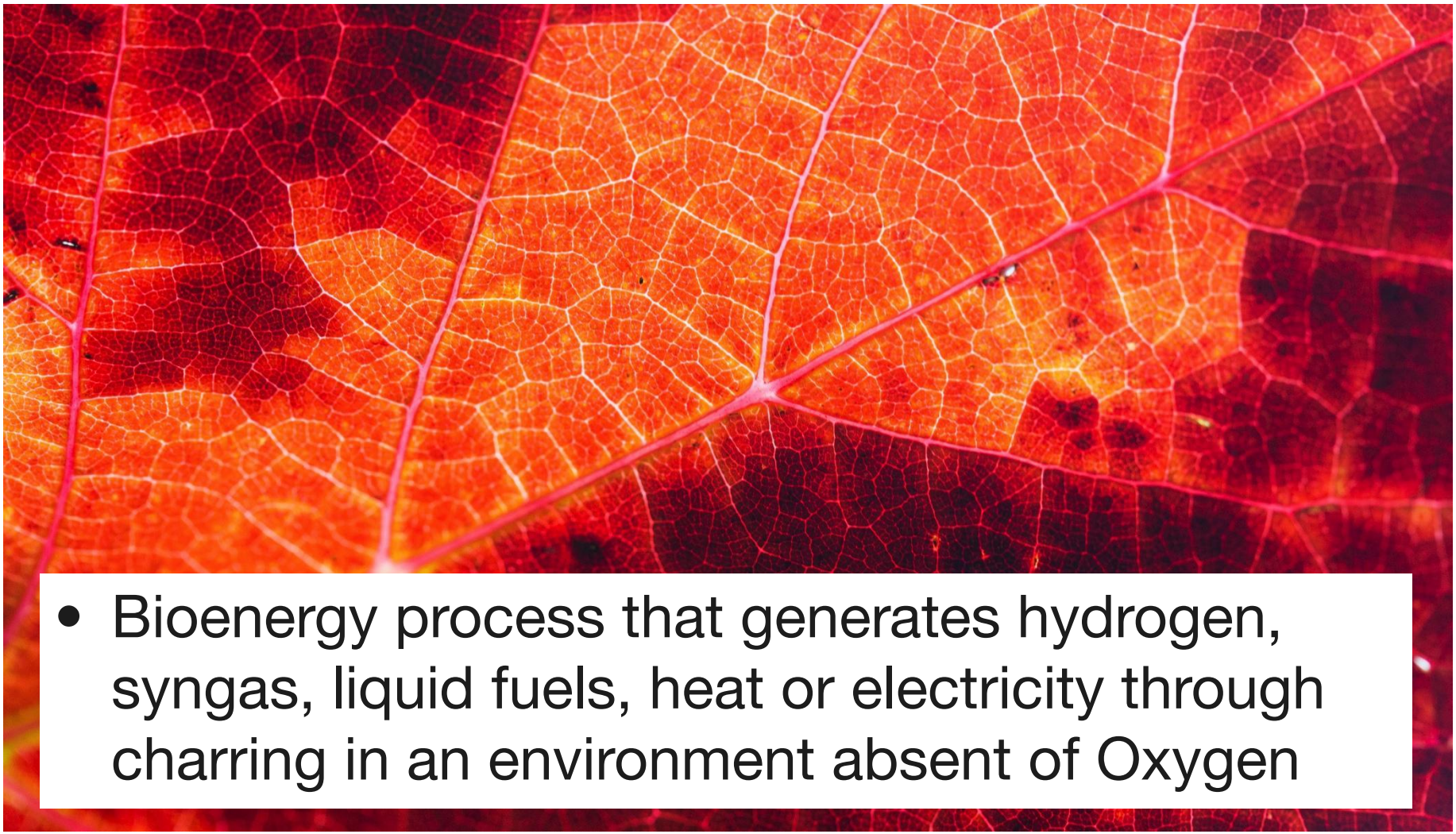
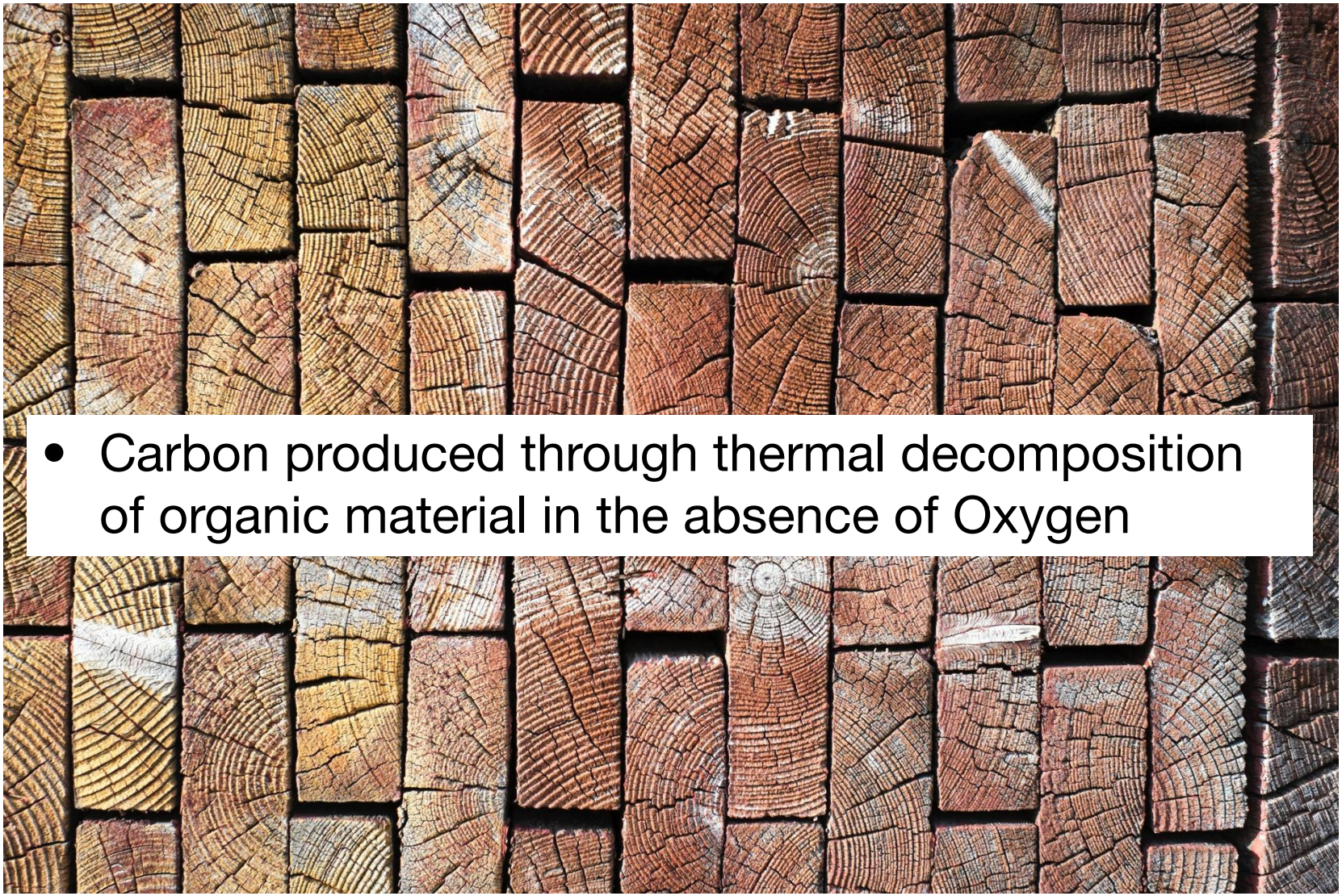
What is Pyrolysis?



