

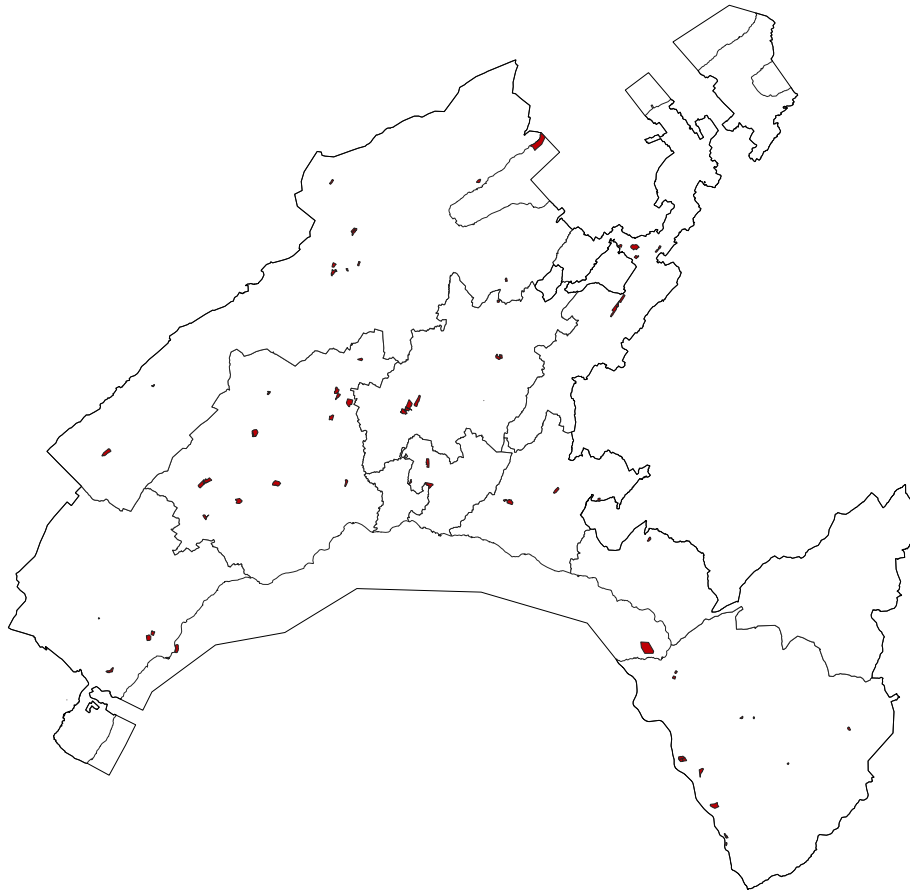
# **Sometimes undoing is doing**

*Creating a new building culture through soil*

## Summary

|                                                                   |      |
|-------------------------------------------------------------------|------|
| The construction industry is a huge polluter                      | p.5  |
| What is happening with soil ?                                     | p.6  |
| We need to shift from an extractive economy to a regenerative one | p.8  |
| The evidence                                                      | p.9  |
| Conclusion                                                        | p.12 |
| Appendix I                                                        | p.15 |
| Appendix II                                                       | p.17 |
| Appendix III                                                      | p.19 |
| Appendix IV                                                       | p.29 |
| Popcorn Time                                                      | p.31 |

## The construction industry is a huge polluter



67 actives landfills in the Canton de Vaud.  
Representing 10.3 Km<sup>2</sup> of surface.  
A quarter of the size of Lausanne.

The construction industry accounts for « 39% of the world's carbon emissions, 11% of which resulted from manufacturing building materials and products such as steel, cement, and glass<sup>1</sup> ». In order to reach net-zero, the International Energy Agency (IEA) has estimated that direct building CO<sub>2</sub> emissions need to fall by 50% by 2030.

« As the global population reaches ten billion, building stock across the world is expected too nearly double. In the next thirty years, exactly the critical time in which we must draw down carbon emissions, building materials alone will account for more than half of the entire carbon footprint of new construction, consuming much of our global carbon budget and assuring a path toward climate catastrophe. So, the need for non-extractive, zero carbon architecture is now. Not tomorrow<sup>2</sup> ».

Other more ecological materials like soil and wood aren't being encouraged because of unfamiliarity and lobbying. Because very little research on this building material has been made. A decade worth of knowledge needs to be caught up. Despite the fact that humans have built with soils for 11'000 thousand of the years, it is only now in 2022 that we are going to build the first load bearing residential building in Zurich in collaboration with engineers, Terrabloc and Roger Boltshauser. Construction engineers, civil engineers and architects are routinely educated on concrete and classical buildings but not soil.

This « énoncé théorique » is in two parts, a brochure, and a documentary film. It talks about shifting our perspective and promoting the use of soil as the answer to sustainable construction environment. Through the lens of a fictional documentary, I want to expose the fate of these excavated material and stress it's potential for the creation a decarbonated urban culture.

<sup>1</sup> IEA & UN environment programme. 2019. *Global Status for Buildings and Construction*.

<sup>2</sup> Stephanie Carlisle & Nicholas Pevzner. 2021. « The Thin Thread of Carbon » In *Non-extractive architecture, On designing without depletion Vol. 1*, Space Caviar, Sternberg Press.

## What is happening with soil?

### Extractivism:

Architecture and the production of our build environment is conditioned and driven by economical models that tend to maximise profit and rentability over sustainability hidden behind a complex chain of production. We can urgently say that this production is conditioned by an extractive attitude where the extraction and construction compose two separate material milieus, co-dependant, yet physically disconnected. We need to be conscious that the construction of a building represents the deconstruction of multiple landscapes at the same time. We must understand that architecture isn't an isolated object in its near environment but « *extends to all the places from which it has been sourced and all the places for which it could be a source of waste*<sup>3</sup> ».

One of the biggest sources of waste in Europe is excavated soils and that in « *2018 accounted for more than 520 million tons of waste and are by far the biggest source of waste produced in the EU*<sup>4</sup> », you could build several cities with that amount. As of today, le Canton de Vaud and le Canton de Genève produce each 2'000'000m<sup>3</sup> a year and under European and Swiss Law<sup>5</sup>, excavated soil « *Spoil* » is still considered a waste.

