MeduSoil

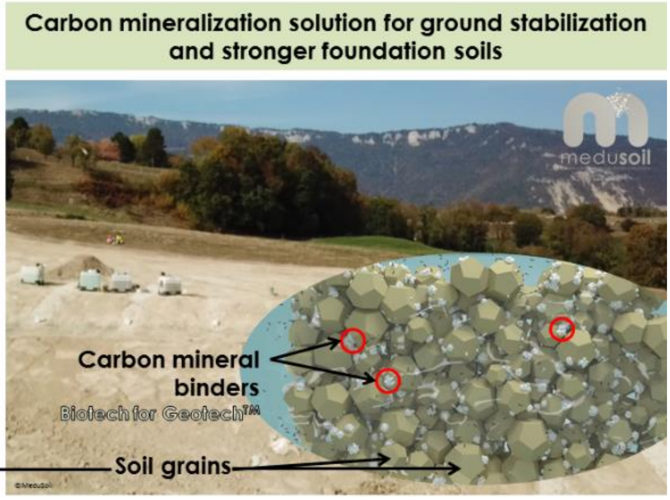
Bio-stabilization of soil replaces concrete piles

visit MeduSoil

based in Lausanne, Switzerland, incubated at Startup-Accelerator
Cif by Dimitrios Terzis, PhD, co-founder and co-inventor

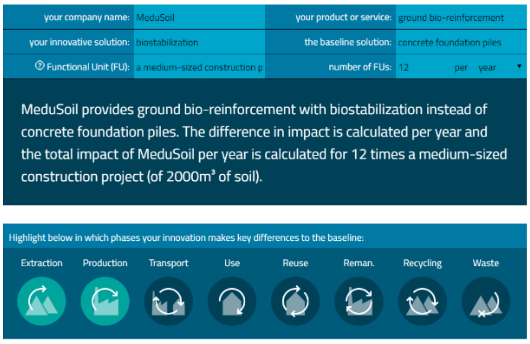
Ground stabilization is needed for foundations of buildings, and to prevent erosion leading to landslides, compromised flood protection or sinkholes. Concrete piles are usually driven into the soil for this purpose, but concrete is known for its hefty climate impact.

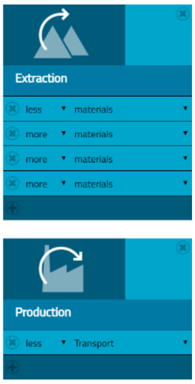
MeduSoil has an alternative solution for soil stabilization that reproduces and stimulates an organic mechanism which already occurs in nature. A liquid mix containing water, urea and lime is injected into the soil and the micro-organisms present there react by forming calcium carbonate; bio-cement.



From their pilot projects, MeduSoil knows how much water, urea and lime are equivalent to a volume of concrete that would stabilize the same amount of soil. To know if MeduSoil offers a climate-friendly alternative to concrete is to answer this question:

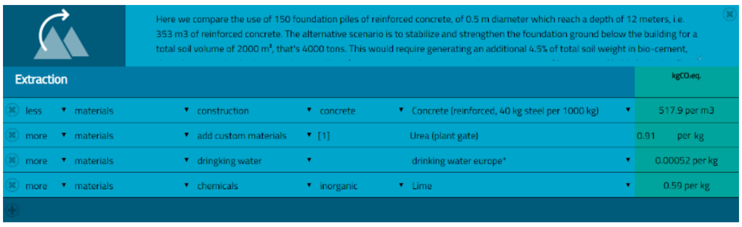
Is the climate impact of the MeduSoil mix and process, less than that of the equivalent amount of concrete?

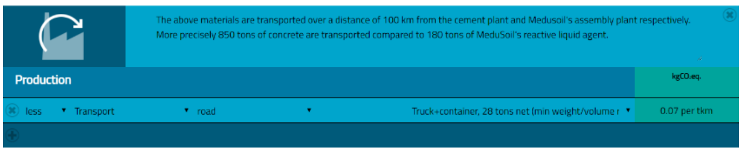




Step 1 of the MeduSoil Cif is straightforward. The impact of MeduSoil scales with the amount of soil stabilized, so the functional unit of 'one medium-sized construction project (of 2000m3)' is well chosen. MeduSoil aims to deliver 12 of these projects annually.

