# Farming in Vermont: A Holistic, Equitable Approach

ENVS 50 Spring 2022

# Foreword

Throughout the Spring of 2022, our ENVS 50 class had the pleasure of working with filmmaker Darnell Martin to help her actualize her vision of creating an environmentally sustainable and socially conscious farm in Bridgewater, Vermont. The farm will serve as a model of sustainable, equitable food production designed to heal the earth, respect traditional ecological knowledge, and most importantly, build community for artists by aiding them in cultivating a relationship with the land. The farm strives to maintain and rehabilitate the local ecosystem, replenishing and thanking the land for all that it has provided us. We view this farm as a venue for reparations to African Americans, Black persons, and Indigenous peoples.

Building a farm from scratch is no small feat, so to help Darnell plan her path, we split into four groups: Farmers of Color Coop, Greenhouse, Farm Fields, and Business. Each of these groups worked on an essential puzzle piece to paint a complete picture of Darnell's farm. At the same time, the Synthesis group, composed of one member of each of the four working groups, made sure each group's work fit together so that the whole project would be greater than the sum of its parts. The four groups organized interviews with experienced professionals in the Upper Valley, conducted extensive literature reviews, and brainstormed ideas to present a comprehensive report detailing key findings and considerations to help Darnell along each step of her journey.

Not only did each group contribute to this guide, but they also created a video detailing the work they completed over the course of the term. These videos are intended as an accompaniment to the book of resources, references, and recommendations that we have prepared. These resources provide concrete technical details and recommendations to facilitate the successful development of the farm.

We would like to thank Professor Ong, Karen Bieluch, and Ella Dobson for their oversight and guidance as we worked through this project. Without them, none of this would have been possible.

# Land Acknowledgement

The ENVS 50 class recognizes that Dartmouth College is built upon the unceded ancestral lands of the Abenaki people. We also acknowledge that Darnell's farm in Bridgewater, Vermont is located along the North Branch Ottauquechee River in the homeland of the modern, consolidated Abenaki Tribal Nation. The people of the Abenaki Nation are connected through kinship, alliances, and diplomacy. The ENVS 50 class recognizes that the Abenaki Tribal Nation is a distinct, sovereign, legal and political entity with its own powers of self-governance and self-determination. We promise to continue to repair our relationship with the Abenaki people through the cultivation of knowledge and food in this course that honors indigenous histories, perspectives, and people. As part of the necessary reparations to the Abenaki people, we are elevating native, tribal knowledge shared by elders by integrating it into the operational plan for Darnell's farm.

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# Part 1 Community Events Menu and Resource Guide

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# Message to the Reader

The Farmers of Color Coop group has been working on designing the farmers of color cooperatives and artists of color retreats so that the farm can live out its mission of creating a safe space, promoting balance, and working towards justice. As a group, we have had discussions about positionality and intersectionality, and are aware that we are a majority white group in a majority white class. As such, we have taken the approach of providing Darnell with many resources and options so that she can make her own decisions regarding the directions she wants to take. Our deliverables for Darnell take the following forms:

- Resource Spreadsheet: Digital spreadsheet with tabs for different types of resources we think will be helpful to Darnell. This document includes links so that websites and resources can be easily accessed.
- Resource Guide: The same resources as above, formatted into a guide so Darnell can read it on paper.
- Digital Resource Map: A Google Maps layer of the resources' locations, to visualize the networks of support Darnell has throughout the Northeast.
- Printed Resource Map: A printed version of the map to serve as a decorative and informative visual resource.
- Community Events Menu: A menu of community events that could happen on the farm, drawing on examples from similar organizations. These events include community workdays, workshops on a variety of skills, and retreats for artists of colors. We also highlight the various spaces on the farm that can be utilized for healing, reflection, and creation.
- A film showcasing farmers in the Upper Valley and at Dartmouth. We place Darnell's mission within the broader context of Black agricultural legacies, youth empowerment, and community growth. We share farmers' stories and their advice to Darnell.

We want to emphasize that these are all options for Darnell to take or leave as she sees fit! We have had fun and learned a lot creating these resources and are so excited to see where the farm goes from here.

# **Community Events Menu Sections**

- 1. Introduction
- 2. Community Workdays
  - a. How do community workdays apply to your farm?
- 3. Farming Workshops for Beginner and BIPOC Farmers
  - a. How do farming workshops apply to your farm?
- 4. Relationship to Land, Self and Culture Workshops and Retreats
  - a. How do land, self, and culture workshops apply to your farm?
- 5. Art Workshops and Retreats
  - a. How do art workshops apply to your farm?
- 6. Healing Spaces on the Farm

# Introduction

This section offers a consolidated list of options for potential community events at Darnell's farm. Our team took inspiration from existing resources and farms centered around BIPOC's relationship with land and foodways to develop a menu of suggestions that can be applied based on what resonates best. The first four subsections are each centered around a different kind of community event: community workdays; farming workshops; workshops around the relationship to land, self, and culture; and art. Each of those four sections concludes with direct applications and benefits to Darnell's farm. The final section of the document is a list of potential healing spaces on Darnell's farm, and how they could be useful for both personal centering and community events.

# **Community Workdays**

## Sections

- 1. Community Workday Examples
- 2. How do community workdays apply to your farm?

## **Community Workday Examples**

Consider inviting the community to **help out at the farm**! Workdays foster a strong sense of **community between volunteers**, as well as **build a relationship between volunteers and the land** while **learning how to steward the land**. Plus, they can help get a lot done quickly! This section includes models of communities pitching in to support a farm.



Image: WILDSEED Community workday

#### Community Workdays at WILDSEED Community Farm and Healing Village

WILDSEED Community Farm regularly hosts community work events, ranging from one to three days. Before the events, they have volunteers RSVP and arrange carpools. The farm also shares an overview of expected tasks and activities, which improves accessibility and helps volunteers know what to expect. In addition to farm work, people can swim, relax, and stick around for bonfires in the evening. This balance of work and leisure helps build community and foster connections to the farm and each other.

#### Community Supported Agriculture Volunteer Program at SUSU commUNITY Farm

SUSU commUNITY Farm hosts a Community Supported Agriculture (CSA) volunteer program that emphasizes contribution to, and not on behalf of, Black, Indigenous, and people of color. Volunteers help with delivering produce, farming, building structures and housing, cooking for events, grant writing, photography, etc. The aim is to build on the power of reciprocal relationships and create generational change in Vermont.

## How do community workdays apply to your farm?

- We know that building a community is very important to you, so holding events early on aimed at fostering community can help create the safe environment you desire for your farm.
- You can use community workdays to help get tasks done in the early stages.
  - Weeding, planting, helping set up buildings, and general maintenance throughout the property are all tasks that community members can contribute to.
- You can be very specific about who you invite to cultivate community while maintaining safety and privacy (for yourself and your guests!).
  - Friends, family, colleagues ... this is your community to build!

# Farming Workshops for Beginner and BIPOC Farmers

#### Sections

- 1. Farming Workshops Examples
- 2. How do farming workshops apply to your farm?

## **Farming Workshops Examples**

Farming workshops are an opportunity to invite individuals to the farm for hands-on training in food systems and agriculture. These workshops are a chance to **redistribute knowledge, foster intergenerational learning, and increase access to general knowledge.** They can also **empower people** and **build a strong community**. This section includes examples of farming workshops that Darnell's farm could use as models for hosting its own workshops. These examples could also be workshops that future staff might be interested in taking part in too as the farm begins developing.

#### Growing Farmers Training Program at Community Crops

The non-profit Community Crops in Lincoln, Nebraska built a program specifically for beginning immigrant and limited-resources farmers hoping for training, technical assistance, and tips on how to start their own market farming business. The Growing Farmers Training Program focuses on the experience of beginner farmers hoping to gain perspective on small-scale organic farming. Participants can choose how many sessions in this 10-session series to attend, which provides flexibility for those who enroll. Skills taught include growing plants in a greenhouse, soil health, business expense tracking, and record-keeping. Registration for each of the workshops is \$20 per workshop, and enrollment in all 10 sessions costs \$150. Scholarships are available for aspiring farmers needing financial assistance.

#### QT + BIPOC 101 Tractor Training at Rock Steady Farm

Rock Steady Farm in Millerton, New York offers a 3-day overnight retreat called "101 Tractor Training" to teach Queer and Trans (QT) farmers and Black, Indigenous, and people of color (BIPOC) adults (18+) how to operate a 4-wheel tractor. Rock Steady Farm prioritizes applications from farmers who already work on farms with tractors and stand to benefit the most from this training, although no prior experience operating tractors is necessary. Participants stay either in a shared room at the next-door retreat center, the Watershed Center, or camp outdoors with their own supplies. The program only accepts 12 farmers in order to provide a more intimate educational experience and allow for one-on-one instruction. The cost of the program implements a sliding scale, where participants can choose to pay between \$50 and \$1000 depending on their financial resources. The actual cost is \$500 per participant.



Image: Rock Steady Farm's Tractor Training

#### Farming Immersion Program at SOUL FIRE Farm

Fellow BIPOC-owned farm SOUL FIRE Farm hosts a Farming Immersion Program. Other BIPOC farmers in New England can gain basic farming skills while also deepening a connection to the land. Programming can include cooking, harvesting, and taking care of animals to bring participants closer together and to the land.

Furthermore, they have cultivated video skillshares on nurturing relationships with the land for beginners in BIPOC farming. These provide training and advice on soil carbon, composting, and agroforestry. SOUL FIRE Farm's "Liberation on Land Series" on YouTube does a great job connecting with viewers.



Image: Farming Immersion Program at Soul FIRE Farm

#### Urban Farmer Training Program at Urban Farming Institute

Bringing urban farms to Boston, the Urban Farming Institute offers individuals the opportunity to explore food systems, environmental challenges, and organic agriculture over a 9-week training program. By building a network of urban farmers, Darnell's Farm can multiply its impact and outreach.

BIPOC GrowTeam Fellowship and Volunteering at Conscious Homestead

Conscious Homestead is a Black-femme-owned farm in Winooski, VT that hosts a fellowship running 2 weekends a month, from June through September 2022. Participants "engage with Afro-Indigenous practices and ways of growing food for themselves and their communities." The program compensates fellows with \$2800, meals each working day, and free organic food grown on the homestead. The program consists of art, social and educational programming, field trips, and workshops to promote hands-on learning and practice with land stewardship.

## How do farming workshops apply to your farm?

- It may feel daunting at times being a beginning farmer, but don't be afraid—you are not alone and there are resources to support you!
- Early on, it may be beneficial to attend some of these workshops and retreats to absorb knowledge and wisdom from more established farmers.
- When comfortable, you can host similar workshops at your farm to help spread the knowledge to others! Possible ideas include farm skills, utilizing a greenhouse, planning for planting seasons, or how to use different tools and equipment. You can also host workshops specific to crops you are growing, such as how to process a certain crop, make jam, use it medicinally, or pickle it. You can also host workshops specific to the healing herbs growing on the farm.

# Relationship to Land, Self, and Culture Workshops and Retreats

### Sections

- 1. Relationship Workshops Examples
- 2. How do land, self, and culture workshops apply to your farm?

## **Relationship Workshops Examples**

Workshops about relationships to land, self, and culture could **promote healing, balance, and justice** on the farm, as well as **build people's connections to each other, the land, themselves, and their cultures,** all very in line with Darnell's mission! This section includes examples as inspiration for potential workshops and retreats that deal with connection to the land and identity.



Image: Darnell's Farm

#### Relevant Events at SUSU CommUNITY Farm

Striking at the center of Darnell's core mission, an Afro-Caribbean focused ancestral learning program can teach and reclaim ancestral African techniques, languages, and other wisdoms of the land. Nearby BIPOC-owned SUSU CommUNITY Farm offers Yoruba language classes, community gatherings around food as medicine, and classes on ritual events such as harvesting, seed planting, and a veggie spiritual bath. Additionally, exploring a relationship to land, self, and culture is incomplete without talking about racial justice. SUSU CommUNITY Farm allows participants to reclaim BIPOC freedom and joy by using ritual afro-indigenous somatic practice.

#### Renewal Week at Knoll Farm

Darnell's Farm can also offer Renewal Week retreats that offer local community members refuge from their day-to-day lives. Knoll Farm's Renewal Week involves inviting small, community-driven organizations to stay free of charge at their farm in an outdoor cabin arrangement. For Darnell's farm, groups and organizations could be invited to help out on the property while given the chance to run their own activities to renew their souls and spirits.

## How do land, self, and culture workshops apply to your farm?

- We can tell that your relationship to the land and your culture is very important to you – programs like these could help bring that to life on your farm!
  - Growing cultural foods in your greenhouse, utilizing native wisdom and techniques in your day-to-day operations, and finding ways to share and celebrate your heritage with others could be great ways to do so.
- Hosting talks and discussions is a great way to create a welcoming and safe environment. Inviting speakers and thought leaders to your farm can help your space act as a knowledge center.

# **Art Workshops and Retreats**

## Sections

- 1. Art Workshops Examples
- 2. How do art workshops apply to your farm?

## **Art Workshops Examples**

Workshops and retreats centering around arts, from visual art to music to theater, could **promote connectedness and healing, and foster the creative spirit** the farm embodies. In addition to having artists stay at the farm to work on projects, hosting more structured arts workshops and retreats could **make art more accessible and approachable for all on the farm** and **promote a culture of trying new things**. This section contains examples of art workshops and retreats that could be the inspiration for programs on the farm.

 Vermont African-American/African Diaspora Artists' Registry at Clemmons Family Farm

Darnell's Farm can draw inspiration from Clemmons Family Farm's registry of Vermont artists that identify as Black, African-American, African, or the African Diaspora. The goal of an artist retreat is to empower a network of Black and BIPOC Vermont artists through professional development, advocacy, and paid engagements. Clemmons also runs retreats and workshops led by artists of color.



Image: A Clemmons Family Farm Artist workshop

#### Let My People Sing!

Music and healing is key for art workshops and retreats. Programming can resemble "Let My People Sing!" which hosts retreats using singing to build community and collective liberation, with the goal of uplifting its participants. Music and healing retreats should restore broken cultural heritage and help connect participants to their chosen ancestors to heal trauma.

#### Singing Retreat at WILDSEED Community Farm

WILDSEED Community Farm hosted a 30-person, 3-day singing retreat led by Haleh Liza entitled, "Songs from the Mystic Wild." A BIPOC retreat deepens human interconnectedness and can inspire other healing retreats. A three-day retreat, similar to that offered by New York-based WILDSEED Community Farm, offers the perfect time to achieve balance.



Image: "Let My People Sing!" program

## How do art workshops apply to your farm?

- Nature is an incredible source of inspiration, and your farm is the perfect place to connect with Vermont's natural beauty!
- Holding workshops for artists of all kinds to share their skills and expertise with the community can help foster an amazing artistic spirit.
- Showcase your own talents! You are an incredibly talented artist and people would love to hear how you do your work.

# Healing Spaces on the Farm

### Sections

- 1. Introduction
- 2. Example Headling Spaces on the Farm

## Introduction

Healing spaces on the farm could **promote rest, increase accessibility, and foster community.** The following suggestions are specific to spaces available at Darnell's Farm and subsequent writing will directly address her.

We know that any changes made to the landscape must be carefully planned, so we have suggested ideas of many different sorts of healing spots to consider!

