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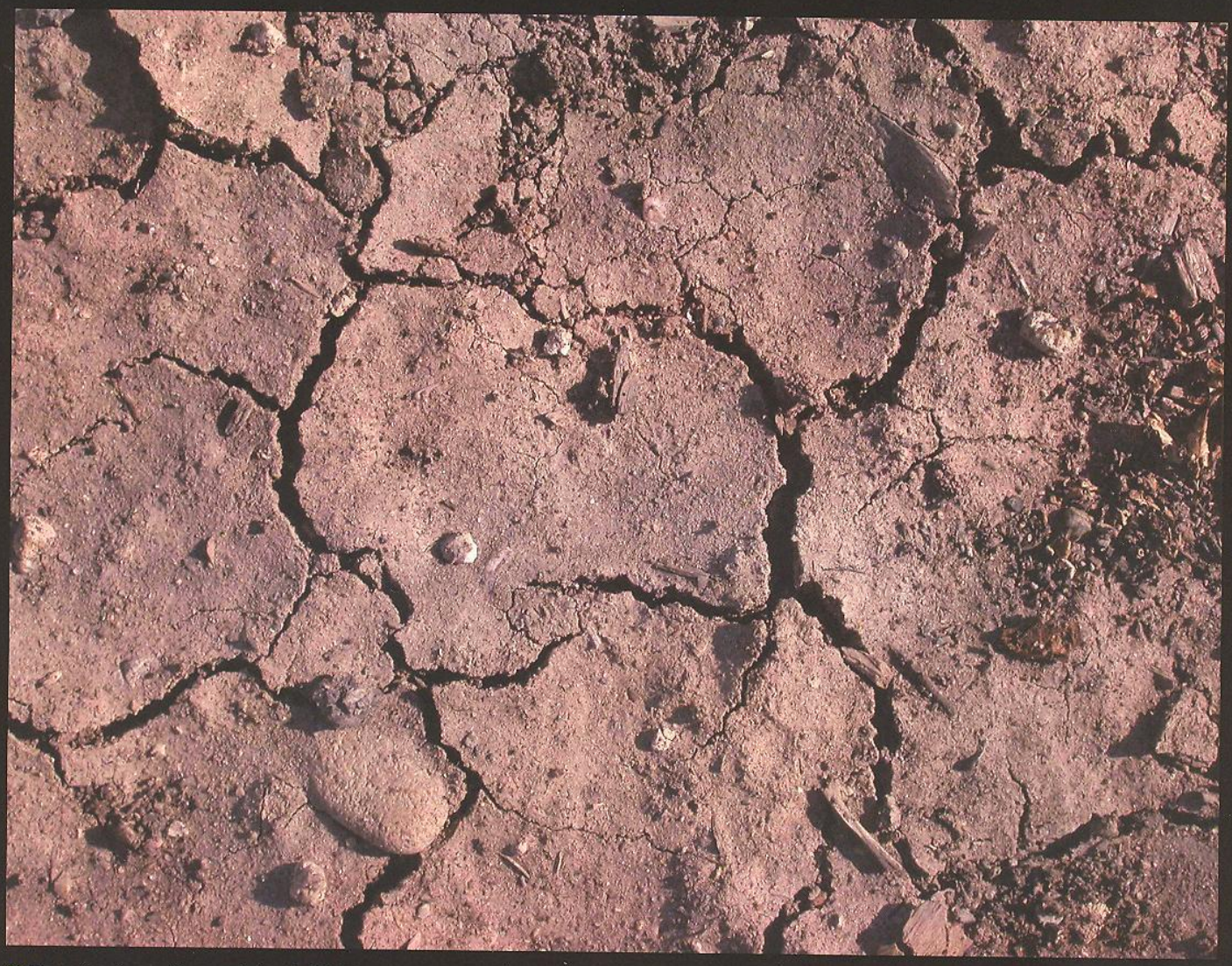
ONLY HEALTHY SOIL CAN



