital
Aarão Reis, a Brazilian urban planner, set up the master plan for the new capital in 1895, based on the ideal plan of Washington D.C. with a symmetrical array of perpendicular and diagonal streets. The master plan was divided into 3 zones - the urban, the suburban and the agricultural. All public institutions were located in the urban zone but no other building regulations existed. 1897 Belo Horizonte was inaugurated, but still unfinished. The city was called Cidade de Minas until 1906 when the name was changed to Belo Horizonte.

Elements of the Idea

- Jardim Zoológico: The block was left empty until 1935 when the Minas Tenis Club opened on the site of the planned zoological garden.
- Praça da Liberdade: The administrative heart with governmental buildings, including the governor’s palace.
- Mercado: Commercial area with a public square that was never realized; in 1971 the Estação Rodoviária, bus terminal, was built on the site.
- Praça Sete: Point zero, where the first parcels were sold. The vast avenues, with a span of 35 meters, were more like linear parks at inauguration time, linking the public buildings and squares, which were set at the intersections. As strict as the plan was drawn, it was never realized that way. Though over time all public functions did find their place within the grid.
Expansion and Verticalization

Parts of the Southern side of the center were still unoccupied when the verticalization around Praça Sete started. At this point it was rather an act of prestige than one of necessity. The city expanded very fast, so that today the Belo Horizonte Area has grown to its outer limits. The process of densification through the verticalization, for which the Edifício Acalaca stands as a symbol, is still going on.

Edifício Ibaté, first high-rise, 30m

Avenida Alfonso Pena

Edifício Acalaca, one of the high-rises on Praça Sete
Strength of Form versus Logic of Urbanization

The building of the new city started with the destruction of Curral del Rey. The farmers of Curral del Rey and the builders of the city were pushed into the suburban zone while the gridded urban zone ignoring topography and the preexisting took its form. Therefore the city started filling from the outside to the inside. After the inauguration the deadlines to finish the city were abandoned by the Minas Gerais government and occupation took place little by little with a slow auctioning of the parcels. The first settlements were found in the downtown area between the main station and Praça da Liberdade, which the map of 1928 shows.

The Grid as a Remaining Fragment in a Contemporary Urban Landscape

Today the planned area is integrated in a larger urban context; a dense weave of specialized and at times well confined urban areas covering the hilly topography of Belo Horizonte. But the strict morphology derived from the older formalistic grid in the center remains and it contributes to the city’s identity.
Income Levels in the Municipality of BH

Average wage BH = 1,500 R$

> 6 times AW
5-6 times AW
3-4 times AW
2-3 times AW
< 2 times AW

Urban Fabric around the Core

75% of the municipal area of BH is built. Its morphology is characterized by very diverse types and uses, which also variegate according to land prices and income levels.
Versatility inside the Grid

Within the originally planned city, today's metropolitan core, two "entities" developed over time, the historical part around Praça Sete named "Centro" and "Sul" (South), which developed more recently. This time gap has resulted in different formal characteristics, as we will see.
CENTRO: A DUSTY DOWNTOWN

The Centro floats in an intriguing interplay between neglect and attraction. Being the starting point of Belo Horizonte, it is the historical center, and many buildings of an earlier time survive, albeit in neglect. The partially abandoned built substance creates an atmosphere and charm of its own.
The Compact Quadra

The downtown area of the city is the historic center and consists today of buildings mainly from the 60's and some rarer from before. These were built wall-to-wall, forming a composed closed image where the linearity of the avenues is underlined and the street space fully experienced.

Block Edge: Immense Extrusions
The Centro Quadra is clearly cut horizontally, where the street level is dominated by commercial uses and the upper levels by residential or office uses.

### Anatomy of a Centro Block

The Centro Quadra is clearly cut horizontally, where the street level is dominated by commercial uses and the upper levels by residential or office uses.
Edifício Maletta: Merging Functions
The Edifício Maletta at the crossroad Rua Bahia - Rua Augusto Lima was built in 1957. It is very popular amongst the city’s inhabitants. Even people from the “South” sometimes come here to eat at Cantina do Lucas or sit in a bar on the access balcony on the first floor. The building units the diverse uses of living, commerce, private and public offices.

Small Unit Apartments
The 30-story high apartment towers in the Maletta building has 318 apartments. They all are 2 bedroom-flats and cost between 900 and 1000 R$ (medium wage in BH is 1,500 R$). There are different people living there, but mainly its students and elderly folk.

Shops and Bars
The well-known access balcony on the first floor of the Maletta offers different commerce at day, for example a print shop, many book stores, cafes, etc. At night it becomes a lively place for nightlife, visible from the street side.

Public and Private Offices
There are 642 offices. Government offices occupy the first four stories. The rent is 800 R$ per room. Some are oriented to the rather dark light shafts, which is a result of the building typology, others are oriented to the street side with nice panoramas.
Courtyard Centro: Parking-Landscapes

The most fundamental reason for the neglect of the downtown area is over congestion and a lack of parking lots. Older apartment and office buildings hardly ever offer car parking, which has lead to unoccupied spaces in the city transforming into parking lots. Landowners of small parcels often create “estacionamientos” - improvised parking lots with a surveillance offer for a small fee.

Parking Fills All Available Courtyard Space
Stores Accompanying the Avenues
The ground floor is clearly dominated by commerce. The little shops are lined up along the street and surround entire blocks.

Activating the Streets
Like little boxes the shops integrate themselves into the bigger building structure. Similar to a garage the shops open fully to the street, liven it up through its colors and goods.
Aparecida, 53, Dressmaker

“I’m from St. Ines, north-east of the center, but I practically live here. I have been working here for 34 years and have many customers. The rent is 2,000 R$ / month. But I have come to own the space. I wouldn’t like to live in the Centro, because then I wouldn’t have to take the bus. The bus is difficult in Brazil. In my free time I go to Praça Sete, Av. Amazonas, Mercado Central, for buying clothes etc. I do this here in the Centro.”

Guiberto, 49, Barber

“I’m living in Gloria, west of the center but I have been working here for 30 years. I have all kinds of customers. A haircut costs about 25-30R$. The shop is 15m². I come here by bus; it takes between 30-60 minutes, depending on the traffic. I would love to live in the Centro, because then I wouldn’t have to take the bus. In my free time I go to Praça Sete, Av. Amazonas, Mercado Central, for buying clothes etc. I do this here in the Centro.”

Thiago, 35, Lawyer

“I was born in Pampulha and have been living here in the Centro since 3 years now. I moved here because of work, which is located 15 minutes by foot. I share this 2 bedroom flat in the 26th floor with a friend. Together we pay 900 R$. I like living here; it is very practical, everything is near and reachable by foot—so I don’t have to get into traffic. I go to Praça Sete for cinema and the bars, to Praça Estação for shows and museums, and to Savassi, but only on the weekends. Sometimes I go to Pampulha to visit my friends who still live there. As soon as I have a family of my own I will move out of the Maletta.”

A Story of Commuting

For many citizens of Belo Horizonte the Centro is still attractive, mainly as a place to work and for cheap shopping. The residents of the area are though often only living there transitonally or when they are dependent on public transport, like students and elderly people.
Urban Equipment for Diverse Activities

Beside the commercial use, the Centro has also had a variety of cultural offers. Due to safety reasons and the unfavorable lack of parking spaces the image of the Centro is under stress today. These conditions and the presence of so many old, abandoned building create a fertile soil for observed emerging subcultures and alternative uses of the urban spaces and equipment.
Public Oasis
The Parque Municipal already existed in the master plan of 1895. With its vast plot and diverse vegetation it offers a nice alternation to the dense Centro.

Between Vibrancy and Neglect
The most urban square is the Praça Sete, which is also the point where most of the traffic passes. Many street sellers use the opportunity and try to sell their products to the masses passing by everyday.

Concrete as Arena
While urban spaces in “Sul”—the southern area of the center—are used in very formalized ways, the public spaces of the Centro are used in creative, diverse, and rather informal ways. Concrete has become the arena for hip-hop battles, or Master of Ceremonies performances (MCs), like at the Duelo at Santa Tereza Bridge. In the Centro the urban space is used by everyone and transformed for everyone. At the Viaduto Santa Tereza, a bridge connecting the Centro to outside Av. Contorno, the Coletivo Familia de Rua, a group of MCs, started the “Duelo,” a weekly battle in which everyone can participate who thinks his lyrics have to be heard. They chose this place because almost all buses pass the Centro, and because the bridge gives them a roof in case of heavy rainfall.

The Place to be Heard
The Praça Sete is a highly frequented circular square with radiating pedestrian streets. It is the original point zero of the city and a very lively place; a lot of people pass by on foot, mainly during the daytime. If concerns are brought up, they are brought up here and you can often see protesters around the obelisk in the center of the square.
Side-by-Side Street Occupation
Four streets around the Praça Sete were turned into pedestrian streets creating enough room and plazas for different uses and happenings. In the evening plastic furniture, occupied by hungry guests, coincide with skaters and street bands playing live music. Therefore the Centro does possess some pockets of nightlife, but many corners are left eerily empty at nightfall, which is uninviting.

Spontaneity
Warm, sociable atmospheres appear at the sound of a single beat. As soon as a loud rhythm starts bumping, people gather around and start dancing. Temporary installations enable these gatherings to occur anywhere and spontaneously, turning the paved streets into dance floors. All it takes is a DJ and his VW van housing a sound installation. These common happenings bring diverse people together.
A Large-Scale Street Event
Every Sunday morning at 5 o’clock, a 600m long stretch of the 8 lane broad Av. Alfonso Pena, neighboring the Parque Municipal, gets closed off and an open-air market is temporarily set up. The stands are subdivided into different sectors for different products, distinguished by colors.
On and Off
At 2 o’clock in the afternoon Av. Alfonso Pena is re-opened to traffic again. Shortly before that, the artisans are rushing to get their things packed and back into their cars.

Leo, 63, Furniture Restorer/Designer
“I’m taking part in the Feira Hippie since 1972, when it all started—41 years already now! Back then we were only about 50 sellers and it took place at Praça Liberdade. In 1991, it was moved to Alfonso Pena. Today there are about 3,000 people working here. During the week I repair old furniture at my home and produce my own leather products, they are all hand-made. I rent out two spots, together 4,5 m², for 122 R$ per month. I sell these beanbags—the case only—for 105 R$.

Wagner, 22, Artist
“I come here every Sunday to sell my products. On Saturday I’m at Av. Rio de Janeiro, and on weekdays I’m moving around on different streets in the whole center. It’s all handmade artisan products, and I create it straight away on the street, so I don’t need to have a license here at the Feira Hippie.”
**Linchpin of Movement**

Because of the configuration of the radial road network and the concentration of jobs in the Centro, it unites different flows of traffic at one entrance point, which lies at Avenida Contorno. Especially at day and at rush hour the Centro is the most lively and hectic place in the city. Also the public transportation system is laid out monocentrically, which leads to increased traffic jams constraining the atmospheric qualities of the Centro.

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**Intuition and Colors**

The color-coding eases orientation in the complex and dense bus network. Buses are colored after their route type, and people who live in BH for a while learn by heart where they go.

- **Linha Troncais**: neighborhood to center and then back again
- **Linha Circulares**: circulating inside Contorno or a neighborhood
- **Linha Diametrais**: neighborhood to neighborhood, passing the center
- **Linha Interbairros**: neighborhood to neighborhood, mostly not passing the center

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**A Dense Network**

The bus network is very dense; almost 100 percent of Belo Horizonte is covered with the bus service. The ways of mapping the bus plans are very diverse and sometimes not accessible or even non-existing.

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**“Catraca”**

The buses are divided into two sections by a turnstile (Catraca), served by a ticket seller. Elderly people travel for free in the front.
Only for a Few
The metro of Belo Horizonte consists of only one line so far. It connects the north and west of the city with the center. The end stations and the central station are by far the most frequented ones. So the metro line works mainly as a express connection between the agglomeration and the center.

Intersection Bus-Metro
The end stations integrate large bus terminals, where buses from the whole agglomeration halt. The commuters switch here from bus to metro to get to the center faster.

Over-Ground Metro
The metro never goes underground but has been implemented on street level following old train tracks from the colonial times. This is one of the reasons why extending the network represents a real challenge, in the already very dense built fabric of the city.

From Nothing to Nowhere: Vilarinho and Eldorado
The citizens label the metro as going from “nothing to nowhere.” The places being served by the end stations are small random villages in the agglomeration of Belo Horizonte.
Remaining Only as a Passage Way?
The Centro works as a huge hub for commuter flows. Many commuters pass the Centro to go to work outside, because of the radial road network that leads all the traffic flows through the Centro. This leads to traffic jams in the whole city, though concentrating on the Av. Contorno. The relation between inhabitants and jobs in the Centro is very unbalanced; the population is rather small. This raises the question whether the old city today only works as a hub for commuters passing through it.
SUL: A NEW LIFE STYLE

The southern area of the originally planned city was always provided with better infrastructure than
the rest of the city. This can be explained by its relatively young age. Sul, or the South, was left empty
for a long time until high-income citizens started to settle there. Today it is a dense area attracting a
lot of service and commerce to the otherwise residential environment, becoming increasingly inde-
pendent from the Centro.
The Fragmented Quadra

The new building stock in Sul works as multiple single components. The freestanding and partially set back buildings negate the typology of the closed block, visually. Ironically, introverted and barred ground floors form inaccessible and rather inactive street level facades.
Anatomy of a Sul Block

The South Block integrates newly built high-rise apartment buildings and old detached houses. More and more office buildings are complementing the arrangement.

-- Metropolitan Core --

-- South: A New Life Style --
Piloti
Lei 2662, 29 de Novembro de 1976 / 1996 / 2010, the building law of 1976, established the “pilotis” or the extruded ground floor based high-rise as a typology. It states that for every building with more than four levels, one has to create a setback from the plot border and secure recreational use on the plot. The pilotis consist most often of a floor in which only 40 or 50% of the plot area is built and the rest is for recreation and common uses. Apart from this, the first and second floors can occupy 100% of the plot, while the ones above should have a setback and occupy only up to 50%. The maximum height on the alignment of the plot is 10.80 meters in the central area, which means that you could build up to 3 floors without a setback. As this demands an artificial drainage system we therefore often find the ground level (1) left 20% vacant. In 1996 the law was changed and the pilotis is no longer compulsory, but after twenty years in effect it is a culture, and remains a part of offer of current residential buildings.

Vertical Condominio
Entering on the street level one have to pass the portier first (1). The garage, often in the 2nd or 3rd floor (2), has room for at least two parking lots per flat and on top of the piloti you often find vast playground and pool areas exclusively for the residents of the condominium (3). The higher the better is otherwise the organizing and rent decisive rule for the apartments in the tower (4).
Secluded Leisure
Above street level, the common space of the Pilotis is an at all time accessible platform offering all kinds of activities but only for the residents of the house.

Diverse and Unused
The activity offers vary from tennis courts, soccer fields and playgrounds to common pool and grill areas. These spaces are quiet, clean and safe, but also often unused.
Courtyard Sul: Leisure Landscape on Platforms
Filling up the whole parcels in the first 2 to 3 levels, the residential buildings clash wall to wall. The courtyards and rooftops form a new topography hiding the parking lots underneath while allowing for an artificial layer of leisure areas.

Infill Programmed with Leisure
Terraced Street Fronts

Distancing of Street and Entrance
The buildings in the south are often very enclosed. The spaces between the street and the entrances are accentuated by a variety of distance-making objects; like fences with unused green space behind them.

Elevated Entrances
To create a more private space for the residences, entrances are often elevated to a higher level. They are also often set back from the streets and guarded by the porter, often desirable by a security concerned middle/upper class.

Offices between Residential Buildings
Sul is mainly a residential neighborhood, but more and more offices are settling here. A location in Sul is more positive for the image than a location in Centro for many companies.

Boutiques
The shops in the south are often situated in different buildings, but preferably in older houses, and the offer is rather for high-income customers. The larger part of the offered services consists of dentist, spa, gym and similar.
Compensation

“Honey, the apartment is shrinking, but the veranda, pool and courtyard increases...” Headline of the Veja BH Magazine, October 2013.

Setting Priorities

The relation apartment-piloti seems to be shifted towards more functions and spaces in the common area.

Investment Pressure

The pressure on old buildings is high as the prices for plots are rising in Sul. Old buildings often have to make space for high-rises, but some of them are left as reminders of how the city fabric used to look like and function, only now they are surrounded by towers.
Elena, 61, House Owner, Travel Agent

“I live in Funcionários, on Rua Bernardo Guimares with my two sisters in our parents house, which they built back in 1952. I like to live there because I can walk to work by foot. It’s only two blocks away, and I like the Savassi neighborhood a lot. Recently we have been getting a lot of phone calls from constructors willing to buy our property. The highest offer was 11 Million R$ so we are seriously consider selling our family heritage. The building soon has to be renovated and that would be too expensive for us anyway.”
A Big Village with a 30 Minute Radius

The citizens of the Sul have a high quality of life. Preferably they like to have all services and family members close by. The workers mainly commute between the agglomeration and the Sul.

Fred, 33, Media Designer

“I was born in Lourdes, and I still live in this neighborhood today. It’s very comfortable because I can go to work by bike and my family lives just around the corner. Apart from that there are many bars and restaurants around here. Savassi is the new heart of BH the place to go out in. I live here with my "other mom." She was our housekeeper and she brought me up. My apartment has 3 rooms, I changed it from 4 to have a more generous living room. All in all it measures 150 m². It’s very expensive to buy a flat here; mine would cost over 1 Million R$ nowadays. I never go to the Centro because there’s no need to, just occasionally to this one restaurant, which I like.”
Formally Programmed Environments
At the main square of Savassi, the liveliest neighborhood in Sul, four streets were modified into pedestrian public spaces, meant to attract commerce, bars and restaurants. The formal occupation of these streets creates a popular and safe space for the inhabitants of the neighborhood. For all of Belo Horizonte the area is also well-known for its nightlife.

Shopping Paradise
The artificial climate and the easy accessibility of different stores in a totally controlled environment is a very favored place to spend time. Shopping malls replace the outdoor public spaces, functioning also as meeting points.
Large-Scale Leisure Enclave

The Minas Tennis Club answers to the “life-style of Sul” to a large extent. In the middle of the dense cityscape the Minas Tennis Club occupies two blocks and offers a large leisure landscape of diverse activities. It all happens behind a high wall enclosing the whole two blocks.
From a Public Space to an Exclusive Sports Club

The history of the creation of the Minas Tennis Club is representative of the development of the southern area as a whole. The master plan of 1897 envisaged a zoological garden covering six blocks, but the plots stayed empty and unused for a long time and were informally used as a place for dumping waste. In the 1930s the governor’s wife was inspired by an article about the sports clubs in the USA and suggested this for Belo Horizonte. Several other actors were working out ideas for a tennis club in the city at the time. The planned zoological garden was concurrently discussed due to hygienic doubts raised as a reaction to the fact that predominantly residential buildings occupied the surrounding blocks. With this in mind the governor decided that a sports and recreation space would better meet the needs of the city and he declassified two lots of the former zoological garden in favor for a sports club, which was to be developed together with private actors. At the beginning the MT Club was a public institution providing a recreation space for all citizens of Belo Horizonte. Over time it got more and more privatized and equipped with variety of activities, and at the highest memberships were sold for 40,000 R$. Today the MTCub offers a vast composition of different sport and recreation elements. Memberships are not sold anymore but can be traded, and meanwhile their value went up to 100,000 R$. There is still a smaller part opened to the public, for visiting this part a day ticket costs 60 R$ which eliminates a visit to the complex for the broader public.

Demarcating Walls

For the passerby the complex can only be perceived from the outside from where the two demarcated blocks appear as a walled void in the dense city.

Private Oasis

Except the silhouettes of the surrounding high-rises, the visitor leaves the city behind when entering the complex—this is another world exclusively for the few.
Shift of Qualities?

By implementing commerce, work and leisure activities, which used to be more dominant in the Centro, Sul is today becoming a new hub. With the “fresher” character of the built environment and the new life-style of the south, Sul set itself apart from the historic center. This shift raises the question of the relation between Centro and Sul. The very formal and often introverted and enclosed atmosphere of the common and private spaces in Sul is standing against the collective uses of spaces in Centro.
CENTRO VIVO

The master plan has long reached its limits when it comes to handling and offering a functional traffic solution for the city as a whole, which has led to an increased yet conditioned independence of surrounding agglomerations and villages. The “Centro Vivo” project was initiated by the prefecture of Belo Horizonte with the intention to anew strengthen the role of the whole central area. The main idea is to revitalize the Centro by implementing housing, and integrating commerce in the southern areas. This should attract investment, liven up the area and reinstitute the centers’ role in the whole metropolitan area of Belo Horizonte.
Official Strategies
The “Centro Vivo” plan was initiated by the city council with an analysis of the Centro in 2007. The goal was to improve the bad image of the Centro and to unify the whole central area as an attractive vibrant place. Several projects have been realized so far, all of which act on different scales—from pedestrian improvement to housing projects.

Cleaning Up
Streets and parks, like the Raul Suases park, have undergone rehabilitation programs and general “cleanup” actions. The upgrading of the Centro has led to better safety conditions.

“Reabilitação do Hipercentro”
After the decrease in population between 1990 and 2000 the Centro-initiative is reaching its goals: and today we witness an increase in population.

“Requalificação Savassi”
Also in the southern neighborhood of Savassi improvements have been done. The square was modified in 2007 adding pedestrian boulevards to attract more commerce. Its success can be seen today: Savassi has become the new place to go out, with a broad nightlife offer.
Translating into Built Strategies

The former Cine Brasil, built in Art Deco style in 1932 at Praça Sete, screened its last movie in 1999. After that it was left empty and plans for destroying the building were made. But instead Cine Brasil was restored and reopened as a museum in 2013, attracting a lot of visitors ever since.

Hotel Tulpi - New Built Luxury

The newly built Hotel Tulpi at the northern, most abandoned, edge of the Centro, a turning of tides?

Hotel Excelsior - Renewal for Residential Uses

The Hotel Excelsior is getting rebuilt for residential uses. The future tenants will be students, elderly people, but also businessmen. A common leisure space will be implemented in the building to match with the new life-style tendencies. A lot of projects like this - implementing residential use in the Centro - are already underway.

Oiapoque — Relocating Street Vendors

As part of the Centro Vivo plan the government removed the street vendors from the Centro, and gave them a space in the new arranged “Oiapoque.” This action should bring more order and safety.

Improved Public Transport

The new Bus Rapid Transit Line will stop at the Centro, this will improve the traffic situation—though only slightly.
To Keep or Tear Down?
There is a strong general tendency to destroy old, low-rise buildings and build new ones, which bring all the comfort and profitability needed. Some of these old, to-be-protected buildings are deliberately abandoned in order to bypass the laws of building protection. Some protected buildings are renewed by the state, but because of lack of funding this is often done by private enterprises with a questionable result. There is an opposing tendency led by a small group of people, who occupy old buildings under protection and infuse them with meaning and program. The people in this movement are convinced that the cultural heritage of the city should not be forgotten and should be used as a space to implement cultural activities, brought by the citizens themselves. The movement started by the occupation of this building built in the 1920s, and it is believed to be followed by many more projects and initiatives like this.
COMMENTARY
METROPOLITAN CORE
The idea of a centralized, dense and vertical metropolis, as evidenced by Belo Horizonte’s grid, is more and more challenged by new centralities in the city’s suburbs. The infrastructural equipment of once purely residential districts, mainly in the south, answers to a new lifestyle built around security and comfort. The center’s age and diversity on the other hand are no longer attractive for Belo Horizonte’s upper and middle class. In the last years, it has seen a vicious cycle of abandonment, neglect and insecurity. Many important commercial, cultural and administrative functions have moved outside and the depopulation might at some point reduce the center to a empty service and transportation hub. Maybe the center’s traditional urbanity – boulevards and urban blocks – can’t compete with Savassi or Belvedere’s lifestyle based on more recent North-American role models with highways, condos and shopping malls. At the same time, slowly and gradually, there is a new generation of urban dwellers emerging, who move between both lifestyles. They have started to occupy the abandoned parts of the city center and are continuously reprogramming and revitalizing it.
BETIM E CONTAGEM
II

BETIM AND CONTAGEM
PRODUCTION AND LOCATION

BRAZIL AS A GLOBAL PLAYER
The String Pullers in the Industrial Development
The Industrialization Kick-Off
Industrial Districts in the Metropolitan Region of Belo Horizonte

CIDADE INDUSTRIAL: AN IDEAL CITY?
Connections and Disconnections
Hybridity
Eldorado of Commerce
Housing—a (Un-)Solved Matter
Criminality
Different Reasons for Green Spaces

FIAT —THE BIG FISH
In & Out: Accessibility and Infrastructure
The Conveyor Belt
The Allure of the Big Fish
Formal and Informal Services
Jardim Teresópolis—a Fiat Suburb

CINCO: LEGAL AND ECONOMIC ENGINEERING
Infrastructure
Sustainability and Environmental Protection
Legally and Economically Fostered
Shift from Heavy Industry to Supplier Industry
Adoption and Exchange with the Immediate Surrounding
Informal Infrastructure Supporting the Industries
The extraordinary economic growth in Brazil, particularly since the ’50s, has made it the sixth largest economy in the world. From being an agrarian society employing slaves, Brazil has made the transition from rural to urban, and from agrarian to industrial, in the last century, with the last few decades strongly marking this economic change. Brazil was a classic, monocultural, export-oriented economy well into the 20th century. At the turn of last century, coffee generated more than 90 percent of the value of all Brazilian exports, and even as late as 1960 sixty percent of the value of all exports still came from coffee. Today, manufactured goods generate more than seventy-five percent of the export revenues while coffee generates less than ten percent. Brazil's enormous industrial development has had its major industrial centers in the states of São Paulo, Minas Gerais and Rio de Janeiro, all located in the south of the country.

BRAZIL AS A GLOBAL PLAYER

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Emerging Economic Tiger: BRIC States

In the decades following World War II, the economic dominance of the United States, Europe, and Japan has been increasingly challenged by the rise of industry in Asia and Latin America. The industrialization of Brazil, China, India and Russia among others has been impressive and clearly sets them apart from much of the rest of the so-called Third World. By the 1980s this industrialization had begun to fundamentally alter the global dominance of the First and Second Worlds.

<table>
<thead>
<tr>
<th>Country</th>
<th>GDPComposition by Sector in Trillion USD, 2012</th>
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<tbody>
<tr>
<td>Brazil</td>
<td>2.476.651</td>
</tr>
<tr>
<td>China</td>
<td>2282.784</td>
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<tr>
<td>India</td>
<td>1.887.048</td>
</tr>
<tr>
<td>Russia</td>
<td>1.813.779</td>
</tr>
</tbody>
</table>

- Primary sector (agriculture & related activities, mining & quarrying)
- Secondary sector (manufacturing & construction)
- Tertiary sector (services: trade, real estate, finance, transport)

**Brazil**

- Brazil as a Global Player –– Betim and Contagem –

**Outgoing Brazilian Capital**

- Up to 0.10
- From 0.11 to 1.00
- From 1.01 to 5.00
- Over 10,00 % of total investment

**Incoming Investments to Brazil**

- Up to 0.10
- From 0.11 to 1.00
- From 1.01 to 5.00
- Over 10,00 % of total investment
Brazil's major exports are iron ore and concentrates (15%), petroleum oils, mostly crude (8%), raw sugar cane (6%), soya beans (5%) and poultry (3%). The major import products consist of cars (6%), refined petroleum oils (5%), parts and accessories for motor vehicles (4%), electronic integrated circuits (3%), packaged medicaments (2%).
The String Pullers in the Industrial Development

Brazil's economic development can geographically be described as polycentric, in which a limited number of new growth poles or regions have captured the lion’s share of the new economic activities. Especially because the new centers are close to São Paulo, the result has been far from a widespread decentralization. The growth of the Brazilian economy after 1930 is strongly connected with state investments, fiscal incentives and infrastructure construction in the industrial sector. In the specific case of Minas Gerais, it was not only the federal government but also, and especially, the state government that held the key to industrialization. It is possible to discern three powerful interest groups in shaping the industrialization process in Minas Gerais: politicians, technocrats and entrepreneurs. Our three case studies, although first selected because of their importance in the region, turned out to be each an excellent example of these three interest groups.
Polycentric Shift
For a long time in Brazil, industrial production was concentrated to the metropolitan area of São Paulo. As time passed the metropolitan region grew so much that it started to suffocate by its sheer size. Traffic arteries congested to the point of collapse, and still suffer immensely. Land prices, rents, relative wages, congestion and infrastructure costs rose sharply. On top of that, two types of costs placed considerable strain on entrepreneurial decisions: the increasing pressure exerted by labor unions (associated with strikes) and the legislation on pollution control (CETESB), which forced many plants to relocate.

Why Not the North?
A concentration of industrial complexes is unlikely to be located in less developed or less populated areas, since these areas lack the fundamental requirements, e.g. infrastructure for technology-based activities. Industrial growth is decided by, and largely dependent on, the assimilation and absorption of technological innovations. Assimilation tends to take place in more developed areas, thus reinforcing industrial concentration.

The Role of Minas Gerais
Although Minas Gerais was (and is) very rich in natural resources, industrialization came quite late, especially when compared with the explosive economic growth of the São Paulo - Rio de Janeiro axis. While the gold rush made Minas the richest captaincy in eighteenth-century Brazil, the exhaustion of gold by the 1770s left the region in decline and decadence. In the nineteenth century Minas grew slowly, largely on the basis of the production of beef, dairy products and other types of foodstuff for local and regional consumption. The situation started to change in the ’50s with Minas Gerais obtaining its relative share during the de-concentration phase of São Paulo. With the quadruple alliance of federal government support, foreign investment, national capital and the state government, Minas came to the fore with the strongest industrialization in the country during the ’70s. It played an important role as a complementary economy in relation to São Paulo, as a supplier of intermediary goods, foodstuffs, mineral and agricultural raw materials.
The Industrialization Kick-Off
The starting point for the industrial development of Minas Gerais was the foundation of the Cidade 
Industrial, situated at a distance of 9 km from Belo Horizonte to protect its urban core. This distance 
from the city made it possible to escape the concession of the company Força e Luz de Minas Gerais, 
a subsidiary of Bond and Share, whose power supply was insufficient and very expensive. Other factors 
that influenced the choice of this location were the proximity to raw materials and the availability of 
water.
Belo Horizonte’s First Two Industrial Neighborhoods

Minas Gerais was industrialized with a lot of effort and support by strategies formed by the technocratic government.
Industrial Districts in the Metropolitan Region of Belo Horizonte (RMBH)

There has been an urban expansion of Belo Horizonte towards the southwest along the road leading to São Paulo. This urbanization process came along with the creation of industrial parks. The biggest industrial areas in the Metropolitan region can be found in this western region, located in Contagem and Betim. One of the greatest tasks on the table for politicians, technocrats and entrepreneurs in the coming decades is how to de-concentrate this industrial growth in Minas Gerais and to develop other industrial zones in the state.
CIDADE INDUSTRIAL: AN IDEAL CITY?

