

# The Farm as Ecosystem

TAPPING NATURE'S RESERVOIR —  
BIOLOGY, GEOLOGY, DIVERSITY



Jerry Brunetti

---

# Table of Contents

1. Cover Page
2. Title Page
3. Copyright Page
4. About the Author
5. Introduction
6. 1 Soil as a Supraorganism the Physical Nature of Soil
  1. Getting Grounded
7. 2 The Mineral Nature of Soil
  1. Minerals to Resist Drought?
8. 3 Trace Elements the Mighty Micronutrients
  1. The Major Micronutrients
  2. Other Trace Mineral Considerations
9. 4 The Biological Nature of Soil
  1. Grow Foods and Go Foods
  2. An Invitation to Become a Legume
  3. Shalajit: Humus for Humans
  4. Looking for Mr. Goodbug
  5. Parasitic Nematodes: an Indicator of Soil Sickness
10. 5 Compost and Compost Teas
  1. Digestion as a Factor in Disease
  2. Compost Tea Trials
  3. From Compost to Tea
  4. From Laboratory to Landscape
  5. Vermicompost: Hi Test Worm Juice
  6. Industrial Yogurt
11. 6 Foliar Nutrition
  1. Appliances to Monitor Progress
  2. Some Foliars and Non-Foliars to Consider
  3. Some Homemade Foliars
12. 7 The Eternal Earthworm
13. 8 Water a Medium for Metamorphosis
14. 9 Systemic Acquired Resistance and Induced Systemic Resistance
  1. Indirect versus Direct Responses
  2. Combined Internal/External Responses
  3. Essential Oils
  4. Plant Responses—Grow or Defend
  5. Psm Benefits
15. 10 Our Precious Pollinators and Predators
  1. Some Forage Plants for Wild Pollinators
  2. Pesticides to Be Aware of
16. 11 Cover Crops Farming in Nature's Image
  1. Carbon to Nitrogen Ratios ("Go" Foods vs. "Grow" Foods)
  2. Weed Suppression and Allelopathy
  3. Cocktail Cover Cropping
  4. Growing Humus with Cover Crops—a Bed at a Time

- 
17. 12 The Tools of the Trade
    1. Using the Soil Test Health Card
    2. Total Organic Matter
    3. Active Carbon
    4. Potentially Mineralizable Nitrogen
    5. Root Health Assessment
    6. Pocket Tools: High-Tech, Fast, and Easy
    7. Ph Meters
    8. Refractometers
    9. Penetrometers
    10. Electrical Conductivity
    11. Ion-Selective Meters
    12. Chlorophyll
    13. Oxidation Reduction Potential (Orp)
    14. Infrared (Ir) Thermometer
    15. Pdsm (Phil Callahan Soil Meter)
    16. Sampling Tools
    17. Soil Tests with Morgan Extract
  18. 13 Back to the Future a Permanent Agriculture
  19. Additional Resources
    1. Pollinators
    2. Cover Crops
    3. Tools of the Trade
  20. Recommended Reading
  21. Index

---

# List of Pages

1.	i
2.	iii
3.	v
4.	vi
5.	viii
6.	ix
7.	x
8.	xi
9.	xii
10.	xiii
11.	xiv
12.	xv
13.	1
14.	2
15.	3
16.	4
17.	5
18.	6
19.	7
20.	8
21.	9
22.	10
23.	11
24.	12
25.	13
26.	14
27.	15
28.	16
29.	17
30.	18
31.	19
32.	20
33.	21
34.	22
35.	23
36.	24
37.	25
38.	26
39.	27
40.	28
41.	29
42.	30
43.	31
44.	32
45.	33
46.	34

---

47. 35  
48. 36  
49. 37  
50. 38  
51. 39  
52. 40  
53. 41  
54. 42  
55. 43  
56. 44  
57. 45  
58. 46  
59. 47  
60. 48  
61. 49  
62. 50  
63. 51  
64. 52  
65. 53  
66. 54  
67. 55  
68. 56  
69. 57  
70. 58  
71. 59  
72. 60  
73. 61  
74. 62  
75. 63  
76. 64  
77. 65  
78. 66  
79. 67  
80. 68  
81. 69  
82. 70  
83. 71  
84. 72  
85. 73  
86. 74  
87. 75  
88. 76  
89. 77  
90. 78  
91. 79  
92. 80  
93. 81  
94. 82  
95. 83  
96. 84  
97. 85

