

## Healthy Soils, Healthy People: The Legacy of William Albrecht<sup>i</sup>

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### Abstract:

William Albrecht was not only a distinguished scientist and brilliant scholar; he was also a true visionary and committed humanitarian. He believed that animals, including humans, provide biochemical photographs of the soils in which their foods are grown. With effective and affordable commercial fertilizers after World War II, the health and natural productivity of the soil no longer seemed to matter. Albrecht risked his academic reputation by warning of the public health risks posed by this so-called modern, industrial agriculture. History provides compelling evidence that he was right. A half-century later, America is facing an epidemic of diet related illnesses, including obesity, diabetes, heart disease, hypertension, and various forms of cancer. If current trends continue, the cost of health care, which is already nearly twice the cost of food, will claim more than one-third of the U.S. economy by 2040. Recent scientific studies have linked a decline in the nutritional value of foods with the industrialization of agriculture. The result is foods rich in calories but poor in essential nutrients. As Albrecht had warned, the declining health of our people may well be a biochemical photograph of the declining health of our soils. Regardless, today's agricultural scientists should embrace the vision and courage of William Albrecht to venture beyond their narrow academic fields of study, to rethink the science involved, and perhaps redefine their disciplines. The health of our nation may be impossible to restore without first restoring the health of our soils.

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William Albrecht was still Chairman of the Soils Department and a familiar name in the College of Agriculture when I first arrived on the MU campus in the fall of 1957. I recall a friend who was a bit offended because Albrecht seemed to be questioning the intelligence of people, like him, who been raised on food from the "worn out" soils of South Georgia. We students weren't aware of the larger controversy surrounding Albrecht's work linking the health of soils to the health of people. While President of the Soil Science Society in 1938, he had written in the Yearbook of Agriculture "A declining soil fertility, due to a lack of organic material, major elements, and trace minerals, is responsible for poor crops and in turn for pathological conditions in animals fed deficient foods from such soils, and mankind

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is no exception."<sup>1</sup> My soils instructor, Prof. E. R. Graham, stuck pretty close to the physics, chemistry, and biology of soils. I don't recall him ever mentioning Albrecht's work linking soil health and human health. Perhaps he didn't want to endure the professional criticism Albrecht received for venturing beyond the narrow bounds of his disciple. The University of Missouri had plant and animal scientists to worry about the health of plants and animals and an entire medical school to deal with the health of people. Professor Albrecht was admonished to restrict his observations to the health of soils.

Perhaps his most controversial, most important, study was a review of World War II era dental records of 70,000 U.S. sailors. He linked the health of sailors' teeth to the health of soils in their native regions of the U.S. In those days, people mostly ate foods grown on local farms or at least grown in their respective regions of the country. He concluded, "If all other body irregularities as well as those of the teeth were so viewed, it is highly probable that many of our diseases would be interpreted as degenerative troubles originating in nutritional deficiencies going back to insufficient fertility of the soil."<sup>2</sup> With the end of World War II, Albrecht called for a major national initiative to restore the health and fertility of America's "worn out" soils.

Instead, the nation's agricultural priorities shifted to producing more and cheaper food. Albrecht anticipated that reliance on commercial fertilizers to increase production would degrade both soil health and human health. He was particularly concerned with an overemphasis on nitrogen, phosphorus, and potash (N, P, & K), would lead to depletion of trace minerals, such as manganese, copper, boron, zinc, iodine, and chlorine, and degrade basic soil health. He wrote "N P K formulas, as legislated and enforced by State Departments of Agriculture mean malnutrition, attack by insects, bacteria and fungi, weed takeover, crop loss in dry weather, and general loss of mental acuity in the population, leading to degenerative metabolic disease and early death."<sup>3</sup>

Albrecht ventured into economics in the late 1950s, at about the same time as I discovered Agricultural Economics as an undergraduate at MU. He wrote, "The costs of growing healthy livestock and healthy people do not fit themselves readily into our economics where costs and earnings must always be matched in monetary values (dollars). We are slow to realize that good health is not a purchasable commodity. Health of plants, of livestock and of humans via proper nutrition... will not submit to solution by monetary manipulations."<sup>4</sup> He became increasingly concerned and outspoken about the potential negative impacts of profit driven farming practices on the health of the land. "We are slow to study the importance of soil fertility to the quality of food, for this is not yet to our economic advantage in the marketplace."<sup>5</sup>