### Moving from waste to reuse:

Consequently, we have to continue discarding this resource as we are facing exponential densification, volumes are rising, and space is becoming scarce. Big corporations are buying agriculture land and forests to dispose this material and capitalise over our waste. What used to be considered a fundamental resource, free and unlimited, has now become source of economic growth for the same corporations whom are vectors in the sprawl of concrete construction and cement production (Orllati & Holcim). As concrete construction expands, sand and gravel resources retract and spoil skyrocket.

### Three main options available now:

- The first is opening new quarries in order to produce more concrete, to produce more soil waste to fill them. But as of today, quarries can only absorb 35% of the volume produced.
- The second, to create open air landfills on agriculture land (65%), « *topography compensation* » where new landscapes emerge. This has its own problems. We have run out of space and the population is against it. Swiss Romandie is therefore put under pressure and is thinking about reusing soil.
- Thirdly, 5% is used for embankments and land development.

### New protocols under consideration:

Under climate pressure, COP 26 has ordered a reduction of our CO2 emission with a first target set for 2030 to insure 1.5 degree rising temperatures in reach. A new protocol for construction must be made to reach these objectives. European commissions for soil management, coalitions, legislations, and regulations must be made to reduce concrete construction, reduce waste, and valorise alternative & sustainable construction models with earth.

Nevertheless, as of today, a handful of contemporary architects are building with soil, developing new tools, and teaching soil as a material, such as:

- Martin Rauch, Austria, considered a pioneer in rammed earth prefabrication.
- Roger Boltshauser, Switzerland, architect, designer of « *Case Study Steel House* » in Rapperswil, rethinking the steel construction by hybridizing it with a load bearing rammed earth walls.
- BC architects, Belgium have gone further by creating a division in their architecture practice that supplies soil materials and consultancy.

### What's happening in Paris?

Paris is expending and is expected to produce 400 million tons of excavated soil by 2030, of which 45 by the Grand Paris express<sup>6</sup>. Stressed by the volume of this disposal (about 22 Cheops Pyramids) and the pollution of its transport, this tipping point has pushed for considering spoil not as burden but as an advantage and tool to rethink our industry. Cycle Terre, Amàco, Sevrans, SciencesPo, European Union and more have formed a coalition of a variety of socio, constructive and economical partners to help build new infrastructure for the revalorisation of spoil. 4'900'000<sup>7</sup> euros of funding were allocated by the EU and 200'000 by the region of l'île de France to build the first fabric of « *terre crue* » in Sevrans. It will revalorise soil into building materials for the development of Grand Paris. The objective being too multiple these fabrics around the hole Paris express while engaging local communities in the process.

<sup>3</sup> Mark Wigley. 2021 « *Returning the Gift, Running Architecture in Reverse* » In *Non-extractive architecture, On designing without depletion* Vol. 1, Space Caviar, Sternberg Press.

<sup>4</sup> European Parliament. 28 April 2021. *Resolution on soil protection (2021/2548(RSP))* Available at [https://www.europarl.europa.eu/doceo/document/TA-9-2021-0143\\_EN.html](https://www.europarl.europa.eu/doceo/document/TA-9-2021-0143_EN.html)

<sup>5</sup> Conseil fédéral suisse, *Ordonnance sur la limitation et l'élimination des déchets*, Pub. L. No. 814.600, Chapitre 1 But, champ d'application et définitions, art.3 d finition (2015, Etat 1er Janvier 2022).

<sup>6</sup> Société du grand paris express, 2021. Construire le Grand Paris Express en préservant l'environnement, disponible sur : <https://www.societedugrandparis.fr/chantier/environnement>.

<sup>7</sup> CycleTerre, Paris, <https://www.cycle-terre.eu/>

## We need to shift from an extractive economy to a regenerative one

We need to consider excavated materials as a valuable resource, not only for capital gain but sustainable living as well. We often relate soil construction to degrowth and concrete to innovation. On the contrary, we need to hybridize both materials to benefit from both complementary qualities. Concrete needs to be regulated and used only where it is primordial, like acupuncture, as it continues to be a very performative material that is essential to support earth development.

To quote Charlotte Malterre-Barthes: « *It has become unmanageable to ignore the complicit role that design disciplines play in environmental degradation, social injustice, and climate crisis. Yet and still, we designers design, architects plan, planners envision, bathing in a delusion of design neutrality and or powerlessness<sup>8</sup>* ».

We need to engage with the design community, because they can change consumers, the clients view, and developers view. We all must start thinking about a practice that goes beyond extraction. Imagining what non-extractive material practice could look like. Instead of producing high energy consuming architecture. « *We have to problematise the role of mater in our design practices in order face the augmentation of material consumption and therefore it's waste<sup>9</sup>* ». An architecture if truly sustainable would concentrate itself on the maintenance of what already exists.

Landscape Architects, Architects, Engineers, Politicians, Real Estate Developers all have a say in the construction of a new material culture where production becomes an integral part of urban society. Calling for new types of spaces and infrastructure. We can successfully create a circular economy through appropriate policies, partnerships and infrastructure that organise new modes of urban governance that help fuel innovation.

<sup>8</sup> Charlotte Malterre-Barthes. 2021. « A Global Moratorium on New Construction » Conference: Berlin Questions 2021, EWERK GMBH. Available at: <https://www.youtube.com/watch?v=wIWRTeFOJNQ>

<sup>9</sup> Charlotte Malterre-Barthes. 2021. « A Global Moratorium on New Construction » Conference: Berlin Questions 2021, EWERK GMBH. Available at: <https://www.youtube.com/watch?v=wIWRTeFOJNQ>

## The evidence

### It is free:

The main reasons for moving from extractive to regenerative are:

- **It is free and the most circular resource available.**
- **It is unlimited, natural, and non-chemical.**
- **It is 100% reusable and its aesthetic**
- **It uses the same building technics and tools on site as concrete.**
- **It has a shorter supply chain than traditional material that need importing.**
- **It is local and promotes local employment.**
- **It is ecological because it naturally regulates temperature and humidity in a building.**
- **It is carbon neutral because it hardly requires any transport or transformation.**

Carbon neutrality is important because we don't have to heat it to 1450 degrees as cement requires. As the price of energy to produce cement and petroleum-based material rises the use of soil will become economically viable. The carbon footprint will become much less, for a given quantity of usable building material than concrete and steel.

