

**SCIENCE IS FUN**

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# Advancing Knowledge and Serving Society: Enlightenment and the Responsibilities of the Enlightened



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Director, Wisconsin Initiative for Science Literacy

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In the Lab of Shakhashiri

**Department of Chemistry**  
**University of Wisconsin-Madison**

**2019 Sigma Xi Annual Meeting & Conference**

**Friday, May 3, 2019 — Madison, WI**



# Greenhouse Gases





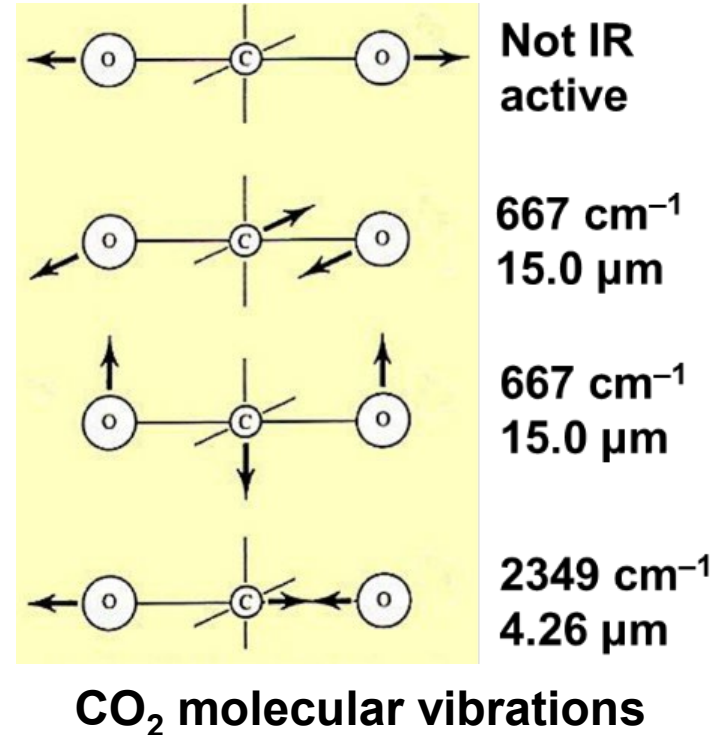
# Greenhouse gases absorb infrared radiation

Composition of Dry Air

Component	Composition	Content (%)
<b>Nitrogen</b>	<b>N<sub>2</sub></b>	<b>78</b>
<b>Oxygen</b>	<b>O<sub>2</sub></b>	<b>21</b>
<b>Argon</b>	<b>Ar</b>	<b>0.94</b>
Trace Gases	-	0.10%

Greenhouse Gases

Component	Composition	Content (%)
Carbon Dioxide	CO <sub>2</sub>	0.040
Methane	CH <sub>4</sub>	0.00018
Nitrous Oxide	N <sub>2</sub> O	0.000033
Water Vapor	H <sub>2</sub> O	0.0-4.0



# Science-rich Sector

# Science-poor Sector



**Scientific Competence**  
**Scientific Expertise**

**Science Literacy**



“Science literacy does not imply detailed knowledge of chemistry or physics or biology, but rather a broad understanding and appreciation of what science is capable of achieving and, equally important, what science cannot accomplish.”



*“Science literacy enlightens and enables people to make informed choices, to be skeptical, and to reject shams, quackery, unproven conjecture, and to avoid being bamboozled into making foolish decisions where matters of science and technology are concerned.*”

*Science literacy is for everyone—scientists, artists, humanists, all professionals, the general public, youth and adults alike.”*





# Industrial Revolution

# Electronic Revolution



# Grand Challenges to Society and to Scientists

Help sustain Earth and its people in the face of:

- Population Growth
- Finite Resources
- Malnutrition
- Spreading Disease
- Deadly Violence
- War
- Climate Change
- Denial of Basic Human Rights, *especially the right to benefit from scientific and technological progress*



# **Grand Challenges to Society and to Scientists**

**“Science and society have what is  
essentially a social contract  
that enables great intellectual achievements  
but comes with mutual expectations  
of benefiting the human condition  
and protecting our planet.”**

