

Underground Economics: Making Markets to Solve Cities' Problems through Topsoil Formation



By Way of Introduction

Cimarron Farm, St. Albans, VT

Carbon Farmers of America

New Soil Matrix

New Soil Quantum

Soil Carbon Coalition







Opening Assumptions

- ✿ Increasing Soil Carbon: Key to Environmental Security, Rural and Urban Economic Development
- ✿ Cities need the environmental services offered by covered, aggregated, high-carbon soils on a landscape scale
- ✿ The watershed and global services generated by soil are decreasing in supply, increasing in demand.
- ✿ Topsoil can be built pretty quickly
- ✿ Cities need it, land managers can produce it: Let the markets begin (!?)

"Do civilizations fall because the soil fails to produce - or does a soil fail only when the people living on it no longer know how to manage their civilization?"

Charles E. Kellog, Soils and Men, the 1938 United States Department of Agriculture Yearbook of Agriculture

Accelerated topsoil formation on agricultural, grazing and desert land addresses natural resource problems at local-global scales

- ✿ Increased agricultural production
- ✿ Water storage and purification in soils and aquifers
- ✿ Mitigation of flooding, drought, wildfire, erosion, dust-storms, eutrophication and ocean dead-zones
- ✿ Climate change mitigation and adaptation

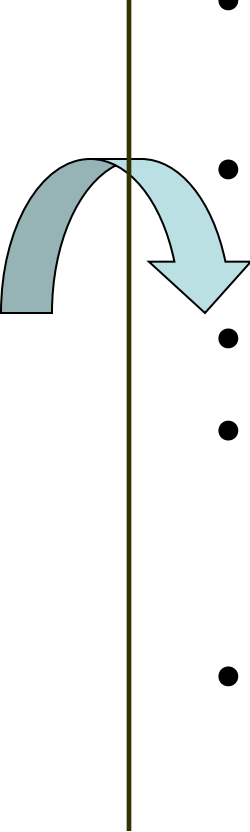
CURRENT Payment for Environmental Services (PES) Markets are establishing around the world.

- ✿ Water is “the new oil.”
- ✿ Carbon Markets
- ✿ Wetland and Habitat Mitigation Banking
- ✿ Payment for Watershed Services

NEW PES market opportunities through topsoil formation:

- ✿ Natural hazards mitigation
- ✿ Municipal water provision through:
 - ✿ Increased infiltration of precipitation resulting in groundwater recharge and purification
 - ✿ Restoration and flow maintenance of surface waters
 - ✿ Water efficiency enabled by reduced irrigation

Quantify and scale solutions from the farm and ranch to solve watershed-wide problems

- Improved:
 - Soil cover
 - Soil Diversity
 - Soil carbon
 - Soil crumb structure
 - Depth of topsoil
- 
- Increased production, quality and food security
 - Regional hydrological regulation
 - Decreased natural hazards
 - Decreased reliance on irrigation and fossil fuel inputs
 - Climate change mitigation and adaptation

Paying land managers to rebuild soils
is smart urban planning.

What does security and wealth for our city look like?

- Functional hydrology: Groundwater recharge, flowing streams and rivers, sustained reservoir recharge, clean water.
- Minimized flooding, drought, wildfire, dust storms, wildfires, eutrophication
- Opportunities for import substitution: Insurance, dams and pipelines, disaster clean-up, digging out roadside ditches, dam silting, etc.
- Strong agriculture and ranching economics in the hinterland

Cases in Point:

New York City Watershed Investment

- 1989 EPA Surface Water Treatment regulations
- Early 90's – Water quality was at a point that a filtration plant would be needed. Estimated Cost: \$6-8 billion construction, \$300 million annual operating costs.
- Unless- high water quality standards could be demonstrated and guaranteed.
- Outcome: \$1.5 billion investment in implementation of best management practices on farms, the upgrade of wastewater treatment facilities, the rehabilitation of septic systems, the improvement of storm water runoff systems and acquisition of land from upstate landowners on a voluntary basis

Suan and Bhodi, Northern India

- The wells were running dry in the village of Suan
- Upstream, in Bhodi, deforestation and poor grazing management.
- People in Suan re-planted the slopes around Bhodi.
- Bhodi residents worked to improve grazing and agricultural management.
- Bhodi: Increased fodder and fuel
- Suan: More well water, less damage from upstream erosion.