### The risk of not shifting to regenerative:

According to the « *Plan sectoriel des décharges contrôlées PSDC (révision 2020)<sup>10</sup>* », the exploitation rhythm is benchmarked at 2'000'000 m<sup>3</sup>/year. It is projected to need for the next 20 years a total of 20'000'000 m<sup>3</sup>/year of space. On average, 60% of unpolluted excavated material is disposed of in landfills, 35% in quarries and gravel pits, and 5% is used for land development.

Now, 121 sites have been identified around the canton de Vaud, representing a total of 134'000'000 m<sup>3</sup>. Based on the report of Heidi.new « *Béton la fin d'une ère ?<sup>11</sup>* » and an interview with the group Orllati in charge of multiple landfills, we can estimate the value of 1 m<sup>3</sup> of soil waste at 30.- /m<sup>3</sup>. Where 3.- /m<sup>3</sup> goes to the landowner and 27.- /m<sup>3</sup> to the corporation in charge of the disposal. Therefore, we can estimate the monumental value of 2'000'000 m<sup>3</sup>/year of soil, at 60'000'000.- /year/canton. It urgent to redirect this throwaway economy towards a smarter and more equal system.

Nevertheless, if considered a proper building resource the potential at the city perspective becomes huge.

<sup>10</sup> Plan sectoriel des décharges contrôlées. Révision 2020, Plan sectoriel des décharges contrôlées. Département de l'environnement et de la sécurité (DES) Direction générale de l'environnement (DGE), Canton de Vaud, Version 30 Octobre 2020.

<sup>11</sup> Alia Bengana, Claude Baechtold & Antoine Harari. 2021. « *Béton, la fin d'une ère ?* » In Revue n.10, Les Explorations, Heidi.new.

### Compressed earth blocs (BTC) numbers:

TerraBloc fabric in Vaud can create with 1 m<sup>3</sup> of soil, 8 m<sup>2</sup> of non-loadbearing earth walls.

And in Paris, the Sevrans fabric will be able to treat 25'000 Tons which is equivalent to 10'000'000 standard bricks (2.5Kg) = 140'000 m<sup>2</sup> of wall.

25'000 Tons of soil processed = 10'000'000 standard bricks (2.5Kg)

1 m<sup>2</sup> = 70 bricks

10'000'000 bricks = 140'000 m<sup>3</sup> of wall

1 dwelling = 1 to 100 tons of soil

25,000 tonnes = 250 to 25,000 dwellings per year.

### The law is changing:

Today, according to Swiss legislation on the Avoidance and the Disposal of Waste (OLED)<sup>12</sup>, soil is considered as an urban waste. This definition should be revised, changing excavated materials status not to a waste one but a resource that must be valorised up to 70% per weight.

According to Jacques Martelain, Director of GESDEC, GE, Switzerland, there is an incentive to create a Tax on excavated material at source. Virtuous projects that will minimise volumes will be rewarded whereas on the contrary they will be taxed.

In Belgium, Zakia Khattabi, Minister for Climate, Environment, Sustainable Development and Green Deal, has published a federal plan of action<sup>13</sup> for the creation of a circular economy between 2021 and 2024. Putting 25 measures at the forefront to boost the circular economy, as: Flow traceability, circularity certificates, durability certificates and more.

In addition, it is to my knowledge the first time the European Parliament acknowledges the issue of waste in a resolution on soil protection<sup>14</sup> adopted in April 2021:

*« Excavated soils accounted for more than 520 million tonnes of waste in 2018(40) and are by far the biggest source of waste produced in the EU; whereas excavated soils are currently considered waste under EU law and are*

*therefore disposed of in landfills; whereas a majority of those soils are not contaminated and could be safely reutilised if a recovery target coupled with a comprehensive traceability system were put in place ».*

*« 23. Reiterates its call for the revision of material recovery targets set in EU legislation for construction and demolition waste and their material-specific fractions to include a material recovery target for excavated soils in the revision of the Waste Framework Directive; calls on the Commission and the Member States to establish systematic diagnosis of the status and reuse potential of excavated soil, as well as a traceability system for excavated soils ».*

Finally, the European Environment Commission of Waste Framework Directive<sup>15</sup> that sets basic concepts and definitions related to waste management, have set a new target for material recovery, using waste to substitute other materials, of non-hazardous construction and demolition waste shall be increased to a minimum of 70 % by weight.

<sup>12</sup> Conseil fédéral suisse, Ordonnance sur la limitation et l'élimination des déchets, Pub. L. No. 814.600, Chapitre 1 But, champ d'application et définitions, art.3 définition (2015, Etat 1<sup>er</sup> Janvier 2022).

<sup>13</sup> Khattabi Zakia, ministre du climat Belge. 2021. Plan fédéral pour l'économie circulaire. Disponible sur : <https://khattabi.belgium.be/fr/cp-un-plan-federal-ambitieux-pour-le-deploiement-de-l-economie-circulaire>

<sup>14</sup> European Parliament. 28 April 2021. Resolution on soil protection (2021/2548(RSP)) Available at : [https://www.europarl.europa.eu/doceo/document/TA-9-2021-0143\\_EN.html](https://www.europarl.europa.eu/doceo/document/TA-9-2021-0143_EN.html)

<sup>15</sup> European Environment Commission of Waste Framework Directive. Available at: [https://ec.europa.eu/environment/topics/waste-and-recycling/waste-framework-directive\\_en](https://ec.europa.eu/environment/topics/waste-and-recycling/waste-framework-directive_en)

## Conclusion

### Three courses of action:

Instead of producing high energy consuming architecture. « *We have to problematise the role of mater in our design practices in order face the augmentation of material consumption and therefore it's waste<sup>16</sup>* ». An architecture if truly sustainable would concentrate itself on the maintenance of what already exists. Therefore shifting from an extractive economy to a regenerative one and create a new construction market.

To achieve this, we need three courses of actions:

### Changes to the law:

We need to implement new legislations and tools to help improve the transparency of carbon accounting and support decision making on projects. Life Cycle Assessments (LCA) of materials is essential to understand the carbon impact of each material. A revision on emissions trading scheme (ETS) has to be made, where the concrete and steel industry have to stop being exempted on carbon taxes and become accountable for their emissions. Implementations of flow traceability and transparency; circularity and durability certificates need to be incorporated to help democratize alternative sustainable construction materials. Other, taxes on excavations, raw material importation and more need to be created to help valorize local materials.

