



Indicators of Soil health And Field Applications

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#soilhealth



Top Why Environmentalists Claim Sufficing Earth Planet

1. Population
Food Security

2. Climate Change

3. Loss Of
Biodiversity

4. The Nitrogen
Cycle

7. Pollution of air, water and Soil





The world's agricultural soils have already lost
90 billion tons of carbon



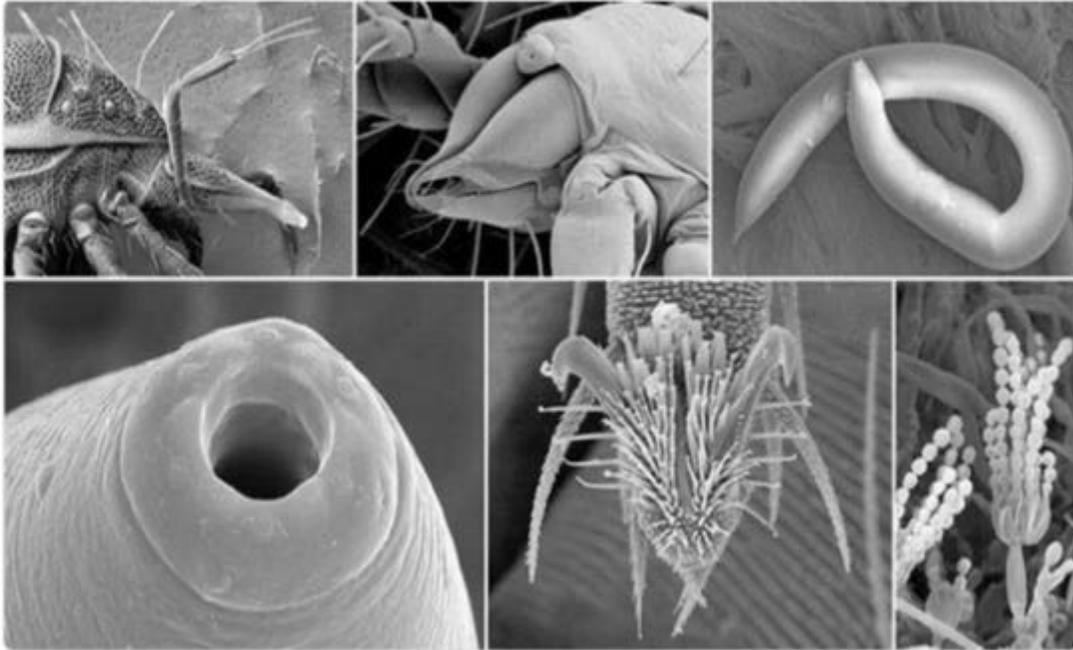
Soil is an Irreplaceable Resource

They Both Contain HE Capacity To Function As A Living System



USDA NRCS @USDA_NRCS · 2h

90% of soil function is attributable to soil microbes. [ow.ly/10aQMe](https://www.ow.ly/10aQMe)