---

98.	86
99.	87
100.	88
101.	89
102.	90
103.	91
104.	92
105.	93
106.	94
107.	95
108.	96
109.	97
110.	98
111.	99
112.	100
113.	101
114.	102
115.	103
116.	104
117.	105
118.	106
119.	107
120.	108
121.	109
122.	110
123.	111
124.	112
125.	113
126.	114
127.	115
128.	116
129.	117
130.	118
131.	119
132.	120
133.	121
134.	122
135.	123
136.	124
137.	125
138.	126
139.	127
140.	128
141.	129
142.	130
143.	131
144.	132
145.	133
146.	134
147.	135
148.	136

---

149. 137  
150. 138  
151. 139  
152. 140  
153. 141  
154. 142  
155. 143  
156. 144  
157. 145  
158. 146  
159. 147  
160. 148  
161. 149  
162. 150  
163. 151  
164. 152  
165. 153  
166. 154  
167. 155  
168. 156  
169. 157  
170. 158  
171. 159  
172. 160  
173. 161  
174. 162  
175. 163  
176. 164  
177. 165  
178. 166  
179. 167  
180. 168  
181. 169  
182. 170  
183. 171  
184. 172  
185. 173  
186. 174  
187. 175  
188. 176  
189. 177  
190. 178  
191. 179  
192. 180  
193. 181  
194. 182  
195. 183  
196. 184  
197. 185  
198. 186  
199. 187

---

200. 188  
201. 189  
202. 190  
203. 191  
204. 192  
205. 193  
206. 194  
207. 195  
208. 196  
209. 197  
210. 198  
211. 199  
212. 200  
213. 201  
214. 202  
215. 203  
216. 204  
217. 205  
218. 206  
219. 207  
220. 208  
221. 209  
222. 210  
223. 211  
224. 212  
225. 213  
226. 214  
227. 215  
228. 216  
229. 217  
230. 218  
231. 219  
232. 220  
233. 221  
234. 222  
235. 223  
236. 224  
237. 225  
238. 226  
239. 227  
240. 228  
241. 229  
242. 230  
243. 231  
244. 232  
245. 233  
246. 234  
247. 235  
248. 236  
249. 237  
250. 238



---

251. 239  
252. 240  
253. 241  
254. 243  
255. 244  
256. 245  
257. 246  
258. 247  
259. 248  
260. 249  
261. 250  
262. 251  
263. 252  
264. 253  
265. 254  
266. 255  
267. 256  
268. 257  
269. 259  
270. 260  
271. 261  
272. 262  
273. 263  
274. 264  
275. 265  
276. 266  
277. 267  
278. 268  
279. 269  
280. 270  
281. 271  
282. 272  
283. 273  
284. 274  
285. 275  
286. 276  
287. 277  
288. 278  
289. 279  
290. 280  
291. 281  
292. 282  
293. 283  
294. 284  
295. 285  
296. 286  
297. 287  
298. 288  
299. 289  
300. 290  
301. 291

---

302. 292  
303. 293  
304. 294  
305. 295  
306. 296  
307. 297  
308. 298  
309. 299  
310. 300  
311. 301  
312. 302  
313. 303  
314. 304  
315. 305  
316. 306  
317. 307  
318. 308  
319. 309  
320. 310  
321. 311  
322. 312  
323. 313  
324. 314  
325. 315  
326. 316  
327. 317  
328. 319  
329. 320  
330. 321  
331. 323  
332. 324  
333. 325  
334. 326  
335. 327  
336. 328  
337. 329  
338. 330  
339. 331  
340. 332  
341. 333  
342. 334  
343. 335  
344. 336

---

# ADVANCE PRAISE FOR THE FARM AS ECOSYSTEM

“One of the most important reference books for the twenty-first century—how do we feed 9 billion people without destroying more precious ecosystems and without having to use toxic chemicals and GMOs? Every farmer, agronomist, and policy maker must read this book and, most importantly, must ensure that this valuable scientific knowledge and the proven best practices are widely adopted to make agriculture truly ecologically sustainable.”