As an emeritus professor, Albrecht became even more outspoken in his conclusion regarding the linkage between soil health and human health. In 1966, he pointed out that the health of the soil affects the nutrient balance between proteins and carbohydrates in both feed and food crops.<sup>6</sup> Furthermore, he concluded only healthy organic soils with the proper balance of both macronutrients and micronutrients could produce the complete proteins necessary for good human health.<sup>7</sup> He distinguished between the "grow foods" grown on healthy soils and "go foods," which were filled with carbohydrates for energy but

lacking in the complete proteins needs for growth and health. “Go foods” make humans fat; it takes “grow” foods to keep humans healthy. I doubt Albrecht would be at all surprised by the epidemic of obesity and other diet related health problems confronting Americans today.

These few references provide but a brief glimpse of Albrecht's work linking soil health and human health and barely hint at the enormous body of less controversial work that brought William Albrecht to the pinnacle of his profession as a soil scientist. My intent here is not to defend Albrecht conclusions as proof, but instead as compelling challenges to soil scientists, agricultural scientists, and scientists in general. My intent is to defend what I will refer to as the “Albrecht hypothesis:” *human health is inseparable from soil health*. This is not a proven fact but a critical proposition that has yet to be properly tested. Albrecht didn't claim to have the final answers regarding soil health and human health. He suggested it would take at least a half-century to unravel the mysteries he had begun to explore.

Unfortunately, few scientists since have had the courage to venture outside of their academic disciplines to explore the impacts of their work on society and humanity. Many consider themselves to be soil scientists, plant scientists, animal scientists, medical scientists, or economists -period. Albrecht knew he needed a basic understanding of all these fields if his work as a soils scientist was to fulfill his public responsibility to society and humanity. He reportedly was dismissed by the academic community because he refused to restrict his work to soil science and eventually was forced into retirement.<sup>8</sup> Today, American society may well be suffering the ecological, social, and economic consequences of the failure to explore Albrecht's hypothesis linking soil health and human health.

I identify with William Albrecht, both personally and professionally. I had to break free of the narrow bounds of agricultural economics when I began to explore the larger and more important questions of agricultural sustainability. I was a respected agricultural economist at the time: Head of the Department of Extension Agricultural Economics and President of the Southern Agricultural Economics Association. I felt the sting of academic rejection and marginalization whenever I raised questions related to crop science, animal science, soils science, ecology, sociology, or philosophy. I never claimed to be an expert in any academic area other than my own. Like Albrecht, however, I knew I needed to understand enough about rest of agriculture, society, and humanity to understand how and why a dysfunctional agricultural economy was degrading the sustainability of agriculture and threatening the future of humanity. My work in sustainable agriculture led me to the work of William Albrecht.

In the late 1980s, I discovered that Albrecht's stature among those in the sustainable agriculture movement was higher than his academic status at the peak of his career. He was and still is considered to be among the best, and possibly the last, of a small group of soil scientists who have contributed anything of real value in restoring sustainability to agriculture. For many sustainable farmers, *The Albrecht Papers*, compiled and published by Charles Walters of *Acres USA*, is the *Bible* on all matters related to soil, which included about everything related to agricultural sustainability.<sup>9</sup> A few other soil scientists have

since taken on task of exploring soil health and sustainable productivity. However, Albrecht's work still represents a voice of authority on all matters related to soils. The public value of his work has been validated in the restored health of many soils, crops, farms, and farm families.

The legitimacy of the Albrecht hypothesis linking soil health and human health has also been validated by more than a half-century of American history. A French contemporary of Albrecht, Andre Voisin, paraphrases the Albrecht hypothesis as: "Animals and men are biochemical photographs of the soil."<sup>10</sup> If we Americans are biochemical photographs of the soil, we are the picture of a nation whose food is grown from increasingly unhealthy soils.