## **Example Healing Spaces on the Farm**

#### The Greenhouse:

- Community members could help construct the greenhouse during community workdays. Once the greenhouse is complete, community members could work inside the greenhouse.
- The greenhouse could be a lighthouse model for learning about how to build and run greenhouses so that they can be constructed elsewhere and give more people access to fresh food.
- The greenhouse will grow culturally relevant foods, which could be relevant to workshops and retreats focused on connection to land and culture.
- The greenhouse could be a space for reflection, meditation, and creative work, utilizing the planned seating areas for solo or group work and leisure.
- The greenhouse could be a prompt to inspire different kinds of art, from being the inspiration for a song to the subject of a painting to the location of a play.

|   |  |  |   |                          | Potential Healing Space            | •                |
|---|--|--|---|--------------------------|------------------------------------|------------------|
|   |  |  |   | 149'                     |                                    |                  |
| ſ | Bananas & Plantains                        | Traditional Continuently<br>Production Space | Traditional Product                     | ion Space: tomatoes pe   | ppers, eggplants, leafy greens     | Seating Space    |
| l | See  | Startling Shelf                              |   | Constitute               | Church                             |                  |
| I |  | Plant Shelf                                  |   | Factorial and hells Mall | Probas                             | Hotals           |
|   | Seed Starting Bench<br>Inupplemental light | (Storage<br>L& heat)                         | Teoplical Community<br>Production Space | Tropical Producti        | ion Space: herbs, spices, okra, ro | oselle, amaranth |

Image: Diagram created by greenhouse team, highlighting seating spaces.

#### A stage:

- Building a stage for performances could open lots of different avenues for showcases at the farm. The barn could be a great place to build a stage sheltered from the elements. The barn's exterior walls could also be used for film screenings, with a simple setup of a screen (or white sheet) and projector!
- Visiting artists could perform using the stage, and participants in art workshops or retreats could have a culminating performance onstage.
- Note: If building a stage, ensure that it is wheelchair-accessible

#### Picnic tables by the river:

- Picnic tables by the river could be a space for connection, reflection, meditation, and creative work.
- Note: we encourage at least some of the picnic tables to be wheelchair-accessible tables. Additional infrastructure, in the form of wheelchair-friendly paths, would also be necessary.



Image: River alongside Darnell's Farm

#### Sitting spots along the walkway in the tree and herb field:

- In the tree and herb field that the farm fields group is planning, having sitting spots could allow people to pause for connection, reflection, meditation, and creative work.
- It would also increase accessibility, allowing a wider range of people to enjoy the field.

#### Firepit seating:

- Ample seating around the fire pit would allow for formal and informal gatherings to happen around the campfire.
- Campfires could be helpful for healing rituals, singing, and promoting healing and community.
- This spot could also host barbecues and community dinners to connect over food.
- **Note:** In addition to the Adirondack chairs currently around the fire pit, it could be helpful to get some benches that seat many people.



Image: Firepit and seating areas on Darnell's Farm

#### Shade tents and shade covers around the farm:

- Shade tents around the farm could be helpful to keep people cool and out of the sun on hot days.
- This could help make being outside more accessible for everything from working on the land to doing creative work to meditating.
- Shaded areas could keep community members cool during workdays.
- Shade tents or covers could also reduce the brightness of a white page or canvas, or the glare on a computer screen, allowing a larger range of artists to work outside.

#### Clearings throughout the property:

- Clearings throughout the property, such as in a few spots in the woods, could allow for moments of healing or learn about the land.
- Clearings could also be a site where people can engage in creative work.
- **Note:** Having seating in these clearings will make them more accessible. It is also important to remind guests to check for ticks after their time in the woods.

#### **Basketball Hoops:**

- Basketball is a cathartic activity that can be used in youth programming events.
- Once the infrastructure is in place, basketball retreats for kids can partner with external organizations, such as those that uplift inner-city kids



Image: Basketball hoop currently on Darnell's Farm

#### Cabin in the woods:

- Having a private space to rest (sleep, meditate, create, etc.) is very impactful.
- Artists can utilize this space (potentially rent it out?) for a personal or couples retreat supporting artistry and privacy.

#### Mobile seating:

- Having extra, lightweight, movable seating allows you to turn any spot into a healing space!
- Having this seating will allow for greater accessibility and comfort.

# **Resource Guide Sections**

- 1. Introduction
- 2. Organizations and Networks
  - a. Vermont Releaf Collective
  - b. Northeast Farmers of Color Land Trust (NEFOC LT)
  - c. A Growing Culture (AGC)
  - d. Northeast Organic Farming Association of Vermont (NOFA Vermont)
  - e. National Black Food & Justice Alliance (NBFJA)
  - f. Dandelion Homesteads
  - g. Black Emotional and Mental Health Collective (BEAM)
  - h. JAG Productions
  - i. National Council of Farmer's Cooperatives (NCFC)
  - j. Vermont Professionals of Color Network (VT PoC)
  - k. Just Construction
  - I. Black Urban Growers
  - m. Vermont Abenaki Artists Association
  - n. Abenaki Nation of Missisquoi
- 3. Similar Farms to Connect With
  - a. Soul Fire Farm
  - b. Clemmons Family Farm
  - c. SUSU commUNITY Farm
  - d. Conscious Homestead
  - e. Radical Imagination Residency
  - f. Nama Farm
  - g. Magnetic Fields Farm
  - h. Sweet Freedom Farm
  - i. WILDSEED Community Farm & Healing Village
  - j. Rock Steady Farm
  - k. Mumbet's Freedom Farm
  - I. Kibilio Refuge Community & Farm

- 4. Grants and Funding Sources
  - a. BIPOC Farmer Micro-Grants
  - b. Food and Land Justice Fund
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  - d. Core Grants Program
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- 5. Farmer Programs and Other Resources
  - a. BIPOC Farmer Legal Fund
  - b. Business Planning and Land Access Support for BIPOC Farmers
  - c. NOFA-VT Farm Beginnings
  - d. Rock Steady Farm Consultations
  - e. Healing Justice Trainings for Black Communities
  - f. Self-Directed Online Farming Courses
- 6. Helpful Publications and Media
  - a. Ask A Sista Farmer
  - b. Liberation on Land Skillshare
  - c. Rock Steady Farm Resource Library
  - d. Youth Food Bill of Rights
  - e. Cafe Convos: Sustainability, Uprooting, and Intersectionality
  - f. Race, privilege and the exclusivity of farm internships: Ecological agricultural education and the implications for food movements
  - g. 'How I turn a profit on an acre of land'
  - h. Root Words Podcast

# Introduction

This section is a collection of resources to aid Darnell's farm as it takes form. We have divided this resource guide into five sections: (1) organizations and networks, (2) similar farms to connect to, (3) grants and funding sources, (4) farmer programs and other resources, and (5) helpful publications and media. This resource guide is intended to be used to help Darnell learn farming skills and how to support a community of BIPOC artists and youth. This guide also serves as a directory of like-minded farms, organizations, and networks with whom Darnell can build connections and hopefully long-term partnerships. This resource guide also exists in spreadsheet form, which we are emailing to you. The resources that have physical locations appear on a Google Maps layer, which can be found at bit.ly/Darnell-Resource-Map, and on the printed map we are giving you.



Photo: Darnell and her dogs at her farm
# **Organizations and Networks**

# Vermont Releaf Collective

Location: Vermont Type: Statewide Collective Website: https://www.vtreleafcollective.org/ Email: hello@vtreleafcollective.org Mission: Supports a membership-based network of BIPOC and BIPOC-led organizations with community building and collaboration opportunities. Individual membership and BIPOC-led organization membership options are available. Hosts events for members (both in-person and virtually) such as workshops and skill shares.

# Northeast Farmers of Color Land Trust (NEFOC LT)

Location: Northeastern U.S. Type: Land Trust Website: https://nefoclandtrust.org/ Email: connect@nefoclandtrust.org Mission: Uses a hybrid model land trust focusing on both community land and conservation land to uplift Indigenous, Black, and POC relationships with land. Connects BIPOC farmers and land stewards to resources and training. (paraphrased from their website)

# A Growing Culture (AGC)

Location: International (based in NYC) Type: Non-Profit Website: https://www.agrowingculture.org/ Email: info@agrowingculture.org Mission: Advancing food sovereignty. Supports seed savers through their "Seed is Power" fund and runs a "Hunger for Justice" storytelling series.

#### Northeast Organic Farming Association of Vermont (NOFA Vermont)

Location: Vermont Type: Non-Profit Website: https://nofavt.org/ Email: info@nofavt.org Mission: "Promotes organic practices to build an economically viable, ecologically sound and socially just Vermont agricultural system that benefits all living things."

#### National Black Food & Justice Alliance (NBFJA)

Location: National Type: Coalition Website: https://www.blackfoodjustice.org/ Email: info@blackfoodjustice.org Mission: Supports a membership-based coalition of Black-led organizations and organizes for food sovereignty, land, and justice.

#### **Dandelion Homesteads**

Location: Sheffield, MA Type: Network Website: https://www.mumbetsfreedomfarm.com/about Mission: "An ecosystem of BIPOC-led cooperatives that co-steward land and co-create sustainable homes, communities, and enterprises. We are powered by Black and Indigenous wisdom, values, and strategies for self-determination and thriving together."

#### Black Emotional and Mental Health Collective (BEAM)

Location: National Type: Collective Website: https://beam.community/ Email: admin.account@beam.community (for partnership inquiries) Mission: "BEAM is a national training, movement building, and grant making institution that is dedicated to the healing, wellness, and liberation of Black and marginalized communities. Our mission is to remove the barriers that Black people experience getting access to or staying connected with emotional health care and healing through education, training, advocacy, and the creative arts."

#### **JAG Productions**

Location: White River Junction, VT Type: Theater Company Website: https://www.jagproductionsvt.com/ Email: info@jagproductionsvt.com Mission: "To produce classic and contemporary African-American theater; to serve as an incubator of new work that excites broad intellectual engagement; and thereby, to catalyze compassion, empathy, love, and community through shared understandings of the humankind through the lens of the African-American experience." **Notes:** JAG Productions is an influential African-American arts-related resource in Vermont.

#### National Council of Farmer's Cooperatives (NCFC)

Location: National Type: Non-profit Website: http://ncfc.org/ Mission: "To advance the business and policy interests of American farmer cooperatives."

#### Vermont Professionals of Color Network (VT PoC)

Location: Vermont Type: Network Website: https://www.vtpoc.net/ Email: thefam@vtpoc.net Mission: To advance the prosperity of BIPOC, also known as People of the Global Majority, in Vermont by driving a new era of professional mobility, promoting their entrepreneurial ventures, and nurturing a powerful professional network. (paraphrased from their website)

**Notes:** VT PoC has a BIPOC business directory through which you can register your farm. You can also use this directory to connect with nearby BIPOC-owned businesses.

#### **Just Construction**

Location: Vermont (with other locations nationwide) Type: Cooperative Website: https://www.justconstruction.org/ Email: justconstructionvt@gmail.com Mission: "By building physical infrastructure for BIPOC leaders throughout the state, we engage in tangible reparative work and support these leaders' ability to lead."

#### **Black Urban Growers**

Location: National (based in NYC) Type: Non-profit Website: https://blackurbangrowers.org/ Mission: "To build networks and community support for growers in both urban and rural settings. Through education and advocacy around food and farm issues, we nurture collective Black leadership to support Black agrarianism and reimagine Black futures. Based in New York City, BUGs reach is national through its annual conference."

#### Vermont Abenaki Artists Association

Location: Vermont Type: Statewide Collective Website: https://abenakiart.org/blog9/ Mission: "To promote awareness of state-recognized Abenaki artists and their art, to provide an organized central place to share creative ideas, and to have a method for the public to find and engage state recognized Abenaki artists.We do this by presenting public programs, cultural events, and museum exhibitions that educate the public in understanding Abenaki art and culture."

**Notes:** VAAA Hosts an annual Abenaki Heritage Weekend in June and takes donations year-round; both offer opportunities to connect with Indigenous people of this land and show solidarity!

#### Abenaki Nation of Missisquoi

Location: Vermont

Type: Collective/Community

Website: https://www.abenakination.com/

Mission: "To engage in efforts which will promote and sustain a strong, healthy, and united community for the members of the Abenaki Nation. It is further our purpose to improve the quality of life for the tribal members we serve by identifying, addressing, and working to decrease gaps in service and treatment across the spectrums of health, human, and social services."

**Note:** Website provides a brief history of the Abenaki people and their chiefs. The organization also hosts a food shelf that takes donations for local families and accepts monetary donations.

# **Similar Farms to Connect With**

#### **Soul Fire Farm**

Location: Petersburg, NY Website: https://www.soulfirefarm.org/ Email: love@soulfirefarm.org Mission: "An Afro-Indigenous centered community farm committed to uprooting racism and seeding sovereignty in the food system."

#### **Clemmons Family Farm**

Location: Charlotte, VT Website: https://www.clemmonsfamilyfarm.org/ Email: contact@clemmonsfamilyfarm.org Mission: Preserve the farm as a critical educational prototype and model for preserving other African-American owned agricultural land; empower VT's Black artists; build a loving multicultural community around African-American / African diaspora history, arts and culture. (paraphrased from their website) Notes: Has on-farm arts programs and leads the Vermont African Diaspora Artists' Registry network.

# SUSU commUNITY Farm

Location: Newfane, VT Website: https://www.susucommunityfarm.org/ Email: info@susucommunityfarm.org Mission: "The SUSU commUNITY Farm is a Afro Indigenous stewarded farm and land based healing center in Southern Vermont that elevates Vermont's land and foodways. We do this by co-creating a life affirming and culturally relevant platform for Black, Indigenous, People of color, youth, under resourced folx, and allies to thrive and experience safety and connection while beginning to develop the tools and agency to heal from the trauma of colonization."

#### **Conscious Homestead**

Location: Winooski, VT

Website: https://www.conscioushomestead.org/

Email: conscioushomestead@gmail.com

Mission: "Conscious Homestead is a BIPOC Urban Farm and Wholeness Retreat in Winooski Vermont stewarded by Candace Taylor. We are committed to co-creating a space that is rooted in healing our ancestral connection to the land while centering BIPOC wholeness and liberation. This lush and beautiful haven is tucked away in Candace's recently transformed backyard. With community support this magicFULL space is available as a retreat dedicated to the rest, nourishment and empowerment of BIPOC."

#### **Radical Imagination Residency**

Location: Corinth, VT

Website: https://radicalimaginationprojects.com/Radical-Residency Contact Form: https://radicalimaginationprojects.com/contact-form Mission: "We open up our studios and gardens to invite BIPOC artists from all over the world to come and share the bounty. We provide three vegetarian meals a day, special guest lectures, and two optional adventures. Our facilities include a wood shop, ceramics shed, fiber barn and shared indoor and outdoor studio spaces."

#### Nama Farm

Location: Montpelier, Vermont Website: https://namafarm.webs.com/ Email: namafarm@gmail.com Mission: Nama Farm is a BIPOC-owned farm led by artist-farmers who grow vegetables and fruits for their line of preserves. They are building a community to support homesteading and direct reparations. (paraphrased from their website)

#### **Magnetic Fields Farm**

Location: Athens, VT Website: https://www.facebook.com/MagneticFieldsFarm/ Mission: A queer/BIPOC-owned farming community that supports affordable housing, affordable land leasing, and culturally important food production. (paraphrased from their website)

#### **Sweet Freedom Farm**

Location: Germantown, NY Website: https://www.sweetfreedomfarm.org/ Email: sweetfreedomfarmny@gmail.com Mission: "Farm, food redistributor, and training site for young BIPOC farmers. We feed folks; we grow food not prisons; we train BIPOC farmers; we host abolition & waffles."

#### WILDSEED Community Farm & Healing Village

Location: Millerton, NY Website: http://www.wildseedcommunity.org/ Email: love@wildseedcommunity.org Mission: "We are a collective of Black Indigenous and other People of Color working in collaboration with our ancestors to steward 181 acres in the Mid-Hudson Valley. We are co-creating a healing sanctuary, ecological farm, and political and creative home rooted in dignity, interdependence, transformative justice, connection to nature and intergenerational love."

