Concerns with Regenerative Agriculture Labels

July 1, 2024

About This White Paper

This white paper has been compiled by associates and advisors of Organic Voices, a 501(c)3 nonprofit organization whose mission is to help consumers better appreciate and eliminate confusion about the benefits of certified organic.

Many of our constituent partners, organizations and companies have reported significant consumer confusion about the differences between USDA certified organic (including regenerative organic certification) and non-organic regenerative claims and representations. Much of the literature and presentations by some non-organic regenerative advocates has promoted comparisons between the terms that are confusing or misleading.. In addition, many of our partners have raised particular concerns about new consumer-facing labels for non-organic regenerative claims that have been developed by for-profit entities.
Various certification experts and scientists who have looked into these labeling programs are deeply concerned that many methodologies lack the objectivity and integrity that consumers and retailers expect.

For these reasons, and to help reduce consumer and retailer confusion, we asked a number of credentialed scientists, agronomists and other experts to examine the claims and practices of non-organic regenerative advocates and labeling schemes, and to catalog published studies and findings that challenge or raise concerns about these claims.

Unfortunately, the public debate and discussion about regenerative is often emotional, with high levels of passion and even ferocity. Many of the scientists and advisors who contributed to this compendium work closely with regenerative advocates and have witnessed and experienced personal attacks in response to having raised questions or concerns about regenerative advocates' claims. Some actually fear that their jobs and livelihoods could be jeopardized in retaliation for voicing these concerns. Consequently, our contributors have requested that their identities are not disclosed, to keep the discussion focused on the science and the message, and not the messengers.

Because our mission is to combat confusion, we want to be fully transparent about our sources. Readers will see the extensive referencing and footnotes in this discussion. We encourage anyone with concerns about the facts or views cited or represented in this paper to examine the references. We welcome feedback and comments at info@organicvoices.org.

Executive Summary

Regenified™, Regenerative Verified™ and Regeneratively Grown™ are new labels for regenerative agriculture. Unlike organic agriculture, which is defined both by global stakeholder consensus and in federal law and regulations, there is no consensus or legal definition for regenerative agriculture. Labels have been introduced for regenerative agriculture by not-for-profit organizations, as well as for-profit companies. Three of the labels by for-profit entities – Regenified™, Regenerative Verified™ and Regeneratively Grown™ – deserve a closer look into their standards, and mechanisms for verification. For consumers looking to purchase foods from farms or ranches that met standards for regenerative agriculture, these labels fall short in several critical ways.

A review of the **Regenified™** standard raises the following concerns:

- It fails to prohibit major pollutants in agriculture:
    - Limits a farmer's ability to use non-chemical methods of weed control by severely restricting and ultimately prohibiting the use of mechanical tillage and cultivation
    - Allows the use of herbicides, insecticides, fungicides and other chemical biocides without any restrictions on toxicity
    - Allows the planting of genetically engineered herbicide-tolerant crops
    - Allows the use of synthetic nitrogen fertilizer, a major source of greenhouse gas emissions, water contamination (surface- and groundwater) and eutrophication.

- It fails to assess or ensure target outcomes for positive environmental impact:
    - Will bring about increases in carbon only in the top layers of soil, thereby missing opportunities to sequester carbon deeper in the soil profile
    - Only calls for measurement and tracking of soil quality and health parameters in the top few inches of soil
    - Requires expensive soil tests that are not widely accepted as reliable indicators of the impact of farming practices on soil health and carbon sequestration, nor widely suited to track soil health in all regions, soil types, and farming systems
    - Misses the major climate impacts of ongoing fertilizer dependence (especially nitrogen) and on-farm fossil fuel use
    - Does not require monitoring for outcomes related to water quality (including herbicide pollution), above and below ground biodiversity, energy use, animal welfare, or social impacts.

- It is largely subjective, without third-party verification or supply chain integrity standards
    - The standard consists primarily of guidance to implement an esoteric framework ("6-3-4™"), with few requirements clearly linked to desirable outcomes that can be verified and enforced by a neutral third party
    - Third-party inspections are not required, and there is no separation between the standard-setting body and the entity performing the on-farm evaluations
    - The standard is written and updated without public input and engagement

- The standard has no supply chain integrity safeguards such as segregation and traceability requirements, and allows farmers who meet the standard on 20-40% of their agricultural land base to market ***all*** their crops as Regenified™.

Regenerative Verified™ and **Regeneratively Grown™** are offered by the for-profit company Soil Regen, LLC. There is no publicly available standard for these two labels. The company's website shares "Process Information." A review of this document raises concerns. Soil Regen, LLC imposes two requirements to use their Regenerative Verified™ and Regeneratively Grown™ labels. Farmers and ranchers must: (1) submit and pay for a Haney soil test done at Regen Ag Lab, and (2) submit at least one piece of documentation showing they have implemented at least one practice that ***they*** consider to be regenerative. There is little or no guidance nor requirements governing:

- How soil samples are to be collected and how many samples are needed across a farm or ranch operation
- How the identified, regenerative practice is being implemented within a farming system, how widely it is being adopted across a given farm or ranch, and its expected benefits.

As with Regenfied™, Regenerative Verified™ and Regeneratively Grown™ standards include:

- No meaningful discussion, limits, or guidance on the use of chemical inputs including synthetic fertilizers, herbicides and other pesticides, GMO seeds, and non-soil systems
- Failure to address several core elements of regenerative agriculture including protecting water quality, above and below biodiversity, animal welfare, and farmworker health and safety
- No third-party inspections of the farms or ranches nor ways to confirm meaningful progress toward any measurable goal

The intent and contribution of consumer-facing food labels is to reward meaningful and positive change on farms and ranches in areas that consumers care about. To accomplish this goal, label programs ***must set a baseline*** that captures at least some of the important performance attributes and addresses the major shortcomings of current practices and systems. Baselines must also provide a way to verify positive change toward goals for improvement embedded in the program's standards and requirements.

Some, and perhaps most consumers expect and hope that food labeled "regenerative" will be grown without heavy and routine use of pesticides, animal drugs, genetically engineered herbicide-tolerant seeds, and synthetic nitrogen fertilizers. Those consumers that rely on the **Regenified**™, **Regeneratively Grown**™ and **Regeneratively Verified**™ labels in guiding purchase decisions could lose confidence in all such label programs as they become aware that these labels do not address the use of practices and inputs consumers are seeking to avoid and regard as incompatible with safe and sustainable "regenerative" agriculture.

An important part of the "pitch" to consumers made by the proponents of these three labels is that they are superior to other labels in the marketplace, including certified organic or 'regenerative organic certified', in promoting changes in farming systems that enhance soil health, produce safer and more nutrient dense foods, keep water clean and pollinators alive, and help mitigate climate change. These assertions are sure to trigger close scrutiny from consumers, farmers and ranchers, food companies, organizations, the government, and perhaps even the legal system.

The American public is increasingly aware that how food is grown and processed has important, and in some cases profound impacts on their health, the quality of life in rural communities, and the planet. Label programs that lack meaningful standards and a way to verify positive outcomes will likely fall by the wayside. Labeling programs that appear designed to promote for-profit businesses and proprietary soil testing methods and labs will, in particular, be subjected to close scrutiny and may struggle to retain consumer confidence.

Table of Contents

Section 1: Regenified™'s on-farm practice standard **6**
Section 1a: No-till and restrictions on non-chemical weed management 6
Deeper dive: Impact of organic farming systems on soil health 9
Section 1c: Allowance of GMOs 16
Section 1d: Allowance of synthetic nitrogen fertilizers 17
Section 1e: Failure to address other elements of regeneration 19
Section 2: Regenified™'s outcome standards **20**
Section 2a: Unenforceable standard with flawed methodology and shallow soil sampling 20
Section 2b: Regenified™ requires relatively expensive tests that are not considered useful indicators of soil health in all regions or farming systems 24
The Haney Test 25
PLFA tests 25
Other tests and considerations 26
Section 2c: Failure to assess total climate impacts 27
Deeper dive: impacts of no-till on carbon sequestration 28
Section 2d: Lack of outcome metrics for water, biodiversity, animal welfare and social outcomes 31
Section 3: Regenified™'s subjective standard and lack of third-party verification **31**
Section 3a: Regenified™'s standard is primarily subjective guidance 31
Section 3b: No separation between standard-setting body and certifier 33
Section 3c: Standard is developed without public input and engagement 34
Section 4: Regenerative Verified™ and Regeneratively Grown™ **35**
Section 5a: Lack of practice standards 36
Section 5b: Flawed outcome standards 36
Literature Cited **38**

Section 1: Regenified™'s on-farm practice standard

Standards for credence attributes (i.e., attributes for which the consumer relies on the label because they could not verify them on their own, such as farming practices with positive environmental and social impacts), should set a meaningful baseline. For these types of labels, it is the baseline that matters, because it reflects what the consumer can be guaranteed when they purchase a product with the label.

The Regenified™ label's standard is titled the **"6-3-4™ Verification Standard,"** which consists mostly of guidance and recommendations rather than clear requirements that could be enforced by a neutral third party. The Regenified™ standard includes a clear and enforceable prohibition on mechanical weed control – tillage and cultivation – without an accompanying clear and enforceable prohibition on herbicides, genetically engineered herbicide-tolerant crops, and other synthetic inputs, including insecticides and nitrogen fertilizers.

The standard also does not address in a meaningful way other elements of regeneration that consumers often expect from a regenerative label, such as protecting water quality, biodiversity, farm animal welfare, and a living wage and safe working conditions and lodging for farm and factory workers.

Section 1a: No-till and restrictions on non-chemical weed management

Some regenerative agriculture advocates tend to describe regenerative agriculture as an outcomes-based approach that allows for flexibility for farmers and does not center on a check list of required practices and prohibited inputs. Yet the Regenified™ standard contains a clear and enforceable prohibition on the most common farming practice for non-chemical weed management: tillage and cultivation.[1]

To move from tier 1 (baseline) to tier 2 (which allows the farmer to market their crops as Regenified™), Section 3.2.1 of the Regenified™ standard requires that the farmer "reduce tillage passes from conventional production practices to current production practices." While "conventional production practices" are not defined and a measurable and enforceable level of reduction in tillage is not specified, the standard becomes clearer and potentially enforceable as a farmer moves to the next tiers.

The standard states: "For tier 3 there can be no more than one tillage pass per year. A farmer in tier 4 is prohibited from tilling or cultivating except for one pass every 2 years; tier 5 prohibits tillage or cultivation except for one pass every 4 years." The standard specifies that "tillage passes include all full width and row cultivation in addition to planting."

As stated, many questions are left unaddressed in these requirements that will have a direct and significant bearing on whether changes in tillage and planting methods enhance, degrade,

[1] Kumar et al. (2020), p. 109

or leave soil health unchanged. The timing of tillage has an important impact on soil health, as does management of crop residues. Crop rotational patterns and use of cover crops alter the need for and impact of tillage operations, and soil health. How a given tillage operation is carried out matters (depth, speed, weight of the machinery and its impact on soil compaction).

