



Promoting Sustainable Living, Working & Building in Chattanooga

# Thank you to our Founding Members!



franklin | architects

# Current Members

- ▶ AIA
- ▶ Antidote
- ▶ AS Filtration
- ▶ Associated General Contractors
- ▶ Berry & Hunt
- ▶ Bloom Architecture
- ▶ BMC Office Technology
- ▶ Chambers Welding & Fabrication
- ▶ Chattanooga Exteriors
- ▶ Chattanooga Gas
- ▶ Chattanooga Neighborhood Enterprise
- ▶ Chattanooga State College
- ▶ City of Chattanooga Water Quality
- ▶ City of Chattanooga Office of Sustainability
- ▶ Compost House
- ▶ Compass Commissioning & Design
- ▶ DH&W Architects
- ▶ Elemi Architect

# Current Members

- ▶ EMJ
- ▶ EPB\* Annual Sponsor
- ▶ Geothermal Chattanooga
- ▶ Grace Frank Group
- ▶ Green's Design & Supply
- ▶ Habitat for Humanity
- ▶ Hamilton County Water Quality Program
- ▶ Hefferlin + Kronenberg
- ▶ Hiwassee Builder Supply
- ▶ Home Choice Windows & Doors
- ▶ Inline Electric
- ▶ Jacob's Paper
- ▶ Lines & Hammer
- ▶ Management Cleaning Service
- ▶ Miller & Martin
- ▶ Mitsubishi
- ▶ Modus Build
- ▶ New Blue Construction
- ▶ Office Furniture Warehouse
- ▶ Pratt Home Builders
- ▶ Real Estate Partners



# Current Members

- ▶ Reliable Building Solutions
- ▶ RENEW
- ▶ River City Company
- ▶ River Valley Blinds & Shades
- ▶ Rock City
- ▶ Rockridge Venture Law
- ▶ Ruby Falls
- ▶ Scout Realtor Group
- ▶ Southern Adventist University
- ▶ Synovus Bank
- ▶ Tennessee Aquarium
- ▶ Tennessee Valley Authority \*Annual Sponsor
- ▶ Tinker MA
- ▶ TRANE
- ▶ TuckerBuild
- ▶ Urban Story Ventures
- ▶ USGBC TN Chapter
- ▶ UTC Office of Sustainability
- ▶ VIEW Windows
- ▶ Wild Ones
- ▶ W.M. Whitaker & Associates
- ▶ Workshop Architecture

# Become a Member!

- ▶ Individual memberships start at \$10/month or \$49/month as a sustaining member!
- ▶ Corporate Memberships start at \$500 Annually!



# Empower

## CHATTANOOGA

We're Continuing Classes!

Tuesdays @ 3pm  
Thursdays @ 6pm

Check our Facebook Page for  
Details!

# Build It Green



**Congrats to Our Recent Graduates!**  
**- Graduation Date TBD -**

# VOLUNTEER



- ▶ Programs Committee
  - ▶ Events Committee
- ▶ Green Prix Parts Manager
  - ▶ Office Support
- ▶ Database Management

# Become a Luncheon Sponsor!

- ▶ For Just \$100, sponsors receive:
  - ▶ 5 Minutes to talk about business or product before the lunch & learn
  - ▶ Ability to place information on tables
  - ▶ Highlighted in our social media and e-newsletter





# Chattanooga Green Prix



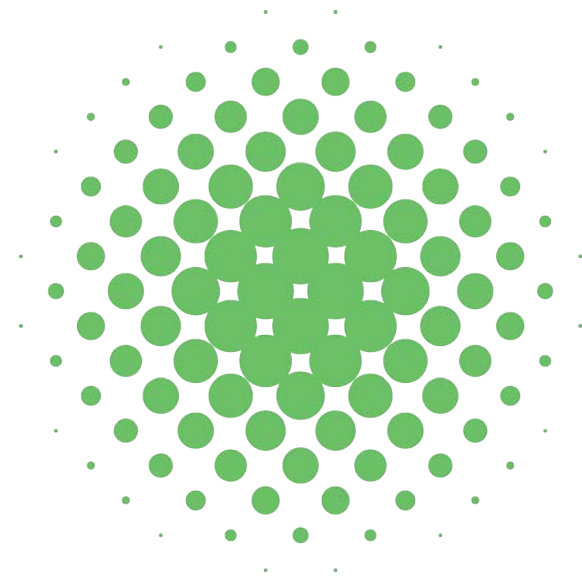
Congrats to Tennessee Valley Robotics  
Team #4 - National Champions!!!

We will all be ready to have some fun soon...

New Date TBD!







green|leader

Preview green | leader for Free!  
Week 1 Available for Online!

# Earth Day Challenge

5 for 50 Challenge! What are you doing?

What are your top 5 personal commitments or goals for the 50th Anniversary of Earth Day? Post an image, create a story or record a video with your thoughts!

Record your "5 for 50" and tag @greenspacescha and @greens.design for a chance to WIN on facebook or instagram tomorrow!

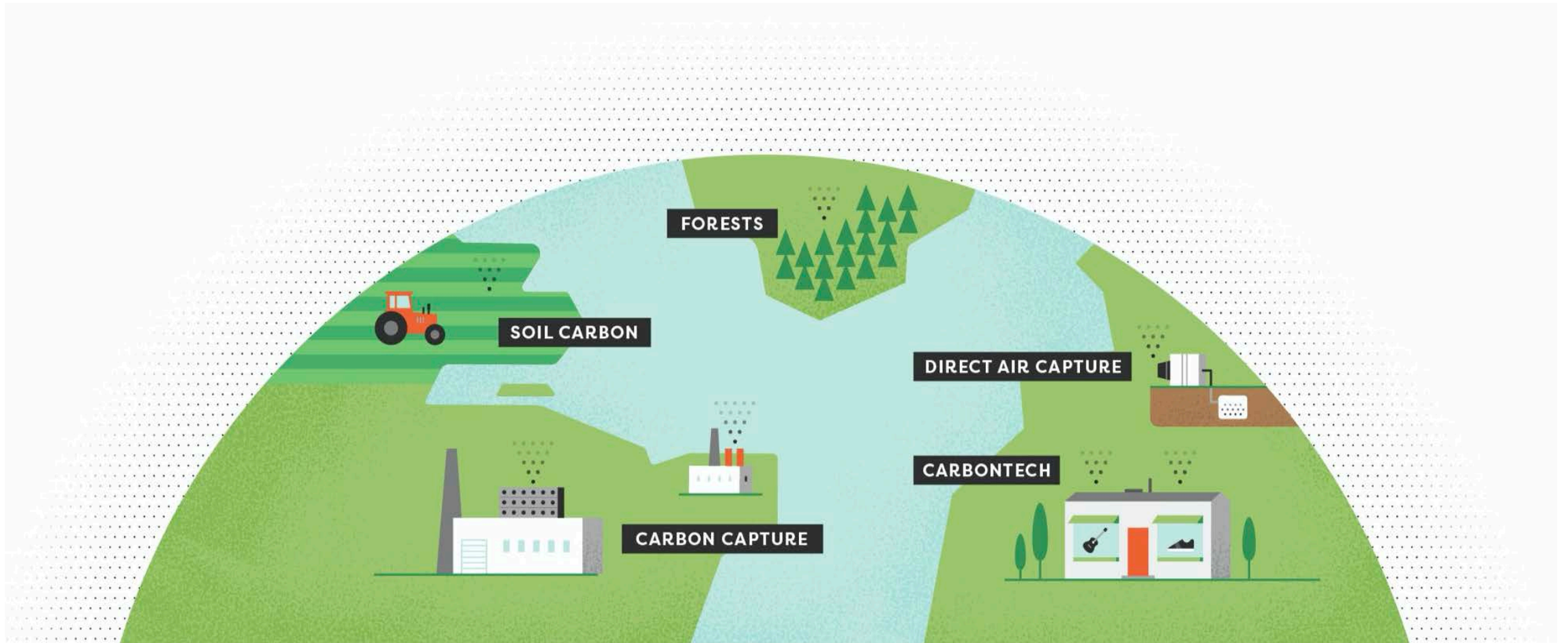
Winner will receive a Green's Design & Supply organic cotton t-shirt, a 2 gpm shower head, a must-have pizza cutter and a FREE green | spaces personal membership!



# Ongeleigh Underwood - What is Carbon Sequestration

[ongeleigh@gmail.com](mailto:ongeleigh@gmail.com)