#### **Rock Steady Farm**

Location: Millerton, NY Website: https://www.rocksteadyfarm.com/ Email: hello@rocksteadyfarm.com Mission: To increase equity in the food system and support queer and BIPOC farmers. Rock Steady is a queer\* owned and operated cooperative vegetable farm. (paraphrased from their website)

#### **Mumbet's Freedom Farm**

Location: Sheffield, MA Website: https://www.mumbetsfreedomfarm.com/ Email: connect@mumbetsfreedomfarm.com Mission: "Mumbet's Freedom Farm is a Black and Brown-led cooperative farm and community sanctuary for connection, creativity, education, and wellness." Notes: Launched fall 2021 and is in development phase – it could be helpful to connect with a farm just starting out!

#### **Kibilio Refuge Community & Farm**

Location: Western Massachusetts

Website: https://kibilio.org/

Contact Form: https://kibilio.org/contact/

Mission: Farm rooted in Black and Queer land sovereignty, embodied healing, and justice. Kibilo's mission is to build and sustain an engaged network to resource our collective journey of repair and reparations. As part of this journey, we seek to support a community that lives and learns together; is rooted in deep democracy and accountability; and fulfills the purpose of building a culture that interrupts coloniality and racialized conditioning while nurturing individual and collective healing. (paraphrased from their website)

# **Grants and Funding Sources**

#### **BIPOC Farmer Micro-Grants**

Type: Private Grant Supporting Organization: Rodale Institute Website: https://rodaleinstitute.org/education/bipoc-farmer-micro-grants/ Award: Between \$500 to \$2000 for a project that has a high potential for meeting the farmer's needs. Multi-year proposals will be accepted for long-term projects. Eligibility: Small-scale BIPOC farmers who are organic or aspiring to transition to organic. Contact: BIPOCgrants@RodaleInstitute.org

# Food and Land Justice Fund

Type: Private Grant Supporting Organization: Liberated Capital Fund Website: https://decolonizingwealth.com/liberated-capital/foodandland/ Award: Ranges from approximately \$5,000 to \$50,000. Eligibility:

- "Grantee partners are organizations and/or coalitions led by BIPOC.
- Grant dollars must be paid to a U.S.-based 501c3 nonprofit organization or fiscal sponsors. Individuals are not eligible.
- Coalitions and organizations working in the field of food and/or agriculture with a focus on BIPOC community food access, advocacy, regenerative farming practices, wellness, education, policy, and supporting BIPOC farmers.
- Funding must be used for a charitable purpose (no direct lobbying).
- Proposals were evaluated by an advisory group of BIPOC leaders with expertise in the sector."

Contact: info@decolonizingwealth.com

#### Fair Food Fund

Type: Investment Fund Supporting Organization: Fair Food Network Website: https://fairfoodnetwork.org/projects/fair-food-fund-entrepreneurs/ Award: "Investments are offered as stand-alone investments ranging from \$25,000 to \$250,000 or as part of a larger financing package." Eligibility: They invest in companies in the food system incorporated in the Northeast United States. They are committed to supporting food enterprises led by women and BIPOC entrepreneurs. They look for businesses that can demonstrate a path to profitability. (paraphrased from their website) Contact Form: https://fairfoodnetwork.org/getstarted/ Notes: In addition to customized financing, they also provide business assistance.

#### **Core Grants Program**

#### Type: Private Grant

Supporting Organization: Food and Farm Communications Fund Website: https://foodandfarmcommunications.org/grantmaking/core-grants/ Award: "\$20,000 to \$30,000 over a one-year term. The Fund can make a very limited number of two-year commitments for projects that need a longer time frame of support." Eligibility:

"Core Grants are intended for projects that support communications strategy, shift public narrative, and build community engagement.

- Be a grassroots organization or network with 501(c)(3) status or with a 501(c)(3) fiscal sponsor
- Have an average annual revenue of less than \$3 million
- Clearly demonstrate an organizational analysis of structural and institutional racism in the food and farm system, as well as a clear understanding and strategy as to how the organization works to advance racial equity and justice

- Clearly demonstrate a commitment to integrating the leadership of its constituents within the organization's governance structures
- Clearly demonstrate a commitment to environmental stewardship and ecological resilience in our food and farm systems
- Be collaborative in approach and practice"

Notes: "The Fund is committed to investing at least 75% of grant funds in BIPOC-led work."

# **Capacity Mini-Grants Program**

Type: Private Grant

Supporting Organization: Food and Farm Communications Fund

Website: https://foodandfarmcommunications.org/grantmaking/capacity-mini-grants/ Award: "From \$1,000 to 5,000. <u>Applicants should only apply for activities that can be</u> <u>completed within 9 months of receipt of a grant</u>."

Eligibility:

- "Be a grassroots organization or network with 501(c)(3) status or with a 501(c)(3) fiscal sponsor
- Have an average annual revenue of less than \$1 million
- Clearly demonstrate a commitment to equity and racial, social, and economic justice;
- Clearly demonstrate a commitment to integrating the leadership of its constituents within the organization's governance structures
- Clearly demonstrate a commitment to environmental stewardship and ecological resilience in our food and farm systems"

Notes: "The Capacity Mini-Grants Program prioritizes small grassroots organizations serving communities including Black, Indigenous, and other people of color; farmers; and farmworkers." The next Capacity Mini-Grants cycle is expected to occur Summer 2022.

# **Farmer Programs and Other Resources**

#### **BIPOC Farmer Legal Fund**

Type: Legal Fund Supporting Organization: A Growing Culture (AGC) Website: https://www.agrowingculture.org/bipoc-farmer-legal-fund/ Description: Provides pro-bono legal services to BIPOC farmers, including entity formation, operating agreements, commercial contracts, purchase and sale agreements, and intellectual property protection.

#### **Business Planning and Land Access Support for BIPOC Farmers**

Type: Support Services Supporting Organization: Northeast Organic Farming Association of Vermont (NOFA Vermont) Website: https://nofavt.org/business-planning-and-land-access-support-bipoc-farmers Description: Provides support services for farmers of color in Vermont.

#### **NOFA-VT Farm Beginnings**

Type: Farmer Training Course Supporting Organization: Northeast Organic Farming Association of Vermont (NOFA Vermont)

Website:

https://nofavt.org/programs/farmer-services/farm-beginnings/apply-farm-beginnings Description: A year-long course designed for aspiring and beginning farmers to learn how to start their farming business. Includes online modules and the opportunity to work one-on-one with an experienced farmer mentor.

Notes: <u>NOFA-VT will provide a full scholarship to anyone who identifies as BIPOC</u>. In 2021, applications for the program were due on September 13th, 2021.

#### **Rock Steady Farm Consultations**

Type: Consulting Supporting Organization: Rock Steady Farm Website: https://www.rocksteadyfarm.com/speaking Description: Rock Steady Farm consults for farms and organizations on coop development, sliding scale, community partnerships, financial management, integrating racial justice into organizational development, and vegetable production technical assistance for farms.

**Notes:** Based on their sliding scale model for honorariums, a 1 to 4 hour consultation has a suggested fee of \$100-\$500 for organizations led by Black, Indigenous, and/or Latinx people with an annual budget under \$100,000.

#### **Healing Justice Trainings for Black Communities**

Type: Training Courses and Private Coaching Supporting Organization: Black Emotional and Mental Health Collective (BEAM) Website: https://beam.community/trainings/ Description: Their training courses increase emotionally intelligent leadership practices among Black leaders. They offer private coaching for organizations to help support Black mental health and wellness.

#### **Self-Directed Online Farming Courses**

Type: Farmer Training Courses Supporting Organization: Market Gardener Institute Website: https://themarketgardener.com/ Description: Founded by organic farmer Jean-Martin Fortier, Market Gardener Institute offers fee-based online courses to teach new farmers how to successfully grow crops. **Notes:** Nearby farms in Vermont recommended this resource for new farmers.

# **Helpful Publications and Media**

#### Ask A Sista Farmer

Supporting Organization: Soul Fire Farm Type: Video Series Website: https://www.soulfirefarm.org/food-sovereignty-education/ask-a-sista-farmer/ Shortened website link for ease (case sensitive!): bit.ly/Darnell-Resource-1 Description: Free virtual show on agroecology that centers voices from Black, Indigenous, People-of-Color, Queer, Trans\*, Disabled, Immigrant, and Poor communities. 3 seasons of video recordings can be found on the Soul Fire Farm website.

## Liberation on Land Skillshare

Supporting Organization: Soul Fire Farm Type: Video Series Website: https://www.soulfirefarm.org/liberation-on-land/ Shortened website link for ease (case sensitive!): bit.ly/Darnell-Resource-2 Description: Farming "how-to" videos that teach practical, land-based skills and feature Black, Indigenous, Latinx, and other people of color farmers and land stewards. Honors African Diasporic and Indigenous wisdom.

#### Rock Steady Farm Resource Library

Supporting Organization: Rock Steady Farm Type: Resource Library (articles, webinars, etc.) Website: https://www.rocksteadyfarm.com/resource-library Shortened website link for ease (case sensitive!): bit.ly/Darnell-Resource-3 Description: Rock Steady Farm's library of resources that support their work, including operational documents, articles, and webinars.

# Youth Food Bill of Rights

Supporting Organization: Rooted in Community Leadership Summit

Type: Document Website: https://cefs.ncsu.edu/wp-content/uploads/FYI-What-is-the-Youth-Food-Bill-of-Rights.pdf?x 77888 Shortened link for ease (case sensitive!): bit.ly/Darnell-Resource-4 Description: A set of rights and principles created by a group of 100+ youth food justice leaders in 2011.

#### Cafe Convos: Sustainability, Uprooting, and Intersectionality

Supporting Organization: Soul Fire Farm & Leah Thomas (Author of Intersectional Environmentalist) Type: Recorded Discussion Website: https://www.crowdcast.io/e/v1ao7uru Shortened website link for ease (case sensitive!): bit.ly/Darnell-Resource-5 Description: Recording of a discussion on how to dismantle systems of oppression to protect people and the planet.

# Race, privilege and the exclusivity of farm internships: Ecological agricultural education and the implications for food movements

Supporting Organization: Scholarly Journal (*Environment and Planning E: Nature and Space*) Type: PDF of Journal Article Website: https://drive.google.com/file/d/13cH671V9KQ\_UI5GFL2Vm3tClqEkMCnmd/vie w?usp=sharinghttps://drive.google.com/file/d/13cH671V9KQ\_UI5GFL2Vm3tClqEkMCnmd/ view?usp=sharing Shortened website link for ease (case sensitive!): bit.ly/Darnell-Resource-6 Description: Research paper discussing the inequities in farm internships.

#### 'How I turn a profit on an acre of land'

Supporting Organization: TEDxJohannesburgSalon

Type: Video

Website:

https://www.ted.com/talks/emma\_naluyima\_how\_i\_turn\_a\_profit\_on\_an\_acre\_of\_land Shortened website link for ease (case sensitive!): bit.ly/Darnell-Resource-7 Description: TED talk by Ugandan veterinarian and small-scale farmer Emma Naluyima about how she uses integrated farming. Video recommended by interviewee Aaron Lee, a Dartmouth College '20.

# **Root Words Podcast**

Supporting Organization: Vermont Farmers Food Center, Shrewsbury Agricultural Education & Arts Foundation, Shrewsbury Historical Society, WEXP, and community members

Type: Podcast Series

Website: https://www.vermontfarmersfoodcenter.org/root\_words

Shortened website link for ease (case sensitive!): https://bit.ly/Darnell-Resource-8

Description: Collaborative series of podcasts showcasing stories of how food and agriculture connect us with our community and our landscape. The project ran from 2018-2021 and discuss topics such as BIPOC taking space, Abenaki land relationships, food security, and sugaring in Vermont/

# Part 2 Greenhouse Plan

Ellie Urdang Lauren Hodess Aziz Woodward Sophia Greszczuk Connor Richmond Chad Lasseter

# Message to the Reader

Greenhouses have a unique ability to transport their visitors anywhere in the world and back through time. When embarking on this project, we sought to create a greenhouse that would enable its visitors to experience the worlds of African, Caribbean and Indigenous agriculture as they are now and as they were thousands of years ago. Through these experiences, we hope visitors can both garner the knowledge of their ancestors and also draw inspiration from them to farm, paint, write and make music in new ways.

# **Greenhouse Sections**

- 1. Introduction
- 2. Crop Catalog
- 3. Greenhouse Operations Technical Guide

# Introduction

The end products of a greenhouse are the result of the seeds planted and the climate created within the greenhouse to nourish these seeds. The first section of this greenhouse guide details the possible crops that can fill the greenhouse with the cultures of African, Caribbean and Indigenous farmers. The second section of this greenhouse guide details the best operating practices which will produce an environment that allows crops to thrive while creating comfortable, reflective spaces within.

# **Greenhouse Crop Catalog**

## **Sections**

- 1. Overview
- 2. Goals
- 3. Proposed Greenhouse Design
- 4. Plants in the Proposed Greenhouse Design
  - a. African & Caribbean Species
  - b. Healing Species from Africa
  - c. Local Indigenous Species
  - d. Common Vermont Greenhouse Species
- 5. Seeds to start for Farm Fields
- 6. Aquaponics
- 7. Appendix: Addition Species

# **Overview**

This document is a compilation of research on plant varieties for the greenhouse. We recommend plants that align with our set of goals. This catalog is meant to provide information so that the farmer can easily select plants.

# Goals

- 1. We want to create a creative and inclusive atmosphere for artists.
- 2. We will grow traditional vegetables and herbs that are culturally important to different groups of people.
- 3. The greenhouse should serve as a lighthouse model for other farmers, especially farmers of color and urban farmers, to learn from and implement within their own communities

# **Proposed Greenhouse Design**



The corner closest to the house (Southern) is the production space of traditional African and Caribbean plants. It receives the most direct sunlight and the species will not block the sun. The close entrance leads to a pathway between floral rows. This door and pathway is wide enough to be wheelchair accessible. The wheelchair path leads to a row of florals and a seating space with a table and chairs. These are surrounded by more flowers and traditional plants. A fan at the door will circulate air from the door into the seating space to reduce heat and make the area more comfortable.

In the center of the greenhouse is the individual sitting area. It is a 7' x 15' tiled space, which will serve as a haven of solitude and reflection. It is surrounded on one side by two avocado trees, and the other side surrounded by a trellis, growing vines and passionfruit. On the other two sides are papaya trees and a citrus hedge. These taller plants will create an enclosure that serves as an artist's retreat. On the uphill side is production space for traditional greenhouse crops. These rows will grow vegetables that will generate some revenue, which will include heirloom varieties.

By the north entrance, there will be a seed starting bench with layers of trays. Additional lighting and heat will go above each shelf. These seeds will be used in the greenhouse and in the farm fields. Banana and plantain trees with wide foliage will be planted on the northern side so they don't block as much sunlight from reaching other plants.

# **Greenhouse Crop Catalog**

Below are a variety of crops suitable for greenhouse growth that also align with the mission of Darnell's farm. Plants are segmented by origin and application.

# African & Caribbean Species

# Bananas



Located in the back left of the greenhouse with the plantains.

**Rajapuri bananas** are a dwarf species that are hardy and produce a lot of fruit.

They are an 8' tree with a broad 3' crown.

Full sun, moist, well drained soil.

# Plantains



Located in the back left corner with the bananas.

The **Dwarf Puerto Rican Plantain** is fast producing and produces a large quantity of fruit.

It is 6' tall and has leaves extending 3' wide. It requires full sun, plenty of water, and high humidity. It is a perennial that can produce 3-5 sets throughout the year.

# **Passion Fruit**



Located by the individual seating area. **Possum Purple** Passion Fruit is a climbing, perennial vine. It should be grown on a trellis. It requires full sun and moist, well-drained soil. Each plant should be planted about 6 feet apart to allow for growth and spread of vines.