- Bioenergy process that generates hydrogen, syngas, liquid fuels, heat or electricity through charring in an environment absent of Oxygen

What is Biochar?



- Carbon produced through thermal decomposition of organic material in the absence of Oxygen

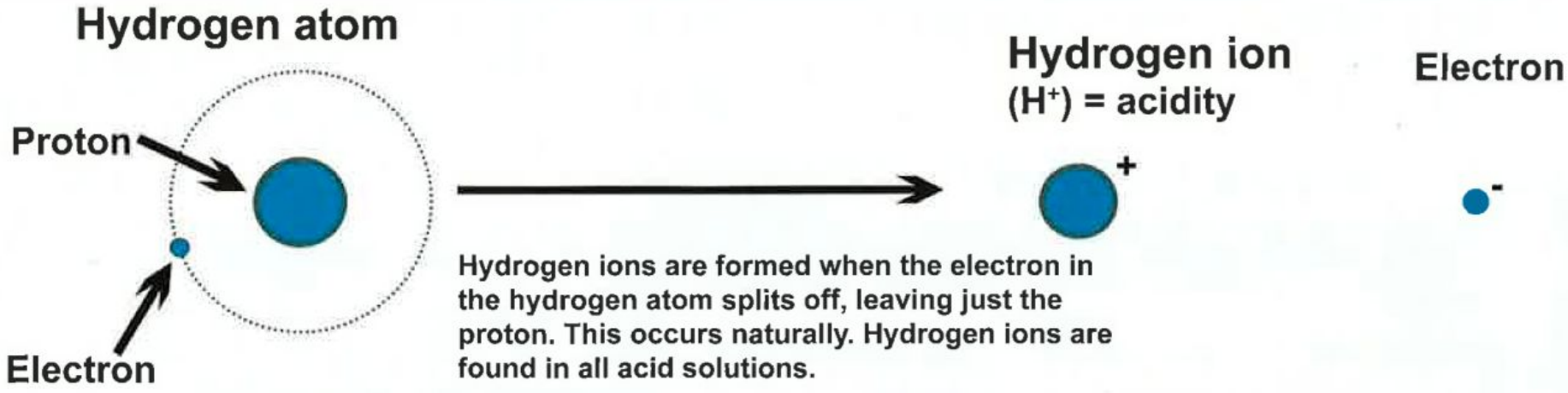
Decomposition of Biomass

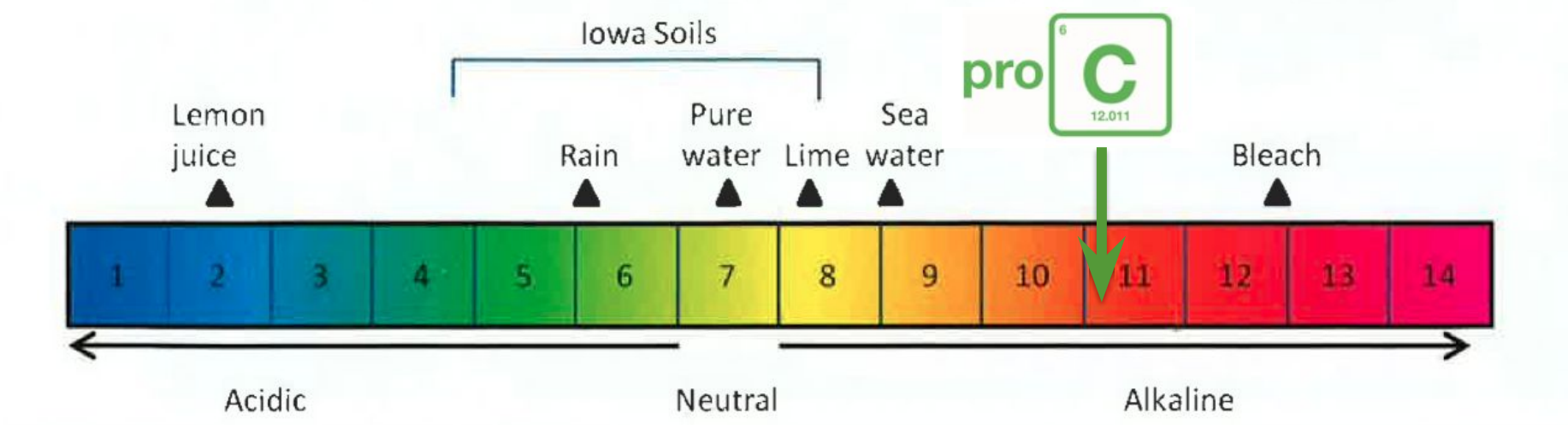
Heating biomass in the absence of Oxygen to 1100°C (2012°F) drives off

- Moisture @ 100°C
- Hemicellulose @ 150°C
- Cellulose @ 300°C
- Lignin @ 500°C

What's left? => CARBON

Our Biochar – Pro-C pH





Proton Power INC.