*Andre Leu, president, International Federation of Organic Agriculture Movements*

“Few people understand the elements of the soil and animal husbandry better than Jerry Brunetti and it is evident in this book. We ignore the knowledge within at our own peril. It is obvious that Jerry’s writing comes from an ‘illuminated mind.’ This book should be on the shelf of every farmer and grower’s library.”

*David Kline, editor, Farming magazine*

“Jerry Brunetti is one of the brightest people I know in biological farming. His book is a treasure of concepts and strategies that will maximize soil fertility to grow nutritionally dense food that will improve your health. Highly recommended.”

*Dr. Joseph Mercola, founder, [Mercola.com](http://Mercola.com)*

“Because I hold the scientific understanding of an evolving Universe and Earth as central to transforming our planet’s crises, it is a relief to listen to an interpretation of farming as primarily the work Earth has been doing for 3.8 billion years since learning to eat photons of the sun’s energy and transform them into life. Everything Earth does to feed all living creatures since the creation of photosynthesis should be the essential guidance that humans need to participate in the mystery, miracle, and craft that we call agriculture. Jerry’s insights into this guidance should make leaders in the present industrial food system blush with shame, as should the leaders in Western education, medicine, religion, economics, and politics for condoning it through their endorsements or through their silence.”

*Sister Miriam MacGillis, founder and director, Genesis Farm*

“Crucial to a new generation of farmers. Jerry combines the magic of biology and the science of chemistry, and puts them both in service of a new kind of farm—which is really a whole functioning ecology.”

*Jack Kittredge, editor, The Natural Farmer*

“Jerry Brunetti has captured both the philosophy and practice of farming in his book *The Farm as Ecosystem*

---

as he reminds us that sustainable farming is much more than just crop and animal production. It involves the management of an ecology encompassing all of the physical, chemical, biological, and social factors that sustain a healthy society. Jerry starts with the soil and shows how everything provides an important contribution to the integrated whole of farming. He describes practical solutions based on perpetual principles to achieve an essential and rewarding contribution to mankind's successful progress. The principles developed in *The Farm as Ecosystem* will guide the avid learner to design a productive architecture as beautiful as it is efficient."

*Don M. Huber, professor emeritus, Purdue University*

---

# **The Farm as Ecosystem**

---

*TAPPING NATURE'S RESERVOIR — BIOLOGY, GEOLOGY,  
DIVERSITY*

---

# **The Farm as Ecosystem**

*TAPPING NATURE'S RESERVOIR — BIOLOGY, GEOLOGY,  
DIVERSITY*

---

*by Jerry Brunetti*

ACRES U.S.A. *Austin, Texas*



---

# **The Farm as Ecosystem**

---

© 2014 by Jerry Brunetti

All rights reserved. No part of this book may be used or reproduced without written permission except in cases of brief quotations embodied in articles and books.

The information in this book is true and complete to the best of our knowledge. All recommendations are made without guarantee on the part of the author and Acres U.S.A. The author and publisher disclaim any liability in connection with the use or misuse of this information.

Acres U.S.A.  
P.O. Box 301209  
Austin, Texas 78703 U.S.A.  
512-892-4400 • fax 512-892-4448  
[info@acresusa.com](mailto:info@acresusa.com) • [www.acresusa.com](http://www.acresusa.com)

Printed in the United States of America

All Wikimedia Commons images licensed under Creative Commons or Creative Commons Share Alike licenses. Information at [creativecommons.org](http://creativecommons.org). Usage of these images does not indicate that the authors endorse this work. All other images © Thinkstock.

Publisher's Cataloging-in-Publication

Jerry Brunetti, 1950–  
The farm as ecosystem / Jerry Brunetti. Austin, TX, ACRES U.S.A., 2014  
xvi, 336 pp., 23 cm.  
Includes index, tables, and illustrations  
ISBN 978-1-60173-041-1 (trade)

1. Agricultural ecology. 2. Soil fertility. 3. Agrobiodiversity.  
I. Brunetti, Jerry, 1950– II. Title.

S589.7 B78 2014  
577.57

---

To my parents, Aurelio and Rena Brunetti, who instilled in me the appreciation that soil, food, taste, health, and joy are contiguous and contagious.

