

DIGGING INTO SOIL HEALTH

Soil Health Principles and Their Scientific Basis

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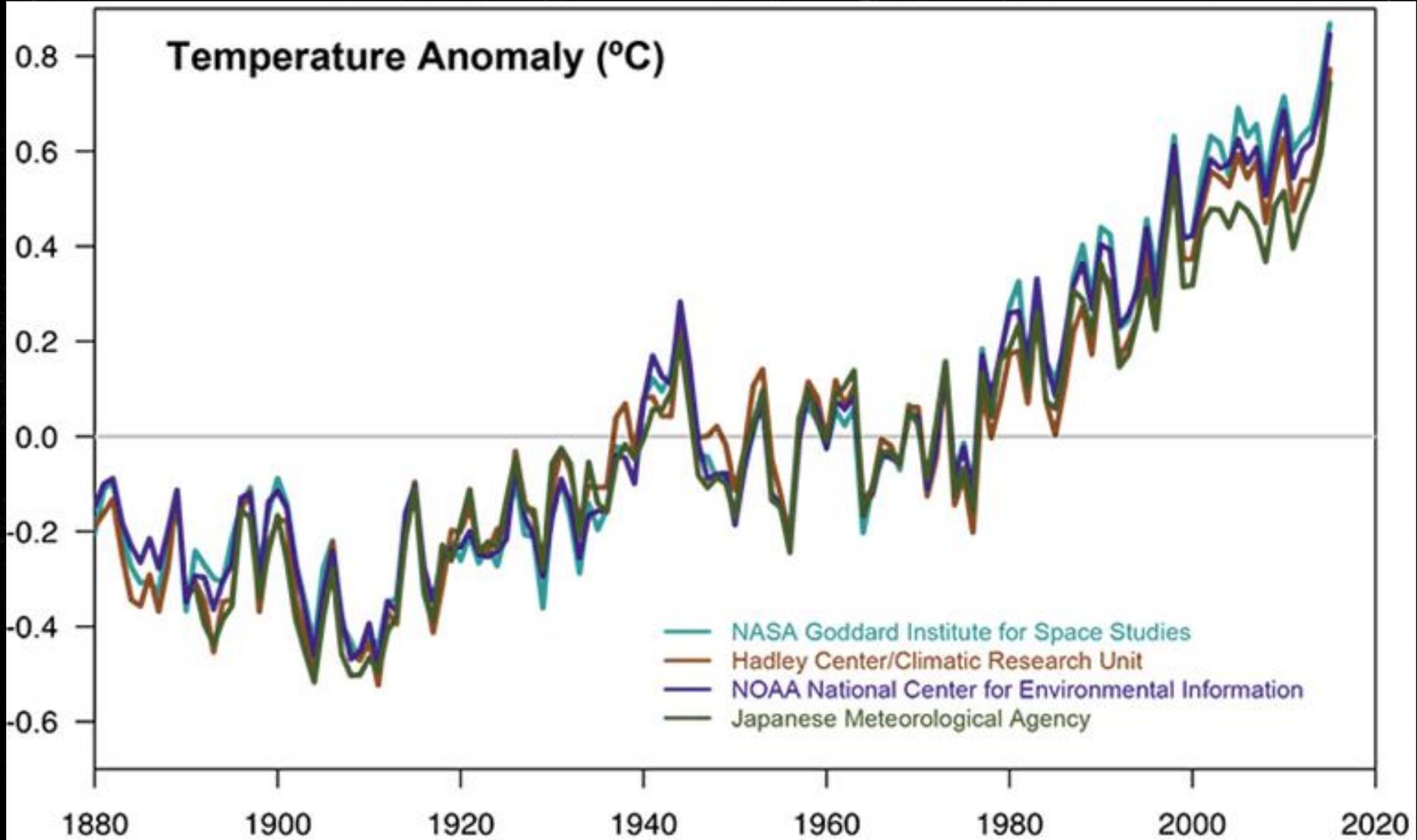
SOIL HEALTH

