

Charcrete LCA in Brightway

Group U1

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Presentation Structure



Background to the project



LCA methodology and system definition



Activities in Brightway



Results



Learnings and feedback

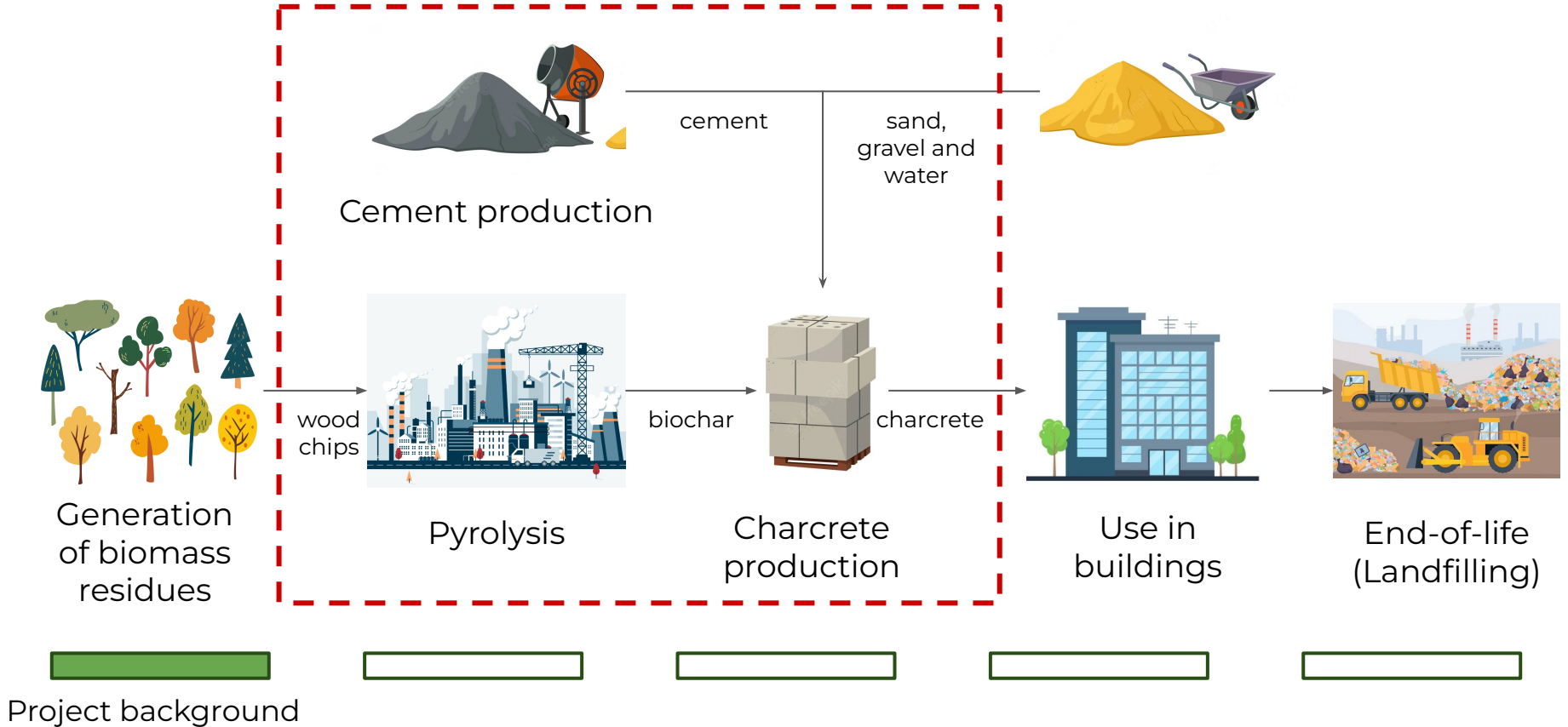


Project background

- Biochar as a carbon sink
- Biochar mixed into concrete = charcrete
- Possible impact reduction in buildings



Charcrete Production Process



Scoping and System Definition

- **Goal:** investigating the effects of replacing some conventional concrete with charcrete
 - **Functional unit:** production of 1 cubic metre of Charcrete
 - **Impact categories:** climate change
 - **Impact assessment method:** IPCC 2013 GWP₁₀₀
-
- Three scenarios: **5%, 7.5% and 10%** biochar in concrete
 - Comparison with conventional concrete production