Pro-C CEC

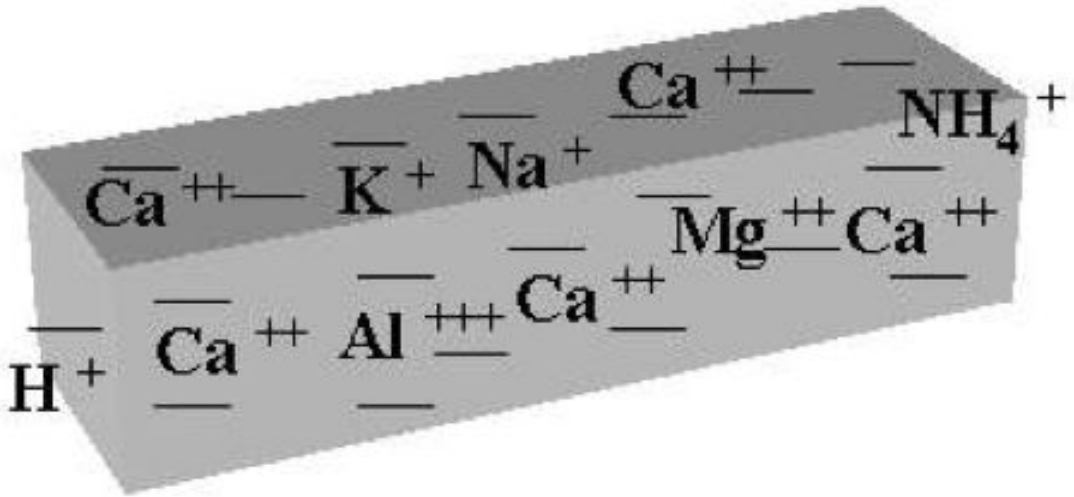


Figure 1. Schematic of a clay particle with negative charges on the surface attracting various cations.

Biochar can assist plant growth by Cation retention.

Proton Power INC.

Pro-C Soluble Salts

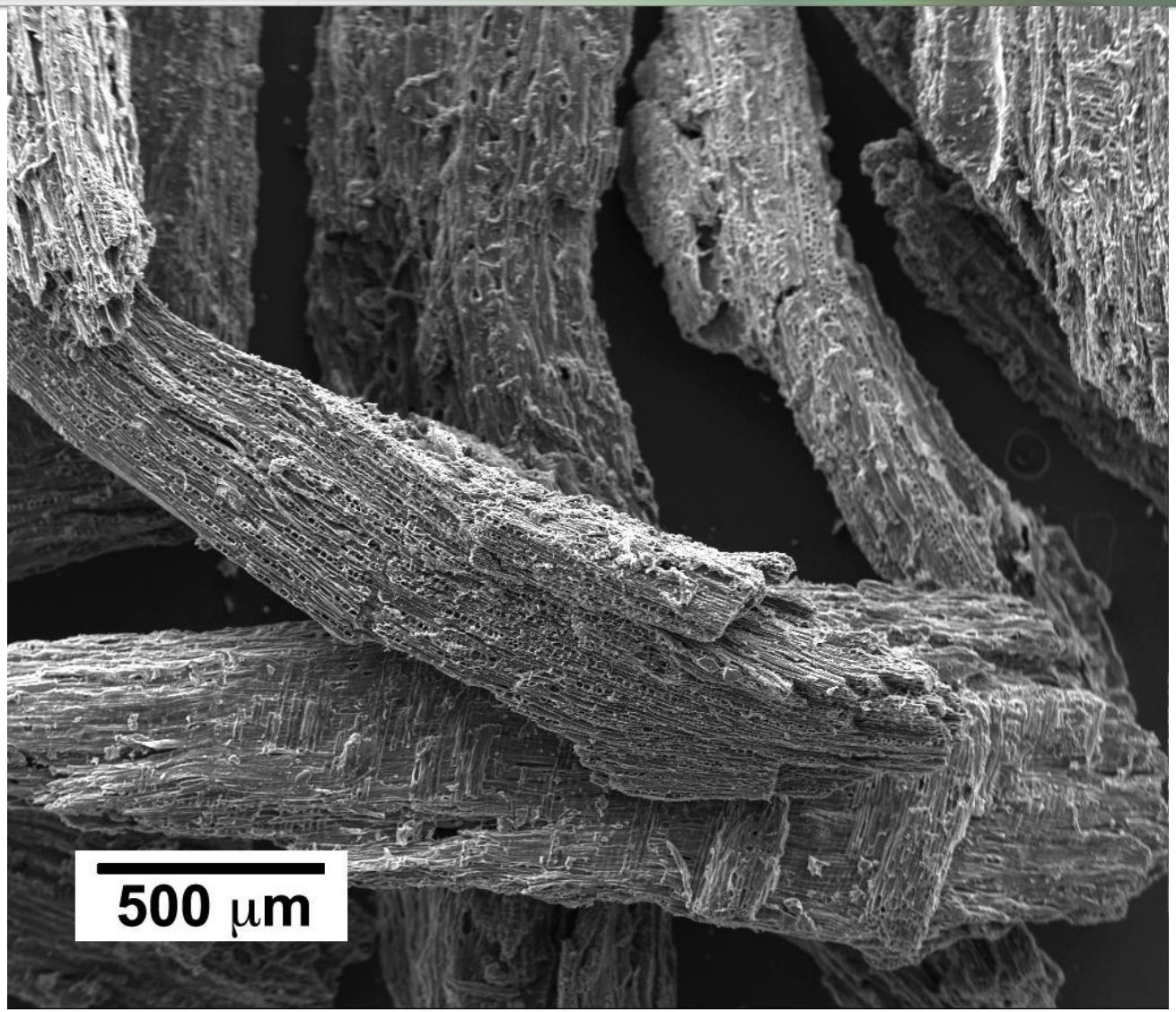
Interpretation of the Soluble Salt Test

Electrical Conductivity (mmhos cm $^{-1}$)	Degree of Salinity	Comments
<0.80	Non-salinity	Generally safe for all plants and seedlings.
0.81 – 1.60	Very slightly saline	
1.61 – 2.40	Moderately saline	Sensitive plants and seedlings of other plants may show soluble salt injury.
2.41 – 3.20	Saline	Salt sensitive plants will show some injury.
3.21 – 6.40	Strongly saline	Salt tolerant plants will grow; sensitive plants will be severely injured by this level of soluble salts.
>6.41	Very strongly saline	Very few plants can tolerate this level of soluble salts.