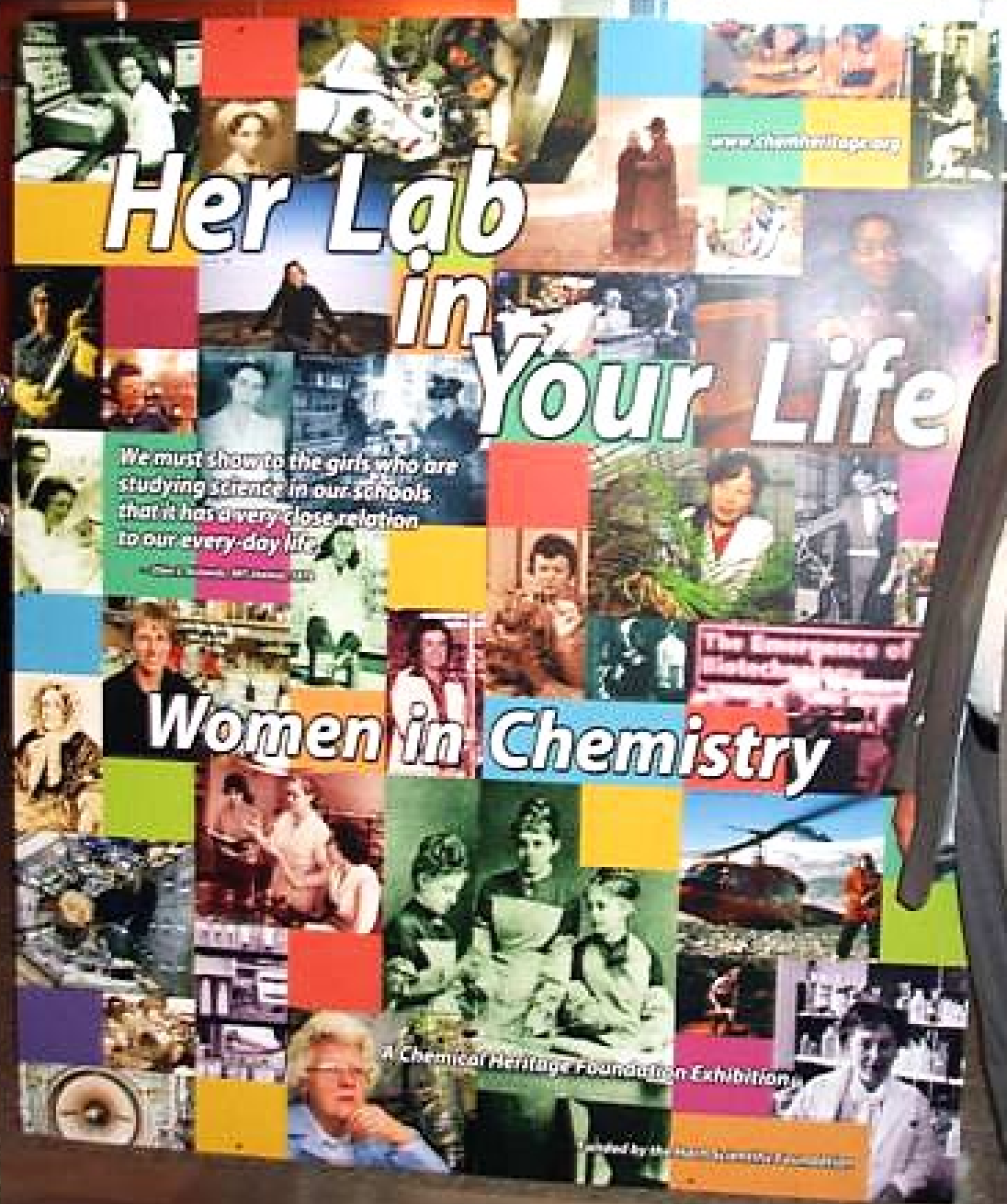


**“We must assure that the next generation of scientists is both highly skilled technically and properly educated to carry on their scientific and educational work for the common good of society.”**

---

**“In a free and civil society people must be virtuous as well as technically skilled.”**





# Her Lab in Your Life

We must show to the girls who are studying science in our schools that it has a very close relation to our every-day life.