LCA Methodology

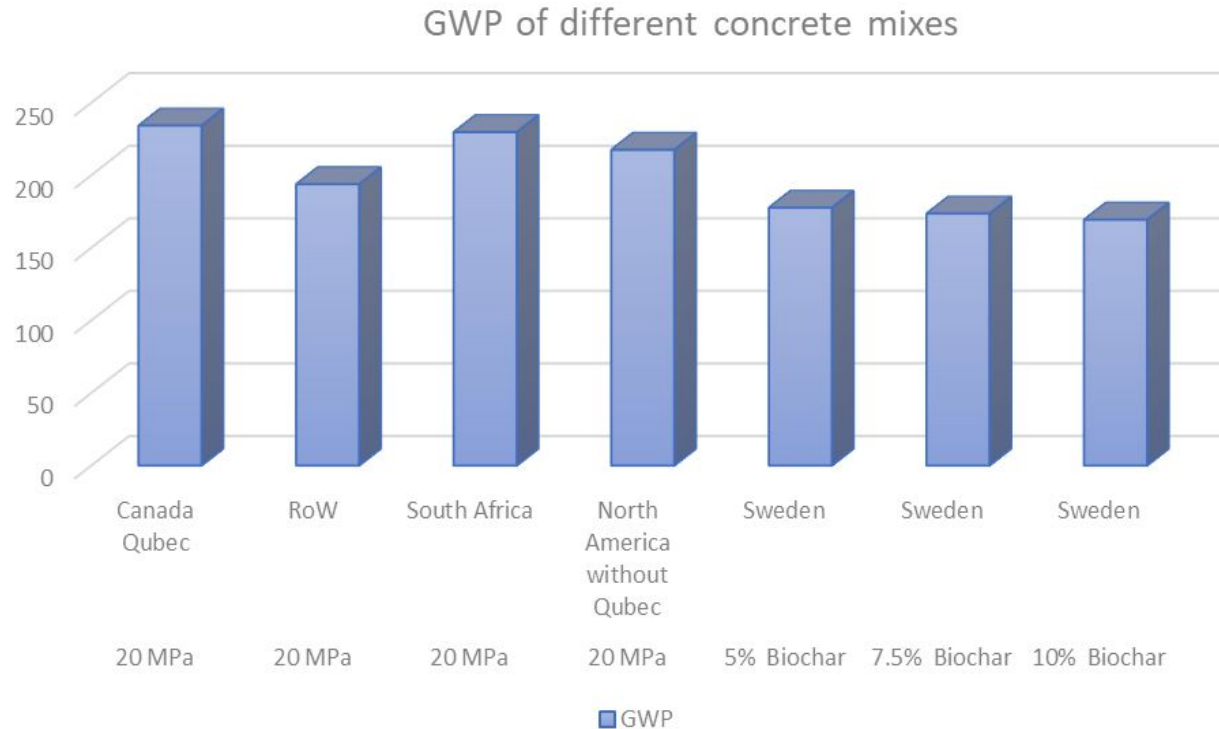
Activities in Brightway (what we did)

- Data collection and import into Brightway as new database
- Scenarios generation through datapackages
- Contribution analysis
- Replacing cement type in charcrete
- Concrete market modification with charcrete
- Uncertainty analysis (background/foreground)
- Correlated samples on CO2 sequestration