There are so many kindred souls in my community of ecology that I could not even begin to enumerate them all. Suffice it to say that family, loved ones, close friends, office staff here at home, *Acre's U.S.A.* personnel, clients, classmates, fellow activists, mentors and the yeomen, supporters, and fellow members of sustainable and regenerative organizations have all made this text possible, due to their encouragement, love and guidance. A heartfelt salute to those nurturing the landscapes, "walking the talk," and bearing witness to this miraculous mystery of creation.

---

## About the Author

JERRY Brunetti works as a soil and crop consultant, primarily for livestock farms and ranches, assisting these operations as they transition away from petrochemical inputs and adopt the practices necessary for organic certification. He also works toward improving crop quality and livestock performance and health on certified organic farms.

His “connect-the-dots” systems approach aims to help farmers and ranchers understand and then implement practices that demonstrate the connections between the health of people and communities and healthy land, healthy crops, and healthy livestock.

In 1979 Jerry launched Agri-Dynamics, Inc. to provide agronomy and nutritional services to livestock operations. Agri-Dynamics, Inc., now also manufactures an integrative line of complementary animal health products that are natural alternatives to pharmaceutical drugs that are particularly useful for certified organic farms, as well as nutritional supplements and pre-mixes for ruminants, swine, poultry, equine, and pets. In 1990 Jerry cofounded Earthworks, a company that provided ecologically based liquid and dry fertility products to the landscape and golf course industries. He recently launched a new endeavor to provide a line of bio-pesticides and liquid colloidal plant foods to both eco-minded conventional farmers and organic growers.

In 1999 Jerry was diagnosed with non-Hodgkin’s lymphoma and given as little as six months to live without aggressive chemotherapy. He instead chose a holistic path of nutrition, detoxification, and immune modulation and applied his vast experience with farming and animal nutrition to his own health.

The links between healthy soil, truly nutritious food, and profitable, sustainable farming are clearly evident in Jerry’s personal and professional experience, and his skill for communicating this to people has won him extensive praise from holistic health professionals, sustainable farming organizations, and many farmers and consumers. He is in high demand nationally and internationally as a lecturer and speaker, and he often speaks to audiences about the relationship of “Food as Medicine” and “Farm as Pharmacy.”

Some of his presentations are available on DVD, including *The Keys to Herd Health, Holistic Veterinary Care* with veterinarian Hugh Karreman, and *Cancer, Nutrition & Healing*.

Jerry is a member of his local Weston A. Price Steering Committee and served as chairman on the Lower Mt. Bethel Township Environmental Advisory Council. He is an honorary board member of the Weston A. Price Foundation, a board member of the Pennsylvania Association for Sustainable Agriculture, and is active in other community-based organizations devoted to rebuilding local food systems and local democracy. In 2008, Jerry received the Sustainable Agricultural Leadership Award from the Pennsylvania Association for Sustainable Agriculture and the Eco-Agriculture Achievement Award from *Acres U.S.A.*

---

# Introduction

OVER thirty years have passed since I first became immersed in the ever-changing and rapidly evolving world of ecological agriculture, and my understanding of agricultural practices has changed and grown with me. As a young adult I attempted to learn and implement as much as I could on a livestock operation. I witnessed enormous changes in both practice and philosophy on how to best make sustainable agriculture profitable, and I later relinquished a number of beliefs and practices in accordance with that oft-cited minimalist axiom: “Less is more.”

Back in the 1970s, there were very few natural farming resources available, or at least visible, to a seeker of nature’s inner workings. Environmentalism, a relatively new arena of investigation, was not at all in synch with agriculture. Agriculture was already in high gear changing its low-input strategies of diversification and self-support in order to maximize output with the fewest amounts of plant and animal species, using the most mechanized means available with the least amount of human involvement. Consequently, the Green Revolution virtually emptied rural America, thanks to very cheap “prehistoric sunlight” called fossil fuels and the newly developed hybrid plants capable of doubling or trebling their yields as long as addicted crops received their doses of petroleum-based plant foods and pesticides. In tandem with this philosophy of bigger bins, bushels, and tanker loads of milk was the family farm exodus to urban areas, deliberately instigated by government policies to reduce farm gate prices and lower the number of farmers in America.