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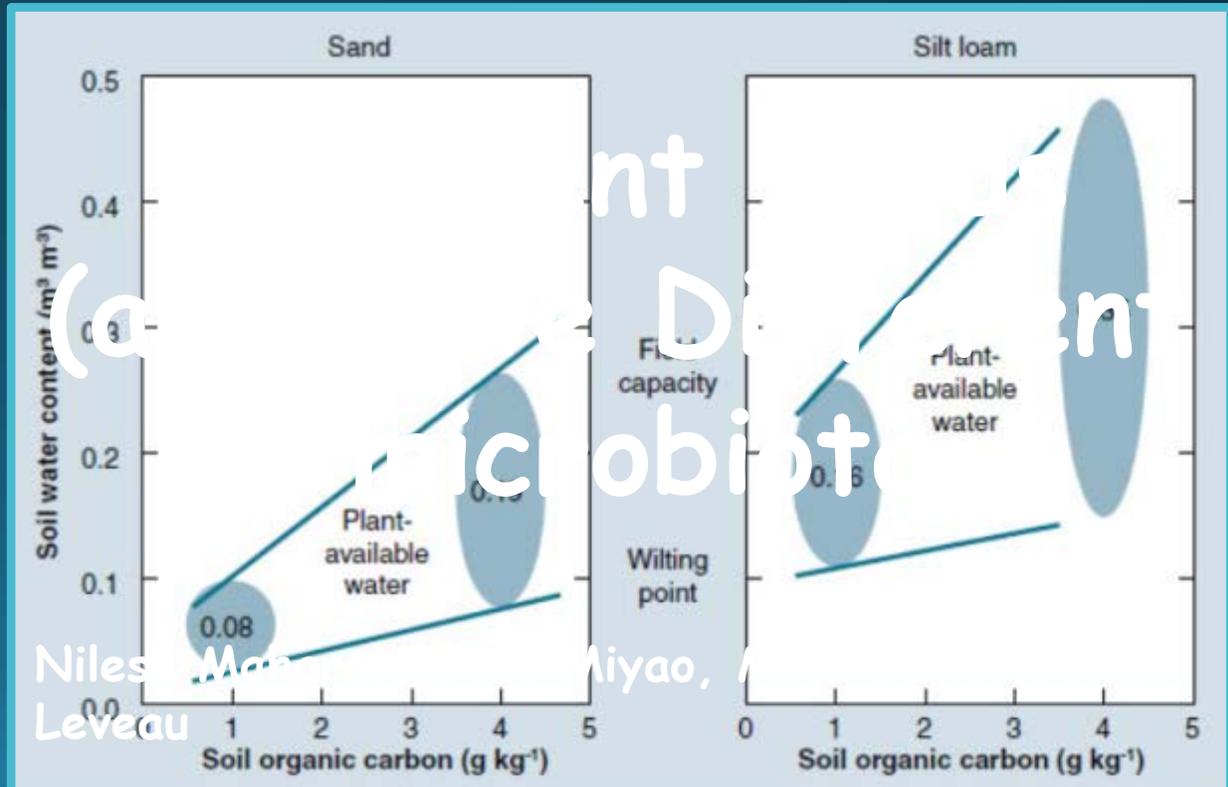
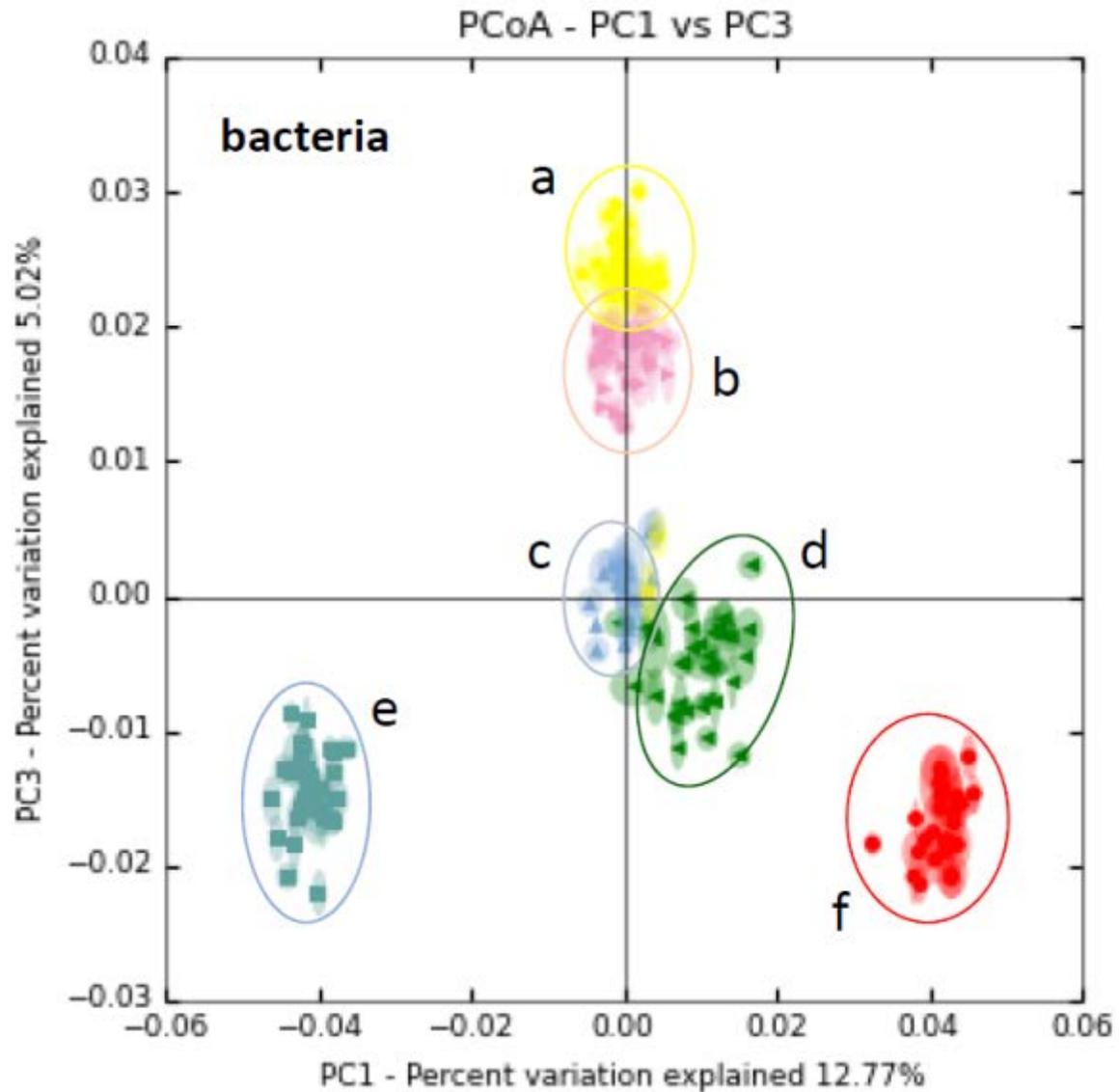