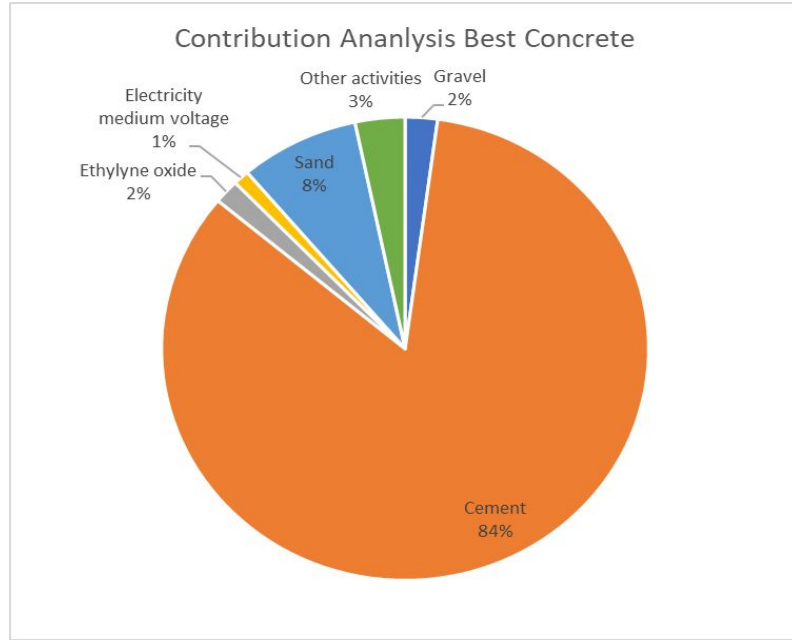
Activities in Brightway

First Results

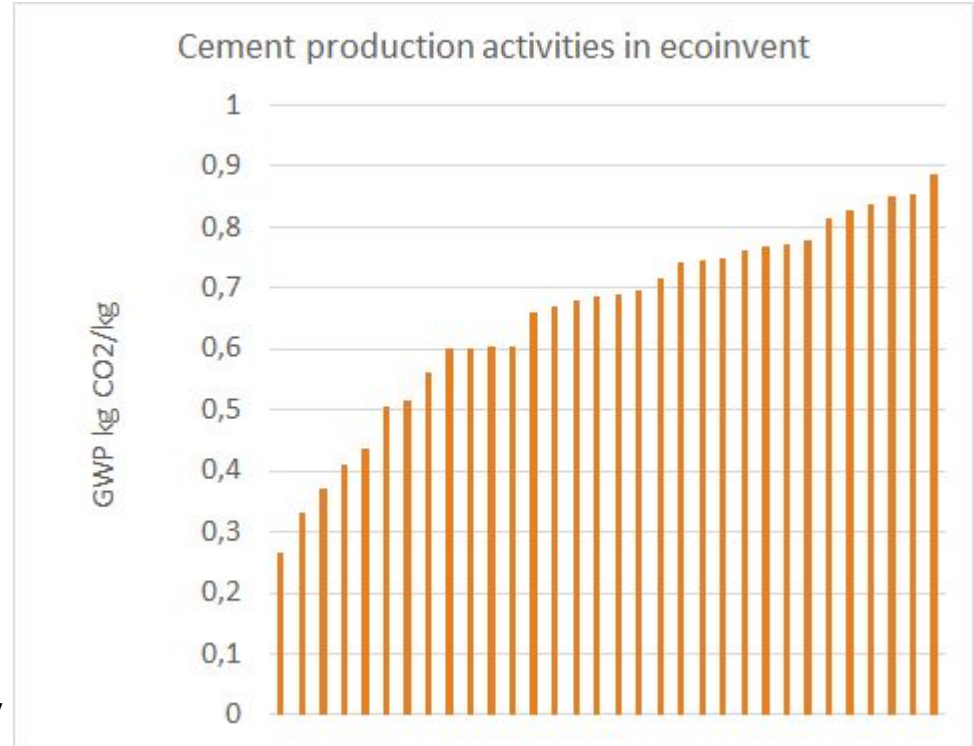


Results

Contribution Analysis

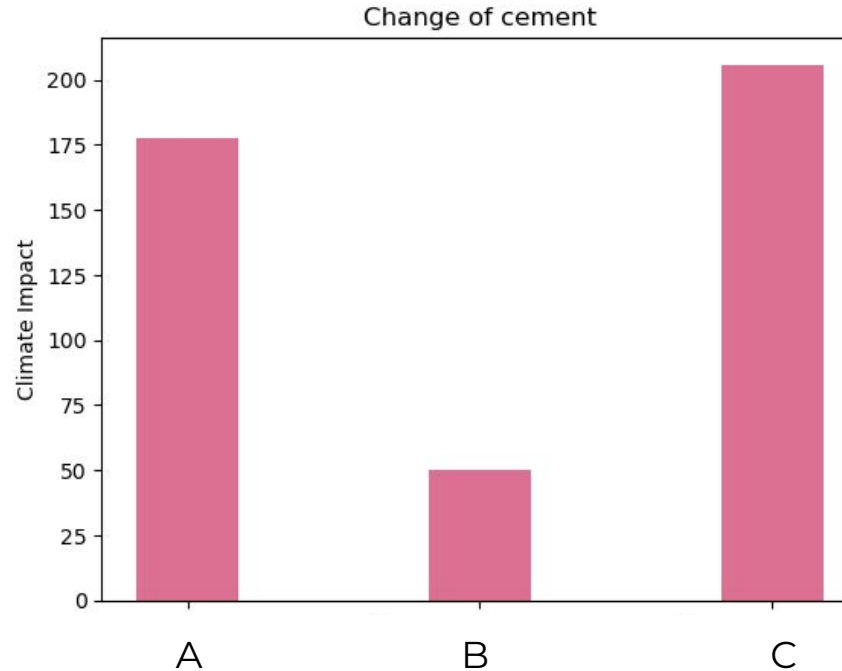


Cement = 85-95 % contribution + large discrepancy



Results

Changing Cement in Charcrete



A: Base case (market for cement, Portland, EU w/ CH)

B: Best (market for cement, blast furnace slag 81-95%, CH)

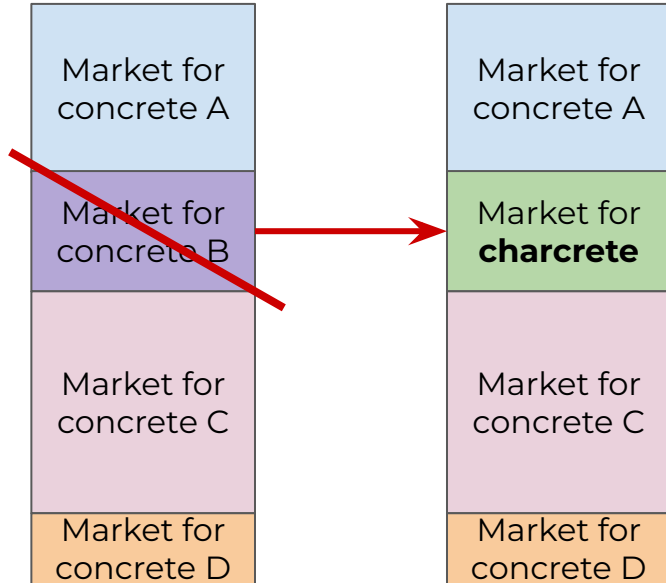
C: Worst (market for cement, Portland, ZA)



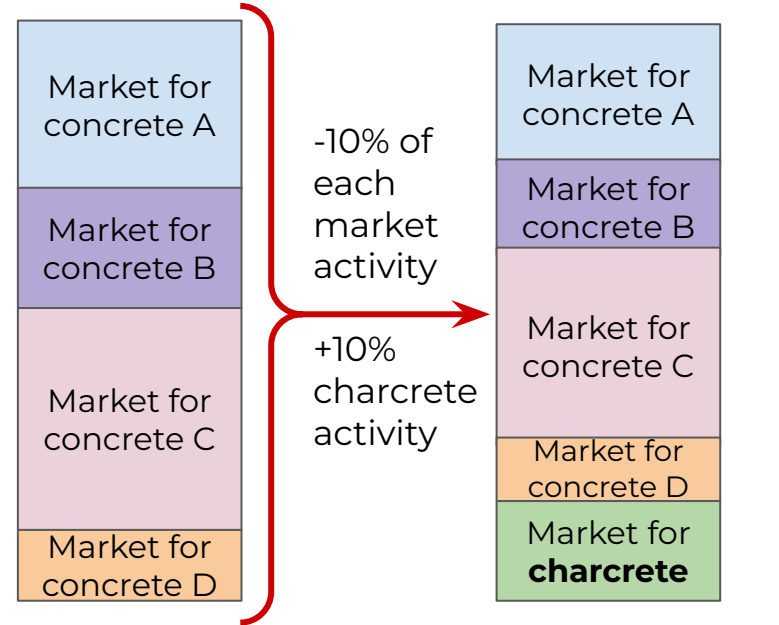
Results

Modifying Markets

A: Charcrete replaces an activity entirely:



B: Charcrete replaces several activities partially:



Results

Generic function

```
def replace_stuff(main_act, sub_act, repl_act, method):  
    ...
```

Inputs:

3 activities

- one main activity in ecoinvent
 - one sub activity to the main activity
 - one replacement activity to substitute the subactivity in the main activity
- 1 method

Returns 2 LCA scores

- the LCA score of the OG main activity
- the LCA score of the main activity with the replacement activity instead of the subactivity

OBS

If the sub_act is not in ecoinvent, create the "missing" column first (draw edges):

```
main_act.new_edge(input=sub_act, amount=0, type="technosphere").save()
```

Ideas for development:

Just first level for now - could we change that? Need to put a maximum "deepness" level?