# Carbon Sequestration





# Biological Carbon Sequestration

CO<sub>2</sub>

CO<sub>2</sub>

CO<sub>2</sub>

CO<sub>2</sub>

CO<sub>2</sub>

Mineralization and humification of carbon components by micro-organisms

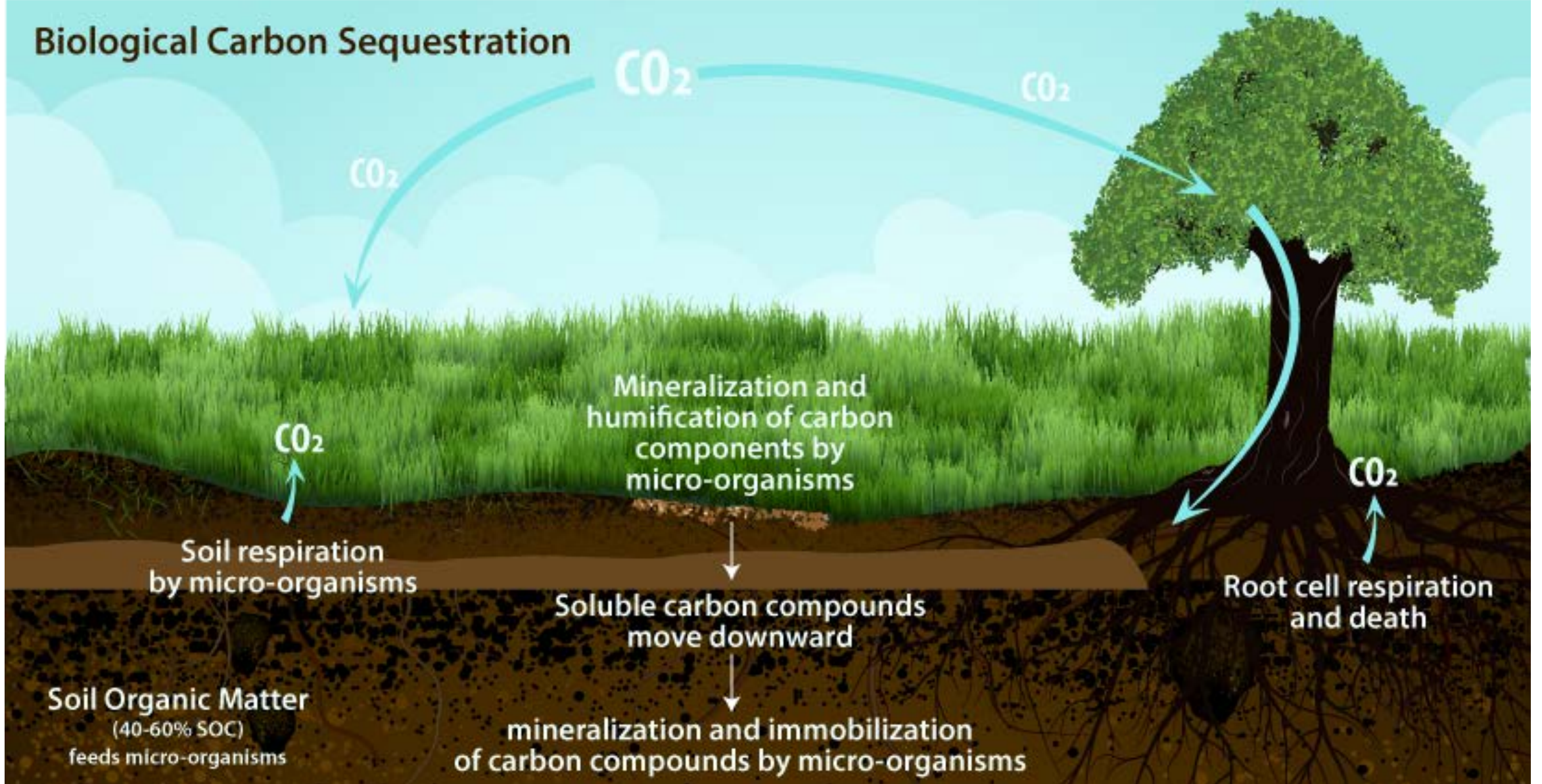
Soil respiration by micro-organisms

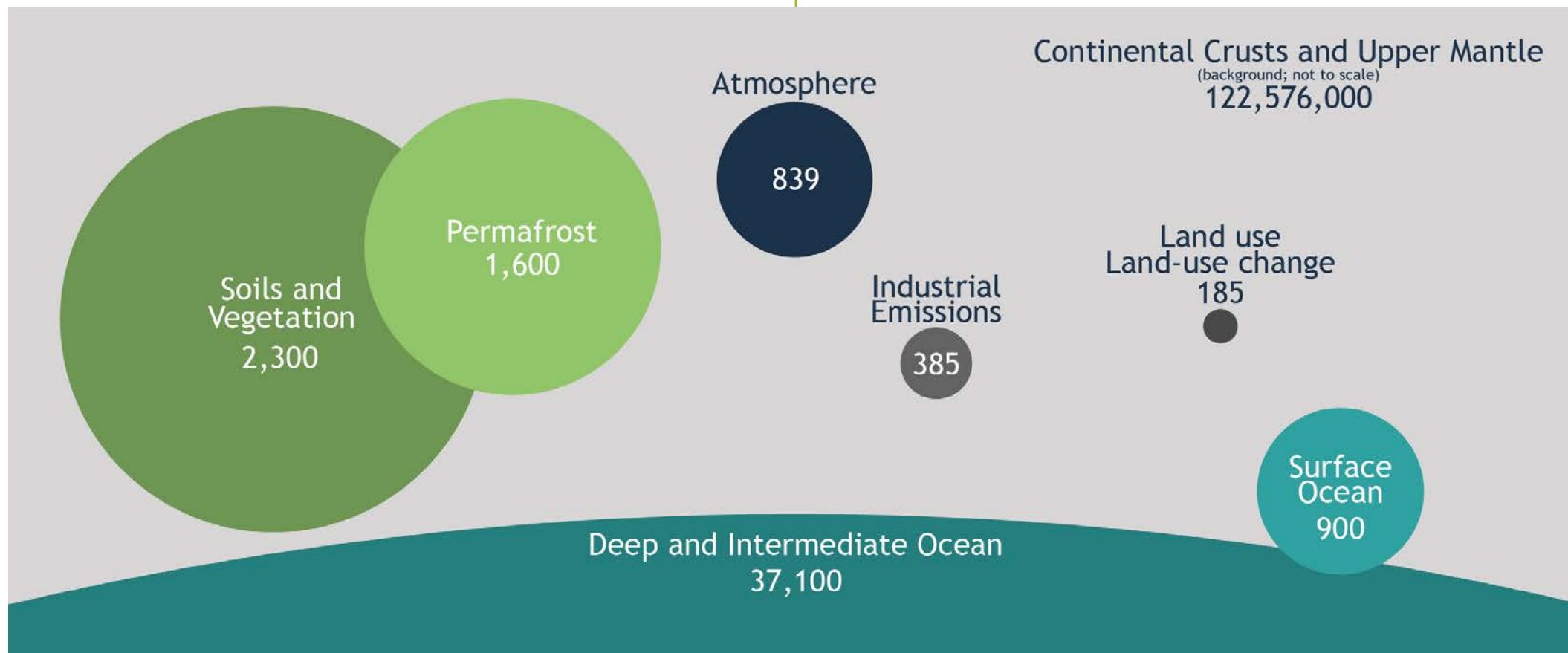
Root cell respiration and death

Soluble carbon compounds move downward

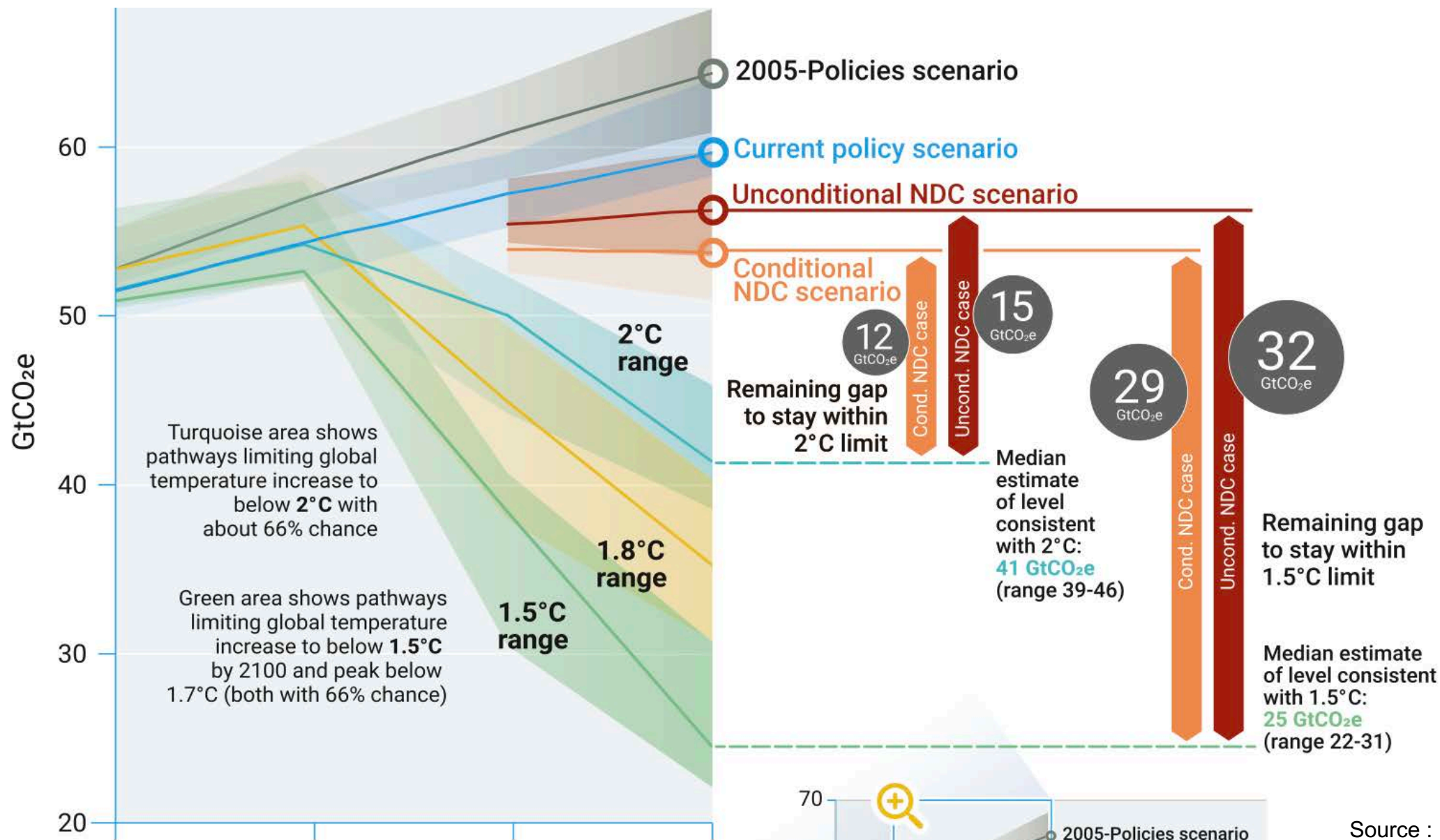
Soil Organic Matter  
(40-60% SOC)  
feeds micro-organisms