# Lemon



**Dwarf Meyer Lemon** trees will be on one side of the individual seating area. It requires full sun. This variety grows to 4-6 feet. It is very fragrant and produces heavily throughout the year. It has white flowers that are pollinated by insects. It is important to make sure the greenhouse windows are open during pollination. If not, they will need pollination help by hand.

# Orange



**Valencia Dwarf** Orange trees will make up the remainder of the citrus hedge by the individual seating area. It requires full sun, especially in the morning. It requires weekly watering. It is important that temperatures in this area can't drop below 50 F. This species will grow 8-10' tall.

The fruit is large and sweet and ripens in the summer

# Avocado



There will be two avocado trees next to the individual seating area. Type A avocados require a Type B Avocado to fertilize them, and vice versa. We recommend a **Del Reo** and **Bacon** Avocado. Both require full sun and moist, well-drained soil. They are perennials and will grow to between 15 and 20 feet if left unpruned.

# Papaya



The three papaya trees will go across from the avocados. **Red Lady Papaya** trees grow 6-7 feet in a container and 10-12 feet in the ground. They bear fruit after reaching four feet and are self fertile. The large oblong fruits are very sweet and high in Vitamin A and C. They require morning sun or all day light shade. The soil should be well-drained.

# Okra



Okra has traditionally been used in African medicine to treat dysentery, diarrhea, and other stomach pain. In this greenhouse, we recommend **Clemson spineless okra**, which is an heirloom variety. It requires full sun, moist soil, and

heavy watering. The plants grow 3-6' tall and 2' wide. It is an annual plant that produces fruits after 56 days. They should be harvested when they are 2.5-3" long.

# **Caribbean Peppers**



Peppers require full sun, well-drained soil, and moderate humidity between 50-60 percent. These heat-loving plants require soil temperatures above 70 degrees. Start seeds 5-6 weeks before last frost, and plant out 18 inches apart. We recommend the **Habanero** (pictured), the **Trinidad Scorpion,** and **Scotch Bonnet** peppers for the

greenhouse. These are peppers native to the Caribbean region, and have great history. Habanero and other hot peppers reach maturity around 80 days after transplant. They will continue to provide ample amounts of peppers until the first frost date.

# Roselle



We recommend the **rico** species for the greenhouse. This species requires full sun, and moist, well-draining soil. Roselle is a type of hibiscus native to Africa. The plants grow 7-8 feet tall, and the flowers are 3-4 inches in diameter. The flowers open up to reveal calyces. Harvest these about 10 days after flowers appear, when they are still tender. They can be eaten raw in salads or boiled in water and strained to make juice. The pulp is used for jams and pies.

# Amaranth



We recommend the **hopi red dye** species of amaranth. It was originally grown as a dye plant by the southwestern Hopi Nation and can be used for red dye. This species requires full sun, and needs to be grown 18" apart, eventually growing to be 2-5' tall.

# **Healing Species from Africa**

# Cape Aloe



Aloe Ferox is native to South Africa and Lesotho. It has been used in traditional medicine for a long time. The juice works as a laxative and deworming agent. The pulp inside has a soothing and moisturizing effect on skin. Traditional healers have long used it to treat burns and skin injuries.

Cape Aloe grows best in full sun and dry, well-drained soil. It is a succulent that grows slowly,

but will reach 4-7 feet. It can be propagated by using offsets, cuttings, or seeds from a mature plant.

# Madagascar Periwinkle



Native to Madagascar, Catharantus Roseus has traditionally been used to treat a wide variety of diseases, such as diabetes. It has also been used as a diuretic and cough remedy. An extract from the flowers is used in the Caribbean to treat eye irritation and wasp stings.

It needs partial sun and partial shade and well-drained, sandy soil. It is important to

avoid overwatering it. It is a perennial that can grow to  $2' \times 2'$ .

## Honeybush



Among other uses, Cyclopia intermedia/genistoides is most commonly used for honeybush tea, a traditional South African herbal tea. It is made by steeping dry leaves in boiling water and has gained popularity throughout the world because of its health, medicinal, and therapeutic properties.

It requires full sun and well-drained soil. It is a perennial shrub that will grow to be 3'-5' in both

directions.

Devil's Claw



Harpagophpytum procumbens is an herb native to the Kalahari Desert and broader South Africa. It has traditionally been used for many conditions, such as mouth or back pain and arthritis. It's chemicals can decrease swelling, so it is often used to treat pain and inflammation, such as arthritis.

It requires full sun and loamy, well-drained soil. While it prefers arid climates, it can survive in a greenhouse if watered infrequently. It is a perennial that is prostrate and mat-forming, growing up to 1.5 meters in length.

# **Local Indigenous Species**

## Sweetgrass



Hierochloe odorata is a native grass that is culturally important to Native Americans. It has a sweet, vanilla-like fragrance that develops when the plant begins to dry. It was commonly used as incense and was braided and burned for religious and peace ceremonies. It is culturally important for handicrafts, especially to decorate baskets, bowls, and mats.

It needs full to partial sun and well-drained soil.

It is a perennial grass that grows 18-24" tall.

# Sage



We are recommending Salvina officianlais, 'Tricolor'. Sage has traditionally been a healing plant for many groups of people. It requires full sun and well-drained soil. While it can be a perennial, in the warmer climate zone of the greenhouse, it will be an annual. It grows in a low shrub that is wider than tall. They should be planted 18-24 inches apart.

## Mint



We are recommending the native wild species of mint, Mentha Arvensis L. It requires full sun to partial shade and moist soil. It is a perennial with a square stem that grows from 6-18 inches. Plants should be spaced 2 feet apart so they have room to grow.

## Yarrow



Yarrow has been used medicinally in many cultures for thousands of years. Tribes, such as the Navajo, have used it for its ability to stop bleeding, prevent infection, and aid blood circulation. It is often used as a soak to relieve pain and heal all sorts of wounds. It can be chewed to numb a toothache. Achillea millefolium requires full sun and well-drained soil. It is a perennial that grows 2-3 feet tall and 2-3 feet wide.

# **Common Vermont Greenhouse Species**

## Cucumber



The **Diva cucumber** seeds should be started 3-4 weeks before transplanting into the bed. Start the seeds indoors after the last frost day. Plant the cucumber starts once the soil temperature reaches 70 degrees. This variety takes about 58 days to mature in the late spring and summer. Plants should be planted 1 foot apart. They do best when tied to a trellis.

## Tomato



Tomatoes require full sun and regular watering. Start seeds indoors 5 weeks before the last frost date. Seedlings can be planted out once the soil temperature reached 60 degrees. Seeds should be planted 2-3 feet apart.Keep the plants well-pruned, grow them upright supporting with a stake or string

trellis. Tomatoes should be planted alongside marigolds, alyssum, or basil. We recommend the following two types of tomatoes.

The **Edox F1 hybrid** (left) is a durable cherry tomato with a rich, sweet flavor. It is highly resistant to diseases often found in greenhouses.

The **Moskvich** (right) is an heirloom variety. They are a little larger, at 4-6 oz and they grow quickly. They are highly resistant to cracking, which makes them ideal for a greenhouse.
#### Eggplant



Eggplants require full sun and ample water. Start seeds 6-12 weeks before last frost, and then plant out 18-24" apart after the soil temperature reaches 75 degrees. The **Black Beauty Eggplant** is a classic American Heirloom variety that takes about 73 days to mature. This variety can be grown initially without support, but will need a support structure once the plant sets fruit.

#### Pole Beans



Pole beans are a type of climbing bean best grown in late spring, early summer, and fall. Pole beans require trellis support, but produce regular harvests of beans once they reach maturity. The best trellis system for greenhouse growing is a mesh netting trellis. This can be strung up along the ceiling of the greenhouse across the length of the rows. We recommend **Forex Beans** as they produce about 7-inch long stringless beans. These should be planted directly into the soil once soil temperatures reach 60 degrees. Plant beans 3-6 inches apart in rows 12-18 inches apart.

#### Seeds to start for Farm Fields

#### Marigolds

Sow seeds 6-8 weeks before the last frost.

Sow thinly by pressing seed into the soil and lightly covering.

Soil type: Moist, well-drained, pH 5.6 - 6.5

When seedlings are big enough to handle and after acclimatizing the seedlings to outdoor conditions, transplant outdoors after frost danger has passed

#### African Kale

**Chomolia** Seeds should be sowed into modules or trays. In June or July, transplant seedlings into the fields. The soil should be well drained.

#### African Chilis

Start seeds 8-12 weeks before the last frost. Transfer the seedlings when the nights are warmer. Do not use peat pots or potting soil because the soil may become too dry or too wet, which could lead to low germination, disease and fungus. Fill small cells or trays with a good sterile seed compost. Plant the seeds on the surface by coveringing them with a fine sprinkling (3mm) of soil or vermiculite. It is important that the compost does not dry out.

#### Acorn Squash

Sow seeds from the end of March through the end of May. Each seed should be started in its own 3-4 inch pot. Seeds should be planted 1 inch deep, completely covered, and watered thoroughly.

#### **Aquaponics**

We appreciate the efficient, sustainable, and productive nature of aquaponics. Because the products are free of pesticides and herbicides and all natural fertilizer for the farm fields can be sourced from fish waste, this aligns with Darnell's goals.

#### **Potential Problems**

Live animals require **full time care**. Until Darnell or a caretaker lives by the farm and can monitor the daily greenhouse operations, aquaponics are not ethical or feasible.

Additionally, many fish or shrimp will die, as they have short life cycles, and aquaponics rely on close-confined tanks to hold the animals and circulate water to the plants. This does not necessarily align with Darnell's mission to use the farm as a sanctuary for animals. If this is not a deal-breaker, aquaponics could be established after 5 years of successfully running a greenhouse. This would allow for enough time to understand and perfect the technical aspects of the greenhouse, planning, and installation of plumbing infrastructure. There are also significant energy and infrastructure costs associated with aquaponic systems, so it would be best to wait until solar power is installed and the greenhouse breaks even.

### Appendix: Additional Species Possible for Planting

Other plants are secondarily recommended for the greenhouse.

### Additional Local Crops

| Crop             | Species<br>recommendat<br>ions       | Growing<br>Season               | Growing conditions                     | Growth Pattern                       | Space requirements | Days to<br>Maturity | Any supplemental resources required?   |
|------------------|--------------------------------------|---------------------------------|--|--------------------------------------|--------------------|---------------------|--|
| Vegetables:      |                                      |                                 |  |                                      |                    |                     |  |
| melons           | minnesota<br>midget                  | late spring,<br>summer          | 70-95<br>degrees                       | vining, can be<br>trained on trellis | 18" apart          | 65-70               | start seeds 3-4 weeks before transplant  |
| summer<br>squash | yellow<br>crookneck,<br>black beauty | spring,<br>summer               | 70-95<br>degrees                       | bush-link, can be<br>tied up a pole  | 24" apart          | 50                  | start seeds 3-4 weeks before transplant  |
| winter<br>squash | honey nut                            | spring,<br>summer, fall         | 70-95<br>degrees                       | vining, can be<br>trained on trellis | 18-36" apart       | 100                 | start seeds 3-4 weeks before transplant  |
| brassica         |                                      |                                 |  |                                      |                    |                     |  |
| radish           | french<br>breakfast                  | spring, late<br>fall            | 50-75<br>degrees                       | small ground cover                   | 2" apart           | 28                  | plant directly into soil, keep<br>well watered, succession<br>sow  |
| carrots          | purple<br>dragon                     | spring, fall                    | 40-75<br>degrees                       | bushy<br>ground-covering<br>greens   | 1.5-2" apart       | 75                  | surface sow seeds during<br>cool temps, keep well<br>watered   |
| beets            | ruby queen                           | spring, fall                    | 50-85<br>degrees                       | bushy<br>ground-covering<br>greens   | 4" apart           | 55                  | direct sow 3-4 weeks<br>before last frost, or from<br>starts after last frost, fall<br>harvests develop sweeter<br>beets |
| lettuce          | may queen,<br>landis winter,         | late fall,<br>winter,<br>spring | 60-80degr<br>ees, frost<br>tolerant    | ground cover, or<br>head-forming     | 8-14" apart        | 50-60               | start seeds 3-4 weeks<br>before planting out, sow<br>seeds every 3 weeks for<br>season-long succession<br>harvests       |
| spinach          | bloomsdale<br>long standing          | fall, winter,<br>spring         | 45-75<br>degrees,<br>frost<br>tolerant | ground cover, or<br>head-forming     | 6-8" apart         | 50                  | start seeds 3-4 weeks<br>before planting out, sow<br>seeds every 3 weeks for<br>season-long succession<br>harvests       |

| arugula           | common                | fall, winter,<br>spring          | 40-70<br>degrees,<br>frost<br>tolerant<br>55-70<br>degrees, | ground cover  | 6" apart    | 50      | start seeds 3-4 weeks<br>before planting out, sow<br>seeds every 3 weeks for<br>season-long succession<br>harvests, harvest outer<br>leaves for continual yields<br>start seeds 2-3 weeks<br>before planting, harvest |
|-------------------|-----------------------|----------------------------------|---|---|-------------|---------|---|
| mustard<br>greens | southern<br>giant     | spring, fall                     | frost<br>tolerant   | ground cover, or<br>head-forming                      | 12" apart   | 50      | outer leaves for continual season harvests  |
| kale              | blue curled<br>scotch | spring, fall,<br>winter          | 45-85<br>degrees,<br>frost<br>tolerant                      | bush-like, upright<br>growth                          | 8" apart    | 55      | start seeds 2-4 weeks<br>before last frost, 8 weeks<br>before first frost   |
| Herbs:            |                       |                                  |   |   |             |         |   |
| chives            | common                | perennial,<br>plant in<br>spring | 55-60<br>degrees,<br>frost<br>tolerant                      | bushy<br>ground-covering,<br>short and thin<br>stalks | 3-9" apart  | 50-60   | start 10 seeds per cell 5-6<br>weeks before transplant  |
| fennel            | florence              | spring, fall                     | 60-70<br>degrees,<br>frost<br>tolerant                      | bulbing stalk with<br>feathery top growth             | 12" apart   | 100     | direct sow in mid-spring,<br>keep uniformly moist<br>throughout the growing<br>season   |
| parsley           | Darki                 | spring, fall                     | 65-70<br>degrees,<br>tolerant of<br>mild frost              | bushy<br>ground-cover                                 | 8-12" apart | 75      | start 3 seeds per cell, 3-6<br>weeks before transplant,<br>keep evenly moist during<br>germination  |
| oregano           | greek                 | perennial,<br>plant in<br>spring | 65-70<br>degrees,<br>mulch in<br>winter                     | bushy<br>ground-cover                                 | 12" apart   | 80-90   | start seeds 10 weeks<br>before last frost, surface<br>sow, seeds require light to<br>germinate. transplant out<br>after seedlings have 4 true<br>leaves.  |
| thyme             | creeping              | perennial,<br>plant in<br>spring | 65-70<br>degrees,<br>mulch in<br>winter                     | bushy<br>ground-cover                                 | 6-8" apart  | 90-95   | start seeds 10 weeks<br>before last frost, surface<br>sow, seeds require light to<br>germinate. transplant out<br>after seedlings have 4 true<br>leaves.  |
| rosemary          | common                | perennial,<br>plant in<br>spring | 65-70<br>degrees,<br>mulch in<br>winter                     | upright bushy<br>growth                               | 8-24"       | 120-180 | recommended to start from<br>cuttings or store-bought<br>transplants. long process<br>and hard to start from seed   |

|      |          |                        | 65-70                |               |           |       | start seeds 6-8 weeks<br>before last frost, transplant |
|------|----------|------------------------|----------------------|---------------|-----------|-------|--|
|      |          | perennial,<br>plant in | degrees,<br>mulch in | upright bushy |           |       | after last frost. plants should be replaced every      |
| sage | extrakta | spring                 | winter               | growth        | 12" apart | 80-90 | 3-4 years  |