When I was an animal science major (it used to be called “animal husbandry”), I was advised that putting animals into farms akin to concentration camps and force feeding them only several species of grains fortified with vitamins, minerals, antibiotics, parasiticides, larvacides, coccidiostats, hormones, ionophores, arsenic, recycled manure, and recycled tankage, ad nauseum, would lead to the agricultural equivalent of winning an Olympic gold medal. All of this hoopla was based on the fact that we could now extract more gallons of milk, bushels per acre, and meat per animal-days with the least amount of people doing the work—again, thanks to oil and machines. “Get big and get efficient (or get out)” were the mantras that operators heard from the U.S. agriculture secretaries, the university extension agents, the U.S. Department of Agriculture (USDA), fertilizer salesmen, and conventional veterinarians whose practices depended on “fire engine” medicine (treating acute symptoms created by stress from confinement and crowding). The lending institutions bought into it, thereby only encouraging farmers wanting an industrial economy-of-scale operation, and the inevitable debt and depreciation that followed.

This industrial model of agriculture on steroids has not only created an economic evisceration of rural communities, it has generated untold amounts of environmental damage, such as a dead zone now the size of Massachusetts in the Gulf of Mexico; a “fast food nation,” as investigative journalist and author Eric Schlosser calls it, contributing to runaway diabetes and obesity; a cancer rate now at 41 percent in the United States alone;<sup>\*</sup> and the annihilation of innumerable species due to the elimination of our precious grasslands and hedgerows.

Farmer was pitted against farmer under the myth that “inefficient” farmers were not entitled to contribute to the “problem” of farm surpluses. Under the prevailing popular theory, it would be a good thing for both agriculture and the nation to have only a few mechanized operators remaining.

And that is precisely what occurred. In 1950 there were about 3.5 million operating dairy farms in the United States. As of 2012, we’re down to about 50,000. That’s a 98 percent attrition! The cow numbers have remained consistent, so the rationale is that those farms remaining are the cream of the crop—the most talented and efficient. No doubt many in that 50,000 are indeed good farmers, but there is no doubt as well that those 3

---

million extinguished dairy farms had employed over 12 million people with an unfathomable amount of experience, knowledge, and talent whose loss we as a nation will forever suffer. And that's just dairy. The same consequences were seen for row crops, vegetables, fruits, nuts, poultry, swine, beef, and more.

Back in the 1970s the two main resources I depended on were the Rodale Institute and *Acres U.S.A.* The Northeast Organic Farming Association (NOFA), Maine Organic Farmers and Gardeners Association (MOFGA), Ohio Ecological Farm and Food Association (OEFFA), and TILTH were fledgling foundations. There was no Midwest Organic Sustainable Education Services (MOSES), Pennsylvania Association for Sustainable Agriculture (PASA), or Pennsylvania Certified Organic (PCO), or any of the other untold numbers of current ecological and/or grass-based organizations that now host pasture walks, farm workshops, and conferences and provide mentoring to interns and apprentices. There was no "certified" organic.

Fortunately, I was preceded by several giants of the profitable production agriculture of the first half of the twentieth century who wrote down much about how biological systems work: Sir Albert Howard (*An Agricultural Testament*), Franklin King (*Farmers of Forty Centuries*), Edward Faulkner (*Plowman's Folly*), Louis Bromfield (*Malabar Farm*), William Kenan (*The History of Randleigh Farms*), Newman Turner (*Fertility Farming*), J. Russell Smith (*Tree Crops*), Weston A. Price (*Nutrition and Physical Degeneration*), and William Albrecht (*The Albrecht Papers*). Rudolf Steiner and his eminent ambassador to America, Ehrenfried Pfeiffer, introduced an entirely new method of farming based on the energetic forces inherent in the Earth and our cosmos, called biodynamics.