What is really supposed to be returned? Can we return the modified version of the main act? - tried it, ended up breaking ecoinvent...

...

```
[90]: cm_score
```

```
[90]: 283.44576866175305
```

```
[91]: cm_score - demand*RNA_score + demand*wc_score
```

```
[91]: 283.0965523271859
```

```
[92]: print(replace_stuff(concrete_market, concrete_RNA, wood_chipping_act, ipcc))
```

```
[283.4457686617518, 283.09872575637183]
```

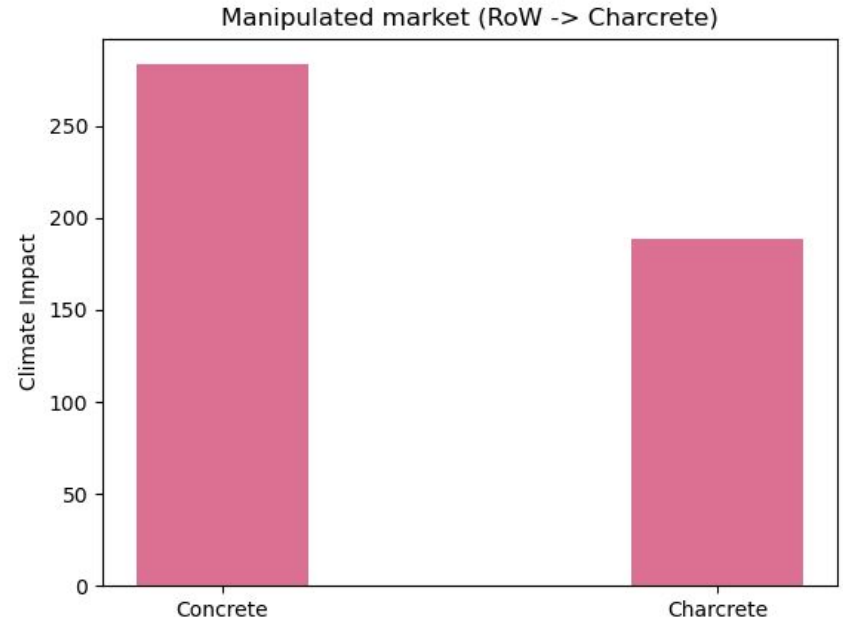
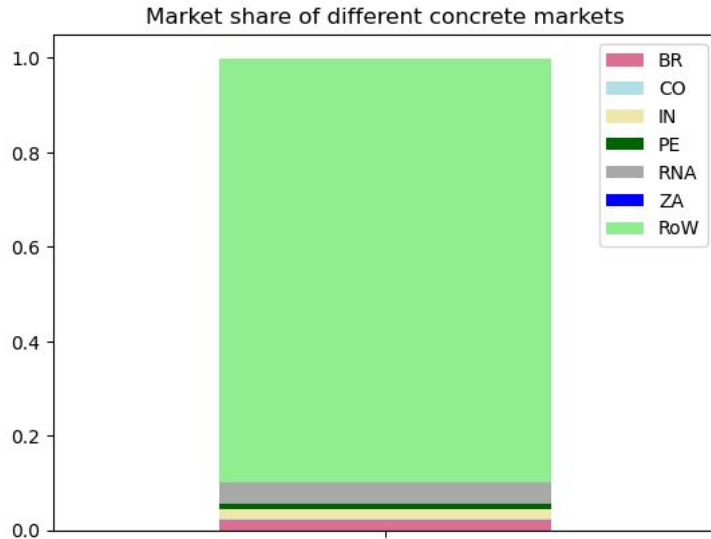
ok!



