SANTA BARBARA COUNTY REGIONAL BEST MANAGEMENT PRACTICES *for* REGENERATIVE AGRICULTURE

(SBRAP)

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for the Santa Barbara Foundation LEAF Grant Program 2017-2018

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The advisory board of our mentors, peers, and colleagues who represent the diverse group of stakeholders that we hope to engage in this conversation.
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TABLE OF CONTENTS

Preface

This document presents nothing short of a renaissance in agriculture. We may be about to emerge from the "Dark Ages of Agriculture", the unenlightened time emerging from the industrial revolution and World War II when we waged war both mechanically and chemically on pests, weeds, human cultures, and nature as a whole- in order to feed and clothe ourselves.

Agriculture is at essence a human pursuit, and as such it is our destiny and responsibility to either work with nature, or literally die trying. It really is a matter of life or death, of peace or chaos, renaissance or collapse. We cannot survive without the basic resources required for life: water, food, shelter, energy, and community- and agriculture is at the center of them all. If we deplete our water, soil, labor pools, and trade relations- agriculture will struggle, and the people along with it.

There is quite a buzz about Regenerative Agriculture as of late, as the silver bullet to our problems. While there are no true silver bullets, it is our opinion that Regenerative Agriculture presents the most practical and realistic solutions to the many problems and challenges we face as humanity- both locally and globally. Beyond our opinion, there is a growing database of scientific validation of some of the claims of Regen Ag, but still more work needs to be done.

We honor the current context of Regenerative Agriculture as an emergent and evolving approach to land management, food production, and ecosystem restoration. We are grateful for the examples set by courageous practitioners and innovators in the field and do not claim anything presented here as an endpoint, but rather as a collection of current thinkings and practices that deserve attention and continued development. This said, we felt that this document was needed in this emerging field to define our context before our original intentions become lost, simplified, or co-opted by multinational corporate interests.

As such we hope this report stimulates the conversation around how to create a practical transition plan for Santa Barbara County and Mediterranean Climate Regions in general, from conventional "degenerative" agriculture to Regenerative Agriculture. This report is not intended to be an authoritative text, rather a stimulus for action, healthy debate, and regulatory renaissance. It is focused on the transition from industrial agriculture practices to Regenerative agriculture practices and does not cover applications of developing regenerative agriculture from subsistence based agriculture, though many benefits are possible in that sector as well.

Our audience includes foundations and non-profit organizations, local farmers and ranchers, regulators and politicians, and the local and global Regenerative Agriculture movement- and moreover those people who care where there food comes from and want to vote with their dollar and support Regen Ag.

Executive Summary

Project Objectives

The objectives of this document, which we have dubbed SBRAP (Santa Barbara Regenerative Agricultural Practices), are summarized below:

- To provide history and context for Regenerative Agriculture both globally and locally
- To justify through examples the need for creating a Regenerative Agriculture food system
- To provide several definitions for RegenAg and explain the desired outcomes of these systems
- To highlight case studies and examples of successful Regenerative Agriculture projects
- To propose Best Management Practices (BMPs) and Processes for Regenerative Agriculture
- To define Metrics and Standards for measuring the effectiveness of Regenerative Agriculture BMPs
- To propose a Regionally Appropriate Food System Model for Santa Barbara County
- Overall to inspire farmers and ranchers to create Regenerative Agricultural systems in Santa Barbara County which can be modeled elsewhere

We hope that this document serves to facilitate the adoption of Regenerative Agriculture practices in Santa Barbara County and as a result improve ecosystem services, our collective resource base, and moreover the bottom line for farmers. The Best Management Practices and Processes recommended herein are intended to help farmers, ranchers, landowners and land managers to be inspired and incentivized to adopt Regen Ag practices and develop their own relevant to their own context.

What is Regenerative Agriculture?

Regenerative Agriculture *builds the environmental, economic, and socio-cultural resources it relies upon by integrating wholistic design and adaptive management practices to create systemic resiliency at every opportunity.*

Regenerative Agriculture practices significantly improve upon the USDA National Organic Program standards, and are applicable at any scale.

Regenerative Agriculture (Regen Ag) has the overarching goal of producing food, fuel, fiber, and pharmaceuticals as by-products of ecosystem regeneration. The wild ecologies managed by indigenous peoples function in this way. Intentional disturbance or selective influence of the natural system created more abundant and healthier ecosystems, producing more resources.

The ***Principles of Regenerative Agriculture*** can be summarized in the following distillation by TerraGenesis International[1]:

- Progressively improve whole agroecosystems (soil, water and biodiversity)
- Create context-specific designs and make holistic decisions that express the essence of each farm
- Ensure and develop just and reciprocal relationships amongst all stakeholders
- Continually grow and evolve individuals, farms, and communities to express their innate potential

[1] http://www.regenerativeagriculturedefinition.com/

We have defined ***Themes of Regenerative Agriculture*** as represented by a nested hierarchy of 3 domains

1. Environmental
2. Socio-cultural
3. Economic

These themes overlap well with the Ethics of Permaculture:

1. Care of Earth
2. Care of People
3. Reinvest surplus into Care of Earth and Care of People

The process of designing Regenerative Agriculture systems, what we call ***Best Management Processes*** (BMPros), is the foundation for success. Without a holistic and thorough plan, a project may struggle to be successful. All elements must be considered and organized in a sequence, as each element of the system builds upon and is related to the others. The following are examples of design tools that help select, organize, and evaluate which Best Management Practices to implement based on the specific context of the project.

<u>List of Design and Management Tools Used in Developing Regen Ag Systems:</u>

1. Regrarians® Platform Design Process
2. Adaptive Management
3. Dynamic Governance
4. Permaculture Design
5. Holistic Management®
6. Resilience Planning

The ***Desired Outcomes of Regenerative Agriculture*** are also best defined within the nested hierarchy of the 3 Themes of Environmental, Socio-Cultural, and Economic. The Best Management Practices are implemented to achieve these Desired Outcomes.

Desired Environmental Outcomes:

- Increased effectiveness of the four ecosystem processes to improve natural capital and ecosystem services on agricultural lands:
    - Water Cycle
        - Increase water resources
        - Buffering of drought and flood cycles
        - Increased effective precipitation
        - Water and air filtration and remediation
    - Mineral Cycle
        - Increased nutrient density within the crops produced
        - Reduced greenhouse gas emissions
        - Preserve and create topsoil
        - Sequester carbon in the system
    - Energy Flow
        - Greater crop/forage production
    - Biological Community
        - Increased species diversity and wildlife habitat
- Eliminate toxic chemical residues in Ag systems and pollution exported from them
- Eliminate and/or utilize all “waste”
- The farm produces a surplus of energy in order to power the operational systems

Desired Socio-Cultural and Regulatory Outcomes:

- High percentage of socially just business models using dynamic governance
- Equitable distribution of labor and wealth
- A community connected to its local food system
- Healthier people from healthier food
- Improved quality of life of farmers and farm workers
- Reduce/eliminate exposure of farm workers to toxic chemicals
- Improved Intellectual and Experiential Capital of local communities
- Humane treatment of livestock
- Improved regulatory environment that supports Regen Ag

Desired Economic Outcomes:

- The farm enterprise is financially resilient
- The farm enterprise generates a significant economic multiplier effect in the community
- Land stewardship is valued for improving ecosystem services
- Increased access to financial capital for Regen Ag Practitioners

Why Regenerative Agriculture Best Management Practices?

Global Case for Adopting Regen Ag BMPs

The predominant global industrial agriculture model relies on resource extraction in order to operate- specifically water for irrigation; minerals for fertilizers; petroleum for tillage, harvest, and transportation; and physical labor often performed by immigrants- legal and illegal. These extractive actions diminish our natural and cultural resources, often polluting ecosystems and impoverishing farming communities. These practices are "degenerative" as they deplete resources they rely on, while the current system makes little effort to account for these "externalities".

Local Case for Adopting Regen Ag BMPs

The County of Santa Barbara has over 700,000 acres of agricultural land currently being farmed.[2] The majority of this land is farmed with degenerative and extractive practices which reduce the resources that agriculture and society itself depend on for survival. This trend is leading to overdrawn aquifers, polluted waterways, and labor shortages. These are significant challenges to agriculture in the region (and the world), and there are solutions that don't require re-creating the wheel.

Industrial Agriculture is the Problem, and Regenerative Agriculture is the Solution

Adopting Regenerative Agricultural (Regen Ag)[3] practices has the potential to improve eco-systemic health: improved health for the land and water bodies through reduced runoff, greater water holding capacity and nutrient cycling in the soil, greater crop/forage production, ecological stability through diversity, improved health for consumers (eating crops with greater nutrient density), increased profits through diversified production, buffering of drought and flood cycles, as well as the innumerable social benefits of having a community connected to its food.

[2] https://countyofsb.org/uploadedFiles/agcomm/Content/Other/crops/Santa-Barbara-County-2014-Agricultural-Statistics.pdf
[3] We refer to Regenerative Agriculture as Regen Ag throughout the document

Regenerative Agriculture Milestones and Publications

Over the past decade, Regenerative Agriculture has gained momentum in both practitioners circles and the public sphere. Several milestones mark the rising trajectory of the need for and benefits of converting modern industrial and degenerative agricultural lands to practices that restore and regenerate soil health. Soil health has become a major concern and unifying topic because it is a common resource that societies worldwide rely upon to provide basic subsistence commodities like food, fiber, and fuel as well as commodities and feedstocks that support global supply networks.

These milestones include, but are not limited to:

- The United Nations including agriculture and healthy soils as aspects of their climate change mitigation plans.
- The publication of
    - Project Drawdown: The most comprehensive plan ever proposed to reverse global warming
    - The Carbon Farming Solution: A Global Toolkit of Perennial Crops and Regenerative Agriculture Practices for Climate Change Mitigation and Food Security
    - Regenerative Organic Agriculture and Climate Change: A Down-to-Earth Solution to Global Warming
- NRCS Soil Health programs
- Rodale Regenerative Organic Certification

Best Management Practices for Regenerative Agriculture

In this document we lay out regionally and context appropriate Best Management Practices for Regenerative Agriculture with the goal of revitalizing agriculture in the County and attempting to reverse the Degenerative Agriculture trend. The BMPs are context specific, and serve to achieve the Desired Outcomes by following the Principles of Regen Ag. The Desired Outcomes are the destination, and the BMPs are tools used to get there - there are many ways to reach the same destination.

The purpose of these practices is to achieve the Desired Outcomes stated above and expanded upon in Section 1.f.. We have broken down the RegenAg BMPs into the 3 main Themes, following from the nested hierarchy of Desired Outcomes:

1. Environmental
2. Socio-Cultural and Regulatory
3. Economic

The BMPs are listed below and also significantly expanded upon in Section 4.b..

Environmental Regen Ag BMPs:

1. Mainframe/Site design
2. Water Management
3. Fertility Management
4. Cropping Systems
5. Livestock Systems

Socio-Cultural and Regulatory Regen Ag BMPs:

1. Farmer and Worker Fairness
2. Regulatory participation and adaptation
3. Farmer Networking, Education, and Outreach

4. Conservation easements

Economic Regen Ag BMPs:

1. Business and financial planning
2. Business models
3. Capital raising
4. Access to markets
5. Building local capacity

Metrics

Metrics are indicators to measure progress toward success. We define success initially as being on trend towards stated desired outcomes and over time reaching those desired outcomes. Metrics are used to evaluate the BMPs practices as implemented and determine whether they are leading to Regen Ag outcomes on a given site under a given set of management decisions.

Metrics provide practitioners a toolkit to assess progress and evaluate whether to continue or adapt practices. From a practitioner standpoint, success is framed in a triple bottom line fashion and made personal and context specific using a tool such as the Holistic Context. Metrics also serve to provide data for scientific research supporting Regen Ag practices, which can have huge implications in the regulatory and economic spheres.

Standards and Certifications

Standards set targets and thresholds for metrics to provide guidance to practitioners, consistency in assessment, and add transparency to the production practice which can facilitate market differentiation. Standards are the basis for certifications which qualify an operation based on a suite of metrics, or require thresholds for specific practices.

Recently, the Rodale Institute specifically designed a Regenerative Organic Agriculture Certification[4] that goes above and beyond the USDA National Organic Program certification. This Regenerative Organic Certification includes a set of Soil Health criteria that must be met. Additionally it specifies Farmer and Worker Fairness and Animal Welfare practices which must be met. Other organizations are currently working on certification standards as well, as such this is a dynamic space.

Case Studies

Globally there are many examples of successful Regen Ag projects that utilize one or many Regen Ag BMPs. There are examples in tropical, temperate, and humid climates that exhibit many of the practices outlined in this document. It is not the scope of this document to highlight all projects globally, and we will focus primarily on Mediterranean Climate examples as they are relevant to the Santa Barbara region in order to glean information and practices from examples in similar climates.

Presently, we are not familiar with a local operation or organization integrating a comprehensive Regen Ag approach. However, we recognize the transition to Regen Ag takes place incrementally and we've chosen to highlight some examples where Regen Ag BMPs are being used to good effect.

[4] https://rodaleinstitute.org/regenerativeorganic/

Regionally Appropriate Food System Model for Santa Barbara County

Currently, more than 99% of agricultural products grown in Santa Barbara County are exported, and more than 95% of the food we eat is imported.[5] Santa Barbara County farmers growing commodity crops are in direct competition with multinational agricultural corporations. Competition is not the only challenge local producers face in the food system. Other challenges include climate and financial constraints, a lack of local processing and distribution, and coordinated marketing and branding campaigns.

The question is- can we be food secure in Santa Barbara, and if so what will it take? A sustainable local food system produces the agricultural products and services that are used in the region while managing waste and stewarding the environment.

The food system is very complicated, though there are some very defined elements. A conceptual example of a sustainable local food system includes the 7 components shown in Figure x. below.

1. Production
2. Processing
3. Distribution
4. Access
5. Consumption
6. Waste recovery

Integrating Small Scale Producers into the Larger Agricultural Framework in SB County

In order for farmers to overcome the challenges mentioned above, we propose some solutions although this list is far from complete. It is beyond the scope of this document and our collective expertise to recommend a thorough action plan, although we hope to stimulate conversation and make a few key suggestions.

Of particular note, these include strategies such as:

- Growing High Value Specialty Crops
- Food Hubs
- Direct Marketing
- Farmers Markets and CSAs
- Buying clubs
- Leasing
- Develop Local Branding
- Processing and value added infrastructure

Climate Appropriate Crops for Santa Barbara County

We developed an extensive plant species matrix (see Appendix) that includes many options for crops appropriate to the Santa Barbara County Bioregion in the regenerative agriculture context. By "appropriate" we mean they satisfy certain criteria:

- The crop is adapted to the local climate and soils, and does not require much supplemental irrigation or fertilization
- The crop has high value economically and/or nutritionally
- The crop is suited to mechanization and commercialization

[5] https://pubs.acs.org/doi/full/10.1021/es1040317

- There exists management protocols from other regions that can serve to inform the local industry

Many of the commodity crops currently grown in the County would not satisfy these criteria, therefore they are not at the top of our list of recommendations. However, we feel that crops that are on the edge of their ability to naturalize and survive without supplemental irrigation and fertilization are acceptable to grow as cash crops on a scale that continues to fulfill the Desired Outcomes.

Barriers to Adoption of Regen Ag

Regenerative Agriculture is an emerging field with many barriers to adoption and, concurrently, opportunities for a renewed agricultural system. At the core, the main barrier to adoption of Regen Ag is a cultural barrier, which includes not only attitudes and opinions, but regulations and laws. It has been said that we need a "Climate Change of the Mind".

Regenerative Agriculture is an emerging field with many barriers to adoption, and concurrently opportunities for a renewed agricultural system. The status quo of chemical-industrial agriculture has a lot of momentum, and like a large ship its course takes a long time to correct. This transition requires at its core a profound paradigm shift, hence smaller shifts are preferable, which over time will reach the same goal.

Furthermore, chemical-industrial agricultural interests lobby regulators to support their way of doing business, and often have a lot of funding and influence behind them. As such, the political arena is a dangerous place for out of the box thinking, however the writing is on the wall for chemical-industrial agriculture and they recognize that their way of life may be threatened if some of the environmental and socio-cultural issues aren't addressed. The proverbial tide is turning. It is becoming clear that these issues are non-partisan and affect us all.

Barriers to local adoption of Regen Ag that we've identified include:

- Environmental Barriers
    - Lack of Local Pilot Projects:
    - Standardizing Monitoring Protocols
    - Practicality
- Socio-Cultural and Regulatory/Legal Barriers
    - Cultural Barriers
    - Regulatory and Legal
    - Access to Information
    - Local Processing
    - Employee Housing
- Economic barriers
    - Access to Markets and Branding
    - Land Values
    - Land Access
    - Estate Planning/Inheritance Tax
    - Economic and wage challenges

Practical Steps to Transition to Regen Ag in SB County

It must be acknowledged that in many contexts the transition from chemical-industrial agriculture (what we would call degenerative ag) to a regenerative system may require a huge shift in management and design, and often these shifts are too drastic for managers to adopt completely at the outset. For this reason we advocate

"baby steps" in transition to allow both the management team and the operation itself to adjust and adapt to the new methods.

While the gold standard of Regen Ag is the idealized state, we must make compromises and work with people where they are at and with the tools at their disposal, understanding that we have similar goals. We have to start somewhere, otherwise we won't get anywhere.

Opportunities for Transition

In addition, many of the opportunities to fund and support the development of regen ag are emerging from the global climate change mitigation efforts as well as the general increase in awareness of how and where our food comes from.

These include

- emerging markets for carbon and ecosystems services[6]
- government programs to improve healthy soil practices and ecosystem health
- research funding for university studies on regen ag
- philanthropic efforts to support regen ag practitioners
- community awareness of the connection between agriculture and the environment

3 Step Transition Plan

We propose a simple step-by-step plan for farmers and ranchers to follow in order to develop their project with Regen Ag Principles, in order to achieve the Desired Outcomes.

<u>3 Step Transition Plan for Adoption of Regen Ag:</u>

1. Apply Best Management Processes
    a. Site Inventory following the Regrarians® Platform
    b. Goals Clarification, Holistic Context, and Financial Planning
    c. Project Design following Regrarians® Platform and guided by the Principles of Regen Ag
2. Implementation of project to achieve Desired Outcomes by following Best Management Practices
3. Complete the feedback loop: Monitor and adapt based on feedback to achieve Desired Outcomes

A Phased Progression into Regen Ag

In addition to a stepwise process for conceptualizing and implementing Regenerative Agriculture operations, we want to emphasise that progress will take place in phases. It is important to recognize practitioners for incremental successes and creating positive trends toward integrated comprehensive Regen Ag Desired Outcomes. A tiered system is recommended, similar to the Bronze, Silver, and Gold certifications proposed in Rodale's Regenerative Organic Certification.

Conclusions

It is clear that the incredible advancements in agriculture have resulted in negative impacts to the environment and society. Although agriculture contributes significantly to things like climate change, chronic diseases, social inequality, and environmental degradation- it is not agriculture in and of itself that is to blame. It is the chemical-industrial agriculture model that is at the root of these outcomes.

[6] https://www.forest-trends.org/ecosystem_marketplace/the-economics-of-activating-dirt-to-absorb-greenhouse-gasses-and-restore-soil/

By shifting our attention to the "how," we realize that not only are these negative impacts mitigable, they are absolutely capable of being turned on their head. Regenerative Agriculture can not only mitigate climate change, it stands a chance to solve it. Regenerative Agriculture can not only mitigate chronic disease it can provide the nutrition to cure it. Since social justice and equality are baked in to the Regen Ag movement, it stands to create the conditions for inequality to be dissolved. No other form of agricultural production both provides the sustenance we need as a society while stewarding ecosystems services.

The benefits to embracing Regenerative Agriculture region-wide will be profound. Doing so provides resilience, ecosystem services, climate change mitigation, biodiversity and wildlife habitat, worker fairness, social equity, and a solid bottom line for the producers- all while providing a food production model that can be exported the world over.

These benefits will ripple far and wide once our county drops that first pebble and becomes a leader in this movement. There has never before been as oportune of a time. The stage is set and it is time for our community to reap the rewards. By identifying and networking with the innovators and early adopters we can build momentum to leap across the chasm and find the critical mass it will take to make this a success.

A Call to Action

In order to be successful in transitioning from degenerative to regenerative agriculture and course correct towards a more resilient future, we need everyone at the table. The issues we face are not partisan but of humanity, this isn't a Republican vs. Democrat issue, this is a human issue.

If we redirect now we can change the course of the ship and avoid disaster. It will take communities voting with their dollars, researchers committed to the cause, regulators willing to change the status quo, and at the end of the day- it will take the boots on the ground to make it happen.

A positive set of options exist. We don't need to invent anything or re-create the wheel, all the tools and resources we need are readily available to us, for little cost. We need farmers, ranchers, regulators, consumers-basically anyone who eats-needs to be in support of this paradigm shift in agriculture in order for it to solve the bigger issues we face collectively.

We can do this. Let's get started!

1. What is Regenerative Agriculture?

1.a. History of the Organic and Regenerative Agriculture Movement

The term "organic agriculture" was coined in the early 1900's as a response to the introduction of ammonia based mineral salts as fertilizers. Various groups around the world promoted organic agriculture during the middle part of the twentieth century. In the late 1990's in the USA organic standards were written by the USDA and a certification process set up through the National Organic Program (NOP).

Some farmers rejected this standardization and control by the USDA with the fear that the organic brand and name would not represent true organic, and thus allow co-option of the term by large corporations. As predicted, larger corporations saw the economic potential and market growth and soon created their own organic lines of products. Companies like Dole, Cargill, Nestle, and Tyson entered the market and by some criticisms watered down the original intention of the movement.

Termed "industrial organic" these companies essentially substitute inputs like fertilizers with organic options, while retaining degenerative farming practices like tillage, intensive irrigation, and unjust labor practices. They sell their products labeled as organic with no distinction to the consumer between scale or practices, besides very general and relatively fluid standards outlined by the NOP. There is speculation that larger corporations influence the NOP to allow previously restricted practices and inputs to be allowable and hence certifiable.

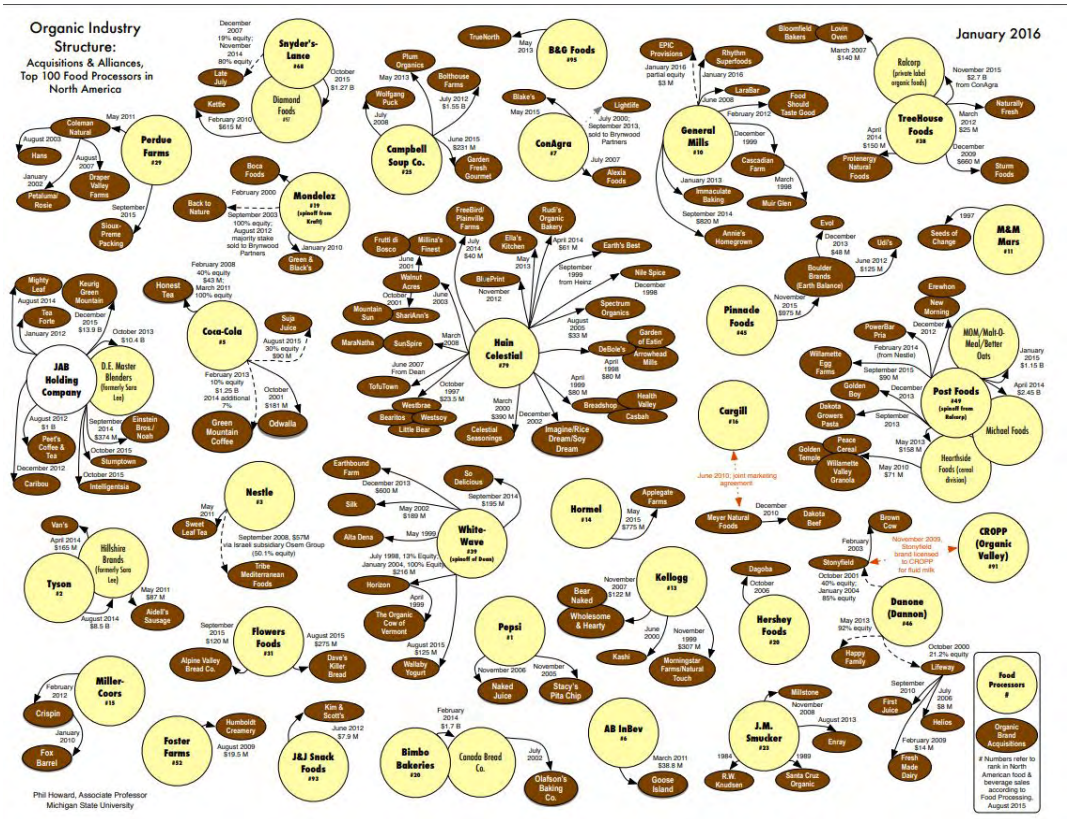


Figure 1. Who Owns Organic[7]

[7] https://www.cornucopia.org/who-owns-organic/

Indeed recently it has been discovered that many shipments of "organic" grain from outside the USA are not in fact organic. The process of inspection is very time consuming and there are limited inspectors, so it is quite easy for ships to falsify documentation. Furthermore, in country inspections by international third party certifiers are likely just as easy to falsify.[89]

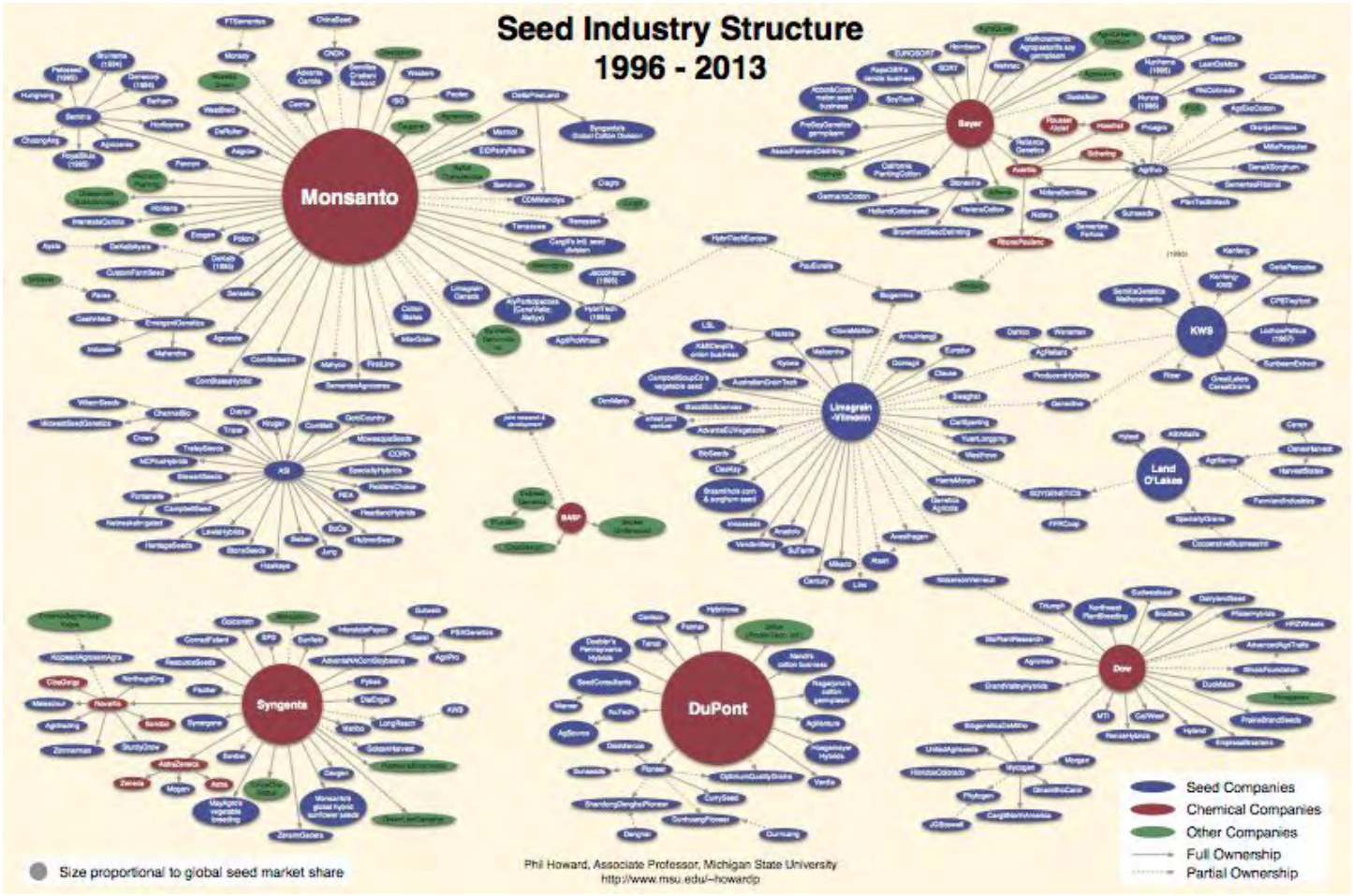


Figure 2. Seed Industry Ownership Structure[10]

The Regenerative Organic Certification[11] recently introduced by the Rodale Institute reflect this desire by farmers to create a new brand and label that represents the products as improved over the organic version. There have been many influences that have helped to shape the Regenerative Agriculture field including Permaculture, Holistic Management and Sustainable Agriculture.

1.b. Definitions of Regenerative Agriculture:

Regenerative Agriculture is highly context specific, and the idealized project representing the "gold standard" can result in very complex systems. Every project has its own unique situation; be it climate, soil type, water resources, regulatory layers, or financial needs. For this reason Regen Ag is best left loosely defined, or defined as a set of principles and practices.

[8] https://www.cornucopia.org/2016/10/amidst-controversy-secrecy-lawsuits/

[9] https://www.organicconsumers.org/news/qai-worlds-largest-organic-certifier-still-bed-horizon-aurora-certifying-factory-farm-practices

[10] https://www.cornucopia.org/seed-industry-structure-dr-phil-howard/

[11] https://rodaleinstitute.org/regenerativeorganic/

Most if not all of the genuine efforts by farmers to use agriculture to rehabilitate and enhance the local environment are beneficial, and these efforts come in many shapes and sizes, and commitment levels. Furthermore the quality of products produced in this way is markedly superior to conventional crops, nutritionally and flavor wise.

A truly Regenerative Agricultural system is basically a human-managed natural system. For example, the cultivated native forests of the Amazon Basin, which have been manipulated by the indigenous people for millennia to produce food, fuel, fiber, pharmaceuticals, and building materials- everything a community needs to survive. These forests are actually highly evolved agro-ecologies which at first glance appear "wild". But to the trained eye it becomes obvious that every plant is in its right place and has a use.

Indeed, many indigenous peoples were actually sublime horticulturalists, and the natives tribes of California and Santa Barbara specifically were no exception. The abundant fields, forests, and rivers that the first European settlers encountered were not completely "natural" or by accident of evolution. The indigenous peoples were horticulturalists of the highest degree and keen observers of natural systems, for observation was one of their most basic and important tools. Fire was the other important tool of indigenous peoples, and they used it judiciously to create disturbance, renew habitats, and to revitalize and protect forests.

For these reasons and others, we feel that Regen Ag is more than just carbon sequestration and soil management. Regen Ag can be seen as a hybridization of indigenous land management systems and modern agriculture, in that the goals are ecosystem health and regeneration, with yields of foods, fuels, and fibers as a byproduct of that end. Furthermore, there are many different expressions of Regen Ag, from various scales, to varying climates.

That said, a generic and relatively simple definition is reasonable and reachable. In our opinion, Regen Ag may be concisely defined with a resource-use lens:

Diversity of Definitions:

Because Regenerative Agriculture is an emerging field with a systems wide approach, there exists a diversity of definitions for the term which are evolving over time.

The Authors' Current Definition of Regenerative Agriculture:
Regenerative Agriculture *builds the environmental, economic, and socio-cultural resources it relies upon by integrating wholistic design and adaptive management practices to create systemic resiliency at every opportunity.*

Regenerative Agriculture practices significantly improve upon the USDA National Organic Program standards, and are applicable at any scale.

Rodale Definition

The Rodale Institute has layered the Regenerative Agriculture approach onto the practice of organic agriculture and has actively been promoting and demonstrating both practices. From their website:

> *Rodale Institute has pioneered regenerative organic agriculture since our founder, J.I. Rodale, wrote "Healthy Soil=Healthy Food=Healthy People" on a chalkboard back in 1942. His son, Robert Rodale, coined the term 'regenerative organic agriculture' to distinguish a kind of farming that goes beyond simply 'sustainable.' To us, that always meant agriculture improving the resources it uses, rather than*

destroying or depleting them. It is a holistic systems approach to farming that encourages continual innovation for environmental, social, economic and spiritual well being.[12]

According to the Rodale white paper *Regenerative Organic Agriculture and Climate Change: A Down-to-Earth Solution to Global Warming,*,

Regenerative organic agriculture refers to working with nature to utilize photosynthesis and healthy soil microbiology to draw down greenhouse gases.[13]

TerraGenesis Definition

"Regenerative Agriculture is a system of farming principles and practices that increases biodiversity, enriches soils, improves watersheds, and enhances ecosystem services.

Regenerative Agriculture aims to capture carbon in soil and aboveground biomass, reversing current global trends of atmospheric accumulation.

At the same time, it offers increased yields, resilience to climate instability, and higher health and vitality for farming and ranching communities.

The system draws from decades of scientific and applied research by the global communities of organic farming, agroecology, Holistic Management, and agroforestry."[14]

1.c. Principles of Regenerative Agriculture

Defining principles tends to lend more towards innovation as they are more general, in the sense that they define processes which can be achieved through many means (and practices), as opposed to defining practices which prescribes the methods to be used to achieve a desired process or outcome. TerraGenesis International has developed two iterations of principles of Regenerative Agriculture. (see Table 1 and list below)[15]:

[12] https://rodaleinstitute.org/regenerativeorganic/
[13] https://rodaleinstitute.org/assets/WhitePaper.pdf
[14] http://www.regenerativeagriculturedefinition.com/ https://drive.google.com/file/d/0B-J4LqIi-f6jbmJOX1p4cVRtWUU/view
as presented by Gregory Landua and Ethan Roland Soloviev
[15] http://www.terra-genesis.com/

Table 1. 7 Principles of Regenerative Agriculture as defined by Terra Genesis International[16]

Principle	Description
Work with wholes, not parts	Instead of segmenting and fragmenting the agricultural landscape, work with an image of the whole farm in mind. Make decisions that benefit the whole system. For example, rather than making separate decisions about crops, irrigation, and nutrient management, see them as one whole dynamic organism. Choose crops that are water-appropriate for your bioregion, plant them in patterns that utilize passive water-harvesting earthworks and fertilize with composted nutrients from animal systems that are fed by excess crop biomass and surplus rainwater.
Design for non-linear multi-capital reciprocity	All eight forms of capital will be in play on a regenerative farm. Direct causal relationships may be a challenge to articulate. Invest in social capital, even though direct financial-capital returns may not be visible; profits may show up in living or material capital that could open new opportunities for the farm. Caring for the four nurture capitals (living, social, cultural and spiritual) should produce long-term returns for the whole system that cannot be predicted or predetermined.
Make holistic decisions aimed at specific systems changes[17]	Working with the whole system of a farm, make choices that aim to simultaneously benefit the place and make change in a specific larger system in the world. For example, Finka Aekolado planted a diversity of heirloom cacao varieties that are better adapted to local bioclimatic conditions and can sell for higher value, benefitting the farm. With this action Aekolado aims to change the global system of chocolate making by producing uniquely flavored beans and processing them at origin to circumvent commodity markets and add value for local producers. The resulting chocolate is remarkably delicious, encouraging customers to vote for Regenerative Agriculture with each purchase.
Express the unique and irreplaceable essence of each person, farm and place	Every entity has a unique essence that is deeper than personality and simultaneously more focused and domain-independent than is a set of values or a brand. Businesses that discover their essence and bring their strategy, leadership and operations into harmony with it become powerfully secure in the marketplace. Individuals who grasp their essence gain great personal agency and have potent personal value to contribute. A place that knows its essence becomes culturally proud, known by others, and its products are sought after for unique qualities (Sanford, 2016). Farms and entities of all scales can regenerate their offerings from their essence, producing new products and services that are in harmony with their history. Therefore, each Regenerative Agriculture enterprise should seek to identify its own essence and the essence of its place, and to express them fully in its work in the world.
Continually develop agro-ecological processes and cultures	No farm is ever done improving its systems and processes, just as no ecosystem is ever done evolving. Working at appropriate timescales, seek novel and more effective paths for all agricultural processes. Also pay attention to how the human culture supports ongoing innovation. An enterprise that invests time and attention into human development will adapt best to changes and volatility in the ecological and economic environment
Connect the farm to its larger agroecosystem and bioregion	Each farm is a whole itself, nested within a whole place, within a bioregion, within a larger ecoregion. Awareness of the interrelationships at these different scales clarifies how the farm contributes to its bioregion and how bioregional trends (including climate change, pests and diseases, new crops and shifting markets) affect the farm. Make conscious efforts to connect to the people and organizations working at different scales to expand the flow of social, intellectual, and experiential capital coming to and from the farm.
Agriculture shifts the world	We are optimistic that humans can reclaim the role of a beneficial keystone species in the larger global ecosystem. Agriculture, if practiced regeneratively, captures huge amounts of carbon and helps reverse global warming. At the same time, Regenerative Agriculture reconnects people to vibrant, healthy food and local cultural traditions, while empowering the two billion people directly involved in agriculture. Growing food and fiber is a human necessity that has the potential to focus attention and creativity into ecological and social regeneration. Regenerative Agriculturists farm and market their products with pride, knowing their work shifts the world in a positive direction.

[16] http://www.terra-genesis.com/regenag-white-paper/

[17] This principle invites a different approach than standard Holistic Management® practice. Instead of basing decisions around a farm family's desired quality of life, we propose that decisions be made based on their strategic influence on something larger than the farm or decision-maker. This leads to a wider view of world systems and increases the capability of Regenerative Agriculture entities to contribute meaningfully to changes in their communities and industries.

As an emerging field, refinement and evolution of ideas is continually happening. This is represented by the evolution of thought with respect to the above principles, which have been further distilled by from the 7 Principles listed above to the 4 Principles below, again by Terra Genesis International[18].

4 Principles of Regenerative Agriculture:

- Progressively improve whole agroecosystems (soil, water and biodiversity)
- Create context-specific designs and make holistic decisions that express the essence of each farm
- Ensure and develop just and reciprocal relationships amongst all stakeholders
- Continually grow and evolve individuals, farms, and communities to express their innate potential

The Principles are used to guide decisions around design and management practices in order to ensure that the desired outcomes are achieved. They are broad and general for a reason to allow for innovation and flexibility in reaching the desired outcomes.

1.d. Themes of Regenerative Agriculture

The ***Themes of Regenerative Agriculture*** are represented by a nested hierarchy of 3 domains:

1. Environmental
2. Socio-Cultural and Regulatory
3. Economic

As shown in Figure 3, these themes overlap well with the Ethics of Permaculture[19]:

1. Care of Earth
2. Care of People
3. Reinvest surplus into Care of Earth and Care of People

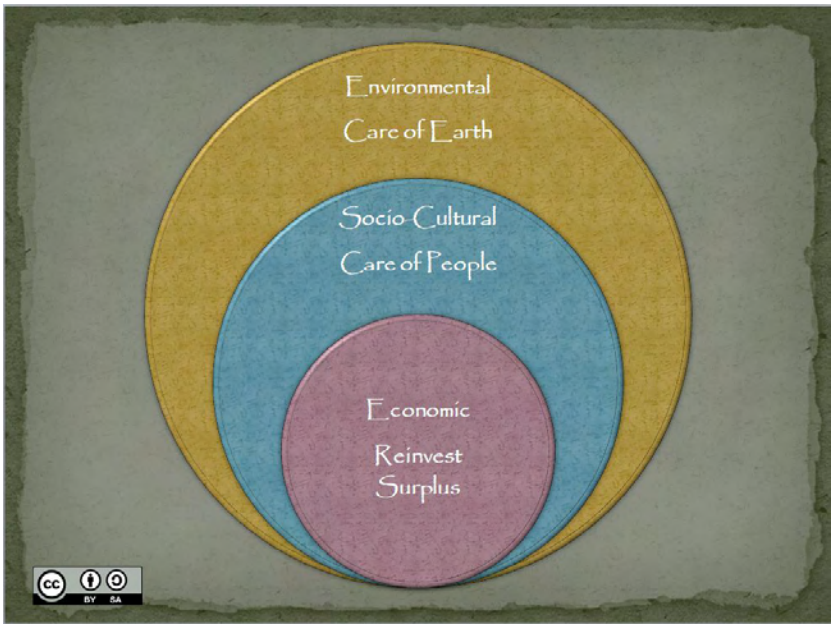


Figure 3. The Themes of Regenerative Agriculture related to the Ethics of Permaculture

[18] http://www.regenerativeagriculturedefinition.com/

[19] https://en.wikipedia.org/wiki/Permaculture

Each layer of the nested hierarchy is an emergent property of the lower layers. For example, in order to have Society and Culture, we require the resources and ecosystem services that the environment provides. In order to have trade and economic exchange of value, we need both an environment that provides resources and a Society and Culture which agrees on valuing resources and information and is capable of communicating to enact trade.

These 3 Themes are consistent throughout this document, and we introduce them first with reference to the Desired Outcomes of Regen Ag, and further in the Best Management Practices themselves. These themes have often been called the "3 legs of the stool of sustainability".

1.e. Best Management Processes (BMPros) of Regen Ag

We propose Best Management Processes (BMPros) in addition to Best Management Practices (BMPs). BMPros are design processes used to inform design and management in order to reach the desired outcomes. Defining goals (and/or outcomes) allows for more innovation, and this is key to developing an appropriate strategy that is context specific. The desired outcomes are more important than the specific practices that serve to achieve those outcomes. The same goal or outcome may be reached through different practices for different contexts. Best Management Processes provide planning tools to select and modify appropriate practices.

The design and management tools outlined below are our prefered processes for determining not only the context of the project but the actual practices that are appropriate given that context.

Design and Management Tools

The process of designing Regenerative Agriculture systems is the foundation for success. Without a holistic and thorough plan, a project may struggle to be successful. All elements must be considered and organized in a sequence, as each element of the system builds upon and is related to the others. The following are examples of design tools that help select, organize, and evaluate which Best Management Practices to implement based on the specific context of the project.

Furthermore, managing the implementation and operations of Regen Ag systems is akin to the framing of the house- the bones of the operation. Being nimble and flexible in developing and running Regen Ag systems is critical as they can tend to be complex and nuanced. The desired outcomes are the result of a well thought out plan with applied adaptive management practices in place.

List of Design and Management Tools Used in Developing Regen Ag systems:

1. Regrarians® Platform Design Process
2. Adaptive Management
3. Dynamic Governance
4. Permaculture Design
5. Holistic Management®
6. Resilience Science and Planning

The Regrarians® Platform Design Process[20]

The Regrarians® Platform was created by Darren J. Doherty and his wife Lisa Heenan and is based off the "Keyline Scale of Permanence" developed by the late, great Australian agricultural designer and farmer, P.A. Yeomans[21] as outlined in his 1958 classic, The Challenge of Landscape. The platform becomes our catch-all

[20] 'Regrarians®, the REX®, the Regrarians Platform® and the Regrarians® Logo are all trademarked brands and marks owned by Regrarians Ltd. founding Director Darren J. Doherty – www.Regrarians.org'

[21] https://en.wikipedia.org/wiki/P._A._Yeomans

and guiding light when analyzing a landscape and/or enterprise. The different categories trend from more permanent and hard to change to least permanent and easy to change.

The Regrarians® Platform provides a simple summary of which aspects of farm design and planning fit into each layer of the platform, and a step-by-step sequence to follow:

1. CLIMATE - You, Enterprise, Risk, Weather: Concerns the various biomes of an enterprise, be they Human or Biospheric. Effectively these climates create "the rules of the game" in the application of the Regrarian Platform.
2. GEOGRAPHY - Landform, Components, Proximity: The "board game" in the Regrarian® platform. The Geography of your landscape places it in its catchment interacting with all other physical elements. It includes topography, demography, and geology.
3. WATER - Storage, Harvesting, Reticulation: The water an enterprise has available to it is relatively fixed. We should be concerned with how we make the best use of what's available in order to maximise the use of this critical resource. We should apply what we have learned in Climate 1 and Geography 2 (as well as capital) to maximize our water potential.
4. ACCESS - Roads, Tracks, Trails, Markets, Utilities, People: Roads, tracks, and lanes are long lived features in our landscapes. Their placement defines our movement and should integrate all the elements that these pathways connect.
5. FORESTRY - Blocks, Shelter, Savanna, Orchards, Natural/Riparian: Perennial woody plant systems are vital, productive and overarching elements in any landscape. Their assemblies can be complex in their outcomes and their placement is critical to support and provide for other systems.
6. BUILDINGS - Homes, Sheds, Portable, Yards: The structures that we build on our landscapes are crucial to our success. The placement and design is directed by the other elements.
7. FENCING - Permanent, Electric, Cross, Living: Subdivide your landscape by following more permanent features. Use the most flexible infrastructure to take advantage of changing opportunities for yield.
8. SOIL - Planned Grazing, Minerals, Fertility, Crops: Easily destroyed and fortunately easily created, soils are the foundation of life. Management is critical to the development and management of soils. Enhance the protection of your soils by considering other elements like Water, Forestry, Fencing.
9. ECONOMY - Analysis, Strategy, Value Chain: The analysis of the market & access to it has never been easier. The difficulty remains in the terms of trade particularly with regards to compliance. We will analyze marketing strategy potentials as well as successes and failures that we have seen in the marketplace. May include direct marketing, cooperative marketing, and other strategies.
10. ENERGY - Photosynthesis, Generation, Storage: Nothing is as fleeting as a photon of light, and the primary role of humanity must be to enhance photosynthesis at every opportunity and encourage its positive side-effects, with nearly all energy systems that humans access originating from the sun.

Darren Doherty explains:

"The game, as it were, is to establish the planning nexus that optimises the predetermined contexts of the humans involved, the landscape they are working within, and the enterprise they are working on.

Our approach is to use the RP as a means by which to capture all of those contexts and then determine which of the RP layers actually need to focus on.

That is to say that on some sites that following the initial appraisal (using the whole RP checklist in our case) we will then determine that the Access, Building and Energy layers don't need our attention right now, and that Water and Fencing really does and that the Climate might need some work too. The farm map might be a bit crap and so the Geography layer comes into play.

That's our practical application of the RP day to day, both with private clients and REX participants."[22]

[22] Darren J. Doherty explaining some of the practical applications of using the Regrarians® Platform as a design and planning tool.

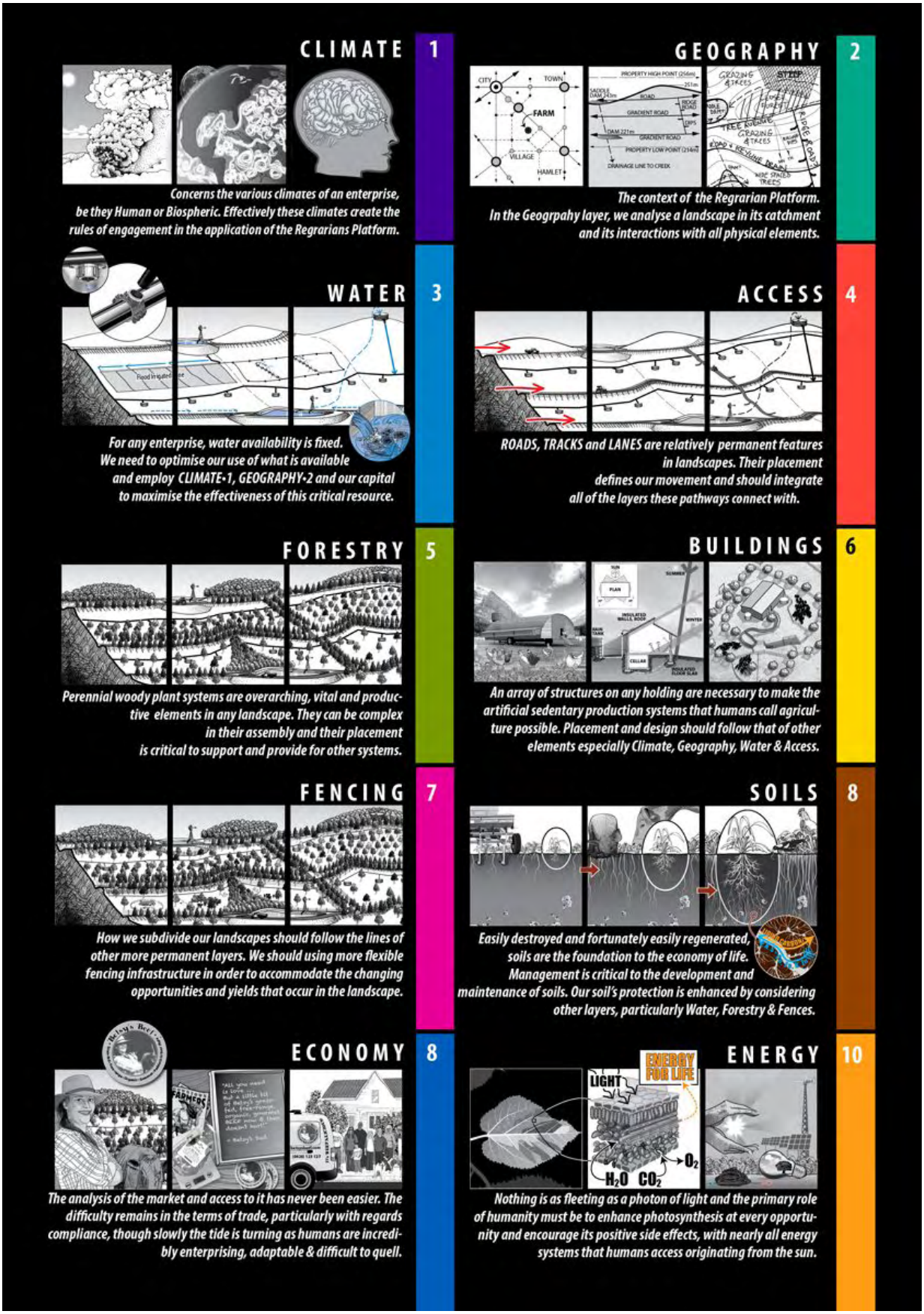


Figure 4. The 10 levels of the Regrarians® Platform[23]

[23] http://www.regrarians.org/about/the-regrarian-platform/

Adaptive Management

A key factor in developing and managing for Regenerative Agriculture is applying adaptive management. Because we're managing complex agro-ecosystems, which respond in unknown ways with unintended consequences, the practice of adaptive management is a critical to achieve the desired outcomes. Due to the current position of Regen Ag in the innovator and early adopter stage, using adaptive management to monitor progress toward the desired outcomes is even more relevant to understanding how Regen Ag BMPs are affecting environmental, socio-cultural and economic health of a farm or bioregion.