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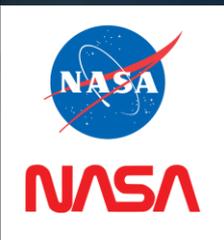
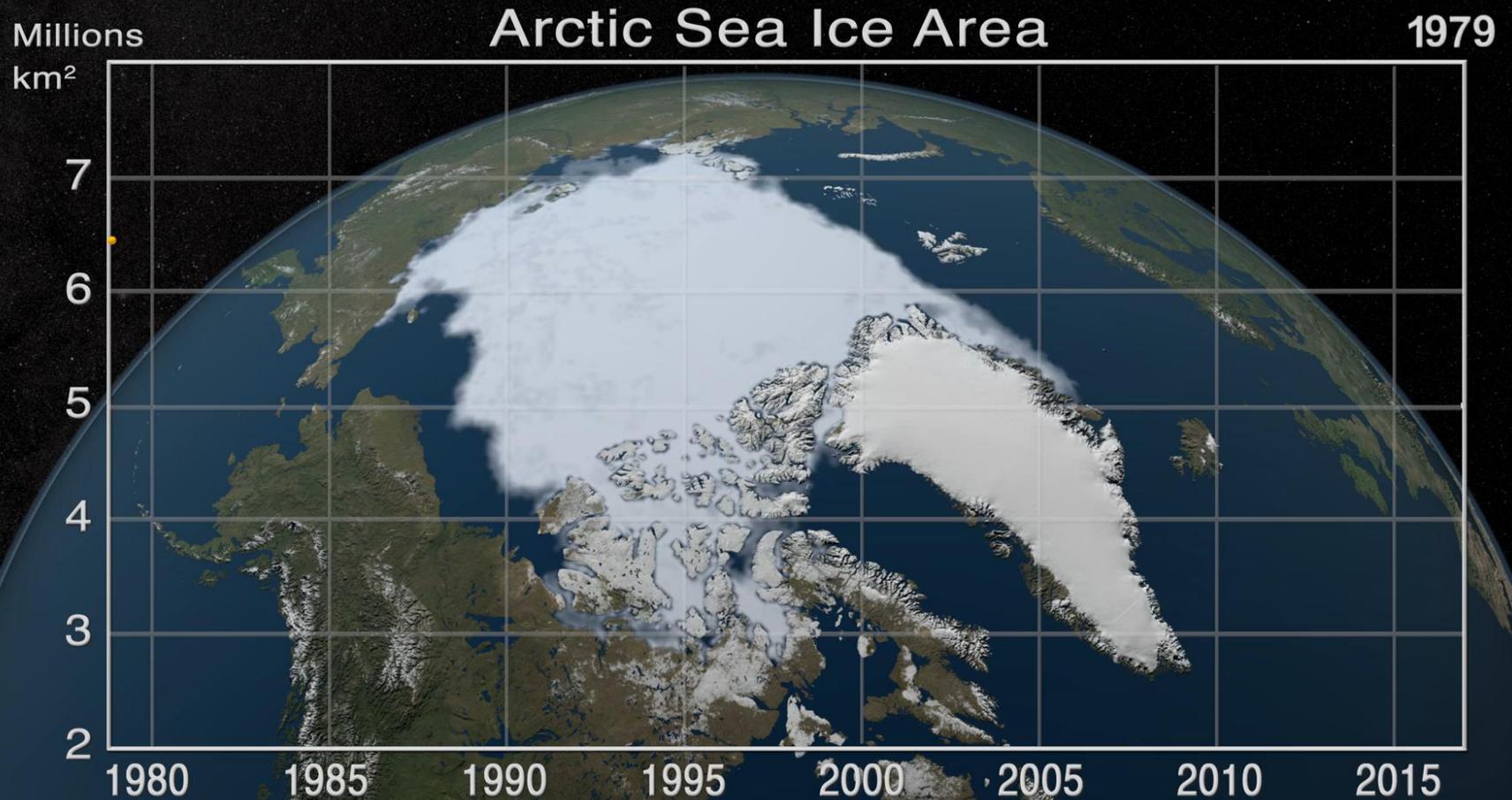
The Current Situation