We must rethink our normative constructive environment that limits innovations due the economical weight of material testing and proofing.

Coalitions and commissions for soil revalorisations, political strategies and federal action plans that promote and support the circular economy and innovated sustainable businesses must be put in place.

According to a study made by PWC<sup>17</sup>, it considers that the economic potential of the circular economy in Belgium is between 1 and 7 billion euros by 2030 and that up to 100,000 additional jobs could be created.

### Changes to the curriculum:

Universities & « *Écoles professionnelles* » must put this concern at the forefront of their research and education. They need to teach, architects, engineers, and other professionals of the industry, through new curricular on how to build with alternative models. Supported by workshops and conferences. As well as changing our view on traditional aesthetics that have been sacralized in an architecture tradition embedded in a concrete aesthetic. Challenging the fundamental idea of architecture as an agent of eternity.

Exhibitions like « *Terre de Paris* » at the pavilion de l'Arsenal in Paris need to multiply, creating awareness for the general public. Putting « *controlled erosion* » at the centre that can support the establishment of an accepted aesthetic that ages with time, as wood does.

### Funding:

For the first time, earth construction (CycleTerre project) was allocated 4.9 million euros by the European Union to help the research on soil and permit them to take risks to innovate. This effort needs to be reproduced and supported by commissions, governments, universities, real estate developers and private investors. All must deploy resources and funding to help developed and spread the values and potential of earth construction. The Dutch Bank ABN Amro<sup>18</sup> has realized the value of reused elements (windows, doors, etc.) and consequently developed not only an investment bank but also a material bank that helps value second life elements. We could imagine the same concept, but this time applied to a material market of soil in the center of a city. La Plaine de Plainpalais in Geneva would be the perfect space to create this market, a visual, immersive, and impactful experience for all actors.

Finally, I'd like to quote Kevin Lynch, « *conceptions of waste are linked to a specific time, place, and culture. Hence, because waste is culturally constructed, modifying our views of it is difficult and argues that we must rethink who we are before we rethink waste* ».

<sup>16</sup> Charlotte Malterre-Barthes. 2021. « A Global Moratorium on New Construction ». Conference: Berlin Questions 2021, EWERK GMBH. Available at: <https://www.youtube.com/watch?v=wIWRTeFQJNQ>

<sup>17</sup> Price Waterhouse Cooper. 2016. « Potential of circular economy in Belgium – Executive Summary ». Federal public service, Health, Food chain safety and environment. Available at: <https://www.health.belgium.be/fr/leconomie-circulaire-potentiel-economique-en-belgique>

<sup>18</sup> Oliver Wainwright. 2020. « The case for ... never demolishing another » In The Guardian. Available on : <https://www.theguardian.com/cities/2020/jan/13/the-case-for-never-demolishing-another-building>

## Appendices

I - Film synopsis, Themes

II - List of interviews

III - Script

IV - Bibliography

### APPENDIX I

#### FILM SYNOPSIS

Set in 2032, this film investigates the destiny of excavate materials. Urged by 1.5-degree (Cop26) target, mentalities have radically changed, and cities have become urban mines for their own reproduction. Waking up towards a new circular economy, we discuss the potential of soil and its drive to create a new urban culture while reminiscing on our 2021's old, and absurd, wasteful attitude.

#### THEMES – INDEX

**PART I:** 2021's Landfills: Setting the scene, an overview in 2021's soil crisis of excavated materials.

**PART II:** Extractivism: When doing is undoing, soil disposal and the concrete industry's attitude.

**PART III:** Uprising: When state & public concern rises, demanding change.

**PART IV:** New Area: Towards a new material culture 2032: Sometimes undoing is doing. Soil has become the most valued material in Switzerland making it a pioneer in the creation of a circular built environment.

## APPENDIX II - INTERVIEWS

### **Alia Bengana**

Professor of soil and biobased material construction, EPFL, VD, Switzerland.

### **Antoine Iweins**

PHD student for TerraForma Lab, EPFL, VD, Switzerland.

### **Anton Maertens**

Business developer at BC materials, Brussels, Belgium.

### **Arnaud Bush**

Engineer and environment director at Morlati.

### **Ben Burnell**

Social media marketing director, Instak, sustainability division, London, UK.

### **Camille Vallet**

Editor at Tracé magazine, VD, Switzerland.

### **Chloé Eckert**

Architect, Partner at office Pont 12, VD, Switzerland.

### **Claude Baechtold**

Journalist for Heidi news, VD, Switzerland.

### **Éléonore Audi**

Software developer at SoilWorks, London, UK.

### **Jacques Martelain**

Director of GESDEC, GE, Switzerland.

### **Mattia Pretolani**

Architect, co-founder Ellipse Architecture, Specialist of earth construction, VD, Switzerland.

### **Nathan Voyame & Ronan Schubnel**

Architecture Students, EPFL, VD, Switzerland.

### **Roberto Gargiani**

Professor & Theoretician of Architecture, EPFL, VD, Switzerland

### **Rodrigo Fernandez**

Co-founder of TerraBloc, material engineer, VD, Switzerland.

### **Romain de Rivaz**

Climat Activiste, Membre of « Jeunes Vert Union », VD, Switzerland.

### **Sally Moore**

Environment Consultant, GE, Switzerland.

### **Silvia Castelat & Boris Pestalozzi**

SDG consultants, EPFL, VD, Switzerland.

### **Simon Pinzelli**

Environment director at Orllati, VD, Switzerland.

### **Simon Rodriguez**

Agro-engineer, EPFL, VD, Switzerland.

### **Yann Dahhaoui**

Finance Professor, specialised in soil, UNIL, VD, Switzerland.

## APPENDIX III - SCRIPT

**SIMON.** À Bioley, il y a 10 ans, mon père fut approché par des entreprises car on cherchait des terres d'exile pour tout déchet d'exploitation contre rémunération. Le terrain est monté de 15m ce qui a changé la dynamique du paysage et on a dû attendre 9 ans avant de pouvoir entièrement le ré-exploiter. Il y a environ 1'200'000m<sup>3</sup>, à 3.- / le m<sup>3</sup>, c'est plus que ce que ce terrain nous aurait rapporté durant toute notre vie. Malheureusement c'étaient des décisions économiques et marchandes qui dictaient des actions qui auraient dû être environnementales.