The declining physical health of Americans is perhaps most obvious in the growing epidemic of obesity. Obesity is not simply a matter of personal inconvenience or embarrassment; it is closely linked to a number of diet related diseases, including diabetes, heart disease, hypertension, and a variety of cancers. Recent statistics classify two-thirds of adults and nearly one-third of American children and teens as obese or overweight. Since 1980, the number of obese adults has doubled.<sup>11</sup> Since 1970, the number of obese adolescents ages 12-19 has tripled and the number of obese children ages 6-11 has quadrupled.<sup>12</sup> According to a 2010 report of the Robert Wood Johnson Foundation, *FAs In Fat; How Obesity Threatens America's Future*, the tendency toward obesity has continued unabated in spite of a host of programs mounted by government and nonprofit organizations to combat it, the latest being President Obama's White House Task Force on Childhood Obesity.<sup>13</sup>

In terms of economic costs, obesity related illnesses are projected to claim about one-in-five dollars spent for health care in America by 2020 -erasing virtually all of the gains made in improving public health over the past several decades.<sup>14</sup> Health care in America now consumes more than 17% of the total GDP or economic output, nearly twice as much as in 1980.<sup>15</sup> If current trends continue, health care will claim more than one-third of all economic output by 2040. With an aging population, growing public demand for public healthcare is almost certain to add to an already ballooning federal budget deficit.

A 2005 New York Times piece drew widespread public attention to the problem of obesity by quoting the authors of an article in the *New England Journal of Medicine*: "Obesity is such that this generation of children could be the first basically in the history of the United States to live less healthful and shorter lives than their parents."<sup>16</sup> Other scientists countered that better health care might offset the trend, but admitted that such care would be very costly. Many of today's children are likely to be very sick for most of their lives, even if they don't die younger.

The tendency is to blame obesity on people, specifically on the psyche or physiology of people who eat too many calories. They are accused of choosing unhealthy lifestyles and unhealthy foods, as a result, eating more calories and burning fewer calories than is consistent with good health. The conventional wisdom seems to be that nothing is basically wrong with the food system; the problem is the unwillingness or inability of people to

make good choices. If the conventional wisdom were true, the problem of obesity could be solved by educating and/or training. People could be encouraged to get more physical exercise and to make the right food choices. Decades of government programs, private and public research, and the emergence of an entire diet & health food industry has failed to make significant progress in reducing obesity.

Albrecht believed that all animals, including humans, have an inherent capacity to select the foods they need to for healthy diets. He observed wildlife and cattle in farm pastures, since he was discouraged from experimenting with farm animals. Respected animal nutritionists of his times had observed that when farm animals were offered a wide variety of foodstuffs most would naturally select healthy balanced diets.<sup>17</sup> However, when livestock were offered a single feed containing nutrients in fixed quantities, they tended to consume more than they needed of some nutrients in an apparent attempt to meet their minimum requirements of others.

If we humans have this same basic tendency as other animals, as Albrecht suggested, whenever our food choices are limited, we may well consume more of some nutrients than we need in an attempt to get enough of others to meet our basic nutritional requirements. In other words, the lack of a few essential nutrients in our diets might leave us feeling hungry even though we have consumed far more calories than is consistent with good health. The sedentary lifestyles of many Americans obviously contribute to the growing epidemic of obesity. However, excessive eating and the resulting excessive weight also contribute to sedentary lifestyles. Many Americans may overeat because their food leaves them undernourished.

In spite of the lack of past success, most public health programs today tend to focus on getting people to change their diets -specifically to eat more fruits and vegetables. More than 40% of Americans reportedly eat no fruits and vegetables on any given day. However, USDA data related to long run consumption patterns indicate that per capita consumptions of fruits and vegetables have been basically flat, with intermittent blips, over past 30 to 40 years, the period of increasing obesity.<sup>18</sup> Declines in consumption of fresh produce have been offset by increases in consumption of processed fruits and vegetables. Interestingly, home gardens accounted for about 25% of all vegetables eaten in the early 1900s but accounted for less than 3% of total vegetable consumption in the late 1900s. This might logically suggest the soil on which vegetables are grown is more important than the quantity consumed.

Some scientific studies have begun to confirm Albrecht's economic hypothesis that an agriculture driven by economic values would deplete the nutritional value of the nation's foods. A particularly revealing study was published in the *Journal of American College of Nutrition* in 2004. It compared nutrient levels in 43 garden crops in 1999 with levels documented in historic benchmark nutrient studies conducted by USDA in 1950. Declines in median concentrations of six important nutrients: protein -6%, calcium -16%, phosphorus -9%, iron -15%, riboflavin -38%, and vitamin C -2% were observed -even when measured on a dry weight basis.<sup>19</sup> Other studies have since found similar results showing diminished nutrient density of foods over time.