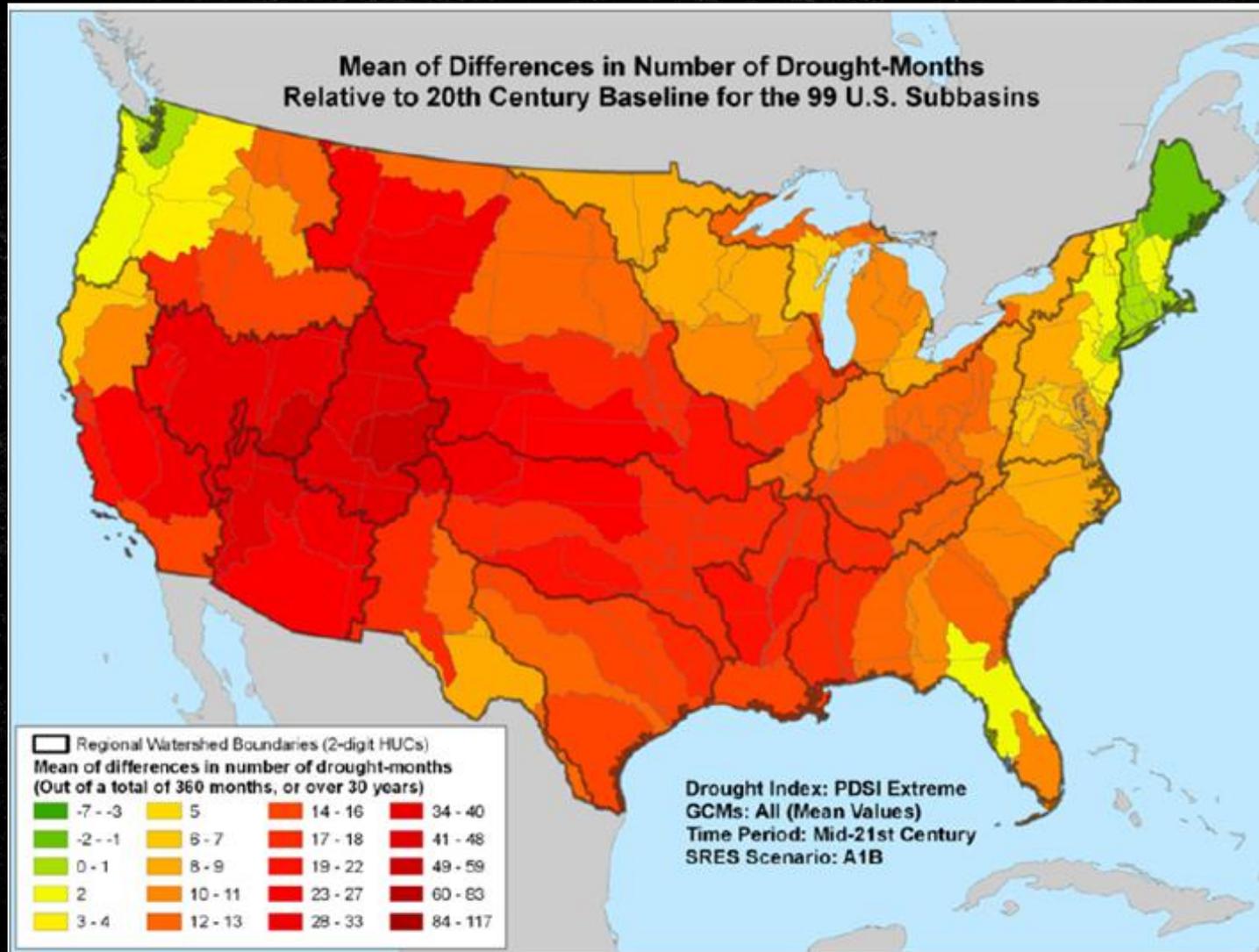
Increasing Temperature



Increasing Temperature

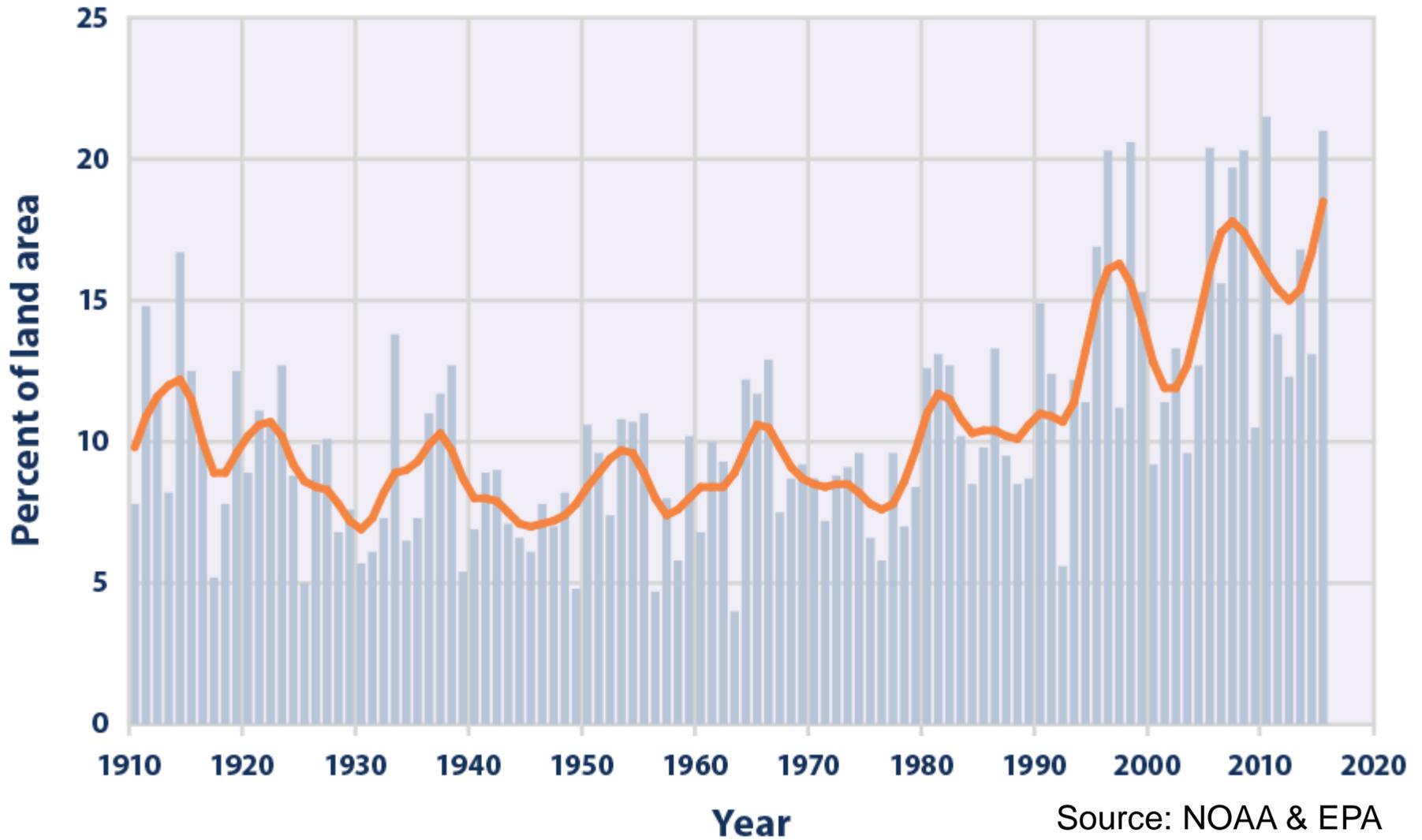


Increasing Drought



Increasing Heavy Precipitation

Extreme 1-day Precipitation Events



Source: NOAA & EPA

Loss of Soil Organic Carbon (0-15 cm)