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The factory of life
Why soil biodiversity is so important

Definition



Niles, Man
Leveau

Niyao, A

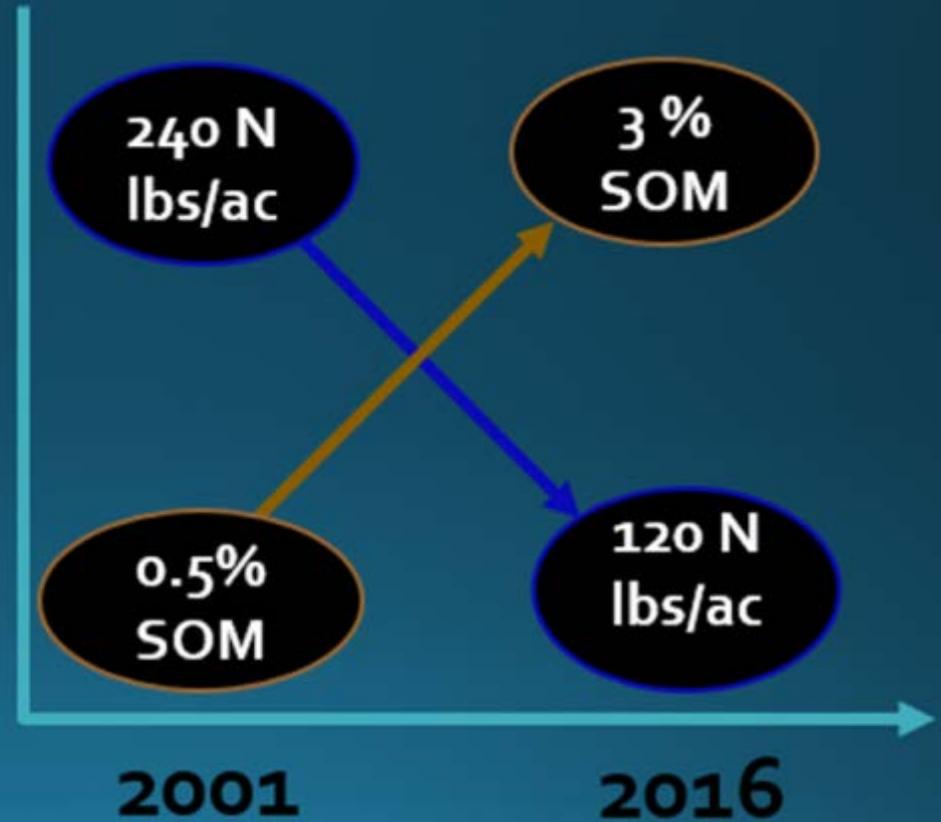
Definition for the Producer

Sano Farm in Fresno, CA



1/3 Reduction in Water Use

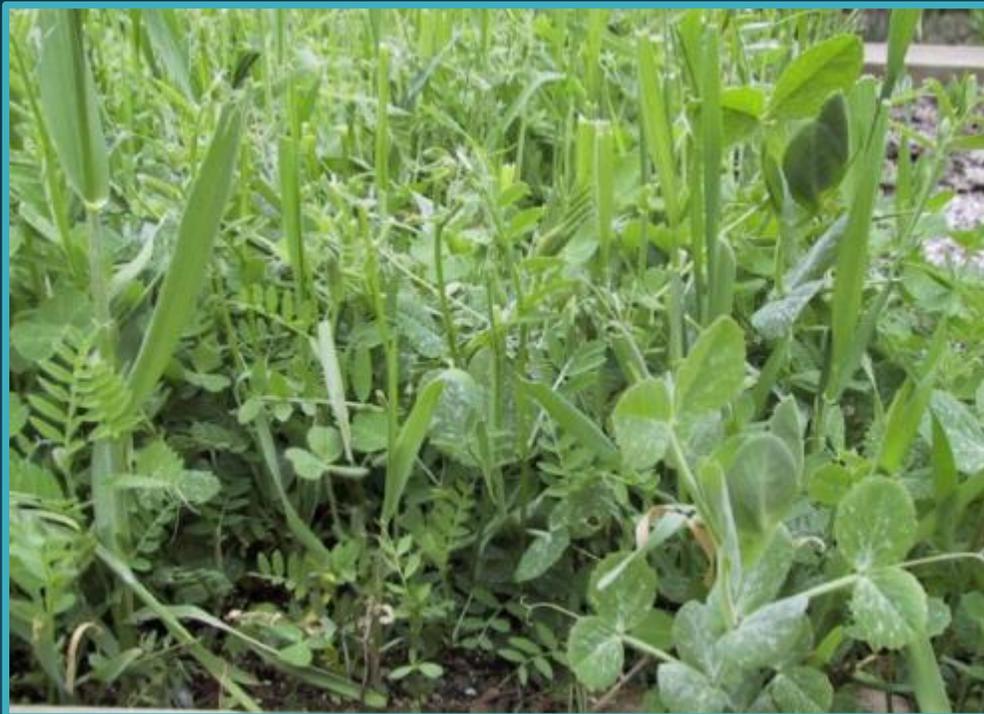
SOM and Nitrogen application



Four Principles to Improve Soil Health

1. Maximize Diversity

- Grass
- Broadleaf
- Legume



Four Principles to Improve Soil Health

2. Keep Living Roots in the Soil

- Root exudates feed and stimulate soil biology



Four Principles to Improve Soil Health

3. Keep the Soil Covered at all Times

- Residues
- Mulches (compost)
- Live Plants



Four Principles to Improve Soil Health

4. Minimize Soil Disturbance

- Breaks down soil structure
- Eliminates living roots
- Exposes the soil surface
- Increases soil respiration rates
- Shifts soil biology to bacterial dominated