**MARIA.** Ici, il y a des terres faiblement polluées et majoritairement pas polluées. Car si on leur dit que la terre est mauvaise c'est sûr qu'ils auront des problèmes. Je pense que ce n'est pas ce qu'ils leur ont vendu. C'est vrai que ça ne fait pas rêver de faire pousser ses légumes dessus. Si c'était moi ça m'énervait. Moi je ne vis pas ici, mais le matin quand on va travailler il y a des camions et des camions. Je pense que les gens qui vivent ici à Biolley, ça doit être difficile.

**CHLOÉ.** Tous ces matériaux d'excavation au sens de la loi sont considérés comme un déchet. Ici sur le chantier, ce qui est délirant, c'est que cela nous coûterait 1 million de francs supplémentaires si on voulait stocker les déblais en Suisse. En fait, il y a un problème de coût. Vu que l'offre est faible, les prix augmentent pour décharger la terre. Évidemment que les maîtres d'ouvrages aimeraient les garder en Suisse et les décharger en train. Mais à quel prix ?

**CLAUDE.** Le Canton de Vaud s'est lifté, comme Michael Jackson. Chaque vallon est une cible pour le remblayer. Le problème c'est qu'on produit énormément de déchets d'excavation. Une pyramide de Khéops par an. Pour 800'000 habitants. On ne bâtit pas une civilisation sur ce genre de plan quinquennal. En fait en ce moment même, Orllati et Holcim se font la

**Simon Rodriguez**  
Agro-engineer, EPFL, VD,  
Switzerland.

**Maria Duver**  
Dweller of Commune de  
Bioley, VD, Switzerland.

**Chloé Eckert**  
Architect, Partner at office  
Pont 12, VD, Switzerland.

**Claude Baechtold**  
Journalist for Heidi news,  
VD, Switzerland.

**Anton Maertens**

Business developer at  
BC materials, Brussels,  
Belgium.

guerre pour racheter des forêts et des terres agricoles dans tout le canton. Pourquoi ? Pour pouvoir ouvrir de nouvelles gravières ainsi que des décharges. Car il n'y a plus de place pour entreposer tous ces déchets en Suisse. C'est devenu le nouvel Or, couler du béton et entreposer du déchet c'est une formule magique. Pour un agriculteur, il touchera 4-./m<sup>3</sup> de gravier extrait, puis 2-./m<sup>3</sup> pour tout remblais de matériaux d'excavations. Alors que l'entreprise elle, touche 30-./m<sup>3</sup> extrait (doublé une fois transformé en béton) et 28-./m<sup>3</sup> pour le remblais. Et ça pour 2'000'000 m<sup>3</sup>. C'est un marché qui consomme à flux tendus, sans risque et sans stock. C'est un pipeline et il est toujours ouvert à fond.

**ANTON.** Hmmm guys, in the construction sector you are really pushing it. We don't see many reductions and if we are serious about what has been said in Paris and Glasgow, we really need to fight climate change more than ever. At the moment concrete and steel producers are exempted from ETS (emission trading scheme) because they are doomed to be too essential for the economy. But this will have to change. We are also building with CraTerre, Joly & Loiret architects, and other actors from the Grand Paris project CycleTerre a coalition to try and make pressure on the parliament to consider soil as a resource. We already see on a European level that circular materials are being prioritized. So, there will be a kind balance and fact check at one point.

We really believe in urban mining and with 2 million tons of earth you can build different neighbourhoods. The potential is quite big at the city perspective.

**NATHAN & RONAN.** Lorsque l'on a remarqué que l'évacuation de ces déchets commençait à remodeler notre paysage, on a réalisé qu'on ne pouvait plus considérer notre environnement comme un site de décharge définitif. Les Zad ont commencé à se déployer un peu partout dans

**Nathan Voyame & Ronan Schubnel**

Architecture Students,  
EPFL, VD, Switzerland.

le canton, autant dans le territoire que sur les chantiers en villes. Elles ont permis de questionner le système de plus en plus profondément. Dans cette volonté de combat et de changement pour faire changer les choses. Et arrêter ce processus de colonisation de la ville sur le territoire. C'est pourquoi on a dû remettre en place un nouveau système législatif.

Finalement on a plutôt appris à considérer les bâtiments comme un espace de stockage provisoire, une organisation transitoire de la matière qui pourrait ensuite être déployée ailleurs. La ville est désormais une mine intégrée pour sa propre reproduction.

**ROMAIN.** People have had enough! So, we the people have changed. We do what we want to do and take responsibly for it! If it weren't for us, the Zads and all the people, nothing would have changed. Corporations would own our all land and for what? To rattle the earth for profitability instead of sustainability

**SALLY.** We didn't think this would grow out of the crisis. But it did. When David Attenborough made his speech at the COP 26 and said: « *We are after all the biggest problems solvers to have existed on earth. We understand this problem, we know how to stop this number rising and put it into reverse. And if divided we can destroy our planet, together we can save it*<sup>19</sup> ». I look around the room, and I thought, we will always be divided. But I was wrong. Change was forced upon us, and we made it happen. To make this change happen there was an important factor. This documentary came out of Lausanne, and something else came out of Lausanne a very long time ago. Pareto's law. We use Pareto's law where 80% of the results comes from 20% of the effort. What we had to do is get to the people that were making the biggest contribution to emissions and climate change problems. And the construction industry was a major player. So,

**Romain de Rivaz**

Climat Activiste, Membre  
of «Jeunes Vert Union»,  
VD, Switzerland.

**Sally Moore**

Environment Consultant,  
GE, Switzerland.

<sup>19</sup> David Attenborough, People's advocate for COP26, Speech, 01.11.2021, Glasgow.

**Roberto Gargiani**

Professor & Theoretician  
of Architecture, EPFL, VD,  
Switzerland.

**Mattia Pretolani**

Architect, co-founder  
Ellipse Architecture,  
Specialist of earth  
construction, VD,  
Switzerland.

80% of the problem came from 20% of the problem. So, the use of rammed earth was the absolute obvious choice for revolutionising the carbon footprint of the construction industry.