Cidade Industrial in Contagem was the first industrial district in all Brazil and the starting point for planned and politically fostered industrial developments.
Connections and Disconnections

There are many inter-municipal streets allowing easy access to the Cidade Industrial. It possesses a strategic position as there are transit roads to all the important economic centers, like São Paulo, Rio de Janeiro, Brasília, Vitória and Salvador. However to get around in the district itself proves to be more difficult as one major highway divides the area in two, with the connections situated only on the edges and one in the center of the district.
The Hexagon And Its Road System
The Industrial City was planned as a hexagon and its road system consisted of radial and concentric streets going to the main square “Praça Antônio Mourão Guimarães”. Although the axes used to have the same width and importance, one of the axes namely the “Avenida Cardeal Eugênio Pacelli” which connects Belo Horizonte to Contagem and Betim grew to become the main connection to São Paulo and to the “Triângulo Mineiro” with its large economical centers Uberlândia and Uberaba. The street has therefore an immense volume of traffic today.

Enhancing the Traffic Flow
To improve traffic flow some modifications were made to the road system. The Avenida Cardeal Eugênio Pacelli was changed into a highway passing below the main square Praça Antônio Mourão Guimarães and the second of the three axes was closed off for cars and turned into a pedestrian zone in order to reduce the traffic volume passing through the square to some extent. But these measures created an imbalance in the usage of the streets: Some streets have an increased traffic volume whereas others are almost not used at all.
**Public Transportation**

There is a metropolitan train and some bus lines (TRANS-CON, BHTRANS and DER) connecting Contagem, and particularly Cidade Industrial, to Belo Horizonte. Furthermore there are other bus enterprises, which connect the district with the larger metropolitan area. The traffic situation is complicated further by the fact that some street sections are serviced by over a hundred different bus lines. Coordination among the different bus enterprises to avoid buses using the same routes would be paramount to decreasing the traffic volume.

**Leftover Spaces**

Some of the former public spaces have lost their meaning with the increase of traffic. Praça Papa João XXIII (1), for example, which used to be quite a nice square with green spaces, is now partly covered by the recently built viaduct and completely cut off. There is no road crossing, making it inaccessible to pedestrians. Praça Antônio Mourão Guimarães (2), though embellished by water fountains, nice pavement and palm trees is mainly used for circulation and not for leisure as the noise of the cars and the exhaust gases do not make it a very agreeable place.

**Pedestrian**

Pedestrians were certainly not an included parameter in the former planning of the industrial district but they are a reality nowadays, even more so with the appearance of schools and commerce in the industrial district. For pedestrians Avenida Cardeal Eugênio Pacelli acts like a barrier (3). The only possibilities to cross from one side to the other are two footbridges, situated 2 km apart from each other (4).
Hybridity

Cidade Industrial has turned out to be the most heterogeneous of the three industrial districts we studied. One finds various scenarios in the district: public buses drive through heavy-industry zones with difficulty, they pass by big trucks parked all along both sides of the streets (1), then boulevard-like streets (2), informal housing next to industry (3,4) and even commerce and restaurants (5,6). The industrial district itself has become a city within the city.
The Plan Amended
Besides the governmental interventions many additional alterations were made to the original plan of the symmetrical hexagon. Enterprises expanded and merged allotments and sometimes embedded streets into them (1) or informal settlements occupied vacant allotments, in some cases even expanding into the streets (2). Many parcels are disused and occupied by inactive industries, but on some of the unused spaces new service infrastructure has emerged. One of the now closed main axes is being used as a parking lot and there is even a nursery school in the street, making good use of its width (3).
The Modernist Plan Overruled

Although the basic idea was to separate industries in order to avoid any incompatible proximity between industries of different activity, they finally mixed all the same. The plan did not work out, simply because there were not enough industries matching the exigencies to fill up the provided allotments. Nevertheless there is still a predominance of industries of the metallurgical and the mechanic/electrical materials branch.
CEASA and the Itaú Power Center
Contagem started to attract people from the entire metropolitan region of Belo Horizonte following the creation of the Itaú Power Center (1) as well as the CEASA, founded in 1974, the second largest wholesale supply center in Brazil and the most diversified one in the world. This in turn attracted even more shopkeepers.

Informal Services
Shopkeepers were not the only ones to benefit from the large commercial centers; a whole range of informal services appeared such as this informal car wash station on the sidewalk at the main street leading to Itaú Power Center.

Eldorado of Commerce
Cidade Industrial, formerly planned to house only industries, is quickly becoming an Eldorado of commerce. The increase in the buying power of the new middle-class is partially responsible for this development but, most of all, what makes it so attractive for commerce is the high flow of people daily passing through the Cidade Industrial on their way to work. A look at the map above confirms this: most of the informal food stalls are located near bus stops. The new Itaú Power Shopping (1) is a good example of what is taking place in the region. What was once one of the largest cement plants in the State of Minas Gerais and one of the main suppliers of raw material to the construction site of Brasília now has given way to the same-name Shopping Center Itaú Power. The chimneys of the former plant remain as a remembrance of the past.
Housing—a (Un-)Solved Matter

Although Cidade Industrial had been planned beforehand, it was not prepared for the enormous exponential growth of the population. There was a small working class area allotted in the original plan but for unknown reasons it was never realized. Thus it was left to the industries to house their workers on their own lots. Another fact that aggravated the housing situation was the absence of a regular collective transport, which made it difficult to get there, encouraging the emergence of the informal housing we see today, which continues to develop, although not necessarily housing only workers.

Sudden Population Growth

Workforce demand in industry attracted an enormous amount of people from rural areas to Contagem. Between 1950 -1960, at the time of the consolidation phase of the Cidade Industrial the population quadrupled. As no housing was provided, the workers began to build their houses themselves in the vicinity of the industries. In fact one still sees some informal shacks in the midst of formal houses when strolling around the neighborhood.

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Housing Provided by the Industries

Only two private enterprises provided housing for their workers; Magnesita and the Portland Cement factory Itaú, which constructed the Vila Operária. The neighborhood was created on the compounds of the factory and it consisted of up to 240 houses and offered a complete service sector of cinemas, pharmacies, small shops, a chapel and even a small medical station. There was an ambulance and a bus to bring the workers’ children to the schools at that time only located in Belo Horizonte. After the closure of the plant in 1998 the village was demolished to make place for the Shopping Itaú Power Center.

Housing Provided by the Government

The construction of the JK housing estate in 1958, adjacent to Cidade Industrial, was an attempt of the government to solve the problem but it was just a drop of water in the sea. It was a part of the Housing Plan of President Kubitschek, a scheme to improve the housing problem and to bring workers closer to the industries concentrated in the region. The Fundação da Casa Popular (Popular Housing Foundation), an organ of the federal government, delivered all in all 400 brick houses, their form, architecture, size and rooms exactly alike. The JK suburb provided a model during the 1960s and 1970s for the development of other local neighborhoods such as Eldorado. The increase in the number of inhabitants in the newly developed region brought about a growing demand for services and products with it. The JK houses were repaid through monthly amortizations to the federal government.

Sudden Population Growth

Workforce demand in industry attracted an enormous amount of people from rural areas to Contagem. Between 1950 -1960, at the time of the consolidation phase of the Cidade Industrial the population quadrupled. As no housing was provided, the workers began to build their houses themselves in the vicinity of the industries. In fact one still sees some informal shacks in the midst of formal houses when strolling around the neighborhood.

Housing—a (Un-)Solved Matter

Although Cidade Industrial had been planned beforehand, it was not prepared for the enormous exponential growth of the population. There was a small working class area allotted in the original plan but for unknown reasons it was never realized. Thus it was left to the industries to house their workers on their own lots. Another fact that aggravated the housing situation was the absence of a regular collective transport, which made it difficult to get there, encouraging the emergence of the informal housing we see today, which continues to develop, although not necessarily housing only workers.
Rejected Plots
Enterprises occupy those parcels offering the best conditions of accessibility and adequate sanitary infrastructures, and kept away from less favored areas and those not suitable for buildings such as the banks of streams. Instead these unsuitable leftover areas were later occupied by families trying to stay in places close to services and especially close to the job opportunities, thus initiating the formation of informal settlements. As one can see on the map on the facing page almost all informal settlements are located near creeks.

Earth Slide in Vila Barraginha
Vila Barraginha was created at the end of the 60s, and consisted of 20 houses built in a small valley formerly used as a waste dump. The name Barraginha refers to an old artificial dam located here, and whose water was used by the industries close by. Since Vila Barraginha was built near a creek, on soil unsuitable for permanent constructions, there were numerous landslides. A serious landslide occurred in 1992, caused by earthworks of an industry located nearby. There were 37 deaths; hundreds of injured and 1,700 people lost their homes. The small chapel that remained standing after the natural disaster now serves as a community center. The place formerly occupied by houses is now used as a football ground. Some inhabitants nearby said that there are plans for creating a jogging route there.

Housing Areas in and around Cidade Industrial
Most of the residential neighborhoods we find in the area today are informal settlements. The few formal housing areas have paradoxically been evicted and demolished.
Expropriation

The informal settlement Vila Itaú (1) in Cidade Industrial is now being expropriated due to the construction of a containment dam (2) as part of a governmental program of urban and environmental re-qualification of the Ferrugem river. This program aims at tackling the problem of floods and pollution of the river. For that reason five containment dams will be constructed in the near future necessitating the expropriation of two more informal settlements. The inhabitants will be relocated to a settlement built by the city council. Marina Almeide who has lived there for over 20 years complains that her family is being forced to accept 80,000 R$ for a house worth 300,000 R$ nowadays. Like many others she doesn’t want to leave the town. Vinícius Marcus Nonato da Silva, a member of the committee of Human Rights of Minas Gerais, questions if it is really necessary to expropriate so many families as there are other places where the dams could be built.

Resettlement: An Imperative or an Excuse?

Water is constantly being polluted with wastewater and garbage coming from informal settlements located near rivers. Floods during rain season and subsequent landslides are an imminent danger for these settlements. Until now, the policy of local councils is to transfer the settlements, but the question is, is this really the only viable solution?

Minha Casa, Minha Vida

“My House, My Life” is a program of the Brazilian federal government aiming at fulfilling the dream of many Brazilian families of having a house of their own. In general, the program is carried out in partnership with the states, municipalities, enterprises and non-profit organizations. For those with an annual gross income of up to R$ 5,000 the program offers certain facilities such as discounts, subsidies and a reduction in the costs of home insurance. Upon free registration by the interested parties, the local council authorities select the families in accordance to multiple references and conditions. The selected families receive information about the date of the draw of the housing units and the date for signing the purchase agreement. The program provides quotas for elderly people, people with disabilities or reduced mobility. In the case of expropriation as in the case of Vila Itaú these families will have priority in being allocated new houses.
Industries Feel Threatened By Informal Settlements

For many years the uncontrolled urban sprawl was a reason for concern to a large number of the enterprises located in the Cidade Industrial. Many informal settlements were just next to the industrial estates (1). Many enterprises attribute the lack of security in the district to the presence of a great number of informal settlements.

Criminality

Cidade Industrial has the highest crime rate in the region of Contagem. A look at the plan above shows that practically all the crimes are committed on the main circulation streets. The majority of the crimes committed are thefts on pedestrians. The high flow of people daily passing through the Cidade Industrial on their way to work attract this kind of petty street crime.

A Park Instead Of Settlements

Complying with the requests of many enterprises the county cleared away some of the informal settlements and built parks in order to avoid further resettlement (2, 3). Although these parks actually create a very nice atmosphere in the dry industrial landscape, our survey showed that the inhabitants of that neighborhood do not make any greater use of these spaces.

<table>
<thead>
<tr>
<th>Avenue</th>
<th>Criminal Incidents</th>
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<tbody>
<tr>
<td>Av. General David Sarnoff</td>
<td>34%</td>
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<tr>
<td>Praça Antonio Mourão Guimarães</td>
<td>9%</td>
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<td>Av. Babita Camargos</td>
<td>16%</td>
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<tr>
<td>Av. Cardeal Eugênio Pacelli</td>
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<td>12%</td>
</tr>
</tbody>
</table>

Armed assault on pedestrian

- Av. General David Sarnoff: 1008
- Praça Antonio Mourão Guimarães: 723
- Av. Babita Camargos: 235
- Av. Cardeal Eugênio Pacelli: 277
- Av. Babita Camargos: 295
- Av. Cardeal Eugênio Pacelli: 170
Reallocation Necessary

Most industries do not use their parcels of land to their full capacity. At the time of the foundation of Cidade Industrial traditional industries used much more space but this changed with modernization and restructuring of the production. Outsourcing parts of the production and the implementation of new technologies led to the reduction of the built square meters. It would be necessary to reallocate plots as to reach higher land-use efficiency. Moreover, many enterprises would be willing to sell unused parts of their plots.

Different Reasons for Green Spaces

By law, industries can only build on up to 55 percent of the area of their lots. The remaining area is to be kept unbuilt to serve as a permeable surface for natural drainage during the rain season as a protection from the relatively high flood risk. Taking this into account, there still remains an unusually large green area in the Cidade Industrial. On one hand this is due to the fact that many deactivated/unused plots are simply abandoned and on the other hand due to the fact that certain industries are not using their lots to full capacity. The problem is that lots are sold with certain constrictions, including a deadline for the construction of the plant. However there is no regulation concerning what should be done when a plant is deactivated.
FIAT—THE BIG FISH

The installment of the Fiat plant in Minas Gerais was a big stepping-stone in the industrial and economic development of the whole state and for Belo Horizonte especially. But it was not without an enormous fiscal incentive from the state government: the state offered an area of 200 ha for a symbolic price to be paid back in 45 years and provided the necessary infrastructure free of charge in the area where the plant was to be built. The state government also purchased 46 percent of the stocks of the new company. Fiat received tax exemptions for 10 years and capital loans from public banks. Although Brazil has not been very successful in generating local technological innovation, Fiat is an excellent example for Brazil’s ability not only to copy the latest technological innovations, but also to generate their own versions and improvements on this technology transfer.
In & Out: Accessibility and Infrastructure

The Fiat plant is situated on the highway leading from Belo Horizonte to São Paulo. The dynamic of access to the factory is well organized. There are five different access gates, each of which has its specific function and access authorization. On the western side of the factory are the gates for the suppliers and the factory workers and on the eastern side are the gates for visitors, business partners and white-collar workers.

West Side

The west side is alive and full of movement. There are informal car washers, food stalls and vendors. It seems as though the streets are not as well maintained as the east side as they are full of bumps.

East Side

The east side of the compound is kept clean and tidy in order to create a good impression on customers and visitors. There are taxis and formal car parking and a proper street signal system.
**Informal Collective Transport**
The public transportation system was quite bad at the time when the first industrial parks in Contagem were created. Workers decided to address the issue, get organized, and created a form of collective transport so they more easily could reach their place of work. Their initiative was so successful that private enterprises started to offer the same type of collective transport to companies.

**Relationship between Peak-Hours and Shift Times**

Nowadays, in spite of a significant improvement in the public system of transportation, the great majority of the industries make use of this service as most of the workers work in shifts, with the first shift starting at about 5:30 in the morning, with the first shift starting at about 6:30 in the morning. Fiat has three shifts. The times of the shifts are set so that the schedule of their private collective buses do not coincide with general traffic peak hours.

**Fiat Plant—A City In Itself**
The Fiat assembly plant can be compared to a city as it possesses all kinds of additional infrastructure—even such functions as firefighters and a police force (also acting as traffic agents and issuing parking tickets for parking violations). There is also a small medical center equipped with a ward for heart surgery (!), some shops and four different restaurants, one of them catering for people on a diet or with food allergies. They are also equipped with their own waste disposal system. Besides all this Fiat also offers a wide range of services for their workers: life insurance, a leisure club in Betim equipped with sports facilities and a venue where the employees can have parties and participate in cultural activities.
Organization
Assignment and management
Fiat Power train Technologies
Research and technology
Car Parts Storage
Momentary storage
Press and Bodywork
Car body press and production (1 & 2)
Paint work
Painting the body (3)

Car Assembly
(4 & 5)

Testing track
Cars are tested on this track or are sent to the streets, but not without a “costume” to maintain the design secret. If problems are recognized it goes back to car assembly (6).

Fiat Transfer Patio
Storage of finished cars for 3 days before pick up.

Ecologic Island
Package styrofoam and 99% of water used in production are recycled and cleaned here.

Conveyor Belt
The smooth streamlined production organizes the work inside Fiat’s factory.
The Allure of the Big Fish

When Fiat installed its plant in Betim it attracted a whole range of suppliers to the region. Fiat imposed the “Just-in-Time” delivery network, which means that their suppliers have to be located within 150 km from their plant. This enables the suppliers to react faster to changes in demand from customers and prevents Fiat and their suppliers to waste money on storage as well as reducing transportation costs.

Fiat’s Suppliers

Moving around in Betim and Contagem, you see Fiat suppliers everywhere. In the closest industrial park Cinco a larger part of the establishments cater to Fiat.
Public transportation
Fiat’s internal transportation:
parking and tracks inside the factory
Fiat transport system for workers, bus stops

Informal restaurants and commerce
(regular menu: R$1.50)
Restaurant for workers inside the Fiat factory
(menus: R$0.50 - 2.00)
Petrobras gas station

Formal and Informal Services
Responding to the continuous movement of supply deliveries to Fiat, an informal market of commerce has appeared around the perimeters of the factory, consolidated for over twenty years now. The prices here are in a higher price range than in other industrial districts. The offer is diverse, ranging from car washers to food stands, jewelry shops to electric toy sellers.

Service Offers
Next to established gas stations (2) and kiosks (3, 4) temporary market stands offering a variety of goods (1) flank the streets and the entrances of the Fiat plant.
Jardim Teresópolis—a Fiat Suburb

The suburb Jardim Teresópolis, a neighborhood opposite the Fiat factory on the other side of the highway, was initially planned as a housing development during the ‘40s by a real estate company called COMITECO. Initially it was advertised as an idyllic and restful place with large lots full of trees intended for middle-class families. However, as sales were negligible the company decided to make the whole approach more popular and started to sell the lots cheaper but without the planned infrastructure that would have been the responsibility of the Betim and Belo Horizonte councils. At the beginning of the ‘50s, the first residents arrived at Jardim Teresópolis. When then Fiat set up a factory in Betim in 1976 many migrants arrived from the countryside hoping to get jobs, but they could only do unqualified work because of their lack of education. So it was that people started living around the industries and Jardim Teresópolis was one of the sites that grew into an informal settlement lacking all infrastructures and in particularly lacking basic sanitation. Nowadays there are though many programs aimed at improving this infrastructure and formalizing the settlements.

Árvore da Vida—The Social Program of an Industry

Fiat has a policy of keeping a good relationship with the community called Árvore da Vida (Tree of Life) guided by values such as valuing life, transformation, prosperity, the autonomy of human beings and sustainability. It was developed by Fiat in partnership with the NGOs Fundação AVSI and CDM, active since 2004. For seven years, this policy has helped more than 14,000 people and 109 local institutions. Besides educational and recreational activities (1) aimed at helping children and young adults to believe in their future and to get better results in school, there are also apprenticeships (2), courses preparing students to find a place in the labor market, programs for strengthening the community and family counseling. These initiatives foster the autonomy of the human being and the empowerment of communities so that they become the protagonists of their own future. Furthermore there is a program, which at the same time generates income and respects the environment by using waste material from the Fiat factory. Materials that remain from the industrial production and that normally would be thrown away are used by craftswomen to create innovative pieces; the leftovers from safety belts and automotive textiles are thus transformed into bags, backpacks and other types of accessories.
In 1970, after the lots of Cidade Industrial were all used up, the Industrial Center of Contagem, CINCO, was founded by an initiative of the public sector, as the second biggest project for industrial expansion in Minas Gerais. A hundred new factories were planned and with them 20,000 new jobs.
Installed Infrastructure
Cinco was planned thoroughly; its location was not arbitrarily chosen but decided upon after a survey of the conditions of the whole region, and taking into consideration especially the proximity of the supplier and consumer market, as well as the easy access to the reserves of manganese from the “Quadrilátero Ferrífero,” and the Refinaria Gabriel Passos which is located also in Betim. CINCO was provided with all the infrastructure that Cidade Industrial lacked so bitterly. Within the start-up period all services were installed, including the implementation of water, sewage and drainage, but also street lighting, asphalted streets and sidewalks and even the planting of trees along the streets was finished (1). A telephone network was also integrated into the existing system of Belo Horizonte. In the past, the telephone network in the Cidade Industrial lacked so precariously that if you had to speak to someone in Belo Horizonte, it was quicker to drive all the way up to the capital and talk to the person directly rather than wait for the telephone connection to be established.

Well-Provided Industries
In congruence with the high demand on well-functioning infrastructure a power substation was built to secure the crucial power supply and railway transport for freight trains between the capital and the new industrial district was implemented.

Infrastructure
Considering the mistakes made when founding Cidade Industrial, where it became clear that the implementation of infrastructure was crucial for the prospering of the industrial district, efforts where made in CINCO; here the entire infrastructure was in place within the first 18 months. The establishment was subsidized by the Brazilian Development Bank (40% of costs) and the county of Contagem, which for the first time took an active role in supporting the industrialization process (offering the remaining 60%). Previously, this had solemnly been done in the costs of the State.
Sustainability and Environmental Protection

Sustainability and environmental protection are concepts that Brazilian politicians have neglected for a long time. According to Jander Filaretti, the principal of the council for environmental protection, it is only in the past ten years that an important change in the way of thinking of the population has been brought about. Numerous pro-green movements have more recently gained strength and different programs have been created aiming to increase public awareness in environmental issues. Compared to Cidade Industrial the conceptualization of CINCO respected the urban fabric and was well integrated without neglecting the environmental aspects.

Helping the Industries to Be Sustainable

When CINCO was founded 20.5% of the area in the industrial district was reserved for green space. In this open space a tree nursery can be found today (1), this since industries have to replace every tree that is cut on their ground by law. These trees are replanted in the city after they have reached a certain height. It is striking how green and clean the area is (2); it is kept up by regular maintenance and cleaning services (3). Laws stipulate that the companies adhere to waste separation and, in partnership with ASMAC, an association of waste collectors, the city of Contagem has established waste treatment facilities for recyclable materials (4) in immediate proximity to the premises of CINCO.
Legally and Economically Fostered

During the time of consolidation of the industrial parks, many organizations were founded to create a support structure fostering the industrial development. By the end of the ’60s, at a time when the economy of the State of Minas Gerais had outrun the national economy in terms of its mining and transformation industries, three important institutions were established: the Development Bank of Minas Gerais (BDMG), the Institute of Industrial Development (INDI) and the Company of Industrial Districts (CDI). Banks played an important role in the industrial development as they helped to appropriate the lots needed to build the industrial districts and provided valuable financial resources for the crucial implementation of infrastructure but also for the supporting vocational training.
The Shift from Heavy Industry to a Supplier Industry

The period following the implementation of the Cidade Industrial can be divided into two distinct phases. In the first phase there was a predominance of the processing industry, i.e. the conversion of raw materials within traditional industrial branches such as metal-mechanic and non-metallic minerals. In the second phase after 1966, there was a diversification of the industrial structure with the creation of the autarchic CINCO—this was a discernible shift from the production of consumer goods to the production of intermediate and investment goods. This was intensified between 1994 and 1998 when traditional industries were adversely affected by the country’s opening-up to the world market, as well as the fall in governmental procurement due to the fiscal crisis. In the metal industry however, there was a drop in the number of employees, but at the same time an increase in the number of establishments, which could indicate an increase in effectiveness and in the output of the sector.

With the Supplier Industry the Transportation Industry Came

After the industries in Contagem became specialized in intermediate goods, logistics gained in importance. This explains the amount of logistic enterprises which have settled in CINCO (see plan on the facing page), under which also driving schools for truck drivers are to be found.

Complimentary Service Offers

With the high flow of traffic on the roads between the industrial parks many sex motels such as the here seen “Love Story” took shop along the busy street, catering to workers and drivers.

Portable Equipment

Since truck drivers often are on the road for many days, their trucks are well equipped and they often even have a small cooking station at the side of the truck. Many “sex motels” appeared along these road stretches. Attendance reaches peak time at 5 o'clock after work is over.

The diagram shows the distribution of different industries and services in the CINCO area.
Adaptation and Exchange with the Immediate Surrounding

Only large and important industries are able to pass the evaluation test of CINCO. Since small-scale industries are not interesting enough no place was assigned to them in the park. Several smaller support industries have now established in the residential area around the industrial district instead. One of them is Usicam Usinagem (above), which produces different metal parts for machines.

Creative Appropriation

Sometimes the exchange between industries and residential areas can create unexpected things. After the installation of electric cables at a nearby industry, the inhabitants used the remaining cable reels to make tables and create a small place for leisure in the shade. It is still being used for barbecues every Sunday.
Informal Infrastructure Supporting the Industries

Some street vendors, living in the immediate vicinity of the industrial district, have set up stalls offering two different meals a day to truck drivers and operatives (3). Along with the establishment of the smaller industries in the residential zone other types of services also appeared. Some residential houses were converted and contain functions such as restaurants to meet the growing demand from the workers in the area (1,2).
COMMENTARY
BETIM AND CONTAGEM

Looking at the temporary constellation of industrial areas and production in the vicinity of Belo Horizonte the municipalities of Betim and Contagem pronounce their relevance—not only historically as the site (Contagem) of the first implemented and planned industrial town during the city’s relatively late industrialization, but also as centers of the current industrial production.

By mapping and investigating the genesis of three different sites, originating in different decades but transformed in relation to, or reacting to, each other, this chapter unfolds the parallel stories of formal establishments and investments supported by, or in some cases succeeded by, informal occupations—including housing—and infrastructure, and how these have evolved side by side in the industrial sector. The partly failed establishment and realization of the centrally planned, modernistic industrial town of Contagem is compared to the more recent “engineered” industrial area of Cinco, an industrial site which developed in response to the well anchored and exclusive car plant of Fiat. Also their respective role and engagement in their surrounding communities and in the city as a whole is described, as are the federal support systems and incentives. The economic success of the examples is compared and contrasted, the history of industry developing in the city is tackled in great detail, and the progression of industrial development is well mapped—one has a very good idea of the relationship of the city to its still relevant industrial base, and the spaces and lifestyles that this creates.
VETOR NORTE
VETOR NORTE
A DISPUTED TERRITORY

TERRITORIAL DEFINITIONS
Many Norths
A Fragile Landscape

ISLANDS AND SEA
An Informal Sea
Borders or Boundaries
Planned Islands

SOIL AND INFRASTRUCTURE
A Large Network of Railways
Benefiting from the Soil
A Radial Road Network

“THERE IS FREE LAND IN THE NORTH”
Economic Strategy: Match São Paulo by 2030
A Complicated Reality
TERRITORIAL DEFINITIONS

Vetor Norte is one of the most important expansion axes of Belo Horizonte, stretching northwards from the city center. The definition of the vector is less clear, originating from an uncoordinated structure of public planning actors. This also complicates the handling of the region, which already is affected by diverse urbanization incentives.
Many Norths

Because of the size of the area and its diverse characteristics, various actors define different borders for Vetor Norte. In terms of economic concentrations, the area would be linked to the industrial cities of Betim and Contagem; the administrative definition is excluding the center but including municipalities less integrated in the metropolitan region. On the other hand, planning actors choose to define the territory based on interesting urban developments.
Areas of Study

ISLANDS AND SEA
1 Venda Nova
2 Riberão das Neves
3 Linha Verde
4 Pampulha
5 Cidade Administrativa of Minas Gerais

6 International Airport of Confins
7 Aerotropolis
8 APA Carste
9 Rail and Soil Resources
10 Road and Real Estate
1897: Creation of Belo Horizonte based on the Plan of Aero Pires

1927: UFMG, Federal University of Minas Gerais, around 41,000 students on an area of 8.7 M. m²

1940: Pampulha
Artificial Lake and residential neighborhood induced by Mayor J. Kubitschek (1940 - 1945) with cultural landmarks designed by O. Niemeyer

1933: Airport of Pampulha
1973: Privatization, operated by Infraero
2005: Governmental Restriction, operations forced to move to Confins
2012: Project of Revitalization: R$ 174,000

1938: Penitentiary Jose Maria Alckmin
2006: Prison Inspector Jose Martinho Drumond built for 820, counting 2,033 prisoners in 2012
2013: Project of first Public-Private Prison Complex CPPP for 3,040 persons

2010: Administrative Complex of Minas Gerais Conceived by Governor Aécio Neves (2003 - 2010) designed by O. Niemeyer of 804,000 m²: 17,000 employees
Moving from former Executive Offices Palácio da Liberdade (Liberty Palace), the first building to be finished during city’s planned development in 1890s

1993: Founding of Municipality São José da Lapa, 2010: Jardim da Gloria: 45% unemployed

2013: Alphaville Minas Gerais 873,238 m², 2,700 MR$ for 1,500 expected persons

1870: first settlements around chapel constructed by Joaquim da Silva Menezes
1897: Creation of Belo Horizonte based on the Plan of Aero Pires

1940: Pampulha
Artificial Lake and residential neighborhood induced by Mayor J. Kubitschek (1940 - 1945) with cultural landmarks designed by O. Niemeyer

1940: Pampulha
Artificial Lake and residential neighborhood induced by Mayor J. Kubitschek (1940 - 1945) with cultural landmarks designed by O. Niemeyer
A Section of Development: New Land Transformations and New Centers

1960s: First Limestone Mining
1894: Railway Station of Vespasiano
1948: Founding of Municipality of Vespasiano
1975: Cimento Liz
220,000 t/year of Cement 382 Mil US$/year 1,07 4 jobs

Sinkhole of Confins
1975: First Condominiums in Lagoa Santa
2013: Up to 30 existing Condominiums in Lagoa Santa

1984: Airport of Confins
2005: Upgraded to International Airport
2014: Expansion to Airport City: 2,4 Bil. US$

1870 Textile Factory Pedro Leopoldo
1895: Railway Station
1973: Holcim Cement Production
1983: Federal Institution LANAGRO

Eucalyptus Plantation of Precon,
Nature Compensation for Mining Activities

1840s: First Fossil Founds by Peter Lund (1801-1880)
1970: Discovery of Luzia, the most antique human Fossil of South America
1990: Inauguration of APA Carste
Karstic Soil Properties, Formation of Caves

2014: Reserva Real by Grupo Design Resorts
11 million m², 2 Billion R$ expecting 20,000 Persons

2013: Projects of Aerotropolis under Construction

- Territorial Definitions –

- Territorial Definitions –

- Veto Norte –
A Fragile Landscape
The northern area is characterized by highly hydropic land with several river basins—which were protected by the government by a federal law in 1979 in order to preserve the natural sources—by cultural heritage, historical and archeological sites. The territory includes the municipalities of Confins, Lagoa Santa, Pedro Leopoldo and Matozinhos all in the northern parts of the RMBH.