Yrs.	Soil	Uncultivated SOC (%)	Cultivated SOC (%)	Author
60	Alboll	5.96	4.16	Anderson
2	Andept	10.8	8.5	Wood
40	Aqualf	1.72	1.18	Sharpley
16	Aquoll	5.58	3.26	Dormaar
14	Boralf	2.69	1.32	Newton et al.
20	Boroll	2.79	1.41	Dormaar
54	Fluvent	2.47	1.21	Haas & Evans



Addressing these Challenges with the Principles of Soil Health (USDA-NRCS)

Keep the Soil Covered as Much as Possible

Disturb the Soil as Little as Possible

Keep Plants Growing Throughout the Year

Maximize Plant & Animal Species Diversity



Key Soil Health Practice: No-Till

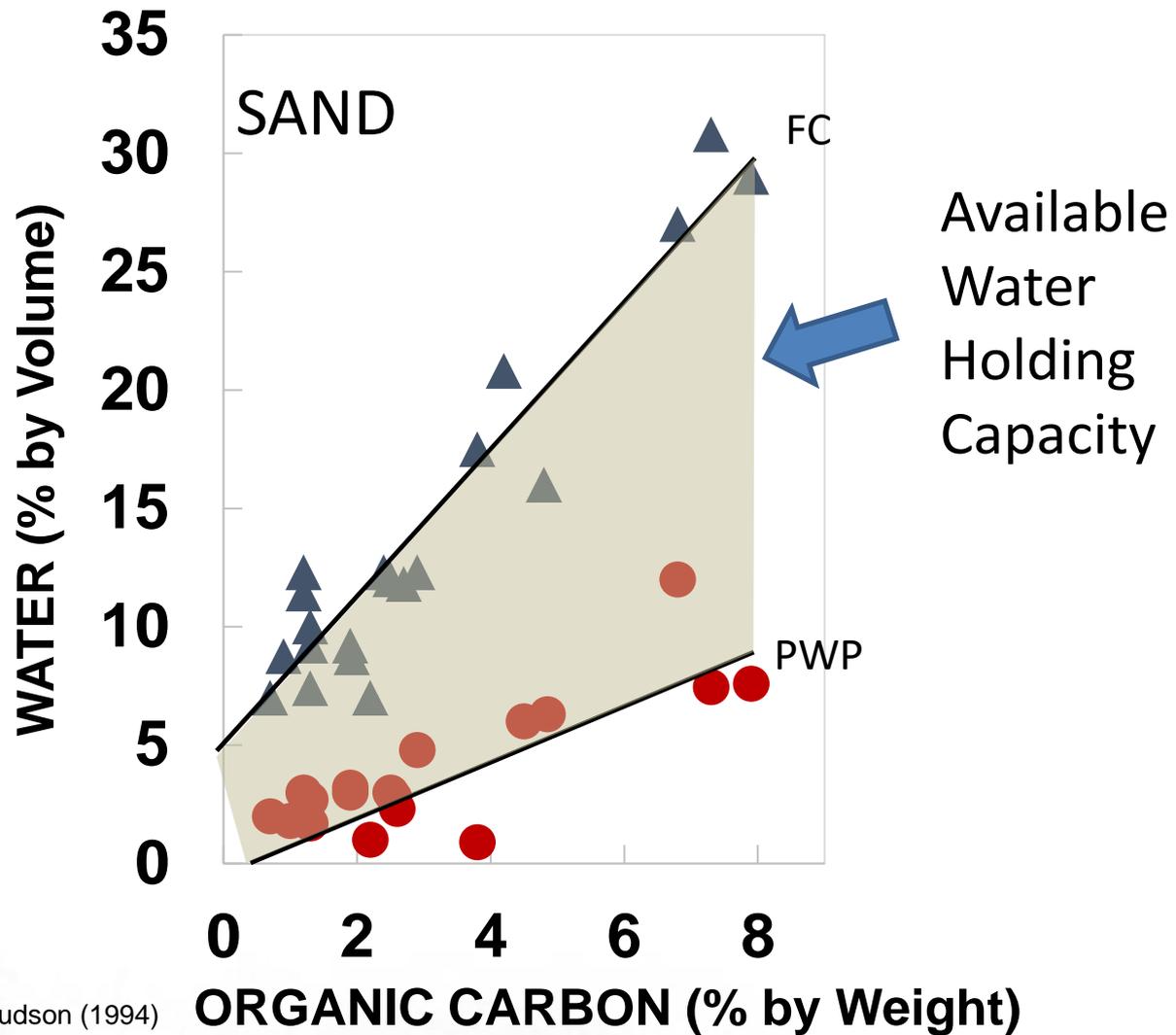


Improving Soil Health

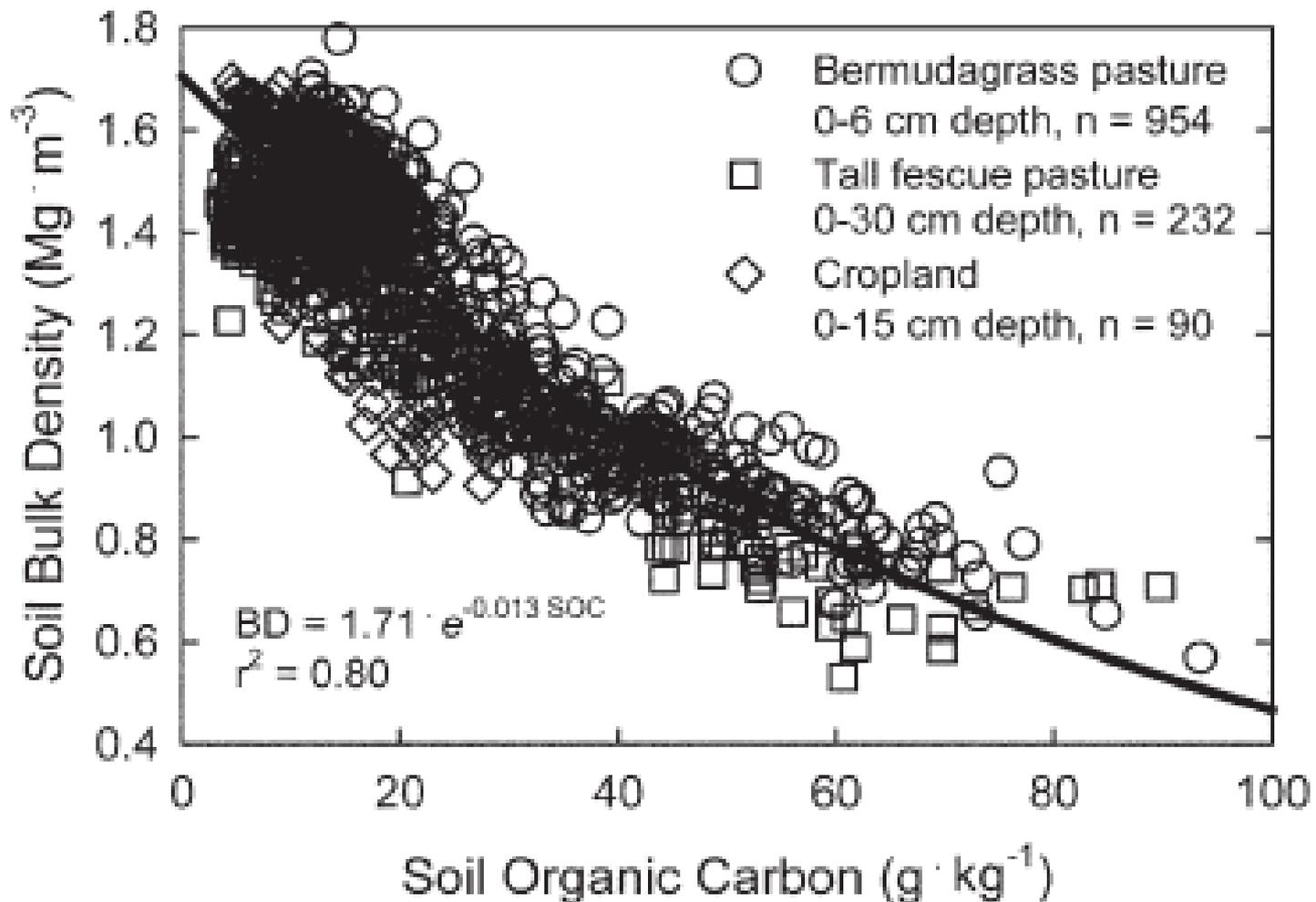
Soil Organic C (Mg/ha)



