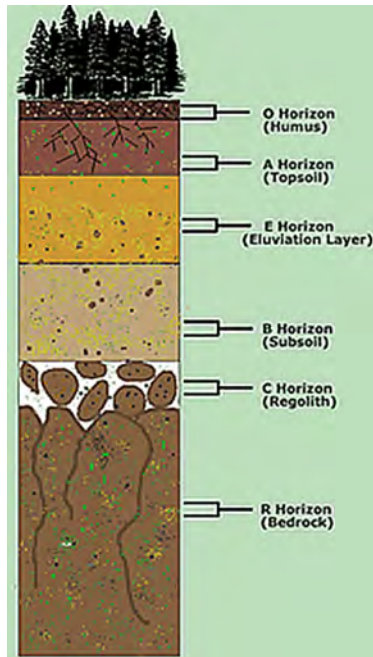


soilpRofile: a new R package to consistently represent soil properties

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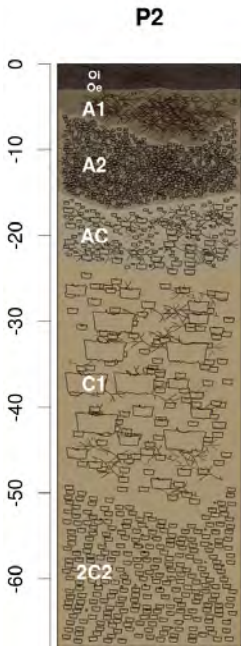


- Soil scientists really care about soil profiles (basically, a hole in the ground)
- Soil profiles are sketched in a number of publications
- Soil profiles are difficult to render and those sketches are time consuming
- Important objects in a soil profile sketch would be: soil color, rock dimension and shape, root abundance, horizon boundaries, etc.
- Consistency is usually lacking

In particular...

Soil properties such as soil color, rock abundance and dimension, roots content are evaluated based on field observations (rarely) and photographs (more likely)



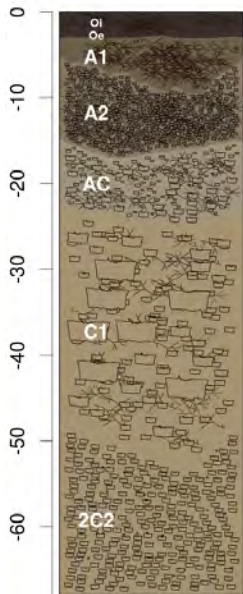


soilpRofile: soon a package
(hopefully)

Objectives

- Represent horizon boundaries, including irregular ones
- Consistently represent rock abundance, shape and dimension
- Consistently represent soil color
- Provide a flexible tool to show depth functions of a given variable

P2



Input data:

a simple table of field observations and lab analyses

Profile	Horizon	Depth (cm)	Rock dim (cm)	Rock ab	Color
P2	A1	0-2/7	2	0.02	2.5Y 4/2
P2	A2	2/7-12/14	2	0.40	2.5Y 5/2
P2	AC	12/14-20/22	5	0.50	2.5Y 6/2
P2	C1	20/22-45/50	20	0.80	2.5Y 6/4
P2	2C2	45/50-65	15	0.70	2.5Y 6/4

Type	Carbon (%)	Root ab	Root dim	Root orientation
chanter	3.37	many	0.20	h
chanter	1.59	common	0.50	h
chanter	1.15	few	6.00	v
chanter	0.96	absent		
chanter	0.91	absent		

The work-flow:

- A function builds the boundaries of a given horizon (with `runif()` some noise is added to get a realistic boundary)
- `polygon()` plots the boundaries
- `areapl(){splancs}` computes the surface area of the horizon
- One shape for rock fragments is chosen (among three available so far) and scaled to the requested dimension

The work-flow (follows):

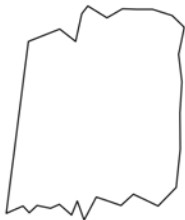
- The number of shapes is computed according the total area of the horizon and the rock abundance
- A number of random coordinates is extracted within the horizon coordinates
- A rock fragment is built and `point.in.polygon()` checks whether it falls within the horizon
- Last two points are repeated in a loop until the final number of shapes is reached

The work-flow (follows):

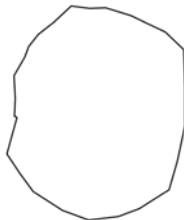
- Root dimension is done qualitatively using different lwd
- For root number and distribution we used the same process as for rock fragments
- When rock dimension is large, a number of smaller shapes is added to mimic realistic classes of rock fragments
- Color for the background is computed by a call to `munsell2rgb()` which converts from MUNSELL color to RGB
- One (or more) variable(s) can be plotted within the soil profile