Results

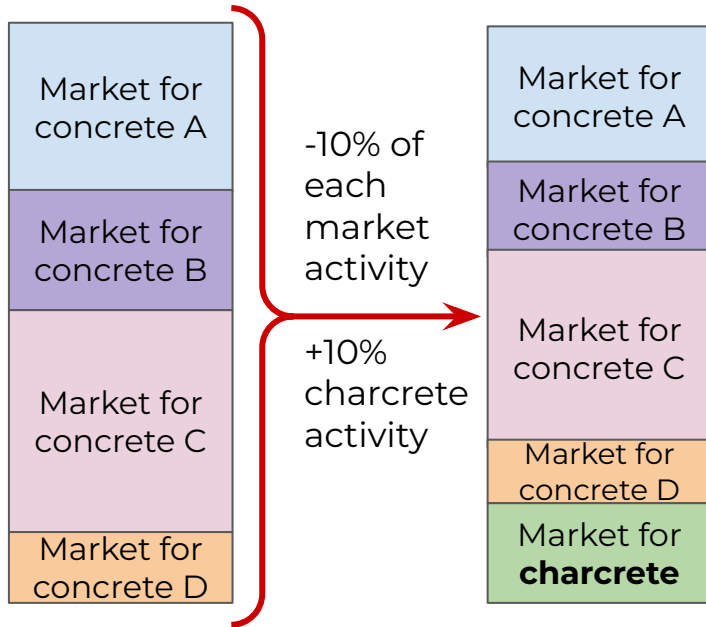
Modify market by substitution

Substitute RoW (89.5% of **Normal** concrete market) with charcrete



Results

Modify market by shares



```
[62]: # What we should get:  
lca1*0.9 + wc_score*0.1
```

```
[62]: 282.8781479604745
```

```
[63]: # what we get  
lca2
```