Crystal Clear Water in the Protected Area of Serra do Cipó
APA Carste of Lagoa Santa

The area under environmental protection is dominated by karstic reliefs, mainly limestone rocks. The groundwater quantity, which is of the higher importance due to the fragile and permeable surface, is regulated by a subtle equilibrium. The karst area contains sites of limestone excavation, eroded surfaces, hanging arch-openings to underground karstic caves (with roofs like on the picture above), sinkholes and lakes.
The Vetor Norte central area has been constantly transformed in the past twenty years. On the one hand, the attempt of creating landmarks generated planned islands and on the other, the insatiable urge for housing induced a sea of low rise, simple constructions. Both the rural exodus and the ambitions of building a representative capital have been shaping the contrasted territory.
An Informal Sea

At the beginning of the 20th century, the region of the actual district of Venda Nova was farmland. With the creation of the Pampulha complex in the ’40s and the announced urban reform, a lot of farmers were urged to sell their land. The rural exodus in the ’70s meant a significant in-migration to the cities. Migrants looking for cheap free land rapidly settled in the north of Belo Horizonte. Because of the demographic explosion and the lack of public investments in infrastructure, the living situations where precarious, a state that was manifested over the following decades.

Rua Claudio Manoel, 1928
The picturesque view from the beginning of the century is hardly to be discerned today.
Venda Nova: A Dense Urban Fabric

The fast settling of new people and the lack of planning in the region of Venda Nova have created a dense and disordered urban fabric. Only the two main roads, the Avenida Vilarinho and the Rua Padre Pedro Pinto, connect Ribeirão das Neves to Linha Verde, the main highway leading to the city center. Today Venda Nova is a commercial and residential district with a low average income and a population density of 9,261 inhabitants/km².

Gathering Together

The dense urban fabric is at times interrupted by unbuilt free patches of land, often used as football fields, which fulfill the role of public spaces.
An Informal Expansion
The formation of new informal settlements is still mostly concentrated to the central parts of the north. However, the reason for the territorial expansion has shifted from rural exodus and internal migration to land valorization. Low class people cannot afford their locations anymore and have to re-settle further away from the city center. Because the formal process of registering a new house takes too long and is expensive, they settle informally on new land without infrastructure, sometimes very quickly. Almost a quarter of the whole population of Belo Horizonte lives in informal dwellings.

Legalizing the Informal
The act of “land regularization” as a measurement to fight the informality and to control the informal expansion first appeared in 1983. The applicant asks for a regularization of his house in order to have more security and to increase the value of his property. The process lasts for about six months and includes a land registry and geo-referencing in order to obtain official land ownership.

A Poisoned Gift
In the past decades the government facilitated the increased consumption, especially of cars: “Everyone should have a car!” On one hand mobility became more accessible, but on the other, traffic increased significantly and poorer people only gained a limited improvement to this means; the majority still being dependent on public buses for travels of longer distances.
Ribeirão das Neves: An Isolated Ghetto

Neves, a municipality in Vetor Norte, is a poor neighborhood located in the west of the district of Venda Nova. Since there are only a few job opportunities, it is considered to be a dormitory town.

Left out of Vetor Norte

For some investors and businesses, Neves is not even part of the Vetor Norte. Their lack of interest in the town is linked to the neighborhood’s bad image. Instead informal actors see to the neighborhood’s needs, like here where small informal commerce is found along the street in front of the prison.

“Let Us Protect Our Children”

Driving out of the town, one can notice this sign where people are requested to denounced violence on children. Neves is infamous for its high criminality rate. It is also known for having a large prison.
"Think, don't vote" is written on this wall—the Linha Verde Highway going north from the city center. From Jardim da Gloria—a very poor neighborhood—the highway, supposed to be a connection, appears just so: a tall wall. Roads connect strategic points but they do not necessarily increase the mobility for everyone. The gap between social classes is still deep and can be felt in urban spaces like these where the rich only rush by.
Two Norths: Social Disparities
The mono-centric model induces a strong dependence of the periphery to the center. The central north is especially dependent on the center because of its lacking job opportunities, while the north is more independent, with, among others, the Airport of Confins generating jobs. Moreover a parallel can be established between the central north and the southwest, having similar high rates of poor and medium HDI.

Different Dynamics
The main expansion vectors are the north and the west, which is indicated by the higher population density in these regions. Again, the central north follows a different development pattern than the north, growing faster and counting a higher population density.
Different Realities
A worker appears like a shadow on the ground floor of the Cidade Administrativa. The administrative center of the state employs around 3,000 people; among them there are not only official state employees but also a lot of lower paid maintenance workers.

Ghettoization
“We have never been to Neves. It is not recommended to go there alone.” Mateus and Marcella, as many students, have been advised not to go to Neves. The ghettoization happens not only physically but also mentally, there is a “culture of fear” of certain suburbs in the city, which, fair or not, can be felt in the neighborhood itself.

Interdependence
Some commuters are waiting patiently at the bus station, where a tent was added to protect them from the sun. The city is dependent on its workers and the workers are dependent on their jobs, concentrated in the city center. The uneven distribution of both jobs and housing possibilities urges for decentralization, but also for better bus connections.
The Road to the North

The Linha Verde is one of the biggest road projects of the past years in Belo Horizonte. The project includes the Boulevard Arrudas, the Avenida Cristiano Machado and the highway MG-010. For the last road, the CODEMIG (Company of Economic Development of Minas Gerais) invested 100 million R$.
A Deep Cut in a Sea of Houses

The Linha Verde highway leads directly to Confins International Airport and Lagoa Santa; 3.5 million people are estimated to benefit from the road. It was realized as part of an economic strategy to develop the airport and its influence range, and along its stretch—where it crosses the dense and poor area of Venda Nova—complexes concentrating economic or political power, like here the Cidade Administrativa, have been, or are being planned.
Planned Islands

The north of Belo Horizonte has always represented the promise of infinite possibilities. The Airport of Pampulha (2) was built in 1933 as a military base in order to connect Rio de Janeiro with Fortaleza. In the 1940s the visionary, and at the time prefect of the city, Juscelino Kubitschek had the idea of the Pampulha neighborhood. Oscar Niemeyer designed the Church St Francis of Assisi (3), the Dance Hall (6) and the Art Museum (4), which made the site an attraction of Belo Horizonte. Later, as the University of Minas Gerais (1) became federal, the campus was moved to Pampulha. Also the stadium Mineirão, built in 1963, soon became a symbol for the city, followed by the Mineirinho (5) seven years later.
Visions and Reality

In Kubitschek’s idea for Pampulha the artificial lake was meant to be the “Sea of Belo Horizonte”, and the whole complex was supposed to be a landmark. Sixty years later, Pampulha is still a well-visited destination, however, the district of Pampulha has turned out to be an area with high social disparities, where large residences are close to poor and dense settlements.

A Landmark

Pampulha is still today known for being a weekend destination, with among others the Guanabara Amusement Park.

The “Sea” of Belo Horizonte

Pampulha Lake should have made up for Belo Horizonte’s missing beaches. The artificial lake is now polluted and is not as attractive as before.

An Island in a Sea of Houses

The old park gave way to a diversified urban fabric as the city swallowed the region in the 1970s with its expansion.

An Island in a Sea of Green

At the time of its creation in the 1940s, Pampulha was still surrounded by nature and green areas.
A Giant in a Park
The new Administration Center of Minas Gerais was inaugurated in 2010. The buildings were realized according to plans of Oscar Niemeyer, one of his last projects. The complex is located in the old Jockey Club of the government and surrounded by a garden, a lake and a huge car park. The complex includes some 270,000 m² and the total investment reached 1.2 billion R$. The surrounding Serra Verde Park is not only meant to reinsure a green space in the city but also to keep informal settlements away from the official, high-prestige complex.

Connections and Disconnections
Shuttle bus lines to the city center were created especially for the employees of the Administration Center(1). There is also a local shuttle bus from the car park to the entrance(2). Even though the complex may be well connected to the city, the three huge buildings do not relate to the densely populated area of the surrounding Venda Nova at all (3).

Afraid of Land Valorization
“We are all afraid of the increasing prices on the land. Maybe we will have to move because we won’t be able to pay for our houses anymore” concludes Mariana, a local resident. The new Administration Center induces a strong land valorization in the poor neighborhood forcing many of the poorer inhabitants to move further away from the city leaving space for housing more well-off citizens.
Transforming the Landscape

When construction began in 1980, huge terracing works were needed to create the artificial plateau supporting the airport runways on the karstic ground.

High Expectations

The International Airport of Confins opened 1984 as an industrial airport. However, the older and small Airport of Pampulha continued to receive most of the international flights for another 20 years. Since 2005, international flights have been transferred to Confins. Today, the Airport receives about 5 millions passengers per year. “Expecting 30 Million Passengers”: as the posters hanging in the Airport state, the government of MG articulates its ambition. The expansion—two new terminals, new landing runways and service areas—is already under construction.

Construction

The functioning airport leaves the impression of an open construction site.
An Airport City

The Metropolitan Agency plans an Airport City at the south end of the airport. This new city should consist of different zones, divided into high (1), medium (2) and low (3) density residential areas, as well as industrial (4), commercial (5) and business (6) zones. Some institutional buildings are also planned as well as a train connection. The whole new city shall then be surrounded by a belt of greenery.

In the Countryside?

“No, we don’t know what they are planning for this area,” answered a family living in the rural area of São José da Lapa.

The Risk of Sinkholes

The impact of the construction sites, already with the airport, are causing a disturbance to the natural equilibrium of the groundwater levels, which lead to the occurrence of sinkholes.

A Rich Landscape

A lot of rivers run through the area, some underground and some on the surface. The project includes plans of bringing some of the underground currents up to the surface in order to integrate the rivers in the urban space.

Left Out

Although the construction of the Airport is generating jobs, the unemployment rate has stayed high in the village of Confins. The infrastructure is very precarious: the village has no public sewage and septic tanks disturb the underground water equilibrium. Recently, the population voted in favor of a new paved road—a symbol of a higher status, although it would also threaten the natural equilibrium.
SOIL AND INFRASTRUCTURE

In the 17th century, the land in the area was mainly used for livestock farming. The first urbanization occurred with the installation of a textile industry in the village Quinta do Sumidouro by Antônio da Silva in 1883. A factory was set up along the river Rio das Velhas, benefiting from the hydraulic potential of the waterfalls with the same name. This first relevant economic activity was expanded with the railway station “Cachoeiro Grande” in 1895. The city was renamed after Pedro Leopoldo da Silveira, a functionary of the Central Railway Company in 1901, and in 1924 Pedro Leopoldo became an independent municipality.
A Large Network of Railways
The 1898 inauguration of the railway system “Estrada do Ferro Central” in Minas Gerais, mainly used for the transportation of industrial goods, established the preconditions and supplied the first economic activities, other than farming, to the countryside. The railway stations of Pedro Leopoldo (1895), Santa Luzia (1893) and Vespasiano (1894) generated early urbanization in the northern region of Belo Horizonte. The generated centrality together with the growing industries created the base for the cities’ development.

Railway Stations as Generator
Towns and centers with identity were built, but today many of these have changed in character and lost in importance.
Highway
Railway

Independence through Productive Industries

In place of the region’s old textile industry, limestone mining, metallurgy and biotechnology industries are lining up along the railway today. The municipalities in the area benefit from the high productivity and the good job opportunities created by the active industries, which also reassures their independence. Municipalities like Ribeirão das Neves, which has grown a lot informally, caused by the pressure from the general city expansion, and has no industrial establishments offering any job opportunities, are in contrast highly dependent on Belo Horizonte. One of the results of this high dependency is a high number of daily commuters.

Lanagro: A Federal Institution

In 1983, the federal Ministry of Agriculture launched the subsidiary LANAGRO of Minas Gerais in Pedro Leopoldo. Employing around 350 persons (1), it is one of the largest employers, attracting and training highly educated staff.

Early Biotechnology Industry

Since 1983 this laboratory is dealing with GMO detection, biotechnology, method validation and food safety.
Benefiting from the Soil
Due to the karstic, mineral soil resources and the provided rail infrastructure of the late 19th century, the first limestone mine was opened in the 1950s, this eventually initiated the cement industry in the area. The industry grew to become one of the most important economies for Belo Horizonte in the following years.

Mines in Their Contexts
The mines transforming the landscape (1-2), reaching the cities (3-4), and next to production sites (5-6)
Omnipresent Pits in Pedro Leopoldo
A noisy conveyor band connecting the mine (4 on previous page) and the production site across town.

São José da Lapa: A City and a Mine
The Mine of Group Lhoist (7 on previous page) and the city are growing into each other.

Cement Production
The cement production reaches 1.7M to 2.3M tons per year, which gives company revenues of up to 400M US$ per year. Each company provides around 180 to 250 direct, mostly locally awarded, employments. With more than five production sites, the northern area of Belo Horizonte is one of the most important production areas for exported cement in Minas Gerais. Most of the products are transported by truck to the growing mega cities of São Paulo and Rio de Janeiro.
Benefiting from the Attractive Nature

The attractive natural environments offer appreciated weekend and holiday destinations and are a common argument to escape the city center. The hydropic soil properties are articulated by the many lakes, waterfalls, the very green and saturated vegetation and the common existence of unique karstic caves of high geological interest.

Leisure

The natural environment invites to enjoy the proximity to water and its leisure possibilities, such as fishing at Lagoa Santa.

An Alternative Coast for Minas Gerais

Enjoying the waterfalls in Serra do Cipó for a weekend seems to be a satisfying compensation for the lack of seaside in Minas Gerais.
A Radial Road Network

The northern areas are popular for second homes for the high-income segment of the city population. The highway from the city center, which has generated a spatially diffused urbanization along the main roads, has reinforced the connection. The escape from the city core has become automated: from the center via the highway, aisle-like through the suburbs, passing along fences of real estates leading up to the final destination—the condominium gate. The former radial concentric network is supposed to be expanded in order to decentralize and interconnect new sub-centers.

A Segregating Network

In contrast to the private, motorized mode of transport, non-motorized traffic participants have to adapt on their own risk: A cyclist in front of the Alphaville condominium on the Linha Verde highway.
Wall-to-Wall: A Pattern of Real Estate

The tradition of so-called condominia originates from the weekend and holiday housing typologies of the upper class population. Common arguments for living in a fenced community are security, one-family housing with private gardens, and proximity to both nature and centrality via public infrastructure.

The Alphaville Concept

With the condominium model of Alphaville in Nova Lima from 1989, the Brazilian real estate company adapted the concept of the American Edge Town. Occupying some 870 thousand square meters along the Linha Verde in Vespasiano the same company will invest around R$ 70M in new housing areas for 1,500 expected inhabitants.

An Inverted Order Compared to the Informal Settlements

In the condominia constructions start with the real estate companies providing infrastructure—roads, water, sewage, electricity—to each individual plot, the houses will only come with the residents. Also walls are erected all around the compound in order to live up to the expected safety.
A Defined but Empty Space—Reserva Real
Landscape à la Carte

Modified: An artificially created hill in Reserva Real.

Object of Speculation
The main argument put forward to buy a slot is the return on asset: investing in the Vetor Norte is deemed to be a confident capital investment. Until now, the majority of the parcels up to 10,000 m² are sold. Several parts are bought by large foreign investors with the objective of reselling, which verify the speculative aspect of this whole development.

Negotiations with Landowners
The landowner A sold his land to Reserva Real only under the condition that his farm would be kept.

Rentabilidade
Comprar uma casa e também um investimento à frente, o Vetor Norte é o ponto de decolagem da especulação imobiliária.

Object of Speculation

Still private land and farm

Landscape à la Carte
Modified: An artificially created hill in Reserva Real.
The Invention of Reserva Real

Designed by the Portuguese Grupo Design Resorts and named after the Estrada Real, the Reserva Real will be the largest condominium of Brazil. Its 11 Million square meters in Jaboticatubas are subdivided into different thematic parts: Equestrian, Golf, Fly-In Community, Bio-villa and Tennis, together forming the “Prime Community” surrounded by a six meter high fence. Planners expect about 20,000 inhabitants and investments of more than 1 Billion R$.

Live out of a Catalogue

The concept relies on environmentally sustainable living, with an “eco farm” garden supplied by solar energy and recycled rainwater. Slots ranging from 500 to 700 m² are sold together with a house typology chosen out of a catalogue with two available styles categories: contemporary or classic. The price for a unit ranges from 500,000 to more than 750,000 R$.

The Masterplan of Cidade da Cultura

“I believe in this”. Jose Miguel Martins, President of Design Resorts.

Cultural City

Inspired by the Navona Square in Rome, this project is a proposal for a new public city within the resort covering the demands of services, business and leisure requirements of the inhabitants. It is supposed to create a new centrality for Jaboticatuba and the Vetor Norte.
“THERE IS FREE LAND IN THE NORTH”

This Citation of Astrid Dias de Assis, Director of AV Norte, an Association of Developers of the Vetor Norte sums up the arguments of the private investors. Vetor Norte as the projection area of the confident visions of an ambitious economic upswing in Belo Horizonte and Brazil is attracting several regional and international investors.
Economic Strategy: Match Sao Paulo by 2030

The economic strategy of SEDE (State Department of Economic Development) rests on economic diversification and a shift from traditional mining to future-orientated industries to ensure, not only a national, but also a global competitiveness.

Macro Dynamics—Local Centralities in the Metropolitan Region

The urge of decentralization goes back to the issues of the concentric city center covering the demand of services of the whole population and concentrating economic, administrative and institutional operations.

“In 2030, the expected GDP of Vetor Norte is 172 Billion US$ which is the actual value of the GDP of the entire State of Minas Gerais”. (SEDE)
Projects and Planning

Vetor Norte has become an experimental playground for regional and international planners and investors wanting to be on board with the expected auspicious economic returns.

Reserva Real

Logistic Platform

Microelectronic Pol

Alphaville

Cetec

Ciaar

Alphaville Precon Park

Metropolitan Business Center

FELUMA

Road Network

Estadio de Vila Rey

Airport City

Fashion City Brasil: 200,000 m² in Pedro Leopoldo 2015

Metropolitan Cathedral, O. Niemeyer’s last project, planning

First terrain preparations

Actual Building Site

Condominia Projects under Construction

Urban-Scale Projects for Future Development

– Vetor Norte –

– “There is Free Land in the North”–
A Complicated Reality

The natural generators of urbanization of the north, both the informal city expansion and the early independent development through infrastructure, are affected by public planning ideas. The punctual interventions are exposing and confronting the population to borders or boundaries of physical and social disparities.
COMMENTARY
VETOR NORTE
The development in the north much entails the same urban schemes as the general urban growth of Belo Horizonte but, as we have seen in past times in the more southern areas of the city, several actors with a strong idea of how to push the growth and economical competitiveness of the city as a whole are concentrating a lot of focus to this northern axis, justified by the reinforced importance of the newly extended international airport of Confins and the thereby given place of Belo Horizonte on the national and global scene.
The student work presents an insight into the complex matrix of interested and active actors behind the current development, but it also presents current aspects of the actual outcomes and results of many of the grand initiatives and tendencies being realized, or that have been realized in earlier times. The many smaller, surrounding municipalities, which have absorbed the rural migrants during the last decades and support the city with workforce, represent a large stock of poor, neglected neighborhoods. These areas are rather flown over by the tendentious development pushing from the city outwards. The specificity of the area is also told by reflecting on the historical and still ongoing limestone mining industry and the sensitive karstic geological landscape and semi-dry cerrado vegetation, which, when convenient, is ignored but at other times charged with the core of being the attractive and auspicious back-drop for the new condominia materializing the dream of escaping the city in favor of countryside and the nature. A plural urban battlefield mapping of yet another dialectic that Belo Horizonte has to its territory.
INHÔTIM
IV

INHÔTIM
AN INLAND ISLAND

AVISION OF AN EXCLAVE
The Patron—Bernardo Paz

AN INTERNATIONAL ART SPACE

TERRITORIAL OCCUPATION
Inhôtim before Inhôtim Art Park
The Territory of Bernardo Paz
Fragments of an Erased Village

AN AUTONOMOUS PLACE
The Inhôtim Island
Brumadinho: Low Touristic Potential Beyond Inhôtim

SPATIAL TRANSFORMATIONS
A Satellite to an Increasingly Important Economic Center

ADAPTED INFRASTRUCTURE
Projected Infrastructure Consolidates the Island Status

DEPENDENCIES VERSUS ISOLATION
A VISION OF AN EXCLAVE

As the art collection of the entrepreneur Bernardo Paz grew, the wish of sharing the experience of his collection with others formed. He decided to create a “Disney land of the arts” as he once called his project. The remote paradise, where once only a weekend house was to be found, was to be far-off the reality chart of everyday life, offering something else and at the same time the space, as an exhibition space, should play in the league of the world leading art museums—a branch of the international art circuit in the Atlantic Forest.
Bernardo Paz was born in Belo Horizonte and grew up in a middle-class family. His father was an engineer and his mother was an artist. After he dropped out of high school Paz worked in a clothing boutique and took a try as a broker. In 1973 he joined an iron ore mine and became a successful mining entrepreneur. He always had a passion for art, collected art and cultivated friendships with artists and curators. In 1980 Paz moved to his holiday residence in Inhôtim in order to realize his dream: a “Disneyland” for art lovers in the hills of Brazil. He travelled to New York and Europe to visit contemporary art galleries, and he bought more land around Inhôtim. In 2009 he sold his mining empire to a Chinese investor for $1.2bn and he invested everything into his new project: The Contemporary Art Park Inhôtim.

The Patron—Bernardo Paz

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Spreading the Word

Works by world known artist and newly erected pavilions by famous architects place Paz’ park on the map.
AN INTERNATIONAL ART SPACE

Already at the time when Bernardo Paz's collection was still private, he built small pavilions on his property to house the art pieces. Additionally he placed free standing sculptures in the garden. In 2001 he employed the first curator to manage his collection. Along with the collection the premises was continuously expanded. In 2006 Paz opened his property to the public. By the year 2013 the park boasts some 400,000 visitors annually and the art has been covered by magazines and newspapers around the world.
Origins of Represented Artists

Latin America is by far the most represented part of the world and Inhôtim is answering up to the natural call of promoting the continent’s artists.
Freestanding and Site-specific

Already before Inhôtim was opened to the public it was given its contours and freestanding sculptures found their place in the park. Later also site-specific installations, sculptures and art works were commissioned and installed through out the whole park animating the laid-out paths and walkways.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1980</td>
<td>Private property</td>
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<tr>
<td>1990</td>
<td>Installation of first freestanding sculptures</td>
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<tr>
<td>2002</td>
<td>Foundation of the institute</td>
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<tr>
<td>2006</td>
<td>Opening to public</td>
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<tr>
<td>2007</td>
<td>Implementation of site-specific artworks</td>
</tr>
</tbody>
</table>
**Pavilions as Exhibition Room**
A dozen pavilions are situated amidst the impressive scenery. There are smaller pavilions which are dedicated to specific artists and others housing temporary exhibitions.

**Pavilions as Art**
Some pavilions and spaces are also built as site-specific installations where the space itself is the art—offering spatial, visual, audio, climatic and tactile sensations.

**Timeline**
- **1980** Construction of first pavilions
- **1990-2009** Pavilion as exhibition room
- **2002** Foundation of the institute
- **2006** Opening to Public
- **2009** Pavilions figuring as art themselves
Botanical Garden

Inhôtim with its over 4,500 native and exotic species has the largest collection of botanical species in Brazil, as well as the greatest palm tree collection in the world with 1,500 species. The park is located in the region of the threatened Atlantic Forest; therefore 60 percent of the park comprises unaltered and preserved original flora.
Inhôtim as a place for education, Inhôtim, 2013

Educational Programs
Inhôtim regularly invites local communities and schools to educational visits of the park along with an offer of different workshops aiming to evoke an interest for art. The weekly free entrance-day also increases the accessibility of the park among the general public and in this way one aims to awake a larger interest in art. In 2013 Inhôtim also started a school project in Belo Horizonte, aiming at training its students in the arts and raising awareness around environmental issues.
TERRITORIAL OCCUPATION

The Inhôtim Art Park is located southwest of Belo Horizonte, next to the town of Brumadinho in the municipality of the same name. The site is about 800 hectares large, but only 10 percent of the area is occupied by the art park and thus accessible to visitors. In the north the property borders a grand mining pit and in the west the settlement of Brumadinho. Whereas the land that is not included in the art park has been left almost untouched, the grounds of the park have undergone dramatic transformations in the past: where a village of 300 inhabitants once lied is now a designed and artificial landscape park and vast parking grounds—all fenced and with a guarded entrance gate.
Land-Use in the Municipality of Brumadinho 2013

**Legend:**
- Forrest
- Mining
- Rivers
- Urban zones
- Land owned by B.Paz
Inhôtim before Inhôtim Art Park

Up until the turn of the last century Inhôtim was a fully functioning village with approximately 300 inhabitants, a school, a church and a sports ground. In the region it was famous for its Congado festivities, an Afro-Brazilian tradition. Most of the former inhabitants were farmers. The good compensation for their land offered by Bernardo Paz in the 1990s and on, made many of the residents sell their properties. Nevertheless according to a survey only 38 percent sold their land by choice, the rest felt a certain pressure, be it because Paz insisted or because the community was about to break apart anyway and they did not want to become isolated. According to the survey the loss of the community is what former residents regret the most. But many also lament that the new living conditions are not compatible with their lifestyles and that they now suffer under increased living costs.

Everyday Life in Inhôtim Village

The former village collected some 50 houses in brick and stone (1). Out of theses less then a handful has been left, the church (3) has even been preserved and is now open to visitors. Most grounds in and around were used by the family farmers for cultivation (2). The Congado festivities are formed around a dance and music tradition formed in Northeastern Brazil during the earlier years of slavery.
The Territory of Bernardo Paz

As of 2013 Bernardo Paz owns about 1,000 hectares of land in the surroundings of Brumadinho. Half of the area has been declared as under nature protection by the Inhôtim Institute. The rest is free to be developed in the future either as an extension of the park or for real-estate purposes.
Relicts of Inhôtim

The church (1) has been renovated and now serves as an event location. The wood-shop was transformed into a gallery. The Institute's Department of Citizenship and Inclusion institutionalized the Congado performance (2) with the goal to support the Afro-Brazilian culture.

Fragments of an Erased Village

Nowadays there is not much remaining from the former village: the principal road and a path, the church and a wood-shop is all we find among the new artificial lakes, pavilions and pathways.
Inhôtim Institute and its park contain and manage all services and facilities needed to meet all thinkable needs of the park’s visitors. This leaves little room left for economical activities and support structures in nearby Brumadinho, but still: the town is changing and programmatic and spatial transformations are rewriting the surface in and around the town. Inhôtim is only one of the actors.

AN AUTONOMOUS PLACE

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The Mission of Expansion

The vision for Inhôtim is steadily amended; while trying to meet, but also proceed and boost visitor numbers, the offer is constantly enhanced. These projects are in their planning phases or already under construction.

The Inhôtim Island

Inside the park the visitors find three restaurants, a cafe, a pizzeria and three snack bars. All of them at an international standard and well above the local price level. The institute also runs its own construction company, a gastronomy service and a design store. With the first hotel on the site being under construction (more will follow according to plans) little is left to wish for. The direct revenues from all Inhôtim’s undertakings stays with the institute.

The Mission of Expansion

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An Employer of the Region

In the past decades a shift from the secondary to the tertiary sector can be observed also in the municipality of Brumadinho. Referring to the numbers of employees Inhôtim is today the third most important employer after the mining companies and the local administration in the municipality.

Attractive Working Conditions

The typical employee at Inhôtim is under 25 years old and has not completed any higher education. For some of them it is their first job, while others have worked without an official contracts for other employers, only 25% had a regular position previous to their engagement in Inhôtim. Additionally to their regular salary every employee is offered breakfast and lunch at the institute’s staff facility, transportation back and forth, medical assistance and a monthly pack of staple foods in remuneration. The training the personnel is given in the service sector is another asset for the young employees: it open-ups new doors on the job market.
In Hopes of Getting a Share of the Emerging Market

While young workers in the region benefit from new job opportunities and the exceptional working conditions, the existing businesses are struggling to get their share of the new service market. Most of the visitors only come to Inhôtim for the day and return to their hotels in Belo Horizonte in the evening; they do not stay overnight in Brumadinho, nor do they consume in the local restaurants or stores. And still several entrepreneurs see a chance of keeping the tourists in town and profiting from their stay; this explains the new hotels, among which we find a five-star hotel, opened up in 2013.
Brumadinho: Low Touristic Potential Beyond Inhôtim
Up to this point Brumadinho was mainly a destination for weekend hide-outs on the countryside for residents of Belo Horizonte. The concept of modest agritourism fits the location perfectly. The potential for culture tourism beyond Inhôtim though is very low.

Downtown Brumadinho
The town is economically doing relatively well, but for the visitor there is little interest and the overall attractiveness of the small town is relatively low.
Brumadinho

A Supportive Act Promoting Cultural Tourism

Estrada Real, a tourism initiative of the state’s Industry Promotion Agency (FIEMG), established a network of cultural hotspots in Minas Gerais. Thanks to Inhôtim one can also find Brumadinho on the map – in line with Diamantina and Ouro Preto the famous baroque towns, and this even though Brumadinho only dates a hundred years back. The initiative proposes a tour along the former gold road, on which gold was transported to the ports in the south in the 18th century.