## Women in Chemistry

A Chemical Heritage Foundation Exhibition

Sponsored by the National Science Foundation



Environment  
Food  
Work  
Style  
Knowledge  
CHALLENGES  
Stuff  
Discovery  
LIFE  
Sanitation

CHIPS





# FORGOTTEN GENIUS

Percy Julian  
and the  
Neglected Science  
of Chemistry

Stephen Lyons

Moreno/Lyons Productions, Boston  
producer of the NOVA documentary  
*Forgotten Genius*

Tuesday, January 22, 2008 – 4:00 p.m.  
Seminar Hall – 1315 Chemistry Building  
1101 University Avenue

Wisconsin Initiative for  
Science Literacy

Sponsored by the Wisconsin Initiative for Science Literacy  
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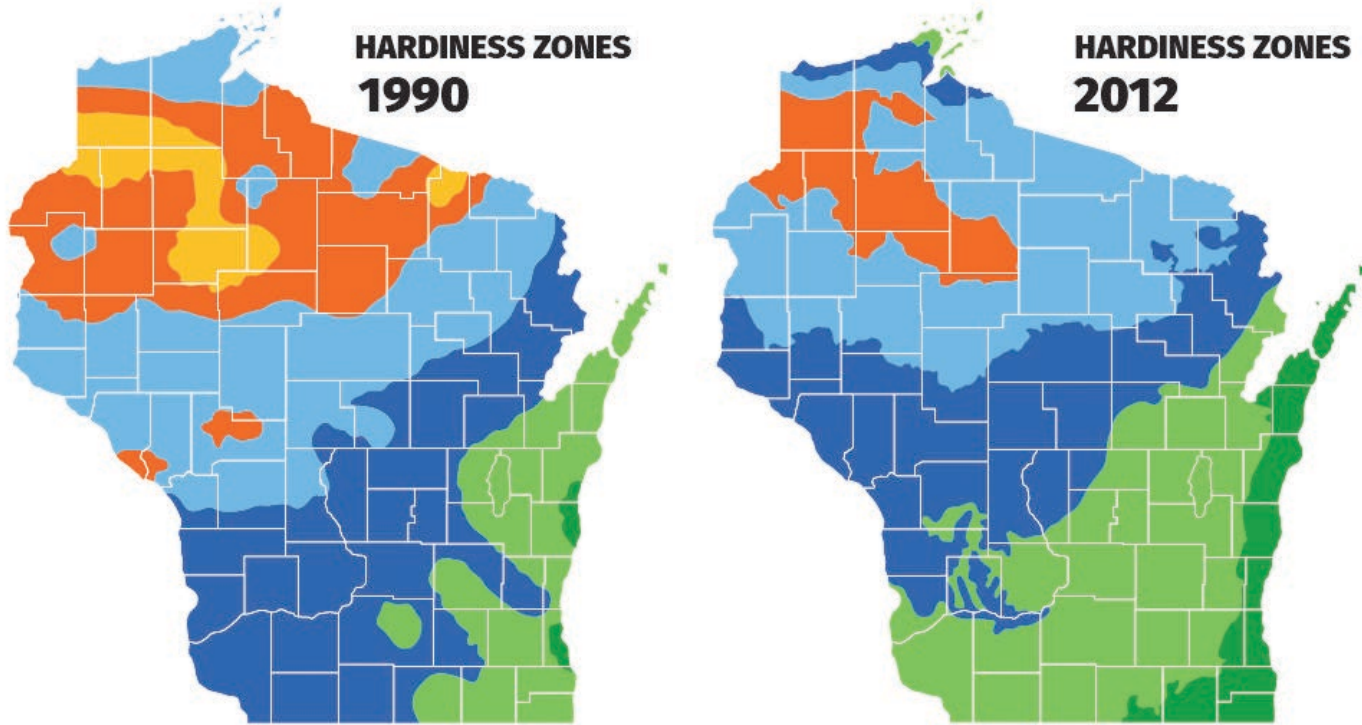