There are now numerous textbooks on soil productivity/fertility available, and my preferred texts are *The Nature and Properties of Soils* by Nyle Brady and Ray Weil (I now proudly possess the fourteenth edition of this amazing textbook, which has persistently been a university reference for decades. This book contains the mother lode of information that best supports the concept of soil as a supraorganism), *How Soils Work* by Paul Syltie, *Life in the Soil* by James Nardi, *Teaming with Microbes* by Jeff Lowenfels and Wayne Lewis, *The Art of Balancing Soil Nutrients* by William McKibben, *From the Soil Up* by Donald Schriefer, *Hands-On Agronomy* by Neal Kinsey, *The Albrecht Papers* (volumes 1–6) by William Albrecht, *The Biological Farmer* by Gary Zimmer, and *Eco-Farm: An Acres U.S.A. Primer* by Charles Walters and C. J. Fenzau. All of these are fabulous resources in understanding this organism we call soil.

There were many more works, all of which are now enshrined in my library along with contemporary masters of ecological farming. Fortunately for me, I had begun reading these works at a young, idealistic age, when I was already jaded about living within the "corporate state," an amalgamation of the military, multinational corporations, a bought-and-paid-for academia, and a government run by regulatory bureaucrats recruited from the very corporations they were supposed to protect us from. The immorality and inequality of the Vietnam War was on my generation's mind, while the environment around us was clearly stressed enough for even the Nixon administration to recognize it and establish the U.S. Environmental Protection Agency (EPA).

During the early 1980s I was lucky enough to find and be mentored by some real agricultural consulting mavericks. John Whittaker, DVM, of Springfield, Missouri, was then the *Acres U.S.A.* columnist for "Whitt's End." Whitt taught me volumes about mold and mycotoxins, acidosis, and blood urea nitrogen/"funny protein," the three primary scourges of an inhumane, toxic, industrial animal agriculture. Don Schriefer of La Motte, Indiana, a regular *Acres* contributor and author of *From the Soil Up* and *Agriculture in Transition*, was one to really ask the fundamental question, "What are your yield limiting factors?" He stressed the primary importance of soil texture, residue decay, pore space, and water infiltration. Mac McCullough, a professor emeritus at the University of Georgia and frequent contributor to *Hoard's Dairyman*, was an out-of-the-box "conventional" dairy nutritionist. I say out-of-the-box because he knew that the American dairy industry was on a collision course with poor margins/low profitability because the high-forage diet was being transitioned into a swine diet that destroyed cow's feet, livers, udders, and reproductive tracts.

Today the torches of restoration, resurgence, and regeneration are being carried by many who are inspiring, motivating, and enlightening those who can listen. All one has to do is attend one of the many "calling on the clans" conferences and be inculcated with firebrand voices the likes of Vandana Shiva, Wendell Berry, Allan Savory, Wes Jackson, Chuck Walters, and Joel Salatin (to name a few).

My real mentors, however, ended up being my farmer clients. They were the ones with the vision; they were

---

“on the ground” observing what changes were occurring with crops or stock, were able to provide me with excellent feedback, and were able to effectively build on what we both initiated. Practices that we tried and often succeeded at during that time would not even be relevant today because we’ve learned so much more about how to “need” so much less. We are less dependent on off-farm inputs once thought so necessary, such as fossil fuel–based fertilizers, pesticides, and drugs. This independence can only come from instituting “whole systems,” which includes inviting diversity by creating ecotones (the points where different ecosystems meet and interact), such as a pasture and hedgerow, a meadow and forest, riparian edges along streams, savannahs, shelterbelts, orchards, wetlands, glades in forests, fens, ridges, forested clearings, estuaries, and so on. These ecotones are sanctuaries and nurseries for life that build resilience into not just the farm but the entire landscape. Holistic management and permaculture thus offer an embodiment of the farm as a microcosm of the macrocosm, which to me is the Earth organism.

Even though this book is demarcated into chapters of specific themes or topics, it is my hope that the reader will experience each chapter as a single thread of a textured tapestry, the image fluid rather than fixed, dependent upon the reader’s aspirations, experiences, loves, and particular reverence for what is sacred and beautiful.

I hope and believe that these collective increments of ecological achievement will continue to enlighten all of us—farmers, patrons, healers, policymakers, ecologists, artisans, laborers, educators, clergy, peace officers, and military personnel—to experience what Ralph Waldo Emerson proclaimed: “To the illuminated mind, the whole world burns and sparkles with light.”