The Typical Inhôtim Tourist Challenges the Present Supply

The typical visitor of Inhôtim is between 26 and 40 years old, well educated and with a sophisticated lifestyle. The fact that the local supply of services does not meet the standard these tourists require is one of the main reasons why Brumadinho can not benefit from the tourist stream Inhôtim is generating. The omnipresent problem of lack of education in service and language, found in all of Brazil, is eminent in Brumadinho as well. In hotels you meet untrained staff with poor to no English skills, hygiene is precarious and the variety of food is very limited.
SPATIAL TRANSFORMATIONS

The Inhôtim Park increased the notoriety of Brumadinho, and one can argue also the attractiveness of the area as a place of domicile. The consequence is visible in the urban structure of the town as much as in the municipality as a whole. The number of multi-story buildings has within six years almost sextupled in the town and in the rest of the municipality gated-communities are springing up. Nevertheless the development cannot only be explained with the presence of Inhôtim; the municipality is part of the Metropolitan Area of Belo Horizonte and attaches to the wealthy south of the state’s capital city, Brumadinho thus, very conveniently, absorbs some of the growth of Belo Horizonte.
The Urbanization of the Municipality

The urban zones as declared by the planning department of the municipality of Brumadinho.
In the year 2002 the town of Brumadinho counted 12 multi-story buildings. Today one finds already 55 of them and the verticalization will continue further. This development not only changes the physical appearance of the town, it also generates jobs: the number of constructing companies has quintupled within ten years and you find more than 10 real estate developers in the town.
An Average Residential Area
Brumadinho has one of the highest GDP per capita in the Metropolitan Region of Belo Horizonte. This is visible in the streets of Brumadinho town. The absence of more precarious settlements in combination with the average house in the town being plastered, colorfully painted, having a garage, a gate and a garden, is evidence for a strong middle class.

Sources of Wealth Increasingly Influenced by the Proximity to Belo Horizonte
Mining (1) Water resources (2) Agriculture (3) Business with attractive real estates (4)
A Satellite to an Increasingly Important Economic Center
As the third strongest economy in Brazil, Belo Horizonte is one of the country’s economical hubs and in contrast to Rio de Janeiro or São Paulo, the city still has not only the capacity to grow, but also the space. Brumadinho is very advantageous located at the southern expansion axis of Belo Horizonte. As the capital grows more and more, suburban settlements spring up in the rural municipality. The municipality of Brumadinho offers the feeling of living in the countryside while still reaching the city center in 45 minutes by car. The real-estate developers promote their properties with the prospect to a safe and healthy lifestyle and approach an upper middle-class clientele.

The Gated Community of Aguas Claras
The suburban gated communities hold the same characteristics as an European single family house residential area: a house for one family (1), a garden (2), one or two cars (3), sometimes a dog – except for the gated entrance (4).
ADAPTED INFRASTRUCTURE

One of the major reasons for the backlog of Brazil in the international tourist market is the bad condition of its transportation infrastructure. Also Inhôtim struggles with this and for this reason the institute took the initiative to improve the transportation network with a series of bigger and smaller infrastructural projects. These improvements will relieve the town of Brumadinho of the increased traffic caused by tourists visiting Inhôtim, but at the same time they consolidate Inhôtim’s status of an inland island by cutting the town and its surroundings off of the network.
<table>
<thead>
<tr>
<th>Travel and tourism factors</th>
<th>Ranking</th>
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<tr>
<td>Natural Resource</td>
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<td>Cultural Resource</td>
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<td>Environmental Sustainability</td>
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<td>Air Transport Infrastructure</td>
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<td>Health and Hygiene</td>
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<td>Price Competitiveness in the Travel and Tourism Industry</td>
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<td>Ground Transport Infrastructure</td>
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</tbody>
</table>

Less competitive

More competitive

Deficits in Road Infrastructure

In 2013 The World Economic Forum analyzed 140 countries and described their Travel and Tourism Competitiveness. Brazil received all over good results because of their huge natural and cultural heritage, but they have big deficits in infrastructure provision.
Existing Transportation Networks

The mining activity in the region exhausts the infrastructural networks and, most prominently, the roads. Large mining trucks use the same routes as visitors to Inhôtim, which explains the bad condition of the roads causing bumpy and uncomfortable trip experiences.

The Ambition to Be Amongst the Leading Art Museums of the World

Out of 300,000 visitors in 2010, 1/6 were students from private and public schools. This year the number of visitors will reach 400,000. Paz reckons that in the future they could reach a million visitors a year—comparable to other internationally recognized contemporary art institutions like the Centre Pompidou in Paris.
Inhôtim

BELO HORIZONTE

Museum of Arts and Crafts

New airport of Brumadinho

This project provides a better access between Inhôtim and the highway, and it would ease the traffic situation of Brumadinho center.

Railway Reactivation for Passengers

Inhôtim has entered negotiations with the town of Brumadinho, Belo Horizonte and the mining company of the region, addressing the question of re-activating the railway system from Belo Horizonte to Inhôtim and Brumadinho for passenger traffic. The result from a visitor survey showed that 80% of the visitors would use the train to reach Inhôtim if offered. One idea is to offer a combination ticket for the Museum of Arts and Crafts in Belo Horizonte, hosted in the newly renovated old main station, and Inhôtim Park.

New Bypass to Inhôtim

An even more visionary proposal is the installation of a brand new airport. This would make the site more accessible for visitors and attract more tourists; it would also be a catalyst for the whole region. The project includes a new road system leading the expected traffic around the center of the town.

New Regional Airport

An even more visionary proposal is the installation of a brand new airport. This would make the site more accessible for visitors and attract more tourists; it would also be a catalyst for the whole region. The project includes a new road system leading the expected traffic around the center of the town.

Future Development in Brumadinho

If the aforethought infrastructural projects that will be implemented, a new outline of the city will be created. Several zones will become very attractive for real estate developments and the square meter price will increase dramatically in these areas.
The institute of Inhôtim sees itself as a small paradise, almost self-sustainable, far-off in the Atlantic Forest in exotic Brazil. At the same time it wants to be associated with the global art circuit and therefore has to comply with the demands of an international clientele. Even though it is not a priority to create an interface with the immediate surrounding, logistics force interdependencies on two levels: firstly with the local administration and the inhabitants of the adjacent town of Brumadinho, and secondly with the state’s capital, its administration, service sector and economy. As much as there are tendencies towards the establishment of an exclave of the international art scene, possibly even more so in the future—a total independence of the surrounding is impossible.
COMMENTARY
INHÔTIM

Bernardo Paz’s art park has become a fixture on the international art circuit. Although it utilized landscape – or more precisely a tropical garden within the cerrado – as a starting point for most of its site specific artwork, the park has little ties with its direct environment. This unique initiative shows both the potential and limits of a “remote island” as a cultural and touristic attraction. It shows that it is indeed possible, with enough vision and capital, to turn a completely undeveloped piece of Brazilian back-country into a global hotspot. It also shows, that this can happen with almost no effect on the hotspot’s immediate environment. Visitors to Inhôtim are usually based in São Paolo. They do not stay in Brumadinho over night and often circumvent even Belo Horizonte. Thus there is no spillover effect in the region apart from the employment opportunities in the park – almost all the guides are young people from the city, while locals do menial jobs such as gardening – and Bernardo Paz’s personal charitable initiatives. On the other hand local residents also had to pay a price for Inhôtim, as the expanding park swallowed and absorbed an entire village of 300 inhabitants, leaving only the church as a relict within the art park.

Whether Paz’s plans to develop this day-trip destination into a full holiday village with hotels and golf courses will be successful remains to be seen. For now we can say, that it is possible, even from the most remote spots in the territory, to plug into the ever expanding networks of global tourism, but that such a connection may be so direct and focused on the single attraction, that it has almost no impact on the territory as a whole.
V
GREEN BELT
CULTIVATION AND URBANIZATION

EXPORT TRADITION
Large Scale—Small Scale

BETWEEN TRADITION AND MODERNIZATION
Family Farming & Dairy Farming
Support Structures

FEEDING THE CITY
Vegetable Farming
Centralized Supply System

LAND IN TRANSFORMATION
Industry
Housing

ADAPTATIONS
The Green Desert
Housing—a Gift and a Curse
Larger Production—Same Space

UNPRODUCTIVE LAND
In the early beginnings of Brazilian colonization the whole economy and agriculture were set up for export markets. To saturate the European demand for sugar the combination of large-scale properties and slave workers was established and endured until the abolition of slavery. By this time the export oriented large-scale agriculture was already well established and cheap labor force was found with the newly arrived immigrants, also from Europe which struggled at this time with poverty and sought greener fields elsewhere. The industrialization of agricultural production later guaranteed the large-scale agriculture, but the rural worker was widely being replaced by machines.
Large Scale—Small Scale
The large and middle-sized property is the most common type of farm in Minas Gerais and found in most areas of the state. The properties are larger in the western parts of the state where flat and fertile land can be worked by big machines and where the yield is produced for overseas. Around and inside the metropolitan areas of Belo Horizonte, São Paulo and Rio de Janeiro smaller scaled properties are predominant.

GDP Brazil 2012: 2,253M US$
The agricultural sector’s contribution to the national GDP amounts to one of the lowest percentage-wise in the world. Burma has, with 56%, the world’s highest percentage, Singapore with 0% the lowest. Regarding the value of the agricultural GDP it ranks amongst the world’s highest.

GDP Agriculture Brazil: 184.7 M US$
Minas Gerais has a long tradition in agriculture and has one of Brazil’s largest agricultural productions; it rose with the gold rush and became strong with the coffee. In the 1960’s the expansion of monocultures into the Cerrado gave its agricultural sector an important addition of land resources.

Brazil generates important revenues by exports. Soya climbed in the last decades to the top and ousted coffee by far.

Agricultural Exports 2012: 95.32M US$
Minas Gerais Export 2012: 7.81M US$
In Minas Gerais, where coffee and dairy production once gave great power to the state, coffee remained a stronghold.
Large Scale Properties in MG
The displayed property occupies an area of 950ha and is located 200km westwards from Belo Horizonte. It is a classic example of a large-scale property, which directs its production towards foreign markets such as Europe, USA and China. This kind of establishment follows the long tradition of Brazilian export agriculture.

Small Scale Properties in MG
This farm occupies an area of 13 ha and is located in the metropolitan area of Belo Horizonte. Such establishments are in almost all cases family farms and are more directed to local food production. They total just a small part of the land occupied agricultural production, but outnumber the large-scale properties by far.
BETWEEN TRADITION AND MODERNIZATION

The industrialization of the agricultural sector has left many rural workers jobless, which resulted in the big rural exodus starting in the 1960s. Rural workers and small-scale farmers that were excluded from the technological boost started organizing themselves and created the movement of the “Agro-cultura Familiar” which translates into family farming. Today’s situation for the family farms is characterized by traditional farming techniques, which have kept the segment afloat for the last 60 years but also the struggle to find their way into new technologies and new markets in order to generate more surplus in a very competitive contemporary reality.
Family Farming and Dairy Farming

Small-scale agriculture in Minas Gerais answers for 54% of the total milk production in the state, which is an activity with a long tradition here. Exemplary for the struggle of the small-scale agriculture and family farming is the lack of knowledge, financial means and access to modern technology for storage, which makes it hard to compete with the large-scale properties who are gaining ground.
The Farm “Fazenda de Restente” (1) is run by the two brothers João Celestino & Mauro Fereiro de Restente. They inherited the farm from their father who purchased the land for dairy farming - one of the main agricultural activities in the metropolitan area of Belo Horizonte. Their cattle herd (2) counts 25 heads and generates a low but sufficient milk production. As an additional income source they started growing eucalyptus in 2007 facilitated by governmental support. To the Restente brothers, the farm serves as an income generator, but also guarantees them a certain self-sufficiency since they also grow several types of grains, as well as vegetables and fruits.
Rural Exodus
The rural population of Minas Gerais began to steadily decline in the 1960s. The rural exodus is a national phenomenon with the biggest migration movement from the poorest rural areas of Brazil to the wealthier southeastern region, consisting of São Paulo, Minas Gerais and Rio de Janeiro. Therefore the population in the capitals of those states grew even more than the rural populations of the states shrunk. As the Brazilian cities seemed to explode in the late 1980s and 1990s, criticism of the overcrowding of the cities first arose. The correlation between the rural exodus and the industrialization of the agricultural production became apparent. Small-scale farmers and unemployed rural workers that started the movement of family farming received support from politicians in the mid 1990s as family farming emerged as a solution to the overcrowding cities by offering a option for people in rural areas to stay.

Defining of Family Farming
Besides producing the majority of Brazilian foodstuffs for the inland consumption, it has a huge social value in rural areas. Family farming offers a tool for Brazil to cope with its class system in the rural areas. It guarantees self-supply for the productive unit and generates monetary means and offers employments. Law Nr.11.326 of 24.07.2006 defines family farming, and states that:
- The size of an establishment must not surpass 4 fiscal modules
- The workforce on the establishment has to come predominantly from family members
- The income has to be generated predominantly based on the own establishment
- The establishment has to be managed by the family.

What Is A Fiscal Module?
The fiscal module is a unit for agricultural land expressed in hectares. The size of one fiscal module is variable and has to be determined for each municipality; it can vary from 5 ha up to 110 ha depending mostly on the soil quality and the topography. One fiscal module is the minimum size for a family farm to remain economically viable. The fiscal module takes into account:
- The predominant agrarian activity in the municipality
- Income generated by the predominant agrarian activity
- Other existing agrarian activities in the municipality with significant impact on income or land use

The variability of the fiscal module is necessary to cover the range of different types of family farms. The fiscal module tends to be smaller close to urban centers and bigger in more remote areas.
Brazil faces severe ecological destruction and poverty, which comes along with a wide range of complex problems and its agriculture is in the midst of it. The socioeconomic potential paired with the environmental vulnerability results in the Ecological-Economic Indicator of Minas Gerais developed and applied for the whole state. It also indicates where help is needed most.

Support Structures

Fazenda Perreira—Fiscal Modules 0,65
The Perreira Family Farm
Alencar Alvez Perreira lives with his wife and two children in their self built house (1) on the land, which he received from his father. Here he cultivates manioc (2), sugar cane and eucalyptus. The sugar cane serves as fodder for his father’s cattle and the eucalyptus is sold as firewood. The manioc is harvested by him and his family and further processed on his establishment to manioc flour. Alencar Alvez Perreira relies heavily on governmental support structures to venture successfully into new technologies. With PRO-NAF he was able to purchase a tractor, which makes work on his plantations more efficient and gives him additional income by offering his services to neighboring farms.
Support mainly for large scale farming

Growing institutional support

Governmental Programs

Industrialization of Agriculture

Family Farming

Family Farming in Politics

Much Needed Help

The exclusive character of the industrialization of the agricultural production worsened the conditions for many rural workers as well as the competitive climate for small-scale farmers. Out of this inequality governmental support emerged. EMATER is a widespread state-run support structure with employs agronomists in most rural munici-

Governmental support

Value of production

Family farming

Family Farming faces many difficulties and hurdles in its daily operations. The national government focuses mainly on support directed towards large-scale agricultural production. For a very long time the lack of support for family farming forced the family farms to rely solely on traditional farming methods. The lack of knowledge and financial means still imposes severe limitations to these fazendas.

Everyday Struggle

Value of production

Governmental support

Large-scale agriculture

Reinforcement of Family Farming

Even though the governmental support does not reach the level of support given to large-scale farming, there are numerous programs to support family farming. The case of Alencar Alvez Perreira shows how some support structures directly benefit the small-scale farmer.
At the same pace as Belo Horizonte grew, its demand for food increased. As the focus of large-scale agriculture remained by focusing on and generating its profit largely from export-oriented production, a niche emerged to appease the city’s hunger. It led to a densification of agricultural activity on the edges of the city forming the so-called green belt. The agriculture in the green belt consists largely of small-scale family farms, whose structure guarantees the flexibility needed in this constantly changing environment. Even though the agriculture in the metropolitan area is a highly heterogeneous field, a concentration of vegetable farming can be observed.
Vegetable Farming
The short transportation distance to the end-consumer in the city favors the production of vegetables in the closest areas. The products remain fresh and there is less damage on the delicate goods. Another reason for the widespread vegetable plantations in the metropolitan area of Belo Horizonte is the dense water network. The cultivation of vegetables requires a considerable amount of water. Therefore plantations of vegetables and especially leafy vegetables are always found close to rich water sources.
The Augustin Family Farm

The farm of the Augustin family (1) is specialized in leafy vegetables such as lettuce, spinach and cove. Around 2000 they started experimenting with culinary herbs, which eventually became a big part of their production as a reaction to the growing demand from the gastronomy sector of Belo Horizonte. By diversifying their portfolio (2) they reacted to their former dependency on just a few products, which is the downside of the specialization in niche markets. The farm and the land were inherited from their parents and is currently being worked by two brothers and their families. The municipality Mario Campos, in which they operate, has its agricultural production basis in vegetable farming and is known as “The Capital of Lettuce”; 30% of the lettuce consumed in Belo Horizonte comes from Mario Campos.
Centralized Supply System

In the 1960s, when the BH’s population was approaching the 10M mark its supply system became increasingly chaotic. A nationwide project, called CEASA (Centrais de Abastecimento S/A), aiming at improving and centralizing the supply system for fruits and vegetables of metropolitan areas arose. The CEASA of BH was inaugurated in 1974 and was built in Contagem, right by the BR-040 highway, which corresponds to the primary means of transportation for food: the truck. The continuous physical growth of the CEASA since its inauguration displays the increasing nutrition demand.
CEASA
The CEASA of Belo Horizonte is the main market place for fruits and vegetables for the whole state of Minas Gerais. The major part of the states production of fruits and vegetables is brought to the CEASA and it serves as the main supplier to the metropolitan area of Belo Horizonte. The complex consists of a network of halls and streets (1) to facilitate the transportation by truck, often coming from far away. 60% of the products (2) sold on the CEASA come from family farms. The CEASA of Belo Horizonte is one of the world’s most diverse marketplaces for fruits and vegetables.
Supply Network

The centralized system of CEASA in Minas Gerais connects remote areas to the capital. To broaden the network, another five smaller local branches were opened in the state of Minas Gerais from 1978 till 1990. The expansion of the network was necessary for its efficiency as there is the problem of elongated transportation distances with having all goods go via Belo Horizonte. But with the metropolitan area of Belo Horizonte being the main consumer of the state’s food produce, the high degree of centralization does allow for the most efficient organization.

Every Road Leads to CEASA

85% of the fruits and vegetables sold in the state of Minas Gerais were traded at the CEASA of Belo Horizonte. This amounts to a daily flow of 4.58M US$ and 6,389 tons of foodstuffs.
LAND IN TRANSFORMATION

There is a considerable amount of agricultural land to be found in the metropolitan area of Belo Horizonte. While the proximity to the city, for many farms, is their raison d’être it can also be their nemesis. The growing demand of land for housing and industry often results in the loss of agricultural land. The family farmer often appears as the weakest stakeholder when conflicting interests appear. Therefore the agricultural land in the metropolitan area of Belo Horizonte is constantly facing transformations.
Industry
The main routes connecting Belo Horizonte with other urban regions in the state and the country, exercise an accelerating effect on the areas around them and within the metropolitan region of Belo Horizonte. Industry and larger uses linked to the tertiary sector are settling in these areas. Such an area is found in the municipality of Igarapé, which has its roots in agriculture but is already experiencing a transformation towards the tertiary sector.
Farm Araujo
The Farm Araujo is run by three sisters and the land is owned by their father who is a retired farmer. The establishment (1) is a characteristic vegetable farm (2). The farm exists on this site since 1973 when they were moved due to changes in the zoning plan of their municipality. Up to this point their father used to run his agricultural establishment in an area nearby which became protected by CO-PASA (the water supply company of Belo Horizonte). In the near future they will be faced with another transformation of their land and they might have to move once again.
The area zoned for industrial use is connected to two main routes: the BR-381 to São Paulo and the BR-262 to Divinópolis. This strategic position is of high value for industrial production, thus the new zoning in 2013 where the original agricultural land was re-zoned as an area for industrial use. The driving force behind the change of the zoning plan was a distribution company for Fiat cars called SADA. Their $90M US-Dollar investment was greatly welcomed and their plant is currently under construction (1). Properties, mainly farms, were bought up beforehand, among them several farms surrounding the Farm Araujo, which is in the industrial zone: sooner or later they will also have to sell and move away. On the way to their farm walls (2) indicate the border of the soon-to-be industrial park.
Area of high interest for housing

**Housing**

The direct access to the BR-381 and the predominance of the automobile in Belo Horizonte makes Igarapé interesting for housing. The resulting land speculation is putting pressure on agricultural land and building sites are more present than vegetable farms as Igarapé has the third fastest growing population in the metropolitan region.
The Leomar Farm

The Leomar family lives in Mario Campos but cultivate land in Igarapé as tenants—called “Meeiros” (1). They represent a common group of family farmers who do not own their own land but have rental contracts with landowners to whom they pay a monthly rent. The family Leomar cultivates mainly leafy vegetables and the business is run by two brothers and their adult sons, who work the fields (2).

The landowner lives nearby and is a retired farmer whose children did not choose to continue farming. He is facing many difficulties with keeping his land as he says: “It’s the law of the dog out here!” referring to the illegal housing constructed on his land and acts of sabotage on his farm.
Transforming Agricultural Land

The land subdivision into smaller plots brought many problems to the municipality of Igarapé such as lacking infrastructure and illegal housing. A way of coping with this phenomenon was to minimize the area zoned for small plots and to maximize the area zoned for large plots. The zoning for large plots, which is mostly used for gated communities and weekend cottages used to be zoned as agricultural land. The hopes of the municipality are not only to curtail the small plot land subdivision but also to attract a wealthier population stratum.
Land Subdivision into Small Plots

The rising prosperity in the metropolitan area of Belo Horizonte and governmental programs such as “Minha Casa Minha Vida” (My House, My Life) enabled many underprivileged people to purchase their own piece of land and build a house (1), or to buy a ready made single family house in a designated development. The process of the land subdivision for small land plots follows a certain pattern. There are real estate companies that buy large plots of land and subdivide them into plots of 360 m² (30x12). These companies are obliged to provide basic installations for water supply, canalization, pavement and electricity. Often those services are provided with the intention to maximize the profit—meaning a lack in quality. The bleak neighborhood and the paltry conditions (2) left many inhabitants, with modest dreams, disappointed: “I am used to a simple life, but here it shouldn't be like this!”

V/404
To avoid having to deal with all the problems around small plot land divisions, the areas zoned for large plots are maximized. This strategy is only possible because Igarapé became attractive to people with the necessary purchasing power (1) such as the commuter who enjoys the amenities of the country life while working in the city, or the owner of a weekend cottage who celebrates the rural lifestyle. To attract this kind of clientele, large plots of land are enclosed by walls and subdivided into plots of sizes ranging from 360m² to more than 1000m². In this case, basic infrastructure (2) is provided and usually additional facilities and services are provided.
ADAPTATIONS

The agriculture in the metropolitan area of Belo Horizonte is experiencing constant mutations and is bound to adapt to the changing landscape. With all the change, new opportunities and markets emerge. The following portraits are from people who came from a non-agricultural background and found a lucrative niche in agricultural activities. They serve as examples of how dynamic the agriculture in the metropolitan region of Belo Horizonte is.
The Green Desert

The expansion of eucalyptus into small scale and middle scale production brought eucalyptus monocultures, the so-called Green Deserts, to the metropolitan area of Belo Horizonte. The high density of eucalyptus plantations in the east of Belo Horizonte is tied to the high demand of wood by the steel industry. The process of converting iron ore to steel consumes a lot of coal made out of wood as a source of energy. The cultivation of eucalyptus reduced the deforestation of native forests in Minas Gerais as the demand of wood could be covered by eucalyptus plantations—as opposed to other areas in Brazil where native forests were cut down to make room for eucalyptus plantations.
A Brazilian Lumberjack

Mister Wagner used to work as a salesman in Belo Horizonte. By spending his holidays on his father’s small rural residence he became attracted to the rural lifestyle. With the National Forests Program, introduced by president Lula, he saw a chance of making a living from an agricultural activity. He turned his back to the city and started his one-man business (1). He buys the still standing trees from plantations, chops (2) them and sells the wood. The work is hard, as he says but the revenue is better than as a salesman in Belo Horizonte.
Governmental Incentive

In 2003, to satisfy the hunger for wood the federal government launched the National Forests Program, with the intention of increasing the pace of expansion for monoculture tree plantations and broadening participation in small and medium scale agriculture. Among the governmental promotion programs PRONAF served to bring public financing for tree plantation to the small-scale farmer.

Paper at Any Cost?

New breeds of eucalyptus trees, also used for paper production, grow extremely fast and are ready to be cut after just 6 to 7 years. Records of 35 meter high trees after just 6 years are reality, but only found in areas with an industrialized large-scale monoculture. In the metropolitan area of Belo Horizonte where this kind of cultivation is not possible the cultivation turns out to be more modest. Which does not mean that it is less problematic. The intensive eucalyptus cultivation exhausts the soil and native plants are not able to grow in-between and animals are rarely found in these green deserts (1).
Housing—a Gift and a Curse
While the increasing construction of residential buildings consumes a lot of agricultural land it also creates opportunities for specialized agricultural establishments. In the case of large plot land subdivision it is the market for ornamental plants and landscape gardening that are supported.
A Garden Specialist

Mr. Takashi was born in Tokyo and studied sociology but always felt the urge to explore the world. When he was 30 years old he migrated to Brazil, which at the time had the largest community of Japanese outside of Japan. Later on he started his own floriculture (1) from which he supports himself, his wife and four children. With the emergence of the gated communities in Igarapé he increasingly directed his production to cater to their needs and special wishes. Today he is specialized in growing ornamental plants (2) for the yards of the big private mansions.
From Cut Flowers to Ornamental Plants

Mr. Takashi’s floriculture is situated on the street leading to the gated community “Fazenda Solar.” During the beginnings of his floriculture he used to bring and sell his products, mainly cut flowers, in Belo Horizonte. The demand for ornamental plants had him not only transforming his portfolio but it also saved him the transportation to Belo Horizonte. Today he sells his plants directly from his farm.

Cold Beers and Camelia Japonica

The gated communities in Igarapé contain many weekend residencies (1) of city dwellers. Cold beers by the pool (2) and the traditional “Churrasco” are part of a celebrated Brazilian lifestyle and put the emphasis on outdoor activities. Combined with the absence of walls around each property the cultivation of the yards and its decoration with ornamental plants enjoys great popularity. Takashi’s market is flourishing, as his floriculture is right in between two gated communities.
As the agricultural land in the municipality of Mario Campos is decreasing due to similar transformations as observed in Igarapé, the rampant spreading of housing constructed since 2000, 30% of agricultural land in Mario Campos has been lost. One way of coping with agriculture in an urban area is to become independent from soil.
Mr. Koyshi was born and raised in Brazil as a descendant of Japanese immigrants; his parents were, like many Japanese immigrants, involved in floriculture and vegetable farming. Mr. Koyshi first worked as a mathematics teacher in Belo Horizonte, but returned to agriculture. He bought land to grow leafy vegetables (2) and seedlings. He always tries to apply new technologies (1) to his craft; a big part of his vegetables are cultivated in hydroponics.
Back to Agriculture

Coming from a rural background Mr. Koyshi's aspiration was to taste a glimpse of that city life he did not know; hence he worked several years as a teacher in Belo Horizonte. The decision to return to agriculture was not only one of preferences but also a monetary one. The agriculture turned out to bring him significantly more revenue than teaching. While many younger inhabitants are leaving the rural areas and the hard work, others are returning.

Hydroponics

Hydroponics (1) is a method of growing plants without soil but instead using a mineral nutrient solution. The roots of the plants are constantly in the nutrient solution, which is being pumped through a tank (2) to keep the concentration of the nutrient solution consistent. The amount of the nutrient solution can be calculated and optimized and herbicides and pesticides are not necessary. Hydroponics are a highly efficient method of cultivation and the production volume is above average. The independence from soil makes hydroponics an interesting alternative in urban areas.
UNPRODUCTIVE LAND

The agriculture in the metropolitan area of Belo Horizonte covers a wide array of agricultural activities and it consists of a highly heterogeneous group of farms and establishments that have the ability to adapt to changing circumstances. As the Brazilian agriculture experienced dramatic transformations during the 1950s and 1960s it is still in the process to find its role on both a global and a national scale. Considering that 85% of the country’s population live in urban areas providing the city with food becomes more important than ever. The constant transformations of the agricultural land in the metropolitan areas are consuming a lot of agricultural land. But there is an unknown variable in-between which is the unproductive and under used agricultural land.
Where Is Unproductive Land Found?

Unproductive and underused land is a common phenomenon in Brazilian agriculture. The reasons for this phenomenon are various and hard to summarize. The ratio of the agricultural production value of a municipality and the size of it shows huge differences only within the metropolitan region of Belo Horizonte. Of the 35 municipalities in the region nine stick out with a really high production value per hectare. Their agriculture is largely based on vegetables which indicates the high profitability of this agricultural activity. The larger municipalities on the outskirts of the metropolitan region with extended rural areas have a low production value per hectare.