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**Warming Is**



**Unequivocal**



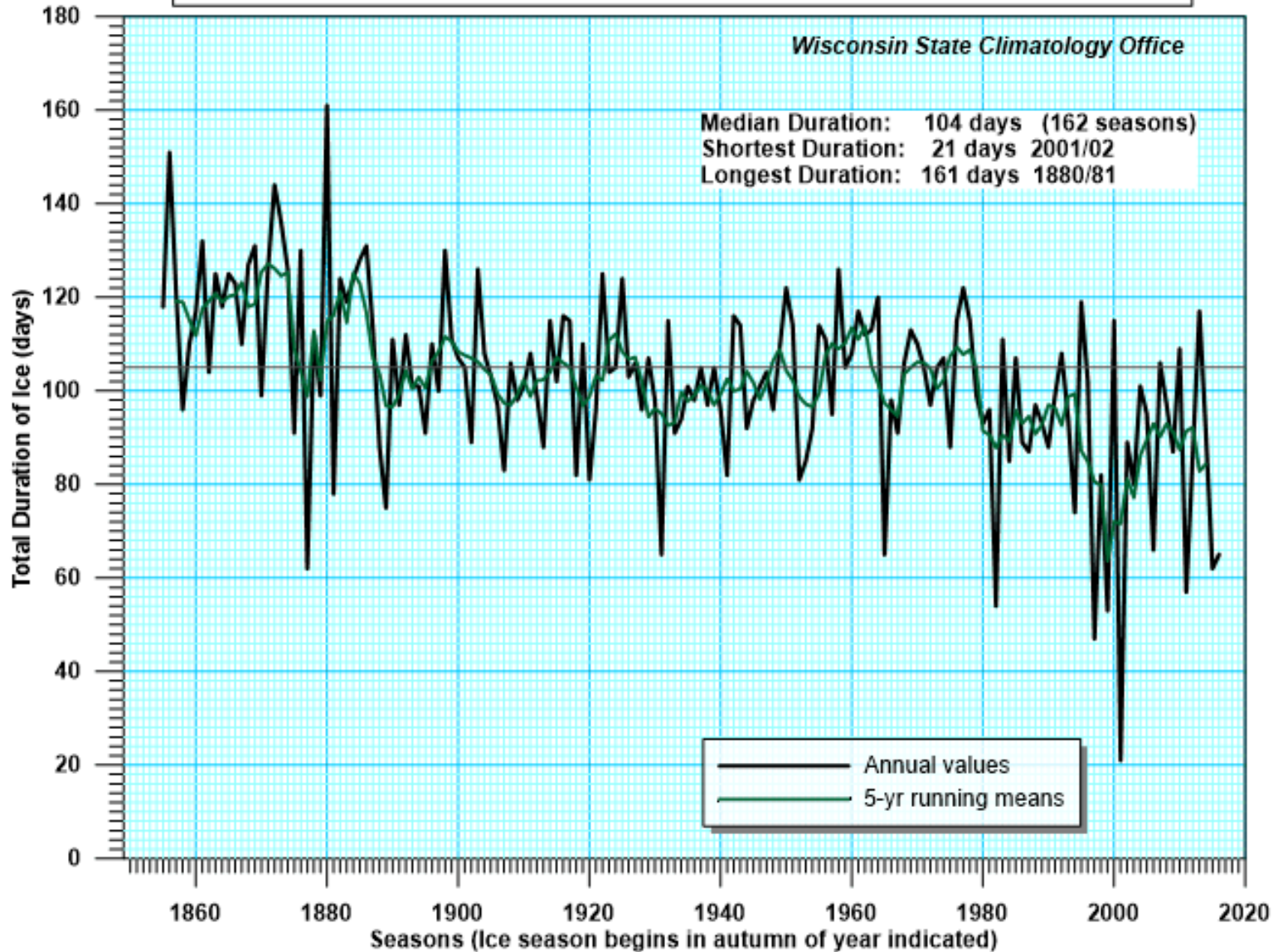
**The zone color key shows the lowest observed winter temperatures in that area.**

Illustration by Brandon Raygo, The Capital Times  
 Data Source: U.S. Dept. of Agriculture, PRISM Climate Group, Oregon State University