### **Additional Tropical Plants**

|      | Species         | Growing    | Hardiness |        | Growth Pattern, | Space        |
|------|-----------------|------------|-----------|--------|-----------------|--------------|
| Crop | recommendations | conditions | zone      | Timing | size            | requirements |

| roselle                     | rico                            | full sun, moist,<br>well-draining soil | 9-10 | annual | bushy growth                 |                 |
|-----------------------------|---------------------------------|--|------|--------|------------------------------|-----------------|
| amaranth                    | Hopi Red Dye (A. cruentus)      | full sun                               | 9-10 | annual | 2-5' tall                    | 18" apart       |
| trinidad scorpion<br>pepper | a Capsicum<br>chinense cultivar | full sun, moist, well draining soil    | 8-11 | annual | 3-5' tall, bushy and upright | plant 18" apart |
| scotch bonnet               | Burkina Yellow or Chocolate     | full sun, moist, well draining soil    | 8-11 | annual | 3-5' tall, bushy and upright | plant 18" apart |
| habanero pepper             | red, orange,<br>chocolate       | full sun, moist, well draining soil    | 8-12 | annual | 3-5' tall, bushy and upright | plant 18" apart |

## Additional Indigenous Healing Plants

| Crop      | Species recommendation | Growing<br>conditions   | hardiness<br>zone | Timing    | Growth<br>Pattern, size                                      | Space<br>requirements |
|-----------|------------------------|---|-------------------|-----------|--|-----------------------|
|           |                        |   |                   |           |  |                       |
| mullein   | common<br>mullein      | full sun, well-drained<br>soil, does not need a<br>lot of water | 3-9               | biennial  | grows low<br>to the<br>ground<br>acting as a<br>living mulch | 1'-2' apart           |
| chamomile | kelway golden          | full sun, well-drained soil                                     | 3-7               | annual*   | 3' tall  | 8" apart              |
| mallow    | checkerbloom           | full sun to partial shade, well drained                         | 3-9               | perennial | 2'-3' tall and wide, bush                                    | 24" apart             |

| soil, and moderate | habbit |  |
|--------------------|--------|--|
| water consumption  |        |  |

### Additional African Healing Plant Recommendations

|      | Species         | Growing    | hardiness |        | Growth        | Space        |
|------|-----------------|------------|-----------|--------|---------------|--------------|
| Crop | recommendations | conditions | zone      | Timing | Pattern, size | requirements |

| Wormwood                 | Artemisia<br>absinthium | full sun, well-drained soil,<br>soil pH around 5.5   | 4-9       | perennial | 2' x 5'                                       | 12 to 24<br>inches |
|--------------------------|-------------------------|--|-----------|-----------|---|--------------------|
| Rooibos                  | Aspalathus<br>Linearis  | full sun, well-drained sandy soil.   | zone 8-11 | perennial | small shrub,<br>can reach 2<br>m              |                    |
| Pennywort<br>(Gotu Kola) | Centella<br>Asiatica    | conditions are never dry,<br>and works well near<br>water or as a<br>groundcover in dark,<br>shady areas | 7+        | perennial | 1' tall,<br>spreads as<br>wide as you<br>want |                    |

| Bitter Melon  | Momordic<br>a<br>charantia    | sunny, well-drained soil<br>with a pH ranging from<br>5.5 to 6.7   | 9-11 |           | vine on the<br>ground or<br>on a trellis | 1' apart    |
|---|-------------------------------|--|------|-----------|--|-------------|
| Umckaloabo<br>(South<br>African<br>geranium)          | Pelargoni<br>um<br>Sidoides   | partial-full sun,<br>well-drained soil   | 9-12 | perennial | 10"-1' x<br>10"-1'                       | 1' apart    |
| Hypoxis<br>(African<br>Potato/Africa<br>n Star Grass) | Hypoxis<br>hemerocal<br>lidea | Plant prefers full sun and<br>dry soils of open garden<br>or rockery. Potted plants<br>do well in a greenhouse | 9-12 | perennial | 36-48 in                                 | 10 cm apart |

# **Greenhouse Technical Guide**

#### Sections

- 1. Overview
- 2. Goals
- 3. Proposed Greenhouse Design
- 4. Heating
- 5. Ventilation
- 6. Humidity Control
- 7. Lighting
- 8. Seed Starting Equipment
- 9. Trellising Equipment
- **10.** Harvesting Equipment

#### **Overview**

This document is a compilation of research on technical aspects of the greenhouse. These recommendations should help get the project up and running. This list is meant to provide information so that the farmer knows what to purchase and install.

#### Goals

- 1. To create the ideal climate for African and Caribbean vegetables, Indigenous plants, and local Vermont vegetables.
- 2. To operate a tropical greenhouse in the most energy efficient way possible to reduce our impact on the environment.
- 3. To create a comfortable environment for artists to sit and enjoy the space.

#### **Proposed Greenhouse Design**



#### Heating

In terms of heating, we believe that the geothermal greenhouse heating system will provide most of the heating and cooling necessary to keep the plants in optimal condition. However, we do expect the long Vermont winters to reduce the ambient temperature of the greenhouse below optimal growth temperatures for many of the tropical plants. We are aiming for a climate that resembles **hardiness zone 9**. This means temperatures between 65-75 degrees and humidity between 60-90%. For this reason, we suggest the use of space heaters in some select locations. Two space heaters should be used in the Bananas and Plantains selection, one should be provided for each of the Community Production Spaces, one should be placed near the Papayas, one should be





placed near the Avocados, and one heater should be placed in each of the seating areas to provide additional comfort to any visitors.

#### The Bio Green Space Heater (left)

is one of the best rated greenhouse heaters available on the market, and with a unit price of \$149.99, the total cost would

amount to \$1,199.92. Along with the heater, Bio Green sells a **Greenhouse thermostat** (right), which can be purchased for \$62.37. We recommend purchasing two (one for each

end of the greenhouse) for a total cost of \$124.74. These thermostats allow for automated heating when necessary during the winter months.

#### Ventilation

Greenhouses are notoriously hot and stuffy, especially during the summer months. In order for plants to remain disease free and keep the space accessible and enjoyable to guests, fans will need to be utilized to circulate air. Airflow is key to the health of all plants, as bacteria and mold thrive in humid, moist conditions. Additionally, fans serve as a regulator for heat, pushing hot air out of the vents in the greenhouse and pulling cooler air from the outside into the space.



We propose the use of at least 30 oscillating fans that can be mounted on the walls and the ceiling of the greenhouse at 15 foot intervals. These **Simple Deluxe** fans have three different speeds that can be adjusted to meet the ventilation requirements of any condition. At a unit price of \$99.99, installing 30 of these fans should cost \$2,999.70. The fans will serve the purpose of both ventilating the crops in the greenhouse as well as keeping the seating areas cool during the hottest parts of the day.

#### **Humidity Control**

In the heat of the summer, evaporation and humidity in the greenhouse will need to be closely managed. A few areas of the greenhouse–specifically the Bananas and Plantains section, the tropical production space, the papaya trees, and the passion fruit section–thrive in more humid conditions. Yet, other areas will have lower humidity requirements. In order to meet humidity requirements for all crops in the greenhouse, we suggest thick mulch be added around the planting areas of the crop sections mentioned above. Mulch, especially wood chip mulch, serves as a moisture reservoir keeping local humidity levels high. In the areas that require less humidity, the fans should be positioned to effectively circulate air across the surface of the leaves because air circulation aids in the quick evaporation of moisture. We are aiming for a Zone 9 climate year-round in the

greenhouse, so normal humidity levels should be between 50 and 60 percent. In the specific sections mentioned previously, wood chip mulch should keep local humidity levels between 60 and 90 percent.

#### Lighting

All of the plants we have selected for the greenhouse require full sun, meaning they need about 8 hours of direct sun every day in order to thrive and meet peak production potential. For much of the year, the farm and greenhouse will receive plenty of light. However, Vermont winters are long, and at our latitude, the sun sets around 4:00 o'clock in the afternoon. For year round production and the survival of the tropical fruit trees planted in the greenhouse, supplemental lighting will be necessary during the months of November through March to meet the eight hour minimum.



The seed company Johnny's Seeds sells these 48-inch **LED Strip Light Kits** at a unit price of \$143.20. The kit allows for all the lights to be wired together and mounted above planting areas. These lights provide an intense 6400K color temperature–ideal for full spectrum horticulture lighting. The LEDs are energy and heat efficient and have a 50,000 hour life expectancy. We recommend purchasing and installing 25 of these lights at a total cost of \$3,580.

#### **Seed Starting Equipment**

Starting seeds in seed trays is key to efficient use of space and ample season-long harvests. To start seeds for the greenhouse and farm fields, we will have two large benches with shelves. The equipment in this area will create local conditions that are ideal for seedlings.

#### To Purchase:



#### 10 x 24-Cell Seed Tray

Recommended for starting cucumber, eggplant, melons, squash, tomatoes, and large-seeded herbs and flowers.

30 x 72-Cell Plug Flats 20 x 180-Cell Plug Flats 20 x 200-Cell Plug Flats



This includes drainage holes and has a rigid structure so it can be used without a tray. The smallest size is recommended for flowers, cauliflower and peppers. Herbs will do well in the middle size. The largest size is meant for lettuce, miscellaneous salads, and herbs.



#### **Commercial Heat Mats (2)**

These mats increase the bottom heat of seedlings and improve germination. They come with a 6 foot 120 volt AC power cord. The mats can be attached to cover a larger area, providing uniform, easily controlled heating. These mats must be used with a temperature controller to ensure roots are not damaged.



#### Heat Mat Thermostat (2)

The thermostat ensures consistent temperature control at the root zone. It can be easily changed to select and maintain the proper soil temperature for germination. It can be changed in different seasons and for different mats for different crops.



#### Hand Seeder (5)

To speed up the planting process, control the flow of seeds through 5 different sized funnels. Saves seeds by making it easy to return unused seeds to the package.



#### Crop Row Seeder (2)

This will help sow seeds quickly. It includes 7 seed plates for a variety of plants that need different spacing. This works well for beans, peas, and more.



#### Leak Proof Trays (80)

This is necessary to contain water drainage from the cell plug flats. It is also useful for bottom watering. These are  $11'' \times 21''$ .

#### **Trellising and Support Equipment**

Some plants require support for best growing conditions. Peas and beans need a structure to climb. Vine crops, such as squash, melons, and cucumbers can produce straighter, better quality fruits if trellised.

Indeterminate, or vining plants, such as tomatoes, will continue to sprawl. They will continue to grow on the ground unless they are supported. Fruits will be less likely to rot if they are lifted off the ground. This helps prevent disease.

There will be a trellis for the passionfruit by the seating area. There will be garden stakes in the Vermont production space for tomatoes and other vegetable plants.

#### To Purchase:



#### Trellis Plus (2)

This 5'  $\times$  60' nylon cord trellis will go in the production area.

It has a 7" mesh net that is ideal for climbing vines, vegetables, and flowers. Support the net with stakes or posts with a top bar or a wire.

At a price of \$30.50, two of these will cost \$61.



#### 8 Foot Garden Stakes

These steel stakes with a thick plastic coating have good grip and rust resistance. They will be necessary to support climbing vegetables. Each package costs \$71.41 and contains 10 stakes. The greenhouse will require 100 stakes, so will cost a total of \$714.10

#### **Harvesting Equipment**

Efficient harvesting of ripe produce will be key to the success and profitability of the greenhouse. Most produce will retain the best flavor, shape, and weight when harvested in the morning before the heat of the afternoon. Produce must be taken out of the field heat and immediately be stored in a refrigerator. This will ensure that all produce remains



fresh while waiting to be sold or eaten by any consumer.

For this reason, we recommend purchasing the **Felco No. 2 pruning Shears** (left). The pruning shears are heavy duty shears that will allow for efficient harvesting while preventing physical

exhaustion. They will cut through any diameter branch, stalk, or stem up to one inch with ease. At a unit price of \$64, we suggest purchasing at least 4 shears for use in the greenhouse at a total cost of \$256. Having four shears stored permanently in different spots throughout the greenhouse will save you time and also allow for more than one person to complete greenhouse harvests or pruning tasks. Additionally, the **Pruner Sharpener** (right) should also be purchased. This specific sharpener anchors onto the spine of the pruning blade and has guide holes that allow for precise angle grinds to re-sharpen the blades of your pruners. Pruner maintenance is key to safe and efficient harvesting. If the pruning shears are kept clean and sharp, they should last for years. At a unit price of \$15.50, we recommend purchasing at least two different sharpeners for a total investment of \$31.

# Part 3 Farming Guide

Casimiro Cosme Michael Guptill Julie Jones Chelsea Moore Jack Walker Ricardo Almazan Jr.

## Message to the Reader

Darnell Martin's mission to create both a sanctuary for BIPOC individuals as well as an organic farm for said peoples to learn about farming and establish a connection with the land is the backbone for the farm guide and farm recommendations. This document will come in two parts- a farm guide and a farm field recommendation. The farming guide will include general information about farming, whereas the farm fields recommendation section will include advice for Darnell to use on her farm specifically. Within the farm fields recommendations section, plants were chosen based on both resilience and ability to grow within the region and also because they hold significance to the BIPOC community. By establishing this farm, Darnell will be able to help BIPOC individuals and communities learn about farming and how they would be able to benefit from and establish their own homegrown healthy foods. These communities will specifically be artists of color, who will be bolstered in their work through the creative spaces that are implemented throughout the field. This is particularly important in helping alleviate food insecurity and empowering individuals through education within so-called "food deserts", sites with lower access to fresh produce and grocery stores, that are often found in areas where BIPOC live. Food deserts, although a contentious topic, can be seen as areas where there is a lack of healthy or fresh foods available for individuals or groups to eat in the region. This can result in increased health issues associated with bad or poor nutrition. This farm has potential to be a lighthouse for BIPOC to find their own path into connecting themselves back with the land that they have historically had taken from them and presenting themselves with healthy food options through sustainable methods.

This document will highlight the different facets regarding two different fields of Darnell Martin's farm in particular, drawing from these cultural, agricultural, and artistics goals established by Darnell. The farm has three main fields and the two farm fields closest to the house will be fully described in order to represent this vision. The document will begin with which plants should be grown on them and continue into how exactly to prepare and maintain the fields. The first part of this document will begin with a more general overview of important topics and ideas that will aid Darnell in her farm then transition into the specified routines, tactics, and plants that Darnell may choose to use in her farm. By creating an outline for Darnell's vision as well as a general outline of farming in general, this document will help prepare Darnell for her future as a woman of color in farming and in doing so help create a space for BIPOC individuals in a sustainable and effective way.

# Farming Guide Sections

- 1. Introduction
- 2. Historical Background and How Industrial Agriculture Harms Land and People
- 3. A Socially and Environmentally Sustainable Approach: Leaving the Land Better than We Found it
- 4. Farming in New England: Plant Hardiness Zones
- 5. Soil Health and Restoration: Preparing the Land
- 6. Plant Type: Annual, Perennial, and Biennial
- 7. Crop Families and Their Interactions
- 8. Pest Control
- 9. Exploring Inputs: Nutrients and Water
- 10. The Day to Day Action: Weeding, Crop Maintenance, Harvest, and Keeping Seeds
- 11. Attracting Pollinators

# Introduction

#### **Sections**

#### 1. A Guide for the New Small-Scale Organic Farmer

#### A Guide for the New Small-Scale Organic Farmer

A small-scale farm is typically run by an individual or small group and is generally less than about 5 acres. The USDA defines a small farm "as an operation with gross cash farm income under \$250,000," and these farms can either be commercial or non-commercial (USDA, 2021.). Although they do not need to fully realize sales of over \$1,000 per year, non-commercial small farms are classified as farms by the USDA as long as they have the land or livestock necessary to generate \$1,000 in sales. Such farms are usually in rural areas and owned and operated by individuals and families who must rely on other forms of off-farm income.