mineralization and immobilization of carbon compounds by micro-organisms









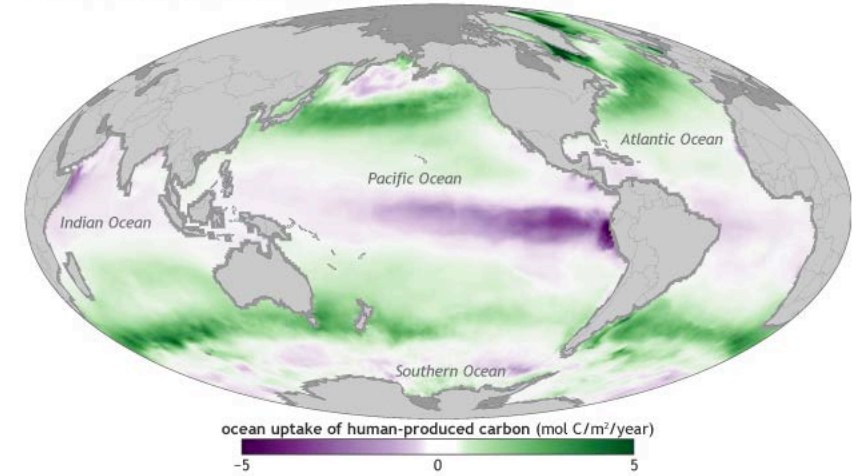
Source : UN

## Geologic CO2 Sequestration potential - USGS

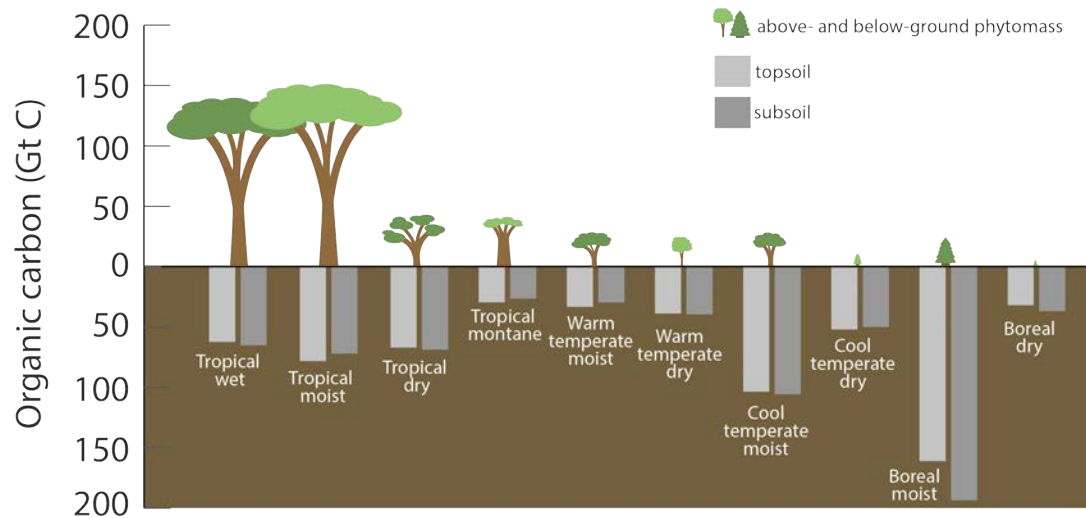


## Ocean Uptake of CO2 - NOAA

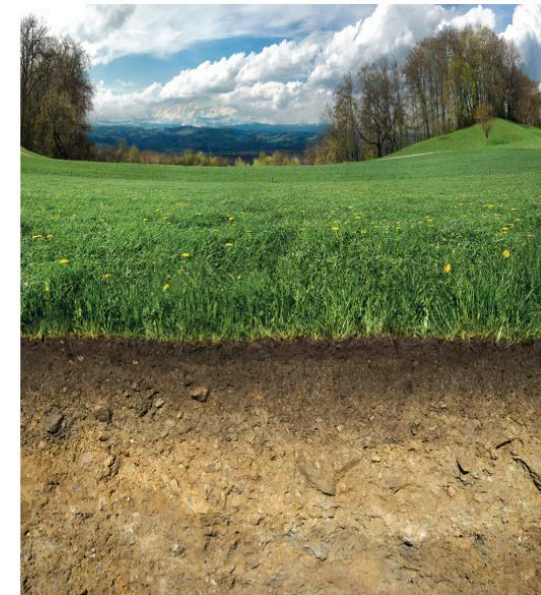
CARBON UPTAKE 36% ABOVE AVERAGE IN 2017



## Above vs Below Ground Forest Sequestration

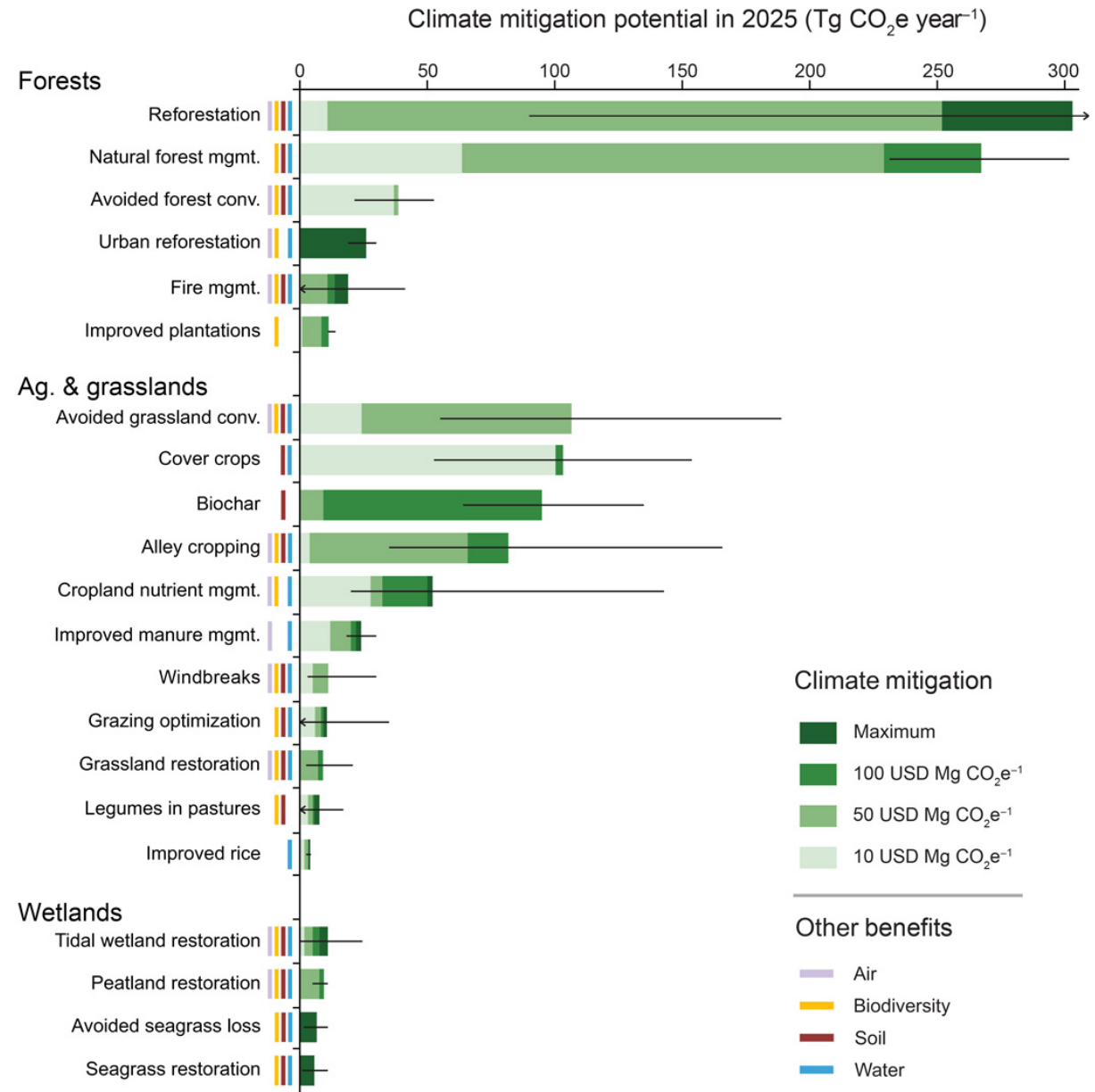
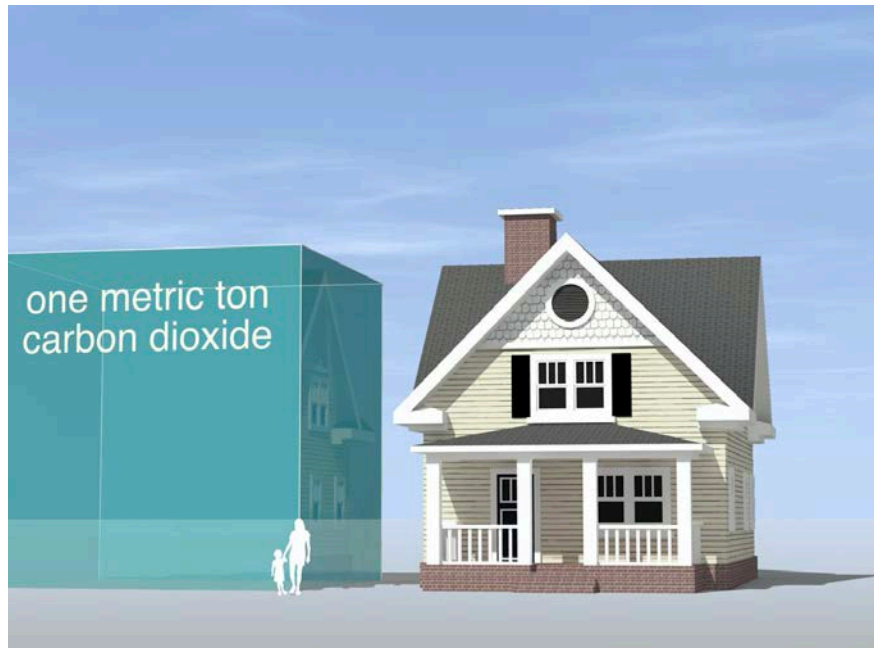


Reduced or No-Till  
Cover Cropping  
Crop Rotation  
Intercropping  
Grassland Restoration  
SilvioPasture  
Agroforestry  
Biochar

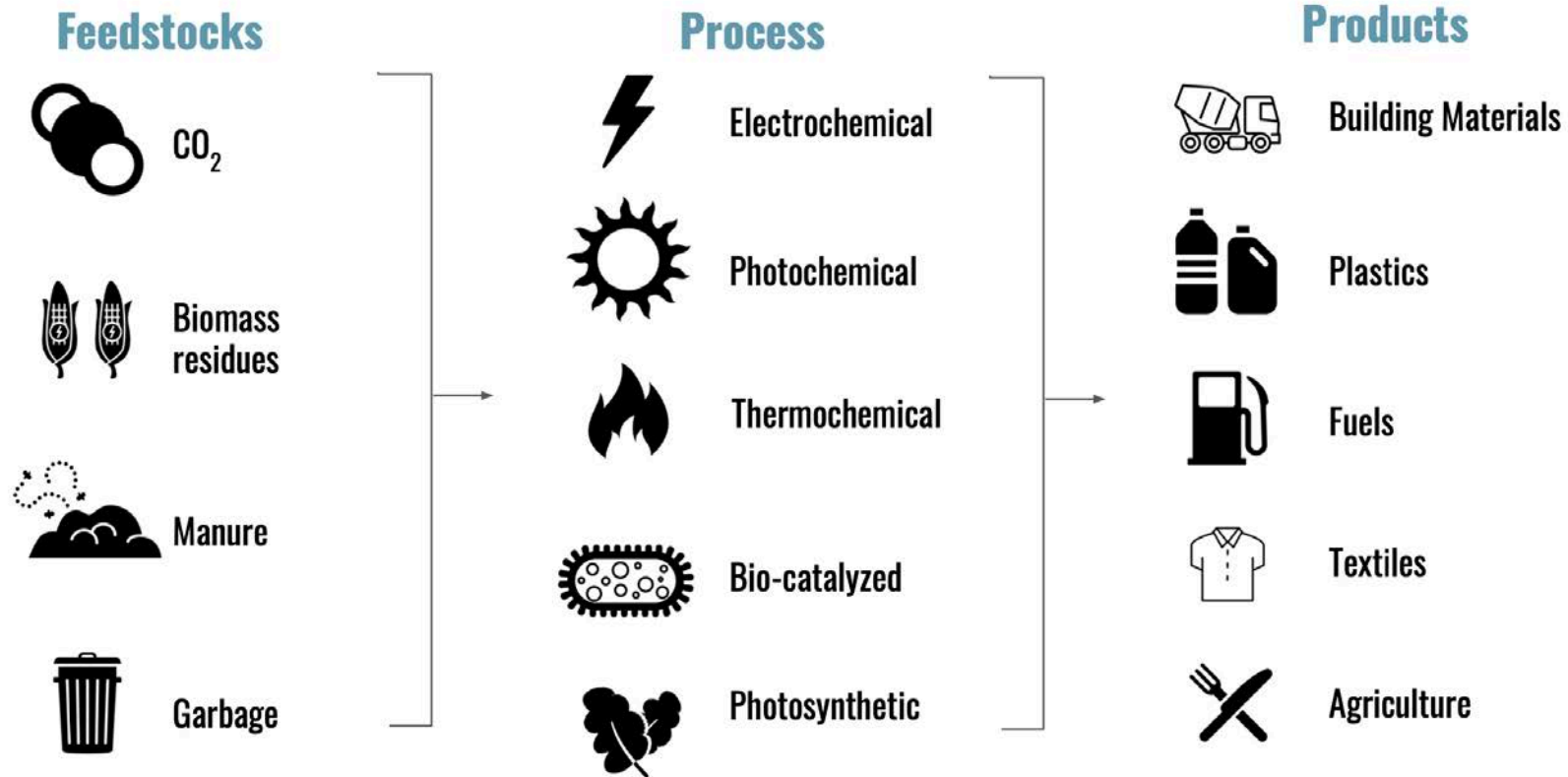




- ▶ ~60 tonnes CO<sub>2</sub>e/Acre of Forest in SE US
- ▶ Reforestation Potential = 30% of Emissions



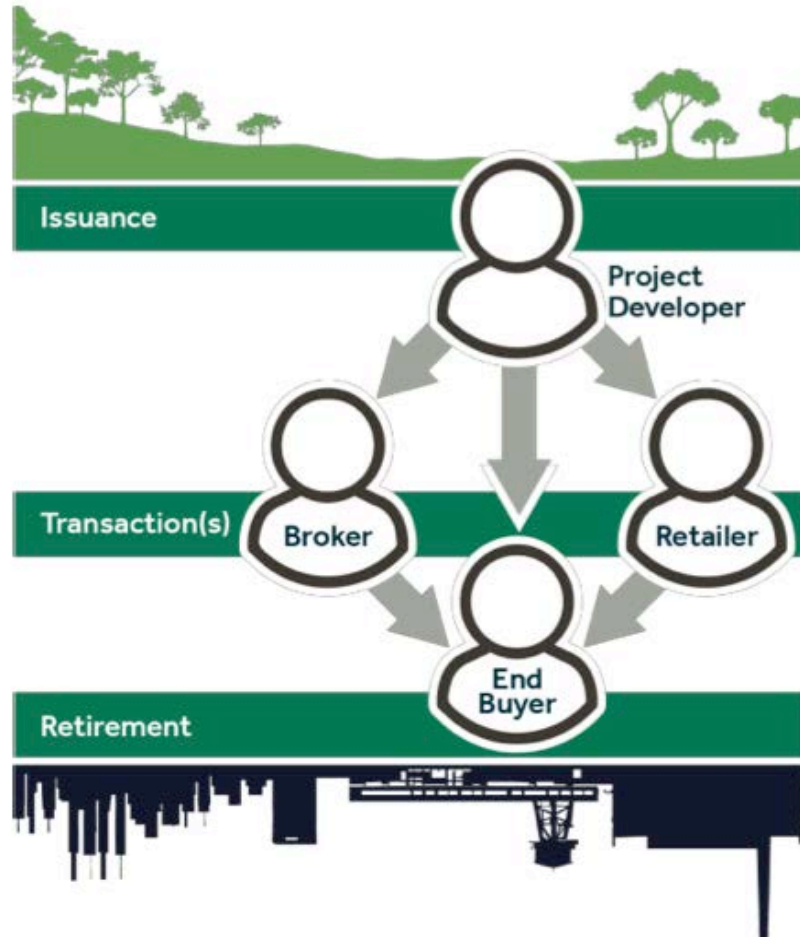
# Mechanisms for Action - Carbon Capture and Utilization



Source: Carbon 180

# Mechanisms for Action - Carbon Markets

Figure 1. Example Life Cycle of a Carbon Offset



CLIMATE ACTION RESERVE

Gold Standard





Questions?