= 1.1 mmhos/cm

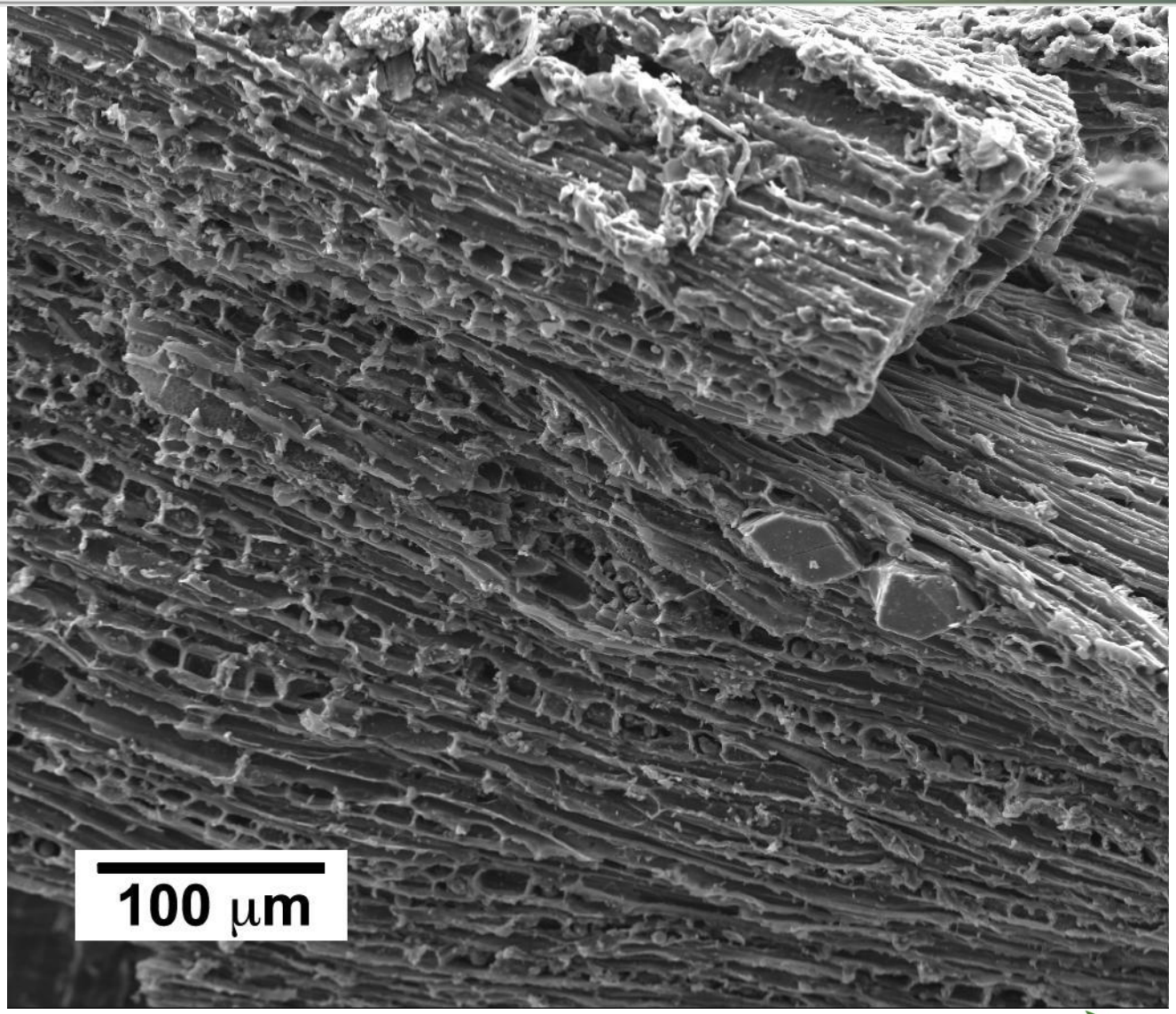
http://blogs.cornell.edu/horticulture/files/2011/11/Soluble-Salts-May-6-2013-o36voh.pdf

Pro-C Surface Area



Proton Power INC.