---

\* “41 Percent of Americans will Get Cancer,” [UPI.com](http://www.upi.com/Health_News/2010/05/06/41-percent-of-Americans-will-get-cancer/UPI-75711273192042/), May 6, 2010, [http://www.upi.com/Health\\_News/2010/05/06/41-percent-of-Americans-will-get-cancer/UPI-75711273192042/](http://www.upi.com/Health_News/2010/05/06/41-percent-of-Americans-will-get-cancer/UPI-75711273192042/).

---

# 1

## Soil as a Supraorganism

### The Physical Nature of Soil

*I conceive that land belongs for use to a vast family of which many are dead, few are living, and countless members are still unborn.*

—Nigerian tribesman

THIS chapter will provide the reader with some collaborative thoughts as to why soil is not merely a substrate, or even a matrix, but truly a supraorganism that is self-organizing, consisting of multiple “organs” that are intelligent and cooperate with each other, and whose functions are based on form and design. Soil truly is a very complex ecosystem made up of ecosystems that know one another. The animate and inanimate are intertwined in a dance of synergy in which the whole is much greater than the sum of its parts.

For many years in the 1980s and into the 1990s, I would focus on the “three-legged stool” of soil composition, namely the chemical (minerals), the physical (sand/silt/clay and soil texture), and the biological (microorganisms and fungi). Each “leg” is completely dependent upon and an integral part of the other two. Physical structure affects pore space, which influences root growth and the activity of useful soil organisms (biology). Lime is applied to soil to increase the pH (chemistry), which affects the structure of soil (physical) as well as the nutrients plants can absorb from the soil (biology). Humus and root residue (biology) affect the appearance and structure of soil (physical) as well as its release of minerals and nutrients (chemistry).

Equally important is the biodiversity of the plants growing in such soil and of animals both wild and domestic living on the soil. Far too many biological or organic farms are woefully “understaffed” with plant and animal diversity. Are organic monocultures of corn, soybeans, and alfalfa really worthy of boasts? Organic or bio-agriculture is certainly a vast improvement over monocultures raised with pesticides, high-salt leachable fertilizers, no cover crops, or tight rotations. And clearly many, if not most, of these farms produce food and feeds that are nutritionally superior to their conventional nonorganic counterparts. But if we are to be honest, there is what is known as “organic by neglect or default.” Merely growing plants without pesticides or commercial fertilizers does not automatically create healthy, tasty, nutritionally dense feeds or food (more on that later).

Supra: A prefix meaning “beyond the limits of, outside of”

If natural systems are the model of how resilience and regeneration are built into soil-plant-animal ecosystems, where does one find monocultures in nature? Tropical rainforests, savannahs, prairies, tundras, deciduous and coniferous forests, and even deserts are all beneficiaries of an amazing array of biodiversity. There are virtually no monocultures in wild, natural ecosystems.

The physical, chemical, and biological systems in soils, in order to be whole, interconnected, dynamic systems, must also be impregnated with the biodiversity of nature. That biodiversity includes the innumerable species of microbes (bacteria, bacteriophages, viruses, fungi, protozoa, algae), the arthropods, miscellaneous insects, and pollinators, even birds and mammals. These biological components in turn depend on the biodiverse presence of hundreds of plant species in the local environment. That is why monocultures are hazardous to the entire supraorganism we call soil. The plants collectively synthesize tens of thousands of compounds, both primary



- [read Turkey Day Murder \(Lucy Stone Mystery, Book 7\) pdf, azw \(kindle\), epub, doc, mobi](#)
- [read Misquoting Muhammad: The Challenge and Choices of Interpreting the Prophet's Legacy](#)
- [download Written in My Own Heart's Blood \(Outlander, Book 8\) \(CA Edition\) book](#)
- [download online Battles in the Desert & Other Stories pdf, azw \(kindle\), epub](#)
  
- <http://anvilpr.com/library/The-Four---Twenty-Blackbirds-Pie-Book--Uncommon-Recipes-from-the-Celebrated-Brooklyn-Pie-Shop.pdf>
- <http://schrolf.de/books/Misquoting-Muhammad--The-Challenge-and-Choices-of-Interpreting-the-Prophet-s-Legacy.pdf>
- <http://betsy.wesleychapelcomputerrepair.com/library/Calcutta--Two-Years-in-the-City.pdf>
- <http://pittiger.com/lib/Battles-in-the-Desert---Other-Stories.pdf>