Ongeleigh Underwood- [ongeleigh@gmail.com](mailto:ongeleigh@gmail.com)



Ted Redmond - Pale Blue Dot,  
Update on Chattanooga Green House Gas  
Inventory

The City of Chattanooga

# Greenhouse Gas

# Inventory

**Draft**



# Agenda

01 Introduction

02 Draft Communitywide Emissions

03 Comparison to Other Communities

04 Q + A



# 01 Introduction

paleBLUEdot LLC

## Our mission:

To hasten the transition to an authentically sustainable, no carbon economy and to elevate the public discourse.



**Ted Redmond**

Architect  
Climate Planner  
Renewable Energy  
Consultant

### paleBLUEdot Certifications/Affiliations



# 01 Introduction

paleBLUEdot<sup>LLC</sup>

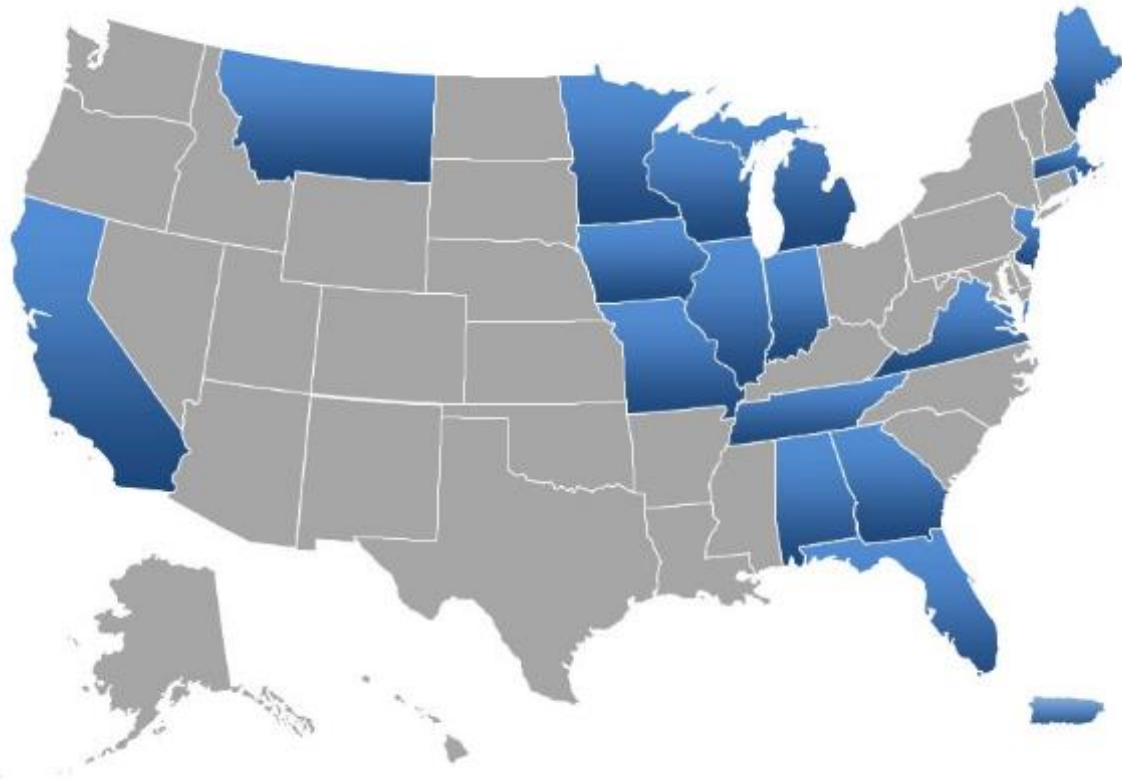
Services:

climate

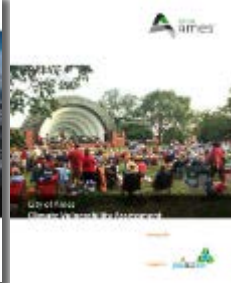
sustainability +  
resilience

renewable energy + net  
zero

# paleBLUEdot Experience



Climate, Sustainability, and  
Energy Planning experience in last  
5 years:  
**40+ Projects in 19  
states**



# 01 Introduction

## What is a Community Greenhouse Gas Inventory?

A community Greenhouse Gas (GHG) Inventory follows a standard protocol to quantify a city's greenhouse gas (GHG) emissions, including CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O. GHG inventories fluctuate year-to-year as we change our energy consumption, get access to better data, or gain new knowledge about how GHGs impact the atmosphere.

## What Are GHG's?

Greenhouse Gases (GHG) absorb radiation and trap heat in the Earth's atmosphere. They are the basis of the Greenhouse Effect. The more GHGs there are, the more heat that is trapped in our atmosphere, leading to Global Warming and Climate Change. GHGs measured in this inventory include carbon dioxide, methane, and nitrous oxide.

## Why Measure GHG?

As described by David Osborne and Ted Gaebler "If you don't measure results, you can't tell success from failure. If you can't see success, you can't reward it. If you can't see failure, you can't correct it." GHG inventories are useful. Planners need them, elected officials want them, and the future may see their development as a basic requirement of state and federal funding.

## What is CO<sub>2</sub>e?

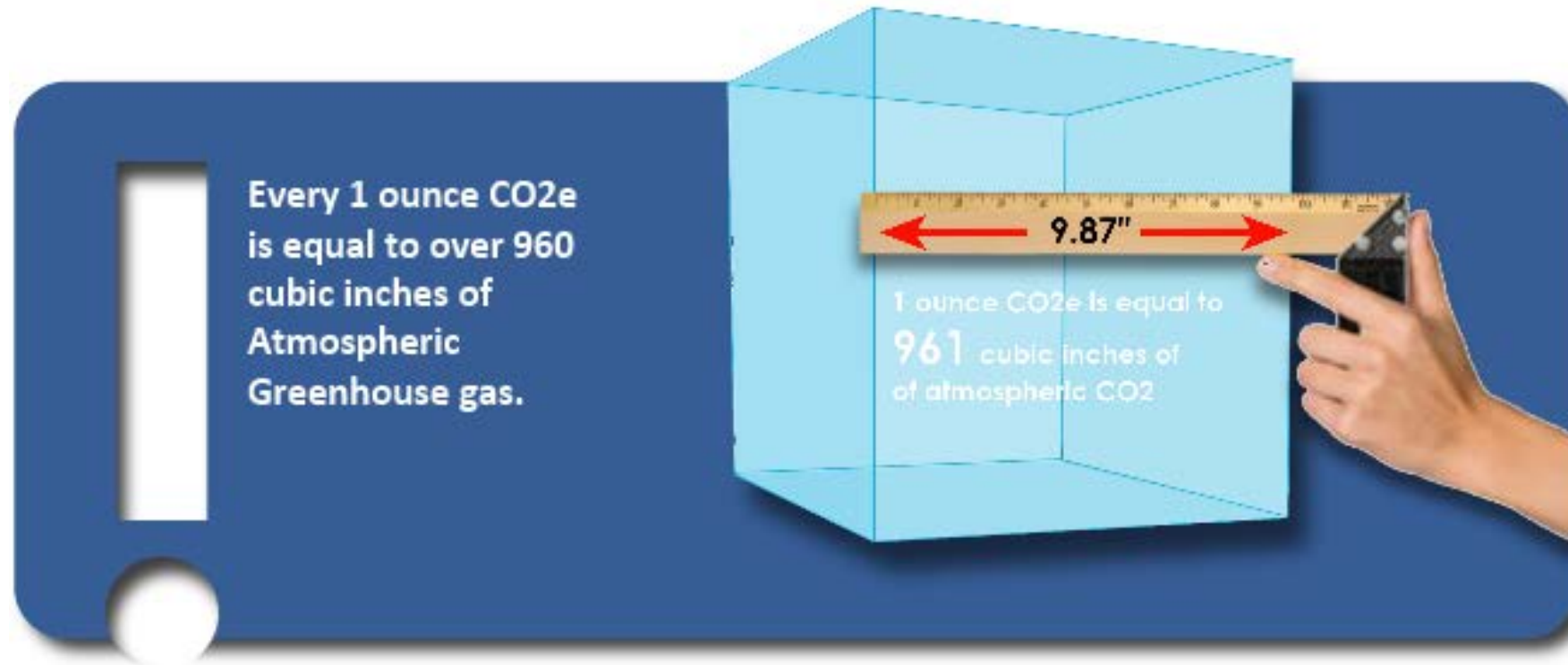
Carbon Dioxide (CO<sub>2</sub>) is a GHG emitted naturally and from fossil fuel combustion for energy and heat. Global warming contributions from other greenhouse gases are referred to in terms of "carbon dioxide equivalent" or CO<sub>2</sub>e, which represents the amount of CO<sub>2</sub> that would have the same global warming potential as other GHGs. Community GHG inventories are tracked in terms of metric tons of CO<sub>2</sub>e.

**GHG Inventories are estimates and have a degree of (reasonable) uncertainty but are still effective for planning action.**



# 01 Introduction

Greenhouse Gas Emissions are measured and reported in weight (metric tonnes)...but what we are really talking about is a volume of human-made, heat trapping atmosphere.



# Greenhouse Gas Sectors

Where do GHGs come from?



## Energy

Emissions are produced from the combustion of natural gas, coal, and other fossil fuels primarily for heating, cooling, and electricity generation.



## Transportation

Emissions come from the combustion of fossil fuels for ground transportation and air travel.



## Solid Waste

Emissions in the inventory estimate the decomposition of biodegradable waste (e.g., food and yard waste) in the landfill.



## Wastewater

Emissions from energy uses are calculated for the collection and treatment of wastewater.



# Citywide Emissions

## 2008 By The Numbers



GHG Emissions

**3,990,893**

25.27 MT Per-Capita

13.21 MT / Job

0.1866 MT / \$1,000 GDP



Population

**157,901**



GDP

**21,384,260,000**

\$135,428 GDP Per-Capita



Employment

**161,359**

## 2018 By The Numbers



GHG Emissions

**2,985,483**

16.54 MT Per-Capita

7.64 MT / Job

0.0964 MT / \$1,000 GDP



Population

**180,551**



GDP

**30,971,172,000**

\$171,537 GDP Per-Capita



Employment

**176,822**

## Ten-Year Trend Dashboard



GHG Emissions

**-1,005,410** **-25.19%**

**-8.74** MT Per-Capita

**-5.57** MT / Job

**-0.09** MT / \$1,000 GDP



Population

**+22,650** **+14.34%**



GDP

**+\$9,586,912,000**

**+\$36,109** GDP Per-Capita



Employment

**+15,463** **+9.58%**

## Chattanooga Citywide GHG Emissions Overview

Citywide total emissions for the City of Chattanooga dropped 25.19% from 3,990,893 metric tonnes in 2008 to 2,985,483 metric tonnes in 2018.