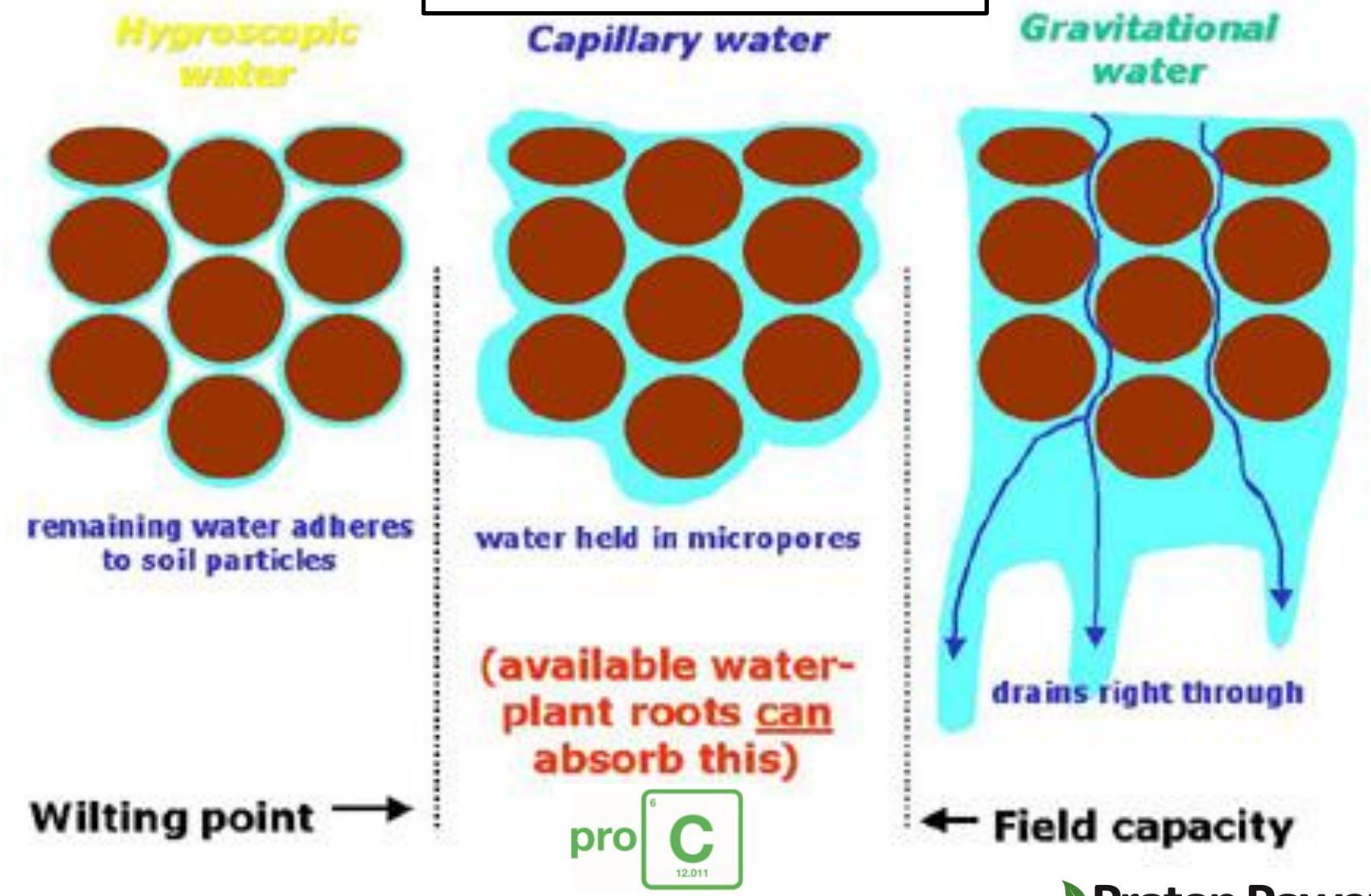
Pro-C Surface Area



Proton Power INC.

Pro-C Water Holding

Dr. Michael C. Hirschi – U of Illinois



Proton Power INC.

Pro-C Water Holding

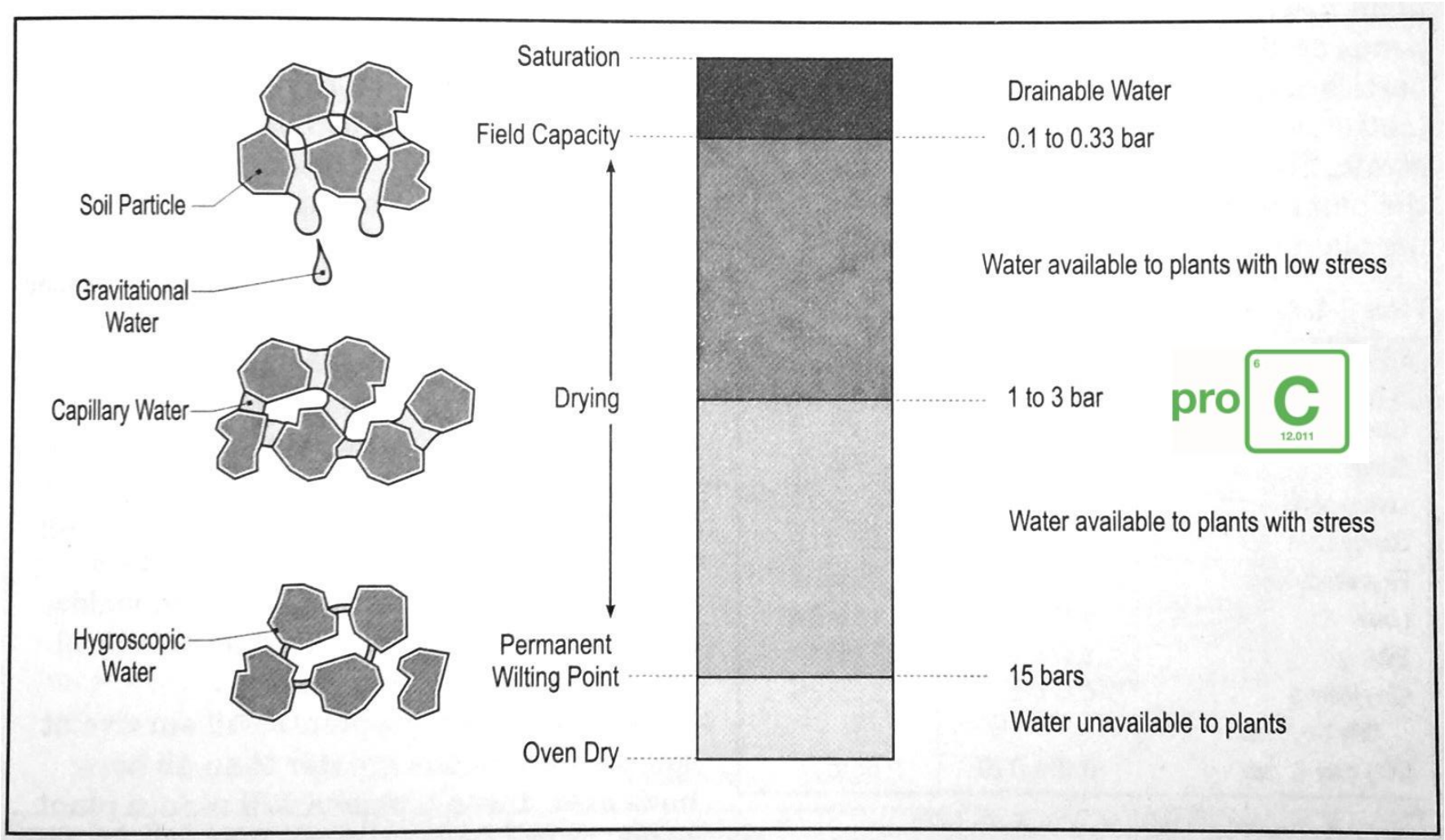


Figure 2-2. Soil moisture tension.

MWPS-30 Sprinkler Irrigation Systems, 1st edition 1999

Proton Power INC.