LOC	YR	Depth (cm)	Soil	CT	NT	Author
AL	2.5	30	Paleudult	23.5	26.2	Terra et al.
IA	15	20	Hapludoll	60.3	71.1	Karlen et al.
IL	8-9	30	Argialboll	46.4	58.5	Yang & Wander
IN	11	20	Haplustoll Haplaquoll	60.0	73.0	Elliott et al.
KY	5	30	Paleudalf	45.9	52.8	Blevins et al.
NE	24	30	Argiudoll	63.3	75.3	Varvel & Wilhelm



Adapted from Hudson (1994)



Georgia studies – Typic Kanhapludults
 Franzluebbers (2010) SSSAJ 74:347–357



Key Soil Health Practice: Cover Crops

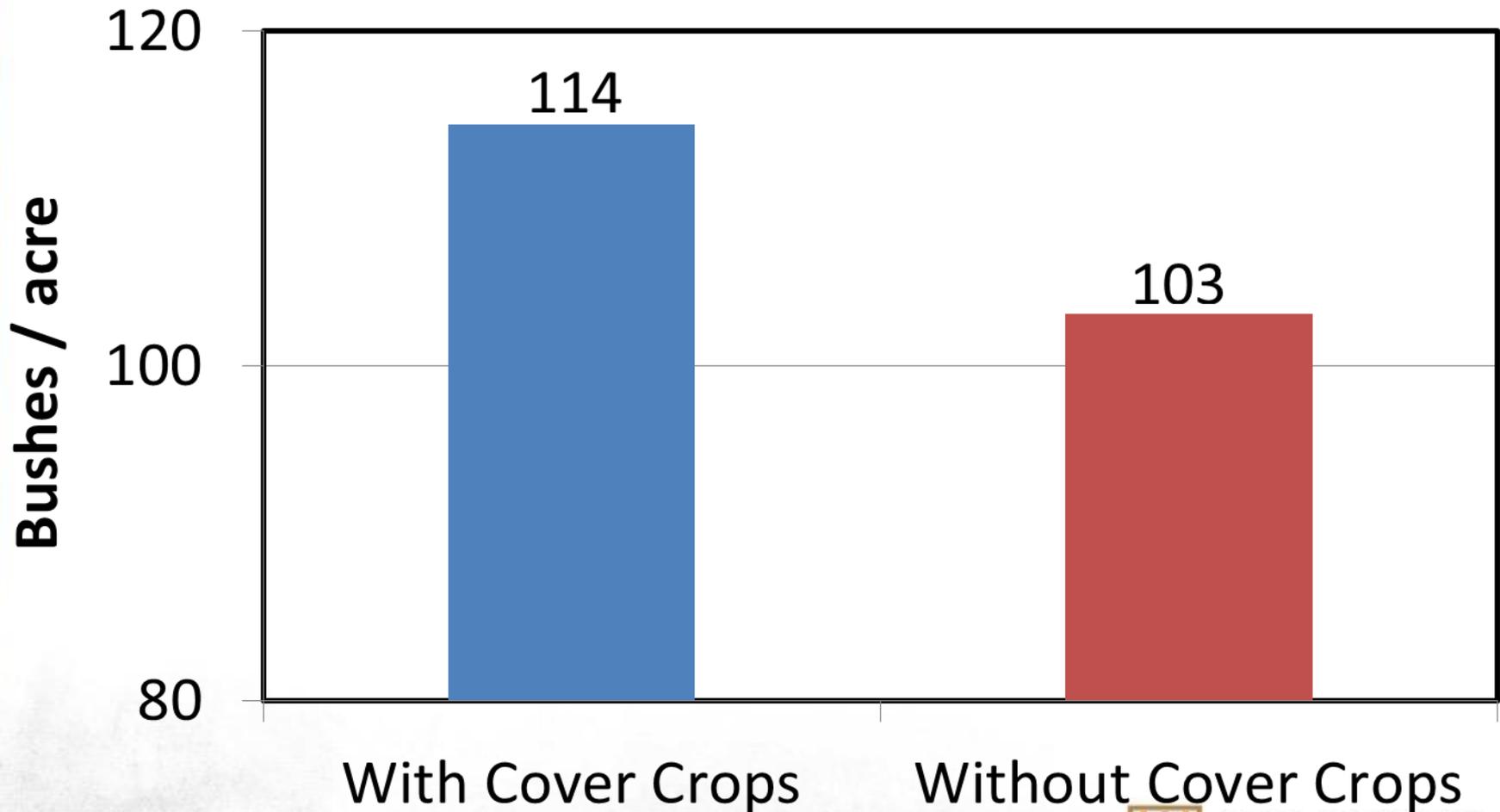


(Derpsch, 2005)



USDA-SARE, CTIC Survey

2012 Corn Yield Drought States



Tillage & Cover Crop Impacts on Infiltration Rate

Location	Years	Tillage & Crop	Impact on Infiltration Rate	Reference
KS	15	NT Winter Wheat-Sorghum	182% Increase with Cover Crop	Blanco-Canqui et al. (2011)
MD	11	NT Corn	164-462% Increase with Cover Crop (different sites & years)	Steele et al. (2012)
KS	11	NT Wheat-Sorghum-Fallow	132-194% Increase with No-Till	Stone and Schlegel (2010)
Malawi	3	NT Corn	165% Increase in No-Till	TerAvest et al. (2015)



Infiltration – Brookings County, SD



Water Quality Benefits









Tillage & Cover Crop Impacts On Soil & Nutrient Losses



State	Tillage & Crop	Cover Crop	Soil Loss	Nitrate N Loss	Soluble P Loss	Reference
			-----	(lbs/ac/yr)	-----	