Change in \$

Change in T

### Think Economic Development is Tied To Increased Emissions?

Think again! Between 2008 and 2018 the City was able to decrease it's GHG emissions by 25.19% while growing it's economy by 44% and adding 9.58% more jobs!



## How Large Are Citywide GHG Emissions?

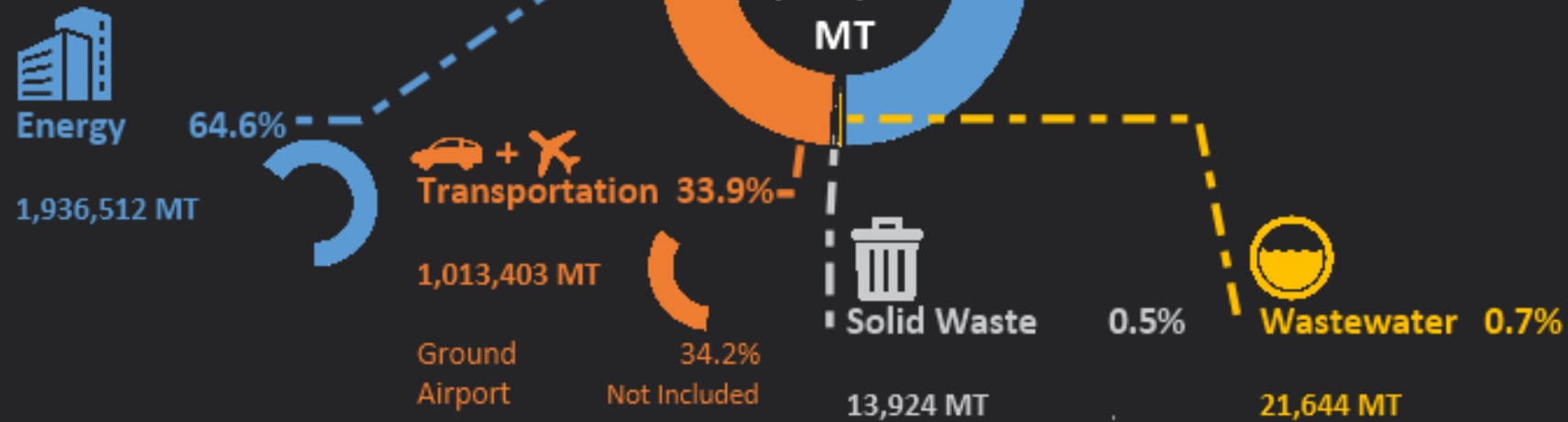
The City's total emissions for 2018 are equal to **58.6 Billion** cubic feet of man-made greenhouse gas. This volume of atmosphere is equal to a cube **3,884** feet on each face, seen here from Bragg Reservation Military Park nearly 5 miles away.

Volume comparison to the Willis Tower, Chicago.

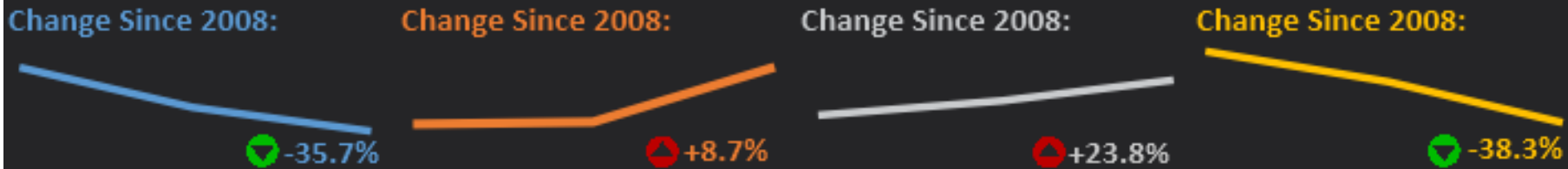


## Findings In Brief - Citywide Emissions

### 2018 Chattanooga Citywide GHG Emissions by Sector



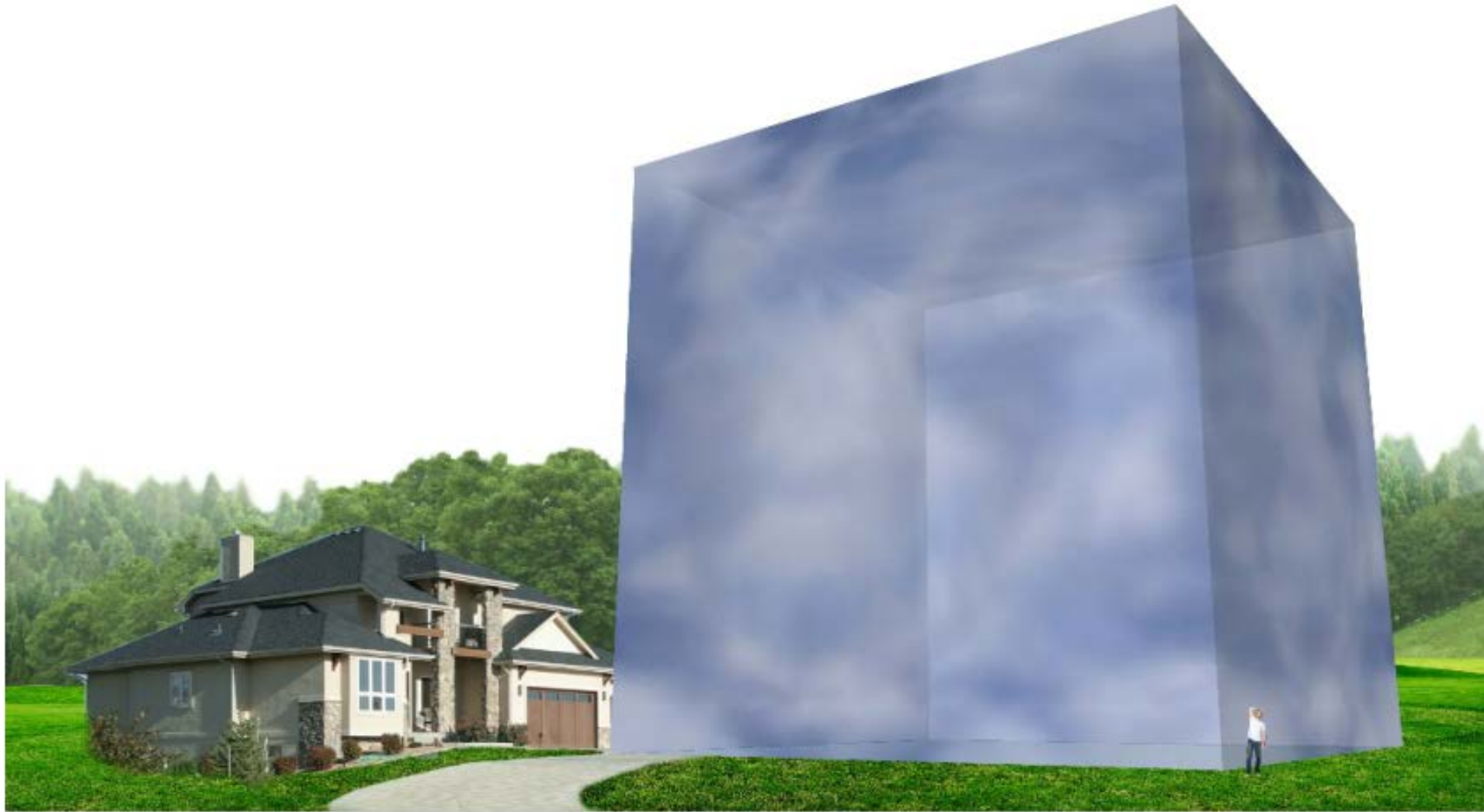
### Five Year Trends by Sector





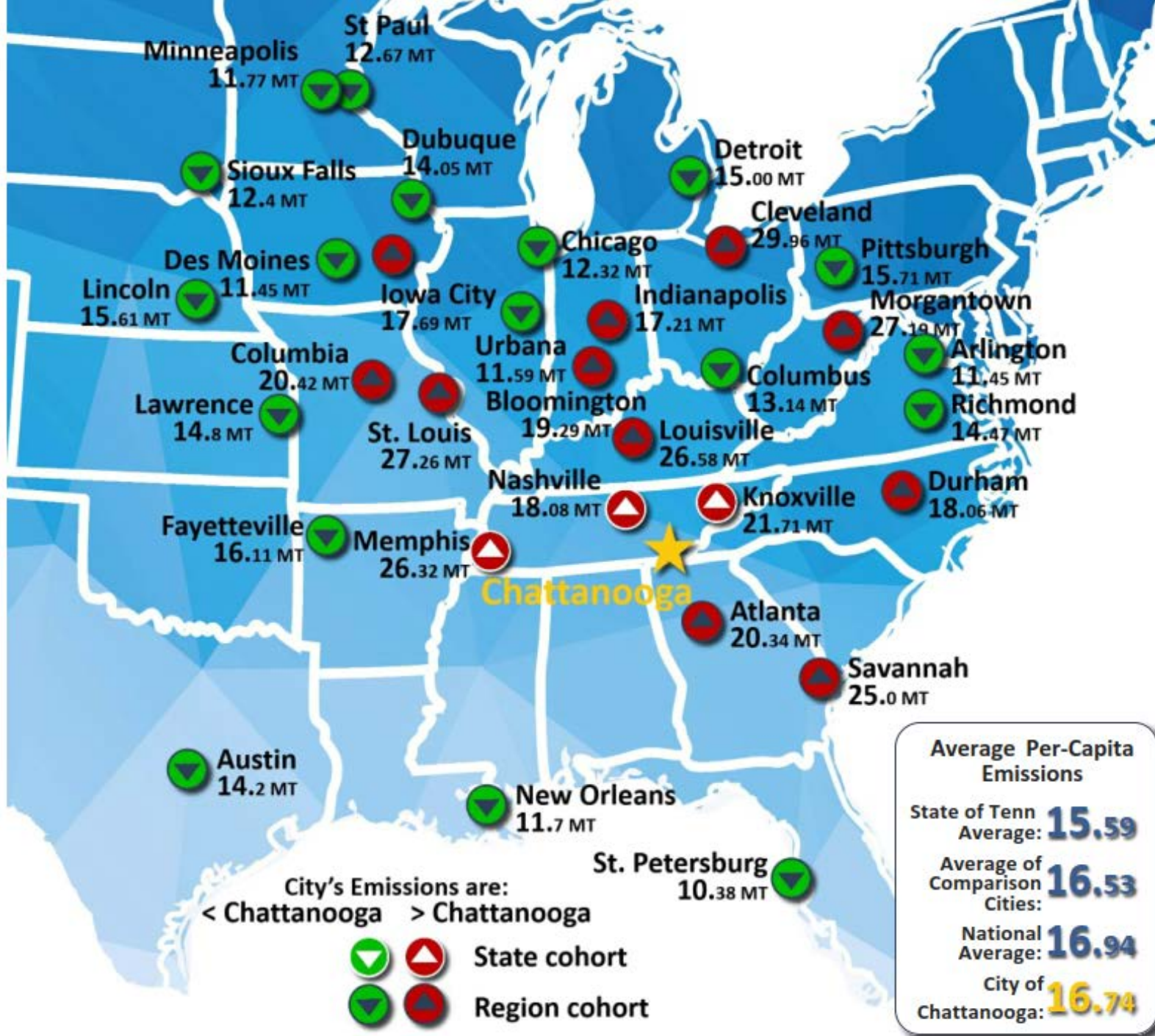
## How Large Are Citywide Per-Capita GHG Emissions?

The City of Chattanooga's citywide emissions per-capita for 2018 are equal to **324,443** cubic feet of man-made greenhouse gas. This volume of atmosphere is equal to a cube **68<sup>7</sup>** feet on each face.