Some examples: rock units

Subangular



Subcircle



Channer



Some examples: root units

Lwd:1



Lwd:2



Lwd:3



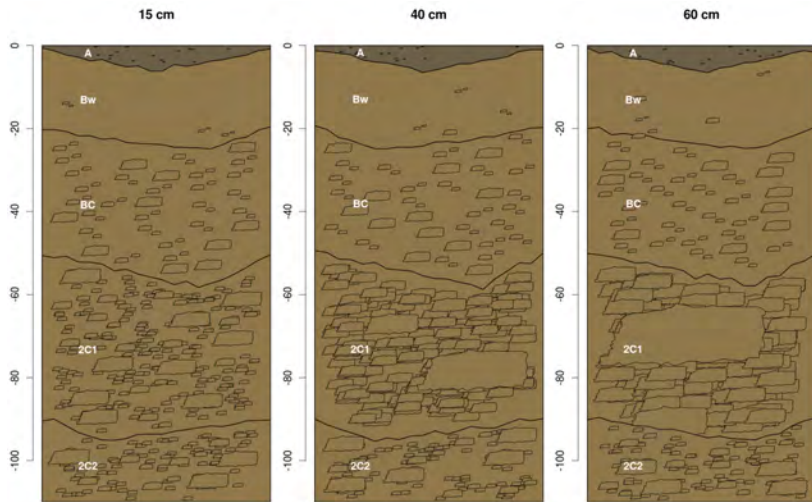
Lwd=4



Some examples: different rock abundances in 2C1: 30-50-70%



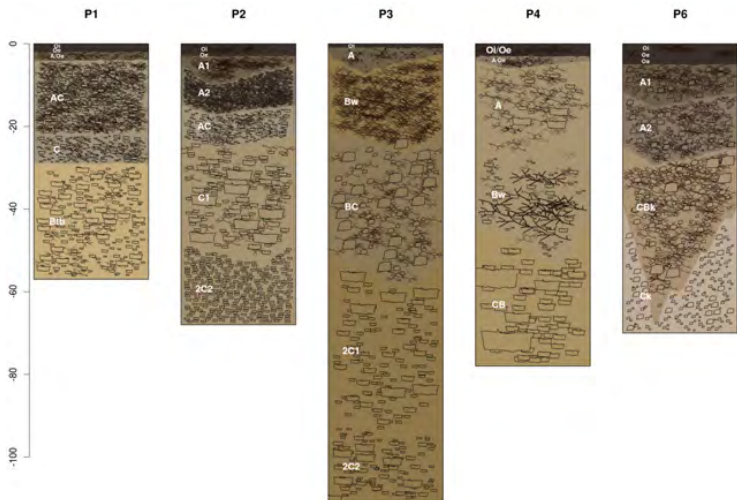
Some examples: different rock dimensions



Some examples: different rock type



Some examples: combined plot with n profiles with `par(mfrow=c(n,1))`



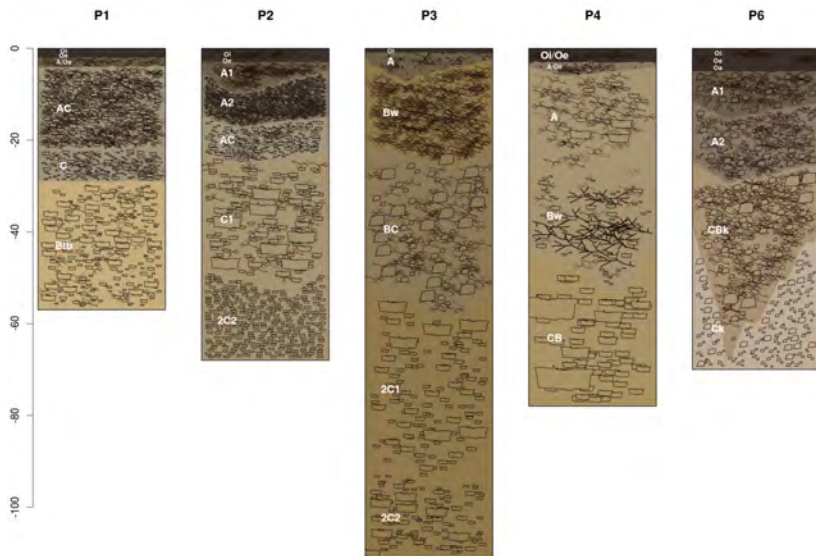
Useful for soil sequences

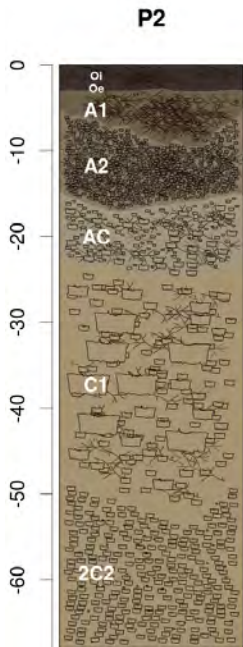
```
1 plot_profile <- function(raw, bottom= NULL,  
2                           yaxt=TRUE, main=NULL,  
3                           element=FALSE, names=TRUE,  
4                           names.col='white', background='munsell',  
5                           element.col='black', element.legend=FALSE,  
6                           element.lims=FALSE, element.lab=FALSE,  
7                           element.type='b', xax.log=FALSE,  
8                           plot.roots=TRUE, plot.skeletal=TRUE,  
9                           random=TRUE, profile_data=NULL,  
10                          legend.labs=FALSE, legend.pos='bottomright',  
11                          horizon.border=NA, element.lty=1)
```