Example in Turlock CA Walnut Orchard

1. Leave crop residue, roots & cover crops in place
2. Apply manure/compost amendments (grazing)
3. Living Roots critical to build slow & stable soil OM pool
4. Reduce Disturbance



Building Aggregates - Glue-makers

- Bacteria - Micro-aggregation
- Fungi - Macro-aggregation
- Aggregates are habitat



January 8, 2017



Raindrops seal soil surface - runoff

Adjacent Field - Same Day



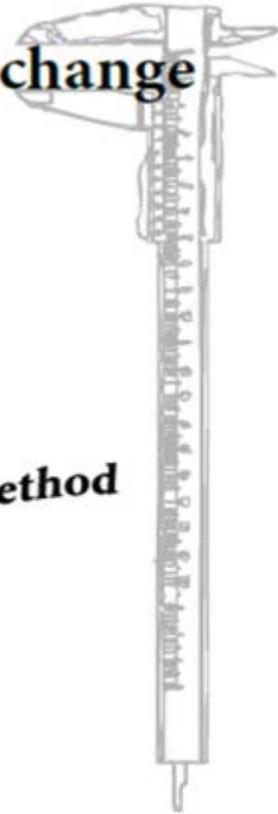
Protected from raindrops - Roots for infiltration



A Major Conundrum in Soil Science is how to Measure Soil Health



Measuring soil carbon change



A flexible, practical, local method

Peter Donovan

version: October 2013

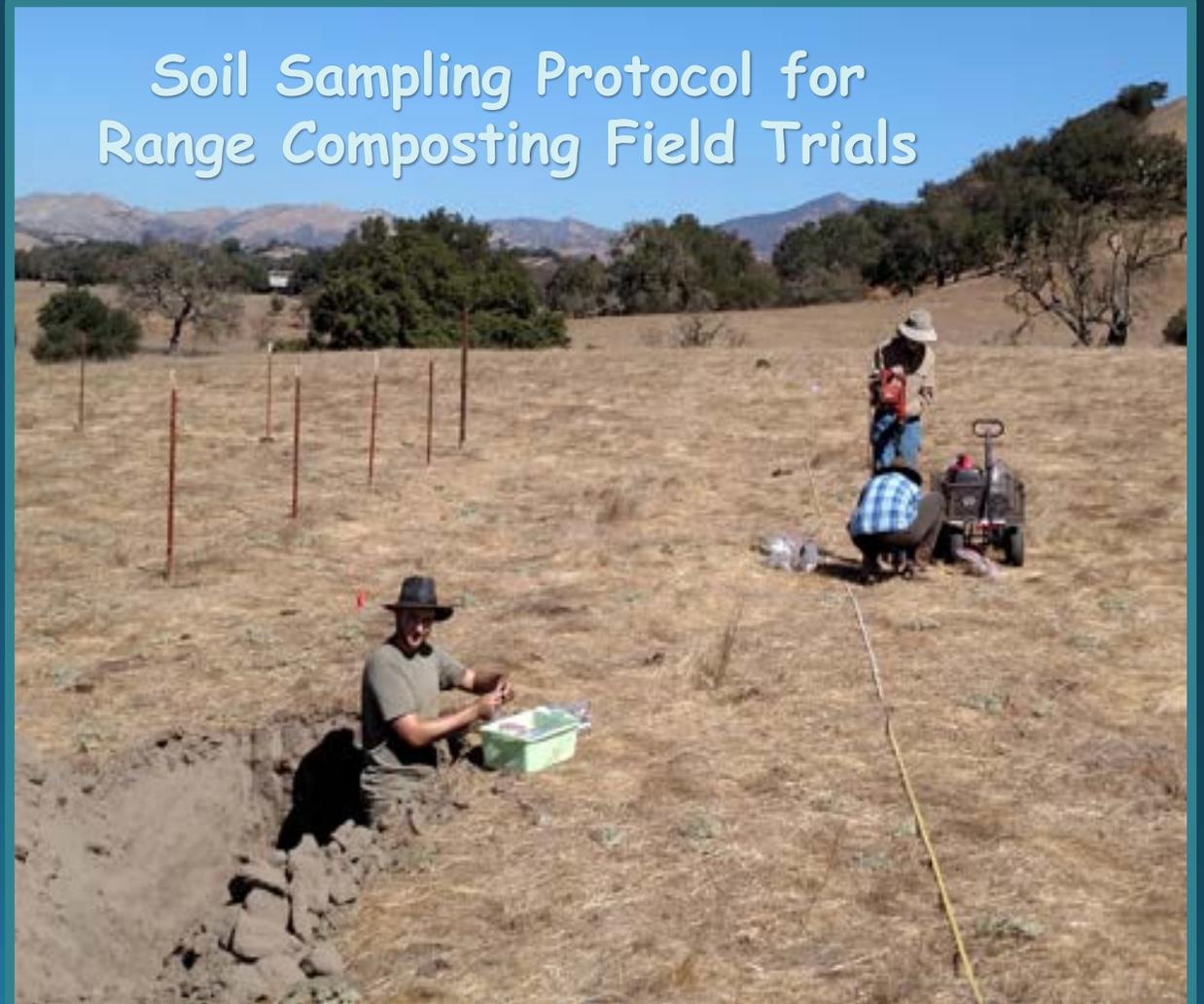


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Peter Donovan

“How you measure something depends on your purpose”

Soil Sampling Protocol for Range Composting Field Trials



Soil Health Assessments and Field Indicators

Kula Upcountry Maui



Conventional Tilled Cropland



Reduced Tilled Organic Farm

Case Study

Joe Green

Pear Ranch

Courtland CA



On - Site Gathering Information on Current Operations, Issues and Goals



Comprehensive Assessment of Soil Health

From the Cornell Soil Health Laboratory, Department of Soil and Crop Sciences, School of Integrative Plant Science, Cornell University, Ithaca, NY 14853. <http://soilhealth.cals.cornell.edu>