Figure 5. The adaptation cycle and actions [24]

Dynamic Governance and Sociocracy[25]

Governance is the keystone component to a successful farm enterprise. The organizational body must be effective and efficient in managing its operations in order to be generative in the short and long term.

Sociocracy, also known as dynamic governance, is a system of governance which seeks to achieve solutions that create harmonious social environments as well as productive organizations and businesses. Its primary decision making process uses consent rather than majority rule; decisions are made in specified forums by individuals within the organizational structure.

Traditional governance models of the industrial age are rife with issues that prevent them from being utilized in a regenerative system. Top-down, command and control management systems which take advantage of land and labor force are simply non-starters. A regenerative enterprise must be governed by a system which is both socially just and energetically efficient.

[24] http://resilienceandsecurity.blogspot.com/2012/05/could-this-be-resilience-cycle-or-just.html

[25] *Thanks to Erik Hjermstadt for writing this section*

Sociocracy has european developmental roots which go back 150 years. Stemming from the Netherlands, it has a modern history of usage across the past four decades. The information of its systems and processes are now readily available through books and internet sources. Its usage is fast becoming popular in new organizations.

Permaculture Design

Permaculture Design is an ecological design system developed by Bill Mollison and David Holmgren in the 1970s. It embeds practical, systems thinking based land design within an ethical framework. The Permaculture Ethics are:

1. Care of Earth
2. Care of People
3. Reinvest Surplus

As a whole systems design concept, Permaculture asks us to look at connections and relationships between elements of a system. The scope of this interconnectedness is represented in the Permaculture flower.

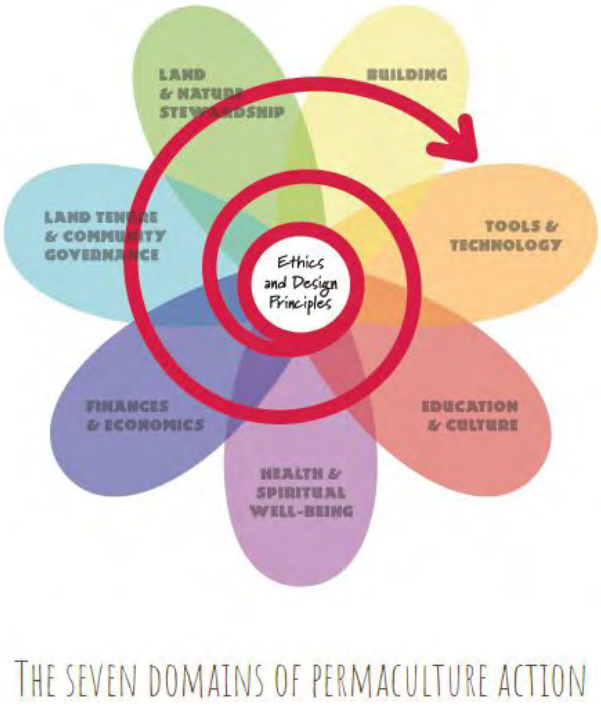


Figure 6. Holmgren's Permaculture Flower[26]

Holmgren and Mollison each developed a set of design principles which can be used to guide design and decision making at any scale and in any context

Mollison's Design Principles:

1. Relative location
2. Each element performs many functions
3. Each important function is supported by many elements
4. Efficient energy planning: zones, sectors, and slope-aspect
5. Using biological resources
6. Energy cycling
7. Small-scale intensive systems
8. Accelerating succession and evolution
9. Diversity

[26] https://permaculturepriniciples.com/flower/

10. Edge effect
11. Attitudinal principles
    a. Everything works both ways
    b. Permaculture is information and imagination intensive
12. Work With Nature
13. The problem is an opportunity
14. Make the least change for the greatest possible affect
15. The yield of the system is theoretically unlimited
16. Everything is connected
17. Relinquishing Power
18. Unknown good benefit
19. Cyclical Opportunity: manage source to sink
20. Functional Design
21. Stability through Diversity
22. Information as a resource

Holmgren's Design Principles:

1. Observe and interact
2. Catch and store energy
3. Obtain a yield
4. Apply self-regulation and accept feedback
5. Use and value renewable resources and services
6. Produce no waste
7. Design from patterns to details
8. Integrate rather than segregate
9. Use small and slow solutions
10. Use and value diversity
11. Use edges and value the marginal
12. Creatively use and respond to change

Holistic Management®

"...Holistic Management® Decision Making... is a framework for empowering decision making that is socially, environmentally, *and* economically sound in the short, medium *and* long term."
Dan Palmer, Very Edible Gardens[27]

Holistic Management® is a whole systems approach to management[28] that includes a detailed methodology for:

1. Decision Making
2. Land Planning
3. Grazing Planning
4. Financial Planning

The process is thoroughly explained in *Holistic Management, Third Edition: A Commonsense Revolution to Restore Our Environment Third Edition* 2016 by Allan Savory and Jody Butterfield and *Holistic Management Handbook: Healthy Land, Healthy Profits* 2006 by Jody Butterfield, Sam Bingham, and Allan Savory. Holistic Management is an entire framework which organizes these topics and more according to Figure 7.

[27] https://www.holisticdecisionmaking.org/introducing-holistic-management-part-1/

[28] https://holisticmanagement.org/wp-content/uploads/2017/03/HM-System-Highlights-Trifold-9.22.2016.pdf

Holistic decision making is a process of decision making and option evaluation developed by Allan Savory and Jody Butterfield and refined by educators, consultants and land managers. It is a primary tenet of Holistic Management.

In order to practice holistic decision making an individual or group documents their 'Whole Under Management' and drafts a 'Holistic Context'. The 'Whole Under Management' includes 1. defining the primary decision makers (stakeholders), and 2. conducting a thorough resource inventory of physical, financial, and community assets. The 'Holistic Context' includes 1. a Statement of Purpose, 2. a set of Quality of Life goals, 3. a list of Behaviors and Systems to support and create the Quality of Life stated, and 4. a vision of the Future Resource Base and community relationships desired.

A 'Holistic Context' is used as a tool to evaluate decisions by asking a specific set of testing questions that integrate the Environmental, Socio-Cultural, and Economic domains. A decision or set of options passes or fails these testing questions based on if it supports the stated 'Holistic Context'. This allows hard decisions in group settings to be evaluated objectively based on the stated intentions of that group, which increases the buy in and effectiveness of decision making and resultant actions.

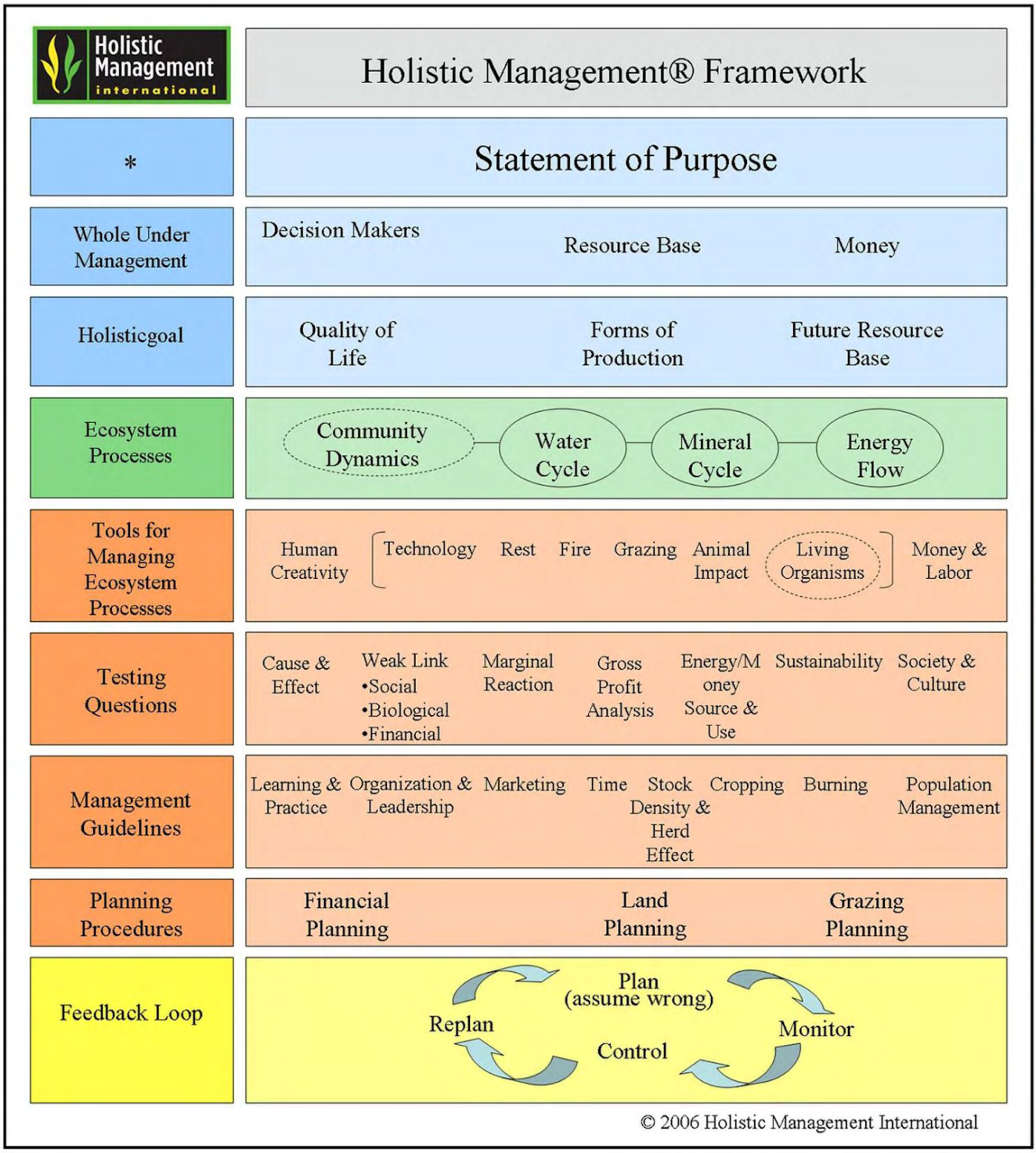


Figure 7. Holistic Management® Framework

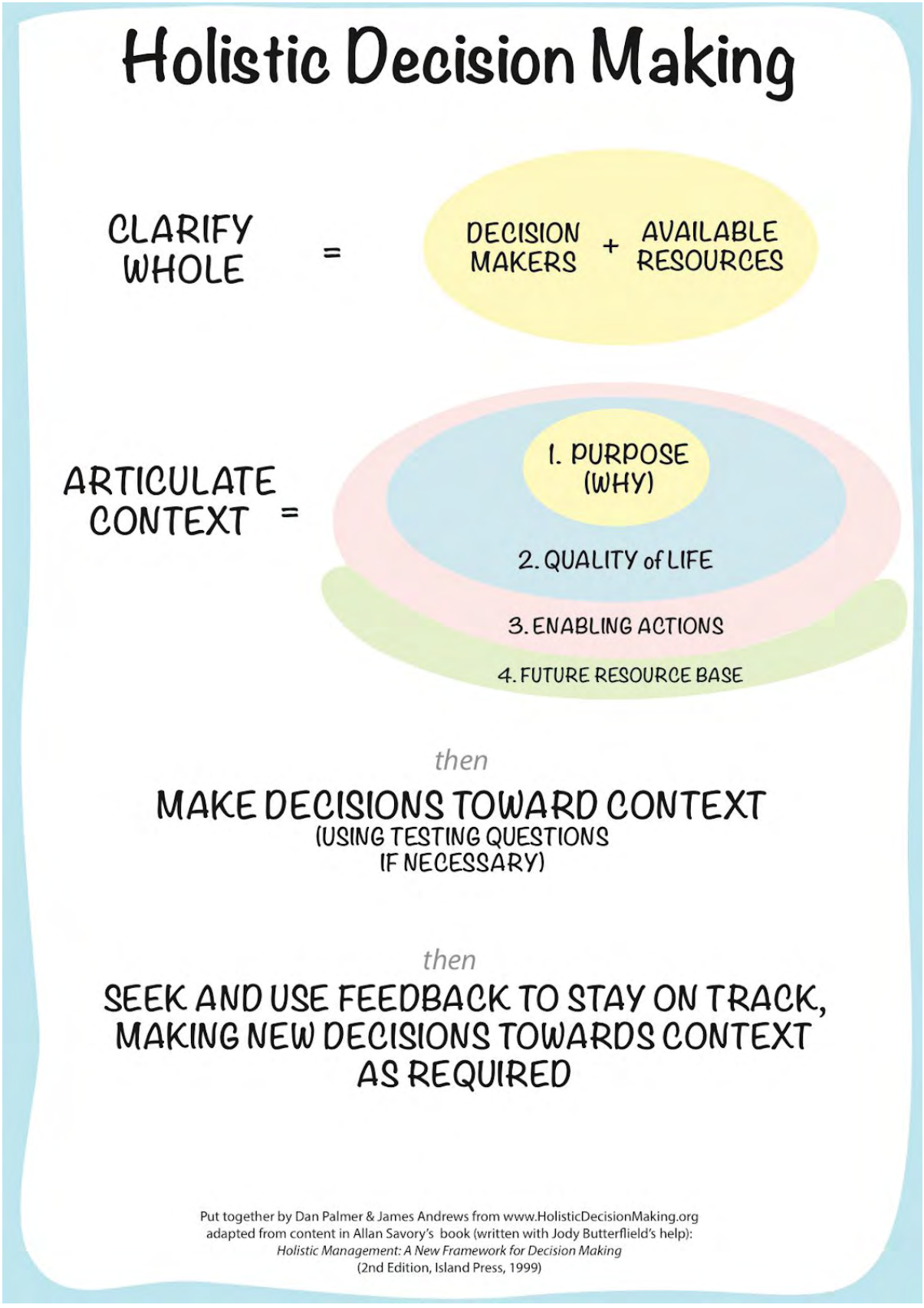


Figure 8. Holistic Decision Making Process using a Holistic Context®

Hence, as such, the first and foremost important work of the project stakeholders is to define the Whole Under Management and the Holistic Context of the project as a whole, as laid out by Holistic Management® International and explained in Section 3.e..

The Whole Under Management includes the Decision Makers and the Available Resources, which can be inventoried using the Regrarians Platform categories to ensure all aspects of farm design and management are covered.

The Holistic Context® is a distillation of 4 interconnected topics that support each other and together form a road-map and guide for how to ensure that the project fits the context of the practitioner, and therefore will be successful (taken from Dan Palmer and VEG[29]):

1. Statement of Purpose: Succinctly captures what the "whole" was formed to do and thus why it exists
2. Quality of Life Statements: Things the decision-makers want to be true of the whole they manage.
3. Systems and Behaviors (formerly Forms of Production): These are actions that support and enable the quality of life statements
4. Future Resource Base: This includes the decision makers' desired vision of the future landscape health according to the ecosystem processes as well as personal relationships and community capacity.

The Holistic Management® Decision Making Process is an in depth topic with many books written on the subject so the process requires much more time and space than we have dedicated to it, and thus it should be stated that this is a very cursory introduction to the concept.

[29] https://www.holisticdecisionmaking.org/introducing-holistic-management-part-1/

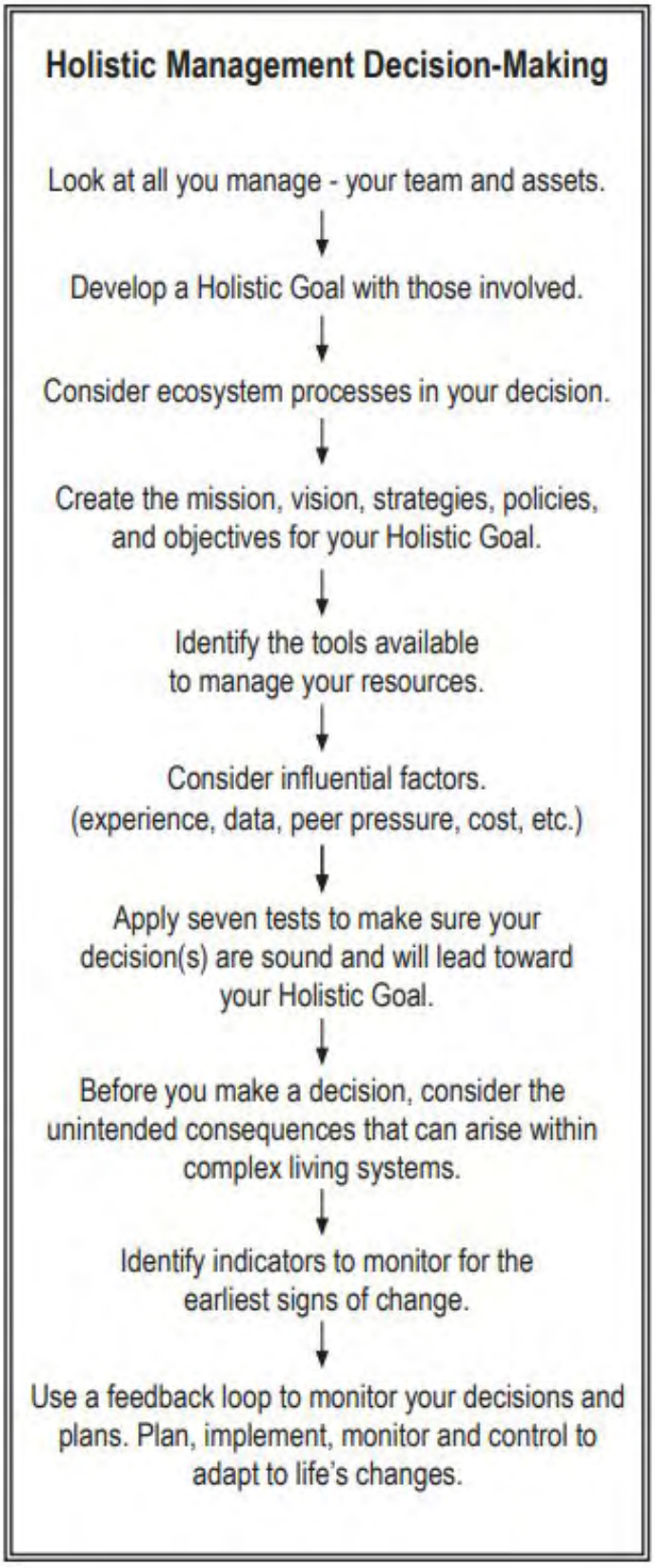


Figure 9. Holistic Decision Making process explained further

The Holistic Management® Framework is summarized below.

Holistic Management® Principles and Practices:
PRINCIPLES
Nature Functions in Wholes
Understand Your Environment

PRACTICES
Practice One: Define What You Manage
Practice Two: State What You Want
Practice Three: Aim for Healthy Soil
Practice Four: Consider All Tools
Practice Five: Test Your Decisions
Practice Six: Monitor Your Results

Test Your Decisions
The testing questions help sift through the variables that are part of making a decision. Does the action or decision meet the triple bottom line toward your Holistic Goal? It is difficult to make decisions that consider all three aspects of the triple bottom line: social, financial, and environmental.

The Seven Tests
1. Root Cause: Does this action address the root cause of the problem?
2. Weak Link: Is the Weak Link Social, Biological, or Financial?
3. Comparing Options: Which action gets the "biggest bang for the buck" toward your Holistic Goal? Where is your highest return?
4. Gross Profit Analysis: Which enterprises contribute most to cover the fixed costs (overhead) of the business?
5. Input Analysis: Is the energy or money to be used in this action derived from the most appropriate source in terms of your Holistic Goal? Will the way the energy or money is to be used lead toward your Holistic Goal?
6. Vision Analysis: Does this action lead toward or away from the Vision articulated in your Holistic Goal?
7. Gut Check: Considering all the testing questions and your Holistic Goal, how do you feel about this action or decision now?

Aim for Healthy Soil
Understanding how ecosystem processes function and what to look for on your land helps you determine how well they are operating and how to work more effectively with Nature to create healthier, more productive land. Ecosystem environments function through four basic processes.

To understand how well ecosystem processes function on your land, get out and walk on it.
Read the land and watch for symptoms of an ineffective process

See Appendix for the original Holistic Management® document.[30]

The Four Ecosystem Processes
Because ecosystems are complex systems, to practice regenerative agriculture, practitioners manage ecosystem processes toward improved health to achieve desired outcomes. This is in contrast to managing land for one or two desired yields.

[30] https://holisticmanagement.org/wp-content/uploads/2017/03/HM-System-Highlights-Trifold-9.22.2016.pdf

Based on the success of Holistic Management® practitioners worldwide, metrics here will be divided into the 4 ecosystem processes as defined in Holistic Management®.[31]

- **The Water Cycle**: the movement of water from atmosphere to soil and back and how that movement affects plant and animal (including human) life.
- **The Mineral Cycle**: the movement of minerals or nutrients and how that movement affects plant, animal and human life.
- **Energy flow**: the movement of energy from the sun through all living (or once living) things.
- The **Biological Community** (Succession) has a never ending development and evolution that we influence.

Methods such as the Bullseye method[32] developed by Kirk Gadzia and Todd Graham provide both qualitative and quantitative protocols for monitoring the 4 ecosystem processes and how management is affecting their trend towards healthy effective ecosystem processes.

The Water Cycle
Although the water cycle is most often associated with rivers, wetlands, lakes, and oceans, a large portion of the effectiveness and health of the water cycle is dependent how precipitation encounters the soil surface and volume and rate of runoff on upland soils relative to infiltration.

The Mineral Cycle: Soil
Managing to improve the overall health of the soil and mineral cycles is a fundamental tenet of Regenerative Agriculture. In order to manage for an effective mineral cycle, we must first identify the primary decay process that occurs on the land we're managing. This relates closely to the regional climates position on the brittleness scale. It can also be affected by microclimate, such as a riparian corridor or spring.

An effective and 'healthy' mineral/nutrient cycle is dependent on the primary decay process for organic matter being biological decay. An increase in the ratio of biological decay to physical/chemical decay represents a positive trend in the mineral cycle. Additionally, an increase in the rate of biological decay increased the rate at which nutrients are being cycled on site and become available for use by another living organism, particularly vegetation.

Energy Flow
"Energy flow is simply the flow of solar energy through green, growing plants to all life, including humans."[33] Energy flow begins with the sun and is often managed by understanding and improving plant primary production across a site. The site is seen as a collection of solar panel and the intention is to create the most surface area of plant leaf for the longest amount of time each year.

Biological Community
"The key to the advance of any terrestrial biological community toward greater complexity is soil cover. If bare soil is covered with living plants or dead plant material (litter, biodiversity and community complexity increases.

You can gauge a community's health by looking at the diversity of its species, the numbers within populations of those species and the age structure within those populations.

[31] Introduction to Holistic Management Manual. HMI. https://holisticmanagement.org/free-downloads/
[32] Bullseye: Targeting your Rangeland Health Objectives. https://quiviracoalition.org/bullseye/
[33] Introduction to Holistic Management Manual. HMI. https://holisticmanagement.org/free-downloads/

The Brittleness Scale

The Brittleness scale is a subjective scale developed by Allan Savory which rates a climate on a 1-10 range based on how evenly precipitation and relative humidity are spread throughout the year. A non-brittle 1 rating refers to a tropical rainforest where rainfall is evenly spread and humidity is generally high. A brittle 10 rating refers to an arid landscape such as the Mojave desert where rainfall is concentrated in one to a few months annually separated by long annual dry periods and humidity is generally low. The term 'Brittleness' was chosen because the lack of moisture and prevalence of physical and chemical decay processes in brittle climates leads to dead plant materials actually being brittle and cracking and snapping when squeezed in hand or stepped on by foot or hoof. Additional work has been done by Jim Howell to clarify the use of the Brittleness scale across a variety of climates.[34]

Once a position on the brittleness scale has been assigned, management of rest, recovery, and disturbances (such as grazing, mowing, cultivation and other actions) can be planned to facilitate improvement in the 4 ecosystem processes. For the mineral cycle in particular, the objective of disturbance in brittle climates like most of Santa Barbara County is to promote biological decay as the primary decay process. The biological decay process promotes the flow of nutrients contained in plant and animal matter into the soil as bioavailable compounds in contrast to the physio-chemical decay process of photo-oxidation which tends towards oxidative off gassing and blowing away of nutrients in dead plant and animal material.

The implications of a site's position on the brittleness scale affect how management decisions and practices affect decay process and vegetative cover and health. Some of these implications are shown in Figure 10 developed by Bruce Ward.[35]

[34] https://managingwholes.com/productivity.htm/

[35] http://www.holisticresults.com.au/green-participant-area/biodiversity-supports-everything/1-3-1-the-implications-of-brittleness

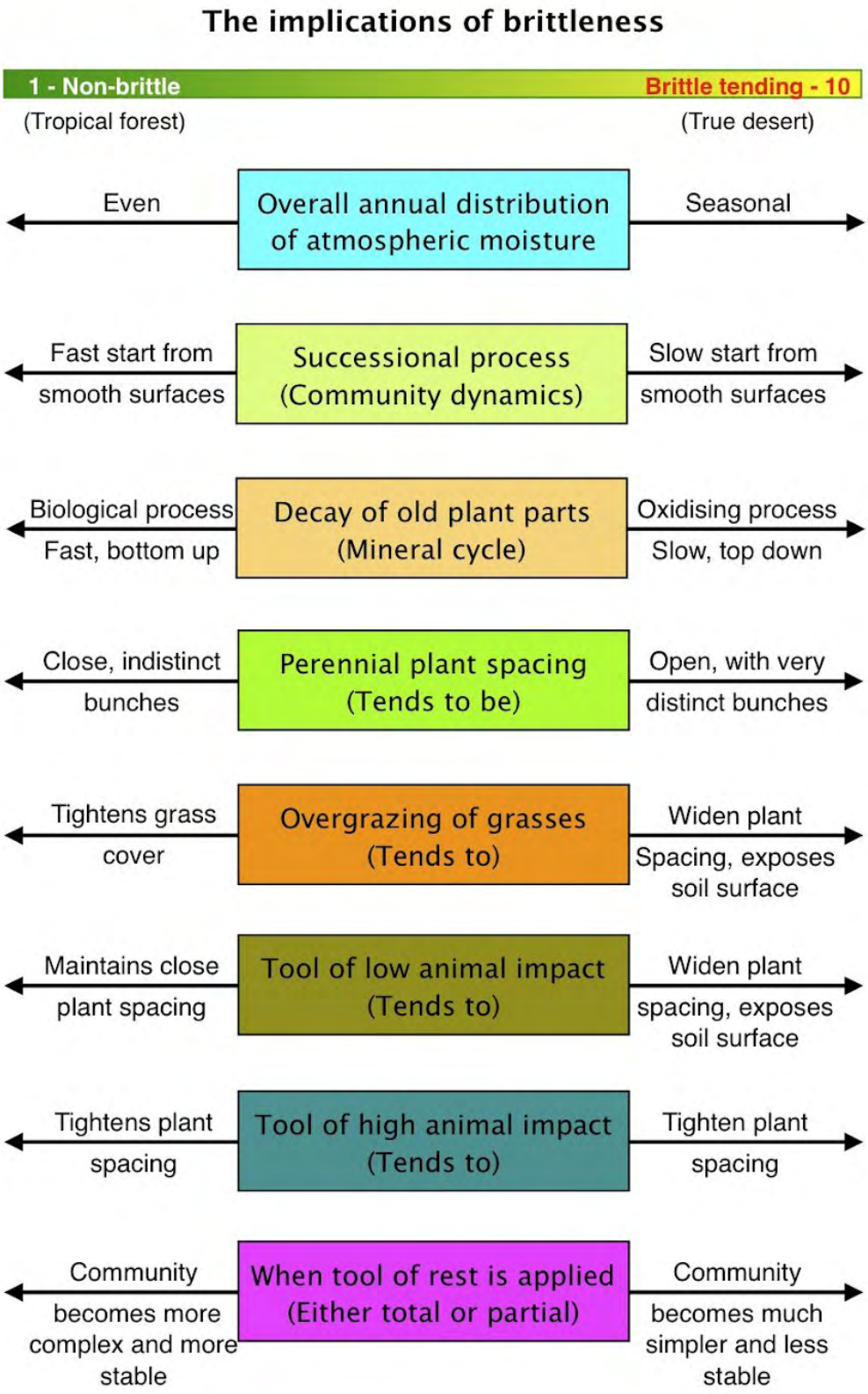


Figure 10. An ecosystem's response to disturbance relative to its position on the brittleness scale (from the late Bruce Ward)[36].

[36] http://www.holisticresults.com.au/green-participant-area/biodiversity-supports-everything/1-3-1-the-implications-of-brittleness
Animal impact is the physical impact that animals have on the system. it is not directly related to over or under grazing. it is related to stock density. the higher the stock density the higher the animal impact. examples are trampling, hoof sheer and intensive manuring. overgrazing is a function of time and occurs on an individual plant basis. if it is bitten once, then bitten again before it has recovered enough to replenish root reserves and regrow enough to start building new root reserves then it is overgrazed. a plant is under-grazed if old growth smothers new green growth and suppresses photosynthesis which leads to senescence.

Resilience Planning

Building resilience at a local and regional level is one of the goals of Regenerative Agriculture. These Best Management Practices (BMPs) are intended to facilitate stage 3 in the Resilience Cycle: Demonstrating Resilience Practices.

It is our intention to make it easier for interested parties to participate in and support Regenerative Agriculture; from farmers and agricultural producers, land managers, to regulators, and consumers. We envision a more resilient and interconnected bioregional environment and economy as one of many beneficial outcomes of increased adoption of Regenerative Agriculture.

Figure 11. Resilience Planning for disaster.[37]

At a policy level from the scale of municipalities to global accords, resilience planning has become a uniting theme. While this may stem from the relatively recent development of the concept of Resilience and Resilience Science, it is also linked to the increase in frequency and magnitude of natural disasters that have impacted communities globally in the 21st Century.

The 100 Resilient Cities network utilizes The City Resilience Framework, "a unique framework developed by Arup with support from the Rockefeller Foundation, based on extensive research in cities" and has developed a Resilience Strategy Process[38] to help cities create and manage a local Resilience plan.

Not only is Resilience a critical factor for municipalities and governments to plan for, it also offers an opportunity to embed support and incentives for Regen Ag into regional policies because the desired outcomes and benefits of Regen Ag build bioregional resilience to disasters such as flood and fire.

1.f. Desired Outcomes of Regenerative Agriculture:

The reason to practice Regenerative Agriculture is to improve the health of our landscapes, communities, and economies. Because health is a broad term, we've selected as set of desired outcomes that are used to evaluate and guide Regenerative Agriculture actions.

[37] https://tidalbasingroup.com/disaster-resiliency/

[38] https://www.100resilientcities.org/how-to-develop-a-resilience-strategy/

The Desired Outcomes of Regenerative Agricultural systems are the results of applying design processes (BMPros) supported by the Best Management Practices (BMPs). The BMPs are put into action to achieve the Desired Outcomes. As such, the outcomes are more important than the practices, as there may be several practices that lead to the same outcome or the same practice may lead to divergent outcomes in different settings.

Focusing on outcomes (patterns) as opposed to the practices (details) helps us troubleshoot and adapt practices which may inspire innovation. It aligns actions regionally and within the movement toward agreed upon beneficial results. Additionally monitoring for desired outcomes leads to an improved awareness of the system itself, which is critical for designing the right system in the first place.

The desired outcomes of Regenerative Agriculture can be organized into the 3 Themes of Environmental, Socio-Cultural and Regulatory, and Economic outcomes:

Desired Environmental Outcomes

- Increased effectiveness of the four ecosystem processes to improved natural capital and ecosystem services on agricultural lands:
    - Water Cycle
        - Increase water resources
        - Buffering of drought and flood cycles
        - Increased effective precipitation[39]
        - Water and air filtration and remediation
    - Mineral Cycle
        - Increased nutrient density within the crops produced
        - Reduced greenhouse gas emissions
        - Preserve and create topsoil
        - Sequester carbon in the system
    - Energy Flow
        - Greater crop/forage production
    - Biological Community
        - Increased species diversity and wildlife habitat
- Eliminate toxic chemical residues in Ag systems and pollution exported from them
- Eliminate and/or utilize all “waste”
- The farm produces a surplus of energy in order to power the operational systems

Desired Socio-Cultural and Regulatory Outcomes:

- High percentage of socially just business models using dynamic governance
- Equitable distribution of labor and wealth
- A community connected to its local food system
- Healthier people from healthier food
- Improved quality of life of farmers and farm workers
- Reduce/eliminate exposure of farm workers to toxic chemicals
- Improved Intellectual and Experiential Capital of local communities
- Humane treatment of livestock
- Improved regulatory environment that supports Regen Ag

[39] Effective precipitation is the percentage of rainfall which becomes available to plants and crops which is improved with increased infiltration and percolation due to improved soil structure.

Desired Economic Outcomes:

- The farm enterprise is financially resilient
- The farm enterprise generates a significant economic multiplier effect in the community
- Land stewardship is valued for improving ecosystem services
- Increased access to financial capital for Regen Ag Practitioners

Regenerative agriculture is based on the sound design of the mainframe of farming operations. This means primarily that the site is first properly assessed and then designed to eliminate soil erosion from wind and rain through soil conservation practices, which includes proper grading of roads and covering the soil with plants and/or mulches. The goal is to build soil, not lose it. Infrastructural elements such as processing centers and agricultural facilities are located near each other to increase efficiency of farming operations, and systems are integrated so that there is synergy with efficiency in management while all "waste" is a resource utilized elsewhere (principles of ZERI).[40]

The reduction of water use through the selection of appropriate crops and the increase of effective precipitation through various soil management practices is another very important facet of regenerative agricultural systems. There is a global water shortage, but this shortage is really an issue of management of our water resources as opposed to a lack of water in the environment.

Common agricultural practices like tillage, which leaves soil bare, reduces soil organic matter and therefore the capacity of soil to hold and store water. One unit of organic matter added to the soil can hold 8 times more water, allowing the soil to act as a sponge. Shifting to ecologically sound management practices can conservatively increase water-holding capacity of soils by up to 15% or more, recharging groundwater and reducing catastrophic floods and droughts.

Regenerative agriculture is rooted in ancient techniques and wedded to the best of modern agro-ecological technologies. Techniques such as agroforestry, composting and cover cropping for soil building are enhanced with our modern understanding of soil microbiology. Sophisticated planned grazing of livestock to improve agricultural lands is now more effective with new and evolving practices such as Holistic Management® and Management Intensive Grazing.

[40] https://www.gunterpauli.com/zeri.html

2. The Case for Regenerative Agriculture

"The Problem is the Solution." Bill Mollison

2.a The Global Setting

The predominant global industrial agricultural model relies on resource extraction in order to operate- specifically water for irrigation; minerals for fertilizers; petroleum for tillage, harvest, and transportation; and physical labor often performed by immigrants- legal and illegal. These extractive actions diminish our natural and cultural resources, often polluting ecosystems and impoverishing farming communities. These practices are "degenerative" as they deplete resources they rely on, and make little effort to account for these "externalities".

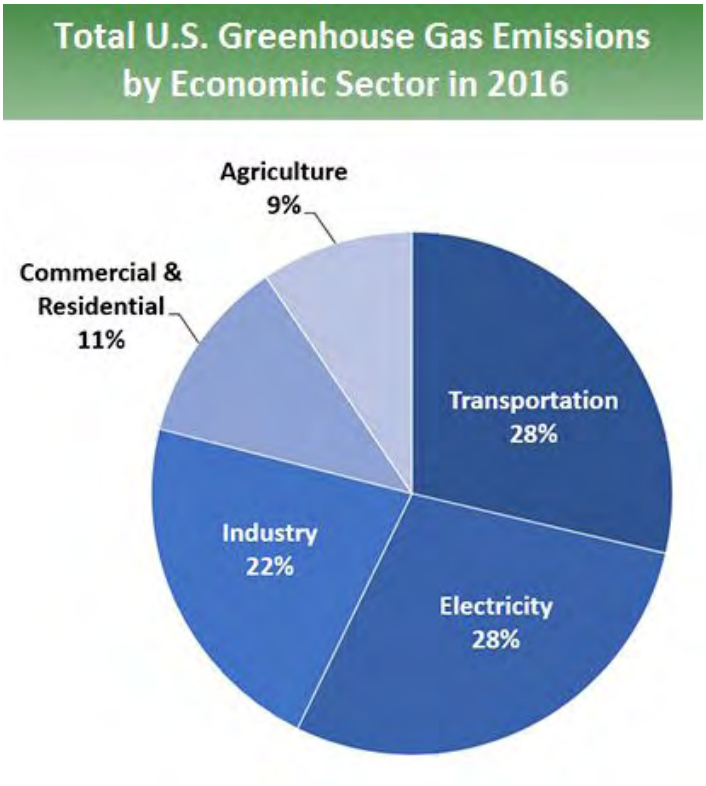


Figure 12. Greenhouse gas emissions by sector[41]

The net sum of these extractive agricultural practices represents a significant contributor to global climate instability represented by resource degradation (both in quantity and quality), landscape form and function through desertification, and societal collapse in the form of resource wars. From the overuse of natural resources, to the over dependence on fossil fuel based inputs (pesticides, herbicides etc), to destructive tillage practices- we have a long way to go to improve the current agricultural model.

In short, Industrial Agriculture is the problem.

[41] https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

Ironically however, a specific type of agriculture proves to be one of the most promising ways to combat not only global climate instability, but a host of other challenges- partly created by industrial agriculture. "Regenerative Agriculture" offers a set of practices that not only reduces greenhouse gas emissions, but has the potential to be "carbon negative" by sequestering significant amounts of atmospheric CO_2[42], transforming it from atmospheric stocks to Carbon stocks in soil and plants. Regenerative Agriculture *generates and improves* the resources it relies on to operate- resources like water, soil, and even labor.

Regenerative Agriculture is a solution, and we have the tools we need to adopt these practices now.

Adopting Regenerative Agricultural (Regen Ag)[43] practices has the potential to improve eco-systemic health: improved health for the land and water bodies through reduced runoff, greater water holding capacity and nutrient cycling in the soil, greater crop/forage production, ecological stability through diversity, improved health for consumers (eating crops with greater nutrient density), increased profits through diversified production, buffering of drought and flood cycles, as well as the innumerable social benefits of having a community connected to its food.

Project Drawdown, dubbed "The most comprehensive plan ever proposed to reverse global warming," identifies Regenerative Agriculture and several Regen Ag practices in the top 100 most impactful practices to combat climate change. These ranked practices include:

- Silvopasture ranked #9
- Regenerative Agriculture ranked #11
- Conservation Agriculture ranked #16
- Tree Intercropping ranked #17
- Managed Grazing ranked #19
- Composting ranked #60
- Nutrient Management ranked #65

By our definition, Regen Ag encompases all of the above practices, and for that reason it is the most important practice to implement. The goal of Regen Ag is to improve natural, social, and financial resources while producing food, and in order to do so we mimic nature by placing elements in proper relationship and function.

Overall, the objectives of Regenerative Agriculture are summarized by Terra Genesis International[44]:

"Each farm is a whole itself, nested within a whole place, within a bio-region, within a larger eco-region. Awareness of the interrelationships at these different scales clarifies how the farm contributes to its bio-region and how bio-regional trends affect the farm. Make conscious efforts to connect to the people and organizations working at different scales to expand the flow of social, intellectual, and experiential capital coming to and from the farm."

Water Resources

Water resources are becoming more scarce and of lower quality globally. Not only are water reserves in overdraft, but the water reserves are becoming more polluted with agricultural and industrial chemicals by the day.

[42] http://carbonfarmingsolution.com/carbon-sequestration-rates-and-stocks
[43] we refer to Regenerative Agriculture as Regen Ag throughout the document
[44] http://www.terra-genesis.com/

Water is the most important resource for the continuation of life on our planet. Without it, little grows. Agriculture is the largest user of water globally, estimated at around 70% of total water used. The quantity of water needed to produce food continues to increase, as the global population grows.

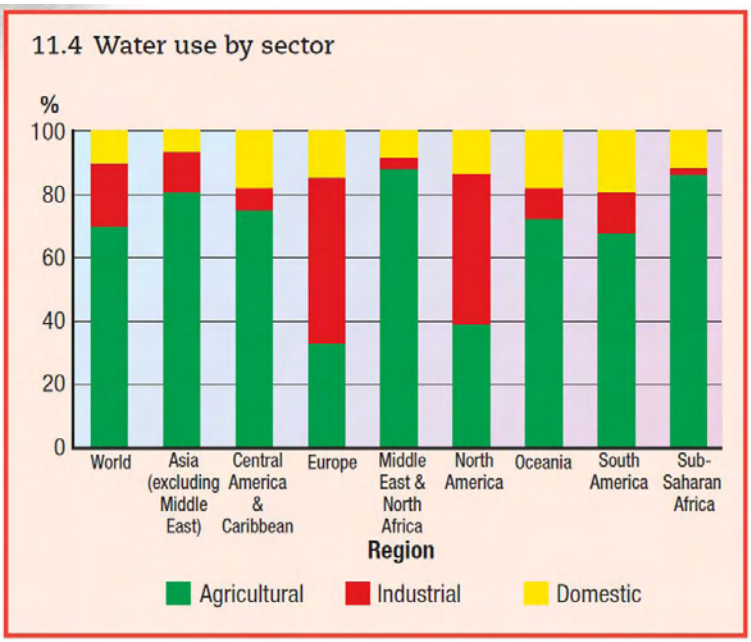


Figure 13. Water use by sector and region.[45]

Many of the world's aquifers are in overdraft, meaning they are being used faster than they can replenish themselves. 37 of the world's major aquifers are becoming depleted, primarily due to agriculture and industry near major population centers.

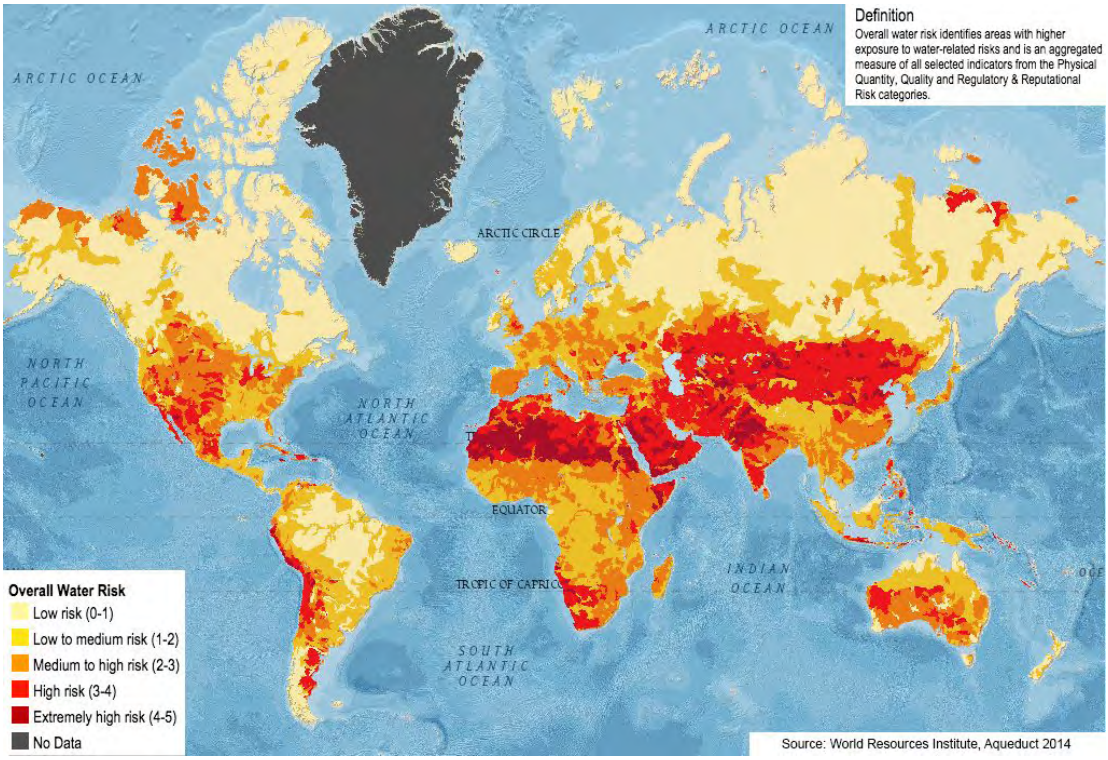


Figure 14. Global overall water security risk[46]

[45] https://www.costellohsie.info/access-to-fresh-water.html
[46] https://en.wikipedia.org/wiki/Water_security

Soil Resources

Civilizations rise and fall according to the health of their soils. Soil loss is one of the most pressing issues facing agriculture and civilization, as our food production is dependent

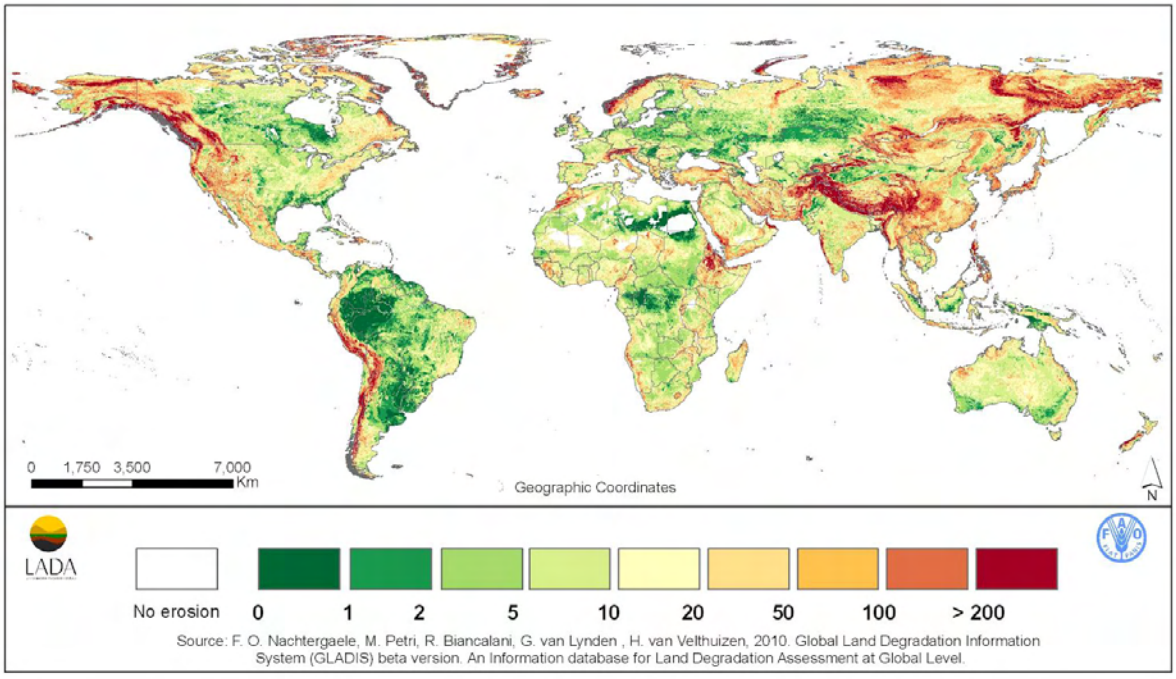


Figure 15. Soil loss globally (Predicted Soil loss in ton/ha/year (USLE equation))[47]

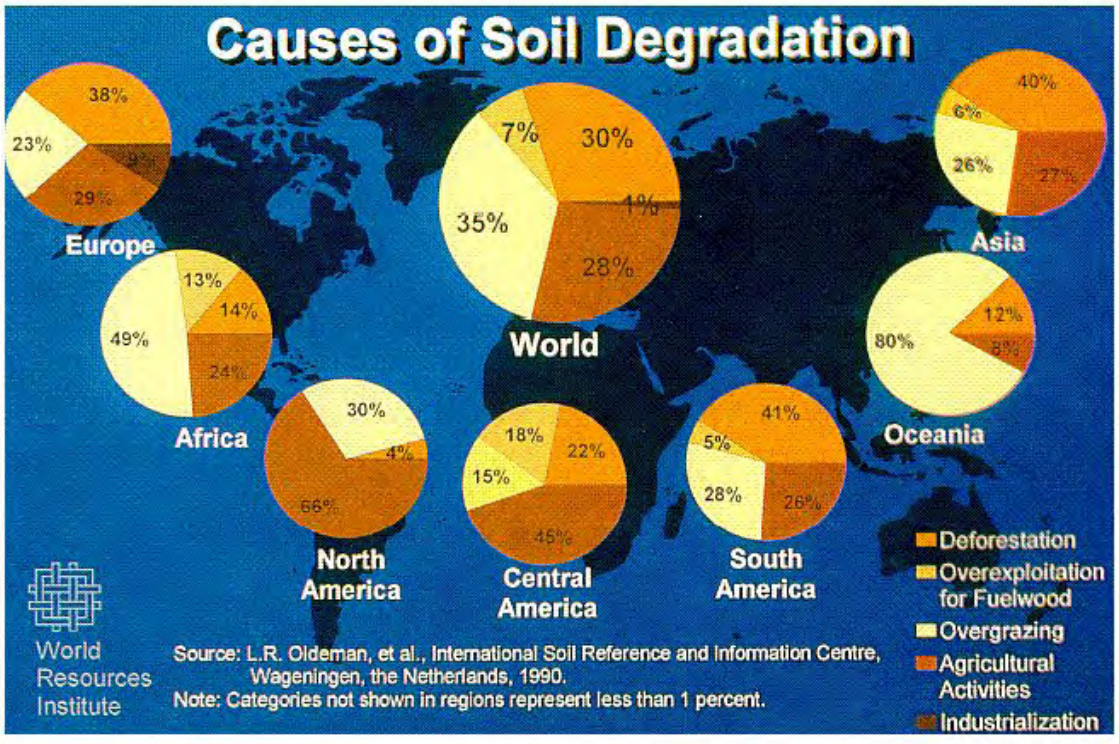
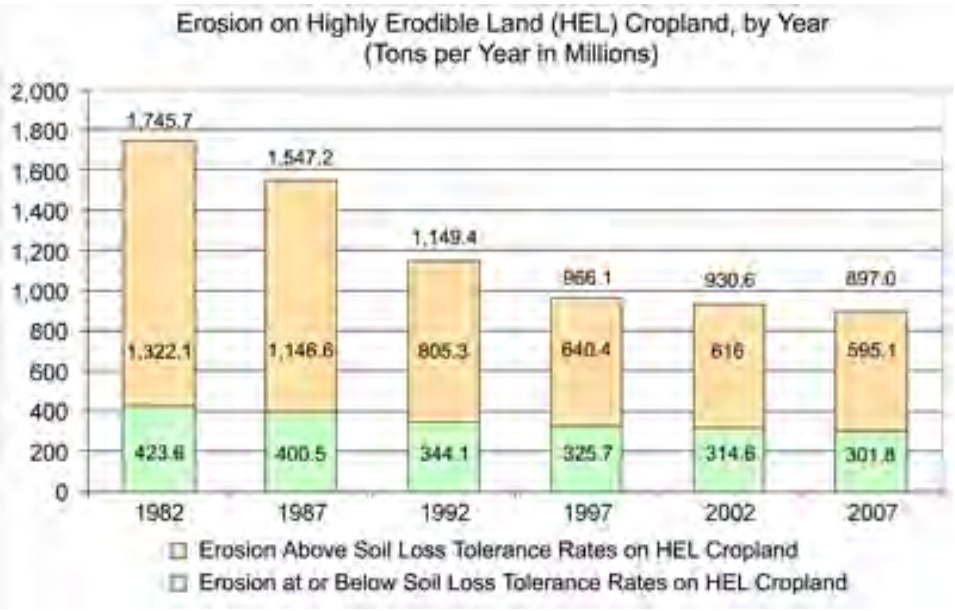


Figure 16. Global Causes of Soil Degradation[48]

[47] http://www.fao.org/soils-portal/soil-degradation-restoration/global-soil-health-indicators-and-assessment/soil-heath-physical/en/
[48] http://blog.agrivi.com/post/soil-degradation

Overall, topsoil erosion rates in the USA are decreasing. Our work is far from done, however, as there is a long way to go from zero erosion to building soil. Is this decline in erosion due to better management, or due to the possibility that all the highly erodible soils have already been lost? Regardless, we need to build soil, not lose it.