In contrast to small farms, larger scale farms – supported by economies of scale and heavily subsidized by the federal government for commodities like corn and soybeans – often do not need to rely on off-farm income. However, while large scale farmers are fully supported by their crops, these export crops grown on large-scale commercial farms do not fully support our food system. For example, only 1% of U.S. corn acreage goes to producing sweet corn eaten by humans directly, while the remainder goes to products like high fructose corn syrup, ethanol, or livestock feed (Miller, 2018).

Thus, the significance of small-scale, smallholder farms extends beyond the size and monetary definitions of the USDA or their ability to generate profit; small or peasant farms, which prioritize actual food production, are our main source of food (GRAIN, 2014). However, due to historical and structural injustices, smallholder farmers and particularly farmers of color are losing agricultural land, making small farms smaller. In the next sections, this guide will provide additional context on the development of the United States' current agricultural landscape and explore the integral role of smallholder farms in providing healthy, nutrient-rich and culturally relevant foods and reversing the harms of industrial agriculture. Once the guide has highlighted the social, environmental, nutritional and cultural importance of smallholder farming – especially when practiced as regenerative agriculture – it will present further information on the ins and outs of

sustainable farming for the new small-scale farmer in New England, imparting concrete knowledge to turn farming dreams into a reality.

# Historical Background and How Industrial Agriculture Harms Land and People

#### Sections

- 1. An Abridged History of Agriculture in the United States
- 2. Industrial Agriculture's Harms to the Land
- 3. Industrial Agriculture's Harms to People

#### An Abridged History of Agriculture in the United States

The history of agriculture in the United States rests on the foundation of centuries of settler colonial enslavement, racism, and discrimination towards Black and African peoples, and the removal and dispossession of Indigenous peoples from the land. From the 1600s to 1865, farming for African Americans meant the forced and exploited labor and knowledge of enslaved people on southern plantations controlled by white landowners (McNeil, 2018). Following the abolishment of slavery, exploitative labor systems continued to shape the relationship between Black people and agriculture in the United States, as discriminatory laws and practices descimated African Americans' access to land and trapped many Black farmers in the vicious cycle of tenant farming and share-cropping. Despite systems of white violence and land grabbing, Black people in the 1920s owned around 15 million acres of land, which included 925,000 Black-owned farms (McNeil, 2018). Yet, these numbers have dwindled: whereas 14% of the nation's farms in 1920 were run by African Americans, today these numbers are down to 2% (Tabuchi and Popovich, 2021).

One of the most significant turns in United States agriculture that has contributed to dwindling numbers of Black American farmers, and small-scale farmers more generally, is the industrialization of agriculture. Over the span of the twentieth century, the agricultural system of the United States transformed to prioritize efficiency in food production, This included the specialization of farmers, whereby diversified farms became monocultures; the mechanization of farm labor; the increased reliance on synthetic fertilizers and chemical pesticides; and the consolidation of smaller farms into fewer and larger commercial farms (Johns Hopkins, n.d.). Today, industrial agriculture refers to the "large-scale, intensive production of crops and animals" and the United States'

agricultural system is largely owned and controlled by large corporations, with devastating impacts on the environment and people (NRDC, 2020).

#### Industrial Agriculture's Harms to the Land

Industrial agriculture imposes great harms on the environment and land. First, industrial agriculture emphasizes monocultures, which grow a single crop on the same land year after year. Monocropping degrades soil health by depleting soil of its nutrients. Once the soil is devoid of vital nutrients for crop growth, monoculture fields must be treated with chemical fertilizers, further harming the environment through fertilizer runoff and pollution (FoodPrint, 2022). Chemical runoff from farms pollutes the lakes and rivers all over the United States, triggering harmful algal blooms, compromising drinking and recreational water, and harming aquatic ecosystems (Swanson, 2013). Conventional agriculture's usage of tillage further contributes to this soil degradation by disrupting soil structure and loosening topsoil so that it more easily erodes, leading to even more nutrient loss (Al-Kaisi et al., 2004).

Not only do these monocultures contribute to nutrient loss and water pollution, but they also greatly decrease biodiversity. Today's conventional agriculture replaces diverse and complex ecosystems with large swaths of a singular crop, making it the primary driver of biodiversity loss; agriculture threatens 24,000 of the 28,000 species at risk of extinction (UNEP, 2021). Finally, agriculture is a large contributor to greenhouse gas emissions, as its machinery consumes high rates of fossil fuels and factory-style animal agriculture emits large amounts of methane (Horrigan et al., 2002).

#### Industrial Agriculture's Harms to People

In addition to being environmentally harmful, industrial agriculture also has had profound impacts on people and especially people of color. First, the industrialization of agriculture was helped along by federal USDA loans and grants, which were systematically denied to farmers of color. For example, in the post-WWII and civil rights era, racism motivated USDA offices and employees at every level (federal, state, and county) to discriminate against Black farmers by subverting governmental agricultural benefit programs (Wills, 2022). Thus, industrialization's consolidation of farmland did not extend to Black farmers; instead, Black farmers were unable to compete with subsidized large-scale white farmers so that the Black farmer population declined 40% between 1935 to 1959, while the white farmer population only declined by 28% (Wills, 2022). Industrial agriculture has led to the

loss of land and livelihoods for many small scale and peasant farmers throughout the United States, along racial lines.

Industrial agriculture further harms people through its exploitation of labor. The agricultural industry relies on the cheap and exploitable labor of migrant workers in order to maximize the agricultural employer's profits. Exacerbated by their status as non-U.S. citizens, migrant workers have very few protections in the United States and are often forced to do grueling agricultural tasks for inhumane hours and very little pay, further implicating industrial agriculture in the oppression of people of color (Sainato, 2021).

Finally, all people are ultimately harmed by the negative health implications of industrial agriculture. The use of synthetic pesticides, herbicides, and insecticides has been linked to human health effects such as elevated risks for cancer, respiratory diseases, reproductive system disruptions (IFM, n.d.). Furthermore, monocultures and GMO crops greatly deplete soils of nutrients and reduce overall biodiversity. This loss of soil nutrients and diversity in the foods we eat translates to less nutrient-rich diets, which are necessary for human thriving.

# A Socially and Environmentally Sustainable Approach: Leaving the Land Better than We Found it

#### **Sections**

- 1. History and Significance of Regenerative Agriculture
- 2. Polycultures
- 3. Certified Organic Agriculture

#### History and Significance of Regenerative Agriculture

As we have seen, the industrial state of modern agriculture in the United States is not socially or environmentally sustainable. In response to the harms wrought by industrial agriculture, we are seeing the emergence of movements across the globe and the United States in which smallholder and peasant farmers are organizing for greater access and control over their food systems. These movements largely focus on regenerative agriculture and peasant agroecology. Agroecology refers to a grassroots social movement, practice, and science, through which farmers attempt to enact change in global food systems; manage farms in particular sustainable ways; and develop information and best practices that can be implemented to create sustainable food systems (FAO, 2018). Similarly, regenerative agriculture refers to agricultural practices that have the goal of maintaining or improving biodiversity on a farm, particularly through improving the farm's soil quality, water quality, and increasing the resistance that the farm has to climate change. Both agroecology and regenerative agriculture speak to the importance of balance between the land, other-than-human entities, and humans that is so central to fulfilling Darnell's vision of leaving the land better than it was found. We envision Darnell's farm as fitting into this movement towards regenerative sustainable agriculture.

As Leah Penniman explores in the introduction of her practical farming guide *Farming While Black*, the history of Black people and the land is not confined to that of slavery and sharecropping in the United States (Penniman, 2018, 3). Importantly, many of the practices central to regenerative agriculture are attributed to Black and brown indigenous peoples from around the globe. In fact, regenerative agriculture as it is

practiced in the United States today was derived from an African-indigenous system that was developed over millennia. It was brought about into farming culture in the United States in the early 1900s by a black agricultural scientist at Tuskegee, Dr. George Washington Carver (Penniman, 2018, 3). Carter wanted to diversify agricultural fields away from cotton, which had damaging effects to the soil that was the result of the continuous monocultures over the past few centuries. Carter made sure to do research on regenerative agricultural practices that help fix nitrogen within the soil and prevent long-term degradation of the soil ecosystem.

By focusing on overall holistic ecological health, these agricultural practices can help rejuvenate the land and bring it back to life, which in turn can help restore the natural balance between humans and nature. This can help provoke a greater relationship and connection between us and the environment and in turn increase the value that we as a species have for the world around us. Furthermore, small-scale regenerative farming can be crucial for people of color in terms of healing and reclaiming their relationship to the land and agriculture, after centuries of slavery and denied access to land. In this way, restoring respectful, intentional, and reciprocal relationships between people, land, animals, and plants takes on a radical nature.

#### **Polycultures**

Maximizing the diversity of agricultural systems is one of the key principles of agroecology. According to La Via Campesina, also known as the International Peasants' Movement, agroecology is centered around how people work with the land but also how we work with each other as people. It is seen as an opportunity to strengthen youth leadership and spaces in rural grassroots communities around the world (La Via Campesina 2017). Not only does agroecology strengthen land-person and person-person relationality, but it also has high potential for environmental and social benefits. Agroecological market gardens are actually able to produce higher yields of certain crops that exceed the yields of non-organic larger farmers. An increase in small agro ecological gardens has potential for reducing the trade gap for fruits and vegetables for local communities, a more reliable food source, and providing year round-employment (La Via Campesina 2017).

Polycultures are an important way to encourage interspecific synergies into a farm. Interspecific synergies describe the interaction and potential cooperation of different species to increase productivity, control pests, and decrease external nutrient inputs. Polycultures also hold cultural, spiritual and agricultural importance to many indigenous peoples from Turtle Island, who had planted the crops that are known as the Three Sisters – beans, squash, and corn (Ngapo 2021). There are a variety of intercropping strategies that can help achieve this polyculture. Intercropping is the growing of two or more crops in proximity in a definite row pattern in order to increase productivity per unit area (Natural Water Retention Measures 2014).



Polyculture, 2021, photograph, University of California, Berkeley

One of the ways includes intercropping with beneficial flower species. As described by the *Farming While Black*, "Marigolds and brassicas are one of our favorite polycropping combinations, both for practical and aesthetic reasons. In fact, planting beneficial flowers down the middle of beds or at the bed ends is the least intrusive way to get started with intercropping" (Penniman, 2018, 123). These flowers are able to attract pollinators as well as predatory insects which can help keep the farm's plants and crops thriving whilst also making sure that pest species are being consumed by their predators in a natural way. In terms of their placability on the farm, *Farming While Black*, also discusses this through the statement, "These flowers can be added at the end of virtually any crop row, but they are especially suited to collaborate with brassicas, cucurbits, and solanums" (Penniman, 2018, 124).

Another intercropping strategy is using one crop as a part of the living mulch of one of its companions. In particular, Penniman describes this through their example with lettuce seeds, in which they state, "we broadcast lettuce seeds into a freshly prepared bed and then blant brassica seedlings into the same bed at their normal spacing. The lettuce

smothers the weeds, yet does not compete with the brassicas, as their roots reach to different depths. We also use low-growing Dutch white clover as a living mulch in the pathways between mounds of winter squash, seeded at the time of transplanting. The clover fixes nitrogen and attracts spiders, which patrol the crops for damaging insects. Living mulches improve soil structure, control moisture, and prevent runoff" (Penniman, 2018, 124). As the result of the positive interactions between the two purposely planted crops on the field, it prevents adverse side effects that would have to be approached if there was only one type of crop on that field. Making sure that the crops are able to be connected with each other to some degree, either through their nutrient intake or through their root depth is imperative to make sure that synergies between the two plants works to ensure a polyculture that is positive for both plant species. In this case, it is important to note that companion plants also can be planted at a different time than the intended crop (Penniman, 2018, 124), which can be useful when ensuring that the soil would be able to sustain multiple types of plants very close to each other.

On another note, there are different types of plants that can be added to the polyculture to ensure that pests and weed species do not infest the area both on and off planting season. In particular, plants that are aromatic, or emit a strong smell, have pest-repellent properties that can also be intercropped around bed edges or with taller crop species (Penniman, 2018, 124). On the other side of things, there are plants that have allelopathic qualities, which can be planted in a field in the fall before crops are planted in the spring. Allelopathic plants secrete chemicals that prevent weed germination, and as such can help prevent weed species from growing within the fields during off seasons.

#### **Certified Organic Agriculture**

Many farms that follow the principles of regenerative agriculture and agroecology also fall under the definition of organic agriculture. Within the United States, organic standards are set and regulated by the United States Department of Agriculture (USDA). For crops that are advertised as organic the USDA has a specific set of requirements. The requirements and an explanation of them are below:

**Requirement 1:** No prohibited chemical pesticides or fertilizers applied to the land for at least three years before the harvest of an organic crop.

**Requirement 2:** Tillage and cultivation practices, crop rotations, and cover crops are used to manage soil fertility and crop nutrients. Animal and crop waste and allowed synthetic material can be used supplementally.

**Requirement 3:** Crop pests, weeds, and diseases are controlled through management practices including physical, mechanical, and biological controls.

Requirement 4: The crops come from organic seeds and other planting stock.

**Requirement 5:** There is no use of genetic engineering, ionizing radiation, or sewage sludge allowed (AMS USDA, n.d.).

Gaining organic certification is important because it can encourage the farm to maintain long-term healthy farming practices. In this case, it puts a requirement on more sustainable and natural ways in which the farm will operate, and in doing so, enables the farm to not only sell their products at higher prices when compared to their non-organic counterparts, but also distinguishes the importance that the individual crops have within the food system.

A significant portion of the techniques that are required to be certified organic have historical importance and have had long histories before they were fully taken up by organic advocates, growers, and consumers within the United States. These groups, however, were largely white and were not truly representative of the roots by which many of these practices had been started from. For example, most modern agricultural practices such as intercropping are often found on predominantly white farms, however, this practice in particular is directly from indigenous groups.

# Farming in New England: Plant Hardiness Zones

#### **Sections**

1. An Overview of Plant Hardiness

#### **An Overview of Plant Hardiness**

Understanding plant hardiness zones is important for determining which plant species are most likely to survive and thrive when grown in a specific location. The 2012 USDA Plant Hardiness Zone Map uses the average annual minimum winter temperature and divides the United States into 10-degree Fahrenheit zones (USDA, n.d.); low zone numbers are associated with colder winter temperatures and typically indicate a shorter growing season.

The state of Vermont contains five different hardiness zones, including 3b, 4a, 4b, 5a, and 5b (Tremblay, 2021). Based on the 2012 USDA Plant Hardiness Zone Map, Darnell's farm in Bridgewater, Vermont, is located in the 4b to 5a (USDA, n.d.). This knowledge of Bridgewater's plant hardiness zones will be a guiding factor in selecting the best-suited crops for planning the farm's three main crop fields. See Part 2, Section 2 for more specific Hardiness Zone information for particular crops.

Climate change is an increasingly important consideration for Vermont agriculture. According to the Vermont Climate Assessment of 2021, we can expect Vermont to become warmer and wetter in the coming years. The state's average temperatures have increased by about 2°F since 1900; the freeze-free period has increased by three weeks since 1960; and precipitation has increased over 20% since 1900 (Waugh, 2021). This means that the region's range of Hardiness Zones will likely shift upwards towards zone numbers more associated with less cold winters and longer growing seasons.



USDA Plant Hardiness Zone Map, from Gardening Know How
# Soil Health and Restoration: Preparing the Land

#### **Sections**

- 1. Soil Basics and New England Soil Types
- 2. To Till or Not to Till
- 3. Preparing the Fields: Tarping and Terracing

#### Soil Basics and New England Soil Types

Soil health is absolutely crucial to the overall health of a farm's ecosystem. Healthy soil not only provides the nutrients and base conditions (moisture, aeration, stability, etc.) needed for crops to thrive, but it also supports soil food webs, diverse communities and networks of organisms from bacteria, fungi, protozoa, worms and other insects (Schonbeck et al., 2019, 2). This web produces soil organic matter (SOM) which is an important component of the top soil, or the top layer of the earth in which crops are planted; the more SOM in this uppermost layer of soil, the better for plant growth.