Tillage is not a monolith; there are different types of tillage, and tillage can occur at different depths in the soil and at different times. A 2021 review demonstrates that soil degradation is more influenced by the frequency and intensity of tillage rather than by single tillage events.[2] The impact of tillage on soil quality and health depends on the farming system tillage is deployed within, ***and*** the other practices incorporated in farming systems, ***and*** how each individual practice is carried out ***and integrated with other practices***.

Just like promoting human health, enhancing soil health is complicated and favorable outcomes depend on timing and some good fortune, and combinations of drivers of change brought about by integration of farming system choices.

Tillage is only one of several important drivers of soil health, crop yields, and farm productivity and sustainability. Assuring adequate fertility and crop nutrients to support realistic yield goals is equally important and is also intimately linked to tillage and planting systems. Likewise, crop rotation patterns and timing, and the incorporation of cover crops in rotations to minimize periods of time when soil remains bare and unprotected, are also critical components of farming systems designed to build soil health, meet crop nutrient needs without heavy reliance on off-farm fertilizers and pesticides, and promote farm profitability and carbon-rich sources of fertility.[3] Numerous long-term farming trials at land-grant universities and non-profit research institutions across the United States have documented long-term and sustained enhancement of soil health, crop yields, and farming system profitability in systems containing more than one tillage pass every few years.[4]

History bears this out as well. In *Farmers of Forty Centuries*, published in 1911 by University of Wisconsin-Madison professor Franklin King, he notes in the book's opening paragraph that the farms he studied in Korea, China and Japan remained productive for millenia with healthy soils that have been "tilled more than three thousand years."[5]

In the United States, tillage has been an integral part of many farming systems that depend on and sustain healthy soils by promoting vibrant below-ground food webs that deter crop pests and help meet the fertility needs of subsequent crops. Some of the most successful and long-standing examples of such farms have adhered to organic farming standards and principles. In a 1980 USDA report on organic farming, survey results showed that most organic

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[2] Blanco-Canqui & Wortmann (2020)
[3] Nunes et al (2020)
[4] Delate et al (2015)
[5] King, F.H. (1911), page 1

farmers had already shifted from intensive moldboard plows to less intensive tillage with chisel and disk plows.[6]

For crops marketed as organic, the USDA organic standard requires that "the producer must select and implement tillage and cultivation practices that maintain or improve the physical, chemical, and biological condition of soil and minimize soil erosion."[7]

For organic farmers, tillage is an important practice that enables a system of farming without chemical biocides (as required by law for organic certification). Nate Powell-Palm is an organic farmer in Montana, where he grows wheat, flax, yellow peas, pulse crops and raises beef cattle on 1500 acres. He explains that tillage is an important practice on his operation. "Because we operate a holistic system, we manage weeds, fertility and disease pressure through our crop rotation. Over the course of eight years, we'll raise four years of annual crops such as wheat or flax, and four years of perennial crops, including alfalfa. We are able to manage our annual crops with two tillage passes per year and then we do not till again for the four years of perennial crops. The alfalfa period in our rotation is essential as it builds the majority of the nitrogen we use and restructures the soil," he explains. "Without tillage, we'd have to use herbicides, which are often ineffective, to manage the fields."

Crops harvested on Powell-Palm's organic farm would not qualify for the Regenified™ label, due to its prohibition on tillage.

Amy Bruch, a certified organic farmer in Nebraska, looked into Regenified™ certification, but was told by Regenified™ consultants that it would be very difficult, if not impossible, to maintain her organic certification while also becoming Regenified™. She explained the many innovative practices to enhance the soil health, productivity, and profits from her field crops to the consultants who visited her farm, only to learn her farm would not qualify for Regenified™ certification without changes in tillage.

"We have electric conductivity zone mapping for intelligent organic nutrient applications, eliminated synthetic pesticides and fertilizers, controlled traffic patterns with all our equipment, strategic cover cropping, innovative weed management tools including flamers and electrocutors, many tools for enhanced water management, no-till organic rotational crops when possible that leverage roller crimping, intercropping, and solid seeding, and not to mention an increased focus on employees including offering living wages, 401K, health insurance, and further education, and so on," she recalls telling the consultants.

The long list of highly innovative practices on her farm didn't seem to matter to the Regenified™ consultants. "The conversation with Regenified™ at the time was a one-dimensional focus on no-till," she says. "As an organic farmer, I see regenerative farming as a system and ***not the deployment of a singular practice like no-till or a cover crop***." With its severe restrictions on

[6] Report and Recommendations on Organic Farming, 1980, page 31.
[7] 7 CFR 205.203

tillage, it forced Amy to consider the choice between mechanical cultivation and its alternative: herbicides. She chose to remain certified organic.

Deeper dive: Impact of organic farming systems on soil health

Federal law prohibits the use of synthetic chemical herbicides and other pesticides in organic farming.[8] Tillage is permitted and serves many useful functions in organic systems.[9] Tillage and mechanical cultivation plays a vital role in preparing seed beds and controlling weeds. It is used to incorporate crop residues and cover crops down into the soil profile, as opposed to just into surface soil as is the case with no-till systems.

Deeper incorporation of residues and cover crops down into the soil also enhances soil carbon sequestration, thereby raising the amount of nitrogen cycling within soil food webs. Importantly, a properly timed and conducted tillage pass combats compaction so rainfall in the coming season will move more quickly down and more deeply into the soil, as opposed to running off, carrying soil and chemical pollutants into surface waters.

Many studies have demonstrated that organic farming systems that include appropriate and strategic tillage enhance soil organic matter content and soil health, as well as carbon accumulation when compared to conventional farming systems.[10] Well established organic farms have been shown to have higher levels of soil organic matter and lower rates of erosion than conventional farms,[11] including a study that compared organic matter content on organic versus conventional farms from all lower 48 states.[12]

A meta-analysis of published data from over 70 studies of pairwise comparisons of nearby organic and conventional farms found that soil organic carbon concentrations, soil carbon stocks, and carbon sequestration rates were significantly higher in soil from organic farms compared to soils from conventional farms. Important factors contributing to this increase in soil organic carbon include external carbon inputs (compost, animal manure) and crop rotations, both of which are required on most organic farms and routinely incorporated in organic farming systems.[13]

Numerous long-term side-by-side farming trials have been conducted in different growing regions of the United States to measure the impact of organic farming systems on soil quality. In the Variable Input Crop Management Systems trial at the University of Minnesota Southwest Research and Outreach Center near Lamberton, Minnesota, soils under organic management were found to have higher organic matter, organic carbon, and microbial biomass as well as increased storage of plant nutrients (e.g., phosphorus, potassium, and carbon). Enhanced soil health was associated with a reduction in soil-borne diseases, higher microbial biomass and

[8] 7 CFR205
[9] 7 CFR 205.203
[10] Lal, R. (2016)
[11] Seufert, V. and N. Ramankutty (2017)
[12] Ghabbour, E.A., et al. (2017)
[13] Gattinger, A., et al. (2012)

activity in the soil (storing and supplying more nutrients to future crops), an increase in mobile humic acids,[14] and importantly, greater soil water-holding capacity compared to the conventional system. This trial was conducted from 1989 to 2007.[15]

The USDA's Farming Systems Project in Beltsville, Maryland, evaluated the sustainability of rotations in organic farming systems compared to conventional cropping systems using both tillage and no-till. Particulate organic matter and soil organic carbon were greater in the organic system (with tillage) than in the conventional no-till system.[16]

The Long-Term Agroecological Research project at Iowa State University found higher soil organic carbon, total nitrogen, microbial biomass carbon, labile organic nitrogen and lower soil acidity in soil under organic management compared to soils under conventional management. Overall soil quality, and especially soil nitrogen mineralization potential, was highest in the 4-year organic crop rotation, including when compared to conventional no-till.[17]

The longest running side-by-side farming systems trial is at the Rodale Institute in Pennsylvania. This farming trial started in 1981, comparing three systems: conventional, manure-based organic and legume-based organic. In 2008, the Rodale Institute researchers divided each of these three systems into a standard full-tillage and reduced tillage system. The study has shown improved soil health outcomes from organic production, including organic systems with standard tillage. As published in 2021 in *Soil Science Society of America Journal*:

> Results also showed that 10 years of tillage treatments did not influence active and total soil organic carbon concentrations, but influenced dry aggregate size distribution and wet aggregate stability. This study suggests that in long-term organic cropping systems, incorporated composted manure and perennial hay vs. legumes alone accumulated the greatest amount of soil organic carbon compared with conventional systems.[18]

While these studies show that organic systems *with tillage* improve soil outcomes over time, including soil organic carbon, there have also been many studies conducted in non-organic systems showing that other practices have a greater impact on soil organic carbon levels than tillage. For example, a 2010 meta-analysis concluded that soil carbon levels were more impacted by cropping frequency and crop diversity than by tillage.[19]

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[14] According to Li et al. (2019), "Humic Acid Fertilizer Improved Soil Properties and Soil Microbial Diversity of Continuous Cropping Peanut: A Three-Year Experiment", *Scientific Reports 9,* "...humic acid changes the soil nutrient content, which not only increases the total nitrogen, total phosphorus, total potassium content of the soil, but also increases the contents of alkali nitrogen, available phosphorus, and available potassium, thus enabling peanut to absorb more nutrients."
[15] Coulter, J., et al. (2013)
[16] Cavigelli et al (2013)
[17] Delate, K., et al. (2013)
[18] Littrell et al (2021)
[19] Luo et al (2010)

Studies have shown that organic farming, with tillage, also reduces soil erosion compared to conventional systems, due to the improved soil structure from other practices that increase soil organic matter levels.[20]

To reduce the risk of erosion and negative impacts on soil health from tillage, there has been a collective effort in the organic farming community to further improve methods for conservation tillage within organic systems.[21] One example is the invention at the Rodale Institute of the roller crimper, a mechanical tool to kill cover crops without the use of tillage or chemicals.[22] While the roller crimper reduces the need for mechanical tillage, it does not eliminate it in organic systems (nor does it eliminate the need for herbicides for non-organic farmers who choose chemicals over tillage).

Dr. Erin Silva, Professor of Organic and Sustainable Cropping Systems at the University of Wisconsin-Madison, studies what the organic farming community refers to as “organic no-till” practices. She explains: “Without synthetic chemicals, many organic farmers rely on soil disturbance to manage weeds; however, this is balanced by ecological approaches to manage weeds, such as cover cropping and diverse crop rotations, allowing for reduced soil disturbance and improved soil health. While innovative organic farmers are experimenting with the use of cover crops to eliminate the need for tillage to manage weeds, these systems remain nascent. Long-term experiments demonstrate that even with soil disturbance, organic systems are still maintaining if not building carbon.”

Yet despite scientific evidence from farming system trials that show clearly that appropriate tillage and cultivation does not negatively impact soil health and organic matter content in organic farming systems, the Regenified™ standard severely restricts tillage of all sorts. A standard that restricts tillage would incentivize farmers to experiment with combinations of practices known to help control weeds, including, unfortunately, greater reliance on herbicides. Because of the emphasis on no-till in the Regenified™ standard, it is reasonable to be concerned that the lack of any meaningful discussion of herbicide and pesticide use in this standard will have the effect of incentivizing greater use of herbicides on many farms.