Unproductive Land as a Potential

Overlying the maps of pressured areas and urban zones it is visible that some of the most productive agricultural land is in a very sought after area. The case studies showed how small-scale farms react in such situations, how quickly land can be transformed and the activities adapted. The question has to be where the small-scale farmer can move. The unused or unproductive land could be seen as a reservoir of land with high potential. It is crucial to identify the small-scale farmer as the protagonist of this process with his ability to cope with such transformations. In this process the support structures could serve as facilitators, and the case studies show how influential they can be.
COMMENTARY
GREEN BELT
Belo Horizonte lies at the boundary point of different biomes and thus of different systems of land exploitation: the mining and coffee farming to the south and west, the meagre cerrado farming to the north and large scale agribusiness to the east. The agribusiness, producing corn, sugarcane and soy on an enormous scale, is a major export-oriented industry and often used synonymously with Brazilian agriculture. In the immediate proximity of Belo Horizonte however, one finds an altogether different type of agriculture; small scale, diverse and locally oriented. In this green belt around the city we find a wide range of different operations, from traditional family farms to high-tech hydroponics. All of them function in close exchange with the city. Fresh produce is transported daily to a wholesale market just outside Belo Horizonte and from there distributed throughout the city. But the connection to the city is not limited to goods; not few of the farmers grew up in the city, were educated there and only later decided to become self-employed as agriculturists. They produce specialized vegetables, spices, eucalyptus trees or flowers. Agriculture, in direct exchange with the city, it seems offers as much changes and possibilities as the urban economy. The dynamic of the city that reaches outwards with its expansions, as is described also successfully in some of the other chapters of this book, is here put acutely through the prism of the land of the farmer, and the properties of the soil of Minas Gerais. A versatile farmer is able to manoeuvre through this complexity, however the chaos of expansion does not perhaps enough heed to the potentials offered by the variegated qualities of the dry cerrado soil. The shifting around of the different play pieces will only work as long as the ground is able to yield produce (lest we hope that hydroponics will present the only future of farming in Minas Gerais).
QUADRILÁTERO
FERRÍFERO
VI

QUADRILÁTERO FERRÍFERO

MINING AS AN ORDERING SYSTEM

MINING AS AN URBANIZING FORCE
The Baroque Capital of Ouro Preto
Tax Money Generator Miguel Burnier
The Steel Giant of Ouro Branco
Living Next to a Steel Plant in Barão de Cocais
No Mining Revenues for João Monlevade

VALE: THE GIANT AND THE REGION
Mine Worker Town Mariana
Genesis of Industrial Quarrying in Itabira
Vale, the Mining Giant

IRON ORE PROCESSING
Extraction Site
Iron Mining in a Global Context

THE EFFECT OF CONSTANT MINING
Scattered Urbanity: Infrastructure and Centers
Rich Soil Leads to Inequality Among Towns
Commuter Lifestyle
Mining Heritage
MINING AS AN ORDERING SYSTEM

The rich metalliferous veins in the mountain range south of Belo Horizonte form the "Quadrilátero Ferrífero," where the logic of a globally oriented mining industry re-orders the aspects and uses of the landscape as well as the flow of people, money, and goods; all under the preconditions of geology and older political borders.
With the rise of industrial mining and new tax laws for mining after the military regime, geology and the municipal borders became the most crucial preconditions for all territorial processes in the Quadrilátero Ferrífero.

Networks of iron ore, the flows of money and people, are triggered and nurtured by the mining and its beneficiation. This research assembles and maps stories of these flows and follows their spatial traces throughout the territory, portraying the specific character of the region.
MINING AS A URBANIZING FORCE

Mining has introduced a type of scattered urbanization in the undulating landscape, which appears to be difficult to occupy and unproductive for farming. After the Ouro Preto gold rush in the 18th century, a locally based steel production emerged in the late 19th century. This again was outpaced by industrial iron quarrying, developing in even more remote valleys and moving on to the next ones after the depletion of a mine.
The Baroque Capital Ouro Preto

In the early 18th century, several gold mining towns affiliated to the city of Vila Rica, later called Ouro Preto, which became the capital of the new state Minas Gerais. Ouro Preto grew to one of the biggest cities outside Europe and adapted a European baroque building style. When the hills in the late 19th century became too narrow for further development, Belo Horizonte was founded as a new administrative center of the state. Although being a popular touristic destination, the main income source of Ouro Preto today is iron quarrying in remote areas of the extensive municipal perimeter. There is no direct road connection between Ouro Preto and its mines, and consequently, most of the workers and companies active in these mines have their quarters not in Ouro Preto but in neighboring towns.

Iron Quarrying Nurtures the Gold City

In 2012, about 60% of all tax revenues of Ouro Preto came from the iron mines at the fringe of the municipal territory.

Ouro Preto’s Role in Brazil’s History

The Ouro Preto gold rush was the first of a series of economical booms in Brazil, making the colony rich and preparing ground for the detachment from Portugal in 1822.
Tax Money Generator Miguel Burnier
The village of Miguel Burnier, in the western part of Ouro Preto municipality, lies at a junction along the ancient railway to Rio de Janeiro, which today is a cargo route for iron transportation. The town had a small iron mine and due to its strategic location it was one of the first sites in Minas Gerais that had a blast furnace for steel production installed in the late 19th century. The mine and the blast furnace closed down in 1993, but recently the shrinking village anew gained in importance and became the biggest single source of Ouro Preto’s tax money, this after the steel and mining company Gerdau discovered big amounts of iron around the village and started to establish facilities to extract the deposits in 2004. The big scale exploitation has far reaching effects on the still impoverished village since the mining company continually extends, buys and converts properties in the urban zones.

Ore Extraction and Population
Miguel Burnier used to be a larger town with a direct railway connection to Rio. One had to change trains here to go to Ouro Preto. Many hotels opened up to meet tourist demands. The railway and the ore deposits brought mining to the town as early as 1893, when Carlos Wigg installed his Usina Wigg Company. Wigg was known for his care for the community, and when he died his wife Alice Wigg donated a church and around 100 houses for workers. Mining expanded after World War II but needed less manpower in general. This change and the closure of the railway for passengers provoked the closure of the hotels and initiated the emigration of residents. Finally, after closing the blast furnace in 1993, people strongly feared the ceasing of their town. This is why Gerdau was highly welcomed in 2004, announcing its plans to start mining again. The residents saw hope in Gerdau to bring new life and prosperity to their village. However, so far the population continues to drop.
Mutation Of the Territory
Gerdau has made the territory of the northwestern part of the village inaccessible for the public, and erected working and processing facilities here. The area is highly supervised and employees are not allowed to talk to visitors.

Frictions in the Town
Although the municipality of Ouro Preto defined an area of the old town as protected, Gerdau destroyed houses and installed itself on the site.
Public Property Island
The church is the only public property left in the mine area. Church visits are allowed only under surveillance.

Real Estate Takeover
The former orphanage is now housing the canteen of Gerdau, where mine workers eat for free.

Living in the Mine
The only resident in the Gerdau area is the sextant of the church; she also received permission to eat in the canteen.
The train station in the small town, being a listed building, has recently been repaired. However, the only one arriving is the mine pit behind the hill, which is coming closer every day. The rock extraction can already be seen on the horizon.

**Herald of Mutation**

The Miguel Burnier mine produced 6.5 million tons of iron ore in 2012. One year later, an increase of the capacity by 75% is estimated, boosting the annual production to 11.5 million tons. A further expansion to deliver 18 million tons is estimated for 2016. One truck in the illustration above symbolizes 2,500 truckloads of 400 tons iron ore each.

**Expansion Plans**

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The Motor of the City

Gerdau’s steel factory southwest of Ouro Branco is the largest in Minas Gerais, producing mainly profiles for the construction industry. It processes the iron ore extracted in the mine of Miguel Burnier and other mines owned by the company.

The Steel Giant of Ouro Branco

Ouro Branco used to be a small town in the southern realm of the municipality of Ouro Preto, whose main economic activity was potato cultivation, until it voted to become independent from Ouro Preto in the 1950s. Today, Ouro Branco is an autonomous city of 35,000 inhabitants, owing its prosperity to the big Gerdau steel factory, which opened up in 1979 and has since been extended several times. To meet the working force demands of the factory Ouro Branco was developed and urbanized by the steel company.

Population Reflecting Development

The restructuring of the company and the acquisition of iron ore mines, Miguel Burnier amongst them, to secure resources, previously announced the expansion plans of Gerdau already in the early 2000s. This was confirmed in 2012 when Siemens received a large order to install new machinery in the factory. A direct reaction to the expansion can be noted in the population development of the city.
Working at Different Locations
Antonio Alfonso Paula Filho and Marcello Pereira da Silva work for MecIn, a steel structure company based in Ouro Branco. MecIn receives orders by Gerdau, Namisa and Vale. Antonio and Marcello live in Congonhas and stay for two weeks at a hotel in Mariana to maintain machines in the Germano mine. They drive a typical mine subcontractor car: Silver color with red-white stripe and identification stickers of the company, the area and the personal number.

Grid Expansion
Gerdau started to develop Ouro Branco in 1979, applying the typical grid of neighborhood patches developed by Eolo Mba. Each patch is designated to a specific workers category, splitting engineers from factory workers. Eight model homes and a financing arrangement with long-term payment plans were set up for the workers.

| Developed neighborhoods since 2000 |
| Expansion 1979 - 2000 |
| Settlement before 1979 |

**Attracting Subcontractors**
Besides factory workers, also subcontractors install their operation base in Ouro Branco, prospecting work commissioned by the steel factory.
Living Next to a Steel Plant in Barão de Cocais

The town of Barão de Cocais emerged with the establishment of the steel factory in the late 19th century, when small-scale steel production based on locally grown charcoal burgeoned. In 1988 the Gerdau Company bought the steel factory at an auction. The raw iron for the steel plant is produced in the Gongo Soco mine owned by Vale, which also lies on the territory of the municipality. Contrary to other steel cities, the settlement in Barão de Cocais has almost encompassed the steel factory, which is enclosed by a 5m high wall, that in some places has been used as a back wall for houses or shops. Nevertheless, steel processing remains visible and strongly contrasts with everyday street life.

Tree Plantations for Steel Production

The steel industry in the 19th century used charcoal as an energy source, causing deforestation and erosion. Steel plants became more independent from close energy forests only when improved railway connections in the late 20th century allowed also the importing of coal. But still today the landscape between Barão de Cocais and João Monlevade is dominated by eucalyptus tree plantations.
No Mining Revenues for João Monlevade
From its early establishment in 1827 until the late 20th century, the steel factory of João Monlevade was the biggest in all of Minas Gerais, producing two thirds of all Mineiro steel in 1943. The company Belgo Mineira, which back then operated the factory, strongly influenced the development of the city, alone fulfilling diverse public functions. Unlike most other cities in the Quadrilátero Ferrífero, João Monlevade has no iron ore deposits within its narrow municipality boarders, and has to get along without the revenues from the mining business. This becomes increasingly difficult, since the steel companies during the last decades gradually withdrew from social investments like financing schools or healthcare, meanwhile the population is still growing, attracted by the job opportunities in the steel factory and the new big Brucutu iron mine nearby.

Withdrawal of Public Commitment
Belgo Mineira kept on being the main managing force in the urban government and built the Margarida hospital, which achieved regional reputation, as well as 4 schools, and granted scholarships to good students. Since the 1980s the company has gradually forwarded responsibilities for the urban development to the municipal authorities. When the company was bought by Arcelor Brasil (later Arcelor-Mittal) in 2005, it completely stopped all social involvement, while still expanding production capacities in João Monlevade. In consequence the city is having troubles funding the public services on its own.

A Steel Factory at the Town Periphery
Unlike in Barão de Cocais, the steel factory of João Monlevade is not located in the city center, but in a valley in the east of the city with access to a river and a railway track.

An Exemplary Company Town
In 1936, Belgo Mineira arranged an urban design competition to expand the town to a worker’s city. Lincoln Continentino, who rebuked competitors like the later famous Lucio Costa to a rear placement, won the competition.

Heavy Traffic Due to Mining Activities
One of the negative effects of mining that affect João Monlevade, without any kind of compensation, is the high cadence of heavy vehicles on the main roads leading through the city.
VALE: THE GIANT AND THE REGION

The mining giant Vale, initially founded by Getulio Vargas as a public enterprise to foster development in Brazil, has always played an ambivalent role of both nurturing and restricting life in the Quadrilátero Ferrífero. After privatization in 1997, the formerly tight relationship between the company and the communities dwindled and Vale became increasingly inaccessible for local actors and concerns.
Bringing jobs and tax money to Mariana Vale holds a certain degree of power in its hands and the town hall (1) depends strongly on the regional headquarter of Vale (2), located on the opposite side of the street. According to law, the municipality has to agree and approve each new project announced by the company based on communal values, but in practice, rather than refuting a disputable proposal, the municipality would just ask for a monetary compensation for expected inconveniences.

Mine Worker Town Mariana
One of the largest mining complexes in Minas Gerais is located in the town and municipality of Mariana. Most of the mine’s workforce also resides in the town, which is thus concentrating both job opportunities and tax income sources to one and the same spot within the municipality.

Neighbor Friendly Rulers
Bringing jobs and tax money to Mariana Vale holds a certain degree of power in its hands and the town hall (1) depends strongly on the regional headquarter of Vale (2), located on the opposite side of the street. According to law, the municipality has to agree and approve each new project announced by the company based on communal values, but in practice, rather than refuting a disputable proposal, the municipality would just ask for a monetary compensation for expected inconveniences.
Employment Relations
Working for Vale can be done in different relations. Jobs that engage people full time with the core activities, like for example the mine workers, are directly hired by Vale (1). If the work only requires a temporary presence on site, like with the maintenance and the construction of machinery, building complexes and installations, subcontractors (2) are engaged. Their relationship to Vale is indirect but often long lasting. A third type of mutual, economic relationship and indirect dependence has developed between Vale and the service sector, like the hotel and restaurant owners (3), in the areas where the company is active.

Residential Worker
Many Vale employees live in Mariana. Before privatization in 1997 they were offered a house by Vale in one of its neighborhoods. Nowadays employees settle throughout the whole city and do not anymore profit from any special conditions.

Non-Residential Workers
Non-residential workers stay at hotels in the city (1) and seasonal workers reside in low standard housing outside Mariana (2).

Short-Stay Workers
Subcontractors working in the mines, doing maintenance for some days, stay at hotels that are paid by their companies. The hotel often serves lunch and dinner to their working guests.

Seasonal Subcontractor Workers
This camp host up to 160 seasonal workers, most of which stay for 3 - 18 months at a time. The majority comes from northeastern Brazil, and every three months they receive a ticket from their company to go home to see their families.
Vale Neighborhoods
Fundação da Vale built several neighborhoods in 1984 when the Alegria mines opened. Houses were sold at special conditions to Vale workers only.

Everyday Life of Mine Workers
Everton Dos Anjos (1) lives in São Sebastião and works as a truck driver for Vale (2). Lou Rival Pereira (4, on the right), a friend of Everton’s father (4, on the left), drives the big mining trucks for Vale (2). Everton’s work schedule (3) repeats itself every five days, which means he has another schedule every week. This is why he sees his family only once a month.
Genesis of Industrial Quarry in Itabira

Itabira is the place where the mining company Vale was founded in the early years of Brazilian industrialization in the 1940s. The city emerged alongside the easily accessible and extensive deposit of iron ore, which to quarry required a large number of workers. For several decades Itabira grew complementary to the mines but the development became increasingly independent as the demand for workforce decreased due to rationalizations. During the last decades the mine, with its growing tailing ponds and the barely crossable cargo railway track, has increasingly affected and directed the form of the city. The conflicts escalated after 1997 and the privatization when Vale became an actor on the global market.

Iron Quarrying in the 1940s

The labor intense and slow quarry methods provide jobs for many people.

Iron Quarrying 2013

Rationalized quarrying makes it necessary to increase the extraction speed in order to provide enough jobs.

The City of Itabira 1972

The rich iron is the source of the booming city’s wealth, and the reason behind the city’s relatively high connectivity. Via the railway the Port of Vitoria/Tubarão as well as other cities in the Quadrilátero Ferrífero were reached.

The City of Itabira 2013

The mines and tailing ponds have overtaken most of the surrounding areas and conflicts with residents increase. The passenger railway station has been abandoned and the trains are only utilized for cargo.
Mother Vale: A Difficult Relationship

A public meeting in 1998 was one of the rare occasions where the omnipresent, but unstated, conflict between the mining company and the community was addressed.

Anxiety starts to rise, people fear loss of job and care, layoffs, early retirement, salary fall and outsourcing of services.

The mayor, FEAM, the Secretary of Environment and the civil society work together with the community to form conditions bound to the LOC.

Vale starts to implement some of the conditions. Inaugurations with free concerts were promoted widely.

FEAM reduces attention to Itabira because LOC is granted.

Neighborhood associations stop talking of conditions because they think the municipality would take care of them.

Vale starts slowing down on the implementations by reassessing conditions.

Communication difficulties with Vale rise because of high staff turnover.

As projects became realized, the community stops pressuring Vale.

Communication difficulties with Vale rise because of high staff turnover.

As a state owned company, Vale provides housing, medical, dental as well as childcare. Employees have a fair paid. Their lives revolve around the company. People accept damage done to the surroundings.

As projects became realized, the community stops pressuring Vale.

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1986 CONAMA
Brings up environmental assessment and environmental licensing for potentially damaging activities & legislation for public participation though public meetings.

1992 UN Conference on Environment, Rio
Awareness of the environmental issues rise.

1995 Vale files for LOC Licence
In order to continue extractions, the State environmental foundation of MG (FEAM) calls to seek an environmental licence (LOC).

1995 Vale announces privatization.

1997 Vale is privatized.

1999 Public meeting Itabira.

2000 LOC is granted with 52 conditions.

2000 Municipal elections
The new mayor J. I. Querino Coelho elevates interests of Vale over those of community.

2001 Vale announces new jobs
The expansion of mining and re-extraction from tailings guarantee new jobs. Concerns about layoffs decline.

2004 LOC is renewed behind locked doors

2007 New Reference Group
Vale representatives stop by the neighborhood only once a month.

"Vale is not the government ... we are no longer state owned!" Devlin Tubino (2011), p 155

2005 Diagnostico Territorial
Vale starts analyzing areas and decides in private what is needed.

2012 Vale receives the public eye award

Fenced City
In 2000, as a result of the public meeting in 1998, the whole city was fenced with only a few openings, to protect people from the mine and its facilities.

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Sport Facilities and Protection

The collection, stabilization and rehabilitation of tailing dams are likewise an outcome of the public meeting in 1998. As a part of the compensation program also the sports field was granted by Vale.

Fenced Railway

People asked for more security along the railway and in response Vale fenced the whole stretch through the city with iron, limiting the accessibility while only securing very few crossings.
Vale, the Mining Giant

Vale was founded in 1942 as a state-owned mining company under the name “Companhia Vale do Rio Doce” (CVRD). The regional headquarter was later moved to Belo Horizonte, and when Vale expanded also to the north of Brazil they established headquarters even in Rio de Janeiro. During the recession of 1997, the idle state company was sold to a consortium of Brazilian and Japanese investors. Vale has since then focused on mining; it sold all its shares in the wood pulp industry and in return bought-up some of its mining competitors and expanded to Canada and several other countries. After a decade of rapid growth, Vale is today the second biggest mining company worldwide, with an annual revenue of 46 billion US$ (2012) and 85,000 employees, out of which about 50% work with the iron production.

Iron Mining—a Federal Affair?

Throughout the 20th century, several federal governments tried to push the national steel production in order to become less dependent on steel imports. One of the first measures was the privatization of subsoil property rights in 1891 to make iron quarrying more attractive. But the iron quarrying only slightly augmented, because several hindrances remained: the iron could not be processed locally due to the shortage of charcoal, and at the same time the iron ore could not be exported, nor could mineral coal be easily imported, this due to the poor state of the transportation infrastructure. Even though entrepreneurs like Percival Farquhar aimed to build such an infrastructure, the lack of accessible capital made it unfeasible for a private company. Therefore Getulio Vargas intervened on a federal level and founded the CVRD in Itabira as well as the Volta Redonda steel mill, which he strategically located between the Quadrilátero Ferrífero, Rio de Janeiro and São Paulo, to foster iron quarrying in the country.
Vale’s main mining business relations

Vale’s involvements in public services

Vale as Provider of Public Services

Vale relocated its global headquarters to Rio de Janeiro, with Belo Horizonte as center for the mines of the Quadrilátero Ferrífero solely. Vale still funds many public services, amongst which are education, culture and local tourism.

1. Tourist Train Ouro Preto-Mariana
   Vale owns the last 3 remaining passenger trains of Brazil.

2. Cargo Railway Network
   1998 Vale bought the state owned railways FCA & EFVM.

3. Univale Private University
   Private education always played an important role in Brazil.

4. Co-financing a Federal University
   The UFOP University educates mining engineers.

5. Museum of Popular Culture
   Heritage Museum at Praca Liberdade in Belo Horizonte.

6. Funding of Inhôtim Art Park
   Vale also sponsors the art park Inhôtim in Brumadinho.
IRON ORE PROCESSING

Post World War II industrialization introduced a new, export-oriented kind of mining. Large-scale extraction with big machines, automatized processing and efficient cargo infrastructure accelerated the landscape transformations, which in areas remote from existing settlements and with advantageous local soil conditions aim to satisfy the demands of the global commodity market.
Extraction Site
The Alegria mining complex is the economical motor of Mariana, and is located about 30 driving minutes north of the city. It is composed of several larger mines, out of which Timbopeba, Germano and Alegria are the largest. Because of its rich subsurface Itabirite deposits, containing 35% iron, it is one of the major and most active mining complexes in Minas Gerais.

Itabirite: Iron Ore Deposits
The extraordinary richness of the underground iron ore veins in the area—with some of them reaching a local thickness of up to 1000m, securing resources for several years to come—is the reason for the large scale excavation complex found in this, otherwise remote, area.
The routes branching off the main road are controlled with simple gates. Sometimes they have little shelters for guards. Fences connected to the left and right side lead into the coppice.

**Restricted Area**
Each part of the Mariana Complex is fenced or restricted by natural barriers like coppice, hollows or hills. The only way to come close to the mine is the access road to the main entrance gate.

**Gates**
The routes branching off the main road are controlled with simple gates. Sometimes they have little shelters for guards. Fences connected to the left and right side lead into the coppice.
Changing Surface

The Mariana complex covers a large area. The surface is constantly changing due to the processes of digging, dumping and sedimentation. Sites for operation and iron processing remain as fixed spots in an altering landscape.

Snapshot of the Surface Character

- Tailings fitting
- Dug surface
- Dumped surface
- Extraction spot
- Processing facility

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Securing the Extraction Minescape

The newer mines are organized like assembly lines. First, the terrain is shaped for the placement of machines, facilities and infrastructure. The new landscape involves plateaus, dams and banking, forming a system for material and people flows. Every step is highly controlled so that each bus or mini car, and each load of ore leaving or entering the area is monitored and observed. Security is set at first priority.
Unloading the Carved Rock Material
Extracted rock is brought from the excavation pit by mining, trucks each carrying a load of 400t at a time.

Temporary Storage
The already crushed rock is stored for some time before it is brought to the ore extraction plant.

Crushing Station
To extract iron ore rock is crushed; the fine sediment is loaded onto trucks and brought to the ore extraction plant.

Iron Ore Extraction
Iron is separated from non-ferrous rocks by magnets. In the process also waste like slurry is generated.
Rock Waste—Dumping
Rock waste contains non-ferrous material and is disposed in banks. For each ton of iron ore, one tone of waste is produced. Dumping piles need to be designed carefully as they transform vast areas in the landscape.

The New Landscape
Today, dumping hills are carefully sketched out with 3-D modeling programs and constructed with GPS coordination. After 20 years the hills slowly starts to blend in with the natural, but the artificial character is still visible.
Grassy Pond

Closed tailing ponds feature a high concentration of silicate, which makes it difficult to grow trees on the sites. A grass-covered swampy terrain remains even 10 years after the closing of the mine.

Sediment Waste—Tailings

Slurry contains non-ferrous sediments, water and additives of the ore extraction process. This highly viscous and foamy broth is collected in large ponds to separate the water from the sediments.
Creating a Tailings Pond
While the water stays on the surface, the sediments settle on the bottom forming new layers. This makes the pond rise over time and the surrounding dikes holding the tailings needs to be elevated. Regardless of the level of the measures taken to protect the environment from impact, some substances still trickle down into the groundwater.

Dam Elevation
The street crossing the dam separates two tailing pond basins. To keep the valley crossable when the pond level raises, the street has to be elevated too.

Reuse of Tailings Water
The remaining water is separated from the sediments. And while the foam is retained, the water is pumped back into the ore extraction plant for reuse.
Iron Mining in a Global Context

Today’s large scale iron ore extraction economy of the Quadrilátero Ferrífero is based on export, and thus highly depend on efficient transportation infrastructure, namely railways connecting the mines to ports on the coast or, for the smaller share, to steel factories that produce for the national market. For this reason, many of the ancient railways of the Quadrilátero Ferrífero, which were partly also used for passenger transportation, have been replaced, improved and extended to serve as cargo lines. The two main lines leading out of the Quadrilátero Ferrífero are today operated and owned by Vale.

Two Cargo Railway Corridors Form the Backbone of the Iron Economy

The two railways link the iron extraction sites directly to important seaports, avoiding passing through any cities, including Belo Horizonte. Their paths are determined only by the topography and, in some parts, by historically established trails or older rail tracks. In 2008, Samarco introduced the first iron slurry pipeline, a transportation technique that might become broadly used in future.
Cargo Loading

To connect a mine to the railway and to enable the trains to turn, ample earthworks are required to re-shape the terrain. In big mines like the Brucutu iron mine (picture) about 1t of material is loaded per second.

Samarco Slurry Pipeline for Iron

The partly Vale-owned company has introduced a pipeline transporting water-iron-composite from the Germano mine to the Ubu Port.

Exportation Routes

The first solely export oriented railway was established in the 1940s, connecting the mines to the city of Vitoria, where Vale built the Tubarão port. Also the old railways to Rio were later extended to enable large cargo train transport.
Recent Global Iron Boom
The global steel demand has exploded since 2000. Since then Brazil doubled its iron production, outpaced only by China who expanded even faster.

Most of Brazil’s Iron Is Exported
The relatively high taxation and the need to import mineral coal make steel production in Brazil economically rather unattractive. Thus, only the domestic steel demand is covered by the inland production, the rest of the iron is being exported unrefined.

Vale Ordered Bigger Bulk Carriers
The bulk ships Vale recently ordered are the world’s biggest, in size only surpassed by some supertanker ships.

Swiss Companies Might Buy LLX-Port
Eike Batista, son of the former Vale-director Eliezer Batista and founder of LLX and other enterprises, offered the LLX Superporto Terminal for sale when he went bankrupt in 2012. Amongst the interested parties were the two commodity traders Glencore-Xstrata and Trafigura, both registered in Switzerland.

Commodity Traders Based in CH
Some of the world’s biggest commodity trading companies have their headquarters in Switzerland, taking advantage from the lax Swiss fiscal legislation.

The Role of Switzerland
Since 2000 Switzerland has become a very big hub for mineral commodity trading - not physically, but legally. Also Vale joined in and founded an agency in Switzerland in 2006. In 2012 the “Tagesanzeiger” newspaper reported that Vale had defaulted cantonal taxes for several years.
THE EFFECT OF CONSTANT MINING

Mining is continuing to reconfigure the territory of the Quadrilátero Ferrífero, just as it has been doing for the last three centuries, coining a particular cultural landscape and a mesh of superimposed infrastructures and networks. The focal points of urbanization oscillated in the area and a lifestyle of continuous alteration is one of its outcomes.

Modified landscape with tree farm, close to Pico mines, Itabirito
Scattered Urbanity: Infrastructure and Centers

After the initial gold rush era when Ouro Preto became the capital of Minas Gerais, the focus of urbanization in the 19th century shifted to steel-producing cities like João Monlevade and Miguel Burnier. In the late 19th century, Belo Horizonte was founded, and the federal government actively pushed the iron quarrying in Itabira. After World War II, efficient highways and cargo railways opened up the territory for mining on remote sites, like Alegria. The newer mines broadly ignore historical ties, and introduce a new scale of mining sites and of processing facilities, like the steel factory of Ouro Branco.

Mine Urbanism Today

Many of the recently established mines are remote from any existing settlement, temporarily introducing an abundant range of infrastructure to these places, from unpaved access roads and a cargo railway loop to water and electricity circuits. A residential development in proximity to the mine on the other hand is neither necessary nor desirable anymore, since the unprecedented pace of extraction leads the mines to be depleted within a few years. All the equipment as well as the well-established commuter bus system are thus developed and optimized to respond to these expected future geographical shifts.
New Infrastructure in São Goncalo
Positive effects of mining become especially visible in small villages like São Goncalo. The revenues from the new mine has enabled São Goncalo to improve its public infrastructure, which they would not have afforded otherwise.

Rich Soil Leads to Inequality Among Towns
The municipality boards, which date back to the pre-iron age, became increasingly important with the industrial iron production, because of the enormous revenue they generate for their respective municipalities via Value Added Tax and the royalty compensations, which for iron are set to 2% of the release value. Especially small communities become instantaneously wealthy when a big mine opens on their territory, as it happened in São Goncalo do Rio Abaixo with the Brucutu mine in 2006. This temporary bonanza causes a very uneven wealth distribution, as well as a strong financial dependency on the mining industry. The latter may threaten the economy of even bigger cities like Ouro Preto, which have no physical impacts to fear of the iron mining at the outskirts of their territory.

Public Park in São Goncalo
An extraordinarily tidy park in the village of São Goncalo.
Commuter Lifestyle
Belo Horizonte is the main hub for the regional administration, and serves as home base for ambulatory engineers doing maintenance in various mines reachable by car in one or two hours, but the majority of the workers involved in the mining also live in towns within the Quadrilátero Ferrífero. These towns range in size from 2,000 to 100,000 inhabitants, summing up to about half a million residents scattered in the hilly area nurtured mainly by the mining industry. The employing companies provide transportation either by lending out company cars or by providing commuter buses. Public transportation on the other hand barely exists.

Bus Service Provided by Companies
Commuting happens mostly over distances of about 30 min., with buses operated by Vale or by private companies. The buses are serving stops placed along the roads, collecting people to bring them to the mine for their working shift.
Mining Heritage

The gradually depleted iron mines leave losses in the balances of the local tax office behind, but also large infrastructures and reconfigured landscapes, which raises the question of what comes after? The proposals on how to deal with the mining heritage range from re-naturalization over re-use for a different purpose, e.g. as a water reservoir, to including the mining activities into an integrated tourism- and landscape preservation strategy under the label of the UNESCO Geo-park. And new proposals might appear, if the perception of industrially and humanly reconfigured landscapes undergoes a similar shift in aesthetic perception as in several other places, like in the Zeche Zollverein in Germany.

UNESCO Geo-park Proposal

Academics of various universities proposed to enlist the Quadrilátero Ferrífero on the UNESCO Geoparks, in order to preserve the unique geological and mining heritage as a touristic attraction, and aiming at establishing a better dialogue between mining companies and the affected population.

Post-Mining Landscape at Pico Mine

The remnants of mining form an impressive landscape that one-day might become a touristic attraction itself.
COMMENTARY
QUADRILÁTERO FERRÍFERO

The territory understood by the “Iron Quadrangle” seems to be single-minded: almost all of the complexity and plurality of events that are described here by the students are in some way related to the industry of mining extraction, iron ore processing, the related steel industry, its packaging and, finally, export. The governance of the territory though is fragmented and far more fine-grained, and this creates differentiations and groupings of its own sort, even if the entire system is interwoven. As a place it is rather unique, and this work depicts that also as a human reality: living and working in the Quadrilátero Ferrífero means adapting to this intricate system of economy and network of settlements.