In addition to important soil organisms, there are also several nutrients that are essential for supporting plant growth. The three main crop nutrients are nitrogen, phosphorus, and potassium. Micronutrients that are used in smaller amounts by crops, but still essential for growth, include boron, zinc, manganese, iron, copper, nickel, chlorine, and molybdenum (UCANR, 2022).

A central consideration is the cycling of nitrogen and nitrogen fixation within your farm's soil ecosystem. In order for plants to be able to uptake nitrogen, organic N must be converted into plant-available inorganic forms like ammonium; this process is completed by important soil microorganisms or nitrogen-fixing bacteria. These bacteria have symbiotic relationships with certain plant groups, like legumes, in which the bacteria form nodules on the plant roots where they can convert atmospheric N into ammonia for the plant. Incorporating these plants into your farm plan and rotating them through the crop rows season to season will help replenish your soils' nitrogen levels.

The pH or acidity of soil is also important to plant growth. pH impacts how certain mineral elements and nutrients are available for crop uptake, and, although different types of crops are better suited for different levels of acidity, many crops have the best

accessibility to nutrients at mid-level pH (UCANR, 2022). Vermont generally has loamy, acidic soil; loam soil includes all three sizes of soil particles: sand, silt, and clay.

Most garden stores or hardware stores carry do-it-yourself soil test kits that can be used to test your farms' soils. We used a My Soil soil test kit to measure 13 plant available nutrient levels: Nitrogen and pH, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, boron, copper, zinc, and sodium. The results of this soil test (collected on May 17, 2022) are depicted below.

| Nutrient           | Your Results | Optimal Range   | Rating  |
|--------------------|--------------|-----------------|---------|
| рН                 | 6.43         | 5.8-7           | Optimal |
| Total Nitrogen (N) | 5.29         | 32-60           | Low     |
| Nitrate (NO3-N)    | 0.51         | 2               | -       |
| Ammonium (NH4-N)   | 4.78         | ÷.              | -       |
| Phosphorus (P)     | 1.45         | 8-20            | Low     |
| Potassium (K)      | 11.5         | 38-80           | Low     |
| Sulfur (S)         | 2.27         | 7-22            | Low     |
| Calcium (Ca)       | 52.53        | 80-320          | Low     |
| Magnesium (Mg)     | 7.36         | 27-70           | Low     |
| Sodium (Na)        | 2.45         | 0.5-30          | Optimal |
| Iron (Fe)          | 3.03         | 3-10            | Optimal |
| Manganese (Mn)     | 27.59        | 4-10            | High    |
| Zinc (Zn)          | 0.1          | 0.1-0.25 Optim  |         |
| Copper (Cu)        | 0.07         | 0.06-0.3 Optima |         |
| Boron (B)          | 0.04         | 0.2-0.6         | Low     |

## Raw Soil Data

#### To Till or Not to Till

Tillage refers to the mechanical agitation of soil and is commonly used as a way to manage weeds and prepare neat crop rows quickly, especially in conventional industrial agricultural systems. Although tillage has some benefits, this practice ultimately leads to poor soil health. As mentioned above, soil health is at the heart of a land and farm's health. Tillage greatly affects the life supported within soil ecosystems and can destroy microbial habitat, kill earthworms and macrofauna, and fragment fungal mycelia (Schonbeck, 2018, 18). As alternatives, no till systems, therefore, increase fungi, macrofauna, and SOM stabilization, while decreasing the mineralization of SOM and nitrogen.

There are certain challenges that come with committing to a no-till agricultural system, especially at the very early stages of setting up your farm when the land has never been cultivated. For example, the Bridgewater farm's fields in their current state are covered in vegetation. This is where tarping and terracing come in handy.

#### **Preparing the Fields: Tarping and Terracing**

Before your farm and fields have been established, tarping is a no-till option for the first step to preparing your fields. Tarping entails laying out large, opaque plastic tarps over the fields to smother weeds without upturning the earth. These tarps will need to be in place long enough for the original vegetation and seeds of would-be weeds to die, at least six months. Once the fields have been tarped, the dead vegetation needs to be pulled up and compost needs to be applied on top to prepare for planting. Tarping is beneficial because it also contributes to building soil organic matter while burying pesky weed seeds. Tarping continues to be useful once your fields are originally established and can be used for shorter 3 or 6 week periods to destroy weeks before seasonal planting. Silage tarps are the usual choice, but black garbage bags, camping tarps, landscaping fabric, or other opaque covers can be substituted if you can not purchase silage (Penniman, 2018, 85).

In preparing your fields, you may find that they are sloped. Terracing is an African land restoration practice that can prevent the soil erosion that often comes with sloped fields. This involves creating a series of "steps" like a staircase, molding the soil into flat areas better suited for planting (Penniman, 2018, 78). Terraces must be laid out in line with the hill's contour and then built up with topsoil or–if there is not enough soil–undecomposed

organic matter that is compacted down and then covered with inches of topsoil. Once the soil is in place, you must weave branches and sticks into the terrace walls, ensuring that the soil is conserved and will stay in place. Finally, level the soil with shovels and plant a cover crop that has strong roots and grows fast, such as buckwheat, rye, or oats (80).

# Plant Type: Annual, Perennial, and Biennial

#### Sections

- 1. Annual
- 2. Perennial
- 3. Biennial

#### Annual

Annual plants are plants that are only capable of growing once per year. Within one growing season, these plants will grow and germinate until they eventually die. As a result of this, they will need to be replanted every single year and as such will require consistent planting on a seasonal or yearly basis.

#### Perennial

Perennial plants are plants that are capable of living more than two years. In this case, they are able to be planted in one growing season or year and will be able to grow again the following year if maintained properly. In these plants' cases, it is important to note that even though they are able to grow repeatedly, eventually they will either be not as productive or will die and eventually need to be replanted.

#### **Biennial**

Biennial plants are plants that can take at least two years to grow through their cycle, however, some can take three or more years to complete their growing cycle. These plants, in particular, are flowering plants, which means that they will end up budding and flowing in their growing cycle. After their growing cycle they will need to be replanted, however, because they are not annual, they will not require yearly replanting. It is important to maintain these plants throughout their growing season.

# **Crop Families and their Interactions**

#### Sections

- 1. How are plant families determined?
- 2. Solanaceae Family
- 3. Brassicaceae Family
- 4. Curcurbitaceae Family
- 5. Fabaceae Family
- 6. Malvaceae Family
- 7. Poaceae Family
- 8. Umbelliferae Family
- 9. Asteraceae Family
- 10. Liliaceae Family
- **11.** Chenopodiaceae Family
- 12. Convolvulaceae Family
- 13. Rosaceae Family
- 14. Ericaceae Family

#### How are plant families determined?

Plant families are separated by differences in flowers, reproductive parts, seeds, and fruit. The terminology of these plant families are in Latin and are often used by botanists to help categorize and determine relationships between the different types of plant species. Plant families are important because they can help act as a guide in determining which types of plants will work well together, as well as help prevent increased pestilence on a farm or a region.

#### **Solanaceae Family**

The Solanaceae family has a variety of notable crops including eggplants, peppers, tomatoes, potatoes, and tobacco. This family is also known as the nightshade family (Penniman, 2018, 109). The entire nightshade family is actually native to the Americas, so growing them in Vermont would be beneficial to growing native plants in the region,

however, it is important to note that some are native to different latitudes, so it is important to see which ones are native to the region. In the case of Darnell's farm, the main plant that comes from this family is the African Chili. Outside of the African chili, these plants have been subject as food sources and drugs in human civilization for millenia. In some cases, they were used as ornamental plants, for their beauty and appearance. Tomatoes, one of the most famous in these species of plants, have undergone a significant amount of gene alterations and genome analysis. Potatoes on the other hand have had significant historical importance, which can be seen through the economic importance that it has in relation to other Solanaceous species (NCBI). Some other plants in this family have a connection to black cuisine and culture.

#### **Brassicaceae Family**

The Brassicaceae family has a variety of notable crops including collards, turnips, cabbage, radishes, kale, cauliflower, broccoli, mustards, and brussel sprouts (Penniman, 2018, 118). Brassica as it currently stands will be present on the field, however, they are able to be substituted in and out of the field.

#### **Curcurbitaceae Family**

The Cucurbitaceae family, known for its summer squash, zucchini, cucumbers, winter squash and melons is the gourd family of flowering plants (Penniman, 2018, 106). This family has plenty of annual and perennial herbs native to temperate and tropical regions, and many species of this family are extremely sensitive to temperatures near freezing. They typically do not have a high nutrient content, except for the winter squash. A lot of these species have vines that climb with long palmate leaves that alternate (Britannica, 2021).

#### **Fabaceae Family**

The Fabaceae family has legumes as the most notable part of their family, particularly including different species of beans, peas, and peanuts (Penniman, 2018, 113). This is also known as the pea family of flowering plants. Some of these beans are important to today's diet like soybeans. The fruit of this family grows in a legume or pod, which will split open, thus releasing the seeds (Britannica, 2019). They are also nitrogen fixers, meaning the plants are in symbiosis with nitrogen fixing bacteria. This converts nitrogen

in the air and soil and feeds it to the legumes, while the legumes provide carbohydrates to the bacteria (Tilth Alliance 2021).

#### **Malvaceae Family**

The Mallow family includes notable crops like okra, sorrel, cotton, and cacao (Penniman, 2018, 114). Despite their love of heat, mallows have the potential to grow well in acidic northeastern soils with the help of black plastic mulch or row cover, and okra is an especially worthwhile crop to grow in the hottest parts of a farm's soil as it is a nitrogen-fixer (Penniman, 2018, 114). Plants in this family may be found worldwide and are important economically, culturally, and ecologically. For example, in tropical regions like the Caribbean, these crops—okra and sorrel in particular—are integral to the cuisine and in tropical Africa the baobab tree carries spiritual significance in African oral stories, provides income for local communities, and are key species in dry savanna ecosystems (Sanchez, 2018). For many Black people in America, the cotton plant is a reminder of the collective trauma of the slave trade that kidnapped African peoples and forced them into the U.S. Cotton Belt; however, reconciliation efforts are underway and many Black farmers now grow cotton as an act of sovereignty and healing (Penniman, 2018, 114).

#### **Poaceae Family**

The Poaceae family includes crops such as millet, sorghum, corn, rice, oats, and rye. These important cereal grasses form the basis of many diets around the world; they also represent the staples of the global food economy. While industrial agricultural monocultures cultivate domesticated versions of these crops with little genetic diversity and reduced nutritional value, this family has been historically and traditionally very diverse and culturally significant. In particular, corn, or maize, is a crucial crop to many Indigenous peoples native to Turtle Island, as it is part of the triad of the Three Sisters; the Three Sisters crops-corn, squash, and beans- are planted in a mutually beneficial polyculture: beans are planted at the base of the corn stalks so that the stalks support the crawling beans and the beans, in turn, restore nitrogen to the soil, fertilizing the corn and squash, while the squash's leaves protect the bean plants from animal predators. Here, corn's significance extends beyond its mere nutritional value, as the Three Sisters appear in many culturally and spiritually important legends centering on their interdependence and the diverse stains of corns yielded by many different tribes serve as a connection to the past and a symbol of resistance to the destruction of Native cultures (Sherman, 2019). In northern climates, careful consideration needs to be made to not plant maize too early (Penniman, 2018, 116).

#### **Umbelliferae Family**

Notable crops in the Umbelliferae family include carrots, parsnips, celery, parsley, and cilantro. These plants are adapted to northern climates and help fill Black communities' culinary niches left empty by African crops that cannot thrive in the soils of North America. For example, as root vegetables, carrots and parsnips replace African tubers (Penniman, 2018, 117). Cilantro or coriander is an important herb and flavoring ingredient to many Latinx and Afro-Latinx dishes and cultural foods. Parsley and celery are pest-resistant and may be incorporated into crop beds as an important element of pest management.

#### **Asteraceae Family**

The Asteraceae family, also known as the sunflower family, is one of the largest flowering plant families. Some of the most popular plants that belong to this family include lettuce, dandelions, and chicory. This family's medicinal and nutritional properties are extensive given the many plant species associated with this family (Rolnik).

#### Liliaceae Family

The Liliaceae Family, also known as the lily family, is fragrant and flavorful. This bulbous family includes onions, garlic, leeks, scallions, chives, and asparagus. As a result of the fragrances that are permeated off of these plants, they can sometimes be used as a form of pest control (Penniman, 2018).

#### **Chenopodiaceae Family**

The Chenopodiaceae family's most prevalent crops are amaranth, spinach, beets, and swiss chard. This family consists primarily of succulent annual or perennial herbs, some are shrubs, and only a few are trees; plant characteristics vary significantly (Penniman, 2018).

#### **Convovulaceae Family**

The Convolvulaceae family consists of sweet potato varieties. Within this family, the yam is a notable figure because it is otherwise known as The Diasporic King of Crops (Penniman, 2018, 122). It is a staple food for Black farmers and both a culinary and spiritual stand in for the African yam. Also, both the leaves and tubers of crops within this family are edible, harvested at the same time, and can be used in various applications. As

opposed to other crops that are grown from seed, sweet potatoes are grown using slips, which you can order or sprout on your own indoors.

#### **Rosaceae Family**

The Roasceae family is also known as the rose family and characterizes medium sized flowering plants, many of which are edible and popular (Petruzzello, 2022). This includes stone fruits (like almonds or apricots), apples, brambles (like blackberries) and their relatives. It is one of the major angiosperm families and generally divided into four subfamilies based on fruit type and fleshiness of skin.

#### **Ericaceae Family**

The Ericaceae family are a family of flowering plants which can usually be found in acidic or infertile growing conditions (Petruzzello, 2022). Some recognized plants within this family include rosemary, huckleberry, and blueberry bushes. The fruit is usually a berry and their flowers are often urn-shaped. Most species of Erucaeae heath are indigenous to South Africa and most prominently the cape (Encyclopaedia Britannica, 2022).

# **Pest Control**

#### Sections

- 1. Pest Control on Organic Farms
- 2. Pest Control Methods
- 3. Natural Pest Control System

#### **Pest Control on Organic Farms**

Organic farms utilize environmentally conscious pest management strategies that combine a variety of practices to control pests. Most of the time, organic farms do not use pesticides on their farms.

#### Pest Control Methods: A combination of the control options listed below are used at the same time to manage pests.

- 1. Biological controls: Using natural enemies to control pests
  - a. Example: Chickens rummaging through fields to eat insect pests
- 2. **Cultural controls:** Deliberate, conscious implementation of farming practices that reduce pest establishment, reproduction, dispersal, and survival
  - a. Example: Crop rotation interrupts the predatory behavior of pests by placing them in a non-host habitat
- 3. **Mechanical & physical controls:** Controls that physically block pests, kill them directly, or create an environment that is uninhabitable
  - a. Example: Rodent traps or physical cages around the base of young trees
- 4. Chemical control: The use of pesticides
  - Organic farms do not use pesticides so this control practice will not be used. This is only here for educational purposes to encompass all possible controls.
  - b. There are some forms of organic pesticides that farms are able to use; however, in many cases, these pesticides are not as effective as their man-made counterparts, which can result in a decreased efficacy in preventing pest issues on the farms.