1) The arboretums dispersed clay in 1987

GROW HEALTHY PLANTS

The story of the Arboretum Tomé

By Michael Martin Meléndrez

Soil has been called the bridge between life and the inanimate world. All life — the entire biosphere — owes its existence to a few dozen elements that must ultimately come from the Earth's crust as it turns into soil. The whole Earth may be viewed as a system, but the soil is the key, as it is the place where systems interact; Where the geosphere, the atmosphere, the hydrosphere, and the biosphere meet! It's a fragile condition where a thin blanket of air, a thinner film of water, and the thinnest veneer of soil combine to support a web of life, diversity and ongoing change. The Earth's land surface is covered by a regolith (rhegos = blanket, lithos = stone), the layer of rock and mineral that has decomposed into fragments of mineral along with the decomposing debris of organic matter. Some of us may call this soil, but soil is more than just mineral, water, oxygen and decaying organic matter, it's also a factory of powerful biological chemicals that are the new generation of interest in the field of Soil Science. In particular are substances called Supramolecular Humic Substances, biologics that do amazing things and when concentrated form a rich top soil. This story is about how my company for 25 years worked on the toxic soils of a future botanical garden in the desert of New Mexico, by first using geological sources of Humic Acids and then discovering how to use 'Supramolecular Humic Substances'.

Twenty miles south of Downtown Albuquerque, in the Rio Grande valley near Los Lunas New Mexico, sits a garden that's an inspiration to those of us who love plants, trees, clean air and beautiful healthy soil. It's called the Arboretum Tomé, a botanical garden of trees, shrubs, medicinal plants and a huge species collection of oaks from all over the world. Also on the grounds can be seen a grove of Giant Timber Bamboo, Walnuts from Japan, cold hardy Eucalyptus and towering Redwoods. Developing the arboretum has been a passion of mine and my wife Kari for about a quarter of a century and it now represents one of the largest species collections of trees found in New Mexico, the Southwest and the Rocky Mountain Region. Of greater significance, it's an amazing example of soil rehabilitation success, proving the science of what I now hang my hat on.

In 1986 the soils of the future Arboretum, exemplified an extreme situation that's a common malady with farm soils across the globe. Conditions that have ended farming on some of the world's most productive soils in valley's of the Nile, the Fertile Crescent, the Rio Grande in the Southwest, and the Central Valley of California, to name just a few. These areas have been damaged and suffer from high levels of dissolved salts, nutrient tie-up, high pH, saline and sodic conditions and dispersed clay soils. Dispersed clays will not breathe nor percolate water properly (see image 1 of the arboretums dispersed clay in 1987)! The cumulative effects of irrigation water high in dissolved solids, fertilizers and generations of