The student work itself presents a compendium of case studies, specific moments and places that together portray one big geopolitical entity, an entity that manages to bypass the neighboring metropolis and play out on the global scale, allying itself rather to the port outlets on the Brazilian coast, and from there across the seas.

It also manages in its thoroughness to give meaning to the cycle of transformation entailed in the process of mining itself, with regards to human occupation and to the reshaping of the earth, by illustrating “older” almost abandoned places, and natural “remnants”, both of which find ways to remain in this whirring field of activity.
VII

NOVA LIMA
MINING LANDSCAPE MEETS URBAN PERIPHERY

LOCALIZING NOVA LIMA
Gold Mining: Settling Inland Brazil

TERRITORIAL INVENTORY
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Urbanization
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MECHANISMS OF URBANIZATION
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Enforced Compensation for Environmental Impacts
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MECHANISMS OF MINING
A Network of Mines and Infrastructure
Environmental Impact and Forms of Compensation
Post-Mining Landscape

CORRELATIONS
Proximity of Urbanization and Mining
Inaccessible Condominia, Mines and Nature

THE SHAPE OF THINGS TO COME
LOCALIZING NOVA LIMA

Nova Lima is a sovereign municipality neighboring Belo Horizonte. The main city expansion and urbanization concentrate along two axes, the Vetor Norte and the Vetor Sul. The northern expansion is characterized by support from the public sector as opposed to the rich and privately developed southern expansion. Nova Lima is naturally separated from Belo Horizonte by the iconic mountain ridge Serra do Curral. However with the expansion to the south, the ridge’s slopes have been conquered and the development has reached Nova Lima, which is now a part of the Metropolitan Region of Belo Horizonte.

Real Estate Eldorado

Unlike Belo Horizonte, the municipality of Nova Lima has only a loose set of building laws, which has led to a number of interesting urban developments by private investors and developers. The real estate market is entirely dominated by demand and the built is a direct translation and realization of a mind-set and of common preferences.
On the Intersection of Urban Periphery and the Iron Quadrangle
Nova Lima falls into the confines of the Quadrilátero Ferrífero, a geographical quadrangle of immensely rich iron ore deposits. Belo Horizonte’s expansion and the large-scale mining occupy the same territory, which has resulted in several conflicts that we have investigated.

The Silent Presence of Mining
Mining is a business with a huge impact on its surrounding environment. This influence used to be overlooked, as most mines were remote and inaccessible. However, the city’s expansion and the urban embracing of the mining region expose possible conflicts.
Gold Mining: Settling Inland Brazil
Minas Gerais was the location of the first gold rush in the world. Exploration parties were sent out in the late 17th century by Portuguese colonialists to conquer the land in order to find gold. When finally gold was discovered, thousands of settlers, even from the home country of Portugal, were attracted by the promise of wealth. Minas Gerais, previously unknown territory, was on the rise to play an important part in Brazil’s colonial history. The settling of the entire region originates in the gold rush and forms a large part of its historical identity.

Projection Plain of Colonial Greed
Brazil was named after the “Paul Brasil,” a reddish wood, which was the first colonial export product to Europe. The naming of Minas Gerais followed the same symptomatic attitude towards the land: Minas Gerais translates into “mines and general (woods).”
When Belo Horizonte was inaugurated in 1897, Nova Lima was far away from the new city and few dependencies developed. The antagonism between the new capital and the colonial town remained until the 1980s when Nova Lima was incorporated into the Metropolitan Region of BH. Gold mining in the city of Nova Lima only stopped in 2004, but the mining activities are still carried on in other municipalities in the region.

The British Colonization

The gold mining is the reason for Nova Lima’s existence and the British company St. John d’el Rey is responsible for most of its construction. Nova Lima is in essence a company town with the central mine as its heart. Approximately 150 British colonials used to live in Nova Lima at that time (most for 6 years at a time). The British segregated themselves from the Brazilians with their own churches, cemeteries, clubs and hospitals. Some of these institutions still exist and were opened to the rest of the community after the departure of the British in 1958.

The Company Town and the New Capital
Possessing and Transforming the Land

The St. John d’el Rey Company and the superintendent John Chalmers constructed a water network across the municipality with the purpose of operating the mine. The dams provided electricity and the canals supplied the mine with the required water.

The World’s Largest Gold Mine

Gold occurs in vertical veins and is mined underground in a mycelium of shafts. With British knowledge and capital, the Mina da Morro Velho became the deepest and most productive gold mine in the world. It was expanded continuously since its opening in 1835 and is up to 3000 meters deep. Until its closure in 2004 it was the oldest operating mine. Although underground, a mine of this size requires a large amount of over-ground infrastructure that is more significant than the mine itself.

The Mineiros

The work in the mine is physically hard and often causes health problems. The Mineiro is still a symbolic figure for Nova Lima, as the society’s identity is strongly linked to the mining. In earlier days the mining company directly or indirectly employed 90% of the population.

Possessing and Transforming the Land

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TERRITORIAL INVENTORY

In the territory of the municipality of Nova Lima the nature, the urbanization and the mining can be identified as the three predominant land uses. Their driving energies differ today, but the natural conditions continue to be the basis for all forces of transformation: the urbanization process is highly influenced by the proximity to Belo Horizonte and the mining depends on the occurrence of iron ore deposits.
Urbanization and mining are the driving forces in the territorial development. The natural conditions are the basis for these developments, but nature is a passive actor next to the driven urbanization and the mining exploitations.

**Patchwork Landscape**

The allocation of land uses in the territory presents a scattered landscape. The uses are split up into several disconnected islands. The highways and the town of Nova Lima are the only visible structuring elements.

**Nature, Urbanization and Mining**

Urbanization and mining are the driving forces in the territorial development. The natural conditions are the basis for these developments, but nature is a passive actor next to the driven urbanization and the mining exploitations.
Natural Conditions

The literal foundation of the mining are the geological conditions enabling a profitable extraction of the deposits. Another asset, yet not as monetarily measurable, is the topography that creates stunning views. Numerous springs originate on the bald hills and flow through the forested valleys into the river Rio das Velhas.
The Mineral Veins - Latent Form

The iron and gold ore deposits occur in the form of veins that were formed by magmatic processes in permeable geological conditions. The metals are also deposited in layers on the rocks.
The Atlantic Rainforest is the native coastal woodland and has a very high biodiversity. It spans over large ranges of altitudes and latitudes and is more diverse than the rainforest in the Amazonas.

The Cerrado, the Brazilian savannah, is the main area of agricultural ambitions. Through the introduction of non-native species and artificial watering, only few original areas of the Cerrado remain intact and unaffected.

Belo Horizonte is located in a very fragile natural environment, the transitional zone of the Cerrado and the Mata Atlântica. The importance of these shrinking biomes makes most of the area a zone of environmental protection.

The typical red soil of Minas Gerais is very soft. This condition in combination at times with the dramatic inclined topography and sometimes ill suited activities causes problems of erosion on many different levels.

The Atlantic Rainforest is the native coastal woodland and has a very high biodiversity. It spans over large ranges of altitudes and latitudes and is more diverse than the rainforest in the Amazonas.

Due to the composition of the ground the incredibly steep ridges are smoothly shaped. The ridges themselves are barren with only little vegetation, but the streams in the bottom of the valleys supply the forests.
Artificial Lakes
In and around Belo Horizonte a number of artificial lakes, built for different reasons, are to be found. The topographical conditions of a valley may enable the construction of a single dam to be sufficient for the appearance of a lake.

Rio das Velhas as Water Supply
The Rio das Velhas is a vital element of the region. Due to the alluvial gold the first settlements of the "Gold Rush" were founded along its shores. As a water supply it remains a crucial element up to this day.

Streams in the Valleys
The small streams that originate from the barren hills constitute the backbone of the local ecosystem. They connect the entire region in this large water system.

Private Reserve of Natural Heritage
A RPPN, “Reserva Particular do Patrimônio Natural” is along with a public zone of nature protection the main means of protection of the environment and of preservation of the balance in the ecosystem.

Belo Horizonte’s Water Supply
The entire southern part of Belo Horizonte is a large environmental protection zone as 70% of Belo Horizonte’s water is drawn from this area. The countless streams originate in the hills and finally join the river Rio das Velhas where the drinking water is collected.
Developed residential

Urbanization

Nova Lima stretches over more than 30 kilometers from north to south, but the required time to cross the area is more relevant than the distance itself. The urbanization of the municipality is closely linked to the emergence of the car. The federal highway BR 040 and the state highway MG 030 function as urban condensers creating a corridor of extensive urbanization along their routes. Proximity to one of these roads means a reinsured linkage to Belo Horizonte.
Dependency on the Highway
Beyond the federal highway the accessibility decreases quickly. Low maintenance of roads and the challenging topography limit urban expansion oriented to Belo Horizonte to the larger roads (BR-040 and MG-030) that follow ridges.

Industry
In Jardim de Canadá construction businesses and machinery companies form an industrial cluster. Their emergence and current existence depend on the mining companies as well as on the urban expansion.

Infrastructure
Although the urban expansion stretches up to 30 km to the south, the city can be reached by car within 30 minutes. The traffic flow on the highways is fluent but collapses in Belvedere, the eye of the needle reaching Belo Horizonte from Nova Lima.

Commerce
Grocery stores for the everyday shopping by the condominiums’ residents are clustered along the highway and in Jardim de Canadá. Since prices in these stores are unaffordable for the poorer local population, a service structure for this segment exists in parallel.

Residential
Due to their natural beauty, the hills in Nova Lima are the preferred location for the Brazilian version of the “American dream.” The ongoing developments in real-estate are exclusively for the upper-class striving to get out of the city.

Commerce
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Dependency on the Highway
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In the course of their operations in Nova Lima, the St. John d’el Rey Company bought large stretches of land, finally owning 65% of the land of the whole municipality. When the company was sold, the property was divided between the two subsequent companies MBR (today Vale) and Morro Velho (today Anglo Gold Ashanti). These two are still the largest landowners in the municipality and own most of the land that is attractive for real estate developments.
St. John d’el Rey
1834 - 1958
Great Britain

Hanna Mining
1958-1972
Canada

Morro Velho
Brazilian
1960

MBR
Brazilian
1972-2006

CVRD
Brazilian state-owned
1942-1997

 Territory under Abstract Rule
Nova Lima has always been under strong influence of, and dependent on the mining companies. It is particularly problematic that these companies are either foreign or too large to care for the specificities of the region other than on an economic basis.

An Urban Fallow on Hold
The climax of gold mining in Nova Lima is over but there is still gold left. A project for a redevelopment of the mining site was commissioned, but will not be realized. Depending on the variation of the gold price in the future, it might be profitable to reopen the mine. The site will therefore remain fallow land.
Global Business
85% of Brazil’s iron ore is exported. The highest quantities go to China, which is not only the largest producer but also the largest consumer in the world.

Global Demand
The demand for iron ore has constantly risen during the postwar years, and since the 2000s demand and prices have exploded due to the Chinese building boom. The privatization of Vale happened at a time when mining was the least profitable.

Landscape Incisions
The pits of the open-pit mines are confined to a relatively small area. With the extraction and production process the hills are transformed into artificially stacked slopes where the geology of the ground is well visible.
MECHANISMS OF URBANIZATION

In Nova Lima, located in the southern periphery of the Metropolitan Region of Belo Horizonte as part of the Vetor Sul, one can discover a variety of different types of urban forms ranging from the historic gold mining town of Nova Lima to scattered weekend houses and condominiums, to the high-rises on the ridge bordering Belo Horizonte. Each type is shaped by its own driving force; a mechanism that has resulted in the current urban configuration and development tendencies.
Peripheral Expansion

The occupation of Nova Lima has passed through different periods of peripheral expansion with the settlements of each time period featuring different characteristics. Infrastructure, especially road constructions, plays a crucial role in the urbanization of the hinterland and still remains crucial for all future developments.
1950-60: Weekend Houses
The increase of mobility with the introduction of cars required an extension of the road network. Peripheral areas such as Nova Lima are now made easily accessible. The scenic nature invites citizens to spend their leisure time there and the first peripheral settlements of weekend houses emerge. Private investors parcelled and developed the land and sold the lots separately.

1970-80: Densification
In this period the parcelisation of properties increases enormously. The previous only temporarily inhabited weekend houses are now slowly transformed into condominiums for permanent residence. The increased and partially uncontrolled parcelisation slows down with the legislation of the land law in 1979. However, the majority of the peripheral settlements can be dated back to this period.

Since 1990: High-End Condominiums
The standard of the converted weekend house condominiums varies from mixed to high-end. With the land law new parcelisations are hindered and therefore only large-scale projects pay off. This goes along with demands of an increasingly higher standard, rendering the projects very valuable. However, many unoccupied lots remain, leaving space for a densification in the future.

Until 1930: Dichotomy
Nova Lima’s origin lies in the gold mining, whereas Belo Horizonte was founded as the new capital of Minas Gerais in 1897. These different roots along with the natural border of the Serra do Curral led to a disconnection between the two cities until the 1930s. Before that, Nova Lima was more tightly connected to Ouro Preto and Sabara along the river Rio das Velhas.
Chronology of Urban Expansion
The increase of inhabitants in Nova Lima started around 1950. Taking into account that more than half of the municipality’s population still lives in the historic city, one is left with a general population growth over time.
DUAL CONCENTRATION

The allocation of inhabitants clearly shows a concentration of people in the historic city and Jardim de Canadá. 50,000 out of 80,000 of the entire population still live in the historic city. This suggests differentiation of urbanity between these hotspots and the rest of the municipality.

PERMANENCE OF OCCUPATION

The transformation of weekend house settlements to regular condominiums comes along with an increased percentage of permanent residents. However, not all settlements have undergone the same process, some differences still exist. The proximity to a highway appears to support permanent occupation.

ORIENTATION TOWARDS THE CENTER

The condominium’s inhabitants orient their life towards Belo Horizonte. As they tend to be rich, they have access to extensive mobility through cars. The majority work either in Vila da Serra or in the city core. Social contacts, and urban lifestyle are being enjoyed in the center as well. The condominiums on the other hand provide the excess of space, quietness, access to nature and security. Urbanity is not asked for in the periphery of Nova Lima.

STAYING IN NOVA LIMA

Nova Lima and Jardim de Canadá clearly vary from the other settlements in the municipality. Their inhabitants also display different everyday networks being less dependent on Belo Horizonte. The majority are workers employed in the mining sector, in condominiums as maids or security personnel, in the civil construction sector, in commercial zones along the highways or in the industry.
A Worker’s Home: Nova Lima

The gold mining in the town is not active anymore but the city’s entire past and identity can be traced back to it. The mining remnants such as infrastructure and some social institutions are still there, some more evident than others. As Nova Lima is almost 300 years old its structure has organically evolved and successively grown. Within the municipality it is also the only settlement deserving the title city as it offers a certain kind of urbanity with genuine public spaces. Historically, Nova Lima has always been a worker’s town and this has not changed. When the gold mining disappeared, many employees switched to the iron ore mining. In addition to the mines industries as well as several commercial zones in the city employ the town’s inhabitants today.
Town Houses

The typical steep roads are lined with small-scale town houses with only two to three floors. Built side-to-side they occupy the entire lot, with the exception of occasional backyards. The town house does not provide special precautions regarding security, and a variation of the type accommodates commercial areas on the ground floor.

Public Square

The Praça Bernardino de Lima in the heart of Nova Lima is the most important public square in the city. It is a lively meeting point with commerce filling the streets and public institutions like the administration of the Municipality of Nova Lima, the theatre and the Miner’s Syndicate flanking its side.
The Hanna Mining Group, a descendant company of St. John D’el Rey, with roots in Canada, founded Jardim de Canadá in the 1950s as a company town. The plan did not deliver the expected results and the project has since developed along its own course. Since the establishment of the area as a residential town did not work out commercial and industrial zones, with concentrations along highway BR-040 and around the gas station, were introduced. Nowadays Jardim de Canadá also features a high density of residents but the area still entails quite some lots remaining empty regardless of their use. This diverse place with its mix of residential, commercial and industrial areas position Jardim de Canadá as an exceptional neighborhood compared to the majority of the other settlements in Nova Lima. There are a variety of standards within these different sectors from low to high-end. The customers of the elevated standards live in the surrounding condominia and the more simple services and grocery shops cater to the poorer local residents. Jardim de Canadá therefore plays an important part as a service node within the region.

Service Node: Jardim de Canadá
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One of the Perpendicular Roads Leading from the Main Highway
**Functional Shed**

The industrial zones, with factories for the local civil construction sector as well as various international companies, are located in the northeastern corner and on the eastern side of the BR-040. The factories are highly functional buildings, mainly constructed as simple metal sheds, ordered adjacent to the street in order to provide a good accessibility for trucks.

**Transit Commerce**

The commercial buildings feature the same functionality as the industrial buildings, but on a different scale. The single-story shops with large windows advertise their products or services. The architectural standard of the buildings do not correlate with the standard of the goods they offer, therefore even a high-end wine store can be found with a leaking roof.
Single Houses
The older formal developments in Jardim de Canadá follow the standard type of a single-family house around Belo Horizonte; each residential unit occupies the center of a lot. The ground floor garage, a small front garden and a fence or wall surrounding the lot complete the type.

Informal Occupation
Characteristic for the informal areas is the occupation of one single lot with up to four different buildings. The standard, compared with favelas, is relatively high. The formalization of the construction and the occupancy follow certain rules: if the owner fails to claim back his property within five years the occupants can claim it as their own if they are able to prove the five-year duration of occupancy.
The Skyline of the Belvedere Ridge

Spreading Across the Border: Belvedere and Vila da Serra
The natural limit to Belo Horizonte’s southern expansion is the ridge Serra do Curral. The rich south expansion, the Vetor Sul, slowly approached the ridge and occupied it with the construction of Belvedere in 1969. Starting with low-rise buildings the demand for this area remained high and led to the construction of the high-rise district Belvedere III in 1988. BH Shopping, Belo Horizonte’s first shopping center, also acted as a catalyst. The desire for high-end apartments is not constrained to municipal borders. Vila da Serra, just across the border in Nova Lima, has recently undergone a similar development of densification and valorization; whereas Belvedere is mainly residential, Vila da Serra has a high percentage of commercial areas.
Direct from the Drawing Table
The development of Belvedere I and II was laid out on the drawing table. The insensitive treatment of the topography is characteristic for the urban expansion in Vetor Sul. This advertisement from 1971 displays the view over Belo Horizonte, the main selling argument of the new area.

Belvedere
The predominant type of building in Belvedere is the apartment tower. A varied street space is offered thanks to the appearance of the towers varying in accordance to their time of construction with the first constructions dating back to 1988. The street itself is often lined with trees and sidewalks insuring certain urban qualities.

Vila da Serra
In contrast to Belvedere, the claim for architectural quality appears to have totally vanished in Vila da Serra. The entire district was constructed within the last 10 to 15 years resulting in a uniform appearance. The streets are seamed with windowless walls instead of shadowing street space-defining trees.
Single Houses in Belvedere I + II
Each residential unit occupies one lot with a maximum of three floors. The ground floor garage, a small front garden and the fence around the lot complete this prototype of the house. The type can be found all over the Metropolitan Region of Belo Horizonte in different variations. The Belvedere version is comparably generous.

Apartment Tower in Belvedere III
The high demand for residential property in Belvedere resulted in a higher density: the properties are piled in apartment towers. A concierge guards the entrance providing the requested security; cars are parked underground or on the street. The buildings, despite being skyscrapers, claim a certain level of architectural quality.
Resort Tower in Vila da Serra

Across the border, Belvedere's apartment tower is transformed into a joystick typology. The allocation of functions is distributed in a much more pragmatic way: the four-story foundation box fills the entire lot, containing parking and shared facilities such as pools and gyms. The apartment towers grow out of these boxes, overlooking the common leisure level and the surrounding landscape.

Investor
Investments in land and planning,
Marketing and
Rate of return

Architect
Development of architectural
Project, submission of Building
permission.

Constructor
Simplification of the project
Reduction of costs and
Architectural language

Projection | Project | Construction

The Token Architect
The architect's role in the construction process of a high-value building is merely to pass the legal requirements concerning building permissions. After having achieved this, the project is handed over to a constructor replacing many parts of the project with standardized solutions to maximize the profit.

Vertical Density - Horizontal Redundancy
In the calculation of density only the apartments are counted, the parking and leisure substructures are left out. Economically and in terms of functionality this substructure is very practical, but from an urbanist point of view they form barricades and increase anonymity.

Junk Space Urbanity
The total lack of any affiliation between the buildings leads to the incidental but deliberate creation of junk spaces without possibilities of housing any complimentary formal uses. In Nova Lima these urban spaces are willfully ignored for the benefit of the additional tax incomes generated by the large developments.
Scattered Condominia: Alphaville
Many condominia are scattered across Nova Lima, differing in size, shape and background: previous weekend house settlements or recent profitable high-end real estate projects. Despite their differences they are all gated, peripheral, expensive and indirectly illegal. Their density is low, and many lots remain unoccupied for longer times remaining an investment for years. The proximity to nature and a stunning view are integral parts of the lifestyle they offer; and this result in a occupation of the top of the ridges characteristic for condominia.
The Lagoa dos Ingleses, an artificial lake from the gold mining era, is the heart of this condominium. In 1998, a private investor collaborated with the brand Alphaville. The construction of the first houses started in 2000 after the infrastructure had first been installed. The second phase, Alphaville II, started in 2004. The lake itself is still property of AngloGold Ashanti and only the yacht and nautical club have permission to access its shores and use the lake.

### Alphaville

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### Several Condominia Around a Lake

The whole area is split up into different independent parts with different investors, identities and functions: the administration and the shopping quarter are in the central area by the main entrance, the residential areas are split up into several more or less independent condominia, the business school and the hotel likewise work as individual units.
Luxurious Single House
Most condominia within the complex are gated and protected by a wall. The variation of the otherwise normal single house type therefore lack the individual surrounding fence. The standards are above average and exhibit individualism with special features such as pools.

The New Urbanism Mall
The entrance zone of Alphaville consists of a mall and an administration complex. The idea of a public urban space is the inspiration for this area. However, one experiences very little urbanity, as it is a highly privatized and protected space. The design by the American SWA group, who laid out the scheme for the entire Alphaville, has the appearance of an American version of the Toscana.
Illegally Gated Public Space

When a new condominium is parcelled, around 35 percent of the area, such as streets and common spaces go into the municipality’s hand and therefore have to be publicly accessible by law. This law makes the closed gated community illegal, but in practice this is rarely respected and most condominia close these spaces off from public accessibility, and care for their maintenance themselves.
Contrasting Ways of Occupation

The variety of settlements to be found in Nova Lima illus-
trates the different ways of occupying the territory and
are to be found in close proximity, as shown by these two
pictures taken from one spot looking in opposite directions.
An Open-Pit Mine Close to Vila de Serra

Enforced Compensations for Environmental Impacts
The most recently built condominias are all large-scale projects. The process of developing the land requires drastic measures such as the clearing of the site, and since most of the settlements are peripheral and not connected, the construction of a house also requires large infrastructural measures. This environmental impact is often overlooked, but has been focused on in the recent past. The condominias Vale dos Cristais and Quintas do Sol came along with the establishment of a Private Natural Heritage Reserve (RPPN) as a compensation for environmental impacts caused by the developments.

An Open-Pit Mine Close to Vila de Serra
A Mining Company Turns to Real Estate
Vale dos Cristais and Quintas do Sol are both property of AngloGold Ashanti and developed in collaboration with Odebrecht Realizações Imobiliárias on land not usable for mining. The developments exemplify the diversification AngloGold Ashanti has been going through after the gold mining branch diminished in Nova Lima.

Gold Mining

Extraction of gold in the Mina do Morro Velho and other mines in the region.

Sulfuric Acid

A by-product of the gold production is processed into sulfuric acid, which serves as raw material for fertilizers.

Energy

Hydropower dams of the complex of Rio de Peixe are still used for electricity production.

Real Estate

Land in property of the company without mining interest is developed for real estate projects.

Vale dos Cristais

The condominium and the RPPN are located right next to each other along the highway MG-030. The legal approval was based on both projects being executed in parallel.

The Condominia on Display

Similar to Alphaville, the representative entrance is spectacularly designed. The scattered and privately constructed lots lie hidden behind the hill.

Nature As a Selling Argument

The real-estate company turns the enforced compensation of its environmental impacts into a promotion strategy: private and exclusive proximity and even an access to unspoiled nature attract wealthy residents. The protected nature as neighbor also prevents possible unwelcome neighbors in the future.
Disposition of Urban Growth

In 2007 the municipality of Nova Lima introduced their plan for the future, the Plano Diretor. This plan identifies large undeveloped areas as residential zones or as zones for urban growth. It also introduces an expansive infrastructure policy: improvement of roads and construction of highways across the municipality. As the proximity to a highway acts as an urban condenser, this road expansion will develop even the remotest area of Nova Lima, endangering the leftover nature.
MECHANISMS OF MINING

In iron ore mining every part of the process manifests itself in the landscape in which it is executed. With large-scale land ownership and the fact that all but one mine belong to one company (Vale) it has been possible to create a network of mines that are all connected forming one production unit in a first instance, that in a second instance connects to the global market. By answering to the global demand for steel, this process locally reveals the structure of the ground we walk on and exposes its riches in a fascinating way. These local incisions create a series of problems that conflict with the residential occupation of the territory and the efforts of environmental protection.
A Network of Mines and Infrastructure
Iron ore is mined in open-pit mining and is closely connected to the geological ground conditions. A mine is placed only where it is profitable. Over time a pit can reach dimensions of 1.5 kilometers in diameter and 200 meters in depth or even more. With the establishment of a mine, a series of legal requirements appear as well as costly installations of infrastructure necessary to exploit the ore.

A Contoured Landscape
For every ton of ore extracted there is 0.8 tons of superfluous material, without any economic use. In this paradoxical process pits and piles are created next to each other and contoured in the typical terraced slope that is conditioned by the softness of the soil.
The Production Chain

The iron ore in Nova Lima is very soft and can be dug out by regular machinery and excavators. The crude ore undergoes dry mechanical and wet chemical filtering during which a slurry of waste material is produced. This by-product is pumped into a tailings dam. The refined ore is loaded on trains, shipped to a port and exported worldwide.

A Leveled Landscape

In the extraction process, water is used to separate fine particles from the iron ore. The slurry is then led into a valley, blocked by a dam where the solid parts can settle and the water evaporate. Slowly the original contours of the valley are transformed and a plain forms. The structure of the filled-up ground is unnaturally homogenous with a concentration of naturally occurring heavy metals and silicates.
The exploration of iron ore provides one of the most important export products in the world today. As such, it is at the beginning of the supply and demand chain for iron mining and is dictated by the world market, and is thereby linked to the economic success of Brazil. 

**Timeline:**
- 1690: Discovery of gold in Minas Gerais
- 1750: Peak of gold rush
- 1860: Alluvial gold deposits empty
- 1888: End of slavery
- 1934: Brazilian mining law (all minerals belong to state)
- 1942: Founding of CVRD as state-owned company
- 1988: New Constitution
- 1999: AngloGold Ashanti take over Morro Velho Mine
- 2000: Chinese boom

**Key Events:**
- 1711: Ouro Preto capital of MG
- 1750: Ouro Preto capital of MG
- 1815-22: Kingdom with Portugal
- 1822-24: Independence war
- 1881: Emancipation of NL
- 1834: St. John del Rey: Mining for gold at Nova Lima
- 1888: Great Depression
- 1914-18: First World War
- 1929: Great Depression
- 1942: Foundation of CVRD as state-owned company
- 1960: Inauguration of Brasilia
- 1988: New Constitution
- 1999: AngloGold Ashanti take over Morro Velho Mine
- 2000: Chinese boom
Environmental Appendixes of Mines

In contrast to the mine, which by nature is temporary, the RPPN is conceived as a permanent object, to remain as a witness after the mining activity is over and the mine closed.

Environmental Impacts and Forms of Compensation

Mining in Nova Lima is no new activity, however laws concerning and regulating the impacts on the social and natural environment have not been installed until recently. The greatest concern is to keep the wetland systems intact. In order to do so, the RPPN (Reserva Particular do Patrimônio Natural - Private Reserve of Natural Heritage) is a requirement for every project that causes damage to these today. These reserves are the territorial manifestations of the environmental concerns.
**Polluted Water**

Acid water, eutrophication, concentrations of heavy metals and excessive alluvium from erosive material are the greatest concerns that lower water quality.

**The Ecosystem’s Kidneys**

The RPPN mitigates the issues involved with mining and it has to be located in the same water system and is about three times the size of the impact. As all streams will eventually flow into the Rio das Velhas it is important to have a cleaning mechanism before the water becomes part of Belo Horizonte’s water supply.

**Twisted Dialectic**

Vale is portraying itself as a big benefactor of the region. They employ 2,700 people, which consequently creates several service and supply jobs around the industry—these often only pay minimum wages. Even though Vale pays taxes and spends money on programs and initiatives addressing social issues in their areas, the negative side of their business shows that their compensations are not enough.

**Corporate Propaganda**

In the age of strategic environmentalism in the stakeholders’ interests, the image of sustainability is more important than actually acting in a sustainable way. Vale spends more money on advertising than on environmental projects.

**Low Taxation**

Several taxes apply to mining; the most important is the CFEM (Financial Compensation for Exploration of Minerals), which charges 2% on the sales. In relation to other mining countries this rate is far below what is common.
Mining has a long history in the region and it is still thriving. Over the last 40 years several mining sites and infrastructural installations have undergone transformation as they have become obsolete. This includes railroads, artificial lakes, buildings and even the pit of the mines. They all have defined or reshaped an area to such an extent that only a limited range of possible future uses is thinkable.

Interrupted Space
Running along the boundary of Nova Lima and Belo Horizonte this iron ore train line has been a fixed element that has divided the land. Now that it is defunct it still remains a border for the two divergent sides of the tracks.
Parque Mangabeira’s Second Nature
The Parque dos Mangabeiras used to be a mine, which closed in the late 1960s and was thereafter transformed into a public park. Re-vegetation of a mine can be successful ecologically, but also aesthetically. However it has to be remembered that a restoration is not possible and what we see here is a form of Second Nature, not native to the site.