B2B: Vittel, France

- Nitrate and pesticide contamination of a lucrative mineral water source. Nestle Waters became concerned.
- A private deal with local farmers was established in which long-term improved agricultural management was rewarded at a rate of \$110/acre/yr for 5 years
 - 18- or 30-year contracts.
 - ~\$200k per farm for equipment and building upgrades
 - Free labour to apply compost in farmers' fields.
 - Free technical assistance

The Regenerative Agricultural Canon

~ 40 tools to rapidly build new soil:

Producer Leadership

| Holistic Management® Model | | | | | | | |
|----------------------------------------|----------------------|------------------------------------------------------|---------------------|-----------------------|-----------------------------|----------------|-------------------------------|
| ★ | Statement of Purpose | | | | | | |
| Whole Under Management | Decision Makers | Resource Base | | | Money | | |
| Holistic Goal | Quality of Life | Forms of Production | | | Future Resource Base | | |
| Ecosystem Processes | Community Dynamics | | Water Cycle | Mineral Cycle | Energy Flow | | |
| Tools for Managing Ecosystem Processes | Human Creativity | Technology Rest Fire Grazing | | Animal Impact | Living Organisms | Money & Labor | |
| Testing Guidelines | Cause & Effect | Weak Link • Social • Biological • Financial | Marginal Reaction | Gross Profit Analysis | Energy/Money Source & Use | Sustainability | Society & Culture |
| Management Guidelines | Learning & Practice | Organization & Leadership | Marketing | Time | Stock Density & Herd Effect | Cropping | Burning Population Management |
| Planning Procedures | Financial Planning | | Land Planning | | Grazing Planning | | |
| Feedback Loop | Replan | | Plan (assume wrong) | | Monitor | | Control |

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Gene Goven and Gabe Brown: The Burleigh County Boys and their Cover Crop Cocktails



Images Courtesy of
Gabe Brown

65 Days After Seeding, Then Grazed



Grazed Cocktail Cover Crops: Results

- Gabe Brown's 4,000 acre farm in North Dakota:
 - 265% increase in organic matter in 11 years
 - 12-fold increase in water infiltration: ½"/hour to 6"/hour
 - 13.6" of rain in 22 hours: zero erosion
 - 10% fertilizer use of the county average
 - 25% herbicide use of the county average
 - 117 bushel corn yield compared to 70 bushel county average

“US EPA: N and P reduction of 45% necessary to reduce the Gulf dead zone to a reasonable size”



Filling in the Gaps: Tools and Capabilities to Facilitate Markets for Watershed Services

- Managers who can deliver
- Monitor, Model, Communicate, Value, Plan, Broker, Execute
- We need to be able to think in whole watersheds, underground and aboveground and across time.