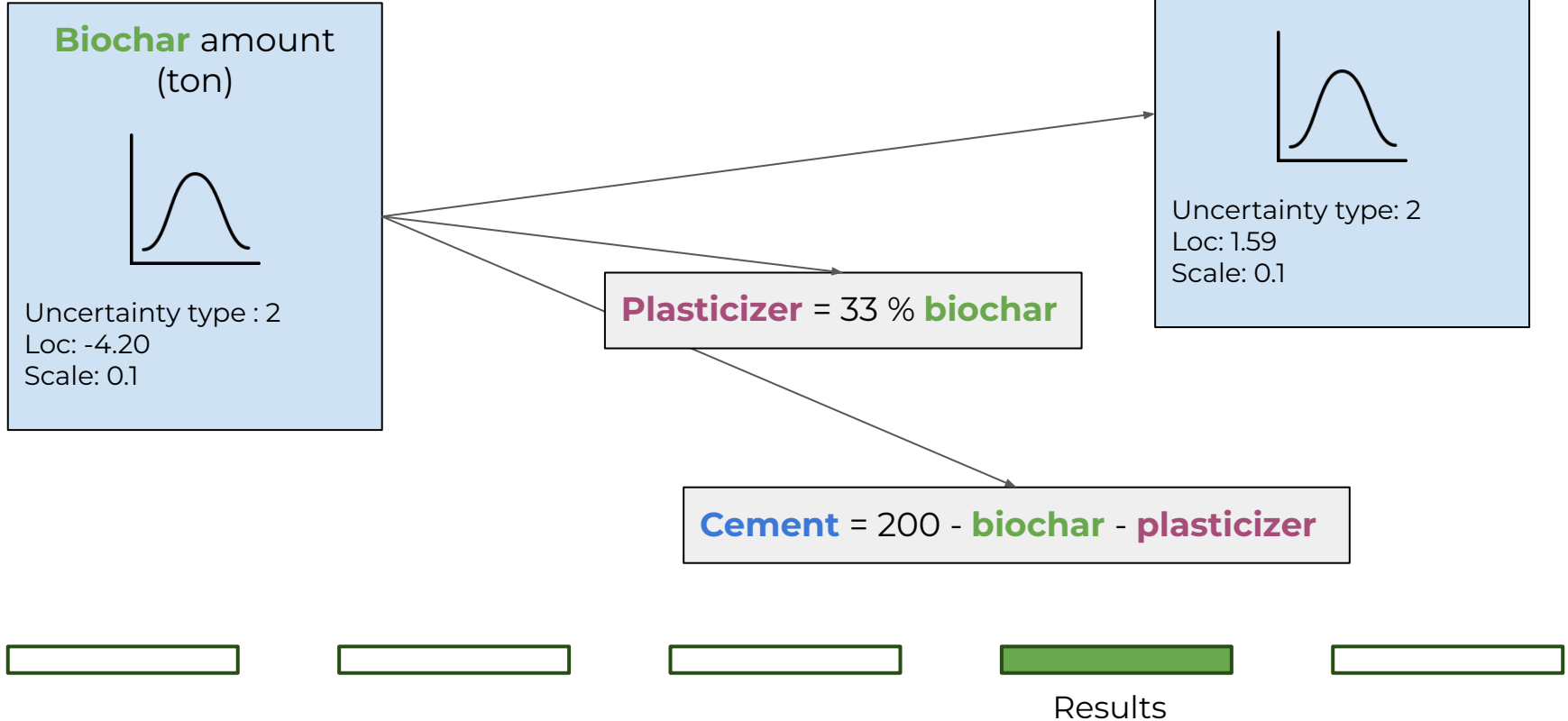
```
[63]: 254.53357198151193
```

???

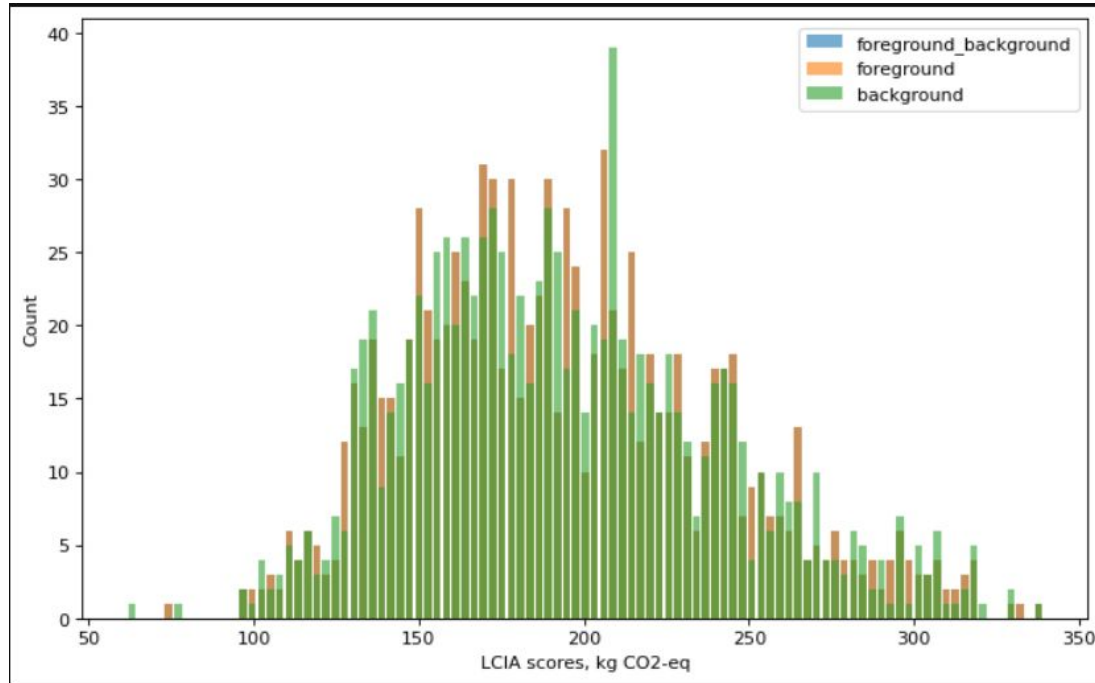


Results

Uncertainties



Uncertainty Analysis



no sensitivity
analysis...



Results

Correlated samples

Link between biochar amount in charcrete and carbon sequestration amount through a simple ratio to run uncertainty analysis

We manage to go all the way through (thanks to Sasha) BUT

our method didn't have a characterization factor for our flow so we cannot see the difference

(but we are pretty confident that it works ;))



Results

“Should I pull or should I go”



Learnings

- Setting up a good working space with JupyterLab and GitHub
- Becoming more confident in Brightway (2.5)
- Importing Excel files to Brightway
- Creating data packages
- *



Learnings

What we loved about this week:

- The food, location and organisation of the course
- Good sense of community and a good vibe
- Tutors have been super helpful and accessible
- Format of content: lectures followed by exercise
- Exposure to high level of Brightway

What we would have changed:

- The pace was a bit fast: difficult to complete exercises in the time given
- An introduction to git/setting up shared workspace would be nice
- Project tasks for different levels so that group members with varying skills can all contribute



Feedback



Thank you