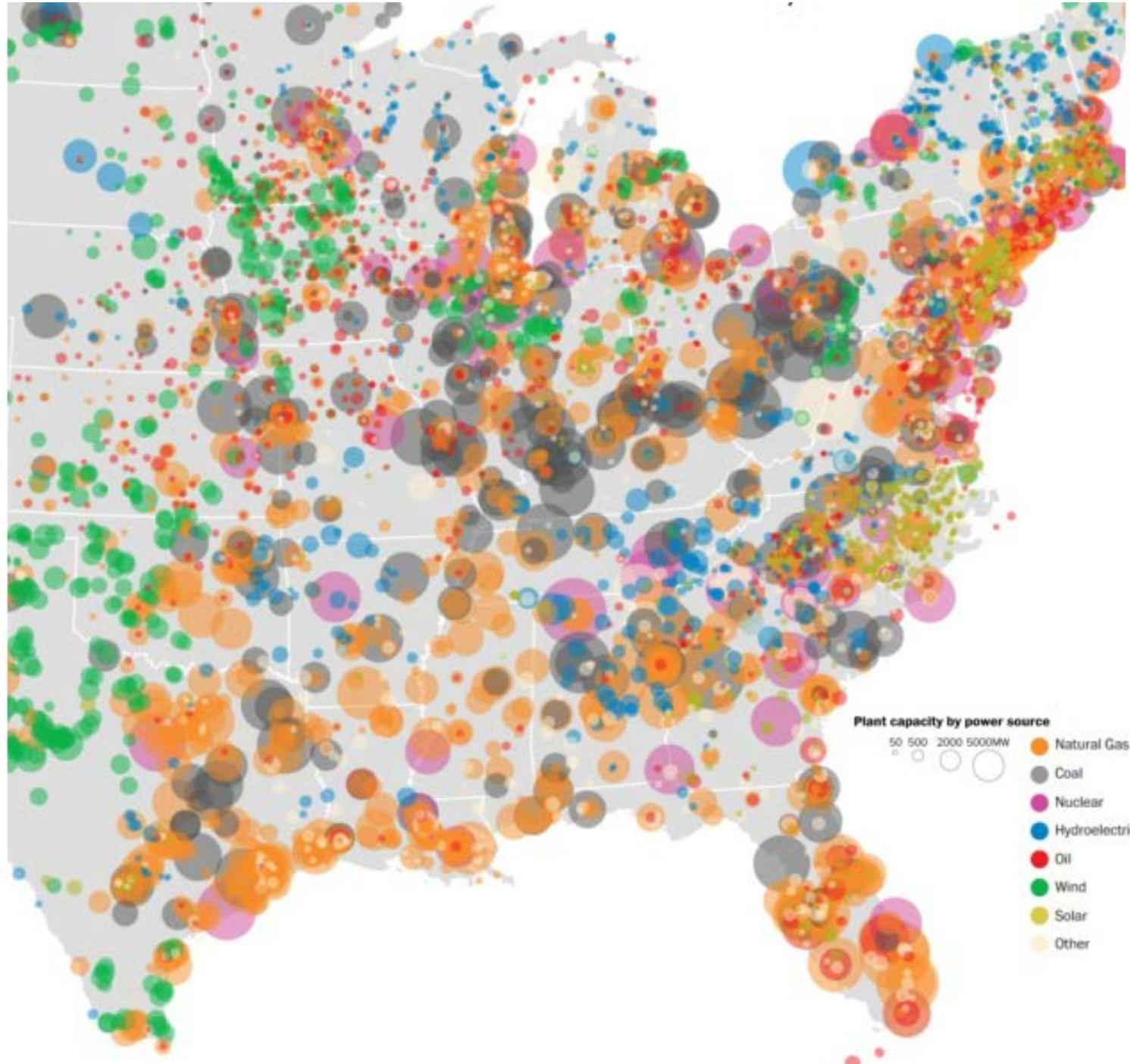


# How does Chattanooga Compare?













## Tennessee Communities

	Metric Tonnes (Thousands)	Per-Capita	Chattanooga Comparison
Knoxville:	3,999.9 TMT	21.71 MT	
Memphis:	17,192 TMT	26.32 MT	
Nashville:	12,276 TMT	18.08 MT	
Statewide Average:		14.59 MT	
Chattanooga:	2,985.5 TMT	16.54 MT	

City of Chattanooga Percentile Among  
Tennessee Communities Compared: **25<sup>th</sup>**



## Regional Communities of Similar Size

	Metric Tonnes (Thousands)	Per-Capita	Chattanooga Comparison
Richmond, VA:	3,152.5 TMT	14.47 MT	
Arlington, VA:	2,480.7 TMT	11.25 MT	✔
Columbia MO:	2,421.4 TMT	20.42 MT	✘
Des Moines, IA:	2,490.5 TMT	11.45 MT	✔
Durham, NC:	4,530.5 TMT	18.06 MT	✘
Knoxville, TN:	3,999.9 TMT	21.71 MT	✘
Lincoln, NE:	4,700.5 TMT	16.51 MT	✔
Savannah, GA:	3,609.5 TMT	25.0 MT	✘
Sioux Falls SD:	1,878.9 TMT	12.4 MT	✔
St Petersburg, FL:	2,693.2 TMT	10.38 MT	✔
<b>Average:</b>		<b>15.62 MT</b>	✔
<i>(population weighted)</i>			
<b>Chattanooga:</b>	<b>2,985.5 TMT</b>	<b>16.54 MT</b>	

City of Chattanooga Percentile Among  
Regional Communities of Similar Size: **64<sup>th</sup>**

## Other Regional Communities

	Metric Tonnes (Thousands)	Per-Capita	Chattanooga Comparison
Atlanta, GA:	9,024 TMT	20.34 MT	✘
Austin, TX:	13,500 TMT	14.20 MT	✔
Bloomington, IN:	1,639 TMT	19.29 MT	✘
Chicago, IL:	33,500 TMT	12.32 MT	✔
Cleveland, OH:	11,889 TMT	29.96 MT	✘
Columbus, OH:	10,983 TMT	13.14 MT	✔
Detroit, MI:	10,329 TMT	15.0 MT	✔
Dubuque, IA:	819 TMT	14.05 MT	✔
Fayetteville, AR:	1,379 TMT	16.11 MT	✔
Indianapolis, IN:	14,630 TMT	17.21 MT	✘
Iowa City, IA:	1,298 TMT	17.69 MT	✘
Lawrence, KS:	1,329 TMT	14.8 MT	✔
Louisville, KY:	16,000 TMT	26.58 MT	✘
Minneapolis, MN:	4,894 TMT	11.77 MT	✔
Morgantown, WV:	805 TMT	27.19 MT	✘
New Orleans, LA:	4,558 TMT	11.7 MT	✔
Pittsburgh, PA:	4,803 TMT	15.71 MT	✔
St Louis, MO:	8,703 TMT	27.26 MT	✘
St Paul, MN:	3,900 TMT	12.67 MT	✔
Urbana, IL:	487 TMT	11.59 MT	✔
<b>Average:</b>		<b>16.2 MT</b>	✔
<i>(population weighted)</i>			
<b>Chattanooga:</b>	<b>2,985.5 TMT</b>	<b>16.54 MT</b>	

City of Chattanooga Percentile Among  
Other Regional Communities: **62<sup>nd</sup>**

# 05 Q+A



paleBLUEdot<sup>LLC</sup>

Ted Redmond

[www.paleBLUEdot.llc](http://www.paleBLUEdot.llc)

Elizabeth Hammitt - Director of  
Environmental Stewardship and Community,  
EPB



# Renewable Energy Credits

101 Information & Products

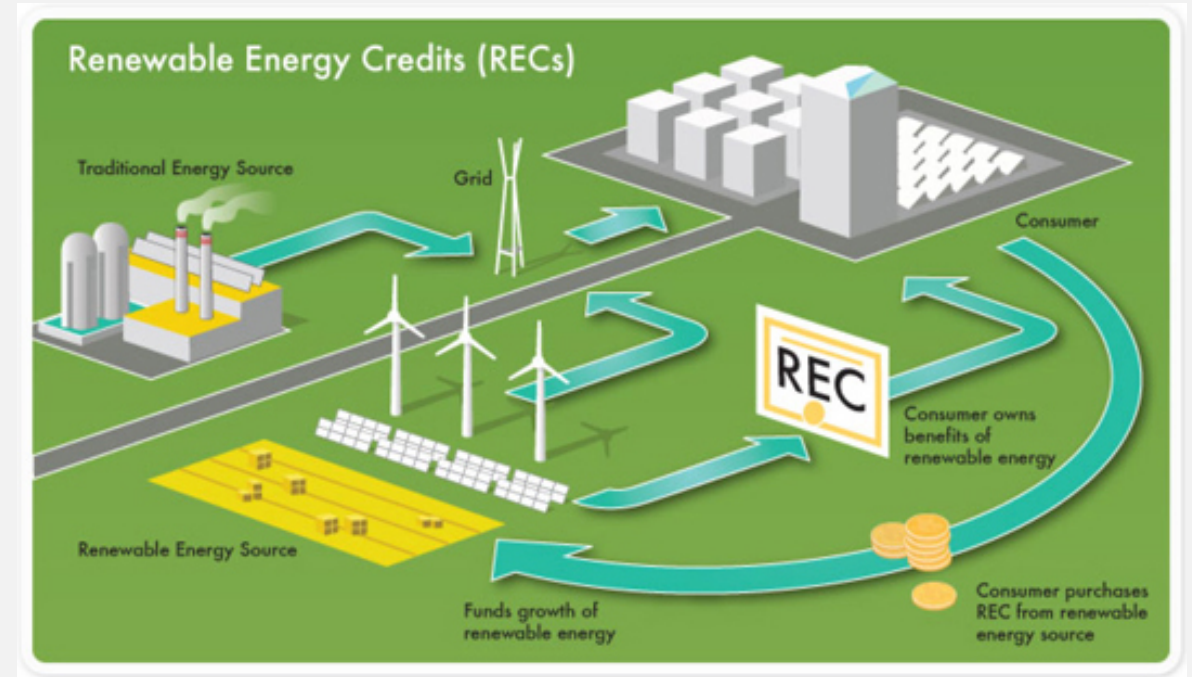




About EPB



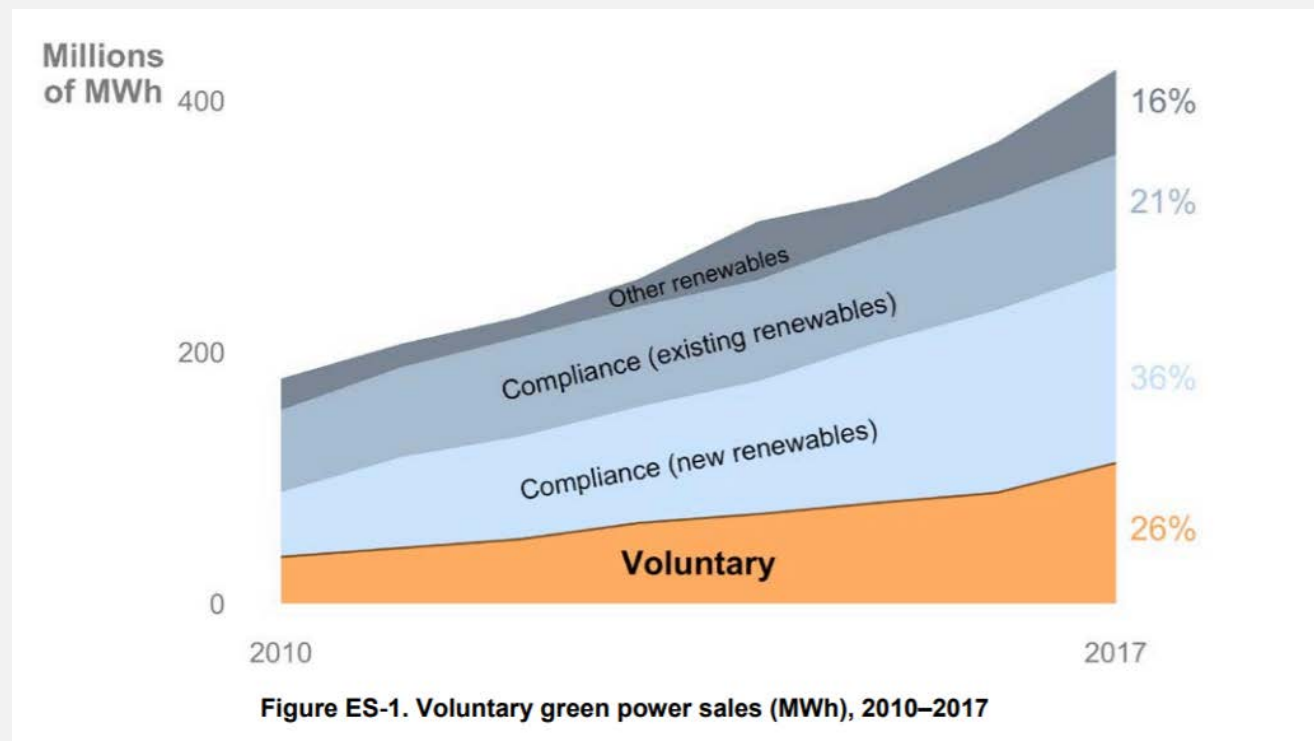
- **ONLY** the calculated environmental benefits from alternative generation *(and energy efficiency)*
- **REC refers to 1 MWh of renewable generation**