Section 1b: Allowance of pesticides, including herbicides

The Regenified™ standard allows the use of pesticides, including insecticides and herbicides. Even the most highly hazardous and highly toxic pesticides are allowed.

Section 2.3.2 of the Regenified™ standard states that farmers and ranchers “develop a plan, including cultural/biological practices, that will be used to reduce or mitigate possible disturbances to the soil chemistry such as pesticides, fertilizer, or manure.”

[20] Seufert & Ramankutty (2017)
[21] Carr, P. (2017)
[22] ‘Organic No-Till’ Helps Farmers Succeed - Rodale Institute

Section 3.2.3 addresses pesticides, including herbicides, by stating that “over the entire cropping rotation there must be a reduction in pesticide (herbicides, insecticides, fungicides, seeds treatments) pounds of active ingredient and number of applications to move from one tier to the next higher tier.”

In the April 2024 revision of the standards, Regenified™ added the following:

Section 3.2.4. “Prior to the use of any pesticide (herbicides, fungicides, insecticides), a basic pest management plan must be developed and approved by the Regenified™ Verification Review Board. Threshold values and locations should be determined for all target pests. The plan should include: 1) expected target pests, 2) planned monitoring strategies and treatment thresholds, 3) planned chemical suppression techniques including rates and timing 4) alternatives considered such as cultural, biological, or mechanical suppression techniques.”

Section 3.2.3 states that “no chemical pesticides may be used on grains in the 21 days prior to harvest.”

The Regenified™ standard fails to address herbicide and pesticide use in a meaningful way. It imposes on farmers requests for information that will be of little value in evaluating efforts to reduce reliance on pesticides. It is widely recognized that tracking and managing pesticide use based on pounds of active ingredient applied fails to take into account the significant differences in the rates of application across pesticides, and the lack of correlation between rates of application, mammalian toxicity, and pesticide impacts on soil health and the environment. Section 3.2.3 does not clarify whether there must be a reduction in total pesticide use, use of herbicides, use of insecticides, and other types of pesticides. Seed treatments are applied at a very low rate, so a 10% cut in the rate of application of atrazine or glyphosate-based herbicide would exceed the total weight of seed treatments utilized in a crop rotation.

The Regenified™ standard lacks any discussion, nor a requirement to target reductions in pesticide use toward those applications known to pose the greatest risks to public health and the environment. The standard does not require farmers to report and document their pesticide use, so there is no way to verify that any changes have been made.

The standard also does not acknowledge nor address the fact that it essentially requires no-till to be adopted by farmers hoping to progress to higher tiers of certification. The standard is also silent on the fact that no-till enhances dependence on herbicides as the primary weed control tactic on the vast majority of farms on which no-till is utilized.

In any given season, there are two main approaches for row crop farmers to effectively control weeds: mechanical (tillage) and chemical (herbicides). Over time, diverse crop rotations with a grass and/or alfalfa forage crop for two or more years are also an important tactic for long-term suppression of weeds.

But on fields producing corn, soybeans, cotton and other row crops, the elimination of one weed management tactic will inevitably lead to greater reliance on others. When organic farmers eliminate herbicides, they cultivate and rely more heavily on mulches and residue management. When conventional no-till farmers eliminate cultivation, they mostly intensify herbicide use, and especially the use of post-emergence herbicides.[23] In fact, many agronomists and agricultural economists consider no-till and herbicide use to be two essential components of a single practice,[24] and the widespread availability of seeds genetically engineered to tolerate “over the top” applications of certain herbicides has been credited as enabling the widespread adoption of no-till farming.[25]

No-till farming is widely adopted in North America. According to a 2018 report by the USDA’s Economic Research Service (ERS), conservation tillage practices – including no-till, strip-till and mulch-till – were used on roughly 70% of soybean, 65% of corn, and 67% of wheat acres in the US.[26] Even strict no-till, with a frequency of tillage that corresponds to the Regenified™ requirement for tier 5 (no more than one tillage pass every 4 years, not counting planting), is already widely practiced, and its popularity continues to rise. Its adoption on wheat acres increased from 20% in 2004 to 39% in 2009 before rising to 45% in 2017. Strict no-till has been adopted on 36% of corn acres and 39% of soybean acres.[27]

This widespread adoption of no-till farming has been enabled by the development and widespread availability of herbicides. The scientific book *No-Till Farming Systems for Sustainable Agriculture* describes its history:

> From 1950 to 1970 the development of herbicides that allowed weed control without tillage, and the development and refinement of low disturbance direct seeding equipment helped no-till practice to develop. However, the high cost of these early herbicides, their lack of effectiveness against some broadleaf weeds, and continuing issues with seeding, meant that no-till was still not widespread. It wasn’t until the 1970–1980s and the development of the broad-spectrum herbicide glyphosate, further refinement of seeding equipment, and demonstration by some early adopters that no-till could be profitable, that no-till systems started to gain popularity. Since the 1990s, decreases in herbicide costs, increases in fuel prices and a growing awareness of the benefits of no-till have acted to drive farmer uptake worldwide.[28]

No-till adoption has increased by 400% in the previous two decades, and no-till is now practiced on 180 million hectares worldwide, representing 12.5% of global cropland. The USA, Brazil,

[23] Maheswari et al (2021)
[24] Sutherland et al. (2021); Perry et al. (2016); Givens et al. (2009); Claassen et al. (2018)
[25] Kumar et al. (2020)
[26] Claassen et al (2018), p. 5
[27] https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=105042. Latest data for corn is 2021 and soybeans in 2018.
[28] Kumar et al. (2020)

Argentina, Canada and Australia are the top five adopters.[29] These countries are also the top users of herbicides.[30]

The rise in no-till agriculture in North America has been accompanied by a dramatic increase in herbicide use. Total herbicide applied to soybean acres rose from 47 million kilograms in 2006 to 87 million kilograms of active ingredient in 2020, despite the acreage remaining constant.[31] As weeds develop resistance to widely used herbicides like glyphosate, no-till farmers are turning to other herbicides. The use of dicamba, an herbicide classified as more hazardous to human health than glyphosate,[32] has increased 97-fold from 2015 to 2020 in the United States.[33]

This connection between no-till and herbicides has been recognized in the popular press for farmers as well. *No-Till Farmer* notes the role of Roundup (glyphosate) on no-till adoption: "It's no coincidence that U.S. no-till acres grew 2.5 times in Roundup's first 10 years (and 7-fold by the time the exclusive patent expired in 2000)."[34]

Agricultural economists have sought to shed light on whether the rise in adoption of no-till and the dramatic increase in herbicide use is coincidence. Numerous studies conclude that it is not, and that no-till and herbicide use are complementary practices.[35] In one of these studies on glyphosate and no-till, farmers were surveyed and asked: "what would change in the absence of glyphosate?" Among the farmer responses: "more tillage would be needed," "zero till farming would be very difficult or next to impossible," and "glyphosate enables zero tillage."[36]

Advocates of regenerative agriculture who focus on no-till contend that no-till in combination with other practices, such as those referenced in the 6-3-4™ framework, drastically reduces the need for chemical pesticides. Since chemicals are expensive, the assumption is that farmers who adopt the 6-3-4™ framework will voluntarily move away from chemical use. While some farmers have achieved reductions in chemicals using the 6-3-4™ system, many have not. A survey of farmers who have implemented the 6-3-4™ regenerative soil health principles after attending Soil Health Academy workshops (required for Regenified™ eligibility and taught by Understanding Ag, the company that owns the 6-3-4™ trademark) shows that a majority did not decrease their use of pesticide use by more than 30%, and more than one-third did not decrease their pesticide use at all.[37] Plus, changes in the pounds of different pesticides applied

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[29] Dang et al., 2020, p. 6
[30] Statista (2023)
[31] Mortensen et al. (2024)
[32] World Health Organization (2020). https://www.who.int/publications/i/item/9789240005662
[33] Mortensen et al. (2024)
[34] https://www.no-tillfarmer.com/articles/11465-herbicide-history-part-ii-no-till-rallies-on-roundup
[35] Maheswari, S.T. (2021); Sutherland et al. (2021); Perry et al. (2016); Givens et al. (2009); Claassen et al. (2018)
[36] Sutherland (2021), p. 9
[37] Soil Health Academy (2024) p. 9 and 10. SHA notes that organic farmers and ranchers participating in the survey "are likely depressing the aggregate impact in the input areas of inquiry." The survey found that 64% of respondents reported that they had not decreased their use of synthetic fertilizers by more than 30% and 61% had not decreased their pesticide use by more than 30%. Thirty one percent of respondents reported they had not decreased their use of synthetic fertilizers and 35% reported no decrease in pesticide or herbicide use.

may or may not reduce public health risks nor adverse impacts on soil health and the environment.

The complementarity of no-till and herbicide use cannot be ignored within the context of a standard that severely restricts tillage, and does so overtly and without an accompanying clear restriction on the use of high-risk herbicides. The Regenified™ standard only mentions that a farmer should “consider” the use of non-chemical pest control methods, and requires a reduction in the volume and number of applications, placing no restrictions based on pesticide toxicity and known risks to public health. There are several problems with this approach that warrant further discussion.

Grounding a pesticide use reduction goal on the pounds of active ingredient applied is inappropriate. In conventional fruit and vegetable systems, growers typically apply 6 to 15 active ingredients, of which one to three will be pesticide products containing petroleum oil, kaolin clay, or sulfur. All such products are applied at very high rates of application. A reduction in the rate of application of sulfur or an horticultural-oil based product by 10% would often exceed the total pounds of insecticides applied in a given crop. The Regenified™ standard inadvertently incentivizes the reduction in rates of application of generally low-risk, non-synthetic pesticides, rather than incentivizing the reduction of much more toxic synthetic pesticides, many of which are applied at far lower rates per acre treated.

The standard’s focus on volume and number of applications could lead farmers to switch to *more* toxic and persistent active ingredients in order to reduce the number of sprays and the volume of active ingredients applied. Pesticides have different toxicity levels to different organisms and behave differently as a function of soil type, weather patterns, and other aspects of farming systems. A single low-dose application of a highly toxic and persistent pesticide is likely to have a much more deleterious impact on human health, soil health, pollinators, and wildlife than multiple high-volume applications of a naturally-derived pesticide with low toxicity and low persistence. This is why tools developed to track the health and environmental benefits of Integrated Pest Management (IPM) take into account pesticide toxicity, persistence, and environmental fate.[38]

By allowing any herbicide to be used one or more times, and requiring an unspecified reduction in volume and number of applications, the Regenified™ standard allows the continued use of glyphosate, dicamba and other more toxic herbicides for weed control. In 71% of cases evaluated in a peer-reviewed meta-review, all of the most commonly used classes of pesticides were found to kill or harm soil invertebrates including earthworms, ants, beetles, and ground nesting bees.[39]

Regenified’s™ lack of measurable and enforceable requirements will likely not lead to much change in pesticide use. By failing to consider toxicity and persistence of pesticides, the

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[38] For example, see the IPM Institute’s “Pesticide Risk Tool” at pesticiderisk.org.
[39] Gunstone et al (2021)

Regenified[TM] standard will forgo the opportunity to support essential changes needed to help farmers back off the herbicide treadmill so many are now trapped upon.