Pro-C Water Holding

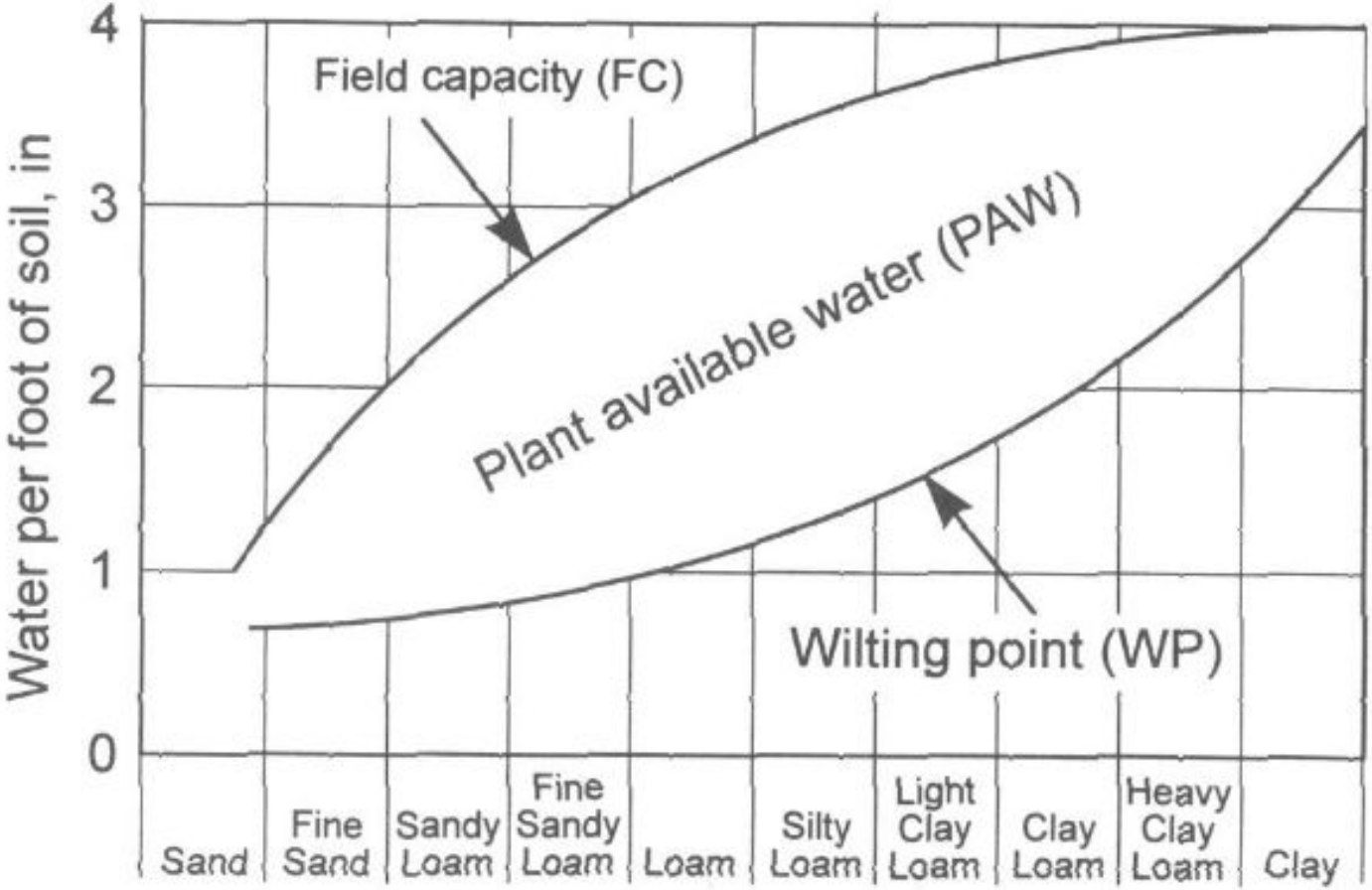


Figure 3.8. Water holding characteristics of soils with different texture.

Ward, Elliot 1995 (Environmental Hydrology, Lewis Publishers)

Proton Power INC.

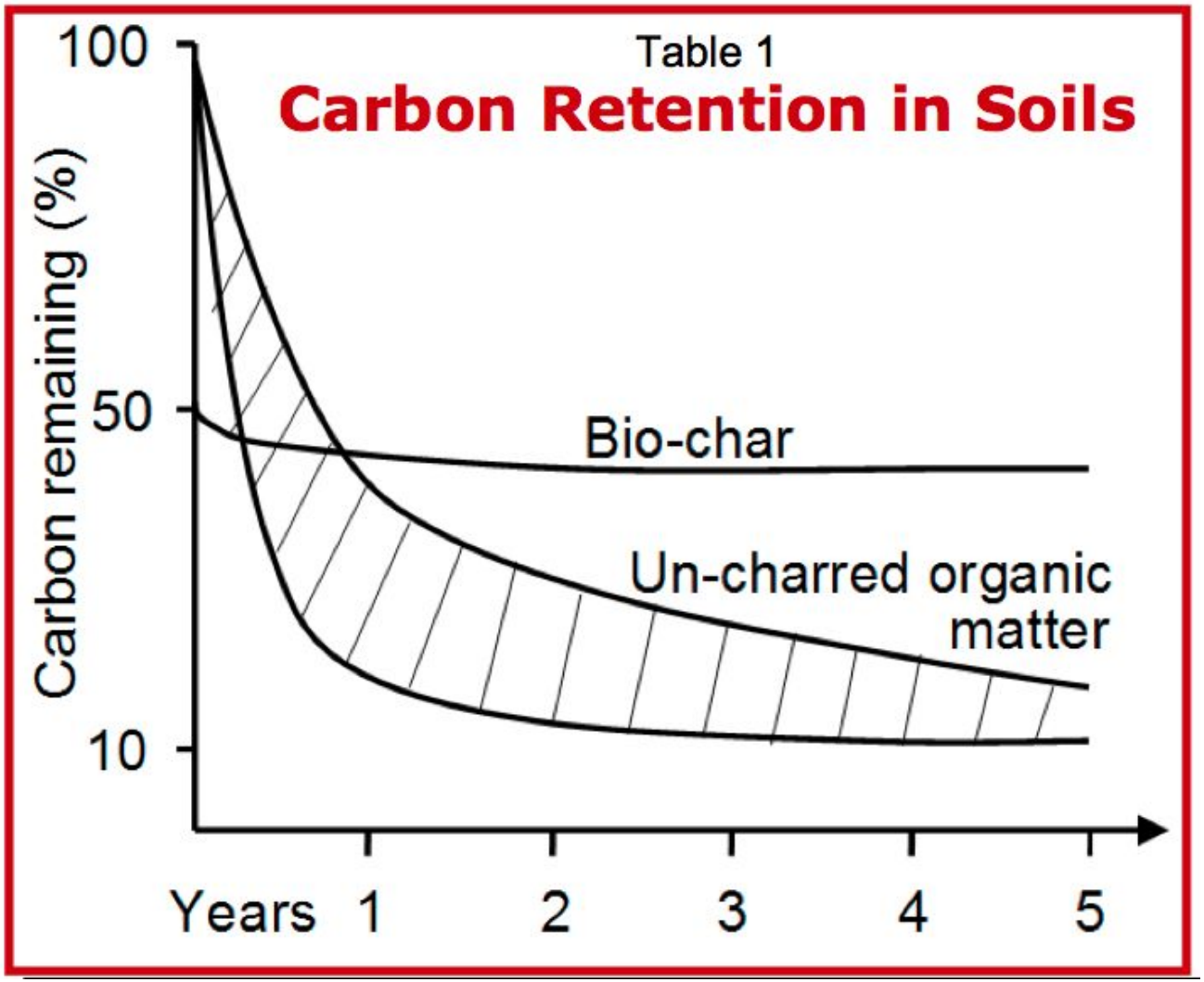
Pro-C Fertilizer Efficiency

Proton Power INC.