# Markets

- Compliance vs. Voluntary



Source: National Renewable Energy Laboratory





## RECs 101: Bundled vs. UnBundled



## 1 MWh (Bulk)

**TVA Southeastern RECs – new: TVA Green Flex**

**Sold in 1 MWh blocks; Minimum: 2,000 MWh annually.**

**Each MWh = \$1.25 / \$2,500 annual minimum**

## Blocks (packages of kWh)

- **EPB SolarShare**

### 20-YEAR LICENSE

ONE-TIME COST OF \$612 +  
ANNUAL MAINTENANCE FEE OF  
\$10 PER PANEL\*

### MONTH-TO- MONTH LICENSE

\$5 PER PANEL PER MONTH\*

### ENERGY OFFSETS

\$5 PER 100 KWH PER MONTH



- **TVA Green Power Switch – new: Green Switch**  
**150 kWh blocks for \$4**

## Technologies

- Solar
- Wind
- Geothermal
- Low Impact Hydro
- Biomass
- Bio fuel
- Landfill Gas

\*Combined Heat & Power Systems

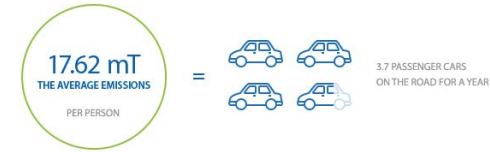
## Product Types

- Combined with energy vs. Stand-alone REC
- Commercial vs. Residential

Know Your Footprint

How It All Works

Sustainability Tips



According to The Union of Concerned Scientists, the average carbon emissions per person in the United States is 17.62 mT per person, or the equivalent to keeping 3.7 passenger cars on the road for a year. Our carbon footprints come from a variety of sources including the following:



DRIVING



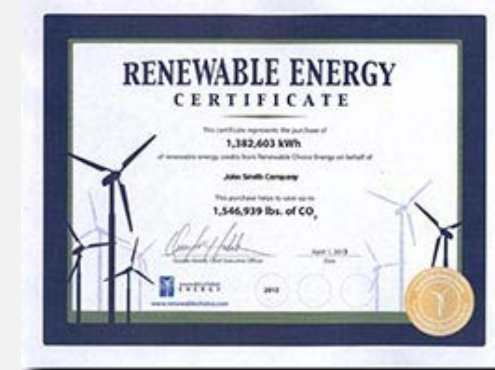
THE ELECTRICITY  
AND GAS USE  
IN OUR HOMES



WASTE  
DISPOSAL



FLYING



- Vintage
- Generation Type
- Geographic Location
- Supply/ Demand
- Compliance vs. Voluntary Market
- Bulk Pricing





RECs 101: Green Power Switch

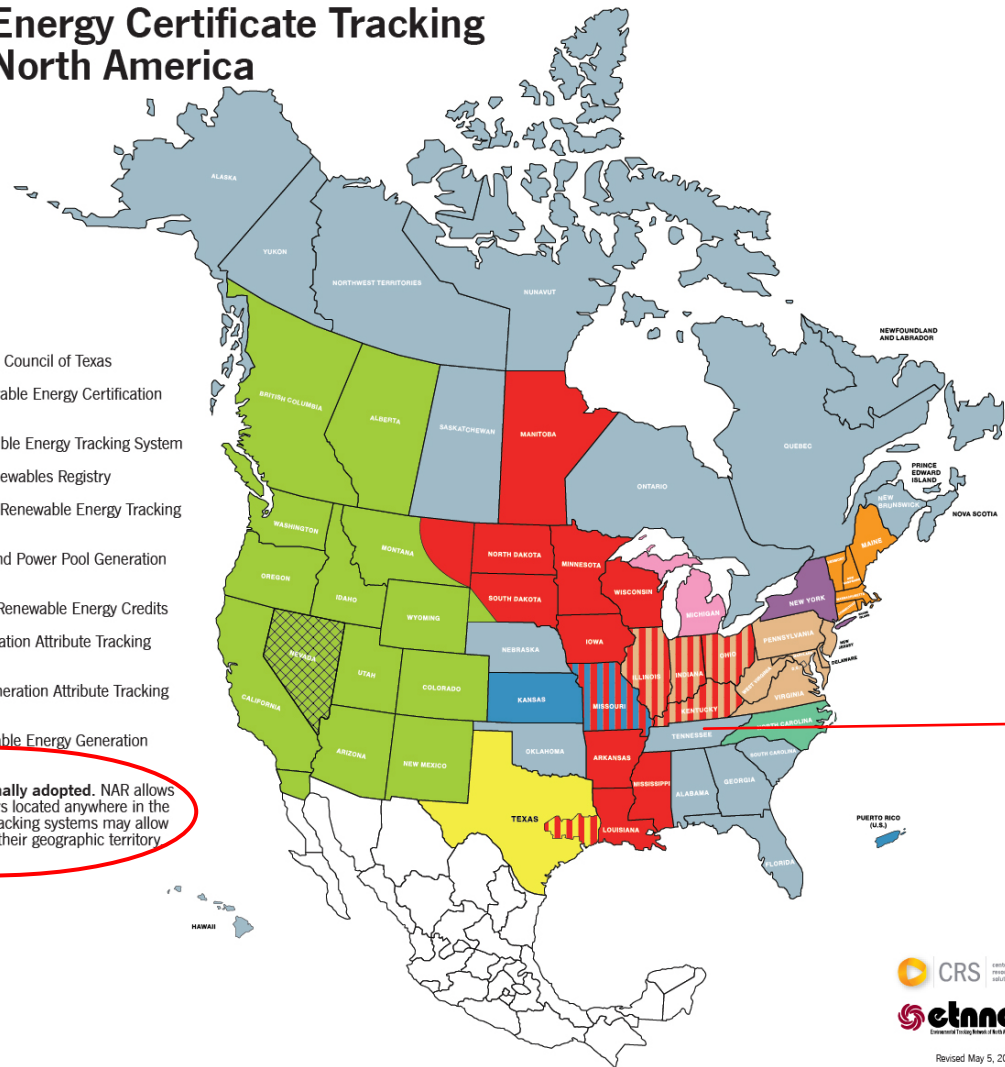




# Renewable Energy Certificate Tracking Systems in North America

## KEY

- ERCOT:** Electric Reliability Council of Texas
- MIRECS:** Michigan Renewable Energy Certification System
- M-RETS:** Midwest Renewable Energy Tracking System
- NAR:** North American Renewables Registry
- NC-RETS:** North Carolina Renewable Energy Tracking System
- NEPOOL-GIS:** New England Power Pool Generation Information System
- NVTREC:** Nevada Tracks Renewable Energy Credits
- NYGATS:** New York Generation Attribute Tracking System (in development)
- PJM-GATS:** PJM EIS's Generation Attribute Tracking System
- WREGIS:** Western Renewable Energy Generation Information System
- No tracking system formally adopted.** NAR allows registration from generators located anywhere in the U.S. and Canada. Other tracking systems may allow registrations from outside their geographic territory



Revised May 5, 2015

TIGRs Registry Home Reports Registry Help

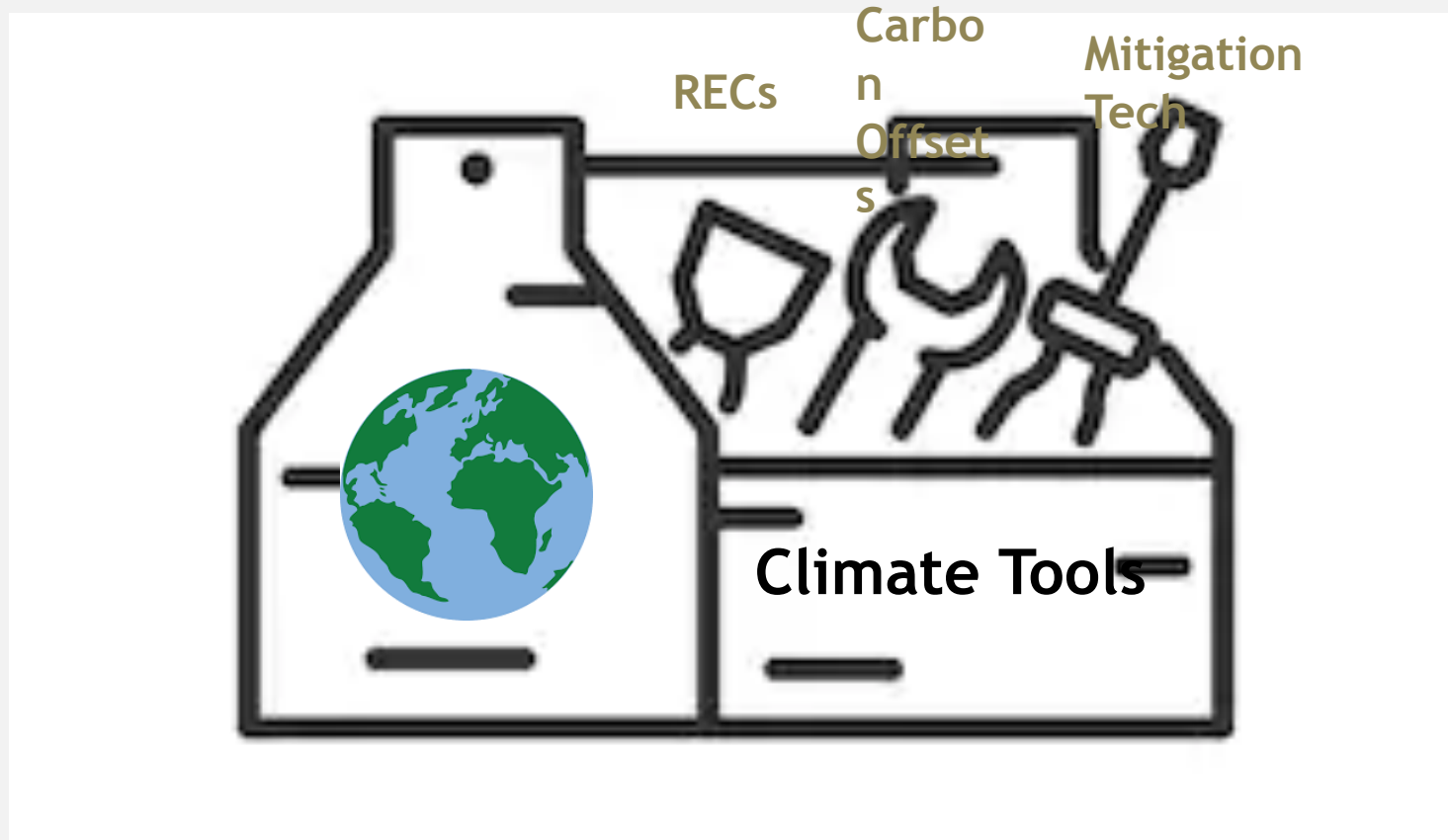
Assets CSV Excel PDF

Account Holder Company	Asset ID	Asset Name	Nameplate Capacity (MW)	Country	Subdivisor	Multi-Fuel Indicator	Fuel Type	Comments
1003	GEN1074	2 Storey Canteen - 15 Benoi Rd	0.276	Singapore	Central Singapore	No	Solar Serving On-Site Load	03/19/2018
1003	GEN1006	3 Pioneer Sector 3 - 3 Pioneer Sector 3	1.559	Singapore	South West	No	Solar Photovoltaics	12/28/2017
1003	AGG1064	Aggregated Projects	2.617	Singapore	Central Singapore	No	Solar Serving On-Site Load	12/19/2017
1003	GEN1134	Apple	0.910	Singapore	Central Singapore	No	Solar Photovoltaics	10/14/2017
1003	GEN1077	Canteen, Locker Room, Toilets -	0.276	Singapore	Central	No	Solar Serving On-Site Load	03/19/2018



# RECs 101: Registering, Trading, and Banking





RECs: One Global Challenge, One of Many Tools



Elizabeth Hammitt

EPB

Twitter: @ElizabethIris11

Connect with me on LinkedIn

Thank you!