The Talents of Roberto Burle-Marx
The specificity of the site and the ingeniousness of Roberto Burle-Marx have been crucial for the creation of this park, enriching the quality of city life Belo Horizonte. For the same reasons this project cannot be a general scheme of what may become of post-mine land in general.
A Lake, a Solution
Filling up a mining pit with water, creating an artificial lake, is an evident solution as water naturally seeps up through the ground. As seen in examples from gold mining re-use projects, a lake can be an asset for an area under development. The Mina das Águas Clárases is the first mine of this size to be closed down and turned into a lake in Brazil. It is, with big interests, viewed as a benchmark for future closure plans.

A Closure Plan for a Whole Region
Two of the iron ore mines in Nova Lima have already been shut down and all the others are expected to follow within the next 5 to 25 years, starting with the northernmost mine. With the closing of the mines a fundamental part of the municipality’s origin and heritage will be history, but at the same time one opens up for new potentials to form.

Liability and Threat
Tailing dams do not only state liability problems since the possibilities for alternative re-uses are limited, but they are also a threat during operation. Active tailings dams have broken in the past, which, for instance, have contaminated the water system in Macacos.
Landscape in Array

Most of the urbanization in Nova Lima is very scattered. But the geological conditions structure the land use to a certain degree and the mines are all aligned along the ridge creating a landscape of successive mines interchanging with nature reserves and condominiums, which all may be transformed in the future.

Landscape of Industrial Composition

The iron ore mining occupies the ridge, but it remains hidden only in a few places. The infrastructure of gold mining, iron ore mining and the urban expansions form an intricate composition.
CORRELATIONS

Nova Lima’s specificity is the location on the intersection of the Metropolitan Region of Belo Horizonte with the Quadrilátero Ferrífero. The interests of these two regions clash in various ways. The large-scale iron ore mining as well as the peripheral expansion of Belo Horizonte developed in parallel in the second half of the 20th century. The resulting territorial conflicts mainly root in the chronology: Who was first? The growth of both forces causes the contemporary proximity, putting more pressure on both. However, in terms of accessibility and privatization both forces have established similar strategies for avoiding unwanted visitors.
Proximity of Urbanization and Mining
The ridges consisting of banded-iron formations are the main area of the clash of interests between the urban growth and the mines. The stunning view from the ridges attracts residents and the high concentration of iron ore promises high revenues to mining companies. The neighboring forces have developed several strategies to deal with their conflicting interests, or in other cases to enforce their own interests.
Parallel Growth of Urbanization and Iron Ore Mining

In the second half of the 20th century both urbanization and the iron ore mining expanded. The increase of industrial production after the Second World War goes along with a higher mobility that pushed both phenomena to excel.
Territorial Manifestation of Borders

The mining companies are very careful to operate their mines with as little attention as possible. Their activities therefore mainly take place in hidden locations. The borders are however more visible and sometimes extremely unnatural.

View Obstruction

The major disturbances of iron ore mining are noise and dust. Strategies of minimizing these impacts are the planting of trees or, if more space is available, the placing of a dumping area with its high piles on the edge of a mine adjacent to a road or a settlement. Another advantage of these measurements is the obstruction of the view for passers-by.
A Fight for Land

Jardim de Canadá is located right next to the large Xavier Capão mine. This close proximity illustrates the fight for land. As this settlement is rather low-end, the mining has more power. On the northern edge the mine already swallowed parts of the settlement; the area across the highway is the compensation area for the "lost" land.

Mining Boom in Urbanized Territory

Albeit its long history in the region, the majority of the mines were opened in the recent past. The privatization of Vale and the rising of prices have increased the mining company’s revenues and direct influence and power in the region.

Hiding Behind the Trees

The mining activities are well protected from the public eye in Jardim de Canadá. The strategic plantation of trees and vegetation to obstruct the view functions only to a certain degree due to the topographical conditions of the area. However, the open pit itself, the place of extraction still remains hidden.
Fluctuating Value
The fight for land in the two case studies Morro Chapéu and Jardim de Canadá raise the question of who has the higher profitability index: settlements or mines? Relatively cheap areas such as Jardim de Canadá are less profitable than mining; expensive neighborhoods like Vila da Serra on the other hand have a higher value than the average iron ore price. Depending on the global demand setting the price, more mines will be opened or closed in the future.

Golf Course as a Mutual Benefit
The golf course at the entrance of the condominium used to be a mine. When the iron ore was exhausted, the hole was filled up and the reclaimed land given to the community which decided to extend their existing small golf course.

Vale Road Maintenance
The access road to the Morro Chapéu is property of Vale. As an attempt of friendliness, Vale maintains the road, providing free access to the condominium reached by it.

Trade-off
The residents of the condominium are often disturbed by the mining activities despite the efforts of Vale aiming at minimizing the impacts. The consolidating mechanisms of trade-offs improve the consensual approval.
Inaccessible Condominia, Mines and Nature

Due to high levels of crime, providing security in urban areas has become a paramount service. A concierge is standard in any larger building regardless of its use. This closing-off of private property manifests itself in the emergence of gates, walls and fences in the cities as well as on the countryside. The resulting phenomenon of protective walls and closed gates apply to all possible kinds of complexes: from visually hidden mines and inaccessible private nature heritages to the gated condominia.

- Publicly accessible roads
- Inaccessible mines
- Gates
- Inaccessible roads
- Inaccessible nature
THE SHAPE OF THINGS TO COME

With the understanding of the mechanisms in play in Nova Lima it is possible to locate and correlate all the territorial elements to each other, but this links (often conflictive) do not result in a scenic dialectic. Settlements, nature reserves and mines are rather islands of their own with limited or no accessibility. Whereas the urban development tends to expand, the mining is expected to move to less disputed areas, but with the advancement of technology, other forms of extraction will most likely continue, when this becomes feasible. The two realities will continue to form the landscape.
Urbanization and Nature
The seemingly apparent correlation of the nature reserves and the settlements is a deception. On the contrary, a majority of the facilitated areas are not accessible and the nature reserves are instead oriented centrifugally from Belo Horizonte.

Mining and Nature
The monopoly of land property is the cause for the scattered and seemingly unordered structure of settlements and natural reserves. The uses have been located on sites where they do not disturb the mining, the only continuous space is in Nova Lima.
Power of the Actors
In the way they structure the land Vale and Anglo Gold are the dominant actors. While the urban actors can only try to arrange themselves on smaller scales, the counterpart to the main actors is the environmental legislation, but in reality the final decisive power on the territorial scale still remains with the mining companies.

Dynamic and Inert Territory
Certain locations in Nova Lima are set to remain in place while the fate of others is more open in the foreseeable future. Nature preserves are in theory set for eternity, settlements are likely to be transformed, but not replaced altogether while the mining activity will stop with the depletion of ore. Since the mining may fade over the next 30 years, it will open up space that could be shaped to a more continuous space than the islands of today.
COMMENTARY
NOVA LIMA

The municipality of Nova Lima, situated as it is first of all on the historical route of gold beaten down by the early Portuguese and British entrepreneurs, as well as representing today the physical domain where a young metropolis meets the industrious operations of iron ore mining, in all its geographical specificity represents a space of convergence: of complimentary but also opposing energies which all lay claim to this space. Its inhabited reality seems to insinuate all of these interrelations, but for the most part they silently work to formulate the landscape, remaining hidden.

The student work represents a rich compilation of maps and descriptions that deconstruct these concealed meanings: to what extent both the urban artifacts projecting from the city outwards and the natural elements created or simply parcelled off and thereby “reserved”, emerge as the result of the procession of the mining machine. The capital of Belo Horizonte is only a reference point for the area, helping to mutually create value in the land, and feeding a desire for a certain type of lifestyle that also tends towards “escaping” the negative aspects of the cluttered city.

An autonomous territory - not planned in the traditional sense but very clearly lined out by a small number of powerful economic actors - becomes recognizable in this work, as well an idea is given as to which processes are opening up more possibilities in this complex field, and which are in fact creating inertness which will not easily allow for more transformations in the future.
O CICLO DA ÁGUA
THE WATER CYCLE
THE RESOURCE’S DIVERSE ROLE IN URBAN GROWTH AND MANAGEMENT

HOW WATER SHAPES THE CITY
Natural Preconditions and Their Impacts on the New City
The Represa Type: Water Storage and Water Buffer
Pampulha—The Lake as a Stage for a Modernist Park and a Modern City Vision
Varzea das Flores—Appropriation, Protection and Development?
Serra Azul—A Protected Reserve and Noble Residences
The Water Resource as an Urban Catalyst

THE NATURE OF THE SUPPLY SYSTEM
Making Water Drinkable: An Old but Established Technology
Overcoming the Topography
Water Consumption
Between High-Tech and Adaptation—A Well Controlled System

HOW THE CITY SHAPES THE WATER
Negating and Hiding the Natural Water Courses
Risk Areas and Informal Settlements
Water Volume Loss Due to Sedimentation
Banning Water from Urban Space

DIFFERENT LEVELS OF WATER TREATMENT
Storm Water and Sewage—Separated Systems?
Different Standards in Sewage Treatment
Water under the Influence of Industry
A Solid Legal and Institutional Framework but Ineffective Implementation

BETWEEN URBAN RELEVANCE AND INSTITUTIONAL CHALLENGE
HOW WATER SHAPES THE CITY

Belo Horizonte was founded in an area with an abundance of water. As the resource determined the location of the new city, its presence in the landscape had, and has, the potential to significantly influence the urbanization process of its evolution. Proximity to water is an important factor for urban development; activities and functions connected to water often create spaces for attractive lifestyles. In this context the represas, the artificial water reservoirs of the metropolitan region, play an important role.
The mountain chain Serra do Curral marks the southern border of today’s Belo Horizonte, and from here many of the areas streams originate. The abundance of water, coupled with the mild climate, were two convincing arguments when the site for the new capital was chosen in 1897. The handling and confrontation with the topography and with the excessive water are issues that still today effect the forming urban configuration.

Embedded in a Mountainous Landscape: The Territory of Belo Horizonte

Serra do Curral and its extensions stretching out northwards are omnipresent in the city of Belo Horizonte. The complex topography is not only characteristic for the urban space but is a challenge to the city’s infrastructural systems—especially to the supply and retention systems.
Topography—A Magnificent Panorama
The mountain panorama was already a popular subject on early drawings and emblems of the city and its contours are still an important reference of identification for Belo Horizonte.

Oversized Building Base—A Reaction to Water and Topography
The city's shallow groundwater table is one of the reasons for the typology of oversized building bases found in the city; a cheaper solution to the otherwise needed underground construction for parking. A large base is also a common way to deal with a steep slope. In many apartment and office buildings parking occupies as many as the first three floors.

Using City Springs—An Old Habit
Originally, there were more than 500 springs inside the city borders. While many have disappeared as the neighborhoods got densely urbanized, others, like the "Bica da Petrolina" in the Sagrada Familia neighborhood, remained accessible for the public also after being canalized. Fetching fresh water at a local well with a 20 or 30 liter storage bottle is for some inhabitants still a part of their daily routine. Believed by some to be healthier than tap water, the water quality of many wells is compromised by pollution caused by waste and by a leaking sewage system.

Mild Weather Conditions
The climate in BH is mild and relatively balanced over the year; temperatures vary little. The rainy season lasts from November till March, and in this period flooding can also occur.
The Represa Type: Water Storage and Water Buffer

The need for a steady and continuous water supply, based on a supply source made up by a capillary water system with a total absence of larger bodies of water close to the city, produced a specific typology of water storage. Since the end of the 1930s, fresh water is dammed and stored in artificial lagoons called represas. The forms of the represas represent the region’s topography in their ramification and narrowness. While they were planned as parts of a technical supply system, they are at the same time attractors and catalysts for urban development.

The first big Reservoir, Pampulha 1938

To the north of the city core, in Pampulha, the first big dam and artificial lake for the city was planned. The goal was first of all to secure fresh water and second to solve the problem of flooding in the areas downstream. Later more of these reservoirs were built farther away from the city center. Together these sources account for the biggest part of the drinking water consumed in the city.
Different Stages of Urbanization

Lake Pampulha (1) is completely embedded in a dense urban structure. Next to the lagoon of Ibirité (2), there are industrial and dense living areas as well as large zones with new developments under construction. While the coastal area of Varzea das Flores (3) is partly occupied, Serra Azul (4) is surrounded by a robust green belt. The grade of urbanization increases with the proximity to the city center.
A Momentous Friendship

The planning of the important public buildings and of the region’s overall layout was commissioned to Oscar Niemeyer, together with landscape architect Roberto Burle Marx, by the then city mayor Juscelino Kubitschek. Later, as president of the nation, he would again commission Niemeyer for the planning of the new capital, Brasilia.

Park and Satellite in the North

The initial plans for Pampulha projected a leisure area around the lagoon, where citizens could swim, promenade, and enjoy various cultural offerings. After the programmed shoreline, a generous residential area was projected. The main development went along the connecting street leading from Pampulha to the city center, today Av. Antônio Carlos.

Pampulha—A Lake as the Stage for a Modernist Park and a Modern City Vision

After the completion of the dam, the idea to build a park and satellite city around the lagoon arose in the early forties. Pampulha was to be developed into a recreation and tourism destination, with a sparsely occupied residential area possessing high living qualities in accordance with modernist ideals and after the plans of a young Oscar Niemeyer. As the lagoon became very popular as a leisure site, its success led to an accelerated urban growth, densification, and thus pollution, in the area. Further boosted by new infrastructure provision, such as the football stadium, the campus of Universidade Federal de Minas Gerais and the enlargement of the Pampulha airport, the region experienced an extensive urbanization in the decades to follow. Even though the price for growth was the abandonment of the initial park idea, the satellite turned into a new centrality in the urban network of BH.

Objects and Space in Dialogue with Water

For Kubitschek, the proposed modernist architecture and layout should symbolize a fulminating break with the existing city structure. Niemeyer’s public buildings are solitaries in a park landscape. The initially planned residential zones were loose and dominated by green areas. Niemeyer’s buildings became icons for Pampulha and for Belo Horizonte itself. The curved forms surrounded by water create poetic moments and picturesque views.
Pampulha in the Metropolitan Network

For the northern area, between Pampulha and Confins Airport, visions for large future developments have been summarized as Vetor Norte—an axis of future concentrated growth. Included are large projects for housing as well as office and public uses. Between the Vetor Norte perimeter and the city center, where still the majority of public functions and urban life takes place, Pampulha may hold a potential to develop into a new kind of centrality.

From Park to City

Occurring for the most part in the seventies, the area around the lake was rapidly densified. Eventually, the parallel extension of the historical center turned the former satellite into just another part of city. Along with the growth of the city came the decay of the park.
Contemporary Pampulha

Around the lake there is still an intact belt of sparsely placed structures. This privileged area is very expensive and popular. But these remainders of the “living in the park” idea are not permeable for the public and do not contribute to an attractive urban space. The border towards the denser back row is clearly visible.

Clubs and Villas—Privileged Hillsides

Despite the loss of the role as city-park, the hillsides in the north and west are very popular for privileged housing. Also, new small-scale condominia developments have been realized here. The built structures are scattered and not dense. Furthermore many exclusive clubs can be found in this region, e.g. the Rotary Club.

Individual Destinations—Not a Place for a Stroll

Unlike the proximity to the city center might suggest, the lake shore is not a place for flaneurs. People nowadays visit only specific destinations along the lake—like the architectural icons of Niemeyer or the sports stadiums—and this by car. The area is in this sense not a successful large public space and cannot fulfill the role of a central park for the city.

Event Site—Centrality by Programs

While the spatial and environmental qualities do not allow the area to function as a city park, it is a popular site for sport and cultural events and celebrations; like the The Volta Internacional da Pampulha, a semi-marathon, which is a yearly event.

Pollution and Decay

The initially idyllic lake soon experienced heavy pollution, mainly due to the region’s inadequate, or all lacking, sewage system and large waste problems. The bad water quality eventually made it impossible to use the represa as a source for drinking water, and swimming was (and still is) considered dangerous. Even though there is a thin green belt all around the lake, the space is rather unattractive for pedestrians at times. Except for the areas around the most popular spots, walkways and basic infrastructure for flaneurs is missing.
Varzea das Flores—Appropriation, Protection and Development?
The idea to build the Represa Varzea das Flores was launched in the 60s by the municipalities of Contagem and Betim. The construction of the reservoir, with the capacity to serve up to 400,000 people with drinking water, was finished already in 1972. The facility was later handed over to the state of Minas Gerais and to the then state-owned company COPASA. Early on the lake was discovered and used for leisure activities. Even though large areas are protected the popularity of the place led to the occupation of parts of the shores by villas, resorts and leisure facilities, which further triggered new developments in its vicinity. While similarities to Pampulha can be recognized, the urban processes around Varzea das Flores happen for the moment on an informal basis.

Water as Leisure Magnet 
The lake is popular for many sports and leisure activities connected to it. In a country associated with the Copacabana and Ipanema beaches, lakes seem to take over the role of the missing sea this far inland.

Numerous Kinds of Pollution
The intense and constant stress caused by the various leisure activities has led to a considerable pollution of the shore areas and to a decrease of water quality. A coordinated effort to prevent pollution is lacking. In media Varzea das Flores has been referred to as the next Pampulha; meaning that the bad water quality could soon make the lake unusable as source for portable water, and swimming could become a health hazard.

A Weekend Hot Spot
On the weekends the shores of the lagoon are crowded. For people from the nearby neighborhoods of Contagem and Betim as well as for tourists from farther away it is a very popular destination for spending a weekend afternoon swimming or a night partying and camping. Many bars and cafés are located directly on the shore, but the offered infrastructure on site is very rudimentary and sometimes lacks any kind of sanitary installation.

Dirt Race Track
Right at the western shore, embedded in the forest, there is a dirt racetrack. It is not officially indicated and seems to be run informally. Traces on site and pictures found on the Internet indicate its popularity.
Contested Coastline

The attractive coastline is occupied on many spots by single villas, groups of holiday houses, resorts as well as leisure facilities. Many new projects are being developed on new plots, among them a couple of condominium complexes. In the north of the lagoon there is a village-like settlement. The majority of the development takes place along the road on the eastern shore. The western side can only partly be reached by car and it is far less developed; here some scattered traditional farms can be found.

Informal Buildings

Along the small roads there are advertisements for parcels offered for sale. The depicted plot was bought by an elderly couple who are now constructing a small farm house for the time after their retirement. They explained that they did not have a building permission, which is also the case for most houses around the lagoon. These are mainly built without legal admission and often in the protected zone. After ten years it is possible to legalize a building by paying a penalty, a legal procedure many home owners practice.

Protected Areas

Some billboards announce that large parts around the lagoon are an Area Proteção Ambiental (APA), but this protection zone is not marked on any zoning plan of Betim or Contagem, nor is the fulfillment of the protection goals coordinated and controlled. Lately, after media brought the growing pollution to public attention, there have been meetings involving the various stakeholders (NGOs, COPASA, municipalities, the state government) aiming to elevate and better implement the status of protected area.

Back to Nature

COPASA states that they try to conserve as much of the delicate area as possible but that they are thus far unable to stop larger developments. Walls of dismantled houses that COPASA has cleared out remain as ruins in the woods.

A Cat and Mouse Game of Appropriation and Protection

As there is no sewage system in the shore areas and the houses for the most part do not have any local sewage treatment, they heavily pollute the groundwater as well as the water of the lagoon. Parcels and houses in areas that are particularly delicate for the environment are bought by COPASA, who then dismantles the houses.
Urban Growth Reflecting the Leisure Offer?

While in the immediate area around Varzea das Flores, the developments are numerous but small-scaled, the city of Betim itself has experienced a fast growth in the last 20 years. The majority of realized projects are large condominiums. The city development and the boom of leisure seem to go hand in hand and most likely they even boost each other.

A Long-term Observer’s Opinion: Missing Will to Prevent Pollution

Jairo, 67, is retired and lives in a nearby condominium. He has been fishing in the lake for many years. The water quality is very bad nowadays, he says, and this makes fishing more and more difficult and the caught fish are smaller. In his opinion, COPASA is doing way too little to prevent pollution and to clean the coastal areas on a regular basis. Also, the volume of the water has diminished. Scientists confirm this observation; the lake is silted by sedimentation.

A Local’s Perspective: An Unsuited Site for Permanent Residence

Paola, 43, lives here with her family because the house, an old farmhouse, belongs to relatives. The commuting to Betim for work is very time consuming and there is only one bus line. Much of the infrastructure, e.g. asphalt roads or grocery stores, is poor or missing. The family is upholding some farming activities to produce goods for their own consumption. On weekends, the lake is overcrowded, it is loud and the visitors leave a lot of garbage behind.
Serra Azul—A Protected Reserve and Noble Residences
The represa Serra Azul was finished in 1982. With a capacity to serve 800,000 people with fresh water it has double the volume of Varzea das Flores. The area around the lake is protected and covered by forest. The later date of construction as well as the size and importance for the water supply of Belo Horizonte favored high protection efforts. Next to the green buffer, there are areas developed for noble residences on large plots. While the built structures are still very sparse, an elaborated road network with large arteries collecting empty parcels announce that future development is to be expected.

Attending to Growth: Constructing Infrastructure in Advance
Throughout vast areas new road networks have been constructed but only a small part of the parcels has been built. Building infrastructure in advance seems to be common for this type of development. The size and amount of the entities announce a considerable future growth but the current impression is also one of speculation.

An Effective Green Wall
The green zone does not only prevent development along the shore area but it also works like a barrier. The lake is difficult to reach and even to be viewed from the surrounding villages. In addition, scattered farms and meadows surround the lake.

Large Countryside Residences
In younger areas the parcels are huge. Most residences are only medium-sized but have generous gardens. Entrances and connecting roads are exquisitely taken care of and give the image of a distinguished country house lifestyle.
Water Resources as Urban Catalyst

The availability of water in the time of the establishment of the city steered the decision where settlement could take place. Water as a physical and contrasting element, like in the case of the artificially created represas, can catalyze urbanization processes in its surroundings. While in Pampulha the creation of a new city part was planned, in New Betim a development on an informal basis is taking place which shows similarities: the boom of leisure activities around the water induce rapid urban growth. The artificial lake of Alphaville is in contrast not used for water supply and was solemnly constructed for this quality - a marketing element of the new condominium complex.

Waiting for Growth

In Ibirité and Serra Azul, as well as in other locations close to bodies of water, there are large areas with road networks and basic infrastructure in place serving still unbuilt plots. Their large number, as well as the huge size of some of the sites, shows that urban growth and development is expected in these regions. Some projects seem, on the other hand, speculative; their sites being seemingly abandoned.

The Attraction of Lakes is Stronger than Legal Constraints

Next to the shores of Varzea das Flores, there are many parcels up for sale. Many are in areas without access to sewage, or are even in the protected zone. That means that getting a building permit will be impossible. Still the attraction of living close to the water seems to be stronger than regulations and zoning, therefore informal construction is usual practice.

Water Lifestyle—A Vetor Agua?

Migration away from the city center towards the periphery have strongly influenced urbanization processes over the past years. A main reason for moving is the wish to live closer to nature in a sparsely urbanized area (and leave an insecure city center). The official planning of the Região Metropolitana de Belo Horizonte (RMBH) anticipates an extension along three vectors: towards the airport Conins in the north, in Nova Lima in the south and in Betim/Contagem in the west. The artificial lakes show how water can act as a magnet for urban growth raising the question whether besides the official planning there is a “Vetor Agua”, meaning that water has a specific role as a magnet in the migration patterns and the city extension.
THE NATURE OF THE SUPPLY SYSTEM

The complex topography of the territory is a challenge for the distribution of fresh water. Following the cycle from purification all the way to the domestic consumer reveals a well-elaborated supply system. Its components rank from technically simple facilities and storage tanks to high-tech management systems—from water towers as landmarks in the urban landscape to an invisible control network. The semi-private company COPASA manages the whole process.
Making Water Drinkable: An Old but Established Technology

The different steps in the purification process at the COPASA Facility at Varzea das Flores reveal an old but established process; while the quality of the purified water almost reaches standards of modern European systems, the cleaning process requires the addition of chemicals that - if not properly disposed of - themselves pollute the downstream river. Four big water treatment facilities produce almost 100 percent of all portable water consumed in the metropolitan region.

Steps in the Purification Process

The water from the lagoon is visibly polluted (1). After adding chemicals, concentrates can be removed by skimming (2). The water is then run through the next filter (3). The water used for cleaning gets polluted during the purification and is thereafter currently released without treatment into the stream (4). An additional filter for cleaning the disposed water is planned to be installed.

The Main Fresh Water Sources

The three represas Rio Manso, Serra Azul and Das Flores together account for 55% of the drinking water. Their capacities are planned to be raised to up to 21 m³/s until 2030, this in order to be able to supply enough water for the growing population, ensuring a sufficient supply at least for the coming decades, according to COPASA. After this planned upgrading though, the system will use the maximum available amount of water.

Supply water capacities today

<table>
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Supply water capacities 2030

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Sewage capacities

<table>
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<th>Source</th>
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<tbody>
<tr>
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<td>4.2</td>
</tr>
<tr>
<td>Serra Azul</td>
<td>5.6</td>
</tr>
</tbody>
</table>
Overcoming the Topography

The water distribution system reacts and reflects the hilly landscape. Water is pumped up to intermediate buffer cisterns situated atop ridges all over the city; from here water reaches the households by gravity. Besides water towers which remain easy to spot, a mostly invisible, yet “smart” network system allows for a flexible distribution despite separation of the different consumers by topographic barriers.

Towers along the Mountain Ridges

The cisterns are distributed along the numerous hills of the complex topography. Like landmarks they can be seen all over the city and in the neighboring municipalities, which are also connected to this supply system.
A Smart Invisible Network

The distribution is regulated by an elaborated system of pipelines, pumps and buffers. It is operated and controlled by highly modern technologies. The integrated system allows most destinations to be served by multiple sources.
Water Consumption

To be able to run the distribution system without additional pumping, fresh water is stored in tanks on the rooftops of each building. Thus pressure imbalances can be compensated for and the gravity is sufficient to bring the water from the cisterns to the final consumer. Also these rooftop tanks are very present in the urban landscape of Belo Horizonte. Fresh water reaches almost all inhabitants of the city and the quality is good.

Informal Tapping and Social Tariffs

The distribution often does not reach each individual household in the informal and less developed settlements. Instead, many recipients tap an official distribution pipe at the same time, creating an informal fork in the system. The inhabitants themselves then organize the billing. In other cases, pipes are tapped illegally. Around 500,000 households profit from a social tariff system for water supply and around 300,000 for sewage disposal.

Water Access and Daily Consumption

Following official statistics, access to drinking water is granted to almost all people of the city. Sewage on the other hand reaches only 92% of the population. This hardly contrasts to the amount of sewer water effectively collected; a difference of 22% is lost. Water consumption in Belo Horizonte is slightly higher than in all of Brazil.

Home Storage and Filtering

Fresh tap water does not come directly from the distribution system but from an intermediate storage container—private tanks found on top of each roof in Belo Horizonte. Tanks in all sorts of sizes can be seen on the roofs; ranking from barrels in the favelas to whole story-sized tanks in apartment houses. This buffer system requires the water to be filtered from bacteria once more before consumption. Small and relatively inexpensive devices are installed for home filtering.

Where the Water Goes

Domestic consumption only makes up 13% of the overall water usage. A major consumer, with over 70%, is agriculture; its share has presumably been sinking, and will continue as the activity gets pushed farther out.
Between High Tech and Adaptation—a Well Controlled System

The supply system’s control center at COPASA reveals a high technical standard and flexible regulation options. Besides modern technology, the system is also characterized by a longtime adaptation towards the territorial challenges, which are both the complex topography as well as the existence of multiple smaller sources. The system works very well; a fact often explained by it being coordinated by one single, powerful actor.

One Single Big Actor - COPASA

The water distribution system supplies almost all municipalities in the Belo Horizonte Metropolitan Region and is operated by COPASA. COPASA was founded as a state company during the military dictatorship. Only in 2006 a privatization combined with (at least theoretically) the state of Minas Gerais left control of the company in other hands. With this background COPASA has still today an almost complete monopoly on the market, and at the same time the coordination of the whole system remains centralized and well coordinated.
HOW THE CITY SHAPES THE WATER

By generating urban forms and elements, water—its physical presence as a body of water in the city comprised of distribution and discharge systems—affects the aesthetic quality of urban spaces and the visual representation of a city's silhouette. It naturally determines the course of any future urban expansion. Regarding the micro-scale in urban plans or within individual physical structures, water acts as an ambience generator, completely defining the aesthetic character and quality. The morphology of urban space, as a field of built space, depends on the presence of water; this is an endeavor to explain the nature of the “form” of a city.
Negating and Hiding the Natural Water Courses

The master plan for Belo Horizonte from 1893 impressively reveals how the artificial grid negates the existing natural waterways and topography of the territory, this in opposition to most cities worldwide that are classified as geometrically irregular. The presence of water often disturbs the geometric austerity, which often gives a particular identity to cities. Belo Horizonte was planned with a rigid geometric pattern and realized with a close to perfect geometrical regularity, forcing the natural waterways to adapt to the superimposed grid.

Engineered Waterways in the City Grid

The natural watercourses are pressed under the surface. Only in the central city park, water is used as a visible element in the public space.
The Domestication of Water

The Rio Arrudas, the most important water transport artery in that region, was tamed and channelized in 1923. To establish an urban environment, the entire region was engineered and equipped with infrastructural facilities. Urban water has a significant aesthetic potential for an urban area, for instance by open views over waterways; visible water in cities often forms public spaces.

Lined Creek Rio Arrudas

The plan shows how the former natural watercourse of the Rio Arrudas was engineered into the city grid.
Creek Typologies

Water in contemporary Belo Horizonte is lead through a complex network of artificial waterways of different sizes and functions. Due to topography, the most important waterway—the west-east flowing Rio Arrudas creek—collects all the storm water and sewage from the city center. The creek of the Rio Arrudas has been modified in different stages and its banks display a variety of engineered profiles. In the outer districts of the city it is a mixture of soil and stone (1), before it changes to a concrete shell closer to the city center (2). In the dense center the increased volume capacity structure is supported by reinforced concrete beams (3) and partially disappears underground favoring road widening measures (4).
Risk Areas and Informal Settlements
Buffer areas for floods are rapidly occupied by informal settlements, which leads to sealed ground surfaces and reduces storm water compensation space. The phenomenon also exists in the outer districts, again the impact can be measured by an increased pressure on the storm water canals in the center.

Lined Creeks and Storm Water
The lining of the canals increased risk of flooding massively; floods occur on a regular basis.