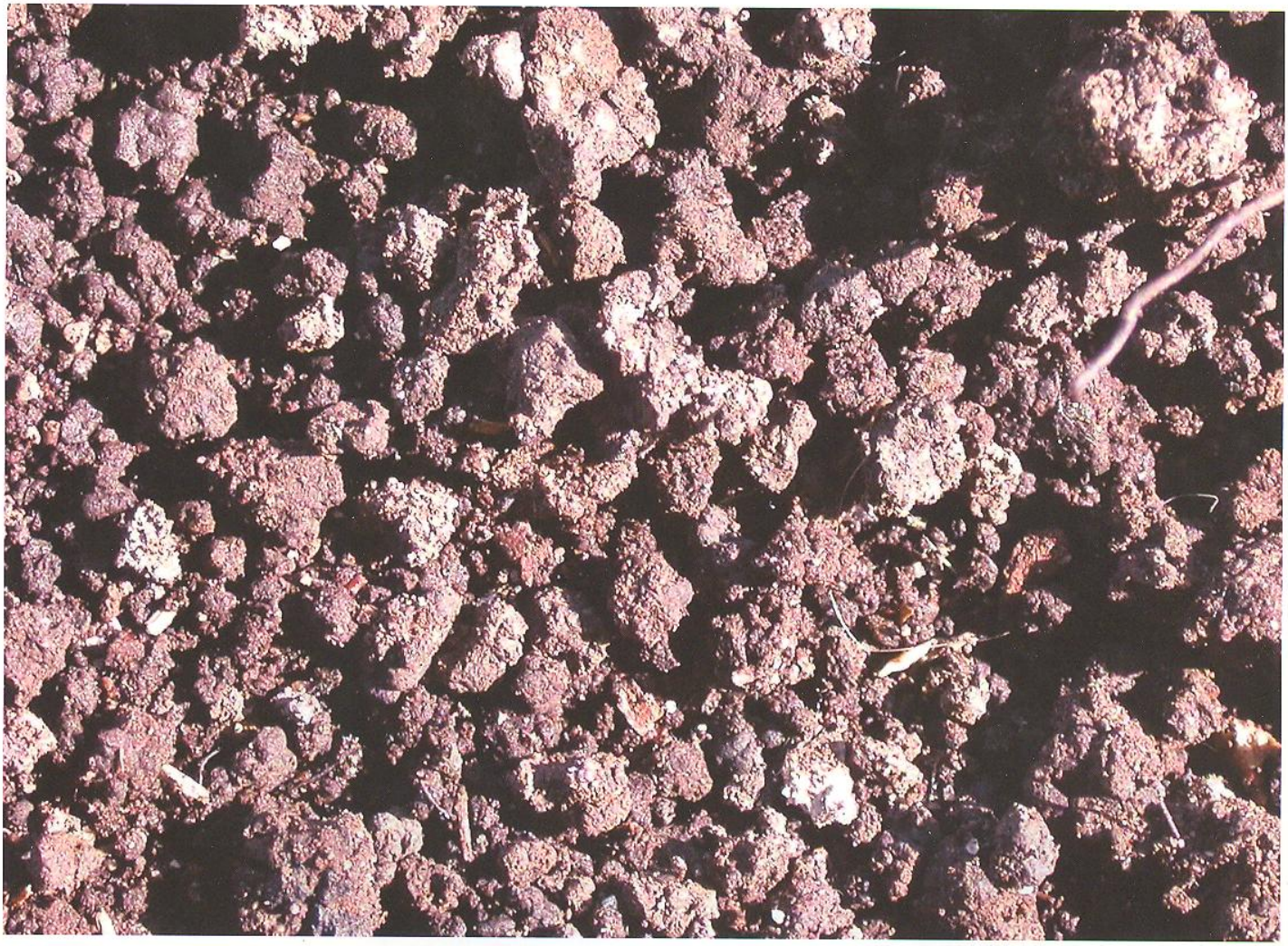
animal manures, have all contributed to the soil reaching a point of cascading failure with a soil that's toxic to most plants. The arboretum soils were a sad situation that traditional soil science had no solution for, other than to abandon the farm and move away. I was dealing with a triple whammy of problems including but not limited to the fact that the soil was saline, sodic and alkaline clay. The kind that turns white in winter, called white death by farmers and which is toxic to most plants (see image 2 of white alkali in the winter). The pH ranged from 8.3 to 9.2 and for those of us who understand pH and soil, that's a horrible situation, but one I was determined to prove I could fix.

Materials Used: The rehabilitation of the soil on the arboretum site was based on the use of two technical materials that I felt were the foundation of a healthy terrestrial biosphere (a 'Soil Food Web'). The two materials used included the mycorrhizal mutualistic fungi and the Humic Acids. It's accepted in science that the Humic Acids are products of soil chemistry, essential for a healthy and productive soil and that they affect the ways that the soil ecosystem works, including the bioavailabilty of organic substances (including pollutants) in the environment 3, 4. While published research on Mycorrhizal benefits have exploded in the past 20 years, the science and source of Humic Acids, along with the manufacturing techniques used to try and make them work better, have changed little in the past 50 years. Humate or Leonardite are the primary naturally occurring sources for Humic Acids, where the soft earth ore has been processed with various techniques in an attempt to make the substance more likely to work. Crushed, micronized, liquefied and coated with proprietary formulas were forms of Humic Acids we used in our early stages of the arboretum rehabilitation process. While improvement was made in the first 10 years, it was slow and minor compared to what we've been able to do more recently. There was a flaw, that I was convinced was in the chemistry of the stuff we depended on as a source of Humic Acids, so I decided to use my academic training from college and personally study the chemistry of Humic Acids. I soon discovered that I needed the help of people smarter than me! With the help of many

2) The soil was saline, sodic and alkaline clay. The kind that turns white in winter.