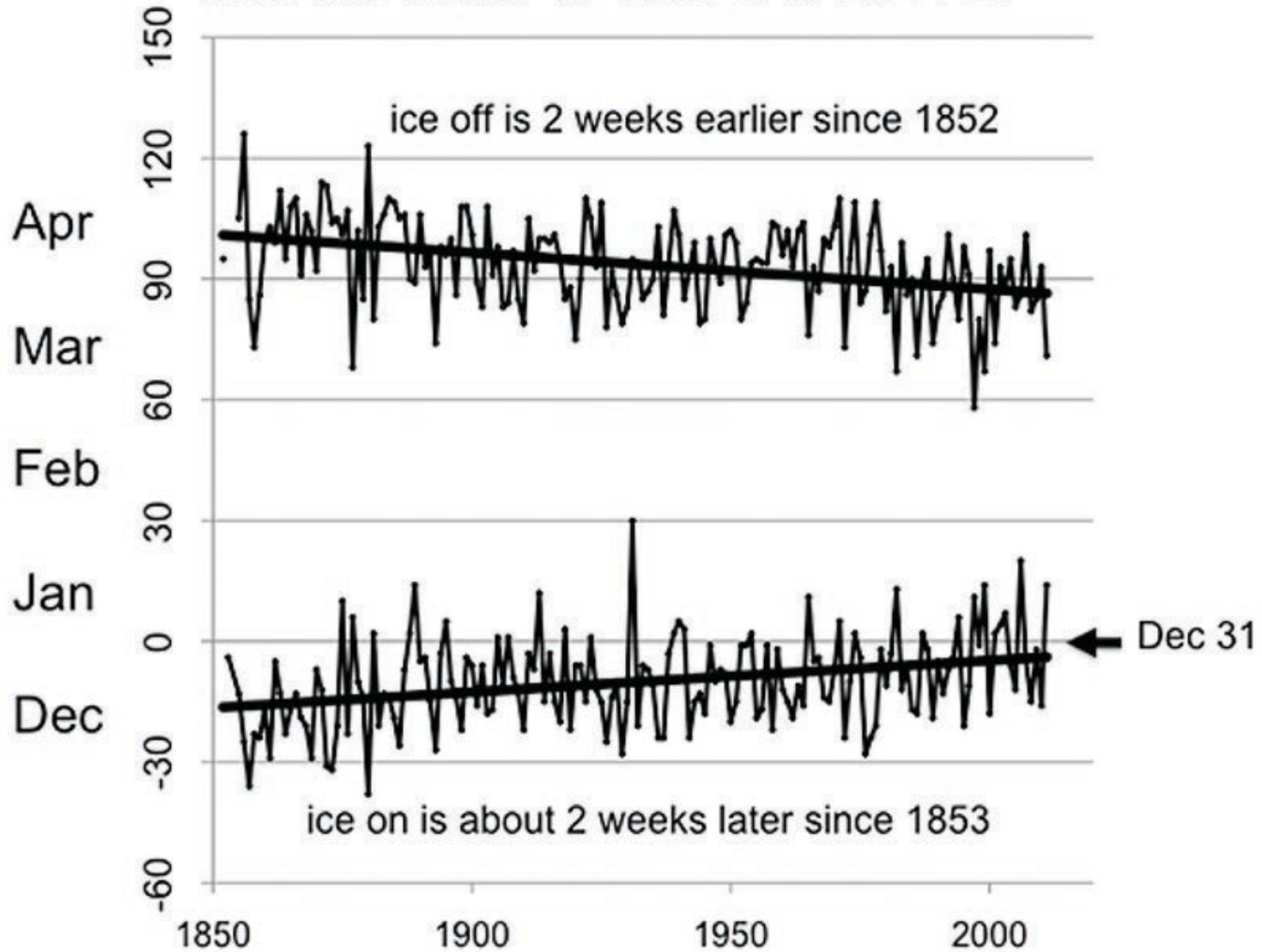




# Duration of Ice on Lake Mendota (1852/53 - 2016/17 Winter Seasons)



# Ice-and ice-off dates for Lake Mendota from the winter of 1852-3 to 2011-2.



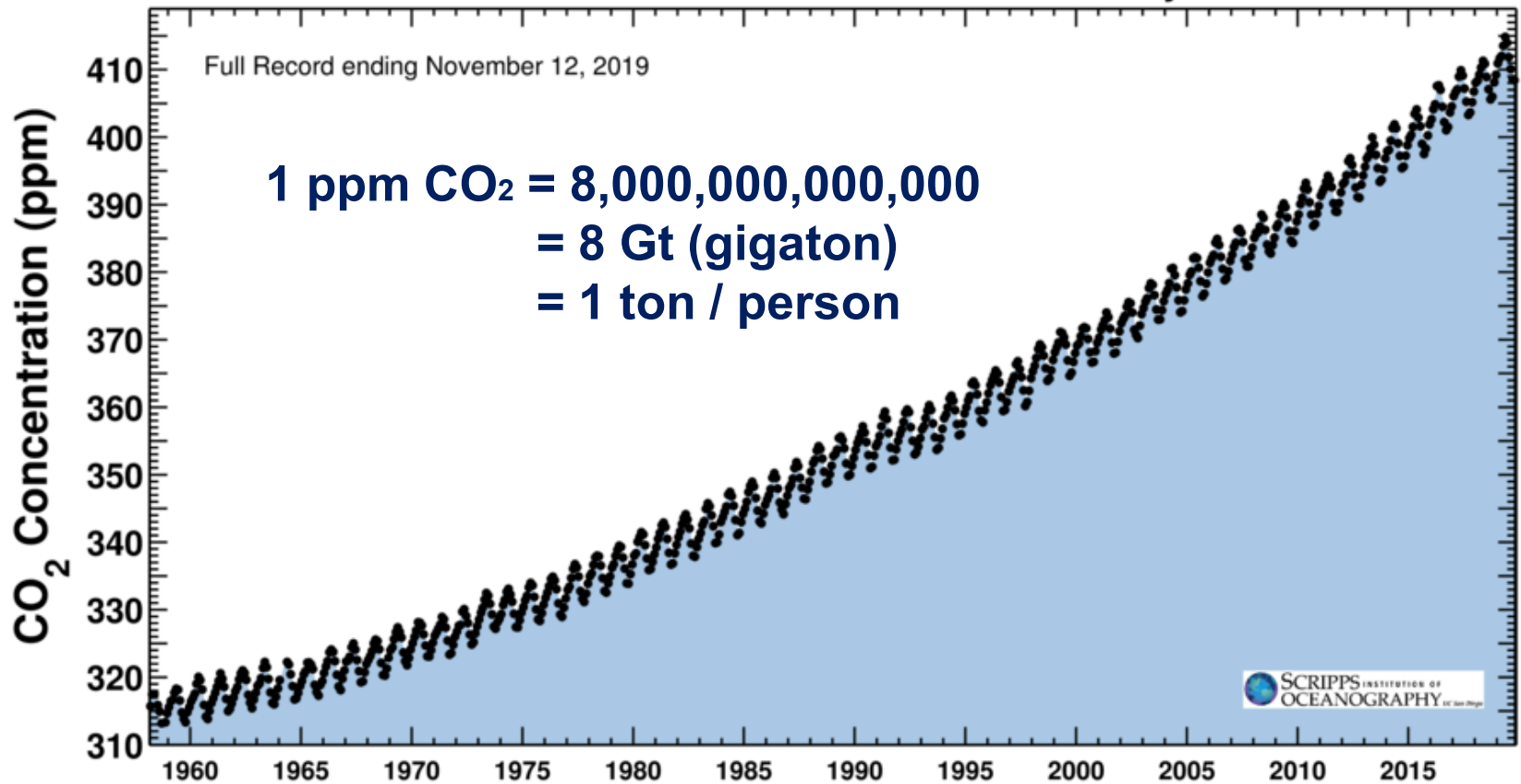


# The atmospheric greenhouse effect

Latest CO<sub>2</sub> reading: **410.28 ppm**

November 12, 2019

Carbon dioxide concentration at Mauna Loa Observatory



# Science is Vital to Democracy





**(IN EVERY ELECTION)**



*“Public sentiment is everything.  
With public sentiment,  
nothing can fail;  
without it nothing can succeed.”*

**>> Abraham Lincoln**



# Scientist-Citizen





# SCIENTIST-CITIZEN

Linus Pauling  
Rachel Carson  
Vannevar Bush  
F. Sherwood Rowland  
Norman E. Borlaug  
Glenn Seaborg  
Richard Smalley  
Carl Djerassi



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Richard Smalley  
Carl Djerassi  
Mary Good  
Francis Collins  
Shirley Malcom  
Neal Lane  
John Holdren  
Jane Lubchenco  
Bruce Alberts  
Sheila Widnall



# SCIENTIST-CITIZEN

**James Hansen  
Michael Mann  
Susan Solomon  
Bill Foster  
Katharine Hayhoe  
Marc Edwards  
Mona Hanna-Attisha  
Marcia McNutt  
Shirley Ann Jackson  
France Cordova  
Geri Richmond**



# SCIENTIST-CITIZEN





**SCIENCE IS FUN**  
**Science in Motion**

**FOSTERING** COMMUNITY APPRECIATION OF SCIENCE

**CULTIVATING** CREATIVITY

**EXPLORING**      **LEARNING**      **SHARING**

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UNIVERSITY OF WISCONSIN-MADISON





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CENTER

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Bones Is Fun

Chemical Demonstrations



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