AL	CT Cotton	None	1997	3.07	0.36	Yoo et al. (1998)
	NT Cotton	None	953	1.25	0.28	
	NT Cotton	W. Wheat	232	0.50	0.14	
GA	CT Corn	None	3271	--	0.25	Langdale et al. (1985)
	CT Corn	W. Rye	838	--	0.27	
KY	CT Corn	None	--	2.20	0.44	Klausner et al. (1974)
	NT Corn	Ryegrass	--	1.26	0.12	
	CT Wheat	None	--	1.02	0.29	
	NT Wheat	Rye/Alfalfa	--	0.83	0.15	
MD	CT Corn	None	234	0.32	0.01	Angle et al. (1984)
	NT Corn	Barley	29	0.04	0.01	
MO	NT Soybean	None	1333	3.00	0.41	Zhu et al. (1989)
	NT Soybean	Chickweed	208	0.69	0.15	
	NT Soybean	C. Bluegrass	83	0.79	0.38	
	NT Soybean	D. Brome	105	0.75	0.24	



Cover Crop Impacts on Nitrate Leaching

Location	Cover Crop	Reduction in Nitrate Leaching (%)	Reference
CA	Rye	65-70	Wyland et al. (1996)
DE	Rye	30	Ritter et al. (1998)
France	Ryegrass	63	Martinez and Guirard (1990)
IN	Winter Wheat (and reduced fertilizer)	61	Kladivko et al. (2004)
IA	Rye	61	Kaspar et al. (2007)
KY	Rye	94	McCracken et al. (1994)
KY	Hairy Vetch	48	McCracken et al. (1994)
MD	Rye	77	Staver and Brinsfield (1990)
MD	Rye	80	Staver and Brinsfield (1998)
MI	Rye	28-68	Rasse et al. (2000)
MN	Rye	13	Strock et al. (2004)

Enriching Soil, Enhancing Life

AN ACTION PLAN FOR SOIL HEALTH



1. Research
2. Measurements
3. Economics
4. Communications & Education
5. Policy



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