professional associates including Bruce Reid (owner of Mesa Verde Resources in New Mexico) and a team of professional Femto-Chemists I hired, I began my quest for understanding the chemistry of Humic Acids. We did an extensive search of the literature and we did Femto-chemistry analysis techniques, where we evaluated the various sources of Humic Acids, both naturally occurring and formulated. The literature soon revealed many holes in the science including the fact that there has never been a molecular analysis and description made of Humic Acids, nor is there an accepted standard for doing a 1st level operational analysis which is what all university and commercial soil labs use 1. It became obvious that some real science was needed to quantify and qualify commercial sources of Humic Acids. With my team of chemists and using for-hire lab facilities we conducted true chemical analysis of the molecular characteristics of Humic Acids and more importantly discover how Humic Acids in soil really function! This is what Femto-chemistry is capable of measuring while a 1st level operational analysis is virtually worthless in determining this quality because it says nothing about the Supramolecular structures present in the formulation or in the soil amendment. As my work progressed, I discovered that not all Humic Acid sources were equal and some did not work at all. As the project moved forward, it was discovered that the study and the manufacturing of Humic Acids was considered "High Tech" and my company was invited to be part of a Technology Transfer Program in cooperation with the State of New Mexico and our National Lab facilities of the Department of Energy at Los Alamos and Sandia National Laboratories. The program is designed to provide technology services and the technical staff of scientists, to help my company get better at what we do. This includes helping us design, formulate and manufacture technical materials with the highest and best degree of efficacy. Both facilities are located about 50 miles apart in New Mexico, not far from me, and both have analytical equipment and a library data base that is exclusive to those facilities. In other words, they can do molecular research on Humic Acids and help me measure the chemical characteristics that a formulation of Humic Acids may have. With

3) The arboretum soils that are now rich with life and loaded with carbon can support this amazing collection of exotic and native trees.



4) The clay in no longer dispersed.

my relationship with the Femto-chemists and the Technology Transfer of the National Labs, we've been able to characterize exactly what makes a Humic Acid molecule a powerful biologic and we've learned how to make them so they will be fully functional 'Surpramolecular Humic Substances'. For me, this has been professionally exhilarating because I now have the tools to prove that these powerful biologics can not only transform a soil, but that they are the weak or missing link in farm soils worldwide. To fix farm soils, they must be fortified, as they are essential and critical chemicals of the soil that are involved with hundreds if not thousands of bio-geo-chemical processes. For thousands of years and accelerating in modern times they have been allowed to erode away from our farm soils and they aren't coming back soon. In the case of our arboretum, we now have a powerful tool that can accelerate our efforts to fix our toxic soils.

The Mycorrhizal inoculation: Using Mycorrhizal inoculants with our plants has also played a huge role as this beneficial fungi can uptake mineral nutrients and water from soil that a plant cannot get by itself. Also, it's the mycorrhizal hyphae that transport liquid carbon down into the soil, to eventually contribute to the formation of more Supramolecular Humic Substances. The liquid carbon is sugar that was made by the host plant during photosynthesis and which is used to feed the mycorrhizal fungi. Mycorrhizal fungi are the pipeline for top soil formation, but they are also lacking almost always on farms across the globe. In urban landscaping they are also the missing link, which contributes to the poor health and short life expectancy of urban trees.

We are now witnessing an amazing transformation of the arboretum soils that are rich with life and loaded with carbon that can support this amazing collection of exotic and native trees (see image 3). The clay is no longer dispersed (see image 4), we no longer have white alkali. We can grow almost any plant we want, as long as it can tolerate our winter. We also have a thick green lawn that requires only minimal watering of about once every two to three weeks, despite the fact we are in a desert (see image 5). This is the Arboretum Tomé, my personal Garden of Eden and the headquarters for my three businesses – Soil Secrets LLC, Trees That Please Nursery & Farm and Soil Secrets Worldwide LLC. It's our example of not only talking

the talk, but of walking the walk. In addition, while re-habilitating the soils of the arboretum, I found that Nature was full of secrets, with many still undiscovered. It's for that reason I named my soil company Soil Secrets LLC, plural as there is more than one secret. The arboretum is available for tours by appointment, with no fees.

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5) A thick green lawn that requires only minimal watering of about once every two to three weeks, despite the fact we are in a desert.