Flood Frequency
Every region of the city at some point was affected by floods in the period of 1922 to 2002.
Urban Risks

Besides floods, there are other risks like erosion, landslides on steep slopes and above former mines; the risk areas often coincide with areas where the informal settlements are to be found.

Informal City Growth on Steep Slopes

The typically Brazilian informal settlement, the favela on a steep slope, lives with the constant threat of large-scale land sliding, especially during the rainy season.
Water Volume Loss Due to Sedimentation

The massive entry of sediments from the catchment areas has led to a strong reduction of the storage capacity of Pampulha as well as of other represas. The annual entry of sediments is estimated to be at least 200,000 to 400,000 m³. The estimates show that in the years from 1957 to 1999 only about 2 million m³ of sediment was registered. Adding it all up: the lakes storage capacity has been reduced by more than 8.5 million m³ to a bare 53% of its original 18.1 million m³. The main source of sediments is unprotected barren soils, which form a significant part of the catchment area. The erosion induced sedimentation is considered to be the biggest problem of the Lagoa da Pampulha. Preservation of water storage capacity is urgently needed, thus it is necessary to remove the sediments and this is carried out at great expense.

Pampulha: Ecological Park on a Newly Gained Area

The Ecological Park was built directly on the sediment area of the small creek feeding the lake.

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Banning Water from Urban Space

The former rivers are hidden and reshaped in accordance with the artificial city grid but they are far from gone. It is very hard to stop a river from flowing, meaning that they have merely been diverted into the sewer system. To deal with water as an urban element in Belo Horizonte means to negate and hide its natural courses.

The Invisible Water

Under many a street in Belo Horizonte water streams have been tamed and channelized in underground sewers.
DIFFERENT LEVELS OF WATER TREATMENT

The state of Minas Gerais did not have a common sanitation policy before 1963 and the water and sewage issue where tackled separately by each individual municipality. The conditions for water supply and sewage collection were not very good. In 1974 the “Minas Gerais Sanitation Company” or COPASA was established with the state of Minas Gerais as the main shareholder. From then on, one official actor alone holds all responsibility for water treatment and distribution as well as for the sewage. COPASA has a quasi monopoly over Minas Gerais, where water supply and wastewater treatment in fact are municipal matters.
Storm Water and Sewage—a Separated System?

Conventional sewage is also termed deep sewage because the sewage pipelines are laid deep beneath the ground. The larger the population served by such a system, and the longer the planning horizon is to cope with future population increases, the larger the diameter of the final pipes. The costs of the pipes, inspection manholes, pumps and pumping stations and their installation are therefore high. The costs of operation and maintenance are correspondingly high because of very conservative design assumptions. Storm water flows through the landscape's natural drainage system. Piped storm water collection was developed in European cities to overcome odors and improve the aesthetic appearance of wastewater disposed together with storm water. The covering up of ditches used for combined sewage was an intermediate step in using natural drainage to construct sewage for combined wastewater and storm water. Piped sewage also allows more land area for roads and footpaths. With the separate collection of wastewater there is though the opportunity to reconstruct some storm water paths to their more natural state, and this is done to improve urban amenity values. In Belo Horizonte the systems are separated—at least in theory—however because of missing links and unconnected informal and formal settlements there is still a huge percentage of untreated sewage flowing directly into the storm water creeks.
The Supply and Sanitation Company
COPASA produces more than 230 million cubic meters of drinking water per year, but only 65% is consumed and a whole 35% is lost. These numbers represent a better efficiency than in other places in Brazil (e.g. in Rio where the loss is 60%), but it could be improved. The situation is more critical for the wastewater: only 61% of the produced volume gets collected and only 40% was treated in 2009. To improve this situation a new treatment plant was built in 2010, granting the capacity to treat the total volume collected. To conclude, COPASA in Belo Horizonte has, for the moment, no particular problem of water supply but there are some future challenges: to reduce the losses of drinking water, to improve the sewage collection and the customer service and to modernize their operating systems.

The Storm Water Authority
The Prefeitura of Belo Horizonte is responsible for the storm water management of the city. In general, Belo Horizonte has a separate storm water drainage channel system. There are some 700 km of perennial creeks in the municipal area. Parts of these creeks have been lined to the extent of nearly 200 km, most of them as culvert concrete channels.

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Water Collection Scheme

Waste Water Treatment

Other Water Treatment

Sewage System Losses
The bad state of the less “lucrative” storm water management system is on the one hand the responsibility of the city, but on the other hand also the highly profitable sanitation business contributes to the current situation.
The sanitation situation in the rich residential area around the lake is alarming because of the total lack of a sewage system in some areas. Untreated sewage is released into the lake.

Another situation of concern is found in the informal settlements, many of which are found on steep slopes where the conventional sanitation infrastructure reaches its upper capacity limit.

The city center of Belo Horizonte is well connected to the channelized sewage system and the drinking water supply, which simply follow the city grid.
Improvised Sewage Systems in Informal Settlements

In this neighborhood, where each household is responsible for its own sewage and storm water management, an improvised pipe system carries both sewage and storm water up the slope. For the individual stakeholder the problem is solved, but this solution has consequences elsewhere: the combined wastewater will end up unfiltered in the channelization network of the city and the improper draining further accelerates erosion on the steep slope.
The so-called “condominial approach” to the construction of water and sewage networks was developed in Brazil during the 1980s as a response to the challenges posed by expanding services into informal, peri-urban neighborhoods. While the condominial model has proved capable of meeting the considerable social and engineering challenges posed by these areas, it is also a generic alternative to the design of water and sewage systems. As for the location of the condominial branches, the requirements established by the local government permitted a great deal of flexibility. The location alternatives are offered to the users: routing through the backyard has the advantage of being significantly cheaper to build due to the shorter lengths and shallower depths of excavation needed. However, the potential disadvantage is that they are inaccessible to staff from the utility companies, placing the responsibility for maintenance on the individual household.
Different Standards in Sewage Treatment

The Belo Horizonte territory holds only two main catchments—the Arrudas creek and Onça creek Catchments—each representing about 50% of the total municipal area. There are no rivers in the municipal territory, although Arrudas and Onça are direct tributaries of the Velhas River, which itself is the tributary of the Sao Francisco River, the longest river entirely within Brazilian borders, running northwards and entering the ocean north of Salvador.
50 Percent—Improvised Pampulha (2)

The facility located between the ecological park and the affluent neighborhood receives water from two creeks. Even though it provides only half of the capacity needed for the region, it is an attempt to address the missing sewage network around the lake.

0 Percent—Stakeholder Conflicts in Ibirité (3)

Here a treatment facility lacks entirely and wastewater is released directly into a dirty pond. An attempt to install a new facility was made twenty years ago by the municipality of Ibirité, but it was never completed. Because of the rapid growth already during the project phase, the projected capacity turned out to be too small. The municipal sewage system was later mandated to COPASA who abandoned the old project in favor of a new one, whose construction has recently been started.
Water under the Influence of the Industry

The industrial processes of the oil refineries require a lot of water, which is taken out of the lake Ibirité. There are two water treatment facilities located on the site: the first one to purify the needed water before it flows into the industrial process, the other facility filters the used water before it runs back into the lake.

Water Use for Industrial Processes

Petrobras’ most important asset is petroleum reserves in Brazil. Its oil field in the Campos Basin accounts for more than 85% of the Brazilian oil production. The company also works on developing “green energy,” including biodiesel fuel.

Pollution by Mining

The chemical processing and the iron ore washing in many cases bring heavy pollutions and endanger the groundwater. Mining is generally associated very positively in the area and companies in consequence enjoy loose control policies from the authorities.
A Solid Legal and Institutional Framework but Ineffective Implementations

For the Portuguese emperors Brazil was the land of unlimited natural treasures. As a heritage, resources such as water for a long time were considered abundant in modern Brazil. But regulations and laws improved considerably and today’s legal framework enables enough possibilities to prevent the multiple sorts of water pollution and enforce obedience to respective regulations. The example of the lacking sewage system in Pampulha shows though how, still today, institutional conflicts, lacking initiatives and unsuccessful coordination can prevent a successful solution to a technically simple problem.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<td>1926</td>
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<td>1938</td>
<td>Construction of the Pampulha Dam</td>
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<tr>
<td>1963</td>
<td>Foundation of COPASA (as COMAG)</td>
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<tr>
<td>1972</td>
<td>Construction of Doce Represa Dam</td>
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<td>1982</td>
<td>Construction of Serra Azul Dam</td>
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<td>2006</td>
<td>COPASA privatization event</td>
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</table>

On the National and Regional Scale: Overlapping Responsibilities

Water issues overlap administrative and political boards in Brazil. To overcome this the institutions of the River Basin Committees was installed about 10 years ago, this is to ensure the consideration of whole water bodies and see to their specific issues across those administrative barriers. But the governing of water on the urban, regional and national scale still shows conflicts of competencies and the field of stakeholders involved insures all but effectiveness.

Informal Appropriation Beats Regulation

Urban growth around the represa Varzea das Flores happens within a field of tolerated but uncertain legal greyzones. The phenomena of informal appropriation of land can be compared to the uncertainties and shades of grey around the praxis applied to the separation and treatment of sewage and storm water.
BETWEEN URBAN RELEVANCE AND INSTITUTIONAL CHALLENGE

All along its seemingly simple cycle, water has many more facets and in many more ways impacts urban processes than as a mere technical system. Water lies in the peculiar field of tension between being a stressed resource and acting itself as a catalyst for urban growth. While the water supply system of Belo Horizonte is well established and controlled, the collection part of the circuit reveals structural difficulties that in the end cause environmental pollutions.
Water as Resource, Technical System and Urban Catalyst

The represas exemplifies how water can evoke this tension between being a delicate natural resource, part of a technical system and itself a catalyst of development.
Urban Space and Layout: The City Domesticates the Water on the Regional and Small Scale

The original city plan of Belo Horizonte ignored topographic conditions. From foundation times, dealing with water was regarded as a mere technical problem. Water in the city has shapes produced by technical necessities or it remains invisible. Water in this sense is more a risk factor than a potential for the lived urban space. This attitude towards water is not only applicable to the city core but characteristic throughout the whole urban body. One big exception is Pampulha; the idea of a park and a less dense satellite city presents the visual and programmatic potential of the lagoon as integral parts in its planning.

Urban Dynamics: Water Shapes the City on the Metropolitan Scale

The spatial attraction of open waters catalyzes urban processes. While in Pampulha or Alphaville this potential is deliberately used, in the case of Varzea das Flores, the appropriation of the water and the impacts on the urban dynamic happen on an informal basis and in conflict to official planning and protection efforts.
COMMENTARY
THE WATER CYCLE
In a country of abundance the very treatment and attitude towards its riches can prove to be the source to prosperity or depravation. In Belo Horizonte water is found in galore, but the quality of the resource distributed as portable water is constantly threatened by the consumers themselves.
The thorough work dissects the technical collection and distribution system of the city, which turns out to be a successful fusion between high and low-tech solutions, flexible enough to adopt to the challenging natural topography and urban configuration. Investigations and reflections on water's role as both an urban generator and form-giver deepen our understanding of the actual meaning of urban water and the delicate balance between the resource and its consumption, all the while offering in fact an interesting investigation into the relationship of the city to its territory—from founding, over its expansion, and finally including its constant rebalancing and renegotiation processes.
APPENDIX
### Sources

**Books**
  Editora Piseagrama, Belo Horizonte
  Fundação João Pinheiro, Belo Horizonte

**Papers**
- BHTRANS (2008), “Plano de Mobilidade Urbana de Belo Horizonte”
- Brito, Fausto, “Sub-Módulo: Dinâmica demográfica migração e mobilidade populacional”
  http://web.cedeplar.ufmg.br/cedeplar/site/pesquisas/pbh/arquivos/mod2parte2.pdf
  http://www.uff.br/ect/UPLOADs/ect%202007_2_3.pdf
  http://www.scielo.br/scielo.php?pid=S1678-86212011000400012&script=sci_arttext
- Furtado, Bernardo Alves (2009)
  Modeling social heterogeneity, neighborhoods and local influences on urban real estate prices
- Prefeitura Municipal de Belo Horizonte (2006), “Plano de reabilitação do hipercentro de Belo Horizonte, Diagnóstico”
  http://www.bibliotecadigital.ufmg.br/dspace/bitstream/handle/1843/RAAO-72VQ85/mes_documentometre_070430c.pdf;itemid=2903073E76A59D7E2B26438D4D6B6193?

**Laws**

**Maps**
- Arquivo Público da Cidade de Belo Horizonte, Planta Geral da Cidade de Minas, 1:10,000 (1895)
- Arquivo Público da Cidade de Belo Horizonte, Planta Geral da Cidade de Belo Horizonte, 1:5,000 (1928)
- Prefeitura Belo Horizonte, Hierarquização Viária do Município de Belo Horizonte; Digital (2011)

**Interviews**
- Izabela Vasconcelos, Sempre Imóveis, Personal Interview (24 October 2013)
- Paulo Zuquim, Architecht, Personal Interview (29 October 2013)
- Fred Duarte, Lourdes, Personal Interview (28 October 2013)
- Ana Isabel Sa, Funcionários, Personal Interview (29 October 2013)
- Guilherme Favoat, Savassi, Personal Interview (28 October 2013)
- Izabela Andrade, Centro-Sul, Personal Interview (27 October 2013)
- Vito Andrade, Centro-Sul, Personal Interview (27 October 2013)
- Thiago, Centro, Personal Interview (27 October 2013)
- Prefeitura Belo Horizonte, “Guia Morador Belo Horizonte”

**Internet**
- http://www.ibge.gov.br
- http://www.fjp.mg.gov.br/
- http://www.bhtrans.pbh.gov.br
- http://www.cbtu.gov.br
- http://www.der.mg.gov.br
- http://maps.google.com

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  - Wagner, Feira Hippie
  - Cleide and Vito, Street Vendors, Savassi
  - Elena, Real-Estate
  - Fabiola, Hotel, Savassi
  - Joaquim, Street Vendor, Funcionarios
  - José Carlos, Estacionamento, Lourdes
  - Filipe, Street Vendor, Lourdes
  - Fatima, Bus Traveler
  - Eliza, Bar Tender, Mercado Central
  - Narna, Club Member, Minas Tenis Clube

Institutions
- Prefeitura Belo Horizonte
- Arquivo Público da Cidade de Belo Horizonte
- Fundação João Pinheiro
- Universidade Federal de Minas Gerais
II Betim and Contagem

SOURCES

Books

Papers
-Alves Furtado, Bernardo (2009), “Modeling social heterogeneity, neighborhoods and local influences on urban real estate prices-case of BH”
-Castro Silva, Wandel Alex; Angulo de Jesus, Diana Kelle; Oliveira Melo, Alfredo Alves (2009), “Ciclo De Vida Das Organizações- Sinus De Longevidade E Mortalidade De Micro E Pequenas Indústrias Na Região De Contagem (MG)”
-I.C.L.E.I (2010), “Energy Company of Minas Gerais delivers Electricity to a low-income Community, with the support of CRER-Betim”
-Moura Tonucci Filho, João Bosco (2009), “XIII Encontro Da Associação Brasileira De Planejamento Territorial De Contagem (MG)”
-Prefeitura Municipal de Betim (2013), “História”
-Alves Furtado, Bernardo (2009), “Modeling social heterogeneity, neighborhoods and local influences on urban real estate prices-case of BH”
-Adao, FIEMG Restaurant Cook, Personal Interview (27 October 2013)
-Juliana Nakagava, Human Resources, Adler, Personal Interview (28 October 2013)
-Andreia, CINCO, Personal Interview (28 October 2013)
-Hélder Pacelli de Freitas Campos, Instituto de Pesquisa e Politica Urbana de Betim, Personal Interview (26 October 2013)
-Dr. Luiz Otto Caetano da Fonseca, Secretaria de Obras e Serviços Urbanos, Phone Interview (29 November 2013)
-Luiz Otávio Caetano da Fonseca, Secretaria de Obras e Serviços Urbanos, Phone Interview (03 October 2013)
-Fabrício Freire, Município de Desenvolvimento Económico: Divisão de Turismo / Divisão de Comércio e Serviços / Divisão de Análise e Incenário à Agropecuária, Phone Interview (30 November 2013)
-Sant Clara Schmiett Terres, Secretaria de Desenvolvimento Urbano, Phone Interview (03 October 2013)
-Alvo, Assessora Jurídica CNCD, Personal Interview (28, 29 October 2013)
-Rita Santana, CEIMG, Personal Interview (29 October 2013)
-Leonardo, Secretaria de Planejamento, Personal Interview (29 October 2013)
-Andrea, CNCD, Personal Interview (28 October 2013)
-Juliana Nakagava, Human Resources, Adler, Personal Interview (28 October 2013)
-Adão, FIEMG Restaurant Cook, Personal Interview (27 October 2013)

IMAGE CREDITS

All graphics and photos by Deborah Suter and Francesca Wyser, except where noted:
P. 159, www.panoramio.com/photo/45952192
P. 169, www.contagem.mg.gov.br/?materia=412711
P. 173, Archiv Centro das Indústrias das Cidades Industriais -Cici

ACKNOWLEDGEMENT

Persons
Larissa Oliveira
Leticia Corradi Oliveira

Institutions
PUC Minas
UFMG
SOURCES

Books
APA Carste de Lagoa Santa

Paper
Study Jurong, SEDE, 2009
Masterplans of municipalities

Laws
Lei 7166 Normas parcelamento uso ocupação solo
Lei 10257-01 Estatuto da Cidade

Maps
The Metropolitan Region, FDDI, 2010
Masterplan Aerotropolis, AECOM, 2013
Zoning Map of APA Carste, IEF ICMBio, ...
Zoning plan of Confins
Parcelling plan of Lagoa Santa

Interviews
Ricardo Messias, IEF Instituto Estadual de Florestas, ICMBio, APA Carste (23 Oktober 2013)
João Paulo Pinto, Grupo Vitoria Uniao (23 October 2013)
Astrid Dias, AV Norte (28 October 2013)
Pedro Barato, Grupo Design Resorts (29 October 2013)
Director of Lanagro MG (30 October 2013)
Mauricio Libanio, Regulizacao Fundiaria Neves (29 October 2013)
Gustavo Horta Palhares, Sandro Oliveira, Agencia de Desenvolvimento RMBH (30 October 2013)
Luiz A. Athayde, Subsecretaria de Investimentos Estratégicos, SEDE Secretario de Estado de Desenvolvimento Econômico (31 October 2013)

Internet
http://www.agenciaminas.mg.gov.br
http://www.deop.mg.gov.br/ithttp://www.parks.it
http://www.sibillini.net
http://www.gransaogapark.it
http://www.comune.noceria.pg.it
http://www.comune.cascia.pg.it
http://osbnorcia.org
http://www.siam.mg.gov.br
http://www.reservarealbh.com.br
http://maps.google.com
http://www.wikimapia.com
http://www.institutohorizontes.org.br
http://www.ibge.gov.br/english/
http://www.snic.org.br/
http://lopopular.lugarrerto.com.br/
http://portalpbh.pbh.gov.br/
http://www.skyscrapercity.com/

IMAGE CREDITS
All graphics and photos by Celia Hofmann, Charlotte Schaeben and students of ETH Studio Basel AS13, except where noted.

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Persons
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Institutions
PUC Minas Gerais
UFMGBelo Horizonte
IV Inhôtim

SOURCES

Books
Das Gracas da Paixao Nogueira Lidiane (2008), “O Inhotim e o espaço turístico de brumadinho” Universidade Federal de Minas Gerais Instituto de Geociencias curso de Turismo, Belo Horizonte

Papers
Fisher Max (21 March 2013), “A surprising map of the countries that are most least welcoming to foreigners”, The Washington Post

Interviews
Baques Vladimir C. Sanna, Director Estrada Real (1 Nov. 2013)
Gomes de Deus Baaventure Marta, Secretaria Municipal Brumadinho de Turismo e Cultura (23. Oct. 2013)

Internet
Frazao Patricia, Director Ville de Montaigne Hotel (25.Oct. 2013)
http://www.inhotim.org.br
http://cidadesnet.com/municipios/brumadinho.htm

IMAGE CREDITS
All graphics and photos by Sophie Chanson and Bettina Dobler, except where noted:
P.294, 300
P.296, 297

P.301
Top: http://www.flickr.com/photos/carlosoliveira-reis/4470193900
Bottom: http://www.flickr.com/photos/carlosoliveira-reis/4466952946

P.302
Top: Nadine Jaberg, Studio Basel

P.303
Top: http://www.inhotim.org.br/inhotim/arte-contemporanea/obras/sonic-pavilion
Bottom: http://bosako-work.blogspot.ch/2009/03/sound-pavilion-sound-pavilion-will-be.html

P.313

P.318, 319

P.321

P.337

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Institutions
Urban Planning Council, Municipality of Brumadinho
Tourism and Culture Department, Municipality of Brumadinho
Inhôtim Institute, Brumadinho/Belo Horizonte
Books
Boris Fausto, "A Concise History of BRAZIL"
Cambridge Universities Press, USA

Papers
José Ribeiro da Silva, Paulo de Jesus (2008)
"Os Desafios Do Novo Rural e as Perspectivas da Agricultura Familiar no Brasil"
SEDRU, CEDEPLAR, PUC MINAS, UEMG, Universidade de Minas Federal (2011)
“Plano Diretor de Desenvolvimento Integrado da Região Metropolitana de Belo Horizonte”
Secretaria de Estado de Agricultura (2013), “Perfil do Agronegocio Mundial”
Secretaria de Estado de Agricultura (2013), “Perfil do Agronegocio Mineiro”
PAI-MG (2011), “Plano Diretor de Agricultura Irrigada do Estado de Minas Gerais”
Frederico de Santana Tescarolo, Kelly Cristina Silva (2012), “RMBH a Região que Habitamos 2”

Laws
President of the Republic (2006), “Lei 11326/06 | Lei nº 11,326, de 24 de julho de 2006”

Maps
Frederico de Santana Tescarolo, Kelly Cristina Silva (2012), “RMBH a Região que Habitamos 2”
SEDRU, CEDEPLAR, PUC MINAS, UEMG, Universidade de Minas Federal (2011)
“Plano Diretor de Desenvolvimento Integrado da Região Metropolitana de Belo Horizonte”

Interviews
Leonardo Vieira de Faria, Cidade Administrativa, Personal Interview (22 October 2013)
João Ricardo Albanez, SEAPA, Personal Interview (24 October 2013)
José Antonio Ribeiro, SEAPA, Personal Interview (24 October 2013)
Mrs. Araujo, Farmer Igarapé, Personal Interview (25, 28 October 2013)
Mrs. Takashi, Farmer Igarapé, Personal Interview (25, 28 October 2013)
Mr. Leomar, Farmer Igarapé, Personal Interview (28 October 2013)
José Maneira, Landowner Igarapé, Personal Interview (28 October 2013)
Mrs. Augustin, Farmer Mario Campos, Personal Interview (29 October 2013)
Mr. Koyshi, Farmer Mario Campos, Personal Interview (29 October 2013)
João Celestino de Resente, Farmer Itatiaiuçu, Personal Interview (31 October 2013)
Alencar Alvez Pereira, Farmer Itatiaiuçu, Personal Interview (31 October 2013)
Mr. Wagner, Businessman Itatiaiuçu, Personal Interview (31 October 2013)

Internet
http://wikipedia.com
http://maps.google.com
http://www.ibge.gov.br
http://www.epamig.br
http://www.embraza.br
http://www.ceasaminas.com.br/
http://www.ruralminas.mg.gov.br
http://www.emater.mg.gov.br
http://www.ief.mg.gov.br
http://geoissemnet.meioambiente.mg.gov.br/zee/
http://www.agricultura.mg.gov.br
http://www.irma.mg.gov.br
http://www.emater.mg.gov.br
http://www.estf.mg.gov.br
http://wikipedia.com
VI Quadrilátero Ferrífero

SOURCES

Books
Rother, Larry (v2012), Brazil on the Rise, Palgrave Macmillan, USA.


Papers
Devin, John; Tubino, Denise Isabel; Yap Nonita T., (2011), Vale and its corporate sustainability performance in Itabira, Brasil: is the glass half full or half empty?, In: Impact Assessment and Project Appraisal, June 2011, p.15 -157


Internet
www.infomine.com
www.geoparkquadrilatero.org
www.reuters.com
www.gerdau.com
www.vaie.com
www.files.siemens.com
www.ibram.org.br; www.mma.gov.br

Laws
Prefeitura Municipal de Ouro Preto, Zonamento Urbano Distrito de Michel Burnier, 2010
Código da Mineração, DNPM Decreto-lei No 227, 1967
CONAMA, National Council for Environment, Resolution No 01/86, Resolution No 09/87

Maps
Companhia de mineradora de Minas Gerais, 1994, Paper Map 1:1 000 000 (Mapa de ocorrências minerais metálicas do Estado de Minas Gerais)

Interviews
-Felipe D’Almeida Pinho, Finance Secretary Ouro Preto, Personal Interview (25. October 2013)
-Irma Teresa dos Santos, Sexton of the church of Miguel Burnier, Personal Interview (28. October 2013)
-Geraldo Liberato, Truckdriver Incomponi, Personal Interview, (30.October.2013)
-Amaro Rosa Campos, Retiree in Rosário, Personal Interview (30.October.2013)
-Antonio Alfonso Filho & Marcelo Pereira da Silva, Maintenance service specialists Mecin, Personal Interview, (30. October 2013)
-Geraldo Evaristo, Engineer Mecin, Personal Interview, (30. October 2013)

Internet
www.shannonstrinna.org/works/material-ecology-of-castiron (Oct. 11, 2013)
http://biblioteca.ca.uem.br/monografia/Geografia-EAD2012/fermando/EA005.pdf
http://portal.iphan.gov.br/portala/baixaFcaAnexo.do?id=2977
d
http://map.google.com

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Persons
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Institutions
Escola de Arquitetura UFMG, Belo Horizonte
PUC Minas, Belo Horizonte
VII Nova Lima

SOURCES

Books
Gar, J. E. (1962), “Geology and Ore Deposits of the Nova Lima and Río Acima Quadrangles, Minas Gerais, Brazil”, Washington, USA

Laws
Florestal Law N° 1413309, State of Minas Gerais

Papers

Internet
http://maps.google.com
http://www.bing.com/maps
http://wikimapia.org
http://www.anglo逻辑dashants.com.br
http://www.pronovalmia.com.br
http://www.reservasparticulares.org.br/pesquisar

Maps
Plano Diretor de Nova Lima, July 2007

Interviews
Sandra Guimarães, Adriana Silveira, Associação Geral Alphaville Lagoa dos Ingleses (October 23rd 2013)
Moacir Gonçalves, Marcelino Antônio Edwiges, Fernando Ferrari, Sindicato dos Mineiros (October 24, 2013)
Julio Guerra Torres, Torres et Miranda Arquitetura (October 24, 2013)
Luis Helio, Vila da Serra Empreendimentos Imobiliários Ltda. (October 28, 2013)
Paul Anderson, Quintas da Jaguara (October 29, 2013)
Fernando Claudio Junior, Vale S.A. (October 29, 2013)
Markus Weber, Brandt Melo Ambiente (October 30, 2013)
Ligia Vial, Amda - Associação Mineira de Defesa do Ambiente (October 31st, 2013)
Heloisa Soares de Moura Costa, UFMG - Instituto de Geociências (October 31st, 2013)

Internet
http://maps.google.com
http://www.bing.com/maps
http://wikimapia.org
http://www.anglo逻辑dashants.com.br
http://www.pronovalmia.com.br
http://www.reservasparticulares.org.br/pesquisar

Maps
Plano Diretor de Nova Lima, July 2007
1:37 500

IMAGE CREDITS
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P. 530 Atlas IBGE (1960), ETH Kartensammlung
P. 533 ETH Kartensammlung
P. 534 top: Atlas IBGE (1960), ETH Kartensammlung; bottom left and right: Uma Janela para o passado
P. 535 top left and right: Uma Janela para o passado; bottom: The Story of Morro Velho
P. 542, 543 Map collection, Geographical library, UFMG, Belo Horizonte
P. 619 top and bottom: www.vitruvius.com.br/revistas/read/minhacidade/11.1303798
P. 620, top right: http://www.bing.com/maps

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Institutions
PUC Minas - Pontifícia Universidade Católica
UFMG - Universidade Federal de Minas Gerais
VIII The Water Cycle

SOURCES

Books
Rinke, Schulze (2013), “Kleine Geschichte Brasiliens” München

Papers
Prefeitura Municipal de Belo Horizonte, UFMG (October 2006), “Belo Horizonte Threats and Uncertainties”

Knauer, de Oliveira et al. (SWITCH, 2010) “Towards integrated urban water management in Belo Horizonte, Brazil: A review of the SWITCH project”

Laws

Maps
http://maps.google.com
http://www.bing.com/maps
GIS Data: Prefeitura de Belo Horizonte
Macro Systema Agua: COPASA
Plans Belo Horizonte: UFMG

Interviews
Prof. Leo Heller, UFMG
Marco Forster, COPASA
Sonja Knauer, Prefeitura de Belo Horizonte
Anderson Mourão, NGO Natureza Viva

Internet
http://curralderei.blogspot.ch
http://www.etg.ufmg.br
http://www.switchurbanwater.eu
http://www.copasa.com.br
http://www.skyscrapercity.com
http://redemineira.inam.mg.gov.br/mapa-bacias/
http://www.manuelezao.ufmg.br
http://www.ibge.gov.br
http://naturezaviva.eco.br
http://www.pbh.gov.br
http://www.petrobras.com.br

IMAGE CREDITS
All graphics and photos by Adrian Baumberger, Oliver Wagener and students of ETH Studio Basel AS13, except where noted.
P. 652, 653, 667
http://www.wikipedia.org
P. 654, 655, 659, 690, 692
http://curralderei.blogspot.ch
P. 794
http://ribeiraoarudas.blogspot.com.br
P. 660, 661, 670, 675, 693, 701, 720, 727
maps.google.com
P. 662, 663
http://designkultur.files.wordpress.com
P. 664
http://www.skyscrapercity.com
P. 667
P. 669, 693, 697, 698, 705
http://www.flickr.com
P. 674
http://www.panoramio.com/photo/17666136
P. 677
http://www.vivareal.net
P. 653, 710, 719, 722, 730
http://www.copasa.com.br
P. 694, 710
http://www.pbh.gov.br
P. 724
http://www.petrobras.com.br

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Persons
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