Pro-C Density

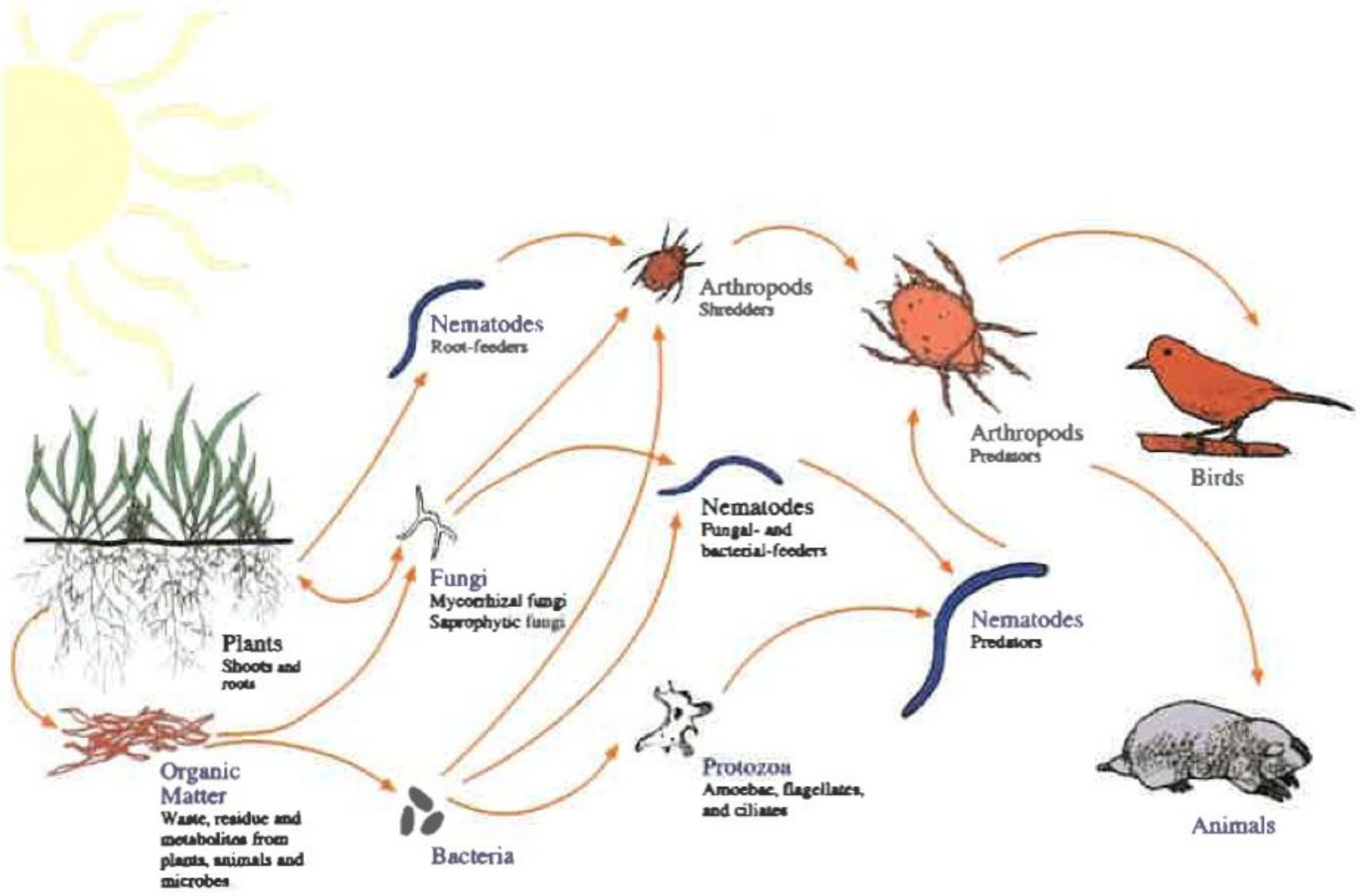
Proton Power INC.

Pro-C Carbon Content



Proton Power INC.

Pro-C Microbial Life



A soil food web, USDA-NRCS.

Proton Power INC.

Second Growth Year

	Cottonwood Average Height (ft)					
	w/o Pro-C		10 t/ac		40 t/ac	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Mean	2.2	11.4	5.3	13.8	6.4	15.0