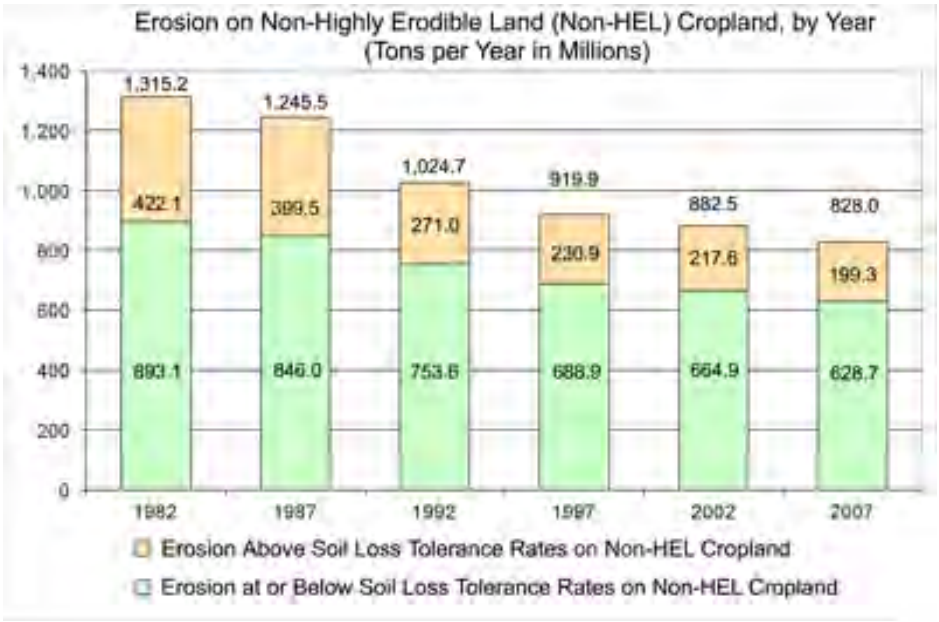


Figure 17. Topsoil erosion trends in USA[49]

Financial and Socio-Cultural Resources

Financial resources and economic resiliency are real challenges to farmers globally. The "bottom line" is generally the most important and pressing issue facing agricultural enterprises- as businesses they will not survive if they are not profitable. Financial profitability has become harder for medium and smaller farmers as they often have to compete with larger multinational agricultural corporations that rely of mechanization and cheap labor to supply the global demand for cheap food.

[49] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/home/?cid=stelprdb1041887

This trend towards paying less for food trickles down to farmers paying less for labor, and farmworker poverty is a global epidemic. Global competition for cheap food and the commodity market coupled with inflation and higher costs of living of consumers is a double edged sword sometimes forcing food supermarket prices below costs of production. In poorer countries, households spend a larger percentage of their total income on food as compared to developed nations.[50]

Farmer suicide is on the rise in countries like India and also the United States, with farmers unable to keep their operations profitable killing themselves. In the USA, farmer suicide rates are higher than those of veterans, with 86 suicides per 100,000 people.[51] This trend is likely to continue with costs of agricultural production rising and farm income dropping.

Regenerative agricultural systems can be more profitable than conventional agriculture, offering better risk-reward scenarios for agri-business and farmers. According to a recent report by Paul McMahon of SLM partners[52] (an asset manager that acquires and manages rural land on behalf of institutional investors) there are a number of reasons why these types of systems can deliver superior risk-adjusted returns:

- Comparable or better yields in most cases
- Lower operating costs because of less reliance on external inputs
- Enhanced natural capital, with the opportunity to increase asset values by regenerating degraded land
- Climatic resilience because healthy soils cope better with droughts and floods
- Positive environmental externalities and the chance to be paid for them, for example through carbon credits
- The ability to sell to higher value markets such as organic or grass-fed and finished meats
- Higher profitability with less volatility

Climate Instability and Regenerative Agriculture

Climate and agriculture are strange bedfellows. Agriculture is responsible for 24% of global greenhouse gas emissions (9% of US GHG emissions), and may be one of the main contributors to climate instability.[53] Conversely, climate instability negatively affects agriculture. Droughts, fires, floods, frosts, and heat waves all have profound impacts on our food production systems leading to crop losses and food supply shortages. Resource scarcity is a leading cause of conflicts globally, as the surge of climate and economic refugees are being linked directly to the lack of these resources[54].

Yet, the problem is the solution. As agriculture is a major contributor to climate change, shifting our production methods to regenerative agriculture as described above can also reverse this trend. By some estimates, if all the arable land in the world increased the soil organic matter by 1%, we could reduce atmospheric carbon to pre-industrial levels. A recent white paper by The Rodale Institute[55] states that:

- If management of all current cropland shifted to reflect the regenerative model we could potentially sequester more than 40% of annual carbon emissions

[50] https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/food-prices-and-spending/
[51] https://www.newsweek.com/farmer-suicide-rate-higher-veterans-479823
[52] http://slmpartners.com/wp-content/uploads/2016/01/SLM-Partners-Investment-case-for-ecological-farming.pdf
[53] https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data
[54] https://en.wikipedia.org/wiki/Environmental_migrant
[55] https://rodaleinstitute.org/assets/WhitePaper.pdf

- If all global pasture was managed using a regenerative model, an additional 71% of carbon emissions could be sequestered
- Even if modest assumptions about soils carbon sequestration potential are made, regenerative agriculture can easily keep annual emissions to within a desirable range

Andre Leu, President of the International Federation of Organic Agriculture Movements (IFOAM), provides a thorough review on carbon sequestration in organic soils from diverse sources and ecosystems. These findings are corroborated by international agronomists and climate scientists- quickly converting farms to healthy soils are now at the forefront of proactive solutions to climate instability.

Regenerating our agriculture offers solutions to many of the "problems" facing the world today- water and food shortages, soil loss, rising energy prices and climate instability. It may seem that agriculture has nothing to do with these issues, but in fact it has everything to do with them, and can address them all as a win for everyone.

2.b. Current Context for Santa Barbara County Agriculture

Agricultural Context of SB County

The Santa Barbara County agriculture elements preamble states: "Agriculture is vital to the needs of the nation and the world. Agriculture is the largest production industry in Santa Barbara County and contributes a very large inflow of money into the county's economy. The County, therefore, recognizes the need to protect and maintain a healthy economy and to provide for the conservation of its agriculture.

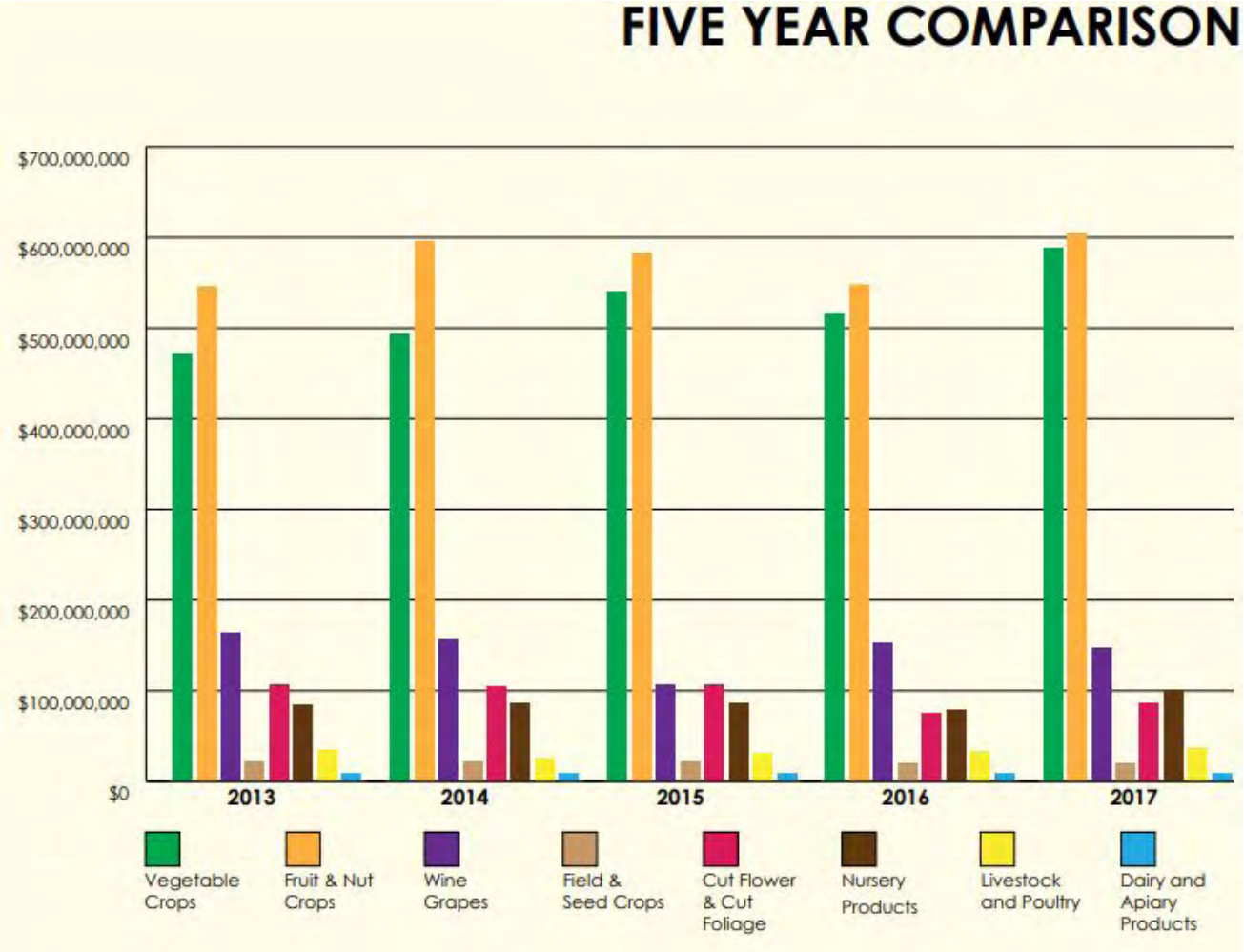
The uniqueness and importance of agriculture in Santa Barbara County requires a specific planning document to guide the county government in addressing the future use of agricultural lands and resources." The agriculture element is a 30 page document updated in 2009 that addresses the importance of agriculture. This document reinforces our county's commitment to agriculture. Maintaining that commitment through the years has been an ongoing challenge.

The County of Santa Barbara has over 700,000 acres of agricultural land, including the following[5657]:
• 67,774 acres of Prime Farmland;
• 12,380 acres of Farmland of Statewide Importance;
• 35,136 acres of Unique Farmland;
• 20,836 acres of Farmland of Local Importance;
• 583,310 acres of Grazing Land.

Farmland in Santa Barbara County on average is priced close to $40,000/acre which is almost ten times the national average.[58,59]

Agriculture is the number one industry in SB County with revenues totalling close to US$1.6B. The County's main crops are (in order of revenue) strawberries, broccoli, and wine grapes.[60]

[56] http://www.cityofgoleta.org/home/showdocument?id=744
[57] https://countyofsb.org/uploadedFiles/agcomm/Content/Other/crops/Santa-Barbara-County-2014-Agricultural-Statistics.pdf
[58]https://www.landandfarm.com/search/CA/Santa-Barbara-County/Farm-for-sale/
https://www.loopnet.com/california/santa-barbara-county_farms-for-sale/
[59] https://www.usda.gov/nass/PUBS/TODAYRPT/land0815.pdf
[60] https://countyofsb.org/uploadedFiles/agcomm/Content/Other/crops/2017.pdf



ITEM	2013	2014	2015	2016	2017
Vegetable Crops	$471,590,681	$493,635,729	$539,846,497	$515,397,033	$588,662,957
Fruit & Nut Crops	$545,939,874	$595,346,546	$582,102,370	$546,727,621	$605,447,793
Wine Grapes	$163,362,417	$155,255,791	$106,198,172	$151,629,764	$146,129,595
Field & Seed Crops	$20,764,227	$21,133,935	$20,388,067	$19,487,436	$19,568,781
Cut Flower & Cut Foliage	$106,619,530	$105,093,374	$105,286,883	$75,040,786	$85,649,464
Nursery Products	$84,832,238	$86,092,464	$85,816,058	$78,911,967	$100,654,079
Livestock and Poultry	$34,904,230	$24,827,984	$31,031,386	$31,804,415	$36,807,327
Dairy and Apiary Products	$8,638,221	$8,595,030	$8,423,129	$7,665,047	$7,430,595
Total	**$1,436,651,418**	**$1,489,980,853**	**$1,479,092,562**	**$1,426,664,069**	**$1,590,350,591**

Figure 18. Production revenues by Crop type in Santa Barbara County[61]

[61] https://countyofsb.org/uploadedFiles/agcomm/Content/Other/crops/2017.pdf

SB County Food Action Plan

In addition to an agricultural heritage and a desire to protect this, there has been a very strong local food movement within Santa Barbara County to address such things as access to sufficient nutritious food, economic vitality, and environmental resilience. These topics became the focus of what has come to be known as the Santa Barbara County Food Action Plan.

The Food Action Plan's main focus is:

1. Invest in our Food Economy
2. Invest in our Health and Wellness
3. Invest in our Community
4. Invest in our Foodshed

.

Out of these 4 actions came the development of 16 goals:.

1. Invest in our Food Economy
    a. Support the next generation of farmers and food system entrepreneurs by creating or expanding agriculture and vocational education at the high school and community college level.
    b. Encourage entry into the local food economy by building access to a collaboration of educational resources and tools that can be utilized by new and emerging food system entrepreneurs.
    c. Develop a preferential purchasing policy model for agencies and institutions.
    d. Strengthen distribution systems for local produce through existing networks, food hubs, and alternative markets.
    e. Form a food incubator/impact investing hub to facilitate investment in food systems development in Santa Barbara County.
2. Invest in our Health and Wellness
    a. Support the development of neighborhood networks of volunteers to provide peer to peer education and empowerment to food insecure community members to improve their health.
    b. Facilitate the adoption and implementation of workplace wellness policies that include support for healthy eating behaviors and access to healthy foods.
    c. Establish "Food as Medicine" programs that promote health through better nutrition.
3. Invest in our Community
    a. Integrate food literacy into all school campus cultures- including in-school and out-of-school programs- throughout Santa Barbara County.
    b. Establish Community Food Access Centers that serve as place-based, food-centric neighborhood revitalization efforts, and which unite multiple functions (including education) in one or nearby locations.
    c. Increase affordability and accessibility to healthy, safe, environmentally-sound, locally grown food for all residents of Santa Barbara County.
    d. Support fair compensation for all members of the food workforce and increase the availability and accessibility to affordable housing to help sustain their vital role in the regional food system.
4. Invest in our Foodshed
    a. Reduce the food system's contribution to greenhouse gas emissions while strengthening its resilience and ability to adapt to long term drought and future climate change scenarios.
    b. Protect existing and potential farm and ranch land, as well as the ecosystem services they provide.
    c. Reduce food waste across all sectors of the Santa Barbara County food system- from producer to consumer- through policy, education, and collaboration.

d. Promote and incentivize the use of Best Management Practices on farms, ranches, and food system businesses in Santa Barbara County.

In addition to the Food Action Plan, the County of Santa Barbara has chosen to support and prioritize efforts that reduce greenhouse gas (GHG) emissions (preparation for climate change). In 2009 the Board of Supervisors adopted the "Santa Barbara County Climate Change Guiding Principles" . The Energy and Climate Action Plan (ECAP) "is a significant part of the County's demonstrated commitment to reducing GHG emissions while protecting the aesthetic qualities and unique resources of Santa Barbara County."[62]

At a state level there is also a significant move toward addressing our state's total greenhouse gas emissions. The Global Warming Solutions Act of 2006, or Assembly Bill (AB) 32, is a California State Law that fights global warming by establishing a comprehensive program to reduce greenhouse gas emissions from all sources throughout the state. AB32 relies on a number of important complementary policies to achieve the bulk of reductions to meet California's statewide 431 $MMTCO_2e$ emissions goal for 2020. The Cap and Trade Program acts as a backstop to these complementary policies.

Some of these cap and trade monies support Regenerative Agriculture such as the Healthy Soils Initiative. This program aims to bolster available funds for beneficial soil building practices. "California's Healthy Soils Initiative[63] collaboration of state agencies and departments, led by the California Department of Food and Agriculture, to promote the development of healthy soils. A combination of innovative farm and land management practices contribute to building adequate soil organic matter that can increase carbon sequestration and reduce overall greenhouse gasses."

Santa Barbara County is clearly committed to the continuation of agriculture and with the way the political and social pressures are leaning, Regenerative Agriculture looks to have a very bright future in this County as well as the State as a whole.

The Current Challenges of Agriculture in Santa Barbara County

Currently, most if not all of the agriculture in SB County would best be described as "degenerative" (it pollutes land and water, uses more water than can be replaced naturally, depletes topsoil, and places CO_2 in the air-contributing to global warming). Of the 720,000 acres of farmland in the county, only approximately 6,200 of those acres are registered as organic, and only a fraction of that would fit the Regen Ag standards.

[62] http://longrange.sbcountyplanning.org/programs/climateactionstrategy/docs/Final%20ECAP_May%202015.pdf
[63] https://www.cdfa.ca.gov/healthysoils/

Top 10 Registered Organic Crops Grown in Santa Barbara County by Acreage			
2016		2015	
1. Strawberries	1295	1. Strawberries	1647
2. Spinach	747	2. Carrots	1025
3. Cauliflower	673	3. Spinach	962
4. Broccoli	642	4. Leaf Lettuce	563
5. Avocados	581	5. Cauliflower	536
6. Celery	497	6. Broccoli	521
7. Blackberries	469	7. Avocados	496
8. Leaf Lettuce	466	8. Celery	414
9. Kale	431	9. Kale	411
10. Pistachios	412	10. Romaine Lettuce	378

Figure 19. Top 10 registered organic crops grown in Santa Barbara County by acreage[64]

Agriculture in Santa Barbara County is challenged on many fronts. Despite being the number one industry in the County, the future of conventional agriculture as we know it is bleak at best. From water and labor shortages, to global competition, farming in Santa Barbara is not for the faint of heart.

Water Quantity

Currently, water is a huge limitation due to a prolonged drought that has left the county in extreme to exceptional drought conditions for the last 4 years. Aquifers are not being replenished by seasonal rains, but water use is at an all time high and demand is rising. Despite a weakening drought in most of California, Santa Barbara remains in exceptional drought.

[64] http://cosb.countyofsb.org/uploadedFiles/agcomm/crops/2016.pdf

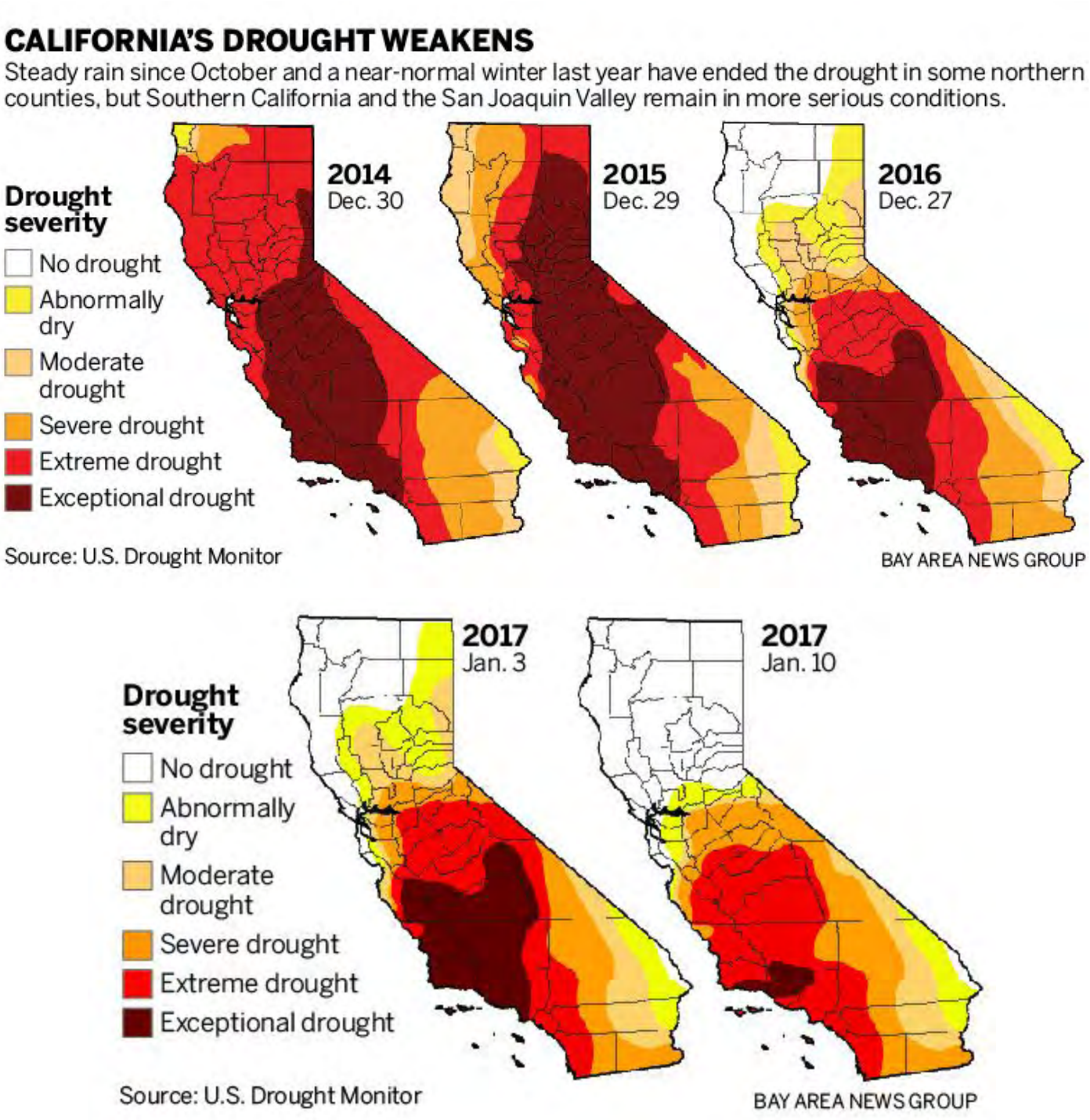


Figure 20. Recent drought trends in California[65]

Groundwater resources are dwindling in the County, with the majority of wells in the county recording record low levels as of 2014.[66] Four years later, the situation seems even more dire, with record low rainfall exacerbating already historically low groundwater water levels. Due to geological variability, groundwater recharge may happen on a yearly basis, or take several decades to even thousands of years to recharge. We cannot know with certainty how long it may take for some of the ancient aquifers to recharge.

[65] http://cosb.countyofsb.org/uploadedFiles/agcomm/crops/2016.pdf
[66] http://countyofsb.org/uploadedFiles/pwd/content/Water/WaterAgency/Status%20Report%20on%20Groundwater%20Basins_Final2.pdf

Some wells in the Cuyama Valley at 3000 feet deep are withdrawing water that may be thousands of years old, called "fossil water". The groundwater in Cuyama is being withdrawn twice as fast as it can recharge, which not only leads to water quality issues but also may cause land subsidence.[67] Much of this water is being used to irrigate lettuce and carrots in this hyperarid desert, with overhead irrigation that may only be 25% effective. It doesn't take a degree in hydrology to realize that this cannot be sustained.

Figure 21. Major Groundwater basins in Santa Barbara County

Water Quality

Non-point source water pollution as a result of conventional agricultural activities has significant negative impacts to watershed health in Santa Barbara County. Stormwater and irrigation water runoff may contain salts, nutrients, sediment, heavy metals and pesticides, which often ends up in local waterways leading to eutrophication and anoxic conditions that kill fish and other riparian invertebrates.[68]

Agriculture has been exempt from the reporting and permitting requirements of the Clean Water Act since its inception in 1948.[69] In 2004, the California Regional Water Quality Control Board (RWQCB) enacted an Agricultural Order as an attempt to regulate agricultural runoff and discharges into waterways. The program requires that all irrigated agriculture file for a permit called Conditional Waiver of Waste Discharge Requirement to monitor a farm's activities and practices as they pertain to water quality and stormwater runoff.

However, this program, commonly called the Ag Waiver since agriculture is mostly exempt from reporting or permitting, has been "watered down" by the County's powerful agricultural lobby, and is far from perfect.

[67] https://watchers.news/2014/08/16/cuyama-valley-groundwater-study/
[68] https://www.sbck.org/current-issues/agriculture/
[69] https://www.epa.gov/cwa-404/exemptions-permit-requirements

Renewed in 2017, the program requires that farms monitor groundwater withdrawal and report total nitrogen application, and the latter only for certain crops like lettuce and broccoli.[70]

Agriculture has almost a free-pass when it comes to monitoring and restricting chemical use. The County Agricultural Commissioner collects reporting from large growers through vendor sales of chemicals and their use must be consistent with the label, however it is almost impossible to monitor on-farm applications of chemicals.

Agricultural reporting of chemical use is a contentious issue and there are many sides to the debate. It is of the authors opinions that synthetic chemical use is detrimental to soil and ecosystem health and as such its use shall be severely restricted or completely eliminated, this includes herbicides, pesticides, and fungicides. We also feel that there are alternative biocides that are appropriate for use in certain contexts, specifically naturally derived chemicals that are processed on farm- for example garlic chile spray as a pesticide.

Labor Shortages

Santa Barbara County agriculture is also challenged with socio-cultural issues, in the form of the availability of cheap and reliable labor. Farmworker labor shortages are common, despite increasing numbers of H2-A guest worker visa applications in the county. Immigration and Customs Enforcement (ICE) raids have deported hundreds of illegal immigrants, many of them farm workers. By some estimates 72% of farm workers in Santa Barbara County are undocumented, and therefor subject to deportation.[71]

The demand for "cheap" food has led to farmworker wages below living standards, especially in Santa Barbara which is one of the top ten "least affordable places to live" in the world.[72] This fact makes it very difficult for people to afford living in the region on farmworker wages, and migrant farmworkers often live 4 to a room sharing costs. Many US born citizens are not able (financially or physically) nor willing to work the grueling hours and low wages of farm labor, that is mostly performed by immigrant farmworkers.

Commodity Crops and Global Competition

Global competition is another challenge to agriculture in Santa Barbara. The County's main crops are (in order of revenue) strawberries, broccoli, and wine grapes[73]; all of which are commodities that are produced in other countries and imported to the USA. Santa Barbara farmers have to compete with countries like Mexico and Chile which have much lower costs of production, specifically lower labor and land costs. As a result many farmers are finding it hard to make a profit on commodities unless they pay lower wages and decrease costs to a minimum, and often environmental practices are the first costs to be cut.

Development Pressure and Land Valuation

As if all of the above wasn't enough, land valuation and speculation in Santa Barbara County is the "elephant in the room" when it comes to assessing the potential of profitable agricultural enterprises in the County. Much of Santa Barbara County is experiencing very high prices for agricultural land. Gaviota in particular, being the last stretch of undeveloped southern California real estate, has an enormous amount of pressure to continue the "leapfrog development" west of the urban limit line in Goleta, and hence land prices are reflective of this fact. The average price per acre for agricultural land on the Gaviota Coast (per current listings) is $42,400.

Inflated land values create an uneven playing field when it comes to making agriculture profitable. Inflated land values challenge not only agricultural viability, but conservation easements, restoration projects and familial succession through estate taxes. Furthermore, the demographics of Santa Barbara and Gaviota in

[70] https://www.waterboards.ca.gov/centralcoast/water_issues/programs/ag_waivers/
[71] Santa Barbara Independent, March 2016
[72] Business Insider, January 2018
[73] https://countyofsb.org/uploadedFiles/agcomm/Content/Other/crops/2017.pdf

particular are shifting from agricultural producers to high net worth individuals and "McMansion" style developments. Some agriculture remains but not as a primary income stream.

The Need for Regenerative Agriculture in Santa Barbara County: A Practical Plan for Adoption

Based on the above issues facing agriculture in Santa Barbara County, agriculture is teetering on the brink of profitability and practicality. Regenerative Agriculture can provide some solutions to these very challenging problems, and may be the best option we have to address these issues head on without ignoring them.

Water quality and quantity, labor issues, global competition can all be addressed within the framework of RegenAg. RegenAg can even address succession and estate tax issues, with proper financial planning and diversified operations farms can become profitable which will reduce the chance of the land selling.

The Bottom Line

The key to the successful adoption of Regen Ag practices by farmers and ranchers County-wide may be the good old bottom line. If farmers and ranchers can become or remain profitable while improving the natural capital of their land base then it follows that the practices are worth the investment. Farmers are not likely to "do the right thing", i.e. choose to not use chemicals, diversify production, or plant riparian buffers- if it jeopardizes the farm itself. Therefore it is of primary concern that we address the various economic issues challenging agricultural profitability.

3. Regenerative Agriculture Milestones and Publications

3.a Milestones

Over the past decade, Regenerative Agriculture has gained momentum in both practitioners circles and the public sphere. Several milestones mark the rising trajectory of the need for and benefits of converting modern industrial and degenerative agricultural lands to practices that restore and regenerate soil health. Soil health has become a major concern and unifying topic because it is a common resource that societies worldwide rely upon to provide basic subsistence commodities like food, fiber, and fuel as well as commodities and feedstocks that support global supply networks.

These milestones include, but are not limited to:

- The United Nations including agriculture and healthy soils as aspects of their climate change mitigation plans[74]
- Rodale Regenerative Organic Certification[75]

United Nations stance on Climate Change

"At COP 21 in Paris, on 12 December 2015, Parties to the UNFCCC reached a landmark agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future."[76]

The UN has stated "Healthy Soils Are a Key Component of Climate Action"[77]

Regenerative Agriculture provides a set of complementary practices and outcomes to the global climate effort because both utilize a holistic perspective which includes environmental, socio-cultural, and economic factors.

Rodale Regenerative Organic Certification

Recently, the Rodale Institute specifically designed a Regenerative Organic Agriculture certification that goes above and beyond the USDA National Organic Program certification. This Regenerative Organic Certification includes a set of Soil Health criteria that must be met. Additionally it specifies Farmer and Worker Fairness and Animal Welfare practices which must be met.[78]

3.b. Publications

Recently, several landmark publications have been published to further the conversation around Regen Ag. Several are listed below.

- Project Drawdown: The most comprehensive plan ever proposed to reverse global warming

[74] https://unfccc.int/topics/land-use/the-big-picture/introduction-to-land-use
http://unctad.org/en/PublicationsLibrary/ditcted2012d3_en.pdf
[75] https://rodaleinstitute.org/regenerativeorganic/
[76] https://unfccc.int/process-and-meetings/the-paris-agreement/what-is-the-paris-agreement
[77] https://unfccc.int/news/healthy-soils-are-a-key-component-of-climate-action
[78] https://rodaleinstitute.org/regenerativeorganic/

- The Carbon Farming Solution: A Global Toolkit of Perennial Crops and Regenerative Agriculture Practices for Climate Change Mitigation and Food Security
- Regenerative Organic Agriculture and Climate Change: A Down-to-Earth Solution to Global Warming

Project Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming is a major collaboration in research and vision for a climate stable, low carbon future. Edited by Paul Hawken (author of Natural Capital), it showcases and ranks 100 'applied, hands-on practices and technologies that are commonly available, economically viable, and scientifically valid."[79]

Food and Land Use are two categories within the Project Drawdown framework. Figure 22 and Table 2 show their findings on the Potential Carbon mitigated by a wide range of practical solutions.

While they differentiate Regenerative Agriculture as a separate practice, we have chosen to integrate the diversity of regenerative and carbon positive land use practices under Regen Ag BMPs.

[79] Project Drawdown. . p. x

Table 2. Mitigation impact of food sector solutions under the three studied scenarios

TOTAL ATMOSPHERIC GREENHOUSE GAS REDUCTION (IN GIGATONS)

	PLAUSIBLE SCENARIO	*DRAWDOWN* SCENARIO	*OPTIMUM* SCENARIO
Biochar	0.81	1.42	1.60
Clean cookstoves	15.81	24.32	24.32
Composting	2.28	3.21	3.61
Conservation agriculture	17.35	12.80	10.29
Farmland irrigation	1.33	1.89	2.33
Farmland restoration	14.09	17.84	30.78
Improved rice cultivation	11.34	16.82	20.16
Managed grazing	16.34	22.22	27.93
Multistrata agroforestry	9.28	16.51	23.65
Nutrient management	1.81	1.87	2.71
Plant-rich diet	66.10	78.65	87.03
Reduced food waste	70.53	83.02	93.72
Regenerative agriculture	23.15	32.59	32.39
Silvopasture	31.19	47.50	65.03
System of Rice Intensification	3.14	4.99	5.89
Tree intercropping	17.20	27.16	36.96
Tropical staple trees	20.19	31.81	47.15
TOTAL	**321.94**	**424.62**	**515.55**

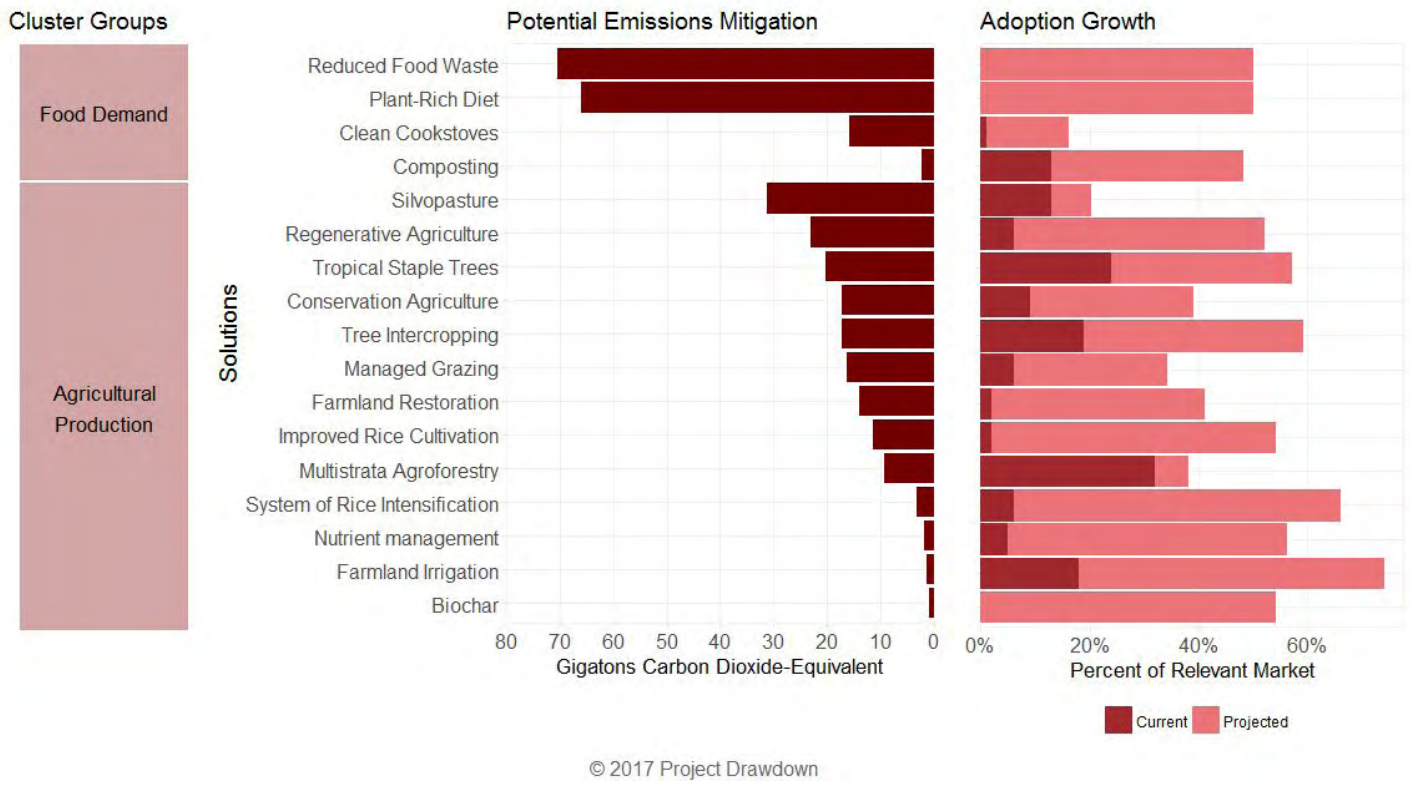


Figure 22. Carbon sequestration of Food Sector groups. Source: Project Drawdown

The Carbon Farming Solution: A Global Toolkit of Perennial Crops and Regenerative Agriculture Practices for Climate Change Mitigation and Food Security was published in 2016. Written by Eric Toensmeier, who teaches at Yale University and has written several books on perennial agriculture and agroforestry, this seminal work lays out a wide range of options for regenerative agriculture practices including detailed profiles of both food and industrial crops that can be integrated into agricultural operations to feed both local and global supply networks. One part of this publication is a wide ranging review of scientific literature and on-the-ground agricultural practices. The Carbon sequestration rates and Soil carbon stocks under a diversity of land use practices are shown in Figures 23 and 24. We have used this reference as a primary source for our environmental Regen Ag BMPs.

One highlight of these publications is the dramatic potential for integrating trees (woody perennials) into agricultural production systems particularly grazing in the form of silvopasture. While these practices are clear winners in terms of increasing soil carbon with all the associated benefits that brings, they are capital intensive in the short term with relatively long term returns on investment (ROIs). Due to this economic relationship, we consider the development of policies and organizations that incentivize farmers and rancher to plant and manage tree crops as high leverage activities and priorities to increase the adoption of Regen Ag.

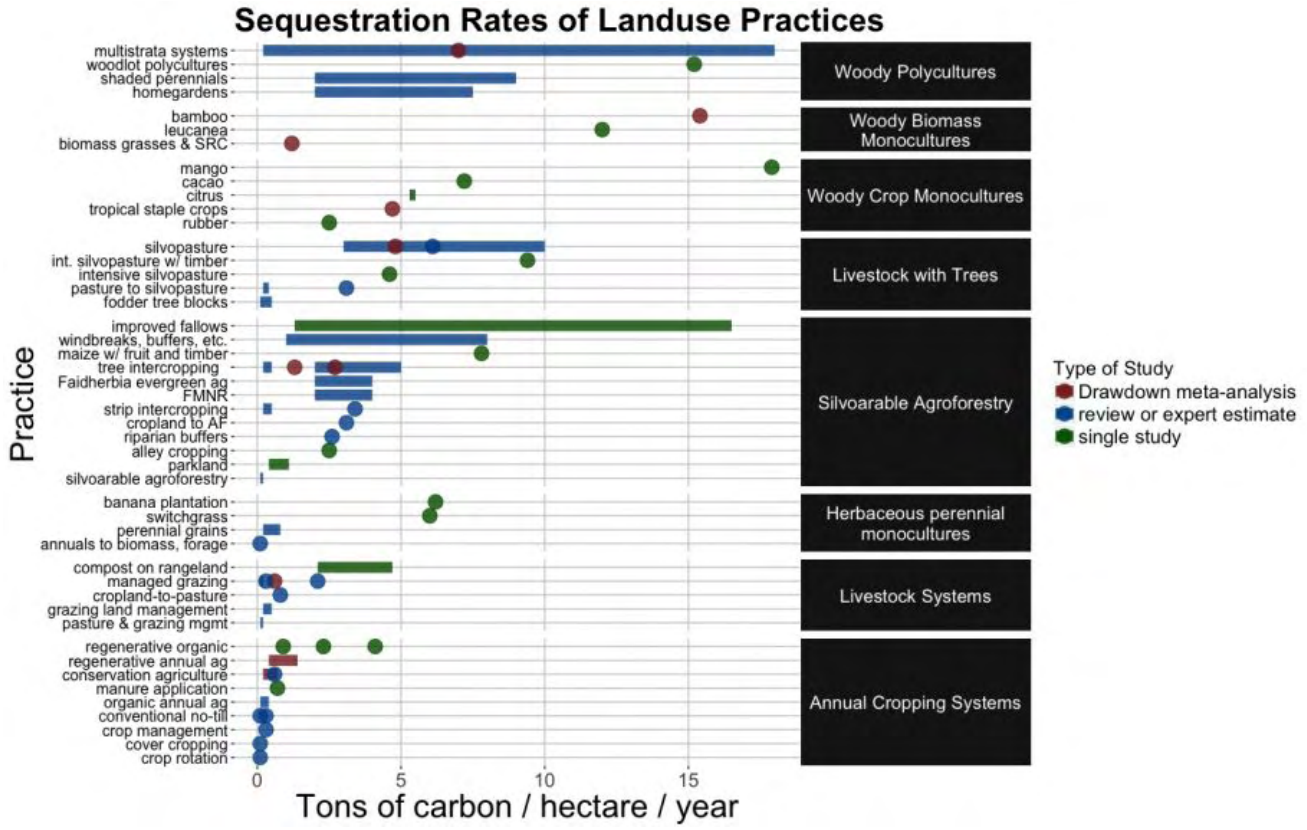


Figure 23. Sequestration rates of Atmospheric CO_2 of various land use practices.[80]

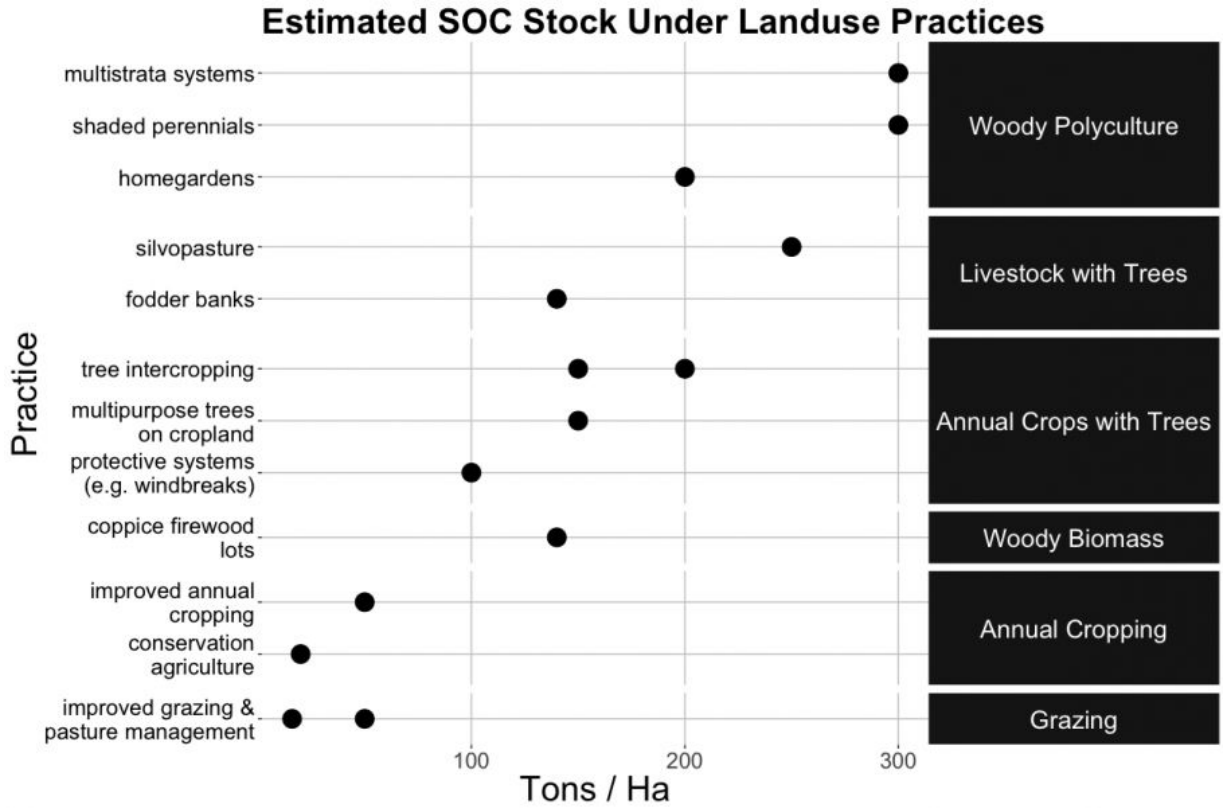


Figure 24. Estimated Soil Organic Carbon (SOC) stock under improved land use practices[81]

[80] http://carbonfarmingsolution.com/carbon-sequestration-rates-and-stocks Data visualization courtesy Rafter Ferguson.
[81] http://carbonfarmingsolution.com/carbon-sequestration-rates-and-stocks Data visualization courtesy Rafter Ferguson.

In their recent white paper, *Regenerative Organic Agriculture and Climate Change: A Down-to-Earth Solution to Global Warming*[82], the Rodale Institute published the results of some of their long term comparison studies of organic and conventional farming systems. Of particular note, this study found organic systems to be more profitable with similar yields and significantly lower energy input and greenhouse gas emissions (see Figure 25).