Sample ID: PP499
Field ID: O-Bosc Pear middle
Crops Grown: pear/pear/pear



Measured Soil Textural Class: **silty clay**

Sand: **1%** - Silt: **48%** - Clay: **50%**

Group	Indicator	Value	Rating	Constraints
physical	Available Water Capacity	0.31	99	
physical	Surface Hardness			Not rated: No Field Penetrometer Readings Submitted
physical	Subsurface Hardness			Not rated: No Field Penetrometer Readings Submitted
physical	Aggregate Stability	20.5	22	
biological	Organic Matter	5.6	96	
biological	ACE Soil Protein Index	2.7	14	Organic Matter Quality, Organic N Storage, N Mineralization
biological	Soil Respiration	0.3	15	Soil Microbial Abundance and Activity
biological	Active Carbon	815	88	
chemical	Soil pH	7.2	96	
chemical	Extractable Phosphorus	8.7	100	
chemical	Extractable Potassium	238.1	100	
chemical	Minor Elements		100	
		Mg: 1453.0 / Fe: 2.2 / Mn: 5.5 / Zn: 0.4		

Joe Green Pear Farm Cover Crop samples analysis, April 14, 2017, Rex

lbs/4 sq. Ft.	#lb: wet biomass/acre	2/3 74 (unit cover crop (estimated actual ground covered by cover crop)	es m of
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			4750	142
			2572	77
Average location 3	39821	26680	4002	120

Please note that only about half to two-thirds of the N listed here will be available to the crop this growing season