**ROBERTO.** Nobody could have imagined that we would have grown out of that soil crisis. According to Alan Berger, « *Adaptively reusing this waste landscape figured to be one of the twenty-first century's great infrastructural design challenges* ». And my friends, we did it. We shifted our thinking from explicit knowledge (designer as sole expert and authority) to complex interactive and responsive processes (designer as collaborator and negotiator). Therefore, really shifting the linear production scheme to a fully circular one.

**MATTIA.** « *Every act of building is only a momentary contribution to a larger whole that is constantly evolving for every transformation. This continuous process of transformation must radically challenge the self-proclaimed identity of a discipline, that loves to see itself, despite all evidence to the contrary, as an agent of eternity* ».

I'm happy we took responsibility and built a new material culture around earth. When you think about it, it's the only one that reflects its own origins so well. A mirror of its own subtraction. The negative element.

We have had to re-invent architecture and how we think about its aesthetics. People had to understand that they live in a continuously changing environment that can degrade and that they only in transition like the forms that they inhabit. The only thing that is continuous is matter and therefore the ephemerality of this system makes it paradoxically eternal. The romantic idea of eternal ruins has been challenged and can't exist. As the ruin of today is the new construction site of tomorrow<sup>20</sup>.

<sup>20</sup> Marc Angelil and Cary Siress, Re: Going around in circles, Regimes of Waste, Ilka and Andreas Ruby eds., Re-inventing Construction (Berlin: Ruby Press) - 2010

**YANN.** Extraire, fabriquer, consommer, jeter. La production physique de l'architecture était suspendue entre deux milieux matériels, le lieu d'extraction et lieu de construction. Et du moment qu'on a fusionné ces concepts et ainsi considérer la terre comme une ressource.

Personne ne pouvait arrêter la machine à croissance du capital. Il était donc possible de capitaliser sur cet élan interne, en tirant parti de la volonté collective de prospérité au plus haut degré. Nous avons donc réalisé que ce développement négatif est un moyen lucratif de miner la ville. En fait, personne n'a réalisé que ça allait exploser comme ça !

Mais après l'impulsion des pouvoirs publiques. Avec l'incorporation de Taxes Carbones, un contrôle des LCA's, taxes d'excavations, certificats de circularités, traçabilité de flux, etc. On était face à une restructuration. On voulait être moins dépendants de l'importation des matières premières. Notamment en récupérant des matériaux existants, tels que la terre. Du fait de son abondance, et nécessitant quasi aucune transformation, on a permis de créer des solutions accessibles, économiques et respectueuses de l'environnement qui sont aussi onéreuses que le béton et sécurisées pour les promoteurs. Ceci a permis une relance de l'économie locale en démultipliant les fabriques de terre.

**KELLER.** « *Subtraction may be seen as a tragic or wasteful loss of value. Treated as the unskilled labor of demolition, is associated with waste that must be quickly carted off and furtively dumped somewhere in the margins.*

*In subtraction economy, physical building envelopes approach the flexibility of their attendant financial envelopes such that negative development is profitable. Mining the city is much more than a poetic or hopeful suggestion. Formula for subtraction would need to make building deletion profitable* »<sup>21</sup>.

**Yann Dahhaoui**

Finance Professor,  
specialised in soil, UNIL,  
VD, Switzerland.

**Keller Easterling**

Architect, writer and  
professor at Yale  
University, USA.

<sup>21</sup> Keller Easterling. 2010. « *Architecture to Take Away: The subtraction of Buildings as a new Construction Economy* ». In *Mine the City, Re-inventing Construction*, Ilka and Andreas Ruby eds, Ruby Press.

**Camille Vallet**

Editor at Tracé magazine,  
VD, Switzerland.

**Silvia Castelat**

SDG consultor, EPFL, VD,  
Switzerland.

**Boris Pestalozzi**

SDG consultor, EPFL, VD,  
Switzerland.

**CAMILLE.** En 2021, il y avait cette idée absurde que nous étions à court de ressources. Nous avons réalisé que le problème ne pouvait pas être résolu par la rareté des ressources mais plutôt par l'abondance d'énergie que l'on gaspillait. Nous avons appris à simplement miner la ville et ainsi réemployer la terre excavée. La ville devient un écosystème de ressources gérant les flux de matières. Ce travail multidisciplinaire permet d'affiner notre conception de modèles urbains alternatifs dans lesquels une production cyclique fait partie intégrante de la société urbaine, durable et décarbonisée.

**SILVIA.** L'aspect réellement politique de la construction en terre pure est qu'elle peut être mise en œuvre n'importe où, indépendamment des lobbies, du cours des actions et du contrôle des prix industriels grâce aux simples faits que c'est une ressource illimitée. De ce fait elle transcende l'idée fondamentale d'un monopole du lobby pris sur une ressource limitée. En conséquent elle permet de questionner certains éléments de l'architecture.

**BORIS.** Réfléchissons à l'enveloppe. Nous avons cette idée que les bâtiments devaient être scellés pour une rétention d'énergie maximale et ainsi nous protéger de l'environnement extérieur pour mieux vivre. Il y avait un paradoxe entre l'enveloppe et la technologie fortement énergivore nécessaire pour la construire.  
« L'enveloppe qui nous entoure doit pouvoir respirer et se diffuser de la même manière que notre corps. C'est pourquoi les bâtiments en terre ne sont délibérément pas encapsulés, scellés ou rendus lisses par des matériaux synthétiques ou à haute densité et à forte intensité énergétique, mais plutôt assemblés et finis à l'état brut, comme des sushis non cuits<sup>22</sup> ».

**ALIA.** Peut-on parler d'amnésie collective ?

Comment on a démocratisé la terre ? Avec 11'00 ans d'expérience. On était accro au béton, car c'était le siècle de la matière liquide. Maintenant grâce à la terre coulée, et des organes régulateurs de la construction en béton on coule avec les mêmes outils que le béton, la terre. C'était impensable il y a 10 ans.

On a aussi toute une génération d'architectes qui sont éduqués maintenant. On a développé un nouveau système d'apprentissage complément basé sur cette matière avec de forts investissements pour pousser la recherche. Ceci a rendu ce matériau socialement accepté, les architectes en raffole et le grand public également. Les gens ont pris leurs responsabilités.