In terms of reducing reliance on synthetic chemical pesticides, the novel biointensive IPM systems pioneered by organic farmers over the last half century are one of the primary sources in the US of practical and profitable, non-chemical pest management system technology. The fact that the efficacy and profitability of such systems are almost always rooted in enhanced soil health should be noted – and indeed promoted – in the Regenified[TM] standard and program. This is another reason why specious pesticides-related claims based on progress through the tiers laid out in the Regenified[TM] standard will be tracked carefully by many interested parties.

Section 1c: Allowance of GMOs

The Regenified[TM] standard allows the planting of genetically engineered seeds and with no restrictions. In fact, the genetic engineering of seeds, and plant breeding technology, is not mentioned in the standard. This is a notable omission in the context of the Regenified[TM] standard's severe restriction on tillage and lack of meaningful restrictions on herbicide use.

Agricultural economists have identified genetically engineered seeds as a third practice that is complementary to no-till and herbicide use.[40] As noted in *No-Till Farming Systems for Sustainable Agriculture,* GMO herbicide-tolerant crops made chemical weed management easier and even more effective, thereby further boosting the adoption of minimum and no-till systems.[41]

The vast majority of genetically engineered crops planted in the United States are engineered to withstand the application of herbicides. Based on USDA survey data, the percent of soybean acres planted with herbicide-tolerant seeds rose from 17 percent in 1997 to 68 percent in 2001, and to 95 percent in 2023. In 2023, 91 percent of domestic corn acres were planted with genetically engineered herbicide-tolerant seeds.[42]

The use of genetically engineered seeds is misleadingly marketed to farmers and the public as a way to reduce the need for pesticides.[43] The way the Regenified[TM] standard is written, a no-till grain grower who plants a cover crop on a portion of the farm's fields, and has three crops in the rotation on some parts of the farm, could attain tier 4 or 5 for all crops grown on the farm, the highest tiers in the Regenified[TM] system. Yet on all fields, they could plant genetically engineered, herbicide-tolerant seeds and apply multiple herbicides, and some more than once

[40] Givens et al. (2009); Perry et al. (2016); Sutherland et al. (2021)
[41] Carpenter and Gianessi 1999, as cited in Kumar et al 2010.
[42]https://www.ers.usda.gov/data-products/adoption-of-genetically-engineered-crops-in-the-u-s/recent-trends-in-ge-adoption/
[43]https://www.fda.gov/food/agricultural-biotechnology/why-do-farmers-us-grow-gmo-crops#:~:text=Farmers%20can%20use%20less%20spray.the%20soil%20to%20control%20weeds; Bayer (2023); Schutte et al. (2017)

per year, while also continuing prophylactic use of seed treatments and fungicides in the hope of increasing yields, at least in some years or on some fields.[44]

Section 1d: Allowance of synthetic nitrogen fertilizers

Regenified™ claims to provide a climate solution, but fails to address one of the major sources of greenhouse gas emissions in agriculture: manufactured nitrogen fertilizers.

Section 3.2.2 states: "Injected fertility should be applied with a low disturbance applicator. If a high disturbance applicator is used, it also counts as a tillage pass. For Tier 4-5 a low disturbance applicator must be used."

Section 3.8 of the Regenified™ standard, which addresses fertilizer use, has only one requirement. Section 3.8.1 states: "fertilizers (including purchased, commercial nitrogen fertilizers) must be applied at crop removal rates or less."

This is not a meaningful or enforceable requirement. The standard does not specify how crop removal rates should be calculated, and by whom, and how on-farm sources of nitrogen cycling in the soil should be accounted for. Crop removal rates are not a static number but a range.[45] These ranges have typically been developed using research solely from conventional systems. Yet farming practices influence the level and mix of nutrients cycling in the soil and nutrient bioavailability to crops. These are among the many reasons crop removal rates and the need for off-farm fertilizer varies and often differ markedly from published crop removal rates. As Dan Kaiser, nutrient management specialist at University of Minnesota Extension, writes: "One thing you need to know about calculating removal-based rates is that the so-called rules of thumb for the amount of phosphorus and potassium in grain may or may not represent what you have in the field [i.e. already in the soil]."[46] Accurate crop removal rate and fertilizer rate calculations requires lab analysis.[47]

The crop removal rate should also be multiplied by yield/acre, yet there is no mention in the Regenified™ standard of how to measure and verify projected annual yields, or how to account for moisture content at time of harvest. Further, crop removal rates alone are not sufficient. Growers should also factor in the baseline concentration of nutrients in the soil (via soil testing) and the ability of soils to retain and supply nutrients (i.e. turnover from soil organic matter, impacts of soil texture).[48] [49] Scientists are just beginning to document the turnover of nutrients from organic amendments and organic matter.

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[44]For example, a four year rotation including GMO herbicide-tolerant corn followed by GMO soybeans, and then two-years of GMO alfalfa.
[45] https://blog-crop-news.extension.umn.edu/2022/11/5-things-to-know-about-removal-based-p.html
[46] https://blog-crop-news.extension.umn.edu/2022/11/5-things-to-know-about-removal-based-p.html
[47] https://blog-crop-news.extension.umn.edu/2022/11/5-things-to-know-about-removal-based-p.html
[48] https://www.soils.org/files/certifications/certified/education/self-study/exam-pdfs/147.pdf
[49]https://www.canr.msu.edu/news/nutrient_removal_rates_by_grain_crops#:~:text=Nutrient%20removal%20amounts%20can%20be,per%20acre%20K20.

Section 3.8 contains two additional recommendations. Section 3.8.2 states that “there should be a reduction in nutrient application rates from previous evaluations.” The use of the word “should” indicates this is a recommendation, and not an enforceable requirement. Recommending a reduction from previous “evaluations” is not meaningful without addressing the baseline level of nitrogen in the soil. If baseline nitrogen levels are elevated, a farmer who reduces applications over time might still be over-applying and leaving nitrogen vulnerable to losses as nitrates to surface and/or groundwater, or as nitrous oxide into the atmosphere (a potent greenhouse gas).

Section 3.8.3 mentions “nitrate test strips used in edge of field water,” and that “nitrate should be below 10 ppm.” Again, the lack of the word “must” and the use of the word “should” indicates this is guidance rather than a requirement. While a properly timed and conducted measurement of nitrogen in “edge of field water” is helpful in managing the flow of nitrates in surface water, it fails to address nitrate pollution of groundwater, which is also a major human health concern (e.g., blue-baby syndrome). No-till or reduced tillage will typically lead to a reduction in soil erosion, and therefore a reduction in nitrate pollution of surface water, but nitrate could still be building up in soil and steadily moving below the root zone on the way to groundwater, especially with increased porosity in these systems and in areas with certain geological features.

The Regenified™ standard’s failure to address synthetic nitrogen fertilizers in a meaningful way is a major shortcoming given the program’s stated goals of promoting soil health and reducing the environmental impacts of agrochemicals. Too much nitrogen in soil triggers spikes in the growth of certain soil microorganisms that thrive by breaking down organic matter, incrementally undermining soil health and increasing the risk of compaction. Other labels for regenerative farming systems, including USDA Organic and Regenerative Organic Certified, prohibit synthetic nitrogen fertilizer. Nitrogen fertilizer is a major source of greenhouse gas emissions in agriculture. Production of manufactured nitrogen fertilizer uses the Haber-Bosch process, an industrial process which relies on natural gas to provide the energy needed to transform atmospheric nitrogen into a form that plants can use.[50] As a result, the production of synthetic nitrogen fertilizers, their transport, and necessary supply chain infrastructure have a sizable carbon footprint. When applied to soil, the greenhouse gas footprint of nitrogen fertilizer further increases, as it contributes to nitrous oxide emissions. Nitrous oxide has 298 times the global warming potential of CO_2 and is also the largest contributor to ozone depletion.[51]

According to the Environmental Protection Agency, nitrous oxide (N_2O) is the largest contributor to global warming potential from cropping systems in the United States, and agricultural soils produce the majority of N_2O emissions.[52] In fact, cropland accounted for 68% of total direct N_2O emissions, compared to 32% from grazing lands and forage fields between 1990 and 2019.[53] On cropland, the largest share of N_2O can be attributed to the application of synthetic nitrogen

[50] Hasler et al. (2015)
[51] Ravishankara et al. (2009)
[52] EPA (2021) (p. 434)
[53] EPA (2021)

fertilizers.[54] N_2O emissions increase linearly with fertilizer application.[55] In agriculture, the majority of nitrous oxide comes from often excessive fertilizer applications, meaning it has the most potential for reduction.[56] Some research has also shown that no-till agriculture may increase nitrous oxide emissions.[57]

A 2022 study published in *Nature Scientific Reports* found that the global synthetic nitrogen fertilizer supply chain was responsible for estimated emissions of 1.13 gigatons of CO_2-equivalent in 2018, ***representing 10.6% of agricultural emissions and 2.1% of global greenhouse gas emissions.***[58] Global emissions from synthetic fertilizers increased more than 9-fold between 1961 and 2010.[59] The authors of the 2022 *Nature Scientific Reports* study conclude: "Reducing overall production and use of synthetic nitrogen fertilizers offers large [climate change] mitigation potential and in many cases highly realizable potential to reduce N_2O emissions."[60]

Nitrogen fertilizer is also a major source of drinking water pollution in rural communities and a leading cause of pollution in marine ecosystems, such as the Dead Zone in the Gulf of Mexico. In the United States, much of the nitrogen runoff from farms winds up in the Mississippi River, which drains into the Gulf of Mexico. Nitrogen runoff from farms contributes to hypoxia, a reduced level of oxygen, in marine ecosystems. When there is less dissolved oxygen in the water, it creates a "dead zone," because most marine life either dies from the lack of oxygen or leaves the area if they are mobile and able to escape. The National Oceanic and Atmospheric Administration (NOAA) states: "habitats that would normally be teeming with life become, essentially, biological deserts."[61] The size of the Dead Zone in the Gulf of Mexico changes slightly every year depending on conditions. In 2017, the Dead Zone was 8,000 square miles (slightly larger than New Jersey).[62]

Section 1e: Failure to address other elements of regeneration

The Regenified™ standard's requirements for supporting on-farm biodiversity lacks specificity. Section 3.10.2 states that "on croplands, plant biodiversity must be increasing from the initial verification to the most recent verification." The standard does not define plant biodiversity, how it should be measured, or what percentage increase is necessary. Since the unspecified increase only has to occur from baseline to the most recent verification, this means that if a farm starts at Tier 1, with no biodiversity, adding one plant species would theoretically satisfy the requirement. Section 2.5.2 is equally vague and unenforceable, stating that producers develop in their written plan "a cash crop planned rotation and cover crops needed to insure adequate

[54] EPA (2021) (Table 5-18 on p. 434)
[55] Cole et al. 1997; Burger et al. 2012
[56] IPCC, 2007; Smith et al. 2007; Reay et al. 2012
[57] Li et al. (2005)
[58] Menegat et al. (2022)
[59] Smith et al. (2014)
[60] Menegat et al. (2022)
[61] NOAA 2021
[62] NOAA 2021

plant diversity." Adequate plant diversity is not defined, nor is the impact of other farming practices like rotations, crop residue management, and pesticide use addressed.