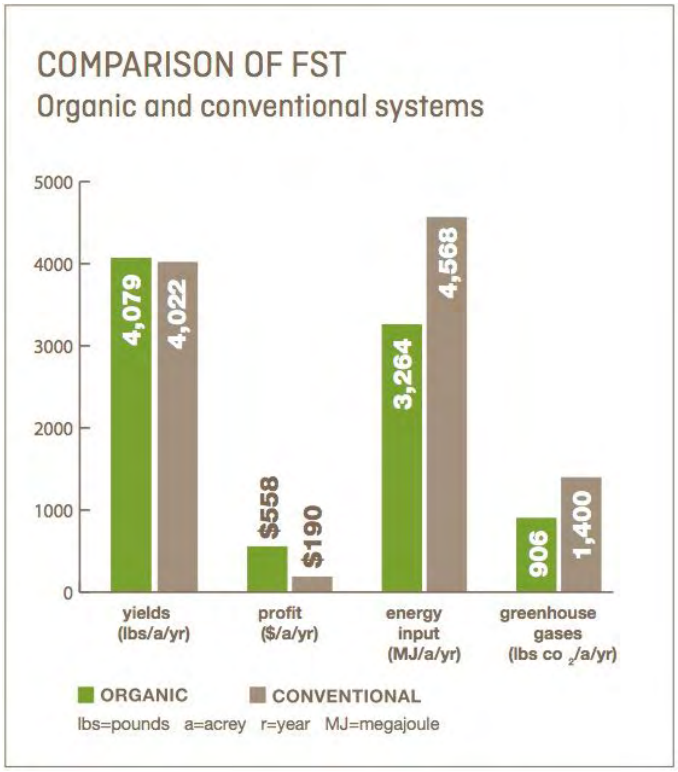


Figure 25. Organic vs Conventional Farm System Trial (FST) over a 30 year period by The Rodale Institute

Regen Ag has the potential to outperform the results according to a recent case study on Brown's Ranch[83] in North Dakota.

[82] https://rodaleinstitute.org/assets/WhitePaper.pdf
[83] http://brownsranch.us/

4. Santa Barbara County Regional Best Management Practices for Regenerative Agriculture

4.a. Why Regenerative Agriculture Best Management Practices (BMPs)?

In this section we propose a set of Regen Ag Best Management Practices (BMPs) which provides a list of recommended practices for farmers, ranchers, land-owners, property and land managers to implement in order to achieve the Desired Outcomes outlined in Section 1.f. We hope to provide a framework for communicating these practices to interested stakeholders by creating a systematic pattern for describing each BMP and how to implement it.

While these BMPs are drawn from global Regen Ag practices, they will need to be customized to the Environmental, Socio-Cultural, and Economic context of Santa Barbara County and Mediterranean Climate Regions in general, and each practitioner's specific context. The intention of providing these BMPs is to facilitate the adoption of Regen Ag by making it straightforward and practical.

Nexus between Ecosystem Restoration and Agriculture

Currently ecosystem restoration and conventional agriculture don't mix. Environmentalists are often pitted against agriculturalists with seemingly divergent goals. Regenerative agriculture presents an opportunity to enhance ecosystem services with restoration benefits while producing agricultural products profitably, so therefore presents a nexus between agriculture and ecosystem restoration where there is a common desired outcome to improving ecosystem services.

Caveat

These BMPs are by no means comprehensive, since the Regen Ag movement is still in the Innovator and Early Adopter stages. New innovations will continue to be developed, trialed, and refined or discarded. All specifics noted in practices are open to interpretation and adaptation.

Defining Best Management Practices can at best be informative and innovative, and at worst be limiting and constrictive. The act of defining practices can tend to be prescriptive, and stifle innovation. However, the industry standard is to define BMPs, so we propose BMPs that are relevant to the context of Santa Barbara County.

It must be acknowledged that in many contexts the transition from conventional agriculture (what we would call degenerative ag) to a regenerative system may require a huge shift in management and design, and often these shifts are too drastic for farmers to adopt completely at the outset. For this reason we advocate "baby steps" in transition to allow both the management team and the operation itself to adjust and adapt to the new methods.

Gabe Brown, revered practitioner of Regen Ag practices said this: "There is no fixed production model in regenerative agriculture, specifics will vary from farm to farm and throughout time and place,' he said. 'The common element in agriculture all over the world is soil."[84]

[84]https://www.lancasterfarming.com/news/northern_edition/principles-of-nature-key-to-farm-profitability/article_66b8a961-e238-58bb-9537-8487b78f17f0.html

Rodale Institute has created the Rodale Regenerative Organic Certification Standards which can be considered BMPs and are far more detailed than the scope of this document allows. We recommend that those interested in pursuing Regenerative Organic Certification become familiar with these standards. We have been part of this conversation and have contributed directly and indirectly to the development of these standards, and continue to do so. The full certification document can be found on Rodale's website: https://regenorganic.org/

4.b. Regen Ag Best Management Practices (BMPs)

The Best Management Practices are methods, techniques, and tools that are utilized to achieve the Desired Outcomes of Regenerative Agricultural Systems. Best Management Processes are used to select the appropriate BMPs for each situation. The practices are not prescriptive, and as such serve only as a guide.

The overarching goals are the Desired Outcomes, and the practices used to achieve the desired outcomes are specific to the context of the project. It is the synergistic effect of correctly chosen practices combined with natural forces that leads to effective ecosystem processes and dynamics, which translates into a healthy and profitable farm that contributes to the greater ecosystem services.

The transition to Regen Ag is embodied by a paradigm shift from one of:

Cost effective production of food and fiber by capturing/monetizing "free" ecosystem services

To one of :

Cost effective production of food and fiber as a by-product of sustaining and enhancing ecosystem functions

Practitioners are encouraged to use the concept of mimicking nature to help innovate practices that create effective ecosystems processes while providing an economically profitable return on time and money invested.

In order to evaluate if a BMP is appropriate for a given operation we encourage monitoring using metrics linked to desired outcomes. If Regen Ag practices are not trending towards Desired Outcomes according to appropriate metrics, then management and/or practices need to be adapted incrementally based on this feedback. This combination of management practice, monitoring metrics, and adjusting management to achieve desired outcomes stems from the field of Adaptive Management.

We have organized the RegenAg BMPs into the 3 main Themes, following from the nested hierarchy of desired outcomes:

1. Environmental
2. Socio-Cultural / Regulatory
3. Economic

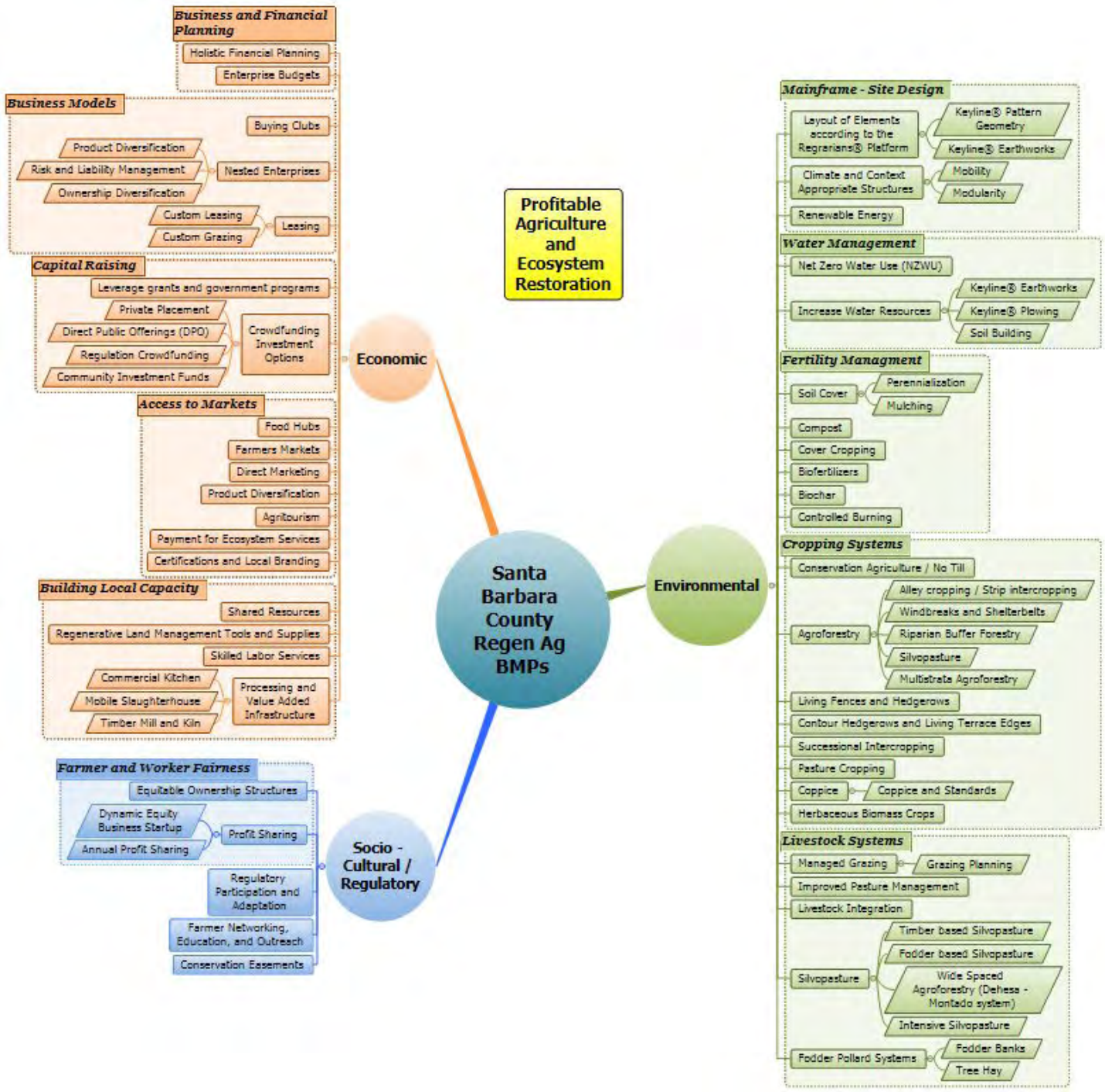


Figure 26. Santa Barbara County Regen Ag Best Management Practices

Environmental Regen Ag BMPs

Systematically increasing soil health is an important facet of regenerative agriculture. Building healthy soil improves crop yields and resistance to pests, decreases the need for external inputs such as fertilizers and pesticides, improves the water holding capacity by adding organic matter to the soil, and dramatically increases carbon sequestration as a byproduct of the above functions.

Most of the following Environmental Regen Ag BMPs are compiled from *Project Drawdown* and *The Carbon Farming Solution*. These publications have identified and evaluated the effectiveness of these practices to sequester atmospheric carbon by building healthy, organic soils.

There is significant overlap between the two publications which represents some worldwide alignment of practices. As you can see Figures 22-24, both include Conservation Agriculture, Multistrata agroforestry, silvopasture, tree intercropping/alley cropping, and more.

In general it should be noted that there are certain practices that we propose should be prohibited or severely restricted in Regen Ag BMPs. It is the opinion of the authors that the use of inorganic synthesized chemicals and biocides are by definition degenerative. We also firmly suggest the elimination or drastic reduction of the use of plastic mulches, and other single use plastic products like drip tape and unnecessary packaging of products.

Any transition to Regen Ag reduces and ideally phases out use of any inorganic synthesized chemicals and biocides. Naturally derived and organic biocides are allowable under certain circumstances such as preventing total crop loss. The following BMPs all assume this general rule and support this through the practice.

Environmental BMP Quick Reference Guide

For easy reference we provide Environmental Regen Ag BMPs in a list and graphic format.

1. Mainframe - Site design
    a. Layout of elements according to the Regrarians® Platform
        i. Keyline® Earthworks
        ii. Keyline® Pattern Geometry
    b. Climate and context appropriate structures
        i. Mobility
        ii. Modularity
    c. Renewable Energy
2. Water Management
    a. Net Zero Water Use (NZWU)
    b. Increase Water resources
        i. Keyline® Earthworks
        ii. Keyline® Plowing
        iii. Soil Building
3. Fertility Management
    a. Soil Cover
        i. Perennialization
        ii. Mulching
    b. Compost
    c. Cover Cropping
    d. Biofertilizers
    e. Biochar
    f. Controlled burning
4. Cropping Systems
    a. Conservation Agriculture/No-Till
    b. Agroforestry
        i. Alley Cropping/Strip Intercropping
        ii. Windbreaks and Shelterbelts
        iii. Riparian Buffer Forestry
        iv. Silvopasture

        v. Multistrata Agroforestry
    c. Living Fences and Hedgerows
    d. Contour Hedgerows and Living Terrace Edges
    e. Successional Intercropping
    f. Pasture Cropping
    g. Coppice
        i. Coppice and Standards
    h. Herbaceous Biomass Crops
5. Livestock Systems
    a. Managed Grazing
        i. Grazing planning
    b. Improved pasture management
    c. Livestock Integration
    d. Silvopasture
        i. Timber Based Silvopasture
        ii. Fodder Based Silvopasture
        iii. Wide Spaced Agroforestry (Dehesa - Montado system)
        iv. Intensive Silvopasture
    e. Fodder Pollard Systems
        i. Fodder Banks
        ii. Tree Hay

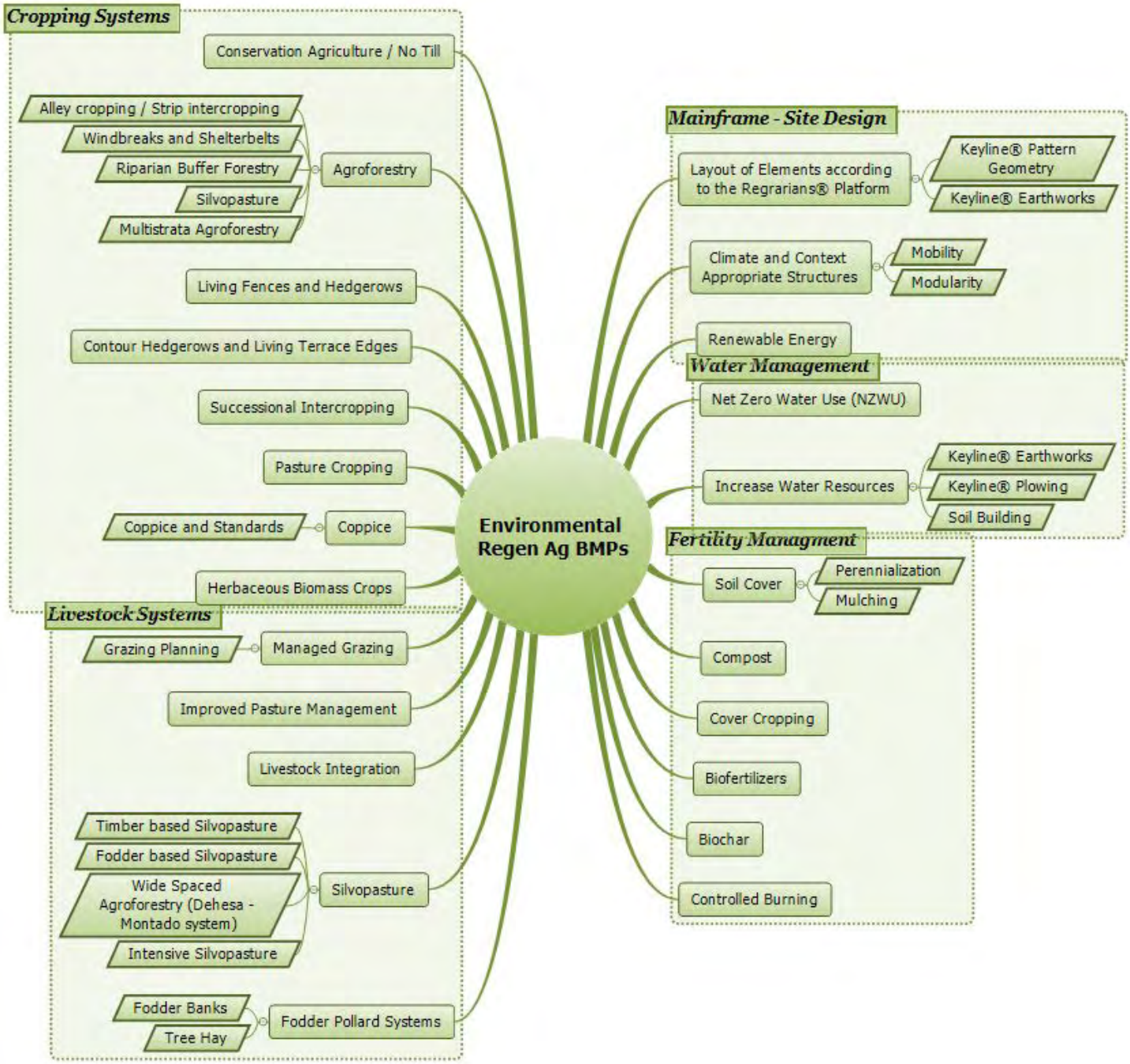


Figure 27. Concept map of Environmental Regen Ag BMPs

Descriptions of Environmental Regen Ag BMPs

1. Mainframe - Site design

The mainframe can be considered the skeleton of the site that provides a backbone for water management and access while integrating structures with tree, fence, crop, livestock, and energy systems. It is critical to carefully design a site with respect to the local climate, geographic, and decision maker settings. We recommend using the Regrarians® Platform to organize and prioritize the sequence of design. In particular, harmonizing the location and shape of access roads to manage stormwater runoff beneficially is critical.

Another aspect of Mainframe Site design is conducting a full site analysis, which includes climate factors such as temperature and precipitation patterns as well as dominant ecological communities and plant families of the region.

1.a Layout of elements according to the Regrarians® Platform

This pattern provides a comprehensive, integrated layout of site elements which includes water storage and management, water harvesting roads, equidistant spacing between tree rows fences, and other infrastructure. This allows near complete space filling on a water retentive pattern and maintains efficiencies of modularity to machine width and other management tools.

An integrated layout developed using Keyline® Design and the Regrarians® Platform is shown in figure x.x. This design includes water harvesting roads, water storage ponds, Keyline® pattern geometry based alley cropping silvopasture, wide spaced agroforestry, riparian buffer forestry, and more.

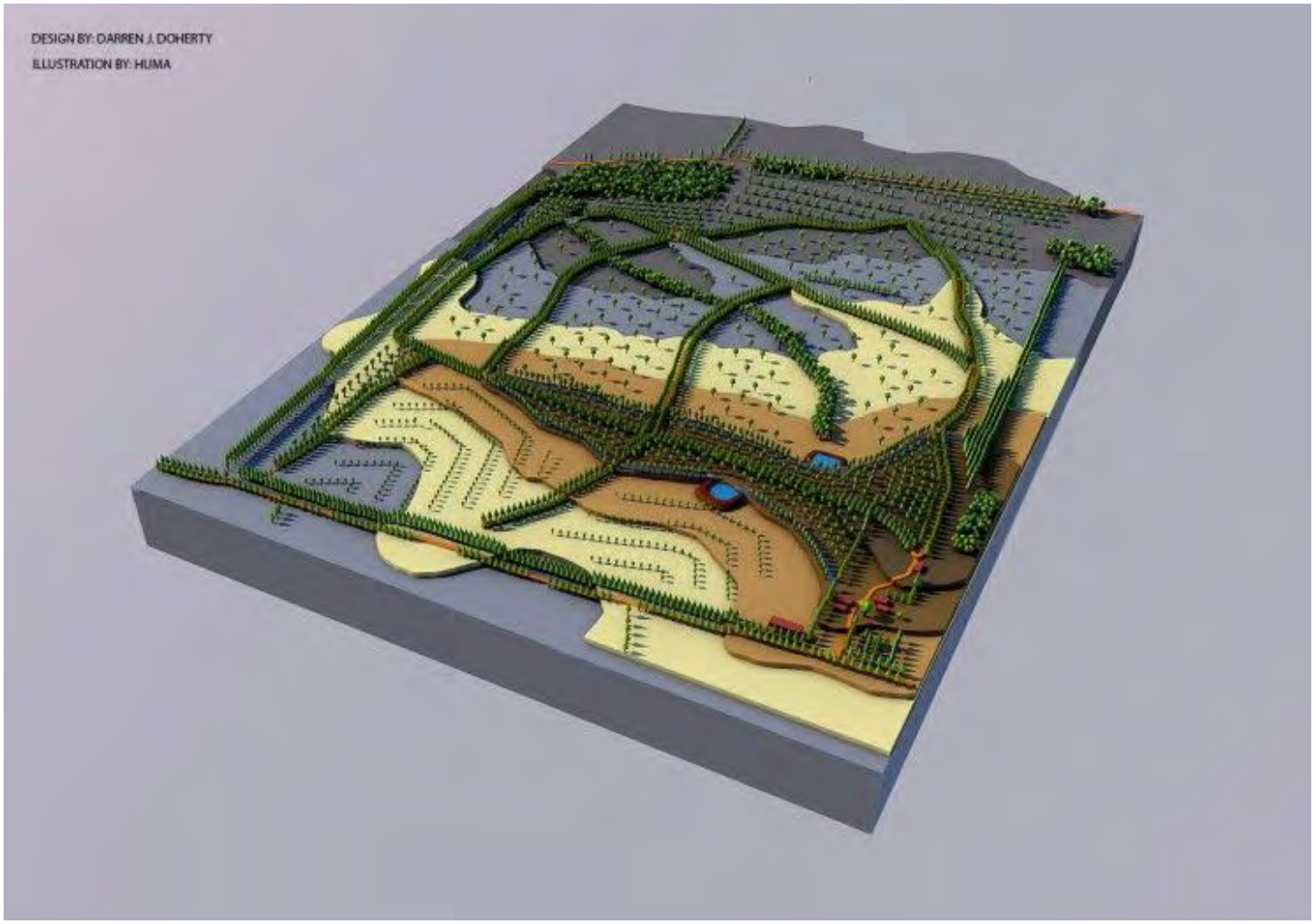


Figure 28. Integrated Mainframe design developed by Darren J. Doherty and Georgi Pavlov using Keyline® Design and the Regrarians Platform.[85]

Resilient Farms for Coastal BC: A Resource Guide[86] by Tayler Krawczyk in British Columbia, Canada is a thorough Regen Ag resource guide organized using the Regrarians® Platform. Many of the references he sites apply to the Santa Barbara County Bioregion, particularly the 4. Access layer resources[87].

[85] http://www.regrarians.org/services/farm-planning/

[86] https://hatchetnseed.ca/resilient-farms-for-bc-a-resource-guide-part-1-of-2/
https://hatchetnseed.ca/resilient-farms-for-bc-a-resource-guide-part-2-of-2/

[87] https://hatchetnseed.ca/resilient-farms-for-bc-a-resource-guide-part-2-of-2/#farm-roads

1.a.i Keyline® Pattern Geometry

The layout and design process for Keyline® Pattern Geometry to create equidistant spacing of elements is covered in Geometry (Chapter 2) of the Regrarians Handbook and a comparison to other layouts is shown in Figure 29.[88]

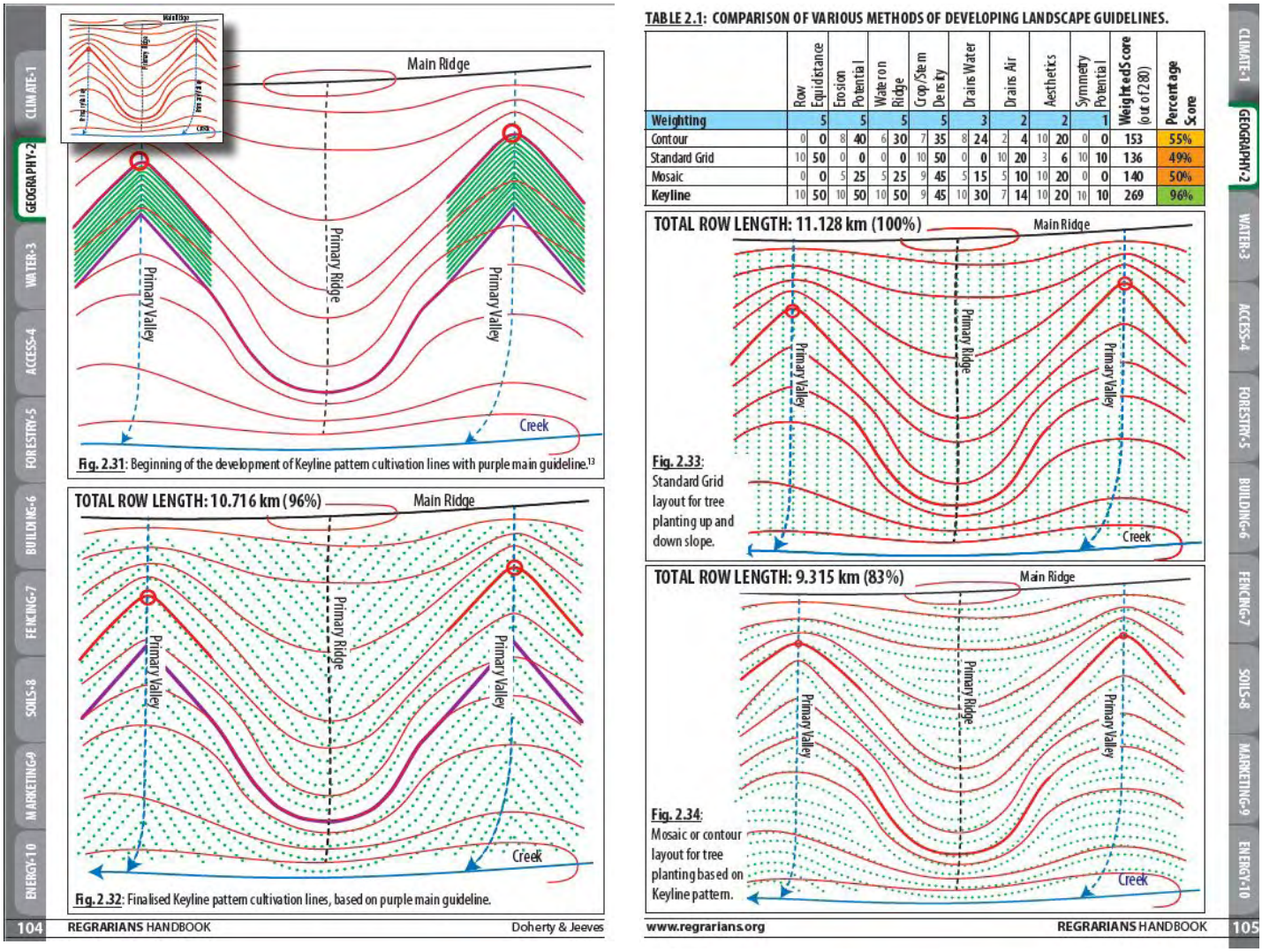


Figure 29. Comparison between various layouts for developing landscapes

1.a.ii Keyline® Earthworks

Keyline® Earthworks sculpt the land in order to eliminate erosion and build soil while restoring the water cycle. A focus is on storing stormwater runoff in catchment ponds for later use as irrigation water. Water conservation channels, water harvesting gradient roads, and ridgeline roads are common Keyline® Design features.

The layout and design process for Keyline® Earthworks is covered extensively in the Regrarians Handbook[89].

[88] http://www.regrarians.org/regrarian-handbook/

[89] Doherty, DJ, Jeeves, AJ, Pavlov, G, Regrarians Handbook, Regrarians Media, Bendigo, Australia, 2015

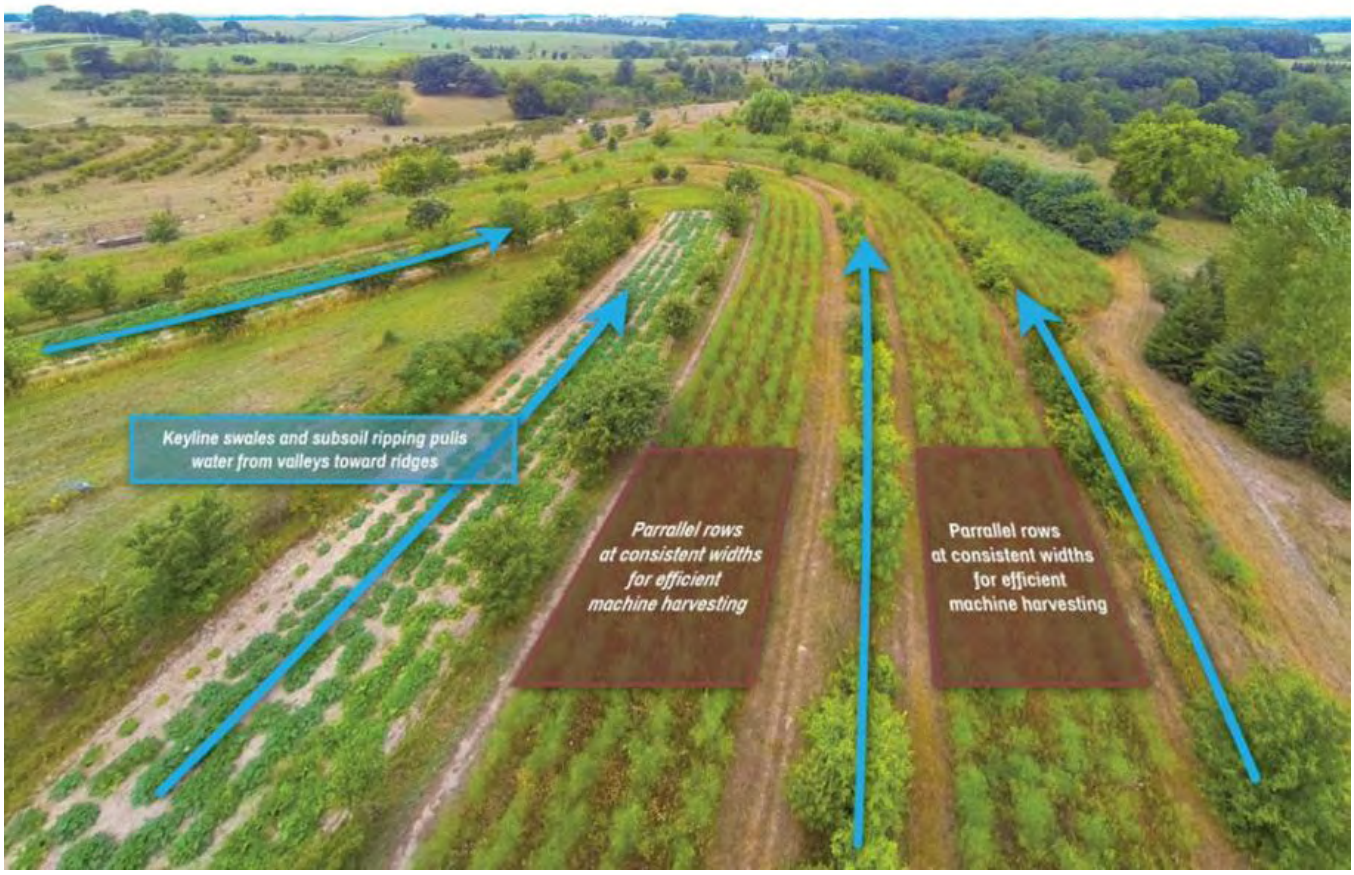


Figure 30. Keyline® Pattern Geometry based alley cropping. [90]

Figure 31. Keyline® Pattern Geometry applied in an agroforesty system in Mexico.[91]

[90] https://www.ecologyartisans.com/

[91] http://www.ridgedalepermaculture.com/agroforestry.html

1.b Climate and Context Appropriate Infrastructure

Ideally all structures are built out of renewable or recyclable materials. Where possible structures built from onsite materials are preferred. Additionally structures should be as durable and efficient as possible. Appropriate design of structures will match climate factors and leverage passive energy opportunities.

1.b.i Mobility

Ecology is inherently variable and often patterned in mosaics. Design for mobility allows modularity to be managed adaptively by increasing the control that a land manager has over operational variables. Mobile infrastructure is particularly relevant to livestock operations because it facilitates the capacity to manage frequency, duration, timing, and intensity of animals on a site. Both the stock density, grazing period, trampling and manuring rate, and rest and recovery period can be managed at a high scale resolution on a landscape when mobile water, fencing, minerals and other infrastructure are mobile.

Figure 32. Mobile Dairy, pastured layers, and shade structures [92]

[92] https://www.facebook.com/TaranakiFarm
http://milkingonthemoove.blogspot.com/2012/10/the-mobile-milking-system.html
http://www.milkwood.net/2014/12/03/joel-salatin-effect-australia/

1.b.ii Modularity

Modular design allows for both efficiency in management and labor as well as scalability with known, flexible production units. examples of modular design include:

1. Alley cropping where alley width is equal to a multiple of machine width, chicken tractor width, and/or electric fencing length.
2. Permanent Biointensive raised beds which are all the same size to facilitate easy rotation, crop planning,sales estimates, and water management.
3. Mechanical harvesting of perennial crops

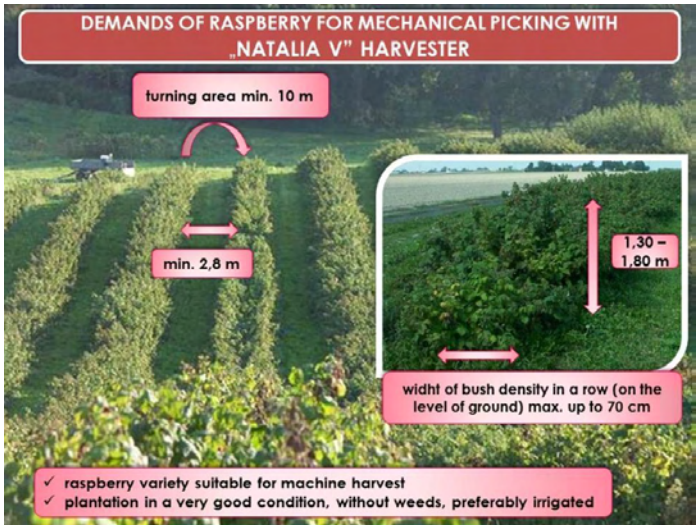


Figure 33. Examples of modular design in Regen Ag: (clockwise from top left) Salatin style pastured poultry, Curtis Stone's modular biointensive annual beds, mechanical harvesting and spacing for equipment. [93]

1.c Renewable Energy

Onsite energy production is recommended when practical. Primarily this includes solar, wind, and biomass energy. Ideally energy production is developed incrementally along with buildings and other onsite energy using infrastructure. Additionally, opportunities to generate surplus power onsite and sell it to urban users may provide new markets for Regen Ag producers.

[93] https://www.facebook.com/groups/Regrarians/photos/
http://www.groaction.com/discover/3745/urban-farming-course/
http://aroniaharvest.com/berry_harvesting.html?module=product_info_page&id=12&cat_id=10

2. Water Management

The basic goal of water management is to bring water use into balance with supply. This can be approached from both sides, decreased use and increased supply.

2.a Net Zero Water Use (NZWU)

We propose that the *ideal state* and most responsible action for agriculture in Santa Barbara and Mediterranean Climate Regions in general is Net Zero Water Use (NZWU)- to use less water than is captured on site, and have a positive water budget. There are two ways to reach NZWU- increase the overall water resources on site, and select crops that are adapted to our climate which don't require much supplemental irrigation. In certain contexts it may make sense to have intensified irrigated systems, but ideally water use will remain within NZWU.

2.b Increase Water Resources

There are several ways to increase the overall water resources on site including improved water harvesting and storage, increasing effective precipitation, and building soil.

2.b.i Keyline® Earthworks

As noted above Keyline® Earthworks harvest rainwater and decrease or eliminate stormwater runoff. Roads are a critical site features that need thoughtful design to harvest stormwater and manage runoff to reduce erosion

2.b.ii Keyline® Plowing

Keyline® Plowing is deep ripping with specialized shanks following a geometrical pattern that is designed to spread rainwater runoff evenly throughout the landscape. Plowing on the geometry increases effective precipitation and infiltration by opening up the soil and spreading out runoff. The deep ripping builds soil and allows water to infiltrate, recharging aquifers.

2.b.iii Soil Building

Improving soil quality has dramatic effects on the effectiveness of the water cycle. Fertility management strategies listed below (in addition to the Keyline® Plowing described above) build soil and improve soil water holding capacity and therefore increase the volume of water soil can hold while increased soil cover slows runoff and increases infiltration, which reduces overall water use and recharges aquifers.

3. Fertility Management

Fertility management is the practice of integrating elements into an agricultural system that replenish and improve soil fertility through passive and active methods such as composting, cover cropping, and the use of biofertilizers. Improved soils have increased Organic matter content, improved nutrient holding capacity (i.e. CEC), improved structure and tilth, improved infiltration rates, and other metrics listed in the NRCS Soil Fertility Kit.

3.a Soil Cover

the ideal operation has 100% soil cover 100% of the time. While this target is achievable in many climates, arid climates and climates with hot dry summers may be limited in cover, particularly in non-irrigated systems. Since sheet erosion is dramatically reduced at 40-60% soil cover[94], this milestone should be an initial target for all operations. Soil cover can be litter, mulch, compost, living plants, rocks, even row covers and plastic.

[94] http://soilquality.org.au/factsheets/benefits-of-retaining-stubble-in-qld
Freebairn, D. 2004. 'Some observations on the role of soil conservation structures and conservation', *Journal of the Australian Association of Natural Resource Management* **7**(1): 8-13.

3.a.i Perennial Plants

Stable natural ecosystems tend towards perennial plants as the predominant, characteristic species. Perennial agricultural systems generally require less soil disturbance, maintain higher soil cover, provide improved wildlife habitat, reduce erosion, are more resilient to droughts and floods, and sequester more carbon into long term storages such as woody biomass. Regional food system improvement included developing tree crops (such as walnut, mulberry, persimmon, pecan, chestnut, and more) that, when combined, provide a balanced diet of carbohydrates, oils, and proteins.

3.a.ii Mulching

Mulch includes any non-living cover for the soil surface, such as straw, wood chips, compost, plastic and more. Mulch protects the soil surface from water and wind erosion, evaporation, and provides food for soil biology. Mulch consisting of organic materials is preferable because it provides food for soil biology.

3.b Compost

Composting is the practice of converting crop residues and other organic matter into humus through assisted and enhanced biological decomposition. The resulting material is used as an input to fields to increase soil organic matter, soil tilth and fertility, and water holding capacity.

3.c Cover Cropping

Cover Cropping is the practice of integrating non-cash crops into the sequence and rotation with cash crops on a given area of land with the goal of increasing soil organic matter and therefore improving tilth and water holding capacity. Cover cropping is practiced in most or all climate zones though the crop species and management varies between individual climates and operations

"The purpose of cover cropping is primarily to manage soil erosion, soil fertility, soil quality, water, weeds, pests, diseases, biodiversity and wildlife in an agroecosystem (Lu et al. 2000)[95]" Each cover crop species used should match an identified resource concern for the farm or plot where planting is planned."

3.d Biofertilizers

Biofertilizers are derived from biologically processed and enhanced raw materials that become concentrated sources of essential plant mineral nutrients like nitrogen, potassium, and phosphorous.

3.e Biochar

Biochar is created through pyrolysis of woody material to create a charcoal that is carbon rich, resists decomposition, and provides a concentrated microbial habitat and has high nutrient and water holding capacity. It is mixed with soils to increase both water holding capacity and nutrient holding capacity while increasing beneficial soil biology. Often it is 'primed' with microbial inoculation prior to application. Biochar, especially when applied at large quantities, may affect soil pH significantly.

The modern practice of biochar is based on the findings of Tierra Prieta soils in the South American tropics where charcoal, manure and bone were mixed with infertile Amazonian soils to retain fertility. High carbon soils are still present hundreds of years after indigenous communities stopped agricultural practices[96].

3.f Controlled Burning

One of the most powerful tools in the toolkit of a land manager is fire. Fire, or more specifically controlled burning, can be used to regenerate landscapes and habitats that would otherwise succumb to catastrophic

[95] Lu, Y. C.; Watkins, K. B.; Teasdale, J. R.; Abdul-Baki, A. A. (2000). "Cover crops in sustainable food production". Food Reviews International. 16: 121–157. doi:10.1081/fri-100100285

[96] https://en.wikipedia.org/wiki/Terra_preta

wildfires as a result of fuel loading. Managed grazing is another tool that mimics fire in that reduces fuel loading and converts organic matter that would otherwise become oxidized and released to the atmosphere in the form of CO_2 and other nutrients. Fire also is a pest management tool, for example the practice of annual burning under the canopy of oaks reduces the amount of oak worms in acorns.

4. Cropping Systems:

Cropping systems focus on vegetation communities designed to create plant based yields. They include both annual and perennial crop systems with a focus on increasing the percentage of perennial plants in the landscape. When an increase in perennial plants is not possible, they focus on keeping the soil covered with living plants or mulch year round and minimizing or eliminating tillage.

4.a Conservation Agriculture / No-Till

Conservation agriculture is a suite of practices including Cover cropping, reduced (No-till) tillage, and crop rotation that was initially developed in the 1970s in response to the soil erosion crisis.[97] It is widely practices and was rated by the IPCC as having a high global mitigation potential being easily adoptable by farmers and ready for implementation.[98] Many tools have been developed to facilitate this practice including air seeders, no-till drill seeders, roller crimpers and more.

Conservation / No-till Agriculture was developed to reduce and ultimately stop tillage as a farming practice to mitigate weeds and prepare soil for seeding. The result of this practice is that crop residues remain on the soil surface as litter which suppresses weeds, reduced evaporation, increases biological decay, and increases soil organic matter.

4.b Agroforestry

According to the USDA, "Agroforestry is the intentional integration of trees and shrubs into crop and animal farming systems to create environmental, economic, and social benefits. It has been practiced in the United States and around the world for centuries. For a management practice to be called agroforestry, it typically must satisfy the four "i"s: Intentional, Intensive, Integrated, and Interactive."[99] The USDA Agroforesty center defines 5 primary agroforestry practices[100] with additional special practices[101] lumped together. Several additional practices have been identified by Toensmeier and the Drawdown Project.

4.b.i Alley Cropping[102] / Strip Intercropping

Alley Cropping / Strip Intercropping is the practice of growing 'alleys' of herbaceous crops between rows of trees. These rows of trees can be cash crops themselves (strip intercropping) or coppiced nitrogen-fixing trees whose role is to support the herbaceous cash crops.

Alley Cropping / Strip Intercropping is practiced for a variety of reasons which include:

1. addition of tree crop products (such as timber, fruit, nuts, bee forage, firewood or fodder) to an annual crop system
2. provision of nitrogen to an herbaceous crop
3. providing microclimatic benefits such as shade and windbreak to an herbaceous crop
4. mitigation of soil erosion by interplanting perennial crops with annual crops (ideally in a contour based layout)

[97] Toensmeier, E. 2016. The Carbon Farming Solution

[98] IPCC, Climate Change 2014: Mitigation of Climate Change, 830-832.

[99] https://www.usda.gov/topics/forestry/agroforestry

[100] https://www.fs.usda.gov/nac/practices/index.shtml

[101] https://www.fs.usda.gov/nac/practices/specialapplications.shtml

[102] https://www.fs.usda.gov/nac/practices/alleycropping.shtml

Figure 34. Alley cropping examples[103]

4.b.ii Windbreaks[104] and Shelterbelts

The practice of planting and managing windbreaks and shelterbelts dates back to antiquity. Windbreaks / Shelterbelts are trees and/or shrubs planted in lines perpendicular to prevailing wind direction intended to shelter crops, people, livestock, and buildings from the adverse impacts of wind. Additionally, these plantings can produce crops, provide wildlife and predator habitat, and mitigate other environmental factors such as excessive heat, cold, hail storms, etc

Windbreaks /shelterbelts primary purpose is to mitigate the adverse effects of prevailing and storm winds by both defleting and diffusing them. Additional benefits of windbreaks can be dust mitigation, noise reduction, shade and shelter for livestock, people, and buildings, production of a crop, and erosion control.

[103] http://thefruitnut.com/home-scale-alley-cropping-trial/

[104] https://www.fs.usda.gov/nac/practices/windbreaks.shtml

Figure 35. Windbreak and shelterbelt examples (Monterey Cypress)[105]

4.b.iii Riparian Buffer Forestry[106]

Riparian Buffers are strips of woody and riparian vegetation planted along rivers and streams or other sensitive aquatic habitats. Originally they were developed to mitigate runoff of nutrients and sediment from annual cropping. Native riparian vegetation can be very effective at this and providing wildlife habitat, however takes away from crop production acreage. Integrated Agroforesty uses crop production species as part of riparian buffers including timber, biomass, fruit and nut, mast/fodder, and specialty forest products. Riparian buffer forests are estimated to sequester 1-8 tons of CO2/ha/yr[107]

[105] http://creating-a-new-earth.blogspot.com/p/important-hardscaping-terms-definitions.html
http://forestandrange.org/modules/windbreak/index.htm Photo courtesy of Rich Straight, National Agroforestry Center
http://www.teara.govt.nz/en/photograph/15594/trimmed-macrocarpa-hedge

[106] https://www.fs.usda.gov/nac/practices/riparianforestbuffers.shtml

[107] Nair, PK. Climate Change Mitigation p. 53

Figure 36. Riparian Buffer Forestry examples[108]

4.b.iv Silvopasture[109] (see livestock systems)
Silvopasture combines growing trees for a crop product with managing herbaceous pasture in the understory for livestock forage.

4.b.v Multistrata Agroforestry
Multistrata Agroforestry is referred to as 'Forest Farming (multi-storey cropping)'[110] by the USDA. Multistrata Agroforests are multilayered agricultural systems that incorporate trees with woody perennials, herbaceous perennials, annual crops, and/or livestock. These range from simple with 2-3 layers and species to very complex with many layers and multiple species per layer. In general, the larger the acreage managed, the fewer layers and species used.

Multistrata Agroforesty is an ancient practice used in many tropical regions for homegardens and more recently in commodity crops like Cacao and Coffee. P.K. Nair estimates that about 247 million acres of multistrata agroforestry exist[111].

[108] http://www.mda.state.mn.us/protecting/conservation/practices/bufferforested.aspx Photos courtesy USDA NRCS
[109] https://www.fs.usda.gov/nac/practices/silvopasture.shtml
[110] https://www.fs.usda.gov/nac/practices/forestfarming.shtml
[111] Nair, PK. Climate Change Mitigation p. 47

A Santa Barbara county example of this is Jay Ruske's artisanal Coffee grown in the understory of Avocado orchards.[112]

4.c Living Fences and Hedgerows

Living Fences and Hedgerows are rows of perennial plants, often trees, which create a fence-like partition in the landscape. Their form can range from densely planted succulents or thorny shrubs to rows of herbaceous plants between annual cropland to pole planted trees in a row with high tensile or barbed wire strung between them. Some regions of the world have extensive living fence and hedgerow networks called *bocage* [113]in the landscape.

Throughout history hedgerows and living fences have been used worldwide to produce crops and provide benefits while delineating the boundaries of farms, properties, and fields. Benefits beyond crops include shelter from wind and dust, wildlife habitat, erosion control, soil fertility, and potentially cheaper cost of fence construction.

4.d Contour Hedgerows and Living Terrace Edges

Similar to Living Fences and Hedrows just with the plantings oriented according to the contour of the topography of a site.

SALT (Sloping Agricultural Land Technology) is also known as Contour based Hedgerow Intercropping (CHIAT) developed in the tropics which deserves research and development in subtropical and Mediterranean Regen Ag systems.[114]

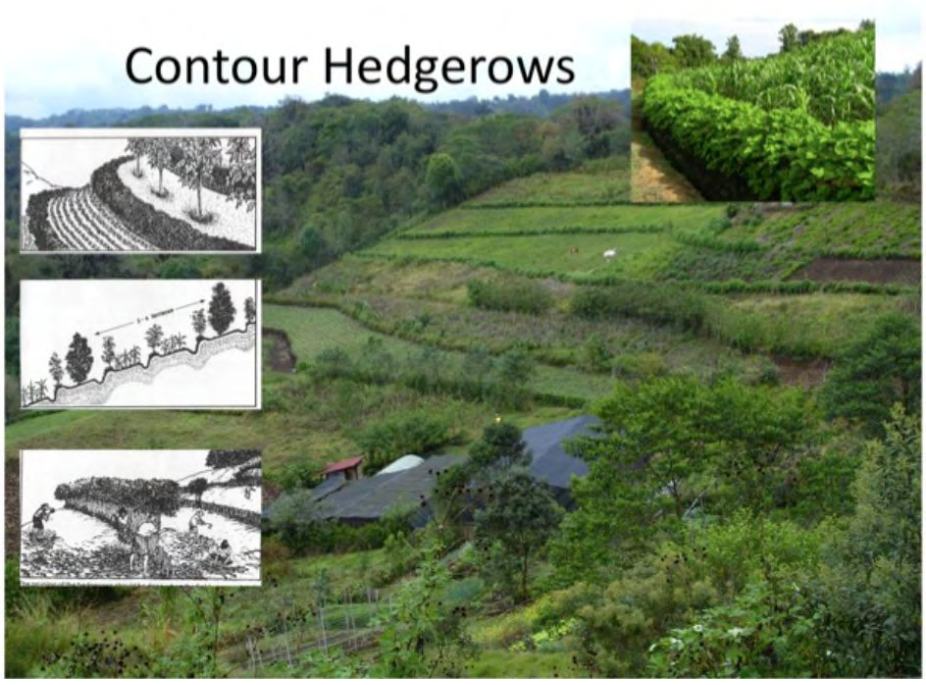


Figure 37. Contour Hedgerows

[112] https://www.frinjcoffee.com/

[113] Baudry, Bunce, and Burel, Hedgerows, 8-9.
http://www.academia.edu/7476589/Hedgerows_An_international_perspective_on_their_origin_function_and_management

[114]https://c.ymcdn.com/sites/echocommunity.site-ym.com/resource/collection/27A14B94-EFE8-4D8A-BB83-36A61F414E3B/TN_72_Sloping_Agricultural_Land_Technology--SALT.pdf http://www.icimod.org/?q=1650

4.e Successional Intercropping
The primary purpose of successional intercropping is to provide an economic crop yield during the establishment of long term perennial crop systems. This practice leverages the solar and machine access available while trees are small to produce annual, short term perennial crop, and/or livestock yields in establishing orchards, farm forestry, or other long term perennial crop systems.