En 2021, à l'ouverture de la première fabrique de terre crue en région parisienne, on n'imaginait pas que maintenant il y en aurait partout en Europe.

**ARNAUD.** En fait, dans les années 20, il y avait un gros problème de place. On générait tellement de matière qu'on avait plus de place pour l'entreposer. On n'avait aucune autre solution que de la décharger dans notre territoire. On générait tellement de volumes, que même les premières petites fabriques ne pouvaient pas absorber ces quantités. On ne savait pas quoi en faire. Le meilleur était que c'était une solution extrêmement rentable. C'était comme durant l'Âge d'or du pétrole. Mais pour la terre, le ciment est sans risque. On n'imaginait pas que la construction en terre à cette échelle était possible. La Lat. allait faire son effet est ce n'était pas avec du pisé ou du bois qu'on pensait pouvoir densifier.

Avec les nouvelles législations et les limitations sur la construction en béton, on a perdu une grosse partie de notre production. Mais on s'est vite réinventé. Finalement on a juste réadapté notre équipement pour la terre. Le béton c'est beaucoup de machines, pas beaucoup de gens. On va jusqu'à coopérer sur de plus grands projets,

**Alia Bengana**

Professor of soil and  
biobased material  
construction, EPFL, VD,  
Switzerland.

**Arnaud Bush**

Engineer and environment  
director at Morllati.

<sup>22</sup> Marko Sauer, Otto Kapfinger & Martin Rauch : *Refined Earth Construction & Design with Rammed Earth*, DETAIL, 2015

**Ben Burnell**

*Social media marketing director, Instak, sustainability division, London, UK.*

notamment Terraforma, où l'on développe un marché de terre au centre de Plainpalais avec l'EPFL.

Mais bon on ne va pas se mentir, on a quand même quelques décharges, cette fois ci en forêt un peu plus cachées.

**BEN.** No one thought we would make it out the soil & climate crisis, but we did. Thanks to us partly. We changed mindsets.

You know in the 20's. Inertia for change was extremely slow, especially in the construction world with this stuck mindset of how things worked. But since we used social media as an active actor in this fight! Things just blew off! People's relationship with each other changed, and in that process, their social contracts, and habits. It was a catalyst to create new social trends and habits fast.

I'd say the Gtek summit was the wakeup call. We radically shifted the content to make users become active in the change.

Therefore, the community grew and came together fast. As for example: One of our content creators, TerraAlex, with 10M followers, show the potential of DIY rammed earth benches.

**ÉLÉONORE.** I love what we have created here. It's the first time that a program makes this connection with you and the environment. We've mapped the production line in a way that depending on your geographic location the software enables you or not to build with a certain material. It is the biggest upgrade ever. A new tool for building a world for the people and the planet.

At Soilworks we are driving the circular economy to build more with less. Making low-carbon construction a reality, where nature and cities thrive together. Architects are now everyday heroes.

**Éléonore Audi**

*Software developer at SoilWorks, London, UK.*

Éléonore is portraying how the software works. Interacting with the software AI « Charlotte » and herself.

**ÉLÉONORE.** Charlotte, remind me what we have to check today?

**CHARLOTTE.** I suggest that we discuss the materiality of the structure.

**ÉLÉONORE.** Great, then let's go to Section RF105.

**CHARLOTTE.** I switch to Axonometric view.

**ÉLÉONORE.** Ah, is it still possible to use the concrete for the floor?

**CHARLOTTE.** Éléonore, be careful you have already reached your quota.

**ÉLÉONORE.** Oh yes, remind me why already?

**CHARLOTTE.** According to the ordinance of the Swiss confederation on the limitation and disposal of resources, you have to re-use 70% of excavated material.

**ANTOINE.** TerraForma, est un labo de recherche à l'EPFL où l'on est en train de développer un marché de la terre au centre de Plainpalais en collaboration plusieurs acteurs.

On a mis en place un système de coopération et non de compétition entre le canton de Genève, la confédération, Orlatti, SoilWorks, ainsi que des acteurs locaux.

Les matériaux viennent soit de sites d'excavation et d'anciens bâtiments en terre obsolètes à recycler et réemployer.

Ainsi, en mettant le projet au centre, on a rendu la population pro-active, notamment à travers des workshops avec une visibilité directe. Je suis content qu'on ait le soutien de la confédération, ça nous permet de prendre des risques. Et sans risque, il n'y a pas d'innovation.

C'est un projet inclusif, qui permet de développer aussi l'artisanat, consolider des formations ainsi que le développement local. On a enfin réussi à construire un système participatif qui mobilise aussi la population, devenant ainsi un enjeu sociétal.

**Antoine Iweins**

*PHD student for TerraForma Lab, EPFL, VD, Switzerland.*

Ceci nous permet donc d'expérimenter quant au rôle que joue chaque membre d'une communauté dans l'acte de construire. Nous nous aventurons dans la production de matériaux, la narration d'histoires, le transfert de connaissances, l'organisation communautaire et tout cela influence notre approche pour concevoir.

Je me réjouis vraiment de cette nouvelle année 2032. Il y a beaucoup de positivisme. Donc go 2032 et n'oubliez pas de danser.

### Kevin Lynch

Author of the book  
*Wasting away, USA.*

**KEVIN.** « Conceptions of waste are linked to a specific time, place, and culture. Hence, because waste is culturally constructed, modifying our views of it is difficult and argues that we must rethink who we are before we rethink waste<sup>23</sup> ».

<sup>22</sup> Kevin Lynch. 1990. *Wasting Away*, Sierra Club Books.

## APPENDIX IV - BIBLIOGRAPHY

**Alan M, Berger** 2006 *Drosscape: Wasting Land in Urban America*, Princeton Architectural Press.

**Alia Bengana, Claude Baechtold & Antoine, Harari** 2021 « Béton, la fin d'une ère ? » In *Revue n. 10, Les Explorations*, Heidi News.

**Charlotte Malterre-Barthes** 2021 « The devils in the Details » In *Non-extractive architecture, On designing without depletion Vol. 1*, Space Caviar, Sternberg Press.