The important differences of MeduSoil are in the extraction and of materials and the production. Extraction entails replacing concrete with the medusoil mix. In production (= stabilizing the soil) the difference in energy use for pumping versus pile driving is negligible, but there is a significant difference in the amount of transport.





In step 2 the concrete used today, and the ingredients of the MeduSoil mix, are selected from the database. Urea is a key ingredient and the database does not include it. There is data for Nitrogen fertilizer and it would be a good equivalent, but there is an important difference between the use of urea as a fertilizer and the use of urea in the MeduSoil process. The chemistry of fertilizer in the field contributes the majority of its climate impact, and MeduSoil needed the impact data for urea without its use as fertilizer. This data was found this publication of fertilizers Europe. The impact of 0,91 kg CO2eq per kg of urea (at plant gate) was used in the MeduSoil Cif as custom data. Quantities are added in step 3.

Result: MeduSoil has significant positive climate impact

The final result of the Climate impact forecast is a one-page overview showing the climate impact of a startup and the assumptions used to calculate this. It contains the LCA must-haves scope, functional unit, baseline, innovation, key differences and LCI data used. The outputs are climate impact per difference, in total per functional unit and in total for the business, all in kg CO_2eq. Total eco-costs are given for human health, eco-toxicity and resource depletion. Red is additional impact; green is avoided impact. The abstract number of tons of CO_2eq is translated into a number of trees with a similar climate impact, a number of people, a number of times driving a car round the world, and other memorable impact numbers to present the impact of your startup.

MeduSoil provides ground bio-reinforcement with biostabilization instead of concrete foundation piles. The difference in impact is calculated per year and the total impact of MeduSoil per year is calculated for 12 times a medium-sized construction project (of 2000m³ of soil).

Extraction	Here we compare the use of 150 foundation piles of reinforced concrete, of 0.5 m diameter which reach a depth of 12 meters, i.e. 353 m3 of reinforced concrete. The alternative scenario is to stabilize and strengthen the foundation ground below the building for a total soil volume of 2000 m³, that's 4000 tons. This would require generating an additional 4.5% of total soil weight in bio-cement, that's biomineralized calcium carbonate. Therefore we account the in-situ production 160 tons of bio-cement (CaCO3) which reflects the consumption of 108 tons of urea (carbon source) and 72 tons of a lime source (calcium source). Lime is used and calcium is approximate. [1] The climate impact of urea is found in "Energy efficiency and greenhouse gas emissions in European nitrogen fertilizer production and use", Frank Brentrup, Yara International ASA, Research Centre Hanninghof, Germany and Christian Pallière, Fertilizers Europe, Belgium, retrieved from fertilizerseurope.com March 2019.
Production	The above materials are transported over a distance of 100 km from the cement plant and Medusoil's assembly plant respectively. More precisely 850 tons of concrete are transported compared to 180 tons of MeduSoil's reactive liquid agent.

Extraction					
−	Concrete (reinforced, 40 kg steel per 1000 kg)	517.9 per m3	353	m3	-182822
+	Urea (plant gate)	0.91 per kg	108000	kg	98280
+	drinking water europe*	0.00052 per kg	300	tons	156
+	Lime	0.59 per kg	72	tons	42480
Production					
−	Truck+container, 28 tons net (min weight/volume r	0.07 per tkm	67000	tkm	-4690

MeduSoil's total impact per year

eco-costs of human health euro	-12127
eco-costs of eco-toxicity euro	-51750
eco-costs of resource depletion euro	-200235
eco-costs of carbon footprint euro	-271066

	Carbon footprint CO_2eq.
Impact per a medium-sized construction project	-46596 kg
Impact of 12 times a medium-sized construction project	-559.2 ton

Equivalent to

25416 trees

115 Average humans

69	564	1086	235	112	101
times driving a car around the world	passengers flying London-New York	barrels of oil burnt	EU households annual electricity	elephants mass (5t) of CO_2	hot air balloons (2800 m^2) of CO_2

"The CIF tool and its rich database enabled us to provide a clear picture of our climate impact in a quantified and robust manner"

– Dimitrios Terzis, PhD, Research Scientist at the Laboratory for Soil Mechanics and co-founder of MeduSoil