4.f Pasture Cropping
Pasture cropping integrates an annual crop yield into a perennial pasture system by combining a warm-season (C4) pasture with a cool season crop, or a cool season pasture (C3) with a warm season crop. Examples include winter wheat or rye with warm season pasture or amaranth or corn with cool season pasture. The pasture is either hayed or grazed down and drill seeded with the desired crop to facilitate the transition between seasons. In a mediterranean climate, thoughtful planning and trials need to inform the selection of crop, pasture type, and irrigation regime. Pasture cropping was developed and tested in Australia. Colin Seis has been profitably practicing it and promoting it since the 1990s[115].

4.g Coppice
Coppicing is the act of cutting a perennial plant or tree down to the ground but not killing it, either during active growth or during dormancy. The plant re-grows new shoots which are then allowed to reach a certain size for whatever use is desired- for animal fodder, firewood, crafts, or biomass fuels. Many hedgerows are designed to be coppiced, such as hazels. Coppicing can be integrated into many agroforestry systems including alley cropping, contour hedgerows, fodder banks, and multistrata agroforestry

4.g.i Coppice and Standards
Coppice and Standards is a proven farm forestry practice for timber production where species are selected for their coppice-ability, then coppiced at maturity for harvest. Stumps then regrow shoots from which the best one is selected and managed for the next cycle of timber harvest. This practice minimizes soil disturbance following harvest because no replanting is necessary. It also shortens the cycle time between harvests because after the first harvest all trees have a mature root system to provide water and nutrients for accelerated growth.

4.h Herbaceous Biomass Crops
These are fast growing crops grown for biomass typically for energy production. They can also be used as fodder for animals, as a cover crop to improve cropland, for composting, or biofertilizer production. Typical global carbon sequestration yields are 3-20 tons C/ha/yr[116]

5. Livestock Systems
All ecosystems on the planet include animals and both wildlife and domestic livestock provide human nutrition worldwide. Current chemical-industrial agriculture often treats livestock poorly in operations like CAFOs. In Regen Ag, Livestock can be a powerful tool to manage ecosystems toward health. At the same time they can live their lives moving across the landscape in the open air. This is well stated in Joel Salatin's approach of Individuality which says:

"INDIVIDUALITY: Plants and animals should be provided a habitat that allows them to express their physiological distinctiveness. Respecting and honoring the pigness of the pig is a foundation for societal health."[117]

Livestock systems show significant promise for Carbon Farming and can be used to bootstrap many long term perennial crop systems with more rapid financial return than tree crops.

[115] http://www.pasturecropping.com/
[116] Rutter, "Woody Agriculture"
[117] http://www.polyfacefarms.com/principles/

5.a Managed Grazing

Managed grazing includes many practices such as adjusting stocking rates, planning and controlling rest and rotation timing, managing intensity of animal impact, and a variety of adaptive grazing practices. Often it include the use of temporary electric fencing to control access to grazing areas, improvement in stockwater distribution and access, and use of tools such as minerals or feed to concentrate or spread out animals

5.a.i Grazing planning

Grazing planning is an critical aspect of managed grazing and can be used as an integrated tool for both crop and livestock management planning. Holistic planned grazing uses a grazing and control chart and 'Aide memoire' process to plan grazing for each year subdivided into the growing season and non-growing season.[118] This chart and process is used to plan the specific number and exact location of livestock for the year. It is then used to monitor and control grazing rotation based on the reality of weather and growing conditions over the year. It is informed by monitoring factors such as animal performance, plant productivity and growing rate, plant phenology, litter cover and trampling, and rest and recovery periods.

5.b Improved Pasture Management

This practice includes planting of deep rooted species of grasses and legumes, fertilization, managed burning, irrigation and fire management. Generally these are integrated with grazing.

5.c Livestock Integration

Livestock may be integrated into plant based production systems to perform a need for the system and also to provide yield(s). Two examples are pasture sanitation with egg layer chickens following cattle or other livestock, and running pigs under walnut trees after harvest to clean the orchard floor. Both practices perform a pest reduction service to the system which reduces or eliminates the need for pesticides, and also provide yields in the case of the examples of eggs and pork. Additionally manure supplies bioavailable fertility.

Toensmeier specifies examples of integrating livestock into crop production systems[119]

1. Feeding livestock crop residues and byproducts
2. Providing manure for crop and field fertility
3. adding pasture and perennial fodder crops to annual crop rotations
4. Grazing under tree crops
5. Consumption of household and commercial waste (especially poultry and pigs)
6. Land clearing, brush management, and weeding
7. Draft power, 'tillage', and compost turning
8. Pest Control: both direct consumption and cleanup of wastes and residues
9. Grazing of pasture cropping and perennial grain systems

Livestock integration can be challenging and drawbacks include crop damage, soil and field damage, and poisoning of livestock. Thoughtful design and management of integrated livestock carefully controls the intensity, duration, timing, and frequency of livestock presence in cropping areas.

[118] Butterfield, J, Bingham, S, and Savory, A. 2006. Holistic Management Handbook: Healthy Land, Healthy Profits

[119] Toensmeier, E. The Carbon Farming Solution. p. 91

Figure 38. Livestock integration[120]

The FAO and IPCC rate crop-livestock integration as having a high climate change mitigation potential and carbon impact.[121] Adding manure from grazing cattle to legume-grain rotations has been shown to double carbon sequestration.[122]

Gabe Brown has documented phenomenal soil carbon gains from Livestock integration combined with cover cropping.[123]

[120] http://www.oli-de-mallorca.com/cultivation-olive-grove-majorca.html, http://brownsranch.us/

[121] FAO, Climate-Smart Agriculture Sourcebook p. 222, IPCC, Climate Change 2014: Mitigation of Climate Change p.830-2

[122] Russelle, Entz, and Franzluebbers, "Reconsidering integrate crop-livestock systems in North America"

[123] https://asso-base.fr/IMG/pdf/Jay_Fuhrer.pdf

Will Harris at White Oak Pastures also manages multi-species Livestock integration.

Figure 39. Multi-species livestock integration at White Oak Pastures[124]

5.d Silvopasture

Silvopasture is the integration of trees into livestock pasture. The trees are usually planted as a secondary crop such as timber and animal fodder.

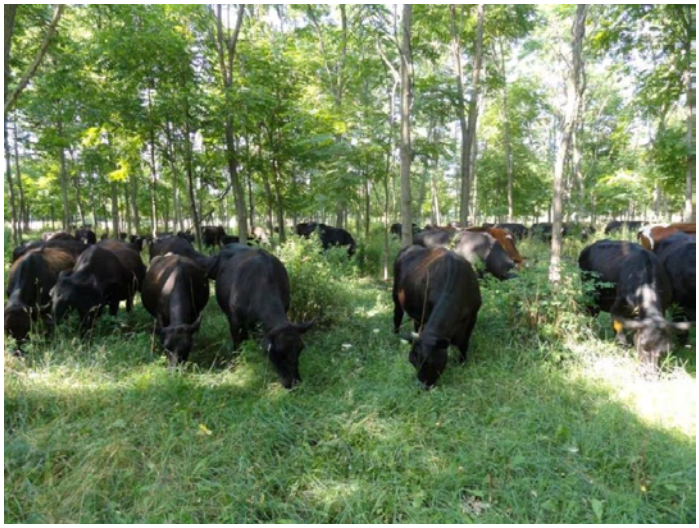


Figure 40. Silvopasture examples[125]

[124] https://www.whiteoakpastures.com/
[125] http://smallfarms.cornell.edu/2011/10/03/the-art-of-silvopasturing-a-regional-conference/
https://www.flickr.com/photos/baalands/2216308884/

5.d.i Timber Based Silvopasture
Timber trees are planted in pasture such as pine which are harvested for saw logs.

5.d.ii Fodder Based Silvopasture
Trees are planted in pasture that provide fodder in the form of fruits, nuts, and/or leaves to the livestock grazing in those systems.

5.d.iii Wide Spaced Agroforestry (Dehesa - Montado system[126])
Wide Spaced Agroforestry is based on historic land management systems of Dehesa and Montado as practiced in the Iberian Peninsula. These systems integrated Cow and Pig rotational grazing of perennial dryland pastures under a wide spaced savannah-like canopy of Oaks (*Quercus suber* and *Q. ilex*), Chestnuts (*Castanea sativa*), and other locally appropriate dryland mast and timber species. Tree density in wide spaced agroforesty is often 8-40 trees per acre.[127] This type of multistrata savannah agriculture provides a diversity of short and long term crop yields while maintaining high quality wildlife habitat in Mediterranean climates.[128]

Figure 41. Dehesa systems [129]

5.d.iv Intensive Silvopasture
Uses extremely high densities of woody nitrogen fixing legumes (3,000-4,000/ha), such as *Leucaena leucocephala,* which are grazed under planned rotation with electric fencing. More than 500,000 acres are currently managed this way. Carbon sequestration rates under this practice can be 8-26 tons/ha/yr[130]

5.e Fodder Pollard Systems
Pollarding is the act of cutting a perennial plant (usually a tree) back to the same spot season after season to manage growth and harvest for various uses, often for animal fodder. Fodder banks and tree hay systems often consist of deep rooted perennials which provide forage/fodder during seasons when pasture growth slows and stops. These practices can both sequester Carbon and increase livestock carrying capacity.

[126] https://en.wikipedia.org/wiki/Dehesa

[127] http://www.doctorrange.com/PDF/Dehesa.pdf

[128] http://www.aftaweb.org/latest-newsletter/temporate-agroforester/92-2005-vol-13/october-no-4/97-dehesa-agroforestry-systems.html

[129] http://www.alqueva-ibericos.com/dehesa_eng.html, http://www.hoyfregenal.es/fotografia/fotos-delgadoexposito/hoyfregenal/dehesa-cuesta-agosto.-721015.html

[130] Cuartas Cardona et al., "Contribution of intensive silvopastoral systems to animal performance and to adaptation and mitigation of climate change p.7-12

5.e.i Fodder Banks

Intensive plantings of fodder trees which serve as fodder reserves for when pasture is lean. Animals are often set out into the fodder bank to forage themselves. Marginal land which supports little pasture growth can be planted to appropriate hardy forage species. These plantings can also provide shelter for animals and can be "sacrifice paddocks".

5.e.ii Tree Hay

These are woody fodder plantings which are traditionally 'cut and carried' to livestock or stored in bundles for winter feeding . Innovation in fodder banking involved integration of mechanical harvesters and curvilinear 'cut and lay' systems along fenced edges of pasture or stockyards.

Synergistic Integration of Regen Ag BMPs

Regenerative Agriculture BMPs can often be integrated within the same site, either in space or in time, to produce a diversity of yields and ecosystem benefits. An example is shown in Box 5.x on Headlands from the Regrarians® Handbook and Regrarians® Workplace Headlands thread. It demonstrates opportunities for integrated agroforestry including shelterbelt, alley cropping, and silvopasture.

Figure 42. Concept plan for Orella Ranch demonstrating integrated agroforestry and Regen Ag BMPs.

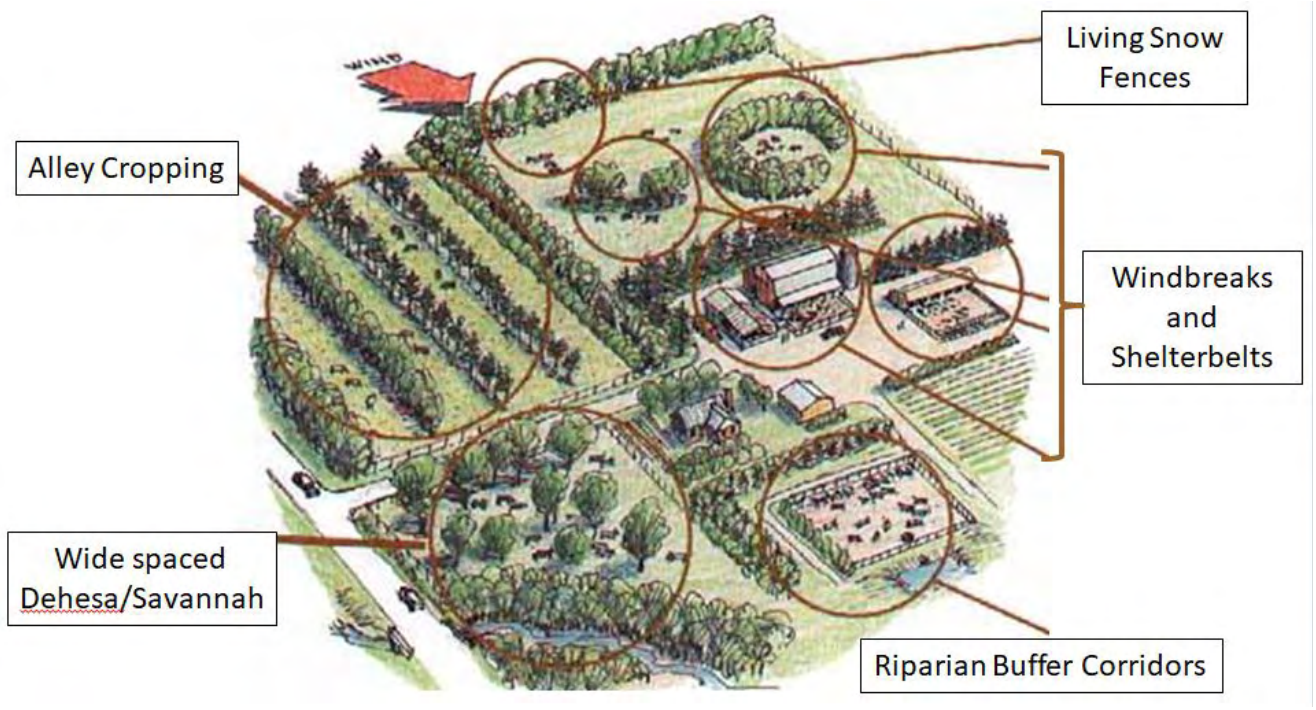


Figure 43. USDA National Agroforestry Center depiction of multiple agroforestry practices on one farm[131]

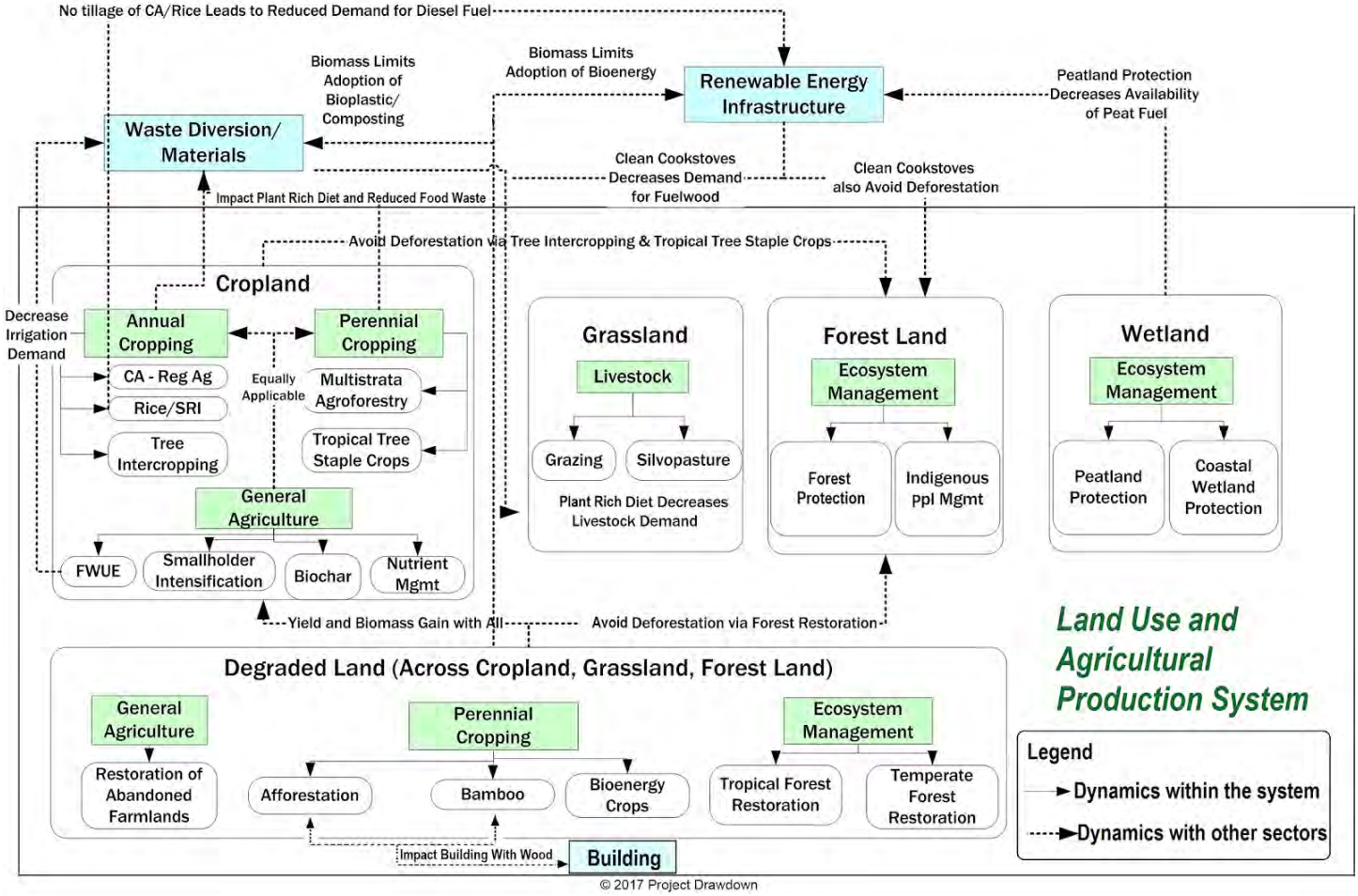
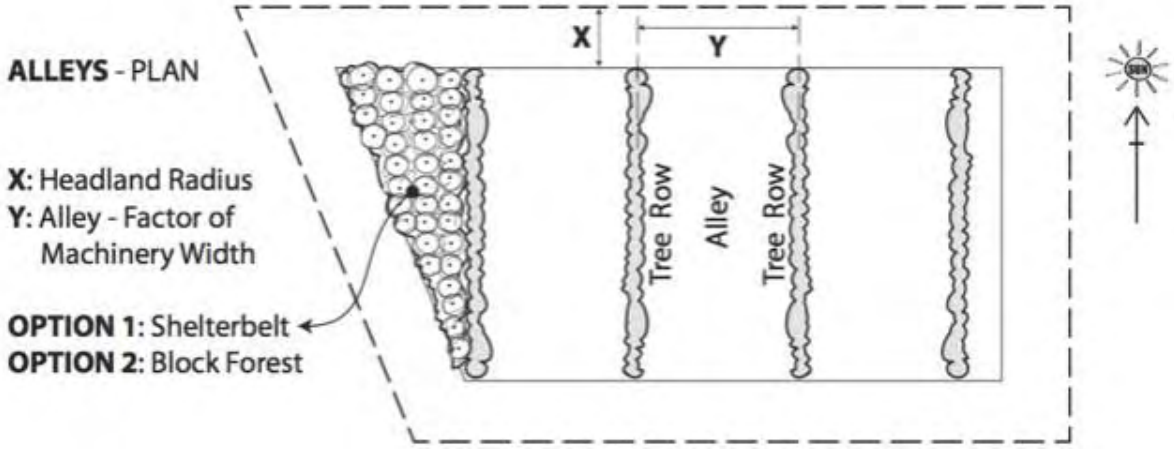


Figure 44. Project Drawdowns Framework for Land Use and Agriculture[132]

[131] http://forest.mtu.edu/pcforestry/resources/studentprojects/silvopasture.html Image courtesy USDA National Agroforestry Center

[132] https://www.drawdown.org/solutions/land-use

Box 1. Headlands and Integrated Agroforestry[133]



[134]

Headlands - How Big?

posted by Darren J. Doherty

Overnight we heard from a client who was suggesting that 75' (22.86m) headlands would be required for her new orchard/tree crop systems.

We typically have headlands of nearly 12-15m (39.37'-49.21'). In intensive (often completely mechanised) orchard systems in southern Europe 6-10m is very normal.

In any system having sufficient room for machinery access is really important, however we also believe it's important to get more of your high income producing species in the ground too.

Response from Georgi Pavlov:

On some orchards and vineyards I've worked on headland width varies within the same system. For example, the headland may be greater along the fence that is perpendicular to the rows and less along the fence that is parallel to the rows since no turning happens there. Also, if there are trellises or there is a possibility that dragged implements may slide downslope during a turn and impact on a fence or trellis then a the headland may be increased (usually with 0.5 m or so).

This adds a new dimension to headland design in which how you design your rows can make a very significant economic difference.

[133] Doherty, DJ, Jeeves, AJ, Pavlov, G, Regrarians Handbook, Regrarians Media, Bendigo, Australia, 2015

[134] https://www.facebook.com/groups/Regrarians/photos/ Design By Darren J. Doherty. Site in Southern Australia.

For this and other reasons headlands are one of the more difficult design components to the point that economic losses from poorly designed headlands can be so great as to justify the cost of utilizing farm robotics and deep geometrical analysis of proposed headland designs in order to find the most optimal scenario.

Usual widths are:
- 4-6 m for most orchards, vineyard and market gardens where mini tractors are used;
- 10-12 m standard offset around cadastral boundaries and other such limiting factors during concepting if a specific figure is not known at the time;
- 12-15 m in larger scale production systems where standard sized tractor are used;
Typically 2-4 times the width of the machinery, accounting for dragged implements. Consider also up to an additional 0.5 m in trellised systems or at steeper (>10 degrees on bumpy landscapes) sections.

Socio-Cultural and Regulatory Regen Ag BMPs

Socio-Cultural BMPs embody appropriate care for people's health and wellbeing. This includes practices at both the farm and regional scales. Many socio-cultural BMPs are practices that unite producers and consumers, build relationships and transparency, educate practitioners and purchasers, and improve the local regulatory setting for implementing Regen Ag. Additionally they include tools to facilitate improved decision making and planning that impact land use and implementation of Regen Ag.

Socio-Cultural BMP Quick Reference Guide

1. Farmer and Worker Fairness
    a. Equitable ownership structures
    b. Profit Sharing
        i. Dynamic equity business startup
        ii. Annual profit sharing
2. Regulatory participation and adaptation
3. Farmer Networking, Education, and Outreach
4. Conservation easements

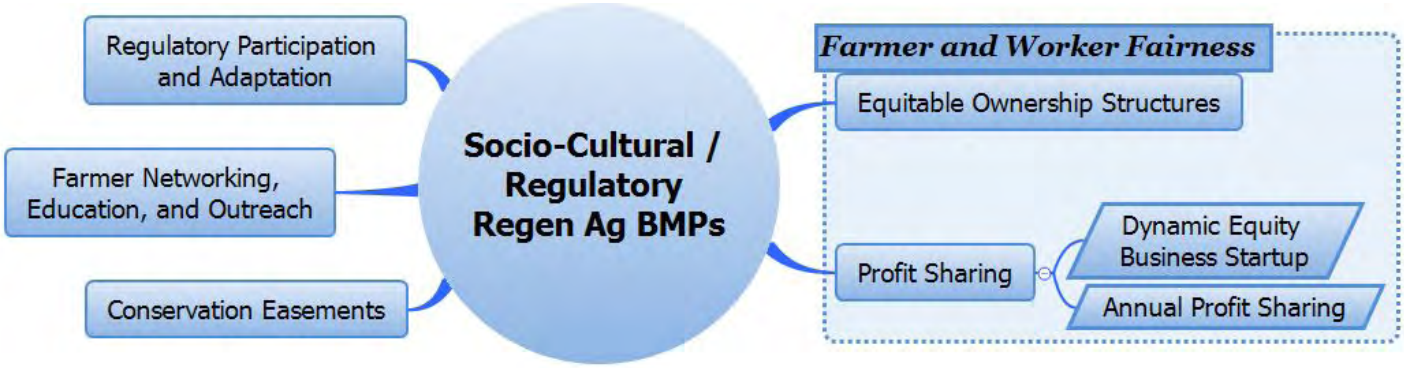


Figure 45. Concept map of Socio-Cultural / Regulatory Regen Ag BMPs

Descriptions of Socio-Cultural and Regulatory BMPs

1. Farmer and Worker Fairness

Rodale Institute Regenerative Organic Agriculture Certification goes into depth on the diversity of human welfare needs and criteria that support farmer and worker fairness.[135] These include Compliance with labor laws, child labor standards, worker rights, discrimination and harassment policies, fair wages and hours, and health and safety requirements.

1.a Equitable Ownership structures

Cooperatives and employee ownership[136] are examples of equitable ownership structures. This practice both democratizes and balances decision making and financial compensation for labor. Cooperatives generally give one vote to each member, regardless of role, when making any significant organizational decisions. Employee ownership allows similar decision making but may also distribute votes based on shares. Employee ownership is often used as a profit sharing mechanism.

1.b Profit Sharing

Profit sharing is both a Socio-Cultural BMP and an Economic BMP, though we placed it here as the main component is financial. It can take many forms from methods for equity splits based on startup contributions to weighting distribution of profits based on annual performance metrics.

Democratization of financial compensation may also take place pre-profit at the wage and salary level. Many companies are now implementing a maximum wage gap in their organization such as 3x, 5x, or 10x. (i.e. 3x means the highest paid person can make no more than 3 times the amount paid to the lowest paid person.)

Many business ownership structures allow for profit sharing. For example, both cooperatives employee ownership also facilitate profit sharing through mechanisms such as a one share per employee basis or Employee Stock Ownership Plan (ESOP) with a range of shareholder levels.

Resources:

1. https://community-wealth.org/
2. http://www.uwcc.wisc.edu/pdf/Cooperative%20Equity%20and%20Ownership.pdf
3. http://cdi.coop/profit-sharing-in-worker-coops/

1.b.i Dynamic Equity Business Startup

Dynamic equity is a method for creating a balanced equity split for both money and labor inputs into startup enterprises. It is a straightforward system of accounting for all monetary and labor inputs into a business prior to breakeven, and distributing equity at this point based on how much each individual contributed to develop the business prior to profitability.

This practice provides a fair and just profit share mechanism which improves buy-in and morale during the startup phase. It allows people who do not have capital to contribute to have their unpaid labor inputs valued and rewarded as investors in a company's development. Flexibility is built into the system with clear pathways for entry and exit as well as partial payments to meet people's financial needs during startup.

[135] https://rodaleinstitute.org/assets/ROC-Framework-Pilot-Ready-March-2018.pdf

[136] https://community-wealth.org/

Mike Moyers describes dynamic equity in his book *Slicing Pie Handbook: Perfect Equity Splits for Bootstrapped Startups*. He provides resources and tools for both the legal agreements and the accounting records that enable to process to work on his website, https://slicingpie.com/

1.b.ii Annual profit sharing

Businesses often distribute a share of annual profits to employees. Often these are performance based bonuses. Some example of this include 1. patronage (commonly called sweat equity), which is profit distributed based on the total number of hours worked during a year, and 2. job creation, which is similar to a sales commission but scaled and distributed based on profits.

2. Regulatory participation and adaptation

The current regulations on land use often contain significant hurdles to implementing Regen Ag practices and making farms profitable. While land use zoning is a valuable way to maintain some levels of quality of a region, they are often used to facilitate development or other degenerative land uses. We support zoning regulations that facilitate profitable operation of a diversity of agricultural enterprises that increase local ecosystem services.

This includes the development of regulations which allow for and incentivise:

1. Vertical integration of farm enterprises such as timber production, milling, drying, and furniture making
2. Agri-tourism enterprises such as AirBnB, glamping, and wellness services(visitor serving facilities)
3. Safe and affordable farmworker housing
4. Value added products
5. Processing beyond the raw state
6. Education opportunities
7. Payment for Ecosystem Services

Several examples are presented in Section 9. Transitioning to a Regenerative Agriculture

3. Farmer Networking, Education, and Outreach

Farmers are busy people who have a lot of practical knowledge and observations to share. Creating tools and situations that facilitate exchange of farmer knowledge in real time builds resilience and connectivity within a bioregion. While branding increases customer awareness and transparency, networking hubs such as a Grange or local coffee shop, allow farmers to communicate about opportunities and challenges to production in real time.

Education is a cornerstone of improving practices. Farmworker and farmer trainings and continuing education increases dissemination of information. A collective resource library organized by Regen Ag themes could provide a growing database of practices, case studies, enterprise budgets, and how to guidance on transitioning to Regen Ag. Tayler Krawczyk had compiled an impressive example of this for the British Columbia bioregion in Canada.[137]

One pattern to emphasize here is a spoke and hub type of relationship that allows a dispersed community to share information and coordinate efforts.

We hope that this document contributes to the body of knowledge available in Santa Barbara County and stimulates contributions to this resource base.

[137] https://hatchetnseed.ca/resilient-farms-for-bc-a-resource-guide-part-1-of-2/, https://hatchetnseed.ca/resilient-farms-for-bc-a-resource-guide-part-2-of-2/

4. Conservation easements

Conservation easements are a tool that allows a land owner to sell specific development rights to a piece of property in perpetuity and put restrictions on the deed based on this sale. This tool was developed to conserve open space and agricultural land use. They can provide significant access to capital to facilitate transitions to integrated Regen Ag practices

Economic Regen Ag BMPs

Reaching and maintaining profitability is critical to any agricultural operation. If a farm can't make a profit then it will not last long, and the desired outcomes will not be achieved.

Economic Regen Ag BMPs are tools intended to increase the ability of farmers to increase their profit margin in a variety of ways including:

1. Access Markets
2. Control Pricing
3. Access and Leverage Capital
4. Decrease Costs

Many of the recommended economic BMPs help small scale producers integrate into the larger agricultural framework. We are not economic or business specialists, and we recognize that there is a lot of work to be done in this sector of Regen Ag BMPs to facilitate the profitable transition of current producers to Regen Ag practices.

Economic BMP Quick Reference Guide

1. Business and financial planning
    a. Holistic financial planning
    b. Enterprise budgets
2. Business models
    a. Buying clubs
    b. Nested enterprises
        i. Product diversification
        ii. Risk and liability management
        iii. Ownership diversification
    c. Leasing
        i. Custom leasing
        ii. Custom grazing
3. Capital raising
    a. Leverage grants and government programs
    b. Crowdfunding Investment options
        i. Private placement
        ii. Direct Public Offerings (DPO)
        iii. Regulation crowdfunding
        iv. Community investment funds
4. Access to markets
    a. Food Hubs
    b. Farmers Markets
    c. Direct marketing
    d. Product diversification

e. Agritourism
f. Payment for ecosystem services
g. Certifications and local branding

5. Building local capacity
    a. Shared Resources
    b. Regenerative land management tools and supplies
    c. Skilled labor services
    d. Processing and value added infrastructure
        i. Commercial kitchen
        ii. Mobile slaughterhouse
        iii. Timber mill and kiln

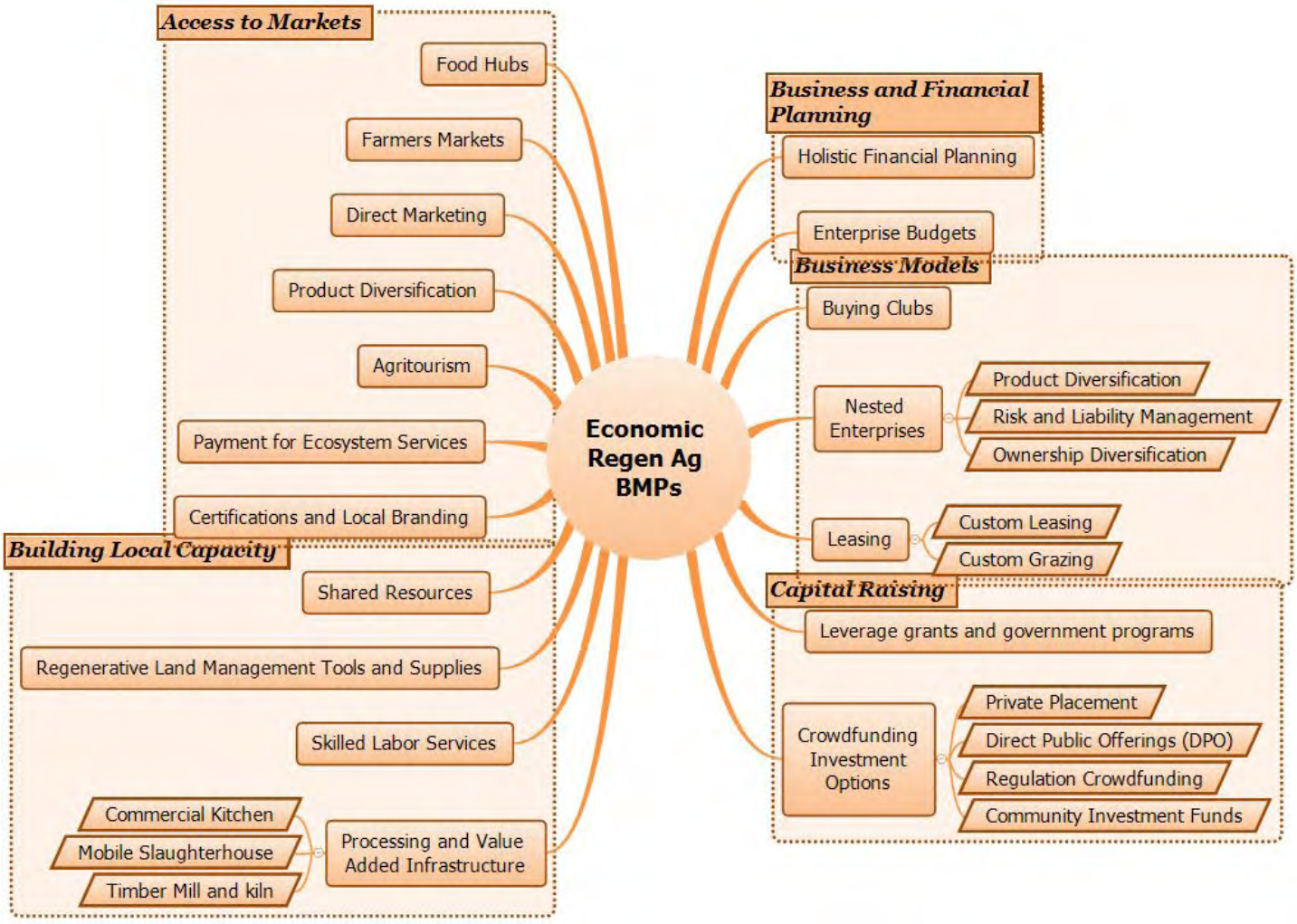


Figure 46. Concept map of Economic Regen Ag BMPs

Descriptions of Economic Regen Ag BMPs

1. Business and financial planning

These traditional business and financial planning processes are core Regen Ag BMPs because they allow operators to think through and vet a diversity of enterprises on both the operational and financial levels. This becomes even more critical when considering nested enterprises and understanding how each enterprise contributes to the economic bottom line and at what scale it needs to be implemented to become profitable. We

encourage Regen Ag practitioners to connect with local business planning and support organizations such as the Small Business Development Center and SCORE.

1.a Holistic Financial Planning

Holistic Financial planning is a 9 step process integrated into the Holistic Management approach

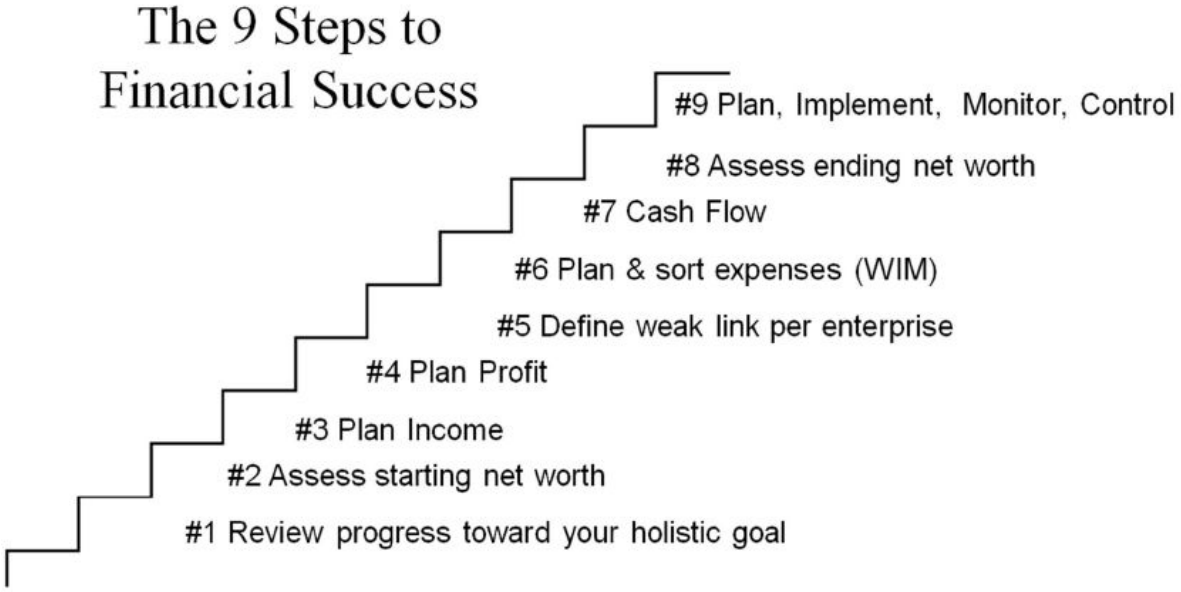


Figure 47. The 9 step process of Holistic financial planning

Holistic financial planning differs from conventional planning in a few ways. Primarily with regards to how profit is framed in the planning process. "Conventional planning often has you plan production and associated revenue, plan expenses, and then check to see if there is any profit left over. The means to achieving the profit may be socially or environmentally unsound. Holistic Financial Planning plans for profit first then tests the means of production for social, financial, and environmental soundness. This simple paradigm shift from production to a profitable triple bottom line helps move people from a "maintenance" mode to an "investment" or "strategic" mode that will move them toward their holistic goal."[138]

[138] Healthy Profits: Holistic Financial Planning. 2007. https://holisticmanagement.org/free-downloads/

Key Distinctions of Holistic Management® Financial Planning

- Harnessing human creativity, logic and rationality to maximize your triple bottom line.
- Gross Profit Analysis that does not include fixed costs
- Profit planning – placing a ceiling on expenses well below planned income
- Classification of expenses:
  "W": Wealth generating expenses that will generate new wealth, because they address the weak link, a logjam or factors adversely affecting the whole business
  "I": Inescapable expenses
  "M": Maintenance expenses (keep the business going but do not generate new wealth)
- All expenses, tools and actions are tested toward your holistic goal to ensure soundness.
- Ownership! Be creative in reaching the desired profit. Redo the plan until you do!
- Financial planning is not complete without the monitoring feedback loop which creates transparency, awareness, and responsiveness within the team.

Financial planning is not an accountant's job but that of the management team. If people are going to be held responsible for generating income or holding down expenses, they should be allowed to come up with the figures under their control.

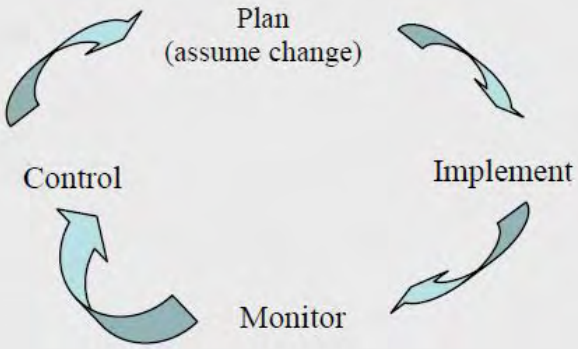


Figure 48. Key Distinctions of Holistic Financial Planning[139]

1.b Enterprise budgets

Enterprise budgets, also known as cost and return studies, are a useful tool for farmers to make "educated guesses" regarding potential profits of agricultural enterprises. Cost studies consist of profit and loss statements including capital expenses, operational costs, revenue streams, market prices, and capitalization costs. The University of California at Davis has performed many cost studies for various agricultural commodities and has them available for free online at https://coststudies.ucdavis.edu/en/.

Enterprise budgets can be powerful tools to connect nested enterprises by identifying where expenses in one operation can be decreased due to activities or resources produced by another operation such as decreases in feed or fertilizer cost.

[139] Healthy Profits: Holistic Financial Planning. 2007. https://holisticmanagement.org/free-downloads/

2. Business models

A business model is a key aspect of any Regen Ag enterprise. There are many types of business models and we do not attempt to cover all of them here. Our intention is to include business models which improve the options farmers have to implement other Regen Ag BMPs. We are not suggesting that all of these should be used together but rather that they can be considered as options depending on the weak links identified using Best Management Processes.

2.a Buying clubs

"A buyers club or buying club is a club organized to pool members' collective buying power, enabling them to make purchases at lower prices than are generally available, or to purchase goods that might be difficult to obtain independently."[140]

To facilitate Regen Ag, buying clubs are a tool which can be used

1. By groups of producers
    a. to purchase equipment that would otherwise be inaccessible to them
    b. to purchase supplies such as seed or feed in large enough quantities to get price breaks
2. By groups of consumers
    a. to pre-purchase farm fresh local products in aggregate or at a coordinated drop off spot similar to the Community Supported Agriculture (CSA) model

Resources:

1. http://www.assocbuyers.com/ordering.asp?cid=6
2. http://startabuyingclub.com/
3. http://cultivate.coop/wiki/Buying_club

2.b Nested Enterprises

The concept of nested enterprises builds of the idea that a farm modeled on an ecosystem creates a diversity of products and that this diversity can be leveraged to build economic resilience and increase profitability. Generally Regen Ag nested enterprise support each other synergistically. The quality or yield of one product is improved by the services or management of another or the expenses required per unit are decreased due to integration of another product. Nested enterprises can take many forms, all of which include adding novel revenue streams to a farm operation. We've identified 3 primary reasons to develop nested enterprises (though more surely exist)

2.b.i Product Diversification

Adding additional products and services to a farm enterprise can help buffer an operation against changes in markets, both prices of products sold and necessary supplies. It allows farmers to connect to new customer segments and may spread out income across a wider range of the year as different products become saleable. One drawback of nested enterprises is that it can increase the complexity of operations and management. Care must be taken to balance the benefits of diversification with an incremental approach that allows managers to troubleshoot operations and produce high quality products. In particular, attention to the timing and labor needs of each product must be considered to avoid decreasing profitability of existing enterprises

[140] https://en.wikipedia.org/wiki/Buyers_club

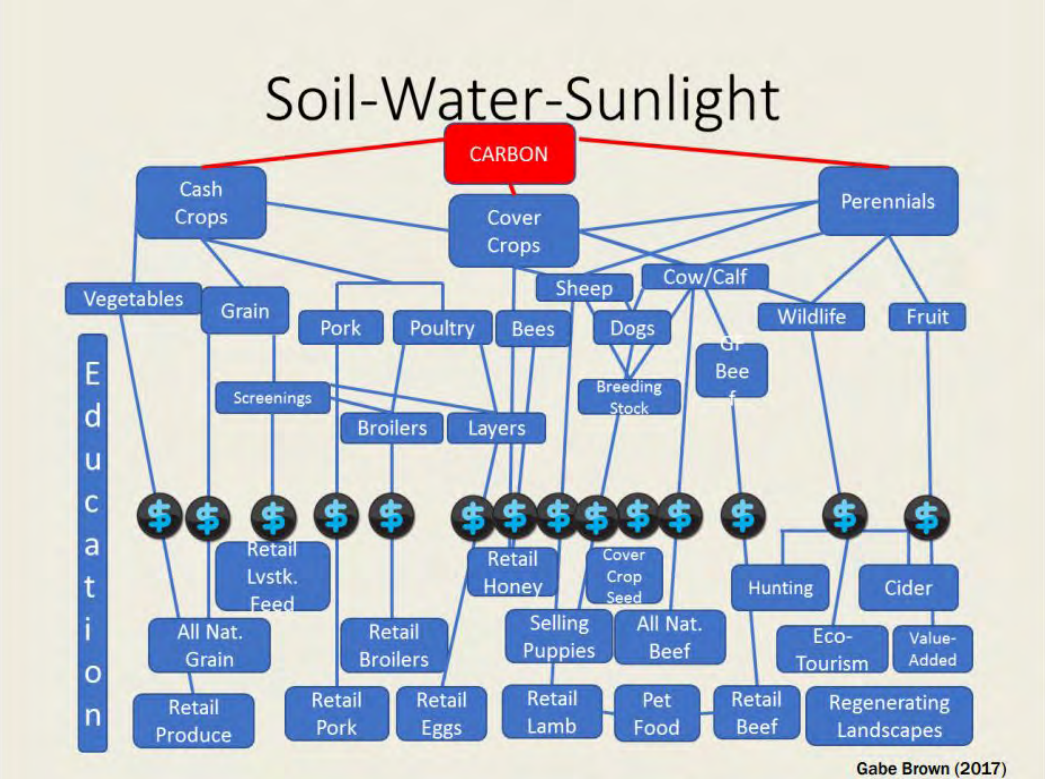


Fig 49. Product Diversification: Joel Salatin and Gabe Brown have pioneered the practice of Nested Enterprises in the USA. [141]

2.b.ii Risk and liability management

Because a wide range of enterprise possibilities exist, risk and liability that apply to some may not apply to others. For example agritourism is less affected by crop failure so lacks a need for crop insurance. For this reason there can exist economic and management benefits from separating diverse enterprises.

2.b.iii Ownership diversification

In order for multiple agricultural entrepreneurs to collaborate and support each other at a farm or ranch scale, ownership diversification can be a tool to both insulate individual enterprises from risk and liability and provide them with more control over their profitability. Many times this can be facilitated through simple traditional agreements such as leases or other business contracts. Often these types of nested enterprise engage in 'Business-to-Business' (B2B) trade. For example an onsite catering company might purchase produce and meat from farming enterprises, add value to them and sell their services to agritourism enterprises such as weddings or retreats.

2.c Leasing

Land tenure is a major hurdle for most aspiring small farmers and regen ag practitioners. Leasing provides affordable access to land for people with limited financial backing. Many larger land holdings often times have land that is either fallow or underutilized. Leasing these areas can often be an affordable solution and can often times provide a win-win situation connecting small producers with large land owners. For example, an orchard operation could lease the understory to a small scale poultry producer for 8-16 weeks following harvest. Running chickens through the understory after harvest can benefit the orchard and provide prime ground for a flock of birds. A cattle operation can lease a section of their land to a pastured poultry operator where the poultry follow 3 days after cattle in rotation. This synergistic example also illustrates what we call a complimentary nested enterprise (explained in more detail in the Nested Enterprise BMP section).

[141] https://www.extension.iastate.edu/soilmgt/files/page/files/archer-economics-of-soil-health.pdf

2.c.i Custom Leasing and Custom Grazing

Custom Leasing and Custom Grazing are contracts between landholders, graziers, and livestock owners. Custom Leasing is a contract between a landholder (leasor) and a grazier (leasee) where the grazier agrees to perform certain duties and follow defined guidelines in exchange for access to land for a specified period of time. Custom Grazing is a contract between a livestock owner (leasor) and a grazier (leasee) where the grazier agrees to manage a set number of animals for a specific period of time. Generally the grazier is paid either a daily rate per animal (i.e $2.25/day per cow) or a rate per pound of weight gained (i.e. $1.75/pound gain)

Both practices facilitate rotational grazing of animals at various locations and for specific times of year while allowing land managers to rest portions of land by removing animals from the site entirely.

Greg Judy document's his methods for using both of these BMPs to increase farm profitability and ecosystem health in his books 'No Risk Ranching' and 'Comeback Farms'.[142]

3. Capital Raising

Getting access to startup capital can be difficult, especially for development of novel practices with long term returns. In addition to traditional capital raising methods such as loans and venture capital investments, methods are now available for distributed crowdfunding investment which allows non-registered investors to invest small amounts in Regen Ag enterprises. This both distributes the ownership and risk across the community and connects urban populations to peri-urban and rural Regen Ag operations.

3.a Leverage grants and government programs

Extensive grants and government "contracts" are available that compliment developing a Regen Ag operation. Some are available from private foundations, from Federal sources (NRCS), and from State agencies (CDFA). Each grant program has its own directive and awards and specifics vary. See Section 9.c. and Appendix for resources.

3.b Crowdfunding investment options

The following are examples of Capital Raising Options. Much of the following is taken directly from industry leaders in mission minded growth: Cutting Edge Capital and Sustainable Economies Law Center.

3.b.i Private Placement

"The term "private placement" refers to the process of raising capital in an offering that is not registered with securities regulators and is not offered broadly to the public. Private placements can take one of several regulatory pathways to be compliant with the law. Private placements include offering types ranging from friends and family investments in a new retail establishment, to angel investments in a social enterprise, to institutional and venture capital investment in a growth company. Any kind of security can be offered in a private placement, including notes, stock (common or preferred), revenue share securities, convertible notes, SAFEs (security agreement for future equity) or others; and the attributes of each one of these can vary quite a bit (differing rates of return, exit options, valuation, etc.). "[143]

3.b.ii Direct Public Offerings

"A direct public offering (DPO) is a term that refers to a public offering of securities by enterprises to virtually everyone in their community or network. DPOs can take one of several regulatory pathways depending on the type of entity and the scope of the network.