Section 3.4.1 and 3.4.2 requires croplands to have "three functional groups (warm, cool, grass, broadleaf, legume, shrub, tree) present in the entire rotation in the form of cash crops, cover crops and/or annual forages" and also that a "diverse, variable crop/cover crop rotation" must be used for tiers 4-5 (farmers can start marketing their crops as Regenified™ starting at tier 2). A consumer purchasing food with the Regenified™ label is therefore assured only that the farm had a 3-crop rotation on some part of their farm.

Section 3.3.1 requires ground cover, and provides tables with the percentage ground cover required. For example, a farm located in an area with 25 inches of precipitation or more is required to have 50-70% ground cover on cropland and grassland to reach tier 2 and 3, and 70-90% ground cover for tier 4 and 5. In "extremely brittle areas" with less than 15 inches of precipitation, the farm is required to maintain 20-30% ground cover, and 30-50% ground cover for tier 4 and 5. A similar set of tables appears in Section 3.9.1, which requires a percent living plant cover. The percentages required for living ground cover in section 3.9.1 align with the percentages required for ground cover in section 3.3.1. It is unclear how these percentages should be calculated, and whether a field can be eligible for Regenified™ if 80% of it is left bare.

Another notable omission from the Regenified™ standard is a prohibition on plastics, including plastic to keep the soil covered and plastics in compost. Plastic pollution in soils is estimated to be worse than in the oceans and there is evidence that it impacts biodiversity, especially invertebrate health.[63] Whether plastic mulches and row covers are allowed and how they must be managed should be addressed explicitly in the Regenified™ standard.

The Regenified™ standard also does not address farmworker protections and wages, farm animal welfare protections (other than providing basics such as food and water and "adequate space to move about and express their natural habits" in Section 3.6.2), farm animal slaughter standards, and protections for natural resources, including biodiversity and water.

Section 2: Regenified™'s outcome standards

Section 2a: Unenforceable standard with flawed methodology and shallow soil sampling

Section 3.9.1 contains the only outcomes-based requirement in the Regenified™ standard: "Soil organic carbon must be on an upward trend." The standard uses the term "should" for all other outcomes (though farmers are required to perform soil tests, including Haney and PLFA, discussed below). To move from tier 2 to tier 3, for example, Section 1.4.4 states that "current evaluation scores and soil tests should be higher than previous scores," but does not specify

[63] Chae, Y., & An, Y. J. (2018); Joos, L., & De Tender, C. (2022); Allouzi, M. M. A., et al (2021)

what constitutes a meaningful increase, what the baseline should be, and what happens in terms of eligibility for the Regenified™ label if one or more evaluation criteria or soil tests have a lower score.

The standard also does not address how a farm will fare in the Regenified™ system that has already attained, or has retained high levels of soil organic matter and carbon relative to the maximum level attainable in a production region. On such farms, variation up and down in soil organic matter/carbon levels is expected and unavoidable. The method and timing when soil samples are collected in organic matter levels, and lab methods and protocols can further skew soil carbon results up or down compared to other labs, or other tests.

For the only required outcome, that standard's use of the term "upward trend" is vague, and would be difficult to enforce. Moreover, calculating soil carbon stocks to ensure an "upward trend" over time is unrealistic. Changes in soil carbon stocks and other measures of soil health can take decades or more. That said, changes in the top layer of soil can be easily manipulated with the addition of high-carbon inputs, especially when the sampling locations are not randomized and the samples are collected not by a neutral third party, but by individuals with an interest in the outcomes (such as a Regenified™ field evaluator, an Understanding Ag consultant, or the farmer).

The Regenified™ standard does not require that samples be collected according to a randomized sampling scheme or by a neutral third party, nor that sampling and testing year-to-year is done in the same way to minimize variations in soil carbon levels that are driven primarily by when and how a sample was collected in the field and tested in the lab.

There is also a strong correlation between soil carbon stocks and soil properties that are beyond the farmer's control, such as soil texture, pH, mineralogy, temperature and precipitation. For example, drought conditions reduce soil water content and also soil organic carbon, regardless of farm management practices.[64] In some cases and parts of rotations, just maintaining soil organic carbon levels is a positive outcome and should be recognized as such. The standard only requires an "upward trend" without specifying from what starting point, and how the slope of the trend line will be established and analyzed. Natural variability driven by weather patterns and the timing of soil sampling, and the method used to collect samples, can have a larger impact on soil carbon levels in any given field than all changes in farming systems from baseline, including adherence to the "should" and "must" requirements in the Regenified™ standard. Accordingly, over time, a farm's eligibility to use the Regenified™ label may depend primarily on factors the farmer has little or no control over.

Furthermore, organic carbon accumulation in the soil is bounded by the inherent characteristics of the soil in conjunction with local weather.[65] Soil carbon and organic matter levels that can be attained in North Dakota exceed by a wide margin the levels that farmers in Texas or much of the arid west can reach. This is because in some northern plains states, ample rainfall in areas

[64] Soares et al. (2023)
[65] Stewart et al. (2007)

with a relatively short growing season can add prodigious amounts of organic matter into soils, followed soon thereafter by cold weather and the freezing of farm soils. Such a weather pattern dramatically slows soil microbial activity for several months per year, thereby allowing organic matter levels to build over time if properly managed during the growing season. Such a weather pattern also keeps heavy machinery off of farm fields for much of the year, reducing the risk of compaction, and shortens the time period when weeds need to be actively managed.

In much of the west, intensively farmed fields grow high-value fruits and vegetables,and often two or more crops per year. Weeds will germinate and thrive almost year round and must be managed. The soil never freezes, and soil moisture levels for most of the year support high levels of soil microbial biodiversity and activity. These factors collectively result in the breakdown and creation of a lot of organic matter, but also place practical limits on realistically attainable soil organic carbon levels, especially compared to agroecosystems like those in the northern plains states.

But in general, soil organic carbon should ideally rise on fields with degraded soil (defined, for example, as a field with 50% or less of the soil organic matter present on well-managed, nearby farms or fields in long-term permanent pasture use). Soil organic matter and carbon levels will, however, plateau; the level at which this occurs will depend on regional weather, soil type, climate, and many aspects of farming system design. If soil carbon levels continue to increase, beyond realistically attainable levels possible with continued farm production, farmland will eventually turn into swampland.

Consider an analogy. Body weight is a good, though imperfect, indicator of overall health, similar to how soil organic carbon is a good indicator of overall soil health. Many people in the US are overweight or obese and suffer higher risk of a range of chronic diseases. However, this does not mean that we should ask all people to keep their body weight on a “downward trend” forever. The Regenified™ standard should not require a continuous “upward trend” in soil organic carbon. It should instead allow for maintenance of soil organic carbon once the realistically attainable level is reached, as well as some variation both up and down from that level year to year, without being pushed downward to a lower tier of Regenified™ eligibility.

This key point also highlights one of the unequivocally positive contributions a program like Regenified™ could make: compiling and vetting the regional and cropping-system specific data needed to establish realistically attainable levels of soil organic matter and soil carbon, along with the detailed protocols and methods required to determine how a given farm is doing relatively to reaching such levels.

This capability would also allow farmers and ranchers who were early and successful adopters of soil health management to qualify for the higher tiers in a program like Regenified™, without having to continue increasing their soil carbon levels.

There are also many methodological problems with the Regenified™ label's outcome-based standard. It does not specify the required depth at which soil samples must be taken.[66] The standard does, however, include a hyperlink to the Regen Ag Lab recommended sampling instructions, which recommend "0-6 inches or 0-8 inches."[67] The average depth of soil sampling in research is 25.7 centimeters, or about 10 inches, but even this depth is recognized to be too shallow, as soil below 30 centimeters holds between 30 to 75% of the total carbon stocks.[68] The Kyoto Protocol calls for 1 meter deep (100 centimeters or 40 inches), and most carbon markets now require this depth.

Shallow sampling often skews soil carbon levels upward, as numerous studies have found.[69] For example, in a long-term trial (19 years) on the impact of farming practices on the long-term soil carbon storage in agricultural fields in California, researchers sampled soil at different depths, up to 2 meters (80 inches). They found that if they only measured soil carbon in the top 30 centimeters, they would have assumed an increase in total soil carbon with winter cover cropping alone, whereas in reality significant losses in soil organic carbon occurred throughout the 2 meter soil profile. They concluded that "ignoring the subsoil carbon dynamics in deeper layers of soil fails to recognize potential opportunities for soil carbon sequestration, and may lead to false conclusions about the impact of management practices on carbon sequestration."[70]

The deeper dive section titled "impacts of no-till on carbon sequestration" in Section 2c on page 28 also shows that several meta-analyses have concluded that no-till practices increase soil organic carbon levels on the surface of the soil without equivalent increases at deeper levels of the soil profile. Many of these meta-analysis and review studies conclude that reported increases in soil organic carbon from no-till systems are based on studies using shallow sampling procedures, and often do not accurately reflect overall changes in soil carbon levels in the rootzone and to the depth impacted by annual farming system choices.

There are additional concerns with the Regenified™ standard's outcome measurements and verification processes. In addition to not specifying soil depth, it does not include a well-defined and comprehensive soil sampling scheme, and requires one sample every 50-100 acres.[71] The standard even allows "extremely large farms with very similar management strategies and soil textures" to take fewer samples per acre.[72] Without clear definitions of key terms such as "extremely large farms" or "very similar management strategies," this language is unclear and therefore unenforceable.

The sampling density of one sample per 50-100 acres will not result in meaningful results on many farms, as it does not account for natural variation nor farming system impacts, and is, as a

[66] Section 4.1.3
[67] https://regenaglab.com/wp-content/uploads/2020/03/Soil-Health-Sampling-Instructions_032020.pdf
[68] Jobbagy and Jackson (2000); Harrison et al. (2011)
[69] Chabbi et al., 2009; Harrison et al. (2011)
[70] Tautges et al (2019)
[71] Sections 4.1.1; 4.2.1; 4.1.4
[72] Section 4.1.5

result, not statistically robust.[73] In a 2023 study, researchers found that random sampling error generated differences that were of the same magnitude as plausible soil organic carbon accrual rates of 1 to 5 metric tons of carbon per hectare per 10 years. The researchers write that reasonably accurate estimates of individual field change are not achievable even with current best practices in soil sampling.[74]

The Regenified™ standard also does not require that sampling locations or plots are randomly assigned. Section 4.1.2 states that the sampling locations are stratified only by soil texture, which is not sufficient. Proper sampling methodology should include variability of mineralogy, pH, ground cover, topography, the history of tillage and cropping systems, etc.

