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**“The Soil that Feeds Us –
Cultivating healthier food and a healthier
environment on the farm”**

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*Innovative Farmer -Scientist Partnerships
for Soil Health*

Sustainability Indicators

Economic

Farm profitability
Operating costs
Income variability
Financial risks

Food costs

Environmental

Energy efficiency
Soil & Water quality
Soil erosion
Wildlife protection

Pesticide impact

Social

Yields
Food quality
Farmland protection
Farmworker salaries
& benefits
Well-being of farm
communities

Source: Sustainability indicators for measuring farming system performance (Reganold, 2013) – adapted from Chiras and Reganold (2010). Reganold, JP. Comparing organic and conventional farming systems: metrics and research approaches. *Crop Management* 2013 doi:10.1094/CM-2013-0429-01-RS.

“Natures Way”

- ▶ Grows a skin for living systems
- ▶ Cycles nutrients
- ▶ Diverse, no monoculture
- ▶ Seeks balance
- ▶ Cost effective (no one was paying to fertilize the prairie for the Buffalo)



Source: R. Haney, PhD, USDA-ARS, Temple, TX. *Soil Health*. Available at: www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_043902.pdf

How Do We Do It?



- ▶ Strip off the soil's skin
- ▶ Destroy organic matter
- ▶ Increase erosion

- ▶ Increase inputs
- ▶ Waste water



Source: R. Haney, PhD, USDA-ARS, Temple, TX. *Soil Health*. Available at: www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_043902.pdf

Working with the system

Go out to where nature has not been disturbed, look at what it is doing and copy it!" – Paul Gautschi

Why mimic nature?

- ▶ It has been doing R&D much, much longer than us
- ▶ It fills niches
- ▶ It creates balance
- ▶ It recycles nutrients
- ▶ It conserves water
- ▶ It is tenacious



Dr. Rick Haney, PhD, USDA-ARS, Temple, TX. *Soil Health*. Available at: www.ars.usda.gov/ARS/Handlers/Download.do

Source: www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_043902.pdf

What Can We Do?

- ▶ Put the skin back on the soil using no-till and mixed species cover crops, which will decrease erosion and inputs
- ▶ Be innovative and tenacious

Dr. Rick Haney, PhD, USDA-ARS, Temple, TX. *Soil Health*. Available at: [DA-ARS, Temple, TX. Soil Health. Available](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_043902.pdf) www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_043902.pdf



Farmer Gabe Brown

Farm and Ranch Guide – NRDC Awards Gabe Brown

2012 “**Growing Green Award**”

View video at:



http://www.youtube.com/watch?v=Fcqs8Ct-2uE&feature=player_embedded#t=10

Keys to Achieving a Healthy Soil

- ▶ Least amount of mechanical disturbance as possible
- ▶ Armor on the soil surface
- ▶ Plant diversity
- ▶ Living roots as long as possible
- ▶ Integration of livestock on cropland

Source: G. Brown. *Grazing Cover Crops and Benefits for Livestock Producers*. National Conference on Cover Crops and Soil Health, SARE-USDA, February 17th-19th 2014, Omaha, Nebraska



Source: G. Brown. *Grazing Cover Crops and Benefits for Livestock Producers*. National Conference on Cover Crops and Soil Health, SARE-USDA, February 17th-19th 2014, Omaha, Nebraska

Cover Crops

- ▶ ▪ Provide crop diversity
- ▶ ▪ Provide soil surface armor
- ▶ ▪ Build soil aggregates
- ▶ ▪ Improve the water cycle
- ▶ ▪ Integrated Pest Management
- ▶ ▪ Build soil organic matter
- ▶ ▪ Nutrient cycling
- ▶ ▪ Enhance pollinators
- ▶ ▪ Adjust carbon/nitrogen ratios
- ▶ ▪ Wildlife winter food & shelter
- ▶ ▪ Livestock integration

Source: G. Brown. *Grazing Cover Crops and Benefits for Livestock Producers*. National Conference on Cover Crops and Soil Health, SARE-USDA, February 17th-19th 2014, Omaha, Nebraska

Cover Crops



Source:

R. Haney, PhD, USDA-ARS, Temple, TX. *Soil Health*. Available at:
www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_043902.pdf



Phacelia and a Native Pollinator

Source: G. Brown. *Grazing Cover Crops and Benefits for Livestock Producers*. National Conference on Cover Crops and Soil Health, SARE-USDA, February 17th-19th 2014, Omaha, Nebraska

Widespread impacts of neonicotinoids 'impossible to deny'. Neonicotinoid pesticides are causing significant damage to a wide range of beneficial species and are a key factor in the decline of bees, say scientists. **BBC** June 23, 2014

<http://www.bbc.com/news/science-environment-27980344>



Lady Beetles (Predators)

Source: G. Brown. *Grazing Cover Crops and Benefits for Livestock Producers*. National Conference on Cover Crops and Soil Health, SARE-USDA, February 17th-19th 2014, Omaha, Nebraska



A Diverse Primer is Ready to Graze!