[142] http://www.greenpasturesfarm.net/
[143] https://www.cuttingedgecapital.com/private-placements/

DPOs democratize capital by allowing both accredited and community (non-accredited or non-wealthy) investors to participate in the offering. By using a DPO, a business or nonprofit can market and advertise its offering publicly by any means it chooses — through advertising in newspapers and magazines, at public events and private meetings, and on the internet and through social media channels. DPOs can be focused on a single state or multiple states. DPOs are available to many different entity structures, including for-profit corporations, LLCs, cooperatives, and revenue generating nonprofits. Raising money through a DPO does not make the enterprise a publicly traded company and, in most instances, it does not require that the enterprise provide ongoing reporting to securities regulators."[144]

3.b.iii Regulation Crowdfunding

"Regulation Crowdfunding (also known as Regulation CF or Reg CF or Title III) was first signed into law by President Barack Obama in April 2012 as one part of the Jumpstart Our Business Startups Act, or JOBS Act. The JOBS Act was was enacted to facilitate access to capital for startups and small businesses, give a broader spectrum of people the ability to invest in startups and small businesses and to stimulate economic growth. Regulation CF is an exemption to the registration requirements under the Securities Act of 1933 which means that a full registration of the security offering is not required. Although a registration and review of the offering by the securities regulators is not required, an issuer of securities under the Regulation CF exemption must meet certain disclosure requirements and must comply with regulations regarding, among others, the marketing of the securities and investor limitations."[145]

3.b.iv Community Investment Funds

"A venture (nonprofit or for-profit) can raise capital from their community either directly or indirectly. The direct approach is sometimes referred to as investment crowdfunding, a term that includes both direct public offerings (DPOs)[146] and Title III Regulation Crowdfunding. Indirectly, a venture can be funded by a Community Investment Fund (CIF). CIFs help to empower communities by allowing community members, anyone of virtually any economic class, to invest in a community fund which in turns invests in ventures, revitalization projects or other mission driven enterprises. CIFs allow communities to build wealth through a cycle of investment, growth, profit (returned to community investors), and reinvestment.

Resources:

1. https://www.cuttingedgecapital.com/what-is-community-capital/

4. Access To Markets

Small scale farmers and innovators of new products often face many challenges with access to markets. These BMPs provide opportunities to improve access to existing markets, expand sales into new market segments, and differentiate products and production methods.

4.a Food Hubs:

A food hub, as defined by the USDA, is "a centrally located facility with a business management structure facilitating the aggregation, storage, processing, distribution, and/or marketing of locally/regionally produced food products."[147] Food hubs are a part of the agricultural value chain[148] model and often share common values relating to conservation, sustainability, healthy food access, and supporting local farmers.[149] A defining characteristic of food hubs is source identification, a food safety and marketing benefit that allows consumers to

[144] https://www.cuttingedgecapital.com/direct-public-offering/
[145] https://www.cuttingedgecapital.com/regulation-crowdfunding/
[146] https://www.cuttingedgecapital.com/direct-public-offering/
[147] https://en.wikipedia.org/wiki/Food_hubs#cite_note-1
[148] https://en.wikipedia.org/wiki/Agricultural_value_chain
[149] https://en.wikipedia.org/wiki/Food_hubs#cite_note-1

trace the origin of products they buy.[150] One of the primary goals of food hubs is to give small and medium-sized farmers access to larger or additional markets. Food hubs also fill gaps in food systems infrastructure, such as transportation, product storage, and product processing.[151] Although companies and organizations that fit the USDA definition have been operating in the United States since at least the early 1970s, most food hubs, as well as the common use of the term, started in or after 2008"[152]

Food hubs serve as regional aggregation and distribution centers and include similar operations to packing houses and warehouses.

Resources

1. https://civileats.com/2016/06/20/want-to-launch-the-next-food-hub-heres-what-you-need-to-know/
2. https://www.ams.usda.gov/services/local-regional/food-hubs
3. http://www.ngfn.org/resources/food-hubs
4. https://civileats.com/2018/01/31/can-food-hubs-scale-nationally-and-stay-true-to-the-cause/

4.b Farmers Markets

Farmers Markets provide small farmers with direct access to retail customers and provide a face-to-face interaction that builds local relationships based on trust and transparency. They are also a cultural center where the regional food system and other local enterprises congregate to extend trade across the local resource supply network.

4.c Direct Marketing

Direct marketing brings price parity to producers by allowing them to sell products at a retail price. It also builds face to face relationships between producers and consumers. Examples include Farm Stands, Farmers' Markets, CSA's, and restaurant sales.

4.d Product Diversification

Adding additional products and services to a farm enterprise can help buffer an operation against changes in markets, both prices of products sold and necessary supplies. It allows farmers to connect to new customer segments and may spread out income across a wider range of the year as different products become saleable. Care must be taken to balance the benefits of diversification with an incremental approach that allows managers to troubleshoot operations and produce high quality products. In particular, attention to the timing and labor needs of each product must be considered to avoid decreasing profitability of existing enterprises. Often it is most effective to diversify by adding value to existing products which spreads producer risk across the value chain .

In addition to diversification of traditional agricultural products, agritourism and payment for ecosystem services are emerging markets that can be synergistically integrated into Regen Ag operations and local regulatory frameworks.

4.e Agritourism

Agritourism connects people from urban areas and other countries to rural and agricultural economies by offering unique or desireable recreational experiences. It includes a wide range of value added activities and services that people pay to experience. These can include

1. Hunting And Fishing
2. Camping And Glamping

[150] https://en.wikipedia.org/wiki/Food_hubs#cite_note-1
[151] https://en.wikipedia.org/wiki/Food_hubs#cite_note-1
[152] https://en.wikipedia.org/wiki/Food_hubs

3. Weddings
4. Retreats
5. Farm Stays
6. Educational Programs
7. Wellness Services
8. Restaurants And Farm To Table Events
9. Corn Mazes, Hayrides, Pumpkin Patches And Games (seasonal tourism)
10. Petting Zoos
11. Horseback Tours

4.f Payment for Ecosystem Services

Payment for Ecosystem Services provides financial compensation for agricultural practices that maintain and improve water and air quality, provide biodiversity and wildlife habitat, and mitigate pollution. Emerging markets, taxes, and use fees are all developing as tools to compensate farmers for Regenerative practices.[153]

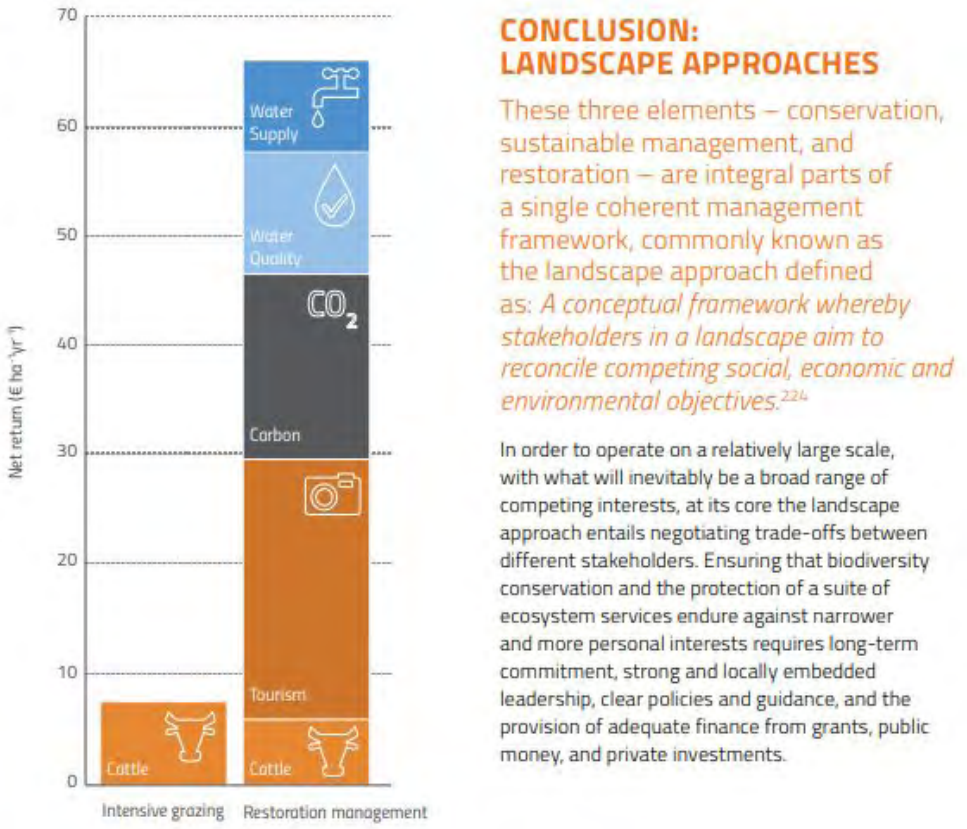


Figure 50. Graph of Economic return of Holistic Landscape Management approach results in South Africa.

Regenerative and restorative land use practices allow nested enterprises and improve revenue streams of non-farm activities which contribute to the overall bottom line for agricultural enterprises.

Taxes on pollution, uses of pesticides/biocides, and other degenerative practices can be leveed and used to fund Regen Ag development and management practices similar to ways currently used internationally in the water sector.[154] In the city of Tucson, AZ the water authority partners with non-profit agencies to channel donations and savings from reductions in use to Watershed restoration projects.[155] A similar model could be used to

[153] https://static1.squarespace.com/static/5694c48bd82d5e9597570999/t/5979f3ff9f7456ddab4b40f6/1501164549462/GLO_Part_2_Ch_9.pdf
[154] https://www.oecd.org/env/resources/46228724.pdf
[155] https://www.tucsonaz.gov/water/conserve2enhance

support Regen Ag practitioners. While taxes are unpopular, they can be a useful method to redistribute money from urban centers to rural areas in exchange for proper management of landscapes to provide ecosystem services that urban populations rely upon or spend millions and sometimes billions of dollars to replace.

Other methods are currently being developed using market mechanisms such as the blockchain[156,157].

Significant challenges in measuring and valuing ecosystem services exist and are prime topics of research for Regen Ag development.

4.g Certifications and Local Branding

Certification
More rigorous than local branding is actual certification of specific production practices. These include both Organic and the proposed Regenerative Organic Certifications described above. Many organic certification organizations exist that Santa Barbara County growers can use to certify their farm and products. Additionally, there are GMO-free and Biodynamic (Demeter) certifications available. For those growing timber crops you may consider a sustainable forestry certification as well.

While certifications demonstrate a standard of quality and consumer transparency, they have a few downsides.

1. they can be diluted over time through changes in requirements and greenwashing
2. they can be costly programs to run and certifications to obtain both on the side of the producer and certification organization
3. they can be overly restrictive and burdensome to the producer, especially someone practicing agile adaptive management

Local Branding
An alternative to certification is to cultivate local, face to face relationships between producers and consumers to create both transparency as well as understanding of the challenges and benefits associated with practicing regenerative agriculture. An example of this approach can be considered 'Uncertified Rational'.

This is embodied by the USDA program 'Know your Farmer, Know your Food,'[158] which has been one of the most successful USDA programs and slogans ever.

This type of relationship can exist with or without local branding and is often enhanced by it.

The development of a local brand for Santa Barbara County or even specific regions such as the Gaviota Coast can provide both transparency for customers and market differentiation for producers. This is often a win-win that boosts internal connectedness and feedback between local producers and consumers. A local brand is relatively easy to create and manage with a collective of producers and local food advocates, and they are often organized as 501c3 not for profit businesses.

Local Brands have been used with success elsewhere and have had benefits to consumers and produces even when areas covered by the brand are as large as statewide. Nevada Grown[159] is a nearby example of this. They provide a unifying brand and a list of producers, products, restaurants, and retailers of local agricultural

[156] https://www.forest-trends.org/ecosystem_marketplace/how-blockchain-can-make-carbon-markets-more-accessible/
[157] https://www.regen.network/
[158] https://www.usda.gov/sites/default/files/documents/KYFCompass.pdf,
https://community-wealth.org/content/know-your-farmer-know-your-food-us-dept-agriculture
[159] https://nevadagrown.com/

products. Additional services include facilitating workshops and research, publishing a local cookbook, and providing educational resources.

5. Building local capacity

One of the challenges facing Regen Ag is a lack of local capacity to manage the agro-ecosystems and to effectively and skillfully add value to agricultural products. Building local capacity to increase the amount of high paying jobs and agricultural products produced locally benefits the whole community. Many options for building local capacity also increase the opportunity for local producers to capture more value and profit margin by decreasing costs of production or adding value to raw products.

5.a Shared Resources

Many resources needed to optimize local Regen Ag operations are not available locally. Sharing of resources builds local capacity by increasing local availability of tools, equipment, infrastructure and other resources.

For example Regen Ag promotes perennialization of agricultural landscapes and keeping the soil covered with mulch and living plants. Tools that facilitate these outcomes such as no-till drills and tree planters are often expensive and not available regionally. Rather than placing the burden on individual landowners to purchase, manage, and maintain these types of equipment, we propose that shared purchase and use of this equipment can provide small scale practitioners access.

Some methods which might allow this shared purchase and use are:

1. Use grants and donations to purchase regional implements such as no-till drill and tree planter
2. A local RCD, government agency, equipment rental company, or non-profit organization holds title to shared equipment which can be rented by local farmers
3. A buying club purchases shared equipment such as no till drill which will allow larger scale practitioners to take the first step to reduced tillage and then add on additional practices

5.b Regenerative land management tools and supplies

Because regenerative land management is an emerging field, many of the tools and supplies used by practitioners are either rare, novel, expensive or a combination of these. This makes them hard to afford at an individual operational scale.

Examples of regenerative land management tools, equipment and supplies that have been developed and are being innovated currently are:

- No till drills for both crop and rangeland seed
- Mechanical tree planters
- Conversion of liquid chemical sprayers to biofertilizer sprayers
- Yeomans' subsoiling plow and iterations of the Yeomans' super plow which integrates a non-inversion subsoiler, no till drill, and liquid fertilizer applicator
- wholesale nurseries for affordable farm forestry nursery stock
- highly efficient perimeter fence and mobile electric fence systems

5.c Skilled labor services

As Regen Ag takes foot within the community, skilled labor for the many diversified aspects of the business will need to be filled. This creates an opportunity. Skilled services may be used throughout the region and not restricted to one farm. For example, one may learn the skill set of pollarding silvopasture trees thus filling a niche within the region as more and more trees are planted and demand this service.

5.d Processing and Value Added Infrastructure
Often small scale and local producers lack the capital needed to develop processing and value-adding infrastructure that allow them to diversify their products and expand their access to markets. By combining efforts with other farmers or local food system organizations to develop locally available processing and value adding infrastructure, the costs, benefits, and risks associated with building and managing this infrastructure can be shared. Examples of processing infrastructure connected to the local food and agricultural supply networks include

5.d.i Commercial Kitchen
Commercial kitchens allow producers to both add value to their products through processing such as baking, preserves, drying and other methods. These value added products both preserve the harvest and provide access to a longer season of sale for producers creating more stability and potential to manage income and pricing. The cottage food act provides a stepping stone into markets for operations with revenues under $25,000/yr.

5.b Mobile Slaughterhouse
Currently USDA certified slaughterhouses only exist in a few areas in California, such as Modesto. The long distance transport to these facilities can be costly and adds additional food safety risk and animal welfare concerns. These facilities are often reserved far ahead of time and can be difficult for small producers to access at a price point that allows them to compete even in retail markets.

5.c Timber Mill and Kiln
Milling and drying of locally grown lumber creates the feedstock for a wide range of local artisans and tradespeople. Development of infrastructure that facilitates processing of both urban timber generated by tree removals and farm grown timber creates an incremental pathway to growing a local timber industry where small scale producers and processors can create livelihoods.

5. Metrics, Standards and Certifications

Metrics, standards and certifications are tools which allow us to monitor, measure, and codify best practices which lead to a Desired Outcome. Metrics are measurements that serve as indicators that help us identify trends and inform our decisions to alter or continue current practices towards a successful outcome. Standards set targets and thresholds for metrics to provide guidance to practitioners, consistency in assessment, and add transparency to the production practice which can facilitate market differentiation. Standards are the basis for certifications which qualify an operation based on a suite of metrics, or require thresholds for specific practices.

Regenerative Agriculture practices create functioning agricultural ecosystems that provide ecosystem services and profitable agricultural products as by-products of well managed agro-ecosystems. Practitioners use the BMPs to guide ecosystem processes toward a Desired Outcome or goal, which must be measurable. The reason we measure indicators via the metrics is to assess progress toward a Desired Outcome, inform management decisions, and gather data to support scientific research.

With reference to Santa Barbara County specifically, quantifying specific metrics will help to track progress towards SB County Food Action Plan goals, to inform regulations, and legitimize provision of ecosystem services such as offsets of GHGs or cleaning drinking water.

For some of the Desired Outcomes we have listed in Section 1.f., there are not agreed upon metrics to indicate progress. We're not experts on metrics, so we've done our best to include relevant and practical measurements and indicators where possible.

5.a. Metrics: Measuring success

Metrics are indicators to measure progress toward success. We define success initially as being on trend towards stated desired outcomes and over time reaching desired outcomes. Each desired outcome must have one or more metric associated with it.

If a desired outcome can't be linked to a metric or indicator that can be assessed then it doesn't provide a tool that can be operationalized in a business, on a farm, or in a regulatory setting. Metrics are used to evaluate the BMPs practices as implemented and determine whether they are leading to Regen Ag outcomes on a given site under a given set of management decisions.

Metrics provide practitioners a toolkit to assess progress and evaluate whether to continue or adapt practices. From a practitioner standpoint, success is framed in a triple bottom line fashion and made personal and context specific using a tool such as the Holistic Context.

Management decisions are informed through analysis of the metrics. The feedback loop of the Adaptive Management process is completed when the practitioner decides to:

1. adapt, if not on track to achieve desired outcomes or
2. maintain trajectory, if the trend is upward toward desired outcomes.

From a regulatory standpoint, success is often measured in comparison to a specific target and assess payment for ecosystem service or qualifications for incentives, for example measuring Soil Organic Carbon to determine if a practice or practitioner qualifies for Carbon Credits.

Environmental Regen Ag Metrics

There are many methods and metrics that have been devised for measuring ecosystem services and function. These range from very simple qualitative methods such as photopoints to highly detailed quantitative methods that require specialized equipment and technical expertise to collect and process data.

The cost in time and money varies dramatically along this spectrum as well. Often, Regen Ag practitioners don't have the time or money to invest in highly quantitative data and are best served by qualitative methods that provide enough information on trends in land health to guide management decisions.

Quantifying environmental benefits of various Regen Ag practices has huge implications. Carbon credits and many funding schemes are based on scientific data and the effectiveness of field practices. Environmental metrics are linked to the stated Desired Environmental Outcomes as shown in the list below.

*Metrics to measure are listed in *italics**

Desired Environmental Outcomes

- Increased effectiveness of the four ecosystem processes to improve natural capital and ecosystem services on agricultural lands:
    - Water Cycle
        - Buffering of drought and flood cycles
            - *stormwater runoff*
            - *water infiltration and water holding capacity (WHC)*
            - *length of growing season*
        - Increased effective precipitation[160]
            - *soil cover*
            - *reduced erosion*
        - Increase water resources
            - *water use*
            - *water infiltration*
            - *aquifer depth and recharge rate*
        - Water and air filtration and remediation
            - *pollutants in streams and ocean*
            - *pollutants in air*
    - Mineral Cycle
        - Increased nutrient density within the crops produced
            - *nutritional profile of phytochemicals, vitamins and minerals*
        - Reduced greenhouse gas emissions
            - *CH_4, CO_2, NO_x emissions*
        - Preserve and create topsoil
            - *percent and depth of Soil Organic Matter (SOM)*
        - Sequester carbon in the system
            - *percent and depth of SOM*
            - *Carbon stocks in landscape (i.e. tree biomass, etc)*
    - Energy Flow
        - Greater crop/forage production
            - *crop yield*

[160] Effective precipitation is the percentage of rainfall which becomes available to plants and crops which is improved with increased infiltration and percolation due to improved soil structure.

            - *length of growing season*
        - Biological Community
            - Increased species diversity and wildlife habitat
                - *species diversity*
                - *species abundance*
                - *age class structure*
- Eliminate toxic chemical residues in Ag systems and pollution exported from them
    - *use of agricultural chemicals such as fertilizers and biocides*
    - *water and soils quality*
    - *levels of toxic chemicals in soils and water*
- Eliminate and/or utilize all "waste"
    - *operations produces no waste*
- The farm produces a surplus of energy in order to power the operational systems
    - *energy use and production*

Socio-Cultural and Regulatory Metrics

These metrics measure whether our management decisions and implementation of BMPs are leading to the Socio-Cultural and Regulatory Desired Outcomes. The metrics used to measure the effectiveness of Socio-Cultural and Regulatory BMPs are utilized in a similar manner to the Environmental metrics in that the analysis of the metrics inform management decisions which is the feedback loop in the Adaptive Management process.

*Metrics to measure are listed in *italics**

Metrics to Measure Desired Socio-Cultural and Regulatory Outcomes:

- High percentage of socially just business models using dynamic governance
    - *employee retention*
    - *percentage of local businesses with employee ownership or equitable ownership*
    - *equitable wage distribution among employee and ownership classes*
    - *workers are paid a living wage*
    - *# of B-Corps registered locally*
    - *# of companies with dynamic governance in their governing documents*
- Equitable distribution of labor and wealth
    - *job availability*
    - *unemployment*
    - *income gap between rich and poor*
- A community connected to its local food system
    - *# and size of farmers markets*
    - *# of local CSAs and CSA members*
    - *# of School to farm field trips*
    - *accessibility of fresh food*
- Healthier people from healthier food
    - *reduction in chronic disease*
        - *quantify number of hospital visits locally*
        - *cases of obesity, diabetes, etc.*
    - *improved childhood nutrition*
- Improved quality of life of farmers and farm workers
    - *farmers are inspired, supported, and fulfilled in their duties*

    - *farmer suicide rate*
    - *participation in continuing education*
    - *continued intergenerational transfer of farm properties*
    - *# of employees with benefits packages*
- Reduce/eliminate exposure of farm workers to toxic chemicals
    - *use of toxic chemical (i.e. County pesticide use reports)*
    - *hospital visits related to exposure to toxic chemicals*
- Improved Intellectual and Experiential Capital of local communities
    - *goods and services are available locally by a web of suppliers*
    - *consumers are educated about local food systems and vote with their dollar*
    - *access to vocational training to enable upward mobility*
    - *skilled employment and business opportunities in ag and business sectors into the local economy*
- Humane treatment of livestock
    - *distance to abattoirs*
    - *number of Certified Humane*[161] *producers registered locally*
    - *adherence to Rodales ROC standards for animal welfare*[162]
- Improved regulatory environment that supports Regen Ag
    - *Regulations that incentivise Regen Ag practices*
    - *Regulations that restrict Regen Ag practices*
    - *Regulations that incentivise ecosystem services locally*
    - *Regulations that promote a true cost accounting of operations*
    - *# of politicians and government employees that support regen ag.*
    - *Streamlined permitting processes*
    - *cost of permitting*

Economic Metrics

The Economic metrics measure whether or not the business models and financial planning is working towards the Desired Outcomes listed below. Finances are often the "bottom line" for any agricultural operation, as they are all ultimately businesses regardless of practices. If the farm enterprise is not profitable, then the farm will go bankrupt and will never have the opportunity to improve ecosystem services.

*Metrics to measure are listed in *italics**

Metrics to Measure Desired Economic Outcomes:

- The farm enterprise is financially resilient
    - *cash positive*
    - *profitable*
    - *debt free*
    - *profits reinvested in operations and to support quality of life*
- The farm enterprise generates a significant economic multiplier effect in the community
    - *money and resources are reinvested in the greater community*
    - *profits redistributed locally*
    - *import and export of resources*
- Land stewardship is valued for improving ecosystem services
    - *Farmers are paid for practices that provide and increase ecosystem services*

[161] https://certifiedhumane.org/
[162] https://rodaleinstitute.org/regenerativeorganic/

    - *the value the community gets from ecosystem services is quantified*
    - *Farmers are compensated for carbon sequestration*
- Increased access to financial capital for Regen Ag Practitioners
    - *amount of investment from community members in support of Regen Ag projects*
    - *amount of capital available from public and private sources*

5.b. Standards and Certifications

Standards

Standards provide guidance to practitioners, consistency in assessment, and add transparency to the production practice which can facilitate market differentiation. Standards can provide the consumer information around production practices and product quality, and help inform purchasing decisions. Standards also provide the producer market differentiation and branding support which tells consumers that the products satisfy certain criteria. Standards provide targets and thresholds for practices which are measured by the metrics.

Rodale Regenerative Organic Certification (ROC)

Recently, the Rodale Institute specifically designed a Regenerative Organic Agriculture certification that goes above and beyond the USDA National Organic Program certification. This Regenerative Organic Certification includes a set of Soil Health criteria that must be met. Additionally it specifies Farmer and Worker Fairness and Animal Welfare practices which must be met.[163] According to their website:

> *Regenerative Organic Certification builds upon the near 100-year legacy of organic movement visionaries like J.I. Rodale and Dr. Rudolf Steiner, and provides stepwise guidance for farming and ranching operations, transportation, slaughter, and processing facilities that produce food, cosmetics, and fiber.*
>
> *The goals of Regenerative Organic Certification are to increase soil organic matter over time, improve animal welfare, provide economic stability and fairness for farmers, ranchers, and workers, and create resilient regional ecosystems and communities.*

This certification framework provides a clear pathway to adoption and practice of regenerative organic agriculture which provides both a rigorous baseline of practices and market differentiation for both consumers and producers who support regenerative organic agriculture practices and desired outcomes.

A major consideration in certification is the desire to offer producers a realistic pathway to certification and not exclude genuine efforts to improve operations. For this reason the ROC framework includes 3 tiers of bronze, silver and gold certification levels to allow producers an entry point that is achievable.

[163] https://rodaleinstitute.org/regenerativeorganic/

Box 2. Regenerative Organic Certifications Levels and Sequence

from Rodale ROC doc II Scope and Structure

Structure

There are three levels of Regenerative Organic Certification: Bronze, Silver, and Gold, with the Gold designation representing the highest achievable level and the Bronze level representing the beginning level.

This tiered approach enables producers to adjust and adapt their practices over time, and allows for continuous improvement.

Levels of Regenerative Organic Certification at the Producer level

Bronze Level: Can be claimed publicly; however, no product labeling is permitted. Annual recertification is required. After three years of Bronze certification, an operation must advance to Silver or Gold if it wishes to make continued public claims. To claim Regenerative Organic Certification at the Bronze level, between 0% and 50% of fiber-or-food-producing land must be certified.

Silver Level: Product labeling is permitted. Annual recertification is required. To claim Regenerative Organic Certification at the Silver level, at least 50% of fiber-or-food-producing land must be certified at initial certification and must reach at least 75% by year 5.

Gold Level: Product labeling is permitted. Annual recertification is required. To claim Regenerative Organic Certification at the Gold level, 100% of fiber-or-food-producing land must be certified.

The Soil Health and Land Management, Animal Welfare, and Farmer and Worker Fairness modules contain "Guidelines" for each level of certification, which provide guidance that operations should meet, depending on the level of certification sought.

Guidelines

Required Practices (R): Practices that operations must meet for an operation to be eligible for Regenerative Organic Certification at the desired level. Required Practices (R) include areas of zero tolerance, where failure to meet these practices may represent a disregard for laws and/or basic human and animal rights. Failure to meet Required Practices (R) must be communicated by the auditor to the Regenerative Organic Certification oversight committee within 24 hours. Operations that fail to meet any Required Practices (R) may not proceed with certification and instead must reapply following a period of no less than six months.

Optional Practices (O): Practices that are encouraged for all, but not required, at a particular level. Optional Practices (O) shift to Required Practices (R) as a producer advances from Bronze to Silver to Gold levels. 4 March 2018

Critical Tolerances (CT): Practices that require action on the part of producers and must be reported immediately and remediated within 30 days. If the Critical Tolerance (CT) is not resolved within 30 days, a producer cannot claim Regenerative Organic Certification. To achieve the desired level of Regenerative Organic Certification, an operation must meet 100% of the Required Practices (R) for that level.

The path for chemical agriculture producers to achieve Regenerative Organic Certification is:

Chemical -Transitional Organic-Certified Organic-ROC Bronze-ROC Silver-ROC Gold

Figure 51. Rodales Pathway to Regenerative Organic Certification [164]

[164] https://rodaleinstitute.org/assets/ROC-Pathway-March-2018.pdf

6. Case Studies for Regenerative Agriculture

6.a Global Case Studies

Globally there are many examples of successful Regen Ag projects that utilize one or many Regen Ag BMPs. There are examples in tropical, temperate, and humid climates that exhibit many of the practices outlined in this document. It is not the scope of this document to highlight all projects globally, and we will focus primarily on Mediterranean Climate examples as they are relevant to the Santa Barbara region in order to glean information and practices from examples in similar climates.

Mediterranean Climate Regions (Köppen-Geiger Climate Zones Csa and Csb)[165] are prime agricultural climates characterized by dry summers and wet winters. Globally these climates exist primarily in developed nations where industrial agriculture is practiced. Analogous climates to Santa Barbara exist in Chile, West Australia, and the Mediterranean region of Europe and North Africa.

Local examples are highlighted in Section 6.b.

Dehesa and Montado systems, Spain and Portugal

The Dehesa and Montado systems of Spain and Portugal respectively are some of the oldest continuously managed examples of climate appropriate Regen Ag systems in Mediterranean Climate Regions globally. These systems have been managed for hundreds if not thousands of years, and integrate wide spaced agroforestry and silvopasture based on oaks and olives, with cattle, sheep, pigs and goats run in pasture. Products often include acorns, wood, charcoal, and cork, with sheep, goats, pigs, and cattle grazing and browsing beneath the trees. Annual grains are often interplanted in pasture. Similar systems exist in marginal and dry regions of Italy, Greece, and South America.

[165] https://en.wikipedia.org/wiki/Mediterranean_climate

Figure 52. Dehesa (Spain) and Montado(Portugal) examples[166]

"The Spanish dehesa is a traditional, but also up-to-date, Mediterranean agrosilvopastoral system. It might be regarded as one of the most successful and efficient examples of how extensive agrosilvopastoral management is not only compatible with nature conservation and sustainable rural development within its environment, but also necessary for the achievement of both goals. Its area, of about 4 million hectares, is marked by two fundamental features: Mediterranean climate and low soil fertility."[167]

[166] http://www.permaculturevoices.com/podcast/permaculture-voices-podcast-022-a-recap-of-darren-dohertys-workshop-and-the-dehesa-system/

[167] https://www.researchgate.net/profile/Hein_Gils/post/Does_anyone_know_of_recent_works_on_the_history_of_Dehesa_Montado_landscapes/attachment/59d651c679197b80779aa353/AS%3A509031450988544%401498373963843/download/dehesa.pdf

Temperate Region Integrated Livestock and Rangeland Example

Brown's Ranch, North Dakota USA

Figure 53. Brown's Ranch, North Dakota

Set in North Dakota with 12-16" of rainfall per year, over the past 20 years of practicing Regen Ag, the Browns have increased soil organic matter by nearly 10% and deepened topsoil by 10" as shown in Figure 54. They have done this through an incremental process of adoption, starting with annual cropland conversion to no-till and integration of cover crops and maturing into livestock integration with high density planned grazing on multi-species covers and perennial pastures. By utilizing Holistic Management and Holistic Planned Grazing, Gabe Brown "has consistently been able to have a 200% higher gross profit per acre and a 20% increase in bushel production than the county average."[168]

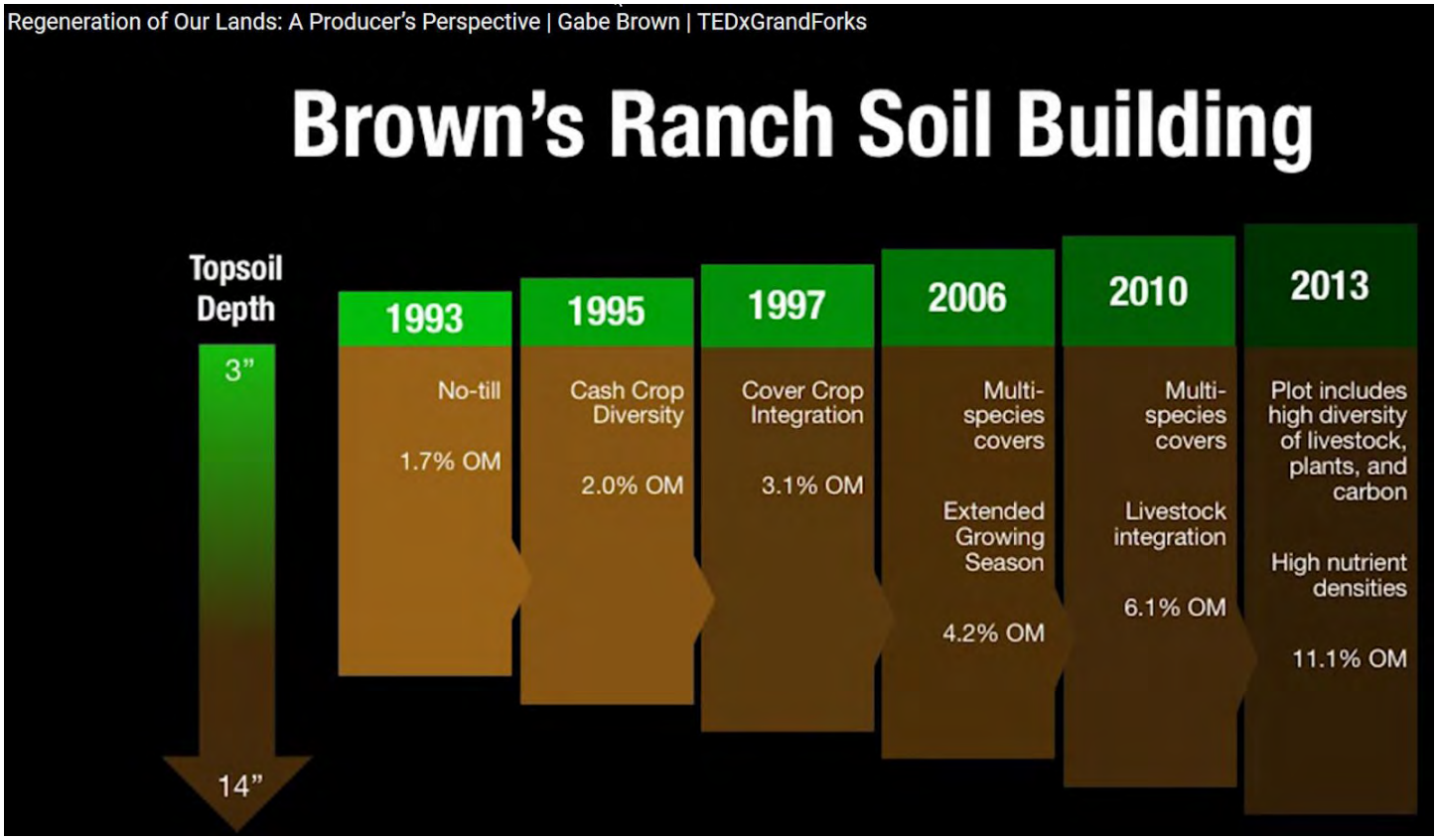


Figure 54. Brown's Ranch Soil Building from 1993-2013 from his TEDx Talk[169]

[168] https://holisticmanagement.org/holistic-management/success-stories/case-studies-browns-ranch/

[169] https://www.youtube.com/watch?v=QfTZ0rnowcc

Large scale Regenerative Land Management

Soils For Life

Soils For Life is an Australian non-profit organization that works to 'encourage the wide adoption of regenerative landscape management practices to restore landscape health and produce quality and nutrient-dense food and fibre.'[170] They have assembled a suite of Regenerative Landscape Management Practices and documented extensive case studies of the beneficial outcomes of these practices. The scale of land managed by practitioners in these case studies ranges from 100 hectares to over 10,000 hectares. These case studies are profiled in their publication Innovations for Regenerative Landscape Management.[171]

The effects of their proscribed Regenerative Landscape Management Principles[172] (see Appendix) can be stunning such as those depicted in this photopoint time sequence from the Bokhara Plains property in New South Wales, Australia.

Figure 55. Transformation of desertified landscape to perennial grassland at Bokhara Plains.[173]

Marin Carbon Project

Figure 56. Compost application to rangeland at the Marin Carbon Farming Project.

[170] http://www.soilsforlife.org.au/about-us-menu
[171] http://www.soilsforlife.org.au/resources.html#report
[172] http://www.soilsforlife.org.au/change.html
[173] http://www.soilsforlife.org.au/change.html

The Marin Carbon project tested the effects of subsoiling, compost application and planned grazing on rangelands in Marin County. Their findings suggest that compost is the most effective of these three treatments at sequestering carbon in the soil. Specifically they found a net carbon sequestration of 55 metric tons per acre per year was achieved when ¼" of compost was applied.[174]

Singing Frogs Farm
Singing Frogs Farm is a 2 acre biointensive market garden based farm in Sebastopol, CA. They are building topsoil while profitably producing annual crops.

They describe their operation on their website as:

"Singing Frogs Farm continues to be a living experiment.
As we, and leading soil scientists, learn more about the biology of the soil beneath our feet, our methods and farming systems here at Singing Frogs Farm are constantly changing and being improved upon. However, nearly every aspect of farm management hinges on the three basic principles of soil management:

1) Disturb the soil as little as possible,
2) Keep a diversity of living plants in the ground as often as possible, and
3) Keep the soil covered and protected as often as possible."[175]

Figure 57. Singing Frogs Farm small-scale, high-yield biointensive market garden on 2 acres making $100,000/ac[176]

Organizations

There exists a growing number of organizations promoting Regenerative Agriculture practices, enterprises and regulations. Together with practitioners these organizations are helping to advance this movement toward the critical mass of rapid adoption.

Regeneration International
The mission statement of Regeneration International is "To promote, facilitate and accelerate the global transition to regenerative food, farming and land management for the purpose of restoring climate stability, ending world hunger and rebuilding deteriorated social, ecological and economic systems." This organization advocates across the globe working with consumers, educators, business leaders and policymakers. From hosting an event on a private ranch in California this November 2018 titled *Hedgerow Establishment and Multiple Benefits* to promoting an upcoming webinar – *Soil Health and Organic Production, Lessons from*

[174] https://www.marincarbonproject.org/marin-carbon-project-science
[175] http://www.singingfrogsfarm.com/our-farming-model.html
[176] http://www.regenerateland.com/evidence-for-regenerative-agriculture/

Rodale Institute's Farming Systems Trial, this organization is the go-to for having a pulse on the global Regen Ag movement. [177]

Kiss the Ground

Kiss the Ground is an organization that is providing an essential linkage between the early adopters and the early majority thus spanning the chasm mentioned in Section 9.a . They are committed to "getting the word out there" about carbon sequestration, water restoration, abundant nutritious food, restored thriving ecosystems and farmer prosperity. This 501(c) (3) charity has produced powerful short videos such as *The Soil Story*[178], and *The Compost Story*[179] that explain complex issues succinctly eloquently.

Based in Los Angeles and equipped with inhouse professional actors and actresses this organization is well equipped to promote the Regen Ag movement.[180]

Quivira Coalition

A humble beginning dating back to 1997, The Quivira Coalition[181] began when two conservationist and a rancher agreed that a ranch that supported wildlife and a healthy ecosystem could also support a viable ranch business. It soon grew into an annual conference, an apprentice program and a supporter of numerous demonstration restoration sites mainly in the SW region. Now, after 20 years of maturing, this organization is one of the best examples of bridging the divide between rancher/landowner and environmentalist/ conservationist. They have put out numerous technical guides[182] including some very appropriate ones for our region such as "*A Good Road Lies Easy on the Land"* and *"Let the Water Do the Work"* by Bill Zeedyk, "*Erosion Control Field Guide: Working with Nature to Heal Erosion*" by Craig and Avery Sponholtz, and "*Rangeland Health and Planned Grazing"* by Kirk Gadzia and Nathan Sayre.

Regenerative Organic Alliance

This is a coalition of organizations led by Rodale Institute, Dr. Bronners and Patagonia. This group ended up producing the Regenerative Organic Certified label which aims to create a new certification program for Regeneratively grown products.

Fibershed

"Rebecca Burgess founded Fibershed's 501c3 to address and educate the public on the environmental, economic and social benefits of decentralizing the textile supply chain. Fibershed develops regional and regenerative fiber systems on behalf of independent working producers, by expanding opportunities to implement carbon farming, forming catalytic foundations to rebuild regional manufacturing, and through connecting end-users to farms and ranches through public education."[183]

ZERI

Zero Emissions Research and Initiatives is a global think tank producing results as to how to tackle some of the worlds most difficult problems. Using nature's design principles as guidance, they seek sustainable and innovative solutions to societies struggles. Gunter Pauli (who has written the Blue Economy) is at the forefront of this organization and has been innovating solutions for decades.[184]

[177] http://www.regenerationinternational.org/
[178] https://www.youtube.com/watch?v=nvAoZ14cP7Q
[179] https://www.youtube.com/watch?v=bqDQD8cvO5Y
[180] https://kisstheground.com/
[181] https://quiviracoalition.org/
[182] https://quiviracoalition.org/resources/
[183] http://www.fibershed.com/
[184] http://www.zeri.org/

Commonland Foundation

Committed to the belief that landscape restoration offers tremendous untapped opportunities for sustainable economic development, this group leads restoration projects based on sound business models. With famed filmmaker and ecologist John D Liu as sitting ambassador this foundation has active projects in the Netherlands, South Africa, Spain and Australia.[185]

Figure 58. Commonland Foundation's 4 Returns

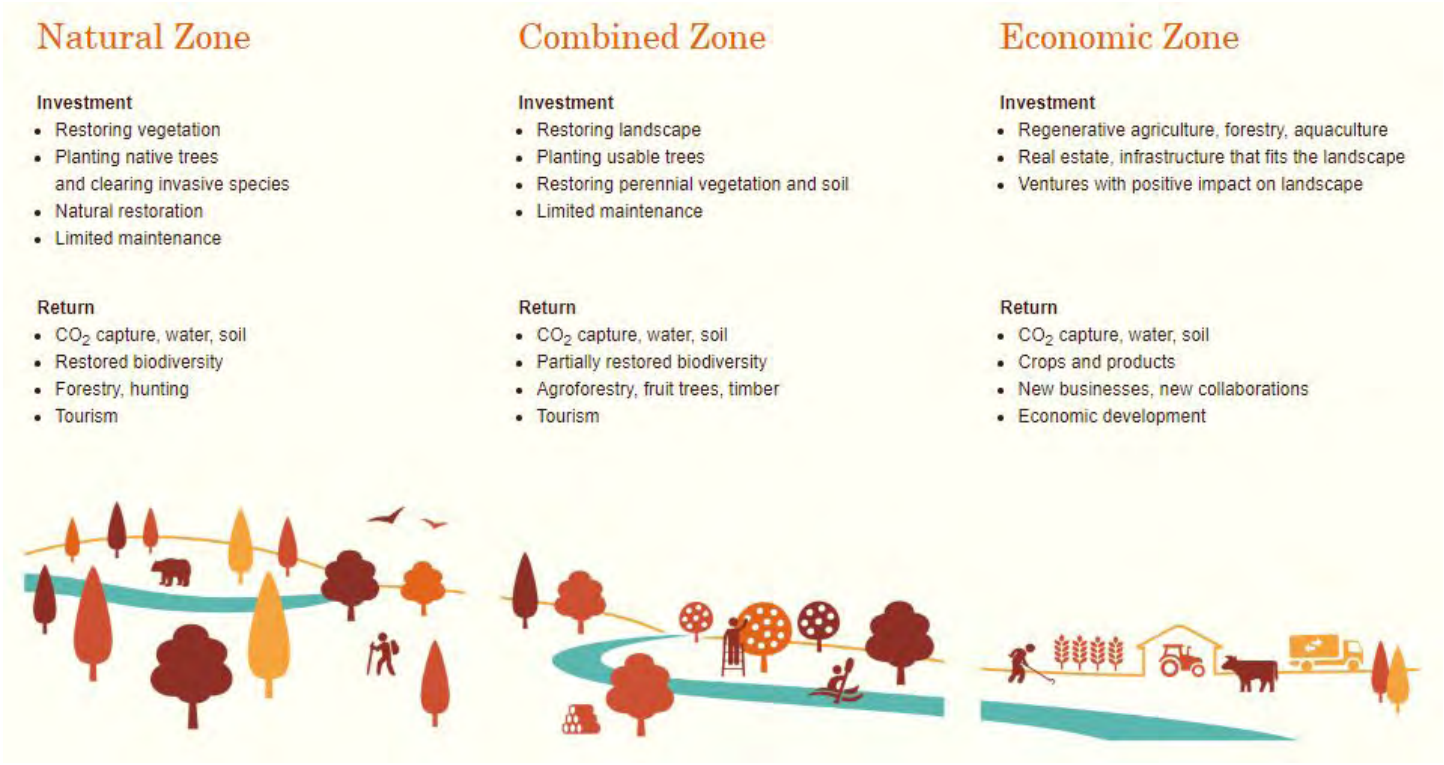
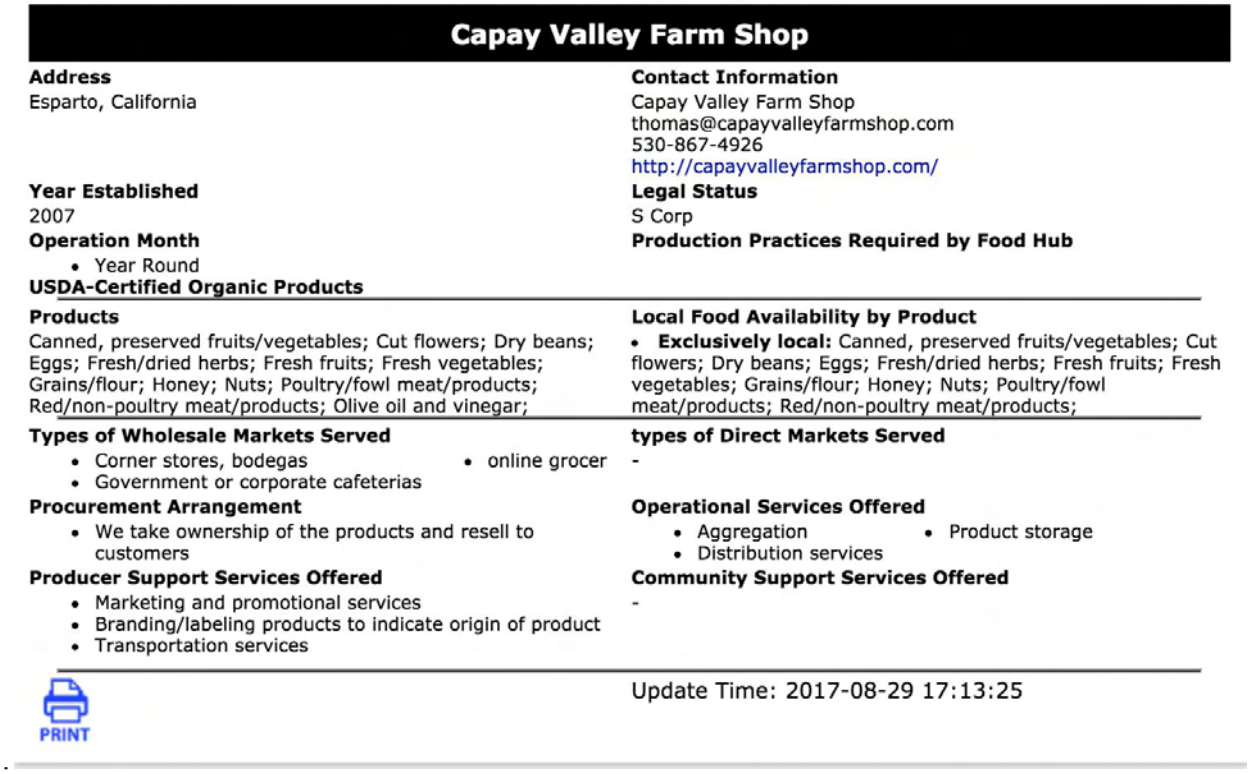


Figure 59. Commonland Foundation's 3 Zones

Food Hubs

A regional food hub is a business or organization that actively manages the aggregation, distribution, and marketing of source-identified food products primarily from local and regional producers to strengthen their ability to satisfy wholesale, retail, and institutional demand. This USDA list[186] compiles many known food hubs within the US and provides data on each one such as this example for the Capa Valley Farm Shop.