Rick Huffines- Executive Director of the  
Tennessee River Gorge Trust



# **CARBON OFFSET PROJECTS INSIGHTS FROM A LAND TRUST**

Rick Huffines, Executive Director

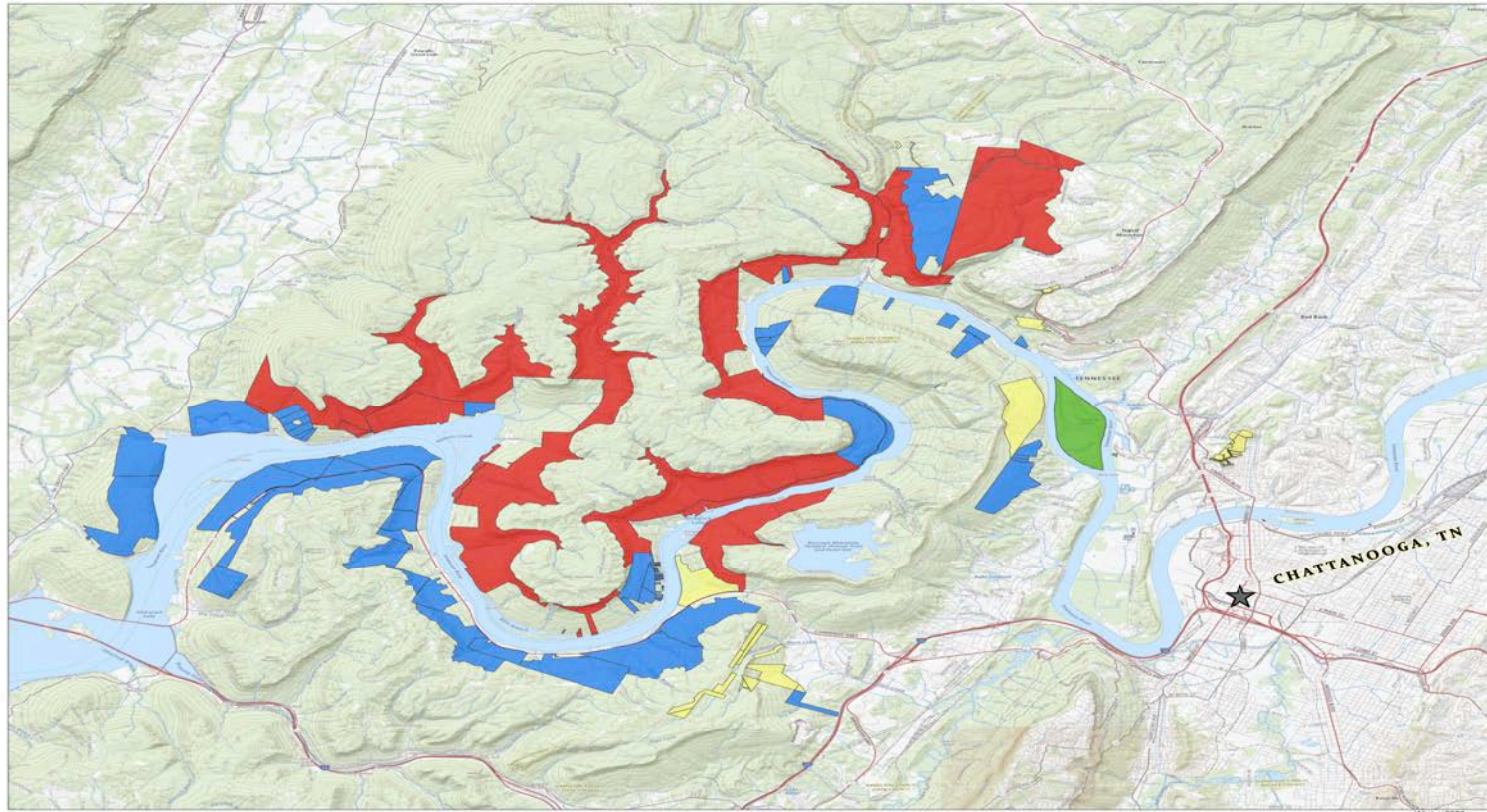




# LANDS WITHIN OUR PURVIEW OF MANAGEMENT



Tennessee River Gorge Trust



**Fee Simple**  
Lands owned by TRGT

**Leased**  
Land leased from the State of Tennessee

**Conservation Easement**  
Protected lands that are privately owned

**Memorandum of Understanding**  
Cooperative agreements with government agencies

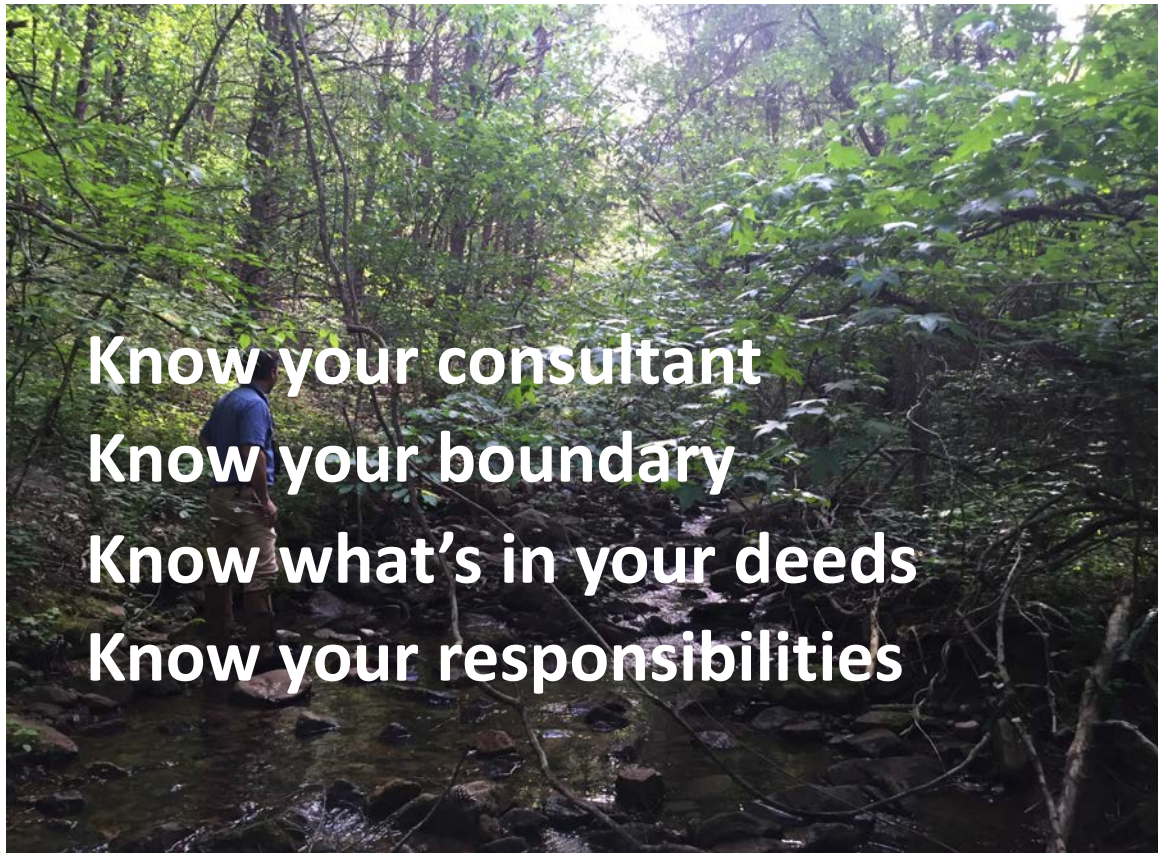






# IMPORTANT THINGS TO CONSIDER

Did I mention “Know what’s in your deeds”?



Know your consultant  
 Know your boundary  
 Know what’s in your deeds  
 Know your responsibilities

Prepared by and return to:  
 CAMERON & CAMERON, P.C.  
 28 Courthouse Square, Suite 100  
 Jasper, TN 37347; from information  
 supplied by the parties.

SEND TAX BILLS TO:	MAP/PARCEL NUMBER
The Tennessee River Gorge Trust, Inc.	Map 995
1214 Dartmouth Street	Parcel 014.00
Chattanooga, TN 37405	

## SPECIAL WARRANTY DEED

FOR AND IN CONSIDERATION of the sum of One (\$1.00) Dollar, cash in hand paid, and other good and valuable considerations, the receipt of which is hereby acknowledged, we, J. HARVEY CAMERON, and THE CONSERVATION FUND, a Maryland non-profit corporation (hereinafter referred to as “Grantors”), have bargained and sold and by these presents do hereby transfer and convey unto

**THE TENNESSEE RIVER GORGE TRUST, INC.,**  
 a Tennessee non-profit public benefit corporation

(the “Grantee”), its successors and assigns, the following described real estate, situated in the Third Civil District of Marion County, Tennessee, and more particularly described as follows, to-wit:

**BEGINNING** at an iron pin on the top bluff of the mountain said point being in the center line of a T.V.A. High Power line; thence leaving said power line and going immediately over the bluff line; thence along the base of the bluff as it meanders and expressed as equivalent straight lines as: South 59 deg. 57 min. West 247.08 feet, South 17 deg. 31 min. West 182.11 feet, South 36 deg. 59 min. West 69.70 feet, South 24 deg. 18 min. West 224.60 feet, South 57 deg. 12 min. West 165.18 feet, South 89 deg. 09 min. West 62.51 feet, North 78 deg. 03 min. West 102.15 feet, North 09 deg. 23 min. East 64.12 feet, North 39 deg. 54 min. West 253.08 feet, North 04 deg. 59 min. West 408.79 feet, North 14 deg. 42 min. West 347.15 feet, North 19 deg. 48 min. West 189.25 feet, North 09 deg. 59 min. West 136.18 feet, North 35 deg. 34 min. West 287.74 feet, North 04 deg. 26 min. East 208.82 feet; thence leaving said bluff’s base North 63 deg. 38 min. East 592.57 feet to an iron pin in the center line of the aforementioned power line; thence along and with the center line of said power line South 26 deg. 22 min. East 1549.53 feet to the point of beginning, containing 30 acres. The above described tract is subject to any easement T.V.A. may have along the Northeast boundary of said tract.

**EASEMENT CONVEYED:** Also conveyed is an unrestricted 50 foot wide permanent and perpetual easement connecting this tract with the pavement of the Tracy City to Sequatchie County Road and the center line of the same being described as follows: Beginning at a point in the North boundary of the above described tract said point being South 63 deg. 38 min. West 449.13 feet from the center line of the power line and the Northeast corner



# QUESTIONS?

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