The standard also does not specify who should collect the soil samples, and whether it should be a neutral third party, the field verifier who is a Regenified™ employee, or the farmer. Test results can easily be manipulated by sampling from certain sites with known, high quality soil (i.e., near hedgerows, areas near barns that have historically been treated with animal manure, low spots in fields where topsoil has collected).

The Regenified™ standard requires follow-up samples after 3 years, and states that "site locations for the soil organic carbon sample(s) will be georeferenced so it can be relocated for future sampling."[75] This suggests that the Regenified™ standard requires soil samples for subsequent verifications to be taken from the same sites as the initial verification. However, to be methodologically sound, samples should be randomized *each time* and should be taken according to a truly stratified random sampling design.[76]

Section 2b: Regenified™ requires relatively expensive tests that are not considered useful indicators of soil health in all regions or farming systems

The Regenified™ standard requires a Haney and/or Phospholipid Fatty Acid (PLFA) soil test, which leaves farmers with only two choices for laboratories: Ward Lab and Regen Ag Lab. The Regenified™ standard hyperlinks to the Regen Ag Lab website, clearly directing farmers to this lab (the founder and CEO of this lab is listed as an advisor on the Understanding Ag website). Ideally, soil tests used to verify adherence to standards and claims that are linked to a consumer-facing label should be analyzed at the land-grant university in the state where the farm is located. Such labs typically keep up with advances in analytical methods and routinely calibrate their testing protocols and equipment. By requiring specific tests at just a few labs, farmers are discouraged from using reputable and regional laboratories. It is also worrisome that some experts are not confident the Haney and PLFA tests are reliable and/or useful indicators of soil health across the diversity of soils and farming systems in the US. In addition, funneling all farmers participating in the Regenified™ program to just two methods and labs cuts

[73] Stanley, P. et al (2023)
[74] Bradford, et al (2023)
[75] Section 4.1.6
[76] Potash, E., et al (2023); Potash, E., et al (2022); Stanley et al (2023); Smith et al (2020)

the program, and its participating farmers, off from the exciting innovations emerging in soil testing methods.

The Haney Test

The Haney test is mentioned in different sections of the Regenified™ standard, suggesting that it is required for Regenified™ eligibility.[77] There are several problems with including the Haney test as a measure of improvements in soil health. The Haney test is not sensitive to management and has been found to be highly variable and inconsistent even in the same management system and soil type.[78] The Haney test needs to be calibrated by context, and even then, it is not guaranteed to be useful, especially because results are highly dependent on soil moisture content at time of testing. Singh et al wrote in a study published in *Soil Science Society of America Journal*:[79]

> Lab procedures used in conducting the battery of tests that go into the [Haney] Soil Health Score are still undergoing standardization. Soil Health Scores currently have high random variability (associated with test methodology). Therefore, it is unrealistic to regard the current Soil Health Score as a reliable indicator of real change in measured parameters in a field over time.

PLFA tests

The Regenified™ standard also includes the Phospholipid Fatty Acid (PLFA) test and recommends increases in two measures included in this test.[80] PLFA is a relatively new test, which only two soil laboratories offer. One of those two labs is Lance Gunderson's Regen Ag Lab, which offers it for $80 per sample (for comparison, standard soil tests at university labs cost $12-14). This expensive test measures microbial biomass and the fungal to bacterial ratio, but it only provides a snapshot in time.[81] When environmental conditions change (temperature, moisture, pH, etc.), so does the microbial community. The standard does not specify the sampling methodology, which is problematic since measures of microbial communities can vary widely depending on when and how the soil is sampled, coupled with how a field and crop

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[77] Section 3.9.5 requires water extractable organic carbon from the Haney test and section 3.9.10 requires percent microbially active carbon from the Haney test. The standard states that the water extractable organic carbon score should be increasing from previous tests, without specifying an acceptable level of improvement. The standard gives a recommended range for microbially active carbon (50-80). In another section of the standard, Regenified™ recommends that CO2 respiration should be increasing (3.10.7) and that the Haney Soil Health Score should be increasing (3.10.8). In yet another section, the standard requires that "carbon must be on an upward trend" from the carbon loss on ignition test included in the Haney test (3.8.6). In section 3.8.7, water extractable organic nitrogen, which is also included in the Haney test, "should be on an upward trend."

[78] Chu et al (2019)

[79] Singh et al (2020)

[80] Section 3.10.9 states that "PLFA - total microbial biomass should be increasing." Section 3.10.10 states that "Arbuscular mycorrhizal colonization should be apparent and improving as % of total fungal population," and section 3.10.11 states that "PLFA - fungal to bacterial ratio should be improving."

[81] Fierer et al. (2021)

residues have been managed in the recent past. Recent, heavy, or recurrent applications of animal manure or compost can dramatically change testing results.

As it only measures microbial biomass and fungal to bacterial ratios, it is not considered a useful indicator of several other dimensions of soil health, and it does not offer useful insights into improved soil health outcomes.[82] Fungal to bacterial ratios do not necessarily offer useful insights, as those ratios can vary for many reasons, making interpretation difficult.[83] The test also does not reflect current ecological understanding of complex, multi-trophic soil food webs.[84]

Will Brinton explains the problems with using the PLFA test to draw conclusions about the impact of farming practices in an opinion piece published in the journal *Agricultural Research and Technology*:[85]

> The notion that PLFA patterns change rapidly enough to use them for management trials is not well supported, and the view that ratios of PLFA's such as trans/cis, indicate community "stress" has not been substantiated consistently. Moreover, the very popular use of PLFA to calculate ecological indexes such as Shannon diversity, Species Richness or Evenness is regarded as certainly flawed.
>
> A recent study in our laboratory of 4 well-characterized soils processed and shipped to recognized PLFA labs revealed just how large discrepancies in findings can be. The average total PLFA biomass recovered from the soils differed by a factor of 2 between the two labs. The ratio of fungi to bacteria (TF/B), the diversity index and stress rankings were substantially different, and in two of the samples, opposite to each other. One PLFA lab assigned the most optimum result to the most depleted sample taken from a 30-year continuous corn trial soil, a Ultisol from North Carolina which also had very low CO_2 respiration, low carbon and poor structure.

Other tests and considerations

The other metrics included in the Regenified™ standard are water holding capacity, wet aggregate stability and bulk density. These are also highly variable metrics, and sample collection methods and analysis have been found to have a greater impact on results than management practices.

Not only are these tests expensive, they are also time consuming, requiring significant labor costs to take soil samples and prepare them for shipping. Shipping soil samples for accurate analysis requires packing the samples on dry ice (though this is not included in the Regen Ag Lab recommended sampling instructions that are linked from the Regenified™ standard).

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[82] Brinton, W.F. (2020); Fierer et al (2021)
[83] Fierer et al. (2021)
[84] Fierer et al (2021)
[85] Brinton, W.F. (2020)

Section 2c: Failure to assess total climate impacts

By focusing on increasing carbon levels in soil, without directly addressing high carbon-footprint inputs and on-farm energy use, the Regenified™ label misses the forest for the trees.

While there is no comprehensive analysis of agricultural greenhouse gas emissions for US agriculture, an analysis of Canadian agricultural emissions by the National Farmers Union sheds light on the major sources of greenhouse gasses from agriculture in North America.[86] This comprehensive analysis shows that carbon fluxes in agriculture (i.e., carbon dioxide emissions from soil as a result of soil respiration and soil carbon sequestration) are a miniscule contributor to agricultural greenhouse gas emissions and carbon sinks compared to other sources. The three single largest greenhouse gas contributors are cattle enteric and manure emissions (contributing 32.3% of total emissions), nitrogen fertilizer production and use (26.6% of total emissions), and farm fuel and energy use (with tractor fuel use contributing 12.4% of total greenhouse gas emissions from agriculture).[87]

Yet Regenified™ claims its standard offers a climate solution, without addressing these major sources of greenhouse gas emissions. The Regenified™ website claims that "croplands worldwide have the potential to sequester up to 1.855 billion metric tons of carbon per year under regenerative methods."[88] The introduction to the standards states that "our Standard is designed to move entire supply chains toward regenerative agriculture, yielding improved climate effects for our planet."[89] As discussed below, claims that farming practices, especially no-till, can offer a climate solution are highly contested in the scientific community. But more importantly, the focus on carbon sequestration in agriculture provides a diversion from the main contributors to climate change from agriculture: the continued reliance on fossil fuels for farming inputs and fuel for tractors and other on-farm machinery, and confined animal feeding operations with grain-heavy feed rations.

The National Farmers Union (NFU) explains why carbon sequestration on farms and ranches should not be seen as a climate solution that can offset agriculture's continued reliance on fossil fuels. In their response to those who advocate for subtracting the tons of greenhouse gasses sequestered in agriculture from the tons of greenhouse gasses emitted from fossil fuels, they write:

> Drawing on extensive published science and expert opinion, the NFU has detailed why greenhouse gas emissions and soil-atmosphere exchanges (including soil carbon sequestration resulting from reduced tillage) should be kept separate when doing greenhouse gas accounting. While soil carbon gains are extremely positive and contribute immensely to ecosystem integrity, soil health, water retention, drought resilience, and climate adaptation, **soil carbon gains should not be seen as**

[86] Qualman and NFU (2022)
[87] Qualman and NFU (2022), Table 3 on p. 15.
[88] https://regenified.com/about-us/
[89] https://regenified.com/about-us/

offsetting, zeroing out, or otherwise erasing actual emissions, especially those from fossil fuels (emphasis added).[90]

Moreover, farming practices focused on soil carbon sequestration could lead to increased emissions of nitrous oxide, which would offset carbon sequestered by 75-310%.[91] Nitrous oxide is 298 times more potent than carbon dioxide as a greenhouse gas.

Finally, the Canadian NFU greenhouse gas analysis did not include the carbon footprint of pesticide production. Insecticide production generates between 15 and 19 kilograms of CO_2-equivalent per kg of pesticide, while herbicide production results in between 18 and 27 kilograms of CO_2-equivalent per kg of pesticide on average – more than double the amount of emissions (in kilogram of CO_2) from burning one gallon of auto gasoline.[92] This calculation is from a study carried out by a team at Cranfield University via a contract with the agrochemical industry.

None of the major sources of greenhouse gasses in agriculture – enteric emissions, nitrogen fertilizers and tractor fuel – are addressed in a meaningful way in the Regenified™ standard. Instead, Regenified™ makes climate claims that seem centered on what the standard clearly prohibits: tillage. Yet according to the scientific literature, the impact of no-till on carbon sequestration is minimal at best.