Organic farming also provides a convenient contrast to conventional agricultural practices. A review by *The Organic Center* of 97 published studies comparing organic and conventionally grown food indicated that “on average” organic foods are more nutritious than conventional foods.<sup>20</sup> Conventional foods often contained more macro nutrients - potassium, phosphorus, and total protein -but organic foods were consistently and significantly higher in Vitamin C, Vitamin E, polyphenols, and total antioxidants, which are frequently lacking in American diets. Farms can be certified as organic after refraining from use of inorganic fertilizers and pesticides for only three years. It may take decades of organic farming to fully restore the chemical and biological health of “worn out” soils.

The blame for obesity also is often placed on the prevalence of highly processed foods and fast foods. Obviously, food processing and distribution deserve a share of the blame. The large corporations are not concerned about diet or health, unless it affects their profits. During the past 30 years, high-fructose corn syrup has replaced cane and beet sugar as the sweetener of choice because it has been cheaper. The growing popularity of carbonated beverages has meant increased consumption of high-fructose corn syrup.<sup>21</sup> Soybean oil, particularly partially-hydrogenated vegetable oil, has replaced lard and butter as the fat of choice, at least partially because it has been cheaper. Vegetable oils have found a growth market in the deep fryers of the fast food industry. In fact a significant portion of increased calorie consumption has resulted from increased spending for food eaten away from home. In recent years, about half of all food purchases are for foods eaten outside the home, about half of which are fast foods.

Best-selling books, such as *Fast Food Nation*<sup>22</sup> and *Omnivore's Dilemma*,<sup>23</sup> document the negative consequences of fast foods and processed foods. Fast food franchises that have thrived economically by selling large portions of foods, high in sweets, fats, and salt, are coming under increased public scrutiny by public health officials. Low income consumers also are lured to the aisles of supermarkets filled with low-priced, high-calorie food choices. Food industry marketers know that humans have a natural taste preference, probably a genetic predisposition, for foods that are high in fat, sugar, and salt. Preferences essential for the survival and health of our primitive ancestors now make us vulnerable to economic exploitation. It's easier to market high calorie foods, particularly when those foods are cheaper. There is little doubt that processed foods and fast foods are contributing to the problem of obesity.

However, highly processed foods, fast foods, and sedentary lifestyles obviously aren't the only significant factors contributing to obesity. Numerous studies have shown significant reductions in nutrient density of crops at the farm level with increasing use of modern yield-enhancing technologies -fertilizers, pesticides, high plant density, and irrigation.<sup>24</sup> This so called “dilution effect” apparently is well known among plant scientists, although rarely mentioned in relation to diet and health outside of organic circles.<sup>25</sup> The Albrecht hypothesis linking soil health directly to human health remains largely unexplored.

Perhaps most challenging to the conventional wisdom of obesity, an international group of scientists recently studied obesity and overweight trends, over a period of five decades, in 8 species of animals that live in close proximity to humans. The study included laboratory animals, but also cats, dogs, and feral rodents. All but one of the 24 populations studied became more obese.<sup>26</sup> The researchers speculated on various possible causes, but one academic reviewer concluded, "We clearly now have evidence that things outside this realm [diet and exercise] can shift the body weight distributions of an entire population."<sup>27</sup> The other species, particularly the wild species, don't eat highly processed foods or fast foods and don't spend their days in front of the TV or playing video games. However, they all eat foods grown on the same soils as the soils that feed their human neighbors - corroborating the Albrecht hypothesis.

The declining nutritional value of America's food should come as no surprise to anyone who understands that today's industrial food systems, including industrial agriculture, is driven by the economic motives of productivity and profits rather than public interests. Profits are derived primarily from factors of *quantity*: acres farmed, head produced, yields per acre, rates of gain, and economies of scale. *Quality* factors typically have far less effect on profits and are most often associated with cosmetic appearance rather than nutrition or health. The primary sources of those cheap calories found in supermarkets and fast food franchises today are plants and animals from farms that rely on modern yield-enhancing technologies rather than inherent soil fertility. As Albrecht feared, we may well be suffering the consequences of an agriculture driven by dollar values, not nutritional values.