[185] https://www.commonland.com/en/4returns
[186] http://www.ngfn.org/resources/food-hubs



Capay Valley Farm Shop

Address
Esparto, California

Contact Information
Capay Valley Farm Shop
thomas@capayvalleyfarmshop.com
530-867-4926
http://capayvalleyfarmshop.com/

Year Established
2007

Legal Status
S Corp

Operation Month
- Year Round

Production Practices Required by Food Hub

USDA-Certified Organic Products

Products
Canned, preserved fruits/vegetables; Cut flowers; Dry beans; Eggs; Fresh/dried herbs; Fresh fruits; Fresh vegetables; Grains/flour; Honey; Nuts; Poultry/fowl meat/products; Red/non-poultry meat/products; Olive oil and vinegar;

Local Food Availability by Product
- **Exclusively local:** Canned, preserved fruits/vegetables; Cut flowers; Dry beans; Eggs; Fresh/dried herbs; Fresh fruits; Fresh vegetables; Grains/flour; Honey; Nuts; Poultry/fowl meat/products; Red/non-poultry meat/products;

Types of Wholesale Markets Served
- Corner stores, bodegas
- online grocer
- Government or corporate cafeterias

types of Direct Markets Served
-

Procurement Arrangement
- We take ownership of the products and resell to customers

Operational Services Offered
- Aggregation
- Product storage
- Distribution services

Producer Support Services Offered
- Marketing and promotional services
- Branding/labeling products to indicate origin of product
- Transportation services

Community Support Services Offered
-

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Figure 60. Example of Food Hub included on the USDA list

Existing Regulations and policies that enable Regenerative Agriculture State by State

State of Hawaii:. Bill (HB1578)[187] Enacted and went into law July 1 Will develop incentives for Hawai'is' farmers and ranchers to improve the resilience of their lands by increasing the soil's carbon content.

State of Maryland: Bill HB1063[188] The act, as approved by Gov. Larry Hogan, requires the Maryland Department of Agriculture to provide incentives including research, education and technical assistance contributing to healthy soils.

State of Massachusetts: House bill No.3713[189] presented by Paul A. Schmid III, would establish a fund for education and training for those engaged in agriculture that regenerates soil health. Indicators of healthy soil include levels of carbon, rates of water infiltration and biological activity.

State of New York: Assemblywoman Didi Barrett introduced Bill A3281[190], a first-of-its-kind bill to use a tax credit model for farmers who maximize carbon sequestration potential on their land. Although the bill did not pass this past year, Barrett incorporated the Carbon Farming Act into the state budget which is providing $50,000 to study incentives for carbon farming tax credits, grants and other programs.

State of California: the Department of Food and Agriculture appropriated $7.5 million from the Greenhouse Gas Reduction Fund to develop and administer incentive and demonstration programs as part of the state's

[187] https://www.capitol.hawaii.gov/session2017/bills/HB1578_CD1_.pdf
[188] http://mgaleg.maryland.gov/2017RS/bills/hb/hb1063T.pdf
[189] https://malegislature.gov/Bills/190/H3713.Html
[190] https://legislation.nysenate.gov/pdf/bills/2017/A3281

Healthy Soils Program[191], actively supported by the California Climate and Agriculture Network[192], a coalition that includes Center for Food Safety[193]. The objective of the demonstration projects is to monitor and demonstrate to California farmers and ranchers that "specific management practices sequester carbon, improve soil health and reduce atmospheric greenhouse gases." The program includes a variety of practices such as mulching, cover crops, compost application, hedgerow planting and buffer strips.

State of Oklahoma: House bill No. 1192[194] passed the "Carbon Sequestration Enhancement Act[195]" in 2001. It involves implementing measures to slow and reverse the buildup of CO2 emissions, promotes improved agricultural practices, and intends to document and quantify carbon sequestration associated with improved agricultural practices.

State of Utah: Utah Legislature passed in 2015 H.C.R. 8[196] : Concurrent Resolution on Carbon Sequestration on Rangelands which establishes soil carbon sequestration as the state's preferred approach to climate change

6.b. Local Case Studies and Examples of Regen Ag Projects in Santa Barbara County

Presently, we are not familiar with a local operation or organization integrating a comprehensive Regen Ag approach. However, we recognize the transition to Regen Ag takes place incrementally and we've chosen to highlight some examples where Regen Ag BMPs are being used to good effect. Below are a few examples.

Conventional Monocrop Avocado Orchard utilizing Regen Ag BMPs

Simple Avo

Teddy Travers manages several avocado ranches owned by Simple Avo in Santa Barbara and Ventura Counties, and he has introduced several of the Regen Ag BMPs to their operations. These ranches represent a practical transition from conventional agriculture to Regen Ag. Small, affordable, and incremental steps are the most practical opportunity to move local conventional agriculture towards Regen Ag BMPs.

Regen Ag BMPs in place at Simple Avo include:

- **Mulching**: The soil is being covered with mulch that reduces evaporation and erosion while feeding soil microbes. The orchard was designed to facilitate mulching as a management practice.
- **Water use reduction**: through installation of efficient drip irrigation
- **Biofertilizers**: mycorrhizal inoculation of trees

[191] https://www.cdfa.ca.gov/oefi/healthysoils/
[192] http://calclimateag.org/
[193] https://soilsolution.org/u-s-state-policy/
[194] http://www.oklegislature.gov/cf_pdf/2001-02%20ENGR/hb/hb1192%20engr.pdf
[195] http://www.oklegislature.gov/cf_pdf/2001-02%20ENGR/hb/hb1192%20engr.pdf
[196] https://le.utah.gov/~2015/bills/static/HCR008.html

Carbon Farming:

Andrew Hill

In the test acre's first growing season — which had 24 inches of rain — Russell Chamberlin shows the grasses on the composted section at right, which grew taller by February 2017, and absorbed more carbon, than the non-composted grasses at left.

Figure 61. Grass growing at Chamberlin Ranch after application of compost

Compost application on rangeland

Chamberlin Ranch

Chamberlin Ranch is participating in a locally sponsored Carbon Farming study similar to the Marin Carbon Project where they are spreading compost on rangeland.[197] They have partnered with Community Environmental Council and created a Carbon Farm Plan with the local Resource Conservation District (RCD), which gave them access to CA Healthy Soils Initiative[198] funding through the USDA NRCS.

"Offsetting the greenhouse gas emissions of countywide agriculture by covering 40,000 acres would require over 1.3 million cubic yards, more than three times the amount that the area's certified supplier can produce, according to the Santa Barbara Independent."[199]

Climate Appropriate species selection

[197] https://www.independent.com/news/2018/apr/19/amazing-ability-pasture-grass-sequester-carbon/

[198] https://www.cdfa.ca.gov/healthysoils/

[199] https://thebottomline.as.ucsb.edu/2018/05/carbon-farming-coming-to-santa-barbara

Figure 62. Packaged jujubes sold by Just Jujubes

Just Jujubes

Just Jujubes[200] produce the Asian fruit *Ziziphus jujuba* which are extremely drought tolerant and well adapted to the Cuyama Valley where they are grown. Jujube is a delicacy, being very nutritious with high levels of vitamins and minerals. Processing is very economical, as the fruit dry well in the open air and store for many months at room temperature.

In addition to using very little water in their fruit production, Taff applies their own compost to the orchards to improve soil organic matter and microbial populations which sequesters CO_2 in the soil, which can save as much as 55 metric tonnes CO_2 per acre per year.[201] They also keep honey bees to pollinate their crops as well as provide an additional income stream.

The owner and operator, Alisha Taff is an Asian woman farmer, who make up less than 0.5% of the farming population in the USA.[202] Of the Asian farming population, women make up 80% of the farmers.

[200] https://justjujubes.com/

[201] https://www.marincarbonproject.org/marin-carbon-project-science

[202] https://www.nass.usda.gov/Publications/Highlights/2014/Highlights_Asian_Farmers.pdf

Educational Organizations

Figure 63. Quail Springs Permaculture, Cuyama Valley

Quail Springs

Located in the Cuyama Valley just over the Ventura boarder is the 450 acre Quail Springs Permaculture Farm. This brittle yet beautiful environment has inspired many individuals over the years. With a focus on programming, land stewardship, and community engagement, Quail Springs is dedicated to working with, inspiring and teaching all those that enter its amazing canyon. A particular passion of theirs is a commitment to the legalization of safe, affordable, non-toxic buildings. Through the years they have energized many though their teachings in the field of Permaculture, Natural Building, Nature Connection and especially their Youth Programs. [203]

Layered Agricultural production model that connects small scale producers to the larger agricultural framework

Frinj Coffee[204]

Frinj Coffee, started by Jay Ruskey in Goleta California, has been actively engaged in bringing a new industry to the State. Coffee is typically grown in much more tropical environments yet Frinj Coffee is proving that rare and specialty coffee is a viable and profitable crop within our County and State. Frinj Coffee "brings together the world's leading experts to vertically integrate this developing industry lying far outside the tropics." They offer growers "science forward approaches and services for all stages of coffee production: seed to bean."

[203] https://www.quailsprings.org/
[204] https://www.frinjcoffee.com/

Figure 64. Frinj Coffee, Goleta

Coffee has been successfully integrated into existing avocado orchards allowing for a diversification of offerings for the the producer. Additional species are commonly found within Jay's orchards including Passion Fruit and Dragon Fruit. Frinj Coffee is teaming up with over 25 additional growers to help with production so that the processing infrastructure they are investing in can utilized far and wide. This type of aggregating resources has allowed them to compete in the larger agricultural framework.

7. A Regionally Appropriate Food System Model for Santa Barbara County

Currently, more than 99% of agricultural products grown in Santa Barbara County are exported, and more than 95% of the food we eat is imported.[205] Santa Barbara County farmers growing commodity crops are in direct competition with multinational agricultural corporations. For example, the market price for local avocados is directly affected by imports from Mexico and Chile.

Competition is not the only challenge local producers face in the food system. Other challenges include climate and financial constraints, a lack of local processing and distribution, and coordinated marketing and branding campaigns. The margins are already thin in agriculture, and Santa Barbara farmers have a steeper hill to climb with respect to economic profitability considering the cost of doing business locally.

The question is- can we be food secure in Santa Barbara, and if so what will it take? A sustainable local food system produces the agricultural products and services that are used in the region while managing waste and stewarding the environment.

The food system is very complicated, though there are some very defined elements. A conceptual example of a sustainable local food system includes the 7 components shown in Figure x. below.

1. Production
2. Processing
3. Distribution
4. Access
5. Consumption
6. Waste recovery

Figure 65. Conceptual diagram of a sustainable local food system[206]

[205] https://pubs.acs.org/doi/full/10.1021/es1040317
[206] http://blog.bostonorganics.com/what-is-a-food-system-anyway

Each one of these components offers opportunities for enterprises to integrate into the food system value chain. Beyond just the food system, Regen Ag proposes that we create an integrated resource supply network to help communities meet all their basic needs locally including fiber, building materials, medicine, and more.

Joel Salatin has proposed a 6 component model for Re-Localization[207] similar to Local Food System models that help us to understand the range of roles people and companies can play to build resilience and create jobs that support Regen Ag and local producers.

1. Production
2. Processing
3. Accounting
4. Distribution
5. Marketing
6. Consumers

His family bases their farming operations on 6 guiding principles[208] that support local food system health.

1. TRANSPARENCY: Anyone is welcome to visit the farm anytime. No trade secrets, no locked doors, every corner is camera-accessible.
2. GRASS-BASED: Pastured livestock and poultry, moved frequently to new "salad bars," offer landscape healing and nutritional superiority.
3. INDIVIDUALITY: Plants and animals should be provided a habitat that allows them to express their physiological distinctiveness. Respecting and honoring the pigness of the pig is a foundation for societal health.
4. COMMUNITY: We do not ship food. We should all seek food closer to home, in our foodshed, our own bioregion. This means enjoying seasonality and reacquainting ourselves with our home kitchens.
5. NATURE'S TEMPLATE: Mimicking natural patterns on a commercial domestic scale insures moral and ethical boundaries to human cleverness. Cows are herbivores, not omnivores; that is why we've never fed them dead cows like the United States Department of Agriculture encouraged (the alleged cause of mad cows).
6. EARTHWORMS: We're really in the earthworm enhancement business. Stimulating soil biota is our first priority. Soil health creates healthy food.

7.a. Integrating Small Scale Producers into the Larger Agricultural Framework in SB County

In order for farmers to overcome the challenges mentioned above, we propose some solutions although this list is far from complete. It is beyond the scope of this document and our collective expertise to recommend a thorough action plan, although we hope to stimulate conversation and make a few key suggestions.

Regenerative Agriculture can be practiced at many scales and in a diversity of ways. One desired outcome of Regen Ag is to build connections within the local food system between producers across a range of scales, consumers, and the other stakeholders in the food supply network. On it's own, 'buying local' both decreases the number of food miles (decreasing energy inputs and other costs and externalities) and increases transparency between consumer and producer.

[207] Author's personal communication with Joel Salatin via carbon economy courses hosted at Orella Ranch

[208] http://www.polyfacefarms.com/principles/

There are several ways to address this issue and give local farmers a leg up in the competition. The first most obvious is for farmers to grow non-commodity crops so they are not in direct competition, because they are selling different products. Others include vertically integrating in a way that is accessible to small scale producers so they can add value to their products through processing, aggregation, and distribution.

Due to the diversity of climate types within Santa Barbara County, it is important to consider that multiple bioregions exist within the county and overlap it's boundaries into adjacent counties. We encourage producers to network both within the county and within their bioregional context outside the county.

These farmer to farmer connections can be accomplished with one or more of the BMPs listed above, such as information and tool sharing, aggregation and distribution, leasing, custom grazing and custom leasing, and more. In particular, small scale producers can join together under a local brand or by leasing portions of land from larger landowners to integrate into and compete in the larger agricultural framework.

It is important for individual producers to recognize which scale they are operating at so they can identify opportunities to connect to the larger agricultural framework. As a community, it is also important to understand how these scales interact.

The scales of note include:

- region
- county
- farm
- sub-farm

We list many ways for small scale Regen Ag practitioners to integrate into the larger regional food system in the Economic Regen Ag BMPs section. Of particular note, these include strategies such as

- Growing High Value Specialty Crops
- Food Hubs
- Direct Marketing
- Farmers Markets and CSAs
- Buying clubs
- Leasing
- Develop Local Branding
- Processing and value added infrastructure

Direct marketing

The 'Know your Farmer, Know your Food' program[209] that the USDA initiated a nationwide movement of consumers who value local food and a connection to the farmers who produce it.

Local brand

A locally recognizable brand creates a highly visible tool to communicate with consumers who value locally produced food. This type of brand is relatively easy to set up and has a low barrier to entry for producers, which makes it "low hanging fruit". An example of a local brand is Nevada Grown[210] which is a non-profit that both registers local producers and educates consumers about the where and how to get access to local agricultural products. One example of a local brand that could be developed is Gaviota Grown.

[209] https://www.usda.gov/sites/default/files/documents/KYFCompass.pdf
[210] https://nevadagrown.com/about-nevadagrown/

Integrated food system concepts

A regionally appropriate food system is likely to integrate many Regen Ag BMPs such as this conceptual model of a Food Hub which includes a buying club, aggregation-distribution infrastructure, processing infrastructure, retail storefront, restaurant, and farmer networking facilities (see figure 66).

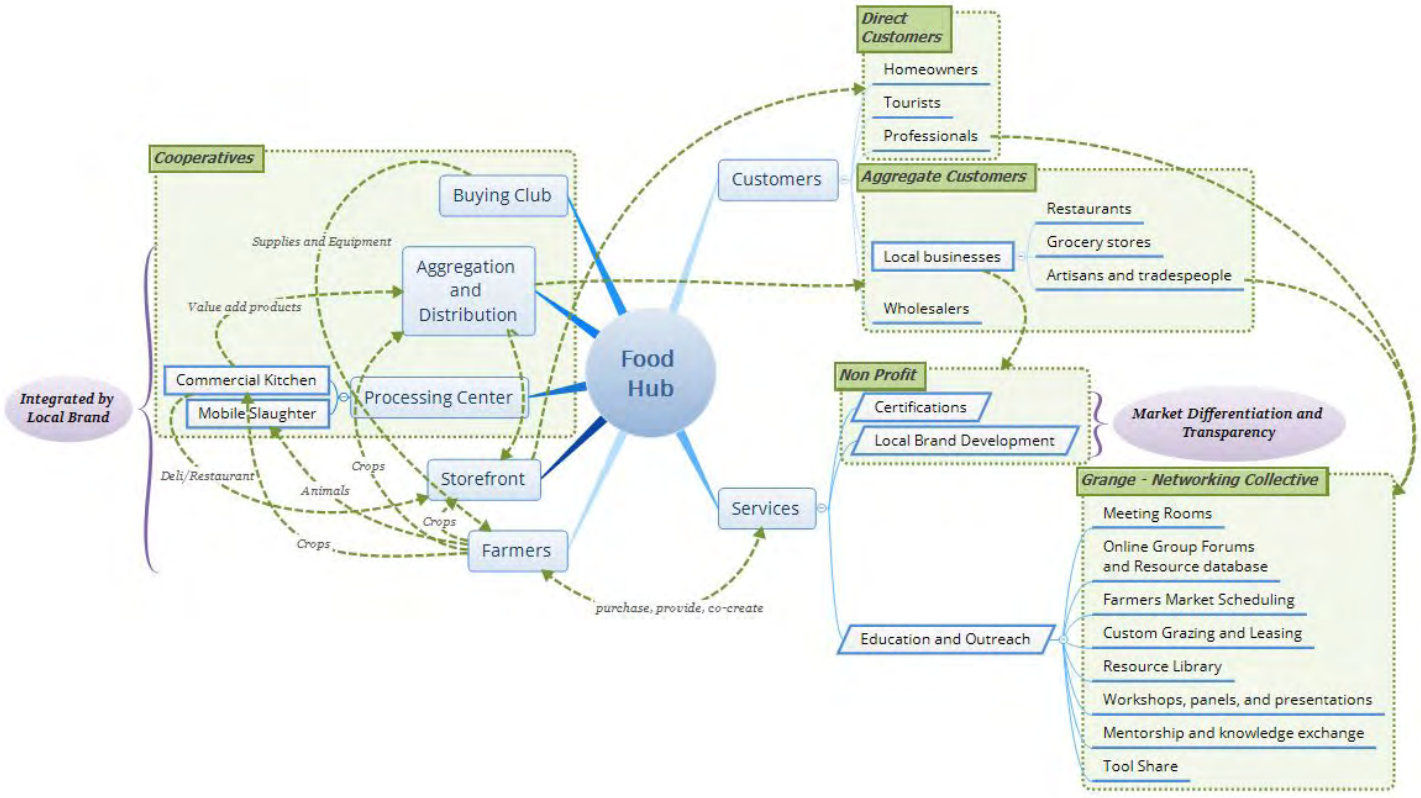


Figure 66. Integrated BMP concept map centered around a Multifunction Food Hub

7.b. Redefining Scalability

Economy of scale is a real challenge for the agricultural sector with competition from foreign markets based on commodity crops sold on the global market. One response is to get bigger- to scale up operations to a size that lowers costs per unit, therefore increasing net profit. This is the conventional approach to scaling up, which has been promoted by the USDA since the 1970's and this dogma is directly responsible for the decline of diversified family farms and the rise of industrial scale agricultural enterprises.

In contrast to this method of scaling up, the Regenerative Agriculture response is to replicate many small scale systems in order to reach an economy of scale. For example, many growers in a region cooperate to produce a single product which is aggregated to reach scale. This is a common practice of Cooperatives like Organic Valley and other growers for larger companies. The cooperative serves as the buyer, the packing house, and distribution center for small scale growers so together they can supply larger markets.

Scalability is also applicable on the individual farm, as it often requires less capital to replicate a simple small system like a chicken tractor that houses 50 birds, than is it to build a single large chicken housing facility. Also, the smaller units allow for more flexibility with planning and adaptability to climate and market factors. It is easier to upsize (or downsize) by just adding (or removing) individual production units.

Fig 67. Aerial photo of Polyface Farms chicken tractor operation. Each tractor houses 50-60 meat birds.

Figure 68. Egg layer mobiles for pastured poultry towed by tractors and combined with electric fence to follow cattle grazing rotation. from Taranaki Farm, NZ

Another aspect of scale applies to accessing markets themselves. The conventional approach of scaling up requires that the farmer have access to wholesale markets where margins are thin. The Regenerative

Agriculture approach is to scale your production to meet the demand of local direct markets. Often this means keeping production limited in order to not flood the local market and reduce the need to sell wholesale or compete in the commodity markets against foreign imports.

7.c. Climate Appropriate Crops for Santa Barbara County

Crop selection is the cornerstone of successful agricultural projects. Selecting the right crop is an inexact science, culminating in an intersection of market research; hydrology, geology and soil biology; climatology and meteorology; botany and plant morphology, and just plain intuition. However, the first and foremost consideration after "Can you sell it?" is "Does it grow well in your climate?" In other words, is the crop climate appropriate?

By "climate appropriate" we mean crops selected for agricultural production should satisfy certain criteria:

- The crop is adapted to the local climate and soils, and does not require much supplemental irrigation or fertilization
- The crop has high value economically and/or nutritionally
- The crop is suited to mechanization and commercialization
- There exists management protocols from other regions that can serve to inform the local industry

Many of the commodity crops currently grown in the County would not satisfy these criteria, therefore they are not at the top of our list for recommendations. However, we feel that crops that are on the edge of their ability to naturalize and survive without supplemental irrigation and fertilization are acceptable to grow as cash crops on a scale that is sustainable for the particular context of the farm ecosystem.

We developed an extensive plant species matrix (see Appendix) that includes many options for crops appropriate to the Santa Barbara County Bioregion in the regenerative agriculture context. It is only a preliminary list and by no means is it exhaustive or complete. Because there exists a wide range of climate and economic contexts in Santa Barbara County, we encourage practitioners to select crops that are most appropriate to their context based on their own research. At this stage both BMP specifics and crop selection are prime areas for innovation and creativity.

A challenge with introducing new and exotic crops is a lack of infrastructure and industry surrounding commercialization of the products. Challenges include customer demand for the crop may be low or limited to specialty markets, a lack of local knowledge of crop management and harvest practices, no local processing or aggregation facilities, and little coordinated market development. Many of these challenges represent opportunities for innovation and development of new products and markets.

Indeed product development and crop research has been a prime focus of the University of California Cooperative Extension which has been trialing new and exotic crops in both California and Florida with the goal of diversifying the local crop selection beyond commodity crops.[211]

[211] http://sfp.ucdavis.edu/pubs/brochures/Exoticfruits/

7.d Integrating Crops and Practices into a Synergistic System

Integrated agroforestry and Regen Ag design proposal

Orella Ranch

Orella Ranch located on the Gaviota Coast is an example of an early adopter of Regenerative Agriculture practices. They have developed a plan to implement a variety of Regen Ag BMPs including Silvopasture, Alley Cropping, Livestock integration, Planned Grazing, Leasing, Nested Enterprises, a Conservation easement, and more. While this plan is for the whole ranch, they are implementing it incrementally, starting small and building on success through modular scalability and addition of nested enterprises. They have also successfully leveraged available funding through the NRCS EQIP and are currently working with the Cachuma RCD to produce a Carbon Farm Plan.

Figure 69. Orella Ranch concept plan for integrated Regenerative Agriculture

8. Barriers to Local Adoption of Regen Ag

Regenerative Agriculture is an emerging field with many barriers to adoption and, concurrently, opportunities for a renewed agricultural system. At the core, the main barrier to adoption of Regen Ag is a cultural barrier, which includes not only attitudes and opinions, but regulations and laws. It has been said that we need a "Climate Change of the Mind".

We continue with the 3 Themes of Environmental, Socio-Cultural, and Economic layers to frame the barriers to adoption. Below we identify some of these barriers and we offer some suggestions as to how to address these in Section 8.b..

Here we identify several categories of barriers to adoption that fit within each theme. The barriers listed are not intended to be comprehensive rather to stimulate conversation about how to overcome barriers locally and incentivise the adoption of Regen Ag BMPs. New barriers are likely to be identified and addressed as practitioners and policy makers continue to innovate and develop Regen Ag BMPs in the region.

List of Regen Ag Barriers

- Environmental Barriers
    - Lack of Local Pilot Projects:
    - Standardizing Monitoring Protocols
    - Practicality
- Socio-Cultural and Regulatory/Legal Barriers
    - Cultural Barriers
    - Regulatory and Legal
    - Access to Information
    - Local Processing
    - Employee Housing
- Economic barriers
    - Access to Markets and Branding
    - Land Values
    - Land Access
    - Estate Planning/Inheritance Tax
    - Economic and wage challenges

Environmental Barriers

Lack of Local Pilot Projects

Globally there are many successful examples of Regen Ag that have existed for hundreds of years, for example the Dehesa and Montado systems of Spain and Portugal respectively. However solid case studies are lacking in Mediterranean Climate Regions and in North America specifically. Reasons for this parity are many, mostly due to the emergent nature of the field and a lack of consensus on what the definition and practices are for Regen Ag. Regulations and financial barriers are also impediments to project development.

Standardizing Monitoring Protocols

When in comes to things like monitoring "increases in soil health" it is important that we are all comparing "apples to apples". In particular, soil carbon sequestration rates are one metric that is extremely important to the overall effectiveness of Regen Ag (especially in climate change circles) and the measuring of this is not yet standardised.

Practicality

A major barrier to implementation of specific practices is the practical reality of implementing them in a cost effective and efficient way. Furthermore the required materials, expertise, and facilities may not be available locally. Innovation is required, and cooperation among practitioners and producers will support the evolution of ideas and practices.

For example, offsetting all of the CO_2 produced in Santa Barbara County would require applying compost to 40,000 acres of rangeland. First of all, the quantity of compost required is beyond the current supply locally. Secondly, actually applying compost on 40,000 acres may not practical nor feasible considering access and weather issues.

The point is that there are no silver bullets, and that specific practices have limitations and may only be effective in certain contexts. For this reason a suite of options is ideal in order to give more options.

Socio-Cultural and Regulatory/Legal Barriers

Cultural Barriers

The status quo of conventional agriculture has a lot of momentum, and like a large ship its course takes a long time to correct. This transition requires at its core a profound paradigm shift, hence smaller shifts are preferable, which over time will reach the same goal.

Furthermore, conventional agricultural interests lobby regulators to support their way of doing business, and often have a lot of funding and influence behind them. As such, the political arena is a dangerous place for out of the box thinking, however the writing is on the wall for conventional agriculture and they recognize that their way of life may be threatened if some of the environmental and socio-cultural issues aren't addressed. The proverbial tide is turning. It is becoming clear that these issues are non-partisan and affect us all.

Desire for a silver bullet:
As a culture, we look for silver bullets. however, it's important to recognize that all the BMPs we have recommended are best applied in an appropriate situation and should not be looked at as one-size-fits-all treatments.

Regulatory and Legal

Incentivising environmentally beneficial changes is one of the best way to create on the ground beneficial action in a timely manner. Unfortunately our system is set up completely opposite of this. The County Regulatory system actually disincentives many positive changes making landowners hesitant and resistant to changing status quo management practices.

For example, improved grazing management practices can oftentimes bring about an increase in native grasses. Since many of these native grasses are perennial they improve rangeland resilience to drought and floods

(deeper roots access water longer and deeper roots "stitch" the soil together creating less erosion and runoff). You would think that these improvements to rangeland health through an increase in native perennial grasses would be celebrated and incentivised. Unfortunately the opposite is true. For purposes of resource evaluation in Santa Barbara County, a native grassland is defined as an area where native grassland species comprise 10 percent or more of the total relative paddock[212] Once a native grassland designation is made then it is considered Environmentally Sensitive Habitat (ESH). Once you have ESH identified on your property your flexibility of management decisions is severely restricted and grazing all together may be terminated.

An additional example is in regard to attracting endangered species. If landowners utilize non lined water impoundment to successfully slow spread and sink water within their landscapes it will often times attract tiger salamanders and red legged frogs- two species currently on the threatened and/or endangered species list.

Again if landowners are creating the conditions for these species to thrive you would think that they would be congratulated and incentivised to do so. However, once a threatened/endangered species has been identified on an individual's property this ESH designation will hamstring there operation detrimentally. Local efforts such as the Gaviota Planning Advisory Committee suggested protections to tackle this issue with adopting something like the federal "Safe Harbor Agreement" legislation. (A Safe Harbor Agreement (SHA) is a voluntary agreement involving private or other non-federal property owners whose actions contribute to the recovery of species listed as endangered or threatened under the Endangered Species Act (ESA))[213]. This protects landowners from unrightful damage. Unfortunately this was not adopted and the issue remains.

The same is true for planting native species. Many landowners would like to reap the benefits of native plant species for things such as pollinator hedgerows and integrated pest management yet this fear of having ESH on their property disincentivizes this them from doing so. Actually it does the opposite. It is not uncommon for landowners to remove native vegetation for fear of being overly regulated.

Because many Regen Ag practices are innovative and integrative, current zoning regulations and other food system and safety regulations can be expensive, burdensome, and prohibitive to small operations. There is also some confusion in regard to permitting of some of these practices. For example, the County of Santa Barbara recognizes grazing and cultivation as two forms of agricultural production. There are two different permit paths for each, so it begs the question how will the County view silvopasture, which is a system integrating trees within a rangeland environment? Will it be regulated as cultivated ag or grazing?

Water use and storage regulations are major challenges to Regen Ag development in SB county. This includes the intersection of many regulatory agencies and regulations. For example pond based water storage is often difficult to develop due to expensive grading and excavation permits even when water rights are available. The statewide measure 'Sustainable Groundwater Management Act' is coming into effect which will regulate use of groundwater by basin and is likely to affect groundwater availability and cost for producers.[214]

The success of many of the Regen Ag operations are reliant on accessing the value added market and therefore processing. Many existing regulations are in conflict with this goal as zoning laws often do not allow processing in agricultural zoning. For example a local walnut farmer in our area was unable to shell his walnuts on site because that was seen by the County as "processing beyond the raw state" and that was not an allowable use in his agricultural zoning.

[212] https://www.countyofsb.org/ceo/asset.c/479
[213] https://www.fws.gov/endangered/landowners/safe-harbor-agreements.html
[214] http://groundwater.ucdavis.edu/SGMA/

Processing of animal products and slaughter facilities. Regen Ag has a strong focus on animal welfare and on site slaughtering (or as close by as possible) reduces the stress of long distance travel for animals going to slaughter and is therefore ideal. Unfortunately our current regulations prohibit selling meat processed on site unless it is a state licensed facility, for obvious health and sanitation reasons. However, the costs and regulations associated with building and operating a slaughter facility are very prohibitive. Other regions have successfully stories in this regard but nothing in the overburdensome regulatory context of the west coast.[215]

Similar to access to markets, lacking a standardised, adopted certification program there is little regulatory protection for the consumer. Until a legal definition exists for Regen Ag there will remain a challenge in this area.

Access to Information

Regenerative Agriculture is a relatively new term for practices, or a sum of practices, that may in fact be very old. Due to its unfolding maturity, access to information about what it actually means and how to practice it is limited.

Local Processing

Much of our processing infrastructure has been lost or severely consolidated over the last 50 years. Laws around processing can be draconian and overburdensome. For example a local walnut grower was unable to shell his walnuts onsite due to it being seen by the county as "processing" and therefore not permissible. Meat processing (beef, pork) is another more challenging issue. Meat that is processed to be sold must be slaughtered in a facility inspected by a USDA food safety and inspection service. Unfortunately, there are no licensed meat processors in the County, the closest being a 2 hour drive one way. Options are extremely limited and often those that exist do not satisfy the ethical treatment of animals ideology of the Regen Ag movement.

Employee Housing

Many of the practices and philosophies of Regen Ag are opposite of conventional mono-cropping agricultural norms. Go Big, mechanize, chemical treat, reduce labor etc are not supported within the Regen Ag movement. Repopulating the agricultural landscape with well cared for, vested and inspired agrarians, stewards and growers of our food will take housing these families on or within close proximity to the land. Current employee housing laws are extremely costly, burdensome and time consuming. Per personal conversation with someone who just went through the it, the process is anything but straightforward. Just permit fees alone totalled more then $15,000 and this is just fees- not the costs of all the required reports/tests, studies etc.

Economic Barriers

Access to Markets and Branding

Without a well accepted certification program for Regen Ag, marketing products with this claim is of little value. Success in the marketplace will require a well known knowledge of what Regen Ag stands for. It can be surmised that Regen Ag producers may be small in production size and therefore need to aggregate resources to gain access to markets.

[215] https://www.whiteoakpastures.com/

Land Values

Agricultural land values within many areas of Santa Barbara County are anything but conducive to agricultural viability. Farmland in Santa Barbara County on average is priced close to $40,000/acre which is almost ten times the national average.[216][217]

Land Access

There exists a disconnect between available land and those folks desiring to care for, nurture and work that land productively. There does not seem to be the opportunities to have face to face conversations within our community such as town hall meetings, granges and other community strengthening occasions. The aging generation that tends to have access/ownership of land tends to not be as social media savvy as the generation desiring the access to land and opportunities.

Estate Planning/Inheritance Tax

This is a moving target based on current federal administration policy. Also, knowledge as to how to deal with multigenerational transfer of land is challenging to acquire without substantial costs and specialized knowledge. Many aging landowners wait until it is too late to address these issues and a huge burden falls upon the next generation.

Economic and wage challenges

There is a clear inequality between farm worker labor and large landholders, the often times multinational entities, that operate farming enterprises. Adoption of a living wage can be challenging when margins are tight like many ag operations experience in their start up phase.

[216] https://www.landandfarm.com/search/CA/Santa-Barbara-County/Farm-for-sale/
https://www.loopnet.com/california/santa-barbara-county_farms-for-sale/
[217] https://www.usda.gov/nass/PUBS/TODAYRPT/land0815.pdf

9. Transitioning to a Regenerative Agriculture

9.a. Increasing Adoption

The Climate of the Mind

It must be acknowledged that in many contexts the transition from conventional agriculture (what we would call degenerative ag) to a regenerative system may require a huge shift in management and design, and often these shifts are too drastic for managers to adopt completely at the outset. For this reason we advocate "baby steps" in transition to allow both the management team and the operation itself to adjust and adapt to the new methods.

While the gold standard of Regen Ag is the idealized state, we must make compromises and work with people where they are at and with the tools at their disposal, understanding that we have similar goals. We have to start somewhere, otherwise we won't get anywhere.

Diffusion of Innovation

Currently, there exists an extensive network of practitioners, consultants, and companies that are integrating Regenerative Agriculture into their professions and practices. Because this is a relatively new movement, most people involved fall into the Innovator and Early Adopter categories on stages of Diffusion of Innovation as developed by Everett Rogers.

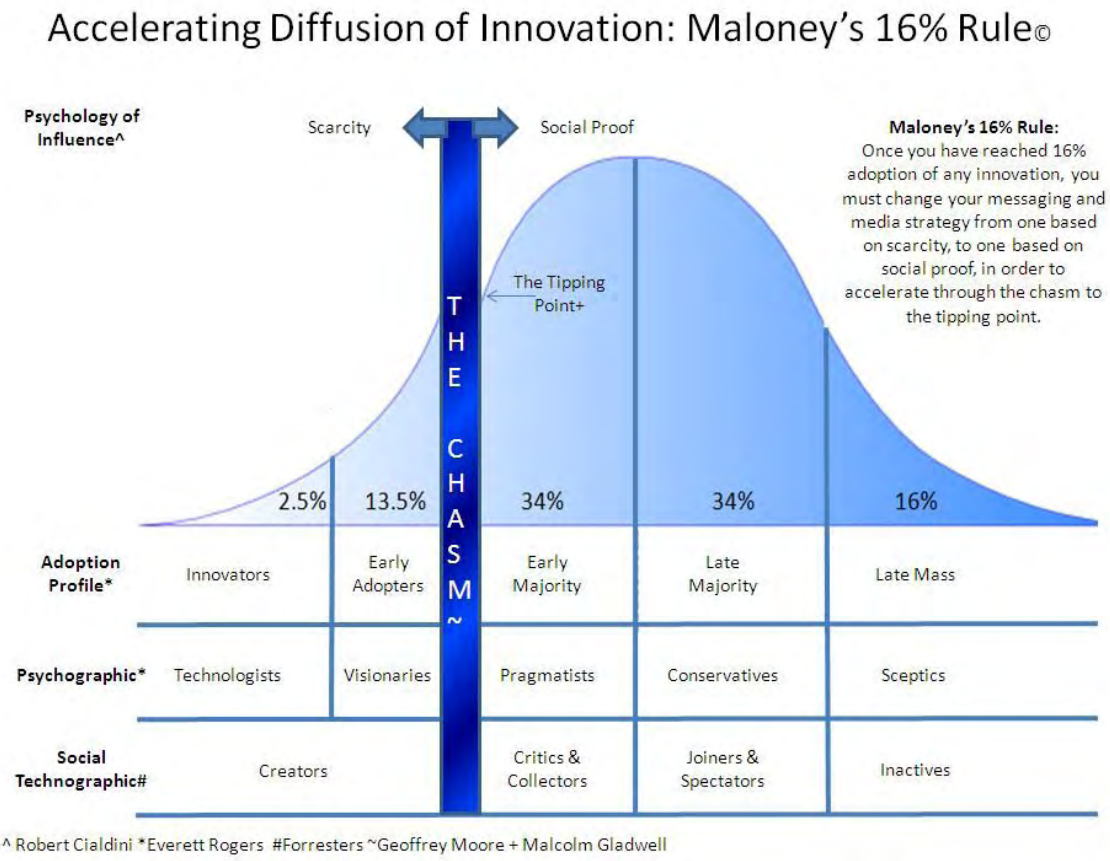


Figure 70. Tools for Accelerating the Diffusion of Innovation.[218]

[218] https://innovateordie.com.au/2010/05/10/the-secret-to-accelerating-diffusion-of-innovation-the-16-rule-explained/

One of our primary goals with drafting this report on Regenerative Agriculture Best Management Practices (BMPs) is to facilitate 'crossing the chasm'- to shift practitioners from Early Adopters to the Early Majority stage. To encourage adoption, we're acting on Rogers' 5-step decision making process. To put it bluntly, we want people to decide to adopt and implement these Regenerative Agriculture BMPs. Here we're focused on the Persuasion stage with our attempt to provide information on the Relative Advantage, Compatibility, Complexity, Trialability, and Observability of each Regenerative Agriculture Innovation.

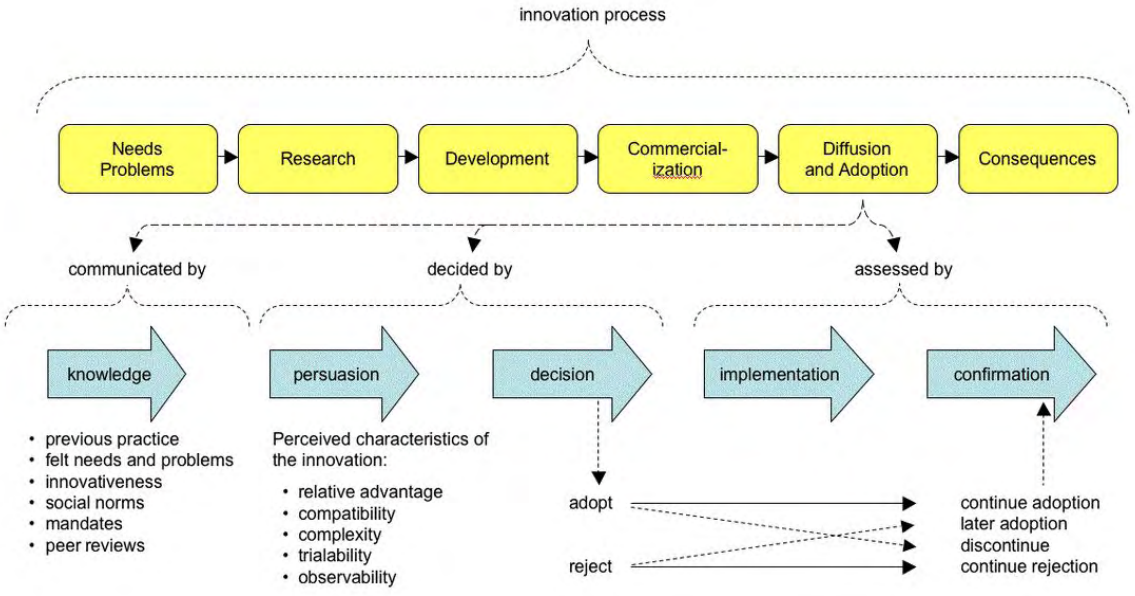


Figure 71. The five stages of adoption of novel ideas. [219]

9.b. Breaking down the Barriers

To support adoption of Regenerative Agricultural Practices we must address ways to overcome the barriers identified above. Below are suggestions for addressing solutions to each one of these known barriers. There are likely more barriers that we haven't identified which should also be taken into consideration as this document evolves and the conversation continues.

We continue with the 3 themes of Environmental, Socio-Cultural, and Economic layers to frame the opportunities to overcome the barriers listed in Section 8.

The Barriers we identified are:

- Environmental Barriers
    - Lack of Local Pilot Projects:
    - Standardizing Monitoring Protocols
    - Practicality
- Socio-Cultural and Regulatory/Legal Barriers
    - Cultural Barriers
    - Regulatory and Legal
    - Access to Information
    - Local Processing
    - Employee Housing

[219] https://hl250group5.weebly.com/core-constructs.html

- Economic barriers
    - Access to Markets and Branding
    - Land Values
    - Land Access
    - Estate Planning/Inheritance Tax
    - Economic and wage challenges

Environmental Barrier Solutions

(Lack of) Local Pilot Projects

Supporting and incentivize more pilot project sites implementing Regen Ag practices is the only way to "ground truth" many of the claims within the movement. Since every context is different, the more sites implementing these practices the better. Support for local pilot projects can be generated from the general public through volunteer labor or crowdfunding, the private sector through investment and venture capital, and municipalities and governments through grant programs (ex. the LEAF program) and streamlined permitting.

Standardizing Monitoring Protocols

Standardized Monitoring Protocols include incorporating mutually agreed upon and defined monitoring practices in order to measure specific metrics and outcomes of Regen Ag systems. Statements such as "increased land health" are fairly ambiguous yet can easily be justified once the metrics are agreed upon. The standardization of our collective monitoring protocols is imperative from a scientific perspective, as consistency is the only way to gather statistically significant data.

Standardized monitoring protocols have not yet been developed for evaluating soil carbon sequestration values and other metrics, but there exist a few strategies that are being used. Considering there are no real standardized metrics the best method is to create replicable testing in situ which shows change over time, as opposed to measuring specific metrics and comparing across sites. More work is needed to coordinate efforts across the County to ensure any data we are gathering is as consistent as possible.

Practicality

Innovation will be required in order to overcome some of the practical barriers to implementation of Regen Ag practices. Innovation can come out of combining multiple practices in a synergistic way, in addition to new practices, systems, and tools.

Cooperation among practitioners and producers will support the evolution of ideas and practices, and hence increasing the dissemination of information and also creating opportunities for practitioners to communicate with each other is important.

Socio-Cultural and Regulatory/Legal Barrier Solutions

Regulatory and Legal (Challenges)

The regulatory and legal environment present big challenges to not only Regen Ag but agriculture in general. Since Regen Ag often incorporates diversified enterprises the black and white nature of our regulatory system is often challenged. We are presenting "out of the box" thinking which is often new to regulators and hence no previous pathway to compliance has been demonstrated.

The State has been a leader in progressive regulation, however our County has yet to choose to "opt in" to some of these programs in order for local producers to benefit (for example AB-626 California Homemade Food Act,

AB-2168 Farm Stands Direct Marketing[220], Proposition 64 Adult Use of Cannabis Act, and accessory dwelling units to name a few). Recently however, the County did pass the Home Occupation Supplement to the Land Use Development Code (Sec. 35.42.190) which created a permit process for small scale businesses to operate from residentially zoned parcels[221]. The recent Gaviota Plan update[222] has some progressive sections namely the Agricultural tiered permitting structure which allows for some additional land uses which are permitted based on their scale.

As seen recently in regard to cottage food laws, farm stands, home occupation, cannabis, and accessory dwelling units, it is often the State that is progressive in changing laws that hamstring innovation, progress and subsequently success. We suggest the creation of a public interest lobby group (perhaps as a spin off of the working group proposed above) to present to the county Board of Supervisors to incentivise Regen Ag operations by offering, for example, streamlined permitting for experimental agricultural operations and/or research farms that are providing measurable public benefit through ecosystem services by implementing Regen Ag BMPs. This could develop into the working group drafting new regulations (and modifying old ones) to support Regen Ag at the county level.

Access to Information

Information sharing from knowledge and experience is key to the success of the movement. This document itself is intended to increase access to information for stakeholders in the County. Field days, seminars, trainings, informal barbeques and events, online web portals and discussion forums are all ways to increase access to information for farmers and ranchers. We propose the information in this document be condensed into Regen Ag BMP Fact Sheets and/or Field Guides for farmers and ranchers to make this information in this document more accessible.

Furthermore we propose the creation of a local "Regen Ag Working Group" to provide a very clear and accessible way for farmers to learn about new practices and share their own. This group could meet monthly or quarterly and feature one local farmer and their project which either highlights a Regen Ag practice or presents a unique challenge that the group can weigh in on. The working group can also forward Regen Ag in the county by hosting events to educate the general public on the practices and issues.

Local Processing

Local processing includes the ability for farmers to process their agricultural products beyond the raw state, and the also includes the capacity of local processors to handle local products. The California Homemade Food Act [223], signed into law in 2012, allows home processors to process and sell jams, pickles and other foods with low risk of foodborne illness. In September 2018 Governor Brown signed into law AB626, (Homemade Food Operations Act) a groundbreaking new law that allows people to sell food they have prepared in approved home kitchens directly to the public with far more opportunities than the previous law passed in 2012. A poultry meat processing exemption from the USDA allows small scale poultry processing without an inspected facility. Although many of these progressive state laws are great for the local food movement, again SB County needs to "opt in" to these programs to make them available to producers locally.

[220] http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200720080AB2168
[221] http://applications.sbcountyplanning.org/PDF/C/Hazardous%20Waste%20Materials%20Supplement%20Form.pdf
[222] The GavPac Gaviota Plan is currently being finalized. A draft can be found here: http://longrange.sbcountyplanning.org/planareas/gaviota/NewGaviotaHomePage.php
[223] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB626

Employee Housing

Permit requirements and eligibility for employee housing vary based on zoning and scale of operations. The recently adopted Gaviota Coast Plan has reduced permitting requirements within the Gaviota Plan Area. Other areas of the county have older regulations that may need updating considering the current rise in living expenses and associated challenges to farm workers. The County is currently working on adopting a farm worker housing program to address these challenges.

Economic Barrier Solutions

Access to Markets and Branding

Access to Markets includes the ability for a farmer to sell their produce in a timely manner for a fair price. This is the most important economic consideration for agricultural enterprises, regenerative or not- if you can't sell your products, you aren't in business. Small scale farmers struggle to compete with larger farms and imported products, and often retailers will prefer larger suppliers because they offer consistency of quality and supply. However, access to markets seems to be improving everyday. Environmental awareness, the importance of nutrient dense foods, the local food movement, climate action through our choices are considerations which influence consumers purchasing choices. Certification can help educate consumers on their purchasing decisions and keep them in line with their values. Aggregation and Cooperatives are ways for small scale farmers to create a supply of product that can compete in a larger marketplace (see Case study on Frinj Coffee). Direct marketing is important for many small farmers as they can see much higher profits than selling wholesale. We propose the SB Certified Farmers Market adjust their charter to prioritize local producers (from within SB County) or open another market which sells only local products, including crafts and Cottage Food Products such as preserves, jams, jellies, and baked goods. Over time as more producers come on line farmers markets could expand their locations and timing across SB county with a focus on providing access to metropolitan buyers for rural farmers.

Land Values

Although land values are market driven, there are ways to mitigate high speculative land values associated with some of our agricultural lands within the County. The Williamson Act[224] of the State of California (officially, the California Land Conservation Act of 1965[225]) is a California law that provides relief of property tax to owners of farmland and open-space land in exchange for a ten-year agreement that the land will not be developed or otherwise converted to another use.

Another option for landowners to reduce their speculative value is to enter into a conservation easement agreement. A conservation easement is a voluntary legal agreement between a landowner and a land trust or government agency that permanently limits uses of the land in order to protect its conservation and or agricultural values. There are many options to customize these agreements and many are focused on preserving agriculture and/or open space. They most often are a deed restriction and therefore tied to the land and not any particular ownership (perpetuity). Locally we have the Santa Barbara Land Trust[226] who is active within our region as well as the California Rangeland Trust[227] which is a statewide organization.

[224] http://www.conservation.ca.gov/dlrp/lca
[225] http://www.conservation.ca.gov/dlrp/lca
[226] https://www.sblandtrust.org/
[227] https://www.rangelandtrust.org/

Land Access

The amount of agricultural land in Santa Barbara County that is fallow is extensive. Creative lease agreements with landowners is one way to create access to land for new farmers. Organizations such as California Farm Link[228] specialize in partnering agriculturalists looking for land to land owners looking to sell, lease or partner.

Complementary nested enterprises that have synergistic benefits to existing operations are a way to allow access to beginning farmers for their own enterprises and "stack functions" on a given piece of land. Examples of this may be a pastured poultry operation that follows the movement of a cattle herd. The chickens benefit from the grubs and larvae growing in cattle manure, and the land benefits from the spreading of the manure and the cattle benefit from the reduction in vector carrying flies.

Labor Issues

Worker owned cooperatives and dynamic equity sociocratic business structures create a win win solution to labor issues. When everyone is an owner there are no employees, and hence no wages besides those generated as profits. This is a drastic difference to the status quo and may present the biggest challenge to the movement.

Our colleagues are working on a dynamic equity[229] Corporate Constitution which will be applicable to agricultural projects and promote equitable distribution of profits. Honoring alternative forms of capital other than "financial" capital (see 8 Forms of Capital[230]) is another method to remunerate employees where applicable.