Deeper dive: impacts of no-till on carbon sequestration

The assumption that the adoption of farming practices required in the Regenified™ standard (focused on severely restricting tillage with adoption of cover cropping and a third crop in the rotation) can mitigate climate change is subject to debate in the scientific community, with many soil scientists questioning the scientific basis for the promotion of soil carbon sequestration through agricultural practices like no-till.[93]

In 2022, the scientific journal *Biogeochemistry* published a special collection of papers, stemming from a symposium of the 2021 Fall Meeting of the American Geophysical Union. The goal was to explore several tough questions about the practical potential for significant carbon sequestration resulting from agricultural practices. A common theme among these papers is that promotion of soil carbon sequestration through agricultural practices like no-till and cover cropping has "likely gotten ahead of the agronomic and biogeochemical science."[94]

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[90] Qualman and NFU (2022), p. 11
[91] Li et al. 2005
[92] Audsley et al (2009)
[93] Davidson (2022); Silva (2022)
[94] Davidson (2022)

One of these papers explored the potential climate mitigation impact of regenerative agriculture practices and concluded that most of the management practices associated with regenerative agriculture are not likely to lead to meaningful net sequestration of organic carbon in soils.[95]

Enthusiasm by some regenerative agriculture advocates for the potential of no-till to sequester soil carbon has grown in recent years (and was promoted in the documentary Kiss the Ground) even though scientific studies have shown for at least two decades that the effect of no-till on soil carbon sequestration in a conventional farming system is negligible.

In a 2007 commentary on "Tillage and soil carbon sequestration – what do we really know?," soil scientists at the USDA's Agricultural Research Service and University of Minnesota wrote: "In essentially all cases where conservation tillage was found to sequester carbon, soils were only sampled to a depth of 30 centimeters or less, even though crop roots often extend much deeper. In the few studies where sampling extended deeper than 30 centimeters, conservation tillage has shown no consistent accrual of soil organic carbon, instead showing a difference in the distribution of soil organic carbon, with higher concentrations near the surface in conservation tillage and higher concentrations in deeper layers under conventional tillage." This makes sense, since the goal of conservation tillage is to maintain a substantial share of last year's crop residue on the soil surface, to protect the soil from rainfall and wind driven erosion. Hence, it is no surprise that in the top few inches of the soil, there is generally more carbon stored and cycling carbon within soil food webs. This tendency to enhance soil carbon levels in just the top few inches of soils is maximized in no-till systems. The researchers conclude: "Though there are other good reasons to use conservation tillage, evidence that it promotes carbon sequestration is not compelling."[96]

A 2010 meta-analysis study of soil organic carbon in tillage versus no-till systems concluded that the impact of adopting no-till is greatly dependent on other farming practices; in this study, no-till led to a significant increase in soil carbon only when double cropping was practiced. Overall, the study found that no-till systems have higher carbon levels in the topsoil layer (0-10 centimeters), but lower concentrations at deeper depths (20-40 centimeters), resulting in no net difference in stocks.[97] This study used global data from 69 paired experiments with soil sampling extended deeper than 40 centimeters.[98]

In 2014, a perspective in *Nature Climate Change* responded to the growing excitement about agriculture's potential to reduce greenhouse gas emissions: "We argue that no-till is beneficial for soil quality and adaptation of agriculture to climate change, but its role in mitigation is widely overstated."[99]

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[95] Schlesinger (2022)
[96] Baker et al. (2007)
[97] Luo et al. (2010)
[98] Luo et al. (2010)
[99] Powlson et al. (2014)

In another meta-analysis of 95 comparisons between no-till and conventional tillage from 57 experimental sites covering various cropping systems, soil types and climatic regions in China, researchers reached similar conclusions. The authors write: “No-till has been widely regarded as a potential option to enhance soil organic carbon sequestration and thus mitigate climate change. However, recent studies have shown that previous estimates of soil organic carbon storage under no-till seem to be overestimated due to shallow sampling and improper soil organic carbon accounting.” Their analysis of trials in China supported these previous findings. They found that adopting no-till led to soil organic carbon accumulation in the upper 20 centimeters of soil but soil organic carbon depletion in the 30-40 centimeter layer.[100]

Similarly, Colorado State University researchers concluded from their 2019 meta-analysis: “We cannot conclude that soil managed with no-till have more soil organic carbon than soils managed with full tillage for these soil types and climates” [referring to cool and warm temperate dry climates, and loamy, silty, and clayey soils in tropical dry climates].[101] Their study used data from 178 experimental sites with 1205 observations, based on criteria that excluded short-term studies and studies with shallow topsoil sampling. Consistent with other studies, they found that the change in soil organic carbon varied by soil depth between full tillage and no-till management, and that “reduced amounts of soil organic carbon deeper in soils may offset an increased amount of soil organic carbon near the soil surface with no-till management.”

A 2020 meta-analysis on soil health indicators and different types of tillage, published in *Geoderma*, found that “overall, an effect of tillage on soil organic carbon and active carbon was not detectable below 15 centimeters.” The authors noted that these findings are in line with previous meta-analyses, and that “the lack of significant no-till effects on soil organic carbon and active carbon relative to intensive tillage below the topsoil layer has been reported in many studies.”[102]

A long-term trial conducted by the USDA and Iowa State University compared an organic tilled and conventional no-till system and found that numerous measures of soil health were enhanced in the organic tilled system compared to the conventional system. In line with findings from other studies, soil organic carbon levels were higher in the top layer of soil in the conventional no-till system compared to the top layer in the organic systems; however, when measuring deeper than the top 2 inches of soil, soil organic carbon levels were higher in the tilled organic systems compared to the no-till system, even when the conventional no-till system included cover crops.[103]

Cover cropping in a conventional system has been found to lose carbon in some cases at depth, leading to a net loss of soil carbon. In the same study, cover cropping in an organic system that featured heavy tillage (even more tillage than either conventional system)

[100] Du et al. (2017)
[101] Ogle et al. (2019)
[102] Nunes et al. (2020)
[103] Teasdale et al. (2007)

significantly increased soil carbon (21.8 metric tons per hectare) with increases observed to a depth of 2 meters.[104]

What these studies show is that no-till does not impact soil carbon sequestration. While more carbon may accumulate at the surface of the soil from no-till systems, carbon levels deeper in the soil are either not impacted, or in some cases, have been shown to deplete with no-till agriculture.

Section 2d: Lack of outcome metrics for water, biodiversity, animal welfare and social outcomes

The Regenified™ standard includes a requirement for soil testing, as discussed in section 2a, but no tests, measurements or outcome reporting are required for other outcomes including water quality, biodiversity, animal welfare, or farmworker pay and protections.

The standard includes vague recommendations for desirable outcomes related to water quality and biodiversity.

Outcomes for water quality are mentioned only once. Section 3.8.3 states that "nitrogen loss is minimized - nitrate test strips used in edge of field water (tile, ditches, streams local to the operation). Nitrate should be below 10 ppm." The term "should" means this is a recommendation, not a requirement.

Section 3.10.4 states that "Wildlife - should be evidence of three to five different types of animals including but not limited to: grazing or browsing ruminants, small mammals, reptiles, etc." Section 3.10.5 states that "Birds - should be evidence of three to five different types (song, game, raptor) of local or migratory species." The term "should" means this is a recommendation not a requirement, and the standard does not include anything on how this should be determined and verified. It is unclear whether the farmer can attest to having seen or heard different types of wildlife and birds, or whether these animals should be spotted and their presence recorded by the field verifier.

Section 3: Regenified™'s subjective standard and lack of third-party verification

Section 3a: Regenified™ standard is primarily subjective guidance

Most of the Regenified™ standard consists of recommendations ("should") related to the 6-3-4™ framework rather than requirements ("must") that can be enforced by a neutral third party. The standard is structured around 5 tiers (a farmer or rancher must move up a tier every 3 years to remain eligible for the Regenified™ label). It allows farmers and ranchers to start using the

[104] Tautges et al. (2017)

Regenified™ label when they reach tier 2 on part of a farm or ranch operation. A consumer, therefore, can only be assured that the food they are buying with a Regenified™ label comes from farms and ranches that met requirements for tier 2 on some portion of their annual harvest. The following are required for initial verification and for tier 2:

- Every 3 years, the farm or ranch makes **improvements** and moves up a tier (1.1.4). Requirements for moving up a tier include:
    - An increase in the percentage of the agricultural land base that meets the requirements in the standards (Section 1)
    - No more than 3 years have passed in the current tier (1.1.3), and
    - A reduction in tillage passes (3.2.1), a reduction in the volume and rate of pesticides (3.2.3) and an increase in living ground cover (3.3.1; 3.5.1; 3.9.1; 3.9.1).
- The farm or ranch performs **soil testing** and is visited annually by a Regenified™ **field evaluator** (1.2.1)
- The farm or ranch has a **written plan** with aerial photography, which addresses the 6-3-4™ principles and was approved by the Regenified™ Review Board (1.2.3; 1.3.2; 1.3.4; 2.1.2; 3.1.1). There is also a requirement for a "basic pest management plan" to be developed and approved by the Regenified™ Review Board (3.2.4).
- The farmer or rancher has attended a multi-day **educational workshop** (1.2.4; 3.1.6).
- The farm or ranch has met the requirements for Tier 2 on **20-40% of their agricultural land base** (1.3.1).

To label plant-based food as Regenified™, the farm must achieve Tier 2 certification, which means the following requirements were met on 20-40% of the land base:

- Reduction in **tillage** passes from previous evaluations. Full row cultivation is considered tillage (3.2.1).
- In areas with low annual precipitation (<15 in/yr), there is at least 20-30% **ground cover** on 20-40% of the agricultural land base. In areas with high annual precipitation (>25 in/yr), there is 50-70% ground cover on 20-40% of the farm agricultural land base (3.3.1; 3.9.1).
- Cropland that requires digging for harvest (e.g., potatoes, beets) is covered within two weeks of harvest (3.3.2)
- **Crop rotations** include plants from at least 3 functional groups (3.4.1)
- No visible **erosion** or sedimentation in the field (3.7.5)[105]
- **Fertilizers** are applied at crop removal rates or less (3.8.1)
- Plant **biodiversity** increased from the initial verification (3.10.2)

Additional requirements for labeling animal-based food as Regenified™ include:

- **Birthing periods** are correct for the context of the area and operation (3.1.4)

[105] In many regions and regardless of the cropping and tillage system, the only way evidence of soil erosion or sedimentation could be missed is if no one is looking when it occurs.

- Livestock have access to **adequate space** to move about, express their natural habits and have **access to feed and water** on a continual basis. Livestock are grazed according to an **adaptive grazing plan** (3.6.2; 3.6.3)
- **Body condition score** of livestock are appropriate for the time of year (3.6.4)
- Livestock are not treated with **antibiotics for disease prevention** and not given **growth stimulants** (3.6.5).
- Poultry have access to **shade** (3.6.3.) and are housed in structures with adequate doors to allow visual and physical access **outdoors** (3.6.4).

Farmers and ranchers are also required to test their soil at baseline and every three years. Test requirements include:

- Tests including Soil Organic Carbon, Haney and Phospholipid Fatty Acid (PFLA) test
- Soil testing is performed at an accredited lab per Soil Science Society of America's Performance Assessment Program (4.1.8)
- Soil Organic Carbon is on an upward trend (3.9.4)

Despite the actual requirements fitting on one page, the Regenified™ standards document is 16 pages. The requirements listed above are interspersed in the standards document, which consists mostly of guidance, including a section on the elements that should be included in the farm's written plan (a requirement for use of the Regenified™ label)[106] and guidance on how to address the "Six Principles of Soil Health including the Three Rules of Adaptive Stewardship and the Four Ecosystem Processes."[107]

While the requirements are the only parts of the standard that are enforceable, they would be difficult to enforce by a neutral third party because many lack specificity needed for independent verification. Many use undefined and subjective terms (i.e.,"correct," "appropriate," etc.) rather than objective measures.