A growing body of scientific evidence indicates the most likely source of America's growing diet/health crisis is the industrialization of our food system, including the industrialization of American agriculture. Our 50-year experiment with industrial agriculture has failed. I believe this conclusion will be readily apparent to anyone willing to seriously examine American diet and health statistics over the past century. It's obvious the current epidemic of obesity has multiple causes. I believe it is just as obvious that one of those causes is the industrialization of agriculture. Admittedly, there is not a scientific consensus concerning causality. However, the diet and health trends of the past century clearly link the epidemic of obesity, and the related problems of diabetes, hypertension, heart disease, and various forms of cancer, with the trends in the industrialization of American agriculture. Albrecht was right, it has been a mistake to depend on economic incentives to ensure the health of soils, plants, livestock, and humans.

Compelling evidence in support of the Albrecht hypothesis can be found in the previously mentioned USDA report of long-term consumption.<sup>28</sup> During the first half of the twentieth-century, as people became less physically active, they ate fewer calories. Americans were consuming roughly 10% fewer calories per person per day in the late 1950s than in early 1900s. Per capita calorie consumption leveled off during the 1960s, even though physical activity obviously continued to decline. In the early 1970s, the number of total calories in the average American diet began a persistent upward trend, while physical activity obviously continued to decline. Calories from fats increased 22%, calories and carbohydrates increased by 19%, but calories from proteins also increased by 16%. Between 1980 and 2004, total daily calories per capita from all sources, including

alcohol, increased by 21%. The logical consequence is the alarming increase in numbers of Americans who are overweight or obese.

During the first half of the last century, Americans were *less* active and they ate *less*. During the second half-century, Americans were even *less* active but they ate *more*. The human species obviously didn't evolve that much over 100-years, but the food system most certainly did. The upward trend in per capita calorie consumption corresponds precisely with the industrialization of the American food system, including the industrialization of American agriculture. The increase in consumption was not simply a response to lower food prices, as the percent of income spent for food dropped more from 1939 to 1969 than from 1969 to 1999. The overconsumption of calories and the epidemic of obesity most closely parallels with the industrialization of the food system and the industrialization of agriculture.

Agriculture of the 1950s was still dominated by diversified family farms producing foods primarily for local and regional markets. The soil on many farms were already eroded and "worn out," but most farms still relied primarily on healthy soils for their productivity. The chemical fertilizers and pesticides, developed from warfare technologies, were just coming on the scene and were seen as the key to farm economic prosperity and national food security. Farming was about to be transformed from a way of life into a bottom-line economic enterprise. Every significant USDA program since the 1950s, including research and education in the Land Grant University system, in one way or another has facilitated the industrialization of agriculture. Government crop subsidies are but the tip of the iceberg of government support for industrial agriculture. By the year 2000, American agriculture was dominated by large specialized corn, soybean, cotton, wheat, and rice farms and large-scale confinement animal feeding operations. Farms had become factories without roofs and fields and feed lots biological assembly lines.

When I returned to graduate school at the University of Missouri in the mid-1960s, after three years in the food industry, the mission of the College of Agriculture was well understood. We were going to make agriculture more productive so more Americans could have access to safe and wholesome food at a reasonable cost. This was America's "cheap food policy." We were going to provide food security for all Americans by making good food cheap. With industrial agriculture, health of the soil didn't matter all that much, and apparently neither did the health of the American people. Since the 1950s, the percentage of their income spent for food dropped by more than half while the cost of American health care has more than doubled.<sup>29</sup>

We have succeeded in making food cheap, but it's time to admit the cheap food strategy of the past 50-years has failed dismally in providing national food security. A larger percentage of Americans are hungry today than were hungry during the 1960s. The latest USDA statistics, for 2008, places total "food insecurity" at 16% with more than 22% of American children living in food insecure homes. Non-government surveys place total "food hardship" for 2010 at close to 20%.<sup>30</sup> The only time significant progress made in food insecurity over the past 30 years was during the unsustainable economic expansion of the

1990s. We need to face reality; we can't feed the hungry by making agriculture more economically efficient.