./code1.R

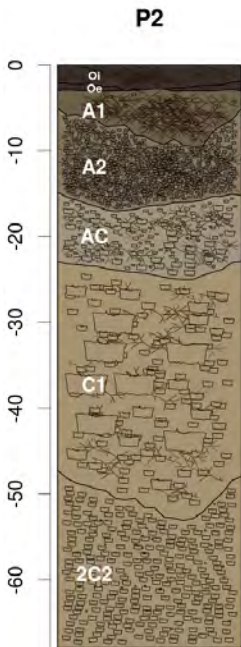
Few more words on options...

Options: bottom=value, yaxt=FALSE

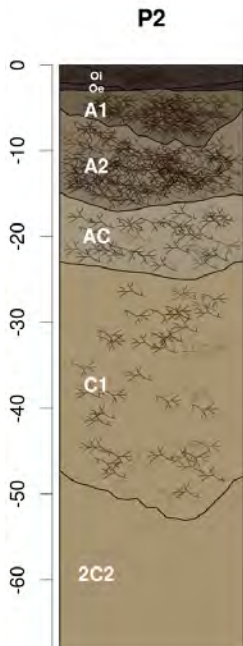




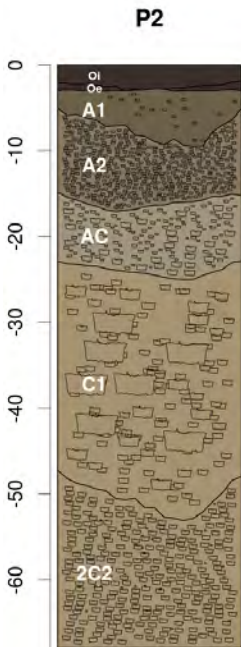
No options
The basic version



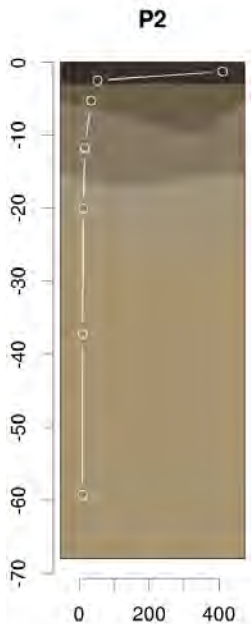
Options: border='black'
The basic version



Option: `plot.skeletal=FALSE`
We can choose to plot only skeletal, or
only roots...

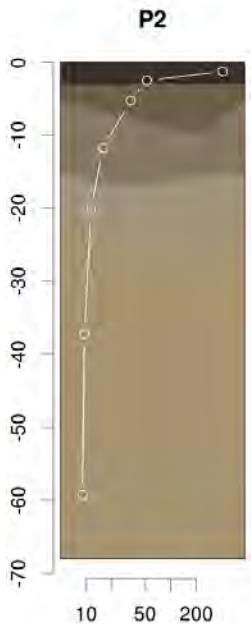


Option: `plot.roots=FALSE`
We can choose to plot only skeletal, or
only roots...



Option: element(s)

- Elements can be plotted on the existing profile
-
-
-



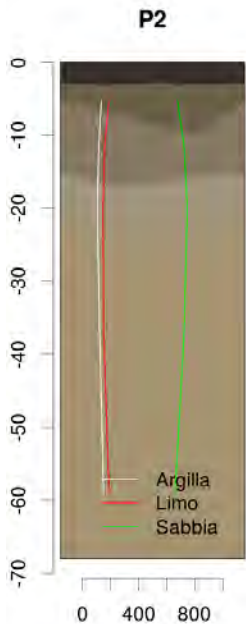
Option: element(s)

- Elements can be plotted on the existing profile
- Log axes is also allowed



Option: element(s)

- Elements can be plotted on the existing profile
- Or multiple panels with the same element



Option: element(s)

- Elements can be plotted on the existing profile
- Or multiple panels with the same element
- And multiple elements within the same profile (with legend)

The option `random=FALSE` provides the possibility to recycle randomly generated data from a previous call to the function `plot_profile()`
This is to reproduce exactly the same graph more than once.

Conclusions and outlook

An example of a combination of very basic R scripting to get a consistent representation of soil properties.

The functions will be soon presented in a short communication which will be submitted to a journal of soil science (strongly requested by the Italian Society of Pedology)

The same approach may be used in sedimentology, geology etc.

With some more options, refinements, etc. this group of functions will likely be ready to become a package (hopefully!!)

A web tool?