**Charlotte Malterre-Barthes** 2021 « A Global Moratorium on New Construction ». Conference: Berlin Questions 2021, EWERK GMBH. Available at: <https://www.youtube.com/watch?v=wIWRTeFOJNQ>

**Conseil fédéral suisse**, « Ordonnance sur la limitation et l'élimination des déchets », Pub. L. No. 814.600, § Chapitre 1 But, champ d'application et définitions, art.3 définition (2015, État 1<sup>er</sup> Janvier 2022).

**CycleTerre** Paris, <https://www.cycle-terre.eu/>

**Dirk Hebel & Felix Heisel** 2020 « Cultivated building materials: The fourth Industrial Revolution? » In *The Material Book*, Ruby Press, 2020.

**European Parliament** 28 April 2021 « Resolution on soil protection (2021/2548(RSP)) » Available at [https://www.europarl.europa.eu/doceo/document/TA-9-2021-0143\\_EN.html](https://www.europarl.europa.eu/doceo/document/TA-9-2021-0143_EN.html)

**European Environment Commission of Waste Framework Directive** Available at <https://ec.europa.eu/environment/topics/>

[waste-and-recycling/waste-framework-directive\\_en](#)

**Jane Hutton** 2021 « Notes on reciprocity and solidarity » In *Non-extractive architecture, On designing without depletion Vol. 1*, Space Caviar, Sternberg Press.

**Jane M Jacobs** 2014 *Buildings Must Die: A Perverse View of Architecture*, Cambridge, Massachusetts London, England: The MIT Press.

**Keller Easterling** 2010 « Architecture to Take Away: The subtraction of Buildings as a new Construction Economy ». In *Mine the City, Re-inventing Construction*, Ilka and Andreas Ruby eds, Ruby Press.

**Kevin Lynch** 1990 *Wasting Away*, Sierra Club Books.

**Khattabi Zakia**, ministre du climat Belge. 17.12.2021 « Plan fédéral pour l'économie circulaire ». Disponible sur : <https://khattabi.belgium.be/fr/cp-un-plan-fédéral-ambitieux-pour-le-déploiement-de-l'économie-circulaire>

**Lucy R Lippard** 2014 « Undermining: A wild Ride Through Land Art, Politics, and Art in the Changing West », New York, New Press.

**IEA & UN environment programme 2019** *Global Status for Buildings and Construction*.

**IPCC, SR15** 2018 « Special Report on the Impacts of Global Warming of 1.5 C above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways », Intergovernmental Panel on Climate Change.

**Marc Angelil & Cary Siress** 2010 « Re: Going around in circles, Regimes of Waste » In *Mine the City, Re-inventing Construction*, Ilka and Andreas Ruby eds, Ruby Press.

**Mark Wigley** 2021 « *Returning the Gift, Running Architecture in Reverse* » In *Non-extractive architecture, On designing without depletion Vol. 1, Space Caviar*, Sternberg Press.

**Marko Sauer & Otto Kapfinger** 2015 *Martin Rauch refined Earth Construction & Design with Rammed Earth*, Munich, Edition DETAIL.

**Matthew Adams** 2019 « *Bringing Embodied Carbon Upfront: Coordinated Action for the Building and Construction Sector to Tackle Embodied Carbon* », London, World Green buildings Council.

**Oliver Wainwright** 2020 « *The case for ... never demolishing another* » In *The Guardian*. Available on: <https://www.theguardian.com/cities/2020/jan/13/the-case-for-never-demolishing-another-building>.

**Paul Emmanuel Loiret** 2021 « *Terre de Paris, Vers un Ancrage Terrestre* », présenté au séminaire S2 JMA-FR1, Redécouvrir la Terre, HEP, Fribourg, décembre 2021.

**Pavillon de l'arsenal** 2017 « *Terres de Paris. De la matière au matériau* » Exposition. Paris  
**Plan sectoriel des décharges contrôlées** Révision 2020, « *Plan sectoriel des décharges contrôlées* ». Département de l'environnement et de la sécurité (DES) Direction générale de l'environnement (DGE), Canton de Vaud, Version 30 Octobre 2020.

**Price Waterhouse Cooper** 2016 « *Potential of circular economy in Belgium – Executive Summary* ».

Federal public service, Health, Food chain safety and environment.

Available at: <https://www.health.belgium.be/>

[fr/leconomie-circulaire-potentiel-economique-en-belgique](https://www.health.belgium.be/fr/leconomie-circulaire-potentiel-economique-en-belgique).

**Romain Anger** 2019 *Pisé - Tradition et Potentiel*, Zurich : Triest.

**Serge Sala** 2020 « *How the circular economy can lead to carbon neutrality* » in *The Material Book*, Ruby Press.

**Société du grand Paris express** 2021 « *Construire le Grand Paris Express en préservant l'environnement* », disponible sur : <https://www.societedugrandparis.fr/chantier/environnement>.

**Stephanie Carlisle & Nicholas Pevzner** 2021 « *The Thin Thread of Carbon* » in *Non-extractive architecture, On designing without depletion Vol. 1, Space Caviar*, Sternberg Press.

**Table ronde** « *Déblais/remblais : comment créer de nouveaux paysages ?* » Intervenant : Jacques Martelain, directeur du GESDEC, Genève. Célia Pépin, architecte-paysagiste. Emmanuel Graz, architecte-paysagiste Ville de Lausanne, en charge du projet Plaines du Loup. Animée par Valérie Hoffmeyer, architecte-paysagiste et journaliste. Pavillon Sicli, Route des Acacias 45, 1227 Genève, 30.11.2021.

## Popcorn time

You can watch the documentary [here](#).

<https://vimeo.com/manage/videos/666739474>

Enter the following password: Earth

Or scan the code:



## Remerciements

Alia Bengana  
Anton Maertens  
Arnaud Bush  
Ben Burnell  
Camille Vallet  
Claude Baechtold  
Chloe Eckert  
Dieter Dietz  
Daniel Zamardbide  
Jacques Martelain  
Julien Lafontaine Carboni  
Mattia Pretolani  
Nathan Voyame & Ronan Schubnel  
Pavillion Sici  
Patrick Morris  
Rodrigo Fernandez  
Romain De Rivaz  
Ruben Valdez  
Sally Moore  
Simon Pinzelli  
Simon Rodriguez  
Tanguy Caversaccio  
Toby Morris  
Viviane Morris Fol  
Yann Dahhaoui