Those who can afford to buy enough food to satisfy their hunger, too often end up buying foods that destroy their physical health. It's not just the problems of obesity, hypertension, diabetes, heart failure, and other problems linked with poor nutrition. America's food/health concerns also include carcinogenic chemical residues, endocrine disrupters, growth hormones, antibiotic resistant bacteria, salmonella, E-Coli 0157:H7, and more recently genetically modified organisms, or GMOs. The health problems associated with these concerns include diminished fertility, various forms of cancers, attention deficit disorder, and a growing variety of food allergies. We don't know how many of these concerns may also contribute to the epidemic obesity. We do know these concerns are all inevitable consequences of an industrial agriculture.

We have justified the demise of family farms, decay of rural communities, pollution of the rural environment, and degradation of soil health as being necessary to provide food security for the nation. These justifications are no longer valid or acceptable. Too many Americans are still hungry; too many Americans are sick. As Albrecht predicted; an agriculture driven by economics failed to provide for the health of the soil or the health of people. The problems we are facing today are the consequence of too many people, including scientists, pursuing their narrow self-interests without considering the consequence of their actions on the rest of society and the future of humanity. That's what economics is all about; the pursuit of individual, impersonal self-interests -not the long run interests of society or humanity.

To meet their responsibilities to society and humanity, agricultural scientists must consider the impacts of their discipline on others and impacts of other disciplines on theirs. The problems with the food system are inseparable dimensions of the same problem. They all involve the physics, biology, chemistry, economics, and even the philosophy of agriculture. The first scientists who find the courage of Albrecht to venture beyond their disciplines should not expect to be praised by their colleagues. Don Huber, a plant pathologist who presented the 2010 Albrecht Lecture, has dared to speak out regarding the impacts of the Roundup herbicide not only on the health of plants but also the health soils and animals. He has been rebuked not only by Monsanto but also several of his colleagues. His critics claim adequate research not been done either to confirm or refute his claims. My question to the scientific community is: why not? Why haven't scientists done this research of such great interest and importance to the public? Huber is widely praised among those who have long questioned the impacts of a host of similar industrial agricultural technologies on the health of soils, plants, animals, and people. He is praised not just for his answers but for having the courage to ask the questions.

Scientists need not sacrifice their disciplinary integrity to address the larger problems of society and humanity. I am a better economist today than I have ever been. I have a deeper understanding of those principles of economics most relevant to my responsibilities to society and humanity. I also have a better understanding of how economics affects and is affected by the whole of agriculture, society, and humanity. I'm confident Albrecht felt the

same about his competence as a soil scientist. All scientists, not just soil scientists, must know at least enough about each others' disciplines to ask the right questions and to reject the wrong answers.

I spent the second half of my 30-year academic career and my time since retirement on a new post-industrial paradigm of philosophy of agriculture. I am trying to help thousands of farmers, and their food customers, all across the nation who are already confronting the larger problems of society and humanity. They are also finding solutions, but with very little help from their governments or their universities. The agricultural institutions are still promoting agricultural industrialization. These farmers may call themselves organic, ecological, biodynamic, holistic, practical, or just traditional family farmers, but they are all balancing the ecological, social, and economic concerns in the pursuit of agricultural sustainability. These farmers understand the health and sustainability of their farms ultimately depends on the health of their soil.

At least six major “sustainable agriculture” conferences in the U.S. draw from 1,500 to 3,000 of these new farmers and their customers annually. The Upper Midwest Organic Growers conference in La Crosse, WI drew more than 3,000 this winter. The combined total of natural, organic, and local foods still makes up less than 10% of America's food, but it is the fastest growing segment of the food market.<sup>31</sup> Major retail surveys indicate about one-third of Americans are looking for foods fundamentally different from the foods they find in supermarkets and fast food restaurants today, and they are willing to pay premium prices to get what they want.<sup>32</sup> These people are not just niche marketers, hobby farmers, or elitist consumers. Together, they are creating the new American food system. They need, deserve, and have every right to expect the help of scientists in their public universities.

If we are to restore the physical and economic health of our nation, agricultural scientists must embrace the vision and courage of William Albrecht. To meet the challenges confronting today's society and the future of humanity, scientists must have the vision to rethink their science, perhaps even redefine their disciplines. To ask the right questions and find the right answers, scientists must find the courage to venture beyond their narrow academic fields of study. This challenge is important to all agricultural scientists, but particularly to soil scientists. The health of our nation may be impossible to restore without restoring the health of our soils. Healthy soils and healthy people; this would be greatest legacy of William Albrecht.

## End Notes

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