Estate Planning and Estate/Inheritance Tax

Succession planning is the proverbial "elephant in the room" for many large agricultural properties that have been in the family for generations. Often the assessed value of the land (and hence property tax) is far below the current market value due to assessment taking place many decades prior. The "Inheritance Tax" rate is now US$11.8M which only affects a small percentage of agricultural properties in Santa Barbara County, but it can force the sale of larger properties if the heirs are not able to cover the tax and subsequent property taxes. This rate is based on current Federal administration and can change at any time. Estate planning is a delicate subject and each family has their own context, expert council is recommended for each individual situation. The most important piece is that estate planning should be given priority, and not left for the last minute.

9.c. Additional Opportunities for Action:

We listed many topic specific opportunities to support local adoption of Regen Ag practices in Breaking down the local barriers to Regen Ag. In addition, many of the opportunities to fund and support the development of regen ag are emerging from the global climate change mitigation efforts as well as the general increase in awareness of how and where our food comes from.

These include

- emerging markets for carbon and ecosystems services[231]
- government programs to improve healthy soil practices and ecosystem health
- research funding for university studies on regen ag

[228] https://www.californiafarmlink.org/
[229] https://slicingpie.com/how-to-use-a-dynamic-equity-split-program-so-everyone-gets-what-they-deserve/
[230] http://www.appleseedpermaculture.com/8-forms-of-capital/
[231] https://www.forest-trends.org/ecosystem_marketplace/the-economics-of-activating-dirt-to-absorb-greenhouse-gasses-and-restore-soil/

- philanthropic efforts to support regen ag practitioners
- community awareness of the connection between agriculture and the environment

Government support

Government support comes from many levels and in many forms. The Natural Resource Conservation Service (NRCS) has offices throughout the country with our local one being in Santa Maria. Housed in the same building as the NRCS is the Cachuma Resource Conservation Service (CRCD) which is a non regulatory state agency. Both of these agencies are committed to helping land managers and producers improve their operation and increase its conservation value. Multiple programs exist and their assistance is free of charge.

Federal

1. Natural Resource Conservation Service (NRCS)
    a. Natural Resource Conservation Service (NRCS) Environmental Quality Incentive Program (EQIP) is a grant funding source that is ideally positioned to promote and support ecosystem restoration and stewardship for agricultural producers and land managers. They provide cost shares and other types of funding.
    b. Get Started with NRCS[232]
    c. EQIP How to apply[233]
    d. California payment schedule[234]

State

1. Resource Conservation District (RCD)
    a. A State organization with a mandate to help farmers and rancher become better stewards providing education, technical assistance and large-scale planning. They work closely with many local, state and federal government agencies, non-profit organizations, private landowners and public land managers on an array of programs that balance economic and environmental goals. Their expertise in helping farmers, ranchers and landowners navigate laws and permits as they pertain to projects is especially helpful. Additional access to funding is also a strong point for them.[235]
    b. Carbon Farm Plans
        i. The local Cachuma Resource Conservation District (CRCD) has been developing Carbon Farm Plans for willing landowners within the region for a few years now. "Carbon farm planning is similar to established NRCS Conservation Planning. But it differs from other approaches to agricultural conservation planning by focusing on increasing the capacity of the farm or ranch to capture carbon and to store it beneficially as soil organic matter (SOM) and above ground in permanent vegetation."[236] This new way of thinking is opening the door to looking at agricultural lands as not only producers of agricultural products but as sources of Ecosystem Services as well. Past precedence has shown that having a Carbon Farm Plan for a given property is a good stepping stone to receiving additional funding through sources such as State Cap and Trade monies.
2. UC Extension
    a. UC Extension provides farmer education and research. In particular they provide continued programming that educates and empowers farmers about the opportunities and benefits of improving ag lands. They provide educational programs for county residents on topics of agriculture, foods and nutrition, food safety, and food preservation. Their new Livestock &

[232] https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/newsroom/features/?cid=stelprdb1193811
[233] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ca/programs/financial/eqip/?cid=nrcs144p2_063961
[234] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/?cid=nrcseprd1328227
[235] http://www.rcdsantabarbara.org/
[236] https://www.marincarbonproject.org/carbon-farming/carbon-farm-plans

Range advisor is committed to improving the state of our rangeland as well as Regen Ag practices.[237]

3. California Coastal Commission (CCC)
    a. The Coastal Commission's mandate is to uphold the California Coastal Act of 1972. The Coastal Act "includes provisions to protect and enhance coastal resources and land uses, including agriculture. Strong protection of agricultural lands and the agricultural economy in the coastal zone is mandated by the Coastal Act. These protections include requiring that prime agricultural lands be maintained in agricultural production, restricting the conversion of agricultural lands to other land uses, conserving agricultural soils, and promoting long-term agricultural productivity."[238] Since the mission of the CCC is to protect and enhance the California Coast we would like to believe and make a case that support for Regenerative Agriculture is warranted.

County

1. County Law (Land Use Development Codes, Local Coastal Plans and Community Plans)
    a. These plans all endorse agriculture along with support for, and strong protections for, natural resources. These go hand and hand with Regen Ag and can be adapted to incentivize adoption. Although actual ordinances differ from community to community and inland to coastal the general focus is to promote the success of agriculture. The opportunity lies in expanding these laws and regulation in incentivize Regen Ag practices throughout the county thus adding to the rapid adoption of Regenerative Agriculture.

Community Support

Our community has proven that it is passionate about the environment, global climate issues and about the local food movement. Regen Ag offers a bridge between all three of these.

1. SB Food Action Plan: The development of the SB Food Action plan shows the commitment our community has to local food movement. The opportunity lies in implementing this plan.
2. Rancher to Rancher Program[239]: The Rancher to Rancher program is a good example of fellow ranchers and land stewards sharing knowledge and experiences about how to better manage their landscapes. They have hosted workshops and trainings on various properties within the state.
3. Livestock and Land[240]: This organization assists livestock property owners interested in implementing Best Management Practices (BMPs) through:
    - Free site visits and consultations
    - Workshops and trainings
    - Publications and brochures
    - Funding assistance for land improvements
4. Philanthropy: As agriculture and its ability to improve ecosystem services is better understood, more money from foundations and private philanthropist will become available. Regen ag research and development will undoubtedly benefit from this.
5. Crowdfunding investment: Communities that are committed to supporting agriculture that benefits the land have an opportunity to put their money where their mouth is. Crowdfunding makes this possible and is an exciting new development not before available.

[237] http://cesantabarbara.ucanr.edu/
[238] https://www.coastal.ca.gov/agriculture/
[239] https://soilcarboncoalition.org/R2R/
[240] https://livestockandland.org/

Local Development Threat

Threat as an opportunity: The growing development pressure within our County provides an opportunity to take action and preserve open space and productive agriculture lands before they are lost to residential, commercial or industrial development. Many members of our community are passionate about this and will provide support and money to see key properties protected.

9.d. Action Plan for Adoption

3 Step Transition Plan

We propose a simple step-by-step plan for farmers and ranchers to follow in order to develop their project with Regen Ag Principles, in order to achieve the Desired Outcomes.

3 Step Transition Plan for Adoption of Regen Ag:

1. Apply Best Management Processes
    a. Site Inventory following the Regrarians® Platform
    b. Goals Clarification, Holistic Context, and Financial Planning
    c. Project Design following Regrarians® Platform and guided by the Principles of Regen Ag
2. Implementation of project to achieve Desired Outcomes by following Best Management Practices
3. Complete the feedback loop: Monitor and adapt based on feedback to achieve Desired Outcomes

Beyond adoption at the farm scale, it is critical to create action at the regulatory level to enable Regen Ag throughout the region. In order to achieve this, we propose the creation of a Regenerative Agriculture Working Group that has as a goal to create a "Practical Plan for Transition to Regenerative Agriculture for Santa Barbara County". While this was one intention of this document, we realized that we needed more information from the various stakeholders within the agricultural community in the County in order to create a truly holistic plan that is likely to be successful. Stakeholders includes community members, businesses, foundations, community organizations, and regulatory agencies. Each of these groups has the ability to promote and leverage the adoption of Regenerative Agriculture practices.

The first step is to perform an analysis or census of County agricultural operations and define their holistic context, in order to determine which landowners are ready and willing to transition to Regen Ag. This is a critical piece that is essentially a baseline study of agricultural operations in the County and will provide critical background information to support planning.

A phased progression into Regen Ag

In addition to a stepwise process for conceptualizing and implementing Regenerative Agriculture operations, we want to emphasise that progress will take place in phases. It is important to recognize practitioners for incremental successes and creating positive trends toward integrated comprehensive Regen Ag Desired Outcomes. A tiered system is recommended, similar to the Bronze, Silver, and Gold certifications proposed in Rodale's Regenerative Organic Certification.

Adoption of Regen Ag is not necessarily an all or nothing decision. In fact, it is often most practical to take small incremental steps to minimize risk and test progress toward desired outcomes.

10. Conclusions

Regenerative Agriculture is Needed and Possible

It is clear that the incredible advancements in agriculture have resulted in negative impacts to the environment and society. The veil has been lifted and the true cost of this form of agricultural production is increasingly prevalent. We can no longer turn a blind eye to it. Although agriculture contributes significantly to things like climate change, chronic diseases, social inequality, and environmental degradation- it is not agriculture in and of itself that is to blame. It is the chemical-industrial agriculture model that is at the root of these outcomes.

By shifting our attention to the "how," we realize that not only are these negative impacts mitigable, they are absolutely capable of being turned on their head. Regenerative Agriculture can not only mitigate climate change, it stands a chance to solve it. Regenerative Agriculture can not only mitigate chronic disease it can provide the nutrition to cure it. Since social justice and equality are baked in to the Regen Ag movement, it stands to create the conditions for inequality to be dissolved. No other form of agricultural production both provides the sustenance we need as a society while stewarding ecosystems services.

The evolution of Regenerative Agriculture is born on the backs of many great practitioners. The history is there. This is the culmination of our evolutionary roller coaster. We need to integrate our ability to sustain ourselves with our ability to build the resources on which our sustenance relies.

Benefits to the Region

Our region is blessed with so much; bountiful land, a mild climate, committed community, financial resources, and an environmental ethic which combine to make Santa Barbara County a fabulous place. We have a commitment to do right by all this.

The benefits to embracing Regenerative Agriculture region-wide will be profound. Doing so provides resilience, ecosystem services, climate change mitigation, biodiversity and wildlife habitat, worker fairness, social equity, and a solid bottom line for the producers- all while providing a food production model that can be exported the world over.

These benefits will ripple far and wide once our county drops that first pebble and becomes a leader in this movement. There has never before been as oportune of a time. The stage is set and it is time for our community to reap the rewards. By identifying and networking with the innovators and early adopters we can build momentum to leap across the chasm and find the critical mass it will take to make this a success.

A Call to Action

In order to be successful in transitioning from degenerative to regenerative agriculture and course correct towards a more resilient future, we need everyone at the table. The issues we face are not partisan but of humanity, this isn't a Republican vs. Democrat issue, this is a human issue. If we run out of resources, there will be no farms, no food, and we will all starve.

Luckily we are not at that point yet here in Santa Barbara, but many regions in the world are. If we redirect now we can change the course of the ship and avoid disaster. It will take communities voting with their dollars,

researchers committed to the cause, regulators willing to change the status quo, and at the end of the day- it will take the boots on the ground to make it happen.

A positive set of options exist. We don't need to invent anything or re-create the wheel, all the tools and resources we need are readily available to us, for little cost. The main resource we do need however is participation-it really will take everyone on board to make a shift of this magnitude. This means farmers, ranchers, regulators, consumers-basically anyone who eats-needs to be in support of this paradigm shift in agriculture in order for it to solve the bigger issues we face collectively.

We can do this. Let's get started!

11. Appendix

References and Resources

Regenerative Agriculture

- Levels of Regenerative Agriculture
  - http://www.terra-genesis.com/wp-content/uploads/2017/03/Levels-of-Regenerative-Agriculture-1.pdf
- Case Studies
  - https://www.ellenmacarthurfoundation.org/case-studies/regenerative-agriculture-at-scale
  - https://ntrl.ntis.gov/NTRL/dashboard/searchResults/titleDetail/PB2014105277.xhtml
  - http://www.regenerateland.com/evidence-for-regenerative-agriculture/
  - http://regenag.com/web/case-studies/
  - http://www.regenerationinternational.org/2017/04/04/cultivate-career-regenerative-agriculture-interview/
  - https://www.drawdown.org/solutions/food/regenerative-agriculture

Agroforestry

- Agroforestry: Enhancing Resiliency in U.S. Agricultural Landscapes Under Changing Conditions https://www.fs.usda.gov/nac/publications/changing-conditions.shtml
- USDA National Agroforestry Center (NAC)
  - Silvopasture https://www.fs.usda.gov/nac/practices/silvopasture.shtml
- Agroforestry Theory and Practices. 2017. by AJ Raj and SB Lal
- An Agroforestry guide for field practitioners http://www.worldagroforestry.org/downloads/Publications/PDFS/B17460.pdf
- World Agroforestry Center http://www.worldagroforestry.org/

Soils

- International Soil Reference and Information Centre https://www.isric.online/
- Status of the World's Soil Resources FAO. http://www.fao.org/documents/card/en/c/c6814873-efc3-41db-b7d3-2081a10ede50/
- The Global Land Outlook. UNCCD. 2017 https://global-land-outlook.squarespace.com/
- NRCS Soil Health programs[241]
  - NRCS Soil Health fact sheets[242]

Examples of BMPs and field guides

- UCANR BMP for nurseries I like the categories in this one: green smiley face(i.e. good), red frown(don't), and potential pollutant, then bullet point actions.
  - same one different formatting
- AG BMP for Minnesota this one has great info and categories for each practice. also some tables we can use. not flash card though
  - see pgs. 17,21,
- Idaho evaluating BMP effectiveness this one has good info on monitoring
  - See p6-7 for BMP Technical Standard
- Caltrans I like the categories in this one

[241] https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/
[242] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/health/?cid=stelprdb1193043

- NV Construction BMPs Easy readability and graphics not quite flash cards
- NV invasive weed field guide which has simple clean flash card style formatting

Holistic Management and Holistic Planned Grazing

- https://holisticmanagement.org/the-regenerative-solution/
- https://www.savory.global/wp-content/uploads/2017/02/about-holistic-planned-grazing.pdf
- https://holisticmanagement.org/wp-content/uploads/2017/03/HM-System-Highlights-Trifold-9.22.2016.pdf

Ecological Monitoring

- US Forest Service Forest ecosystems https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_021209.pdf
- USGS aquatic ecosystems https://www.usgs.gov/centers/oki-water/science/ecological-monitoring?qt-science_center_objects=0#qt-science_center_objects
- FAO community based ecological monitoring http://www.fao.org/forestry/14700-0271f3fb3f50174269227fd97906437a9.pdf
- Bullseye Targeting your Rangeland Health Objectives Rangeland ecosystems https://quiviracoalition.org/wp-content/uploads/2018/03/BullseyeTargeting-Your-Rangeland-Health-Objectives.pdf

Soils For Life Regenerative Land Management Principles

Table 3. Regenerative Land Management Principles as defined by Soils For Life[243]

Principle	Description
Manage holistically	Think of the entire system in managing your property. Establish and work towards your own environmental, financial, and personal/social goals. Seek to understand and address underlying causes rather than just dealing with visible symptoms, and work to maximise natural system functioning.
Care about the land as a resource	Understand and value the natural resources which contribute to your production (eg. healthy soils, pasture). Manage production demands to suit the capacity of your land. Adjust stocking rates or change or integrate enterprises to enable regenerative practices and sustainable production.
Commit to education and constant learning	Research widely, try different things and don't be afraid to make mistakes. Adapt practices to suit your own circumstances.
Search out communities of interest for help and advice	Not everyone is comfortable talking about or trying regenerative landscape management practices – but there are many who are and they are also willing to share ideas and provide support. These communities are an invaluable resource.
Improve the structure and overall health of soil, starting by enhancing organic matter content	A healthy soil underlies everything – literally. Learn about soil and seek to restore its physical, mineral and biological balance. Start with increasing organic matter to build soil organic carbon and stimulate biological activity. Minimise soil disturbance and keep soil permanently covered with vegetation or crop residue.
Use and conserve rain where it falls and improve hydrological function	Improved soil structures and increased vegetation will enable you to capture rainfall and have it infiltrate the soil to support your plants and animals for longer. Work to slow the flow of water across and through your landscape and minimise evaporation.
Strive for a diversity of vegetation, including maximum ground cover, for the majority of the time	Groundcover and vegetation not only protect the soil from erosion and loss, but also build more soil. A diversity of vegetation provides resilience against climate variation and minimises the impact of pests and weeds. Manage your stock and landscape to ensure pastures have adequate rest and recovery time to thrive.
Work on best land first and extend from there	Maximise production on the best performing areas of the property first. Use additional income to invest in poorer performing areas without compromising cash flow.
Manage in times of plenty for times of shortage	Conditions will always change. By enhancing your landscape through improving soil health, water-use efficiency, maintaining groundcover and adjusting your stocking rate to match your land's carrying capacity, you will build resilience to a changing climate and enable sustainable production.
Reduce reliance on inputs	Reduce or cease the use of chemical fertilisers and biocides (herbicides, pesticides, etc.) to support biodiversity and enable healthy biological functioning and nutrient cycling. Save money too!
Observe, measure and respond	Keep records and photos to show incremental changes and inform you which practices are working and which are not so you can extend or change them for best effect.

[243] http://www.soilsforlife.org.au/change.html

Regenerative Enterprise

1. 8 Forms of Capital: Terra Genesis International also introduced to the world a novel new way of looking at capital. Generally most people when the speak of capital they mean financial capital. TGI proposes 7 other forms of capital that may be considered as yields to the system.
    a. *SOCIAL CAPITAL* Influence and connections are social capital. A person or entity who has 'good social capital' can ask favors, influence decisions, and communicate efficiently. Social capital is of primary importance in politics, business, and community organizing.
    b. *MATERIAL CAPITAL* Non-living physical objects form material capital. Raw and processed resources like stone, metal, timber, and fossil fuels are 'complexed' with each other to create more sophisticated materials or structures. Modern buildings, bridges, and other pieces of infrastructure along with tools, computers, and other technologies are complexed forms of material capital.
    c. *FINANCIAL CAPITAL* We are most familiar with financial capital: Money, currencies, securities and other instruments of the global financial system. The current global society focuses enormous amounts of attention on financial capital. It is our primary tool for exchanging goods and services with other humans. It can be a powerful tool for oppression, or, (potentially) liberation.
    d. *LIVING CAPITAL* Living capital is made up of the animals, plants, water and soil of our land—the true basis for life on our planet. Permaculture design teaches us the principles and practices for rapid creation of living capital. Permaculture encourages us to share the abundance of living capital rather than the intangible "wealth" of financial capital. (Note: "Natural Capital" could be a synonym for Living Capital, but the 1999 book "Natural Capitalism" by Hawkens et al. focuses more on a slightly updated system of capitalism than on the true wealth of living systems. The current Slow Money movement is also making strides in a similar direction, seeking to transfer financial capital into the living forms of soil, animals, and agriculture.)
    e. *INTELLECTUAL CAPITAL* Intellectual capital is best described as a 'knowledge' asset. The majority of the current global education system is focused on imparting intellectual capital. Science and research can focus on obtaining intellectual capital or 'truth', though it is often motivated by the desire for financial or social capital. For example, "going to university" is primarily an exchange of financial capital for intellectual capital.
    f. *EXPERIENTIAL (OR HUMAN) CAPITAL* We accumulate experiential capital through actually organizing a project in our community, or building a strawbale house, or completing a permaculture design. The most effective way to learn anything comes through a blended gathering of intellectual and experiential capital. 'Human Capital' is a combination of social, intellectual and experiential capital, all facets of a person that can be gathered and carried in essentially limitless amounts.
    g. *SPIRITUAL CAPITAL* Spiritual capital contains aspects of intellectual and experiential capital, but is deeper, more personal and less quantifiable. Many of the world's religions include a concept of 'the great chain of being', a holarchic understanding of existence where spiritual attainment (in this context, the accumulation of spiritual capital) leads to different levels of being.
    h. *CULTURAL CAPITAL* Cultural capital describes the shared internal and external processes of a community – the works of art and theater, the songs that every child learns, the ability to come together in celebration of the harvest or for a religious holiday. Cultural capital cannot be gathered by individuals alone, it can only be gathered by a community of people. It could be viewed as an emergent property of the complex system of inter-capital exchanges that takes place in a village, a city, a bioregion, or nation.

Land Health Assessment Tools

Bullseye: Targeting your Rangeland Health Objectives[244]

Methods such as the Bullseye method[245] developed by Kirk Gadzia and Todd Graham provide both qualitative and quantitative protocols for monitoring the 4 ecosystem processes and how management is affecting their trend towards healthy effective ecosystem processes.

The Bullseye monitoring method was developed by Kirk Gadzia and Todd Graham as a practical method for ranchers and land managers to monitor the effects of their management actions on land health. It is most applicable to rangeland and grazing operations. The Bullseye method uses a spider diagram to plot the qualitative evaluation of 14 Rangeland health indicators relative to the stated goal for each indicator. This facilitates management decisions to take actions that improve the health of the land and move each indicator towards the stated goal. It also allows a land manager to track land health trends over time and assess whether a particular management regime has 'moved the needle' or not.

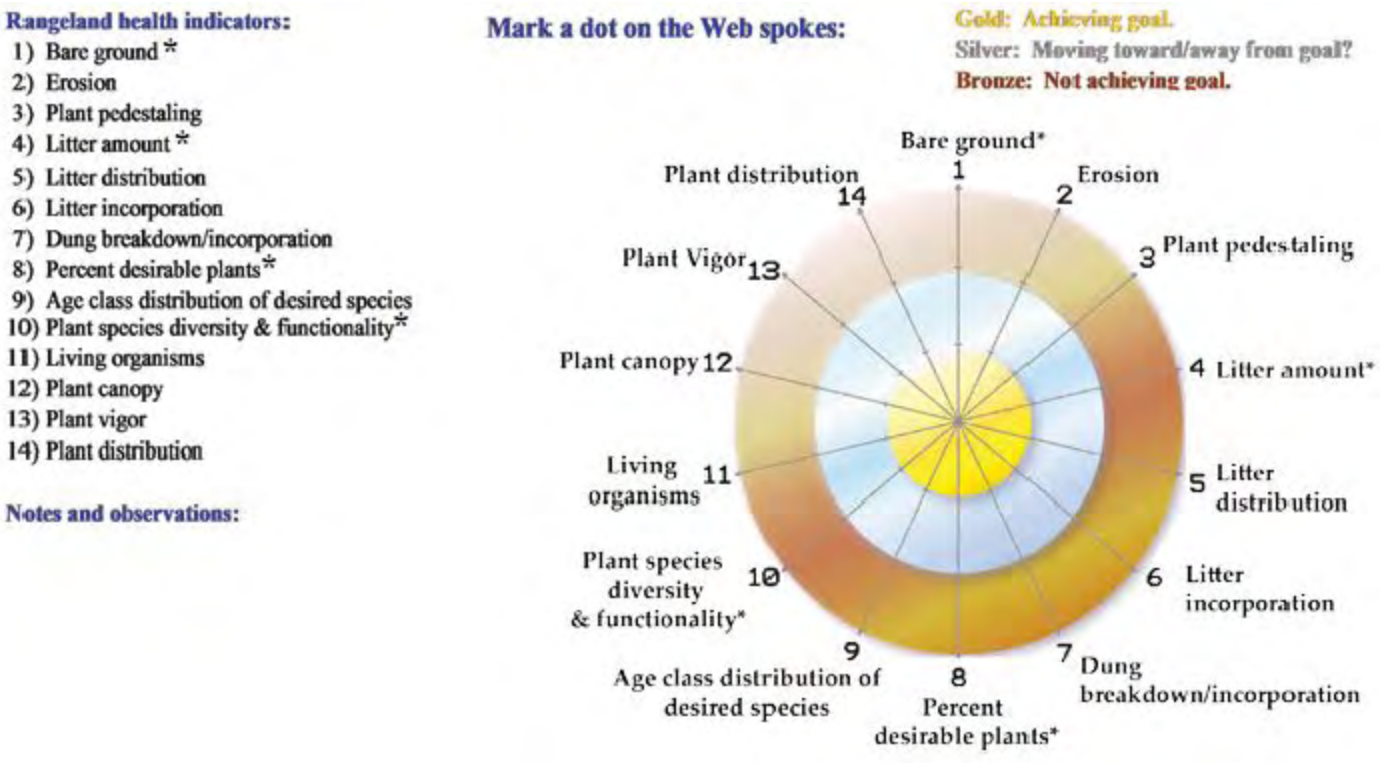


Figure 72. Bullseye monitoring score sheet

[244] http://rmsgadzia.com/PDFs/Bulleseye.pdf
[245] Bullseye: Targeting your Rangeland Health Objectives. https://quiviracoalition.org/bullseye/

NRCS soil quality kit

The NRCS Soil Quality Kit[246] is a set of monitoring protocols which measures a range of soil qualities to assess soil function and changes in soil function. The qualities measured include biological, chemical and physical indicators of soil quality.

The 10 test/indicators monitored are

- Biological
    - Soil Respiration
    - Earthworms
- Chemical
    - Electrical Conductivity (EC)
    - Soil pH
    - Soil Nitrate
- Physical
    - Bulk Density
    - Infiltration Rate
    - Aggregate Stability
    - Soil Slaking
    - observations
        - depth of topsoil
        - resistance
        - structure
        - texture

Additionally 2 water quality tests are included in the Soil Quality Test Kit

- Water Nitrate and Nitrite levels
- Water Salinity

While these indicators provide a basis for understanding as soils function and changes in that function, they are not directly correlated to Regenerative Agriculture. Generally Regenerative Agriculture BMPs will lead to

- Increased or High
    - Soil respiration
    - Earthworms
    - Infiltration rate
    - Aggregate stability
    - Slake stability rating
- Balanced
    - Soil pH (closer to 7)
- Decreased or Low
    - Bulk Density
    - Electrical Conductivity

[246] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/health/assessment/?cid=nrcs142p2_053873

Holistic Management® Framework

Principles
1. Nature functions in wholes 2. Understand your environment

Practice One

Inventory (Whole Under Management)	Management Team	Assets

Practice Two

Purpose	Mission Statement

Holistic Goal	Quality of Life and Values	Behaviors and Systems	Vision

Practice Three

Ecosystem Processes	Biological Community	Water Cycle	Mineral Cycle	Energy Flow

Practice Four

Tools for Managing Ecosystem Processes	Human Creativity	Technology	Rest	Fire	Animals and Living Organisms	Money and Labor

Practice Five

Planning and Monitoring Processes	Financial Planning	Land Planning	Marketing & Business Planning	Crop Planning	Grazing Planning	Biological Monitoring

Testing Question Categories	Root Cause	Weak Link	Comparing Options	Gross Profit Analysis	Input Analysis	Vision Analysis	Gut Check

Practice Six

Feedback Loop	Plan (Assume change) → Implement → Monitor → Control

HMI
Healthy Land. Healthy Food. Healthy Lives.

Holistic Management® Whole Farm/Ranch Planning System Highlights

Holistic Management Decision-Making

Look at all you manage - your team and assets.

↓

Develop a Holistic Goal with those involved.

↓

Consider ecosystem processes in your decision.

↓

Create the mission, vision, strategies, policies, and objectives for your Holistic Goal.

↓

Identify the tools available to manage your resources.

↓

Consider influential factors. (experience, data, peer pressure, cost, etc.)

↓

Apply seven tests to make sure your decision(s) are sound and will lead toward your Holistic Goal.

↓

Before you make a decision, consider the unintended consequences that can arise within complex living systems.

↓

Identify indicators to monitor for the earliest signs of change.

↓

Use a feedback loop to monitor your decisions and plans. Plan, implement, monitor and control to adapt to life's changes.

Holistic Management Principles and Practices

PRINCIPLES

Nature Functions in Wholes

Taking a holistic perspective means paying attention to relationships between different aspects of the "whole." When you manage your land resources, build biodiversity, or improve production, you can't change or control one thing without impacting something else.

Understand Your Environment

All environments are not the same. Environments exist on different ends of a scale linked to humidity and how quickly dead vegetation breaks down. Tools respond differently in these environments.

PRACTICES

Practice One: Define What You Manage

Each of us is responsible for managing an **inventory** made up of your **management team** and your **assets** (land, equipment, clients, money, etc.).

Practice Two: State What You Want

To begin the process of creating your Holistic Goal—describe the life you want to live, based on your deepest values.

Practice Three: Aim for Healthy Soil

This practice uses four fundamental ecosystem processes in Nature, to assess the health of your land. They are:

Water cycle	Energy flow
Mineral cycle	Biological community

Practice Four: Consider All Tools

Use the following tools for managing your resources:

Human Creativity	Fire
Technology	Animals/Living Organisms
Rest	Money and Labor

Practice Five: Test Your Decisions

Before moving forward with a decision or action, ask seven testing questions to help ensure that your decision or action is socially, environmentally, and financially sound.

Practice Six: Monitor Your Results

After you gather information, consider a number of factors, test each action toward your Holistic Goal, and create monitoring criteria to give you an early indicator if your plan goes off track.

Test Your Decisions

The testing questions help sift through the variables that are part of making a decision.

Does the action or decision meet the triple bottom line toward your Holistic Goal? It is difficult to make decisions that consider all three aspects of the triple bottom line: social, financial, and environmental. Some decisions may be economically sound, but are implemented at the expense of the environment or human welfare; others are environmentally sound, but economically unfeasible or harmful to humans. When we don't manage for all three aspects, our decisions can have undesirable or even disastrous results.

These seven tests supplement other considerations when making a decision (research, gut feelings, intuition, cash flow, etc.). Use testing to help you explore options.

The Seven Tests

1. **Root Cause**
   Does this action address the root cause of the problem?

2. **Weak Link**
   - Social: Are there any social concerns regarding this action?
   - Biological: Does this action address the weakest point in the life cycle of this organism?
   - Financial: In my enterprise, what single thing will have the greatest positive impact on my ability to generate more income?

3. **Comparing Options**
   Which action gets the "biggest bang for the buck" toward your Holistic Goal? Where is your highest return?

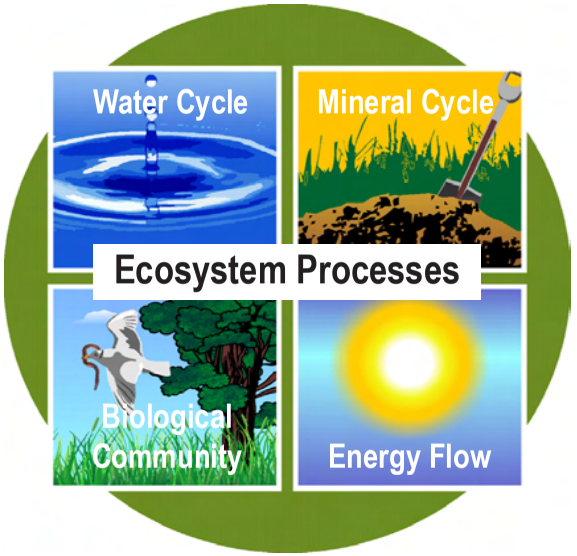
4. **Gross Profit Analysis**
   Which enterprises contribute most to cover the fixed costs (overhead) of the business?

5. **Input Analysis**
   Is the energy or money to be used in this action derived from the most appropriate source in terms of your Holistic Goal? Will the way the energy or money is to be used lead toward your Holistic Goal?

6. **Vision Analysis**
   Does this action lead toward or away from the Vision articulated in your Holistic Goal?

7. **Gut Check**
   Considering all the testing questions and your Holistic Goal, how do you feel about this action or decision now?

Aim for Healthy Soil



Understanding how ecosystem processes function and what to look for on your land helps you determine how well they are operating and how to work more effectively with Nature to create healthier, more productive land. Ecosystem environments function through four basic processes.

The Water Cycle

The movement of water from atmosphere to soil and back and how that movement affects plant and animal life.

The Mineral Cycle

The movement of minerals and nutrients and how that movement affects plant and animal life.

Biological Community

The ongoing development of biological communities.

Energy Flow

The movement of energy from the sun through all things.

To understand how well ecosystem processes function on your land, get out and walk on it.

Read the land and watch for symptoms of an ineffective process.

Santa Barbara County Regionally Appropriate Tree and Shrub Crops for Regenerative Agriculture

Plant species matrix format and portions of data adapted from The Carbon Farming Solution by Eric Toensmeier

Genus	Species	Common Name	Family	Crop type	Plant Type	Climate	Humidity	Culitvation	Management	Agroforestry Services	Fodder	Invasive	Other Systems
Acacia	*angustissima*	Timbre	Fabaceae	tannin, medicinal, gum, dye	tree	subtropical to tropical, tropical highlands	semi-arid to humid	regional crop	standard, coppice	nitrogen	insect		
Acacia	*murrayana*	Murray Wattle	Fabaceae	protein	tree	warm temperate to tropical	arid to semi-arid	historic wild staple, new crop	standard, coppice	nitrogen, windbreak			FMAFS
Acacia	*victoriae*	Elegant Wattle	Fabaceae	protein	tree	warm temperate to tropical	arid to semi-arid	historic wild staple, new crop	standard, coppice	nitrogen, windbreak			FMAFS
Acacia	*melanoxylon*	Blackwood Acacia	Fabaceae	timber	tree	subtropical to tropical	semi-arid to humid	regional crop	standard, coppice			yes	
Acacia	*stenophylla*	Shoestring Wattle	Fabaceae	timber	tree	subtropical to tropical	semi-arid to humid	regional crop	standard, coppice			yes	
Acca	*sellowiana*	Pineapple Guava	Myrtaceae	fruit	small tree	temperate to sub-tropical	semi-arid to humid	regional crop	standard			no	
Albizia	*julibrissin*	Mimosa, Silk tree	Fabaceae	biomass	tree	cold to warm temperate, mediterranean	semi-arid to humid	regional crop	standard, coppice	nitrogen, alley crop, contour hedgerow, crop shade	bank, insect	yes	
Albizia	*lebbeck*	Lebbeck tree	Fabaceae	biomass, pesticide	tree	subtropical to tropical	semi-arid to humid	minor global crop	standard, coppice	nitrogen, crop shade	bank	yes	
Araucaria	*bidwillii*	Bunya Bunya	Araucariaceae	balanced carb	tree	mediterranean, subtropical to tropical	humid	regional crop only	standard				
Argania	*spinosa*	Argan	Sapotaceae	oil	tree	subtropical to tropical	arid to semi-arid	new crop	standard				
Atriplex	*nummularia*	Old Man's Saltbush	Amaranthaceae	fodder	shrub	warm temperate to subtropical	arid to semi-arid	regional crop	coppice, fodder	windbreak	bank		
Atriplex	*canescens*	Fourwing Saltbush	Amaranthaceae	fodder	shrub	cold to warm temperate	arid to semi-arid	minor global crop	coppice, fodder		bank		
Castanea	*spp.*	Hybrid Chestnuts	Fagaceae	nut, biomass, tannin	tree	cold to warm temperate	humid	new crop	standard, coppice				woody agriculture
Castanea	*sativa*	Eropean Chestnut	Fagaceae	nut, biomass, tannin	tree	mediterranean, warm temperate	semi-arid to humid	minor global crop	standard				strip intercrop
Casuarina	*equisetifolia*	Australian Pine	Casuarinaceae	tannin	tree	subtropical to tropical	arid to humid	minor global crop	standard	nitrogen, windbreak		yes	
Ceratonia	*siliqua*	Carob	Fabaceae	fruit, seed gum	tree	Mediterranean, subtropical	arid to semi-arid	minor global crop	standard	windbreak	pod		irregular intercrop
Citrus	*limon*	Lemon	Rutaceae	fruit	tree	subtropical to tropical	arid to humid	global crop					
Citrus	*unshiu*	Mandarin	Rutaceae	fruit	tree	subtropical to tropical	arid to humid	global crop					
Citrus	*sinensis*	Orange	Rutaceae	fruit	tree	subtropical to tropical	arid to humid	global crop					
Coffea	*arabica*	Coffee	Rubiaceae	fruit	shrub	subtropical to tropical	semi-arid to humid	global crop	standard			no	
Corylus	*avellana*	European Hazel	Fagaceae	protein-oil	shrub	boreal to warm temperate, Mediterranean	Semi-arid to humid	new crop	standard, coppice				woody agriculture
Corylus	*hybrids & neohybrids*	Hybrid Hazel	Fagaceae	protein-oil	shrub	boreal to warm temperate, Mediterranean	Semi-arid to humid	new crop	standard, coppice				woody agriculture
Corylus	*colurna*	Turkish Tree Hazel	Fagaceae	protein-oil	tree	Warm temperate, mediterranean	Semi-arid to humid	regional crop only	standard				strip intercrop
Corymbia	*citriodora*	Lemon-scented Gum	Myrtaceae	biomass	tree	subtropical to tropical	Semi-arid to humid	minor global crop	standard, coppice				SRC
Corymbria	*maculata*	Spotted Gum	Myrtaceae	timber	tree	subtropical to tropical	Semi-arid to humid	regional crop					
Corymbria	*citriodora*	Lemon-scented Gum	Myrtaceae	timber	tree	subtropical to tropical	Semi-arid to humid	regional crop					
Croton	*tiglium*	Croton Oil Plant	Euphorbiaceae	oil, hydrocarbon	tree	subtropical to tropical	arid to humid	regional crop	standard				
Cupressus	*macrocarpa*	Monterey Cypress	Cupressaceae	timber	tree	cold to warm temperate	arid to humid	regional crop					
Cytisus	*proliferus*	Tagasaste, Tree Lucerne	Fabaceae	fodder	shrub	warm temperate, mediterranean	semi-arid	minor global crop	coppice	nitrogen, alley crop	bank		
Diospyrus	*kaki*	Persimmon, Asian	Ebenaceae	fruit	tree	cold to warm temperate	arid to humid	minor global crop					
Eriobotrya	*japonica*	Loquat	Rosaceae	fruit	tree	warm temperate, mediterranean	arid to humid	minor global crop					
Eucalyptus	*camaldulensis*	Red River Gum	Myrtaceae	biomass, tannin	tree	subtropical to tropical	arid to humid	global crop	standard, coppice	windbreak			SRC
Eucalyptus	*globulus*	Bluegum	Myrtaceae	hydrocarbon, medicinal	tree	warm temperate to subtropical	arid to humid	minor global crop	standard, coppice				SRC
Eucalyptus	*microtheca*	Coolabah	Myrtaceae	biomass	tree	subtropical to tropical	arid to semi-arid	global crop	standard, coppice				SRC
Eucalyptus	*tereticornis*	Forest Red Gum	Myrtaceae	biomass	tree	subtropical to tropical	semi-arid to humid	minor global crop	standard, coppice				SRC
Eucalyptus	*sideroxylon*	Red Iron Bark	Myrtaceae	biomass	tree	mediterranean to tropical	semi-arid to humid	minor global crop	standard, coppice				SRC
Ficus	*carica*	Fig	Moraceae	fruit	tree	subtropical to temperate	semi-arid to humid	global crop	standard			no	
Gevuina	*avellana*	Chilean Hazelnut	Proteaceae	oil	tree	warm temperate, mediterranean	semi-arid to humid	new crop	standard				
Gleditsia	*triacanthos*	Honey Locust	Fabaceae	balanced carb, biomass	tree	Boreal to warm temperate, Mediterranean	semi-arid to humid	minor global crop	standard, coppice	living fence	pod, bank		
Grevillea	*robusta*	Silky Oak	Proteaceae	timber	tree	warm temperate, mediterranean	arid to humid	regional crop					
Hylocereus	*undatus*	Dragon Fruit	Cactaceae	fruit	cactus	subtropical to tropical	semi-arid to humid	regional crop					
Juglans	*californica*	California Black Walnut	Juglandaceae	protein-oil	tree	mediterranean	semi-arid	regional crop only	standard				
Juglans	*nigra*	Black Walnut	Juglandaceae	protein-oil	tree	warm temperate, mediterranean	semi-arid to humid	global crop	standard				irregular intercrop, strip
Juglans	*regia*	Persian walnut	Juglandaceae	protein-oil	tree	warm temperate, mediterranean	semi-arid to humid	global crop	standard				irregular intercrop, strip
Lavandula	*sp*	Lavendar	Lamiaceae	oil, medicinal	shrub	warm temperate, mediterranean	arid to semi-arid	global crop					
Leuceana	*leucocephela*	Guaje	Fabaceae	fodder	tree	warm temperate to tropical	semi-arid to humid	regional crop	standard, coppice	fodder			
Lycium	*barbarum*	Goji Berry	Solanaceae	fruit, medicinal	shrub	temperate to subtropical	arid to semi humid	global crop	coppice	fodder	chicken		
Macadamia	*ternifolia*	Macadamia	Proteaceae	oil	tree	subtropical, tropical highlands	semi-arid to arid	minor global crop	standard				multistrata
Madhuca	*longifolia*	Butter tree	Sapotaceae	oil	tree	subtropical	semi-arid	regional crop only	standard				
Malus	*pumila*	Apple	Rosaceae	fruit	tree	temperate to mediterranean	humid to semi-arid	global crop	standard	fodder	fruit	no	
Moringa	*oleifera*	Moringa	Moringaceae	protein, oil, medicinal	tree	subtropical to tropical	semi-arid to humid	minor global crop	standard, coppice	alley crop, contour hedgerow, livin	bank		homegarden, FMAFS
Moringa	*peregrina*	Ben tree	Moringaceae	oil	tree	tropical	arid to semi-arid	regional crop only	standard				
Moringa	*stenopetala*	Moringa	Moringaceae	oil	tree	subtropical to tropical, tropical highlands	semi-arid to humid	regional crop only	standard, coppice				
Morus	*alba*	White Mulberry	Moraceae	biomass	tree	cold temperate to tropical, tropical highlands	semi-arid to humid	minor global crop	standard, coppice	contour hedgerow, living fence	bank, insect		dyke-pond
Morus	*alba ssp tatarica*	Russian Mulberry	Moraceae	biomass	tree	cold temperate to tropical, tropical highlands	semi-arid to humid	minor global crop	standard, coppice	contour hedgerow, living fence	bank, insect	yes	dyke-pond
Morus	*australis*	Korean Mulberry	Moraceae	biomass	tree	cold temperate to tropical, tropical highlands	semi-arid to humid	minor global crop	standard, coppice	contour hedgerow, living fence	bank, insect		dyke-pond
Morus	*macroura*	Pakistani Mulberry	Moraceae	biomass	tree	warm temperate to tropical	semi-arid to humid	minor global crop	standard, coppice	contour hedgerow, living fence	bank		
Morus	*nigra*	Black Mulberry	Moraceae	biomass	tree	cold temperate to tropical, tropical highlands	semi-arid to humid	minor global crop	standard, coppice	contour hedgerow, living fence	bank		
Morus	*rubra*	Red Mulberry	Moraceae	biomass	tree	cold temperate to tropical, tropical highlands	semi-arid to humid	minor global crop	standard, coppice	contour hedgerow, living fence	bank	yes	
Olea	*europaea*	Olive	Oleaceae	fruit	tree	mediterranean, tropical	semi-arid	global crop	oil				woody agriculture, irreg
Parkinsonia	*aculeata*	Palo Verde	Fabaceae	protein, biomass	tree	subtropical to tropical	arid to semi-arid	minor global firewood crop	standard		pod, bank		
Parthenium	*argentatum*	guayule	Asteraceae	hydrocarbon	shrub	subtropical	arid to semi-arid	minor global crop	coppice				
Pavonia	*spinifex*	Gingerbush	Malvaceae	fiber	shrub	warm temperate to tropical	semi-arid	regional crop	coppice				
Persea	*americana*	Avocado	Lauraceae	fruit	tree	subtropical to tropical	semi-arid to humid	global crop					

Santa Barbara County Regionally Appropriate Tree and Shrub Crops for Regenerative Agriculture

Plant species matrix format and portions of data adapted from The Carbon Farming Solution by Eric Toensmeier

Genus	Species	Common Name	Family	Crop type	Plant Type	Climate	Humidity	Culitvation	Management	Agroforestry Services	Fodder	Invasive	Other Systems
Pinus	*brutia*	Calabrian Pine	Pinaceae	hydrocarbon	tree	mediterranean	semi-arid	regional timber	standard				
Pinus	*pinea*	Italian Stone Pine	Pinaceae	protein-oil	tree	warm temperate to subtropical, mediterranean	arid to semi-arid	minor global crop	standard				
Pistacia	*vera*	Pistachio	Anacardiaceae	protein-oil	tree	Warm temperate to subtropical, mediterranean	arid to semi-arid	global crop	standard, coppice				strip intercrop
Pithecellobium	*dulce*	Manila Tamarind	Fabaceae	biomass, tannin	tree	subtropical to tropical, tropical highlands	semi-arid to humid	minor global crop	standard, coppice	nitrogen, alley crop, living fence, v	pod, bank, insect		
Prosopis	*chilensis*	Algarrobo de Chile	Fabaceae	pod	tree	warm temperate to tropical, tropical highlands	arid to semi-arid	regional crop	standard, coppice	nitrogen	pod, bank		
Prosopis	*glandulosa*	Honeypod Mesquite	Fabaceae	pod	tree	warm temperate to subtropical, tropical highlan	arid to semi-arid	historic staple	standard, coppice	nitrogen	pod, bank	yes	
Prunus	*spp.*	Plum	Rosaceae	fruit	small tree	mediterranean	arid to semi-arid	regional crop	standard	bee forage, habitat		no	
Prunus	*illicifolia*	Catalina Cherry	Rosaceae	fruit	small tree	mediterranean	arid	wild staple	standard	bee forage, habitat		native	
Prunus	*persica*	Peach	Rosaceae	fruit	small tree	mediterranean	arid to semi-arid	regional crop	standard	bee forage, habitat		no	
Prunus	*serotina*	Capulin Cherry	Rosaceae	fruit	small tree	mediterranean	arid to semi-arid	regional crop	standard	bee forage, habitat		no	
Prunus	*armenica*	Apricot	Rosaceae	fruit, oil	tree	cold to warm temperate	semi-arid to humid	global fruit, minor nut	standard	bee forage, habitat			
Prunus	*dulcis*	Almond	Rosaceae	nut, oil	tree	cold temperate to subtropical, mediterranean	semi-arid to humid	global crop	standard	bee forage, habitat			
Psidium	*guajava*	Guava	Myrtaceae	fruit	tree	subtropical to tropical	semi-arid to humid	global crop	standard			no	
Psidium	*cattleyanum*	Strawberry Guava	Myrtaceae	fruit	shrub	subtropical to tropical	semi-arid to humid	regional crop					
Pyrus	*communis*	European Pear	Rosaceae	fruit	tree	temperate to mediterranean	semi-arid to humid	global crop	standard	fodder		no	
Pyrus	*pyrifolia*	Asian Pear	Rosaceae	fruit	tree	temperate to mediterranean	semi-arid to humid	global crop	standard	fodder		no	
Quercus	*ilex*	Holly Oak	Fagaceae	balanced carb, tannin	tree	Warm temperate to subtropical, mediterranean	semi-arid	regional crop	standard		mast		dehesa
Quercus	*kelloggii*	California Black Oak	Fagaceae	balanced carb	tree	temperate to mediterranean	semi-arid	wild staple	standard		mast		
Quercus	*suber*	Cork Oak	Fagaceae	cork, tannins	tree	Warm temperate to subtropical, mediterranean	semi-arid	regional crop	standard		mast		dehesa, strip intercrop
Quercus	*agrifolia*	Live Oak	Fagaceae	cork, tannins	tree	Warm temperate to subtropical, mediterranean	semi-arid	regional crop	standard		mast	native	dehesa, strip intercrop
Quercus	*lobata*	Valley Oak	Fagaceae	cork, tannins	tree	Warm temperate to subtropical, mediterranean	semi-arid	regional crop	standard		mast	native	dehesa, strip intercrop
Rhamnus	*californica*	Coffeeberry	Rhamnaceae	fruit	shrub	temperate to mediterranean	arid to semi-arid	wild staple					
Rhamnus	*crocea*	Redberry	Rhamnaceae	fruit	shrub	temperate to mediterranean	arid to semi-arid	wild staple					
Ricinus	*communis*	Castor Bean	Euphorbiaceae	oil, wax	shrub	Warm temperate to subtropical, mediterranean	arid to humid	global crop	standard	windbreak, crop shade	insect	yes	multistrata
Robinia	*pseudoacacia*	Black Locust	Fabaceae	biomass	tree	Cold temperate to subtropical, tropical highlanc	semi-arid to humid	minor global crop	standard, coppice	nitrogen, windbreak	bank	yes	SRC
Rosmarinus	*officinalis*	Rosemary	Lamiaceae	oil, medicinal	shrub	temperate to mediterranean	arid to semi-arid	global crop					
Sambucus	*cerulea*	Elderberry, blue	Adoxaceae	fruit	shrub	temperate to mediterranean	arid to semi-arid	minor global crop					
Sambucus	*mexicana*	Elderberry, Mexican	Adoxaceae	fruit	shrub	temperate to mediterranean	arid to semi-arid	minor global crop					
Vernicia	*fordii*	Tung oil tree	Euphorbiaceae	oil,medicinal	tree	subtropical	semi-arid to humid	minor global crop	standard				
Ziziphus	*jujuba*	Jujube	Rhamnaceae	fruit, medicinal	small tree	temperate to subtropical	arid to semi humid	minor global crop	standard				