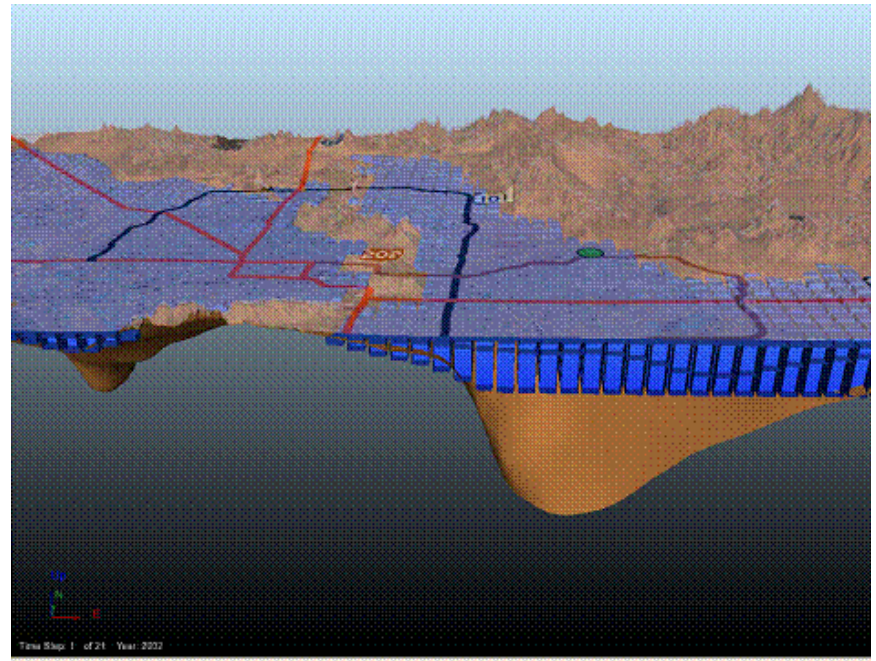
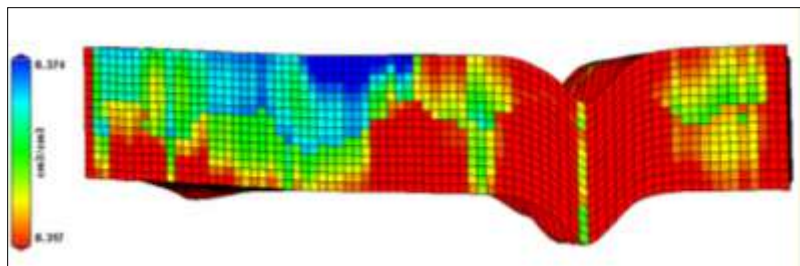
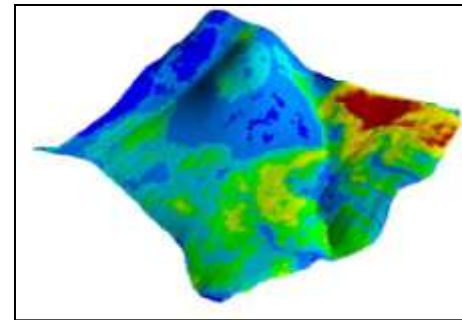
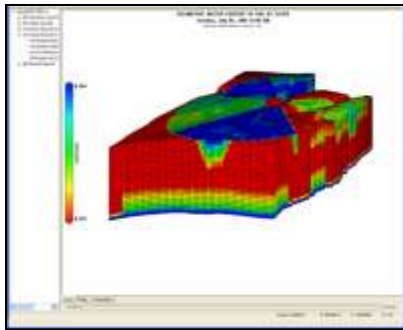


Image:ASU Decision-Support Theatre

Landscape-Scale Soil Monitoring and Quantification of Services Provision

- Quantifies provision of range of environmental services benefits arising from soil formation
- Accounts for spatial variability in soils
- 4' plus depth

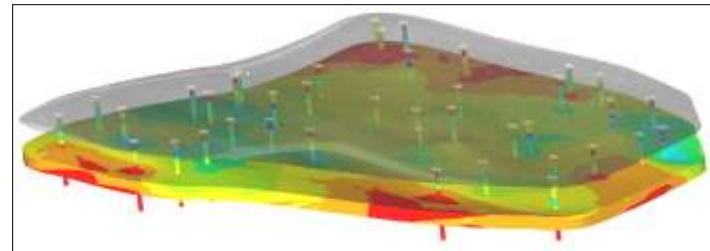


The New Soil Matrix

Operating System for the Soil Age

Decision Support Tools for:

- Accelerated topsoil by ranchers, pastoralists and farmer
 - Quantification and monetary valuation of resulting environmental services
- Artificial Intelligence assisted future resource base scenario modeling and policy formation by urban, corporate, NGO and government managers
 - Performance-based Water, Carbon, Biodiversity and Risk Mitigation environmental markets.



Building Momentum

- Prove our case with monitoring, demonstrate that we can solve cities problems cost-effectively, soon, lastingly.
- Make use of information technology to communicate the complexity of nature working.
- Live like it's the last day of your life, ranch like the future depends on it.

The Soil Carbon Challenge

- ❶ Soil Carbon Coalition
- ❷ An X-Prize style challenge to see how fast land managers can increase carbon in soils.
- ❸ Please join.
- ❹ www.soilcarboncoalition.org



Tony Malmberg

Map of Soil Carbon Changes



www.soilcarboncoalition.org