Recent Follow-up to the Management System

Cover Crop in May 2017



Pruning



Tall Stature Annual Cover Crop



Flail mower

Rethinking Soil Health Management System

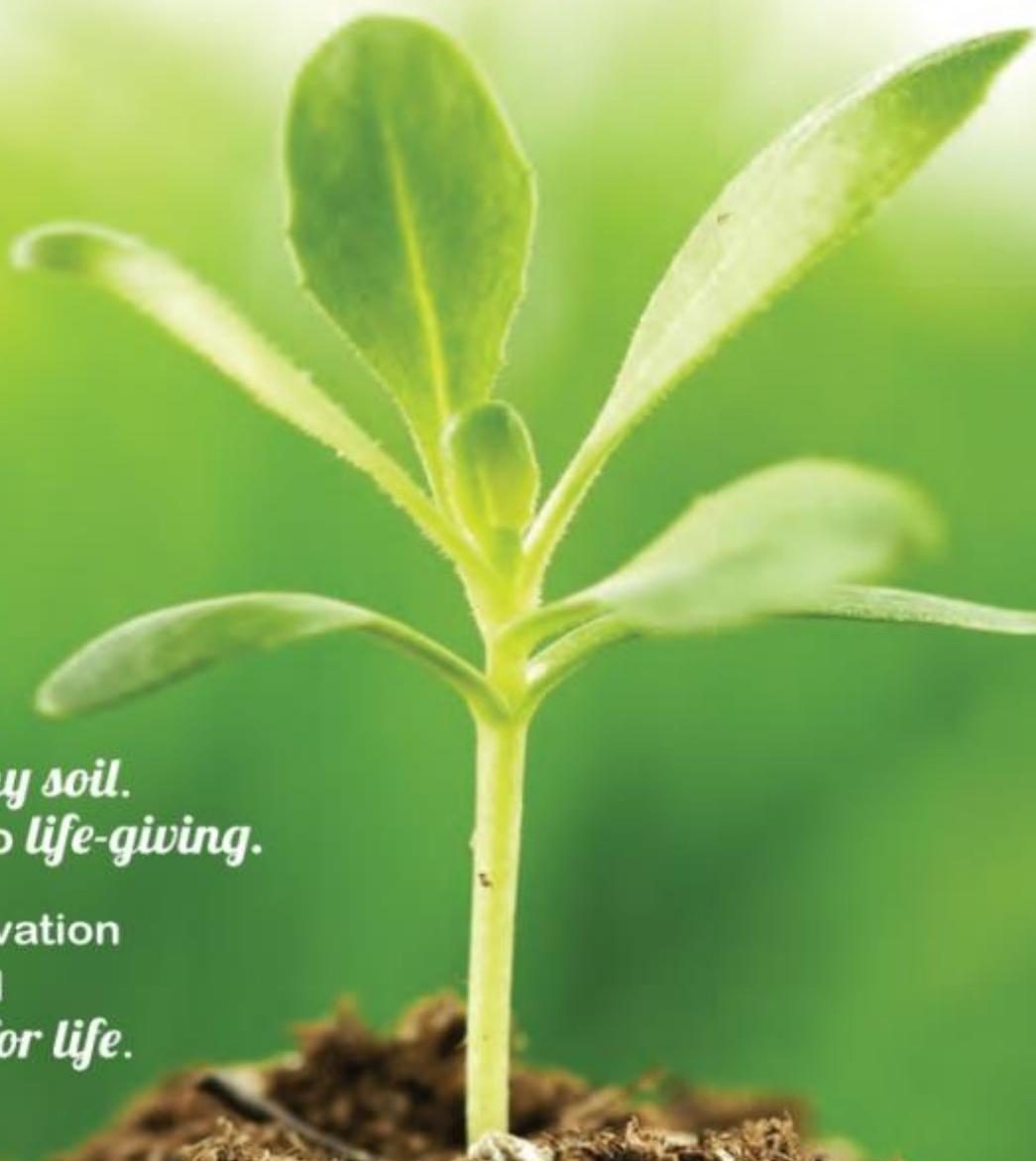




Long LIVE the SOIL

There's an amazing amount of life in *healthy soil*.
More importantly, that *living resource* is also *life-giving*.

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Service is working with America's farmers and
ranchers to keep it *healthy* and *functioning—for life*.



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