Section 3b: No separation between standard-setting body and certifier

While Regenified™ claims to be a certification, it lacks the basic structure and components of a certification scheme. Regenified™ is structured with no separation between the owners of the standard-setting body and the certifying body. Such separation is considered necessary to avoid conflicts of interest, a pillar of ISO-17065.

Ideally, there is also a separate accreditation body that accredits the certifying body, to further ensure that inspections and audits are performed without bias. Instead, Regenified™ is one entity that sets the standards, employs the field verifiers who evaluate the farm or ranch and the soil test results, reviews the field evaluation and soil test results, and makes the final decision about the eligibility of a farm or ranch to carry the Regenified™ label. This presents an unbroken

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[106] Section 2
[107] Section 3

chain of inherent conflicts of interest, since the standard-setting body is incentivized to grant certification status to as many farms and brands as possible.

A credible certification scheme works with independent certifying bodies that remove bias from the inspection and audit process. This inherent conflict of interest running throughout the Regenified™ program is especially troubling given its business structure: Regenified™ is a for-profit venture with investors and shareholders who will expect financial returns on their investment (and such profits/ROI will invariably come from the farmers and ranchers participating in the program).

This conflict of interest is further amplified by the fact that the standard does not specify minimum qualifications for the Regenified™ employees who will perform the field evaluations, other than that they "will all be trained by Regenified™" and "will have attended a Soil Health Academy."[108] This raises questions about the criteria and knowledge base field verifiers will possess and be free to draw upon in verifying adherence to the trademarked framework developed by Understanding Ag and taught in Soil Health Academy workshops.

It will be very difficult, if not impossible, for a neutral third party with qualifications in agroecology or other related agricultural science fields to perform an inspection to determine eligibility for the Regenified™ label. The standard also lacks an adequate appeals process and does not specify the sanctions for violation of the standards.

Section 3c: Standard is developed without public input and engagement

Another important element of a credible and meaningful certification scheme is the inclusion of public and industry input in the standard-setting process. The standard-setting body should specify the process for updating the standards, solicit input from stakeholders on their standards, and use a transparent process to review and incorporate this input. Ideally, a request for comments should be posted publicly on the standard-setting body's website, with a deadline for comments. Regenified™ has not specified the process for updates and revisions, nor has it posted any requests for stakeholder input.

While the Regenified™ standard is made available to the public, it is not easy to find. The Regenified™ website has a Resources page, where one might expect to find the standards documents, but which only includes a media toolkit.

Section 3d: Lack of segregation in the supply chain

Meaningful certifications for consumer-facing labels also specify how supply chain integrity will be handled. Some certifications require segregation throughout the supply chain to assure consumers that the foods they are purchasing were grown on farms or ranches that meet the standards. Others do not require supply chain segregation but use a mass-balance approach.

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[108] Sections 5.3.1 and 5.3.2

The Regenified™ standard does not address how supply chain integrity and traceability will be handled, nor does it include segregation or traceability requirements. The lack of segregation requirements raises concerns, since the Regenified™ standard has a tiered structure. When a farmer has 20-40% of their “ag land base” qualified for use of the Regenified™ label, they can use the Regenified™ label. Without standards for segregation and supply chain integrity, this raises concerns about whether crops from non-Regenified™ acres can also be sold under the Regenified™ label.

Section 4: Regenerative Verified™ and Regeneratively Grown™

Regenerative Verified™ and Regeneratively Grown™ are two labels offered by Soil Regen, LLC. Regeneratively Grown™ is for livestock and Regenerative Verified™ for crops. The company offers the use of their labels when soil samples from the farm or ranch meet a minimum score on a soil test, performed at the laboratory where Soil Regen, LLC’s co-owner’s spouse is the Chief Scientific Officer. If the soil samples meet the minimum score on the soil tests, Soil Regen, LLC requires the farmer or ranches to send them at least one piece of documentation showing that at least one practice was implemented on the farm or ranch. These labels are not third-party certifications.

Section 4a: Lack of practice standards

Soil Regen, LLC outlines two steps for the use of their labels. There are no written standards and no requirement for second- or third-party on-farm inspections or verification. The company asks the farmer or rancher to send them at least one piece of documentation to “verify that at least one of the regenerative agriculture management practices is being utilized on that field for that crop.”

Without a standards document, Soil Regen, LLC does not have a list of required practices or prohibited inputs. Soil Regen, LLC simply specifies that producers show “evidence of including one of the Regenerative principles to meet Regenerative Verification,” and states that “these principles include but are not limited to: 1. Keep the soil covered at all times, 2. Minimize physical and chemical disturbance, 3. Maintain a living root throughout the year to harvest sun, rainfall and carbon, 4. Strive for diversity in both plant and animal species, 5. Livestock integration, 6. Utilize these practices within the context of climate, personal experience, and individual situations.”[109]

Soil Regen, LLC requires only one piece of documentation to show that one of the “practices is being utilized on that field for that crop.”[110] They state that the grower “will be asked to verify their practices in one of the following ways,” and lists “documentation and visual evidence.” Documentation includes but is not limited to: “planting records, seed tickets, fertilizer receipts, notarized statements of management practices.” Soil Regen, LLC states that “visual evidence

[109] https://www.agsoilregen.com/_files/ugd/ccd5e7_6d29a95ff27b469fa31e67aa880b98d7.pdf, p. 2
[110] https://www.agsoilregen.com/_files/ugd/ccd5e7_6d29a95ff27b469fa31e67aa880b98d7.pdf, p. 5

may also be required such as in-field photographic evidence of planting, cover crop stands, livestock, fencing, etc." and lists other forms of possible visual evidence.

Rather than require a neutral third party to visit and inspect the farm, Soil Regen, LLC allows the farmer or rancher to take photos or write a statement that they are implementing practices that they consider to be regenerative.

Section 4b: Flawed outcome standards

The other step required for farmers or ranchers to use the Regenerative Verified™ or Regeneratively Grown™ label is to send soil samples to Regen Ag Lab for a Regenerative Certified™ test.[111] This test, according to the Regen Ag Label website, provides a Haney Test and a "Regen Ag Lab certified score."[112] According to the Regen Ag Lab website, this "allows you to track change in individual fields where your management zone (0-6) is scored against your baseline (6-12)."[113] There are serious problems with this approach.

As discussed in Section 2d, the Haney test is a relatively new and controversial soil test, based on findings that it is not sensitive to farm management practices and tends to provide highly variable results.[114] This test is not offered by university laboratories, and few accredited soil laboratories offer it. Even if other laboratories offered the test, Soil Regen requires growers to send their soil samples to Regen Ag Lab and pay for a Regenerative Certified™ test.

The Regenerative Certified™ test compares results from soil taken at 0-6 inches (what they refer to as the management zone) to soil taken from the same location at 6-12 inches (what they refer to as the baseline). There is no scientific basis for such a comparison. The zone impacted by farm management practices often differs from 0-6 inches, and the 6-12 inch layer of soil is not widely accepted as the appropriate basis for determining a soil health baseline.

It has been widely understood for some time that farm management practices influence the surface 12 inches, or 30 centimeters (for instance, the average sampling depth for soil carbon research is around 25 centimeters).[115] In recent years, studies have begun to show that farm management practices have a significant influence on deep soil carbon, up to 100 centimeters or 39 inches deep.[116]

Furthermore, one of the foundational definitions of soils is that they are vertically differentiated bodies. Depending on the complex interaction of what are known as the *soil forming factors* (parent material, climate, organisms, topography, and time), each soil has a distinct variation in what are referred to as *genetic horizons*. The US Department of Agriculture's Natural Resources

[111] https://www.agsoilregen.com/_files/ugd/ccd5e7_6d29a95ff27b469fa31e67aa880b98d7.pdf
[112] https://regenaglab.com/services/soil-health-analysis/
[113] https://regenaglab.com/services/soil-health-analysis/
[114] Chu et al (2019)
[115] Aguilera et al. (2013), Haddaway et al. (2016)
[116] Fontaine et al. (2007), Shi et al. (2013), Zhou et al. (2017), Cardinael et al. (2018), Tautges et al. (2019)

Conservation Service's soil survey has a 100-year history cataloging over 25,000 unique soil "pedons", or individual soils, that vary in the depth of differentiated horizons (soil pedons literally vary at distances as short as inches apart). The way that soils behave depends in large part on this vertical differentiation – the way water and air moves through the soil profile, the way roots distribute themselves, the way carbon and nutrients translocate or transform. A test that compares the first six inches of soil to the next six inches of soil is not rooted in basic soil science as it ignores the complex, context-specific and dynamic nature of soils.

The Regen Ag Lab Regenerative Certified™ test ignores another basic concept in agricultural soil science: that surface soils are strongly influenced by factors that are beyond the control of the farmer or rancher. These strong influences on surface soil characteristics include climate and the surface deposition of new materials (i.e. due to crop residues, wind erosion or flooding).[117] For instance, in semi-arid or arid environments, it is very challenging to build soil carbon and improve measures of soil health in the surface layer (0-6 inches) due to the overriding effects of high temperatures and lack of water, but positive impacts can often be realized deeper in the profile where climate has less of an influence.

It is arguably impossible to judge how farming and ranching practices are affecting soils by selecting arbitrary depths to compare, especially if the depth of sampling is restricted to only the surface layers (up to 12 inches). Yet Soil Regen specifies that "a score greater than the minimum threshold qualifies for Regenerative Certification."[118] According to this process, farmers and ranchers whose practices are improving their soil from 6-12 inches (possibly even 6 to 24 or 36 inches), but who are experiencing climate-driven declines in soil health metrics from 0-6 inches, would be interpreted as degenerative rather than regenerative, and would not qualify for the Regenerative Verified™ and Regeneratively Grown™ labels.

The Haney soil test is the only outcome verification required for the use of the Regenerative Verified™ and Regeneratively Grown™ labels. Testing soil or water for herbicides, insecticides and nitrates, which are common pollutants from agriculture, is not required. Outcome verification for other elements of regeneration, such as biodiversity, animal welfare and farmworker pay and protections is also not required.

While websites affiliated with the Kiss the Ground and Common Ground documentaries describe Soil Regen, LLC as a certification, Soil Regen's labels do not meet the basic requirements for certifications. Reputable certifications include a separation between the standard-setting body and the entity performing the inspections, and require third-party inspections. Soil Regen does not have a standards document that would enable a third party to enforce requirements or prohibitions.

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[117] Jobbagy and Jackson (2000), Doetterl et al. (2015)

[118] https://www.agsoilregen.com/_files/ugd/ccd5e7_6d29a95ff27b469fa31e67aa880b98d7.pdf

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