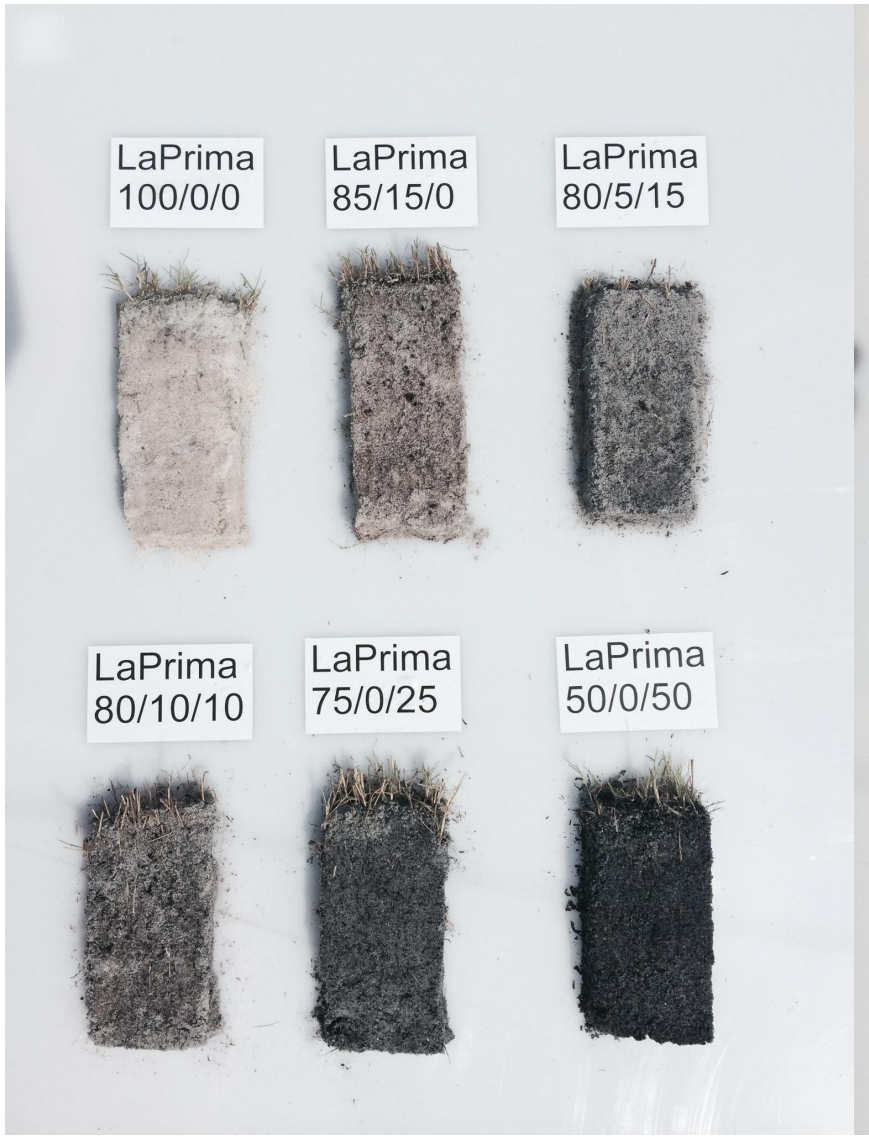
	Cottonwood Average Base Diameter (in)					
	w/o Pro-C		10 t/ac		40 t/ac	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Mean	0.57	1.26	0.80	1.89	0.99	2.12

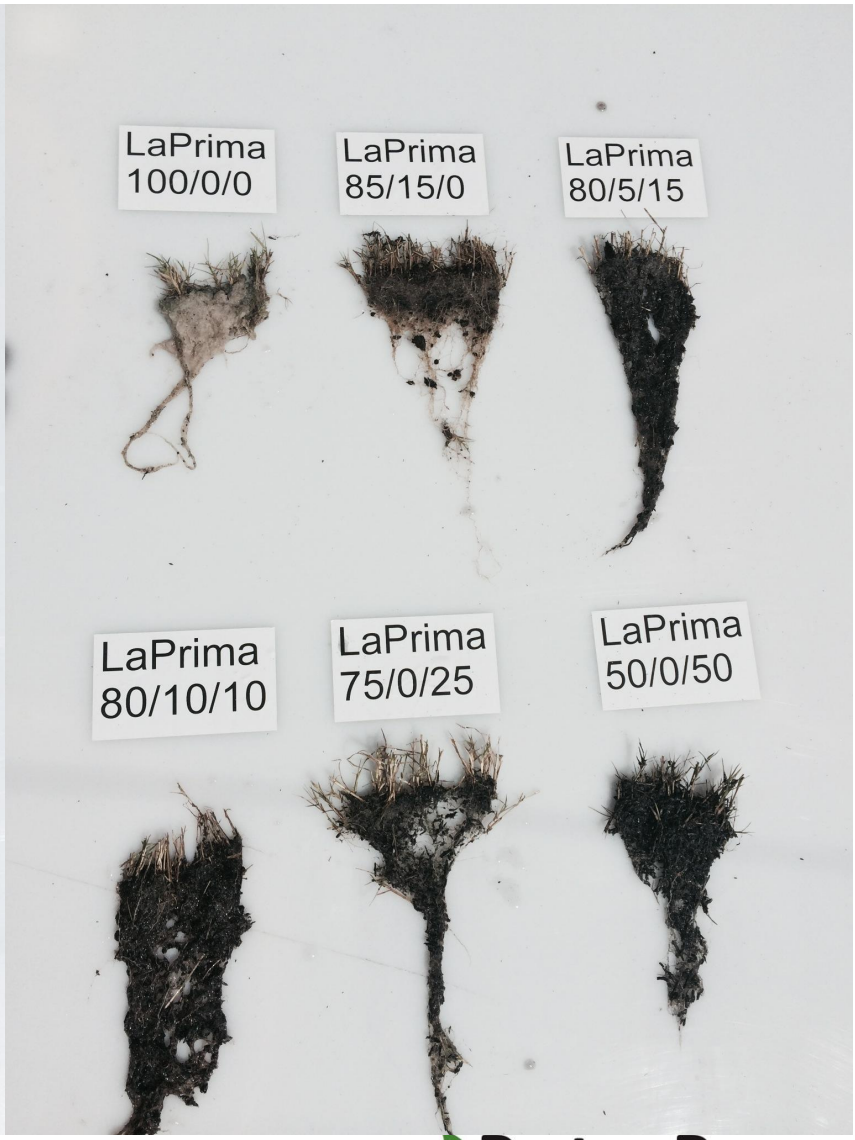
Our Biochar – Pro-C Microbial Life

Proton Power Cottonwood Poplar Tree Planting - Soil Analysis

pro C	Density	Total Bacteria	Total Fungi	Total Fungi/Total Bacteria	Nematodes	Flagellates	Amoebae	Ciliates	Nitrogen Cycling Potential
Plot	g/cc	µg/g	µg/g	ratio	#/g	#/g	#/g	#/g	(lbs/ac)
Control	0.82	1753	829	0.47	4.78	701	16906	56	75-100
10 t/ac	0.78	1551	651	0.42	2.32	2744	35456	362	100-150
40 t/ac	0.72	442	770	1.74	9.49	3851	38503	38	100-150

Pro-C Turf Grass





Proton Power INC.

In Summary

- Our biochar is different because of our unique PPI process
- Surface Area Improvements
  - Reduced Density
  - Increased Water Holding Capacity
  - Foster Microbial Activity
  - Increased CEC
- pH around 11 but not a liming agent
- Biochar is Stable in the Soil