Source: G. Brown. *Grazing Cover Crops and Benefits for Livestock Producers*. National Conference on Cover Crops and Soil Health, SARE-USDA, February 17th-19th 2014, Omaha, Nebraska.

Diversity

- ▶ Sunflower
- ▶ Sorghum/sudangrass
- ▶ German millet
- ▶ Soybean
- ▶ Cowpea
- ▶ Kale
- ▶ Radish
- ▶ Turnip
- ▶ Sunn Hemp
- ▶ Safflower
- ▶ Buckwheat
- ▶ Fava Bean

Persian Clover
Berseem Clover
Hairy Vetch
Hybrid Pearl Millet
Crimson Clover
White Millet
Oats
Flax

Source: G. Brown. *Grazing Cover Crops and Benefits for Livestock Producers*. National Conference on Cover Crops and Soil Health, SARE-USDA, February 17th-19th 2014, Omaha, Nebraska.



Diversity Drives Soil Health

Soil Health Tool/Methods

The Soil Health Tool (SHT):

- ▶ “relies on information gleaned from newly developed soil-testing methods geared towards soil microbial activity and the readily available substrate that they act upon. In other words, we assess the soil as a doctor might assess a living being, using many measurements of health viewed collectively to attain an overall picture of soil vigor.”

Dr. Rick Haney, PhD, USDA-ARS, Temple, TX. *Soil Health*. Available at: www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_043902.pdf

Questions about Soil Health?

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Source: Rick Haney, PhD, USDA–ARS, Temple, TX, *Soil Health*. Available at:
http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_043902.pdf

Soil Quality/Food Quality



Sources: Reganold JP, Andrews PK, Reeve, JR, et al. Fruit and soil quality of organic and conventional strawberry agroecosystems. *PLoS ONE*. 2010;5(9): e12346. doi:10.1371/journal.pone.0012346.

Reganold, JP. Comparing organic and conventional farming systems: metrics and research approaches. *Crop Management*. 2013; doi:10.1094/CM-2013-0429-01-RS



Healthy!

Sources: G. Brown. *Grazing Cover Crops and Benefits for Livestock Producers*. National Conference on Cover Crops and Soil Health, SARE-USDA, February 17th–19th 2014, Omaha, Nebraska.

Stelzer C. *Mob Grazing: 21st Century Grazing Management. A comprehensive guide to implementing and managing a grazing operation in the 21st century*. Agricultural Insights (eBook); 2012

Additional Resources

(web-based)

Gabe Brown Ranch:

<http://brownsranch.us/>

Brown's Ranch Facebook page:

<https://www.facebook.com/pages/Browns-Ranch/106328396064498?fref=ts>

Soil Matters on the Farm (video)

<https://www.facebook.com/iwla.org>

<http://www.youtube.com/watch?v=QtRKxBZ1Y3Q>

Dr. Rick Haney (USDA-ARS, Soil Scientist, Temple, TX):

<http://www.ars.usda.gov/pandp/people/people.htm?personid=31733>

<http://woodsend.org/soil-health-tool/overview/>

Dr. Kristine Nichols (USDA-ARS, Soil Microbiologist, Mandan, ND):

<http://www.ars.usda.gov/pandp/people/people.htm?personid=35170>

Additional Resources

(print-based)

Academy of Nutrition and Dietetics: Standards of Professional Performance for Registered Dietitian Nutritionists (Competent, Proficient, and Expert) in Sustainable, Resilient, and Healthy Food and Water Systems. *J Acad Nutr Diet.* 2014;114:475–488

Ohlson K. *The Soil Will Save Us: How Scientists, Farmers, and Foodies are Healing the Soil to Save the Planet.* New York: Rodale Press; 2014.

Reganold, JP. Comparing organic and conventional farming systems: metrics and research approaches. *Crop Management* 2013 doi:10.1094/CM-2013-0429-01-RS.

Underwood T, McCullum-Gomez C, Harmon A, Roberts S. Organic agriculture supports biodiversity and sustainable food production. *J Hunger Environ Nutr.* 2011;6:398–423.