#### Natural Pest Control System

#### 1. Pest identification: Know your current pests and predict future pests

- a. Research common pests in Bridgewater, Vermont via the internet
- b. Ask your neighbors or other local farmers about pests they deal with and how they minimize pest damage. For example, you could draw from horizontal farmer to farmer learning, aka the campesino-a-campesino social process methodology that the National Association of Small Farmers used to create a grassroots agroecology movement in Cuba (Rosset et. al, 2011). Tapping into this methodology will help you learn how to increase resilience to pests and climate change.
- c. Be prepared for new pests on the horizon
- d. Keep a detailed log of pests encountered on the farm each year

#### 2. Protecting Crops & Preventing Damage

 Taking into account results from the pest identification step, apply control methods mentioned in the previous section to minimize farm damage and crop loss.

#### 3. Monitor & Analyze the performance of implemented control methods

a. Keep track of pest populations and their habits throughout farm fields, analyzing and noting the damage various pests cause

#### 4. Manage rising problems

a. If a certain pest is not effectively compromised by the control practices you implemented, take further action to control that pest by adjusting practices

#### 5. Reevaluate:

a. After a year's worth of pest mitigation, analyze the performance of your current pest management strategy and make adjustments accordingly to the following year's strategy. To optimize success, take into account the performance of your current strategy as well as potential migrating pests you and other local farmers predict will appear on your farm in the coming year(s).

# 6. Continue monitoring and making adjustments for the years to come (Environmental Protection Agency)

#### **Climate Change**

With the shifting of climates in the region and globally, there has been adverse effects on the pest species within regions. This includes the general migration of pest habitats as well as pest populations that can negatively impact farms. It is impossible to truly predict which types of pests will occur in the far future, however, in the near future there are a variety of pests that will move up north as the result of increasing minimum annual temperatures. These minimum annual temperatures typically kill off regional pest species, however, with the increasing of these temperatures, it is possible for these species to move north.

#### **General Pests in the Area**

Dartmouth College's Environmental Studies Department has done studies at the Dartmouth Organic Farm on the different types of pest species within the area, as well as their predators. They are shown in the diagram below.

| Insect Pest      | Insect Predator                                      |
|------------------|--|
| Aphids           | Lacewing, Ladybug, Minute pirate bug, Praying mantis |
| Cabbage loopers  | Parasitic wasp                                       |
| Caterpillars     | Minute pirate bug, Parasitic wasp                    |
| Cutworms         | Parasitic wasp                                       |
| Flea larvae      | Beneficial nematode                                  |
| Flies            | Fly parasite   |
| Fungus Gnats     | Fungus gnat predator                                 |
| Grasshoppers     | Praying mantis                                       |
| Grubs            | Beneficial nematode                                  |
| Leaf hoppers     | Lacewing, Ladybug, Minute pirate bug                 |
| Leafminers       | Leafminer parasite                                   |
| Mealybugs        | Lacewing, Ladybug                                    |
| Mites            | Lacewing, Ladybug, Minute pirate bug, Predatory mite |
| Mosquitoes       | Praying mantis                                       |
| Moths            | Lacewing, Praying mantis                             |
| Root weevils     | Beneficial nematode                                  |
| Scale            | Lacewing, Ladybug, Minute pirate bug                 |
| Slugs            | Beneficial nematode                                  |
| Snails           | Beneficial nematode                                  |
| Thrips           | Lacewing, Minute pirate bug                          |
| Tomato hornworms | Parasitic wasp                                       |
| Whiteflies       | Minute pirate bug, Whitefly parasite                 |

#### The Importance of "Pests": Pests are Necessary to a Farm's Operations

While the word "pest" has a negative connotation, and it is important "pest" species are kept to healthy population levels, they are essential to farm operations. Without pests, beneficial predators, such as predatory pollinators, would not visit farms. Some argue there is no such thing as a "pest"; rather, all animals and insects are beneficial to every farm, as long as their populations are kept in balance with other beneficial species. Balanced pest and pest predator populations yield healthy farm results.

# **Exploring Inputs: Nutrients and Water**

#### Sections

- 1. Nutrient Inputs: Fertilization and Restoring Soil Health
- 2. Importance of Crop Rotation
- 3. Water Inputs: Irrigation

#### **Nutrient Inputs: Fertilization and Restoring Soil Health**

In terms of nutrients, there are a variety of ways in which nutrients can be added to the soil. This includes compost, which can come from dead plant material or foods that are found on the farm. This compost would need to be closely monitored to ensure high levels of nutrients that are capable of being used by the plants. Another form in which nutrients can be inputted into the fields' soil is from animal waste, which can come from cows, chickens, goats, and other animals that are commonly found on the farm. These animals, however, typically require a significant amount of food and land area to graze healthily, and should be taken care of and quartered off from the rest of the farm. If allowed to free graze, for example, goats would consume a significant proportion of the crops on the field, thus decreasing agricultural output.

According to the soil test kit results depicted in the above section on Soil Health and Restoration, Darnell's farm will require inputs of the following nutrients: nitrogen, phosphorus, potassium, sulfur, calcium, and magnesium. It may be beneficial to initially plant and grow a nitrogen fixing cover crop to the upper field for one season before planting a true crop field; this will allow for the restoration of the soil's necessary nitrogen levels. Additionally, compost and manure contain these plant nutrients that are currently low in Darnell's farm's soil.

#### **Importance of Crop Rotation**

In terms of crop rotations, it is important to ensure that a single crop is not used on one specific bed or part of the land repeatedly. This can drain that specific area from different nutrients, which would result in decreased productivity for the land, and as such harm the plants in the long term. Over different periods of time, it is important to involve nitrogen-fixing plants, which are key to restoring nutrients of the soil between growing seasons. Without that, there could be a general decrease in the overall amount of

nitrogen within the soil, which is an essential element that is needed. Some of the nitrogen fixers that are notable are legumes, which can be a good part of this rotation.

Crop rotation is also beneficial for pest management because it would change the specific plant species that are available for specific pest species to consume. In particular, specific types of pests only consume specific plant species. By changing the species that are present on the farm, this will directly impact the access of specific plant species, which will help the long-term maintenance of pest species in the area. There is also the ability to optimize interactions between multiple plant families, which in turn could help the plants grow more effectively on the land in the long-term.

#### Water Inputs: Irrigation

For smaller organic farms, there should be a focus on drip irrigation. Drip irrigation focuses and localizes water into drops that are brought to the plant very close to the roots. This type of irrigation ensures that there will not be a significant amount of evaporation in hot weather as well as decrease the amount of water that goes into runoff. Overall, this will decrease the environmental damage, as well as the costs that are associated with watering the plants on the farm in the long-term, when compared to surface or sprinkler irrigation. In comparison, surface irrigation, which has water distributed over and across the land, has large amounts of water available to evaporate or drain off into the surrounding area. Sprinkler irrigation utilizes large high volume and pressure sprinklers that shoot from a few specific locations on the field. This not only increases the amount of evaporation, but also can fire water directly into unused or unneeded areas of the field.



Drip Irrigation at Work, 2022, photograph, University of New Hampshire

# The Day to Day Action: Weeding, Crop Maintenance, Harvest, and Keeping the Seeds

**Sections** 

- 1. Weeding and Weed Suppression
- 2. Transplanting versus Direct Seeding
- 3. Harvesting
- 4. Seed Keeping

#### Weeding and Weed Suppression

In terms of weeding and weed suppression it is important to make sure that the cover crop on the fields is smothered before planting any new crops. This is important because it will prevent the germination and establishment of weeds, which can cause a competition for resources like light, water, and nutrients within the soil (Snell n.d.). Making sure that the weeds are taken out of the farm by pulling them out as quickly as possible will prevent them from spreading throughout the field. It is important to remove them and take them as far away from the farm as possible to ensure that any of their plant material does not remain on the farm, thus preventing them from growing back throughout the season.

#### **Transplanting versus Direct Seeding**

In some of the plants' cases, they will need to be transplanted from smaller forms onto the farm. Transplanting is when the seeds are allowed to germinate in one location, particularly within a greenhouse, and then moved from their small containers out onto the field, thus enabling them to grow during their most vulnerable times in a controlled and efficient environment. This will help to make sure that they are able to be stable and capable of surviving on the farm fields once they are transplanted. Seeding will typically begin in late-March to early-April in the greenhouse, and then again in June for plants with multiple harvests (this includes Kale, and other greens). Plants like radishes, peas, and most herbs, however, are able to be directly seeded. Direct seeding is when the seeds are introduced to the farm's fields directly and are able to germinate on the fields instead of moving them from the greenhouse in a small plant state.

#### Harvesting

#### Kale and Collard Greens

Kale and Collard greens will have upwards of ten leaves when healthy. Smaller leaves will grow towards the center and larger ones will grow toward the outside of the plant. Depending on preference, they can be allowed to grow into large plants, or are able to be picked when they are a bit smaller. They can be picked every two weeks once the leaves have grown back to the size of a hand.

#### Chives

Chives are able to be harvested as soon as the leaves are long enough to be of use within a kitchen. Depending on the quality and size of chive plant that is needed or wanted to be sold, they can be harvested. The flowers of chives are not known for having great flavor, and they should only be harvested once they have a hollow stalk.

#### **African Chilis**

African chilis typically begin to turn color at the crown of the chili. The crown of the chili is near the top where the green part of the plant connects to the chili. It is important to wait until the entirety of the chili changes color to the correct color and then carefully pick or cut the chili from its stem to harvest it. Tunisian baklouti peppers are one variety of African chili that could be planted and used to make a food that is very culturally relevant in Northern Africa, harissa or North African chili paste.

#### Squash

Winter squash will grow on a vine and be able to be picked once the squash has a hard outer rind, which is deep in color. This can occur anywhere between late September into October. Most types of winter squash are able to be stored in a cool, dark place until they are needed to be sold or consumed.

#### **Sweet Peas**

Sweet peas should be ready to harvest after 3 weeks of the plant's flowering, particularly when the pea pods are three to four inches long and almost cylindrical in shape. It is important to taste the pea plant's before actually harvesting from the plant, as each individual plant will have a different taste from one another, which could mean that they are generally consumable or not mature enough to actually be picked.

#### Radishes

Radishes are usually ready after three to five weeks. The root, which is the radish itself, should be at least an inch in diameter before actually harvesting the plant. Making sure that the plant matures to the point where it has a reddish color is important as well to ensure the quality of the plant instead of harvesting the plants before they are fully capable of growing.

#### **Blueberries**

Blueberries are ripe when they are grey-blue all around the fruit. It is important to gently roll the berry off the stem and put it into your palm or into a bucket for harvesting. If they are not removed gently, it poses a risk of damaging the plant and decreasing the long-term quality of the blueberry plant on the farm.

#### Apples

Apples are ready to harvest after a few years of planting the tree. Although it will take more than five years for larger sized trees to grow to the point where they are able to actually produce fruit. In the cases of the apple varieties being introduced to the farm, it is important to make sure that the fruits are fully grown and red in color. Taking them early off of the stem can damage the tree as well as decrease the quality of fruit. When picking apples from trees, it is important to gently pull them off of the stem of the branch, making sure not to damage the branch when removing it.

#### **Plum Trees**

Similar to apple trees, it will take a few years for the tree to mature in a way that enables it to grow fruits. Plums, like apples, have their fruits dangling from the branches on stems. Depending on the variety of plum, it is important to make sure that they are the correct color and size. If they are not the proper color or size, this will diminish the quality of the fruit that is received from the farm, and instead prevent it from actually being tasty.

#### **Seed Keeping**

Seed keeping is a practice that allows for the conservation of genetic and cultural heritage and extends centuries back as an act of resistance and preservation. Penniman (2018) describes the importance of seed keeping by relating the story of African women braiding rice, okra, and millet seeds into their hair to insure their futures as the transatlantic slave trade spread and they feared their own kidnapping and disappearance (149). These seed smuggling practices continued throughout slavery and allowed for the preservation of cultural crops and agricultural knowledge.

Today, as a few powerful corporations aim to control all the world's seeds and we have lost almost 75% of plant genetic diversity, seed keeping remains a very important practice.

#### **Self-Pollinating Plants**

With self-pollinated plants, these seeds are some of the best choices for seed saving, particularly because they will have similar genomes year after year (Grabowski, 2018.). In particular, these plants will be able to reproduce a similar flavor, texture, and growing ability from one year to the next. Many of these plants have seeds that do not need to be specially treated before they are stored.

#### **Cross-Pollinating Plants**

In terms of cross-pollinated plants, these seeds may have different flavors year after year because of the impact that adjacent farms or plant species have on their genome (Grabowski, 2018). This may be optimal if the plant's needs are slightly different from season to season. Typically, though, these cross-pollinated seeds can result in inferior quality.

#### **Open-Pollinating Plants**

Open-pollinated plants are fertilized by bees, moths, birds, wildlife and other natural mechanisms, producing seed that will grow into a plant with the same characteristics the following year (Penniman, 2018, 152). It is important to keep these seeds because open-pollinating plants are at risk of in-breeding; trading seeds with other seed keepers can help maintain large populations and restore genetic diversity.

#### Drying

When drying seeds, such as from more wet interior plants, it is important to make sure they are dry. When the seeds come from a liquid material, it is important to remove all of the liquid that is attached or near the seeds. This can be done by straining them out gently with hands and then drying them completely off with a paper towel. In the case of pepper plants, it is important to make sure that the pepper is fully ripened to the point where they begin to wrinkle (Grabowski, 2018). Once they wrinkle, carefully remove the seeds directly from the pepper and place them out on a paper towel or another absorptive material so that they dry. It is important to make sure that they are fully dried off. Be sure to leave some pepper plants on the field so that they are able to be picked for seed keeping, if not, then the seeds will not be viable for reproduction in the following year.

With bean or pod plants, they also should be allowed to fully ripen. In their case, it is important to make sure that they brown and dry on the plants themselves before plucking them off (Gabrowski, 2018). This should occur after a month after these plants are normally plucked, so it is important to make sure that you leave some plants specifically for seed keeping. After they turn dry and brown, make sure to take the pods from the plants and lay them out to dry indoors or in a closed-off dry area. They should be out to dry for about two weeks before using their seeds, and after these two weeks, it is possible to leave them inside of their shells or to take them out of their shells for a more space efficient storage method.

#### Storage

When storing seeds, they can be stored in tightly sealed containers that are airtight. If there is a large airtight container that is being used, the individual is able to store them in small paper packets. It is imperative that the seeds are kept cool and dry, as not to kill the seeds or cause them to germinate whilst in storage (Grabowski, 2018). Temperatures above 32 degrees Fahrenheit, but below 41 degrees Fahrenheit are ideal as they will not freeze the seeds, but they they will contain them at a set temperature. Using silica-gel desiccant within the packaging can also prevent moisture from building up inside of the container with the seeds.

# **Attracting Pollinators**

#### **Sections**

- 1. Bees aren't the only pollinators
- 2. Benefits of Pollinators
- 3. Creating a Safe Haven for Pollinators
- 4. Helpful Resources
- 5. Pollinator Friendly Solar

#### **Bees aren't the Only Pollinators**

When most people hear the word "pollinator", bees are usually the first species to come to mind, but there are six other pollinators that play an integral role in pollination activities. Bees are the most prominent pollinators, accounting for 80% of the pollination that takes place. The remaining 20% of pollination is attributed to butterflies & moths, wasps, flies, beetles, and birds (these are listed in order of pollination capabilities: most pollination contribution to least pollination contribution).

#### **Benefits of Pollinators**

Maximizing pollination on farms has been shown to increase crop yield and improve the quality of the crops produced. In addition, tactical pollinator attraction and retention on farms can serve as an effective and environmentally beneficial pest management strategy. Many native insect and animal pollinators serve as natural enemies to crop pests. Creating a safe environment for these predatory pollinators will help keep pest populations under control.

Farm alterations geared towards creating a pollinator-friendly environment may also qualify for government programs that provide financial support for various farming activities.

#### **Creating a Safe Haven for Pollinators**

#### **Native Plants**

Each category of pollinator has generalists and specialists. Generalists have adapted to thrive in many environments, while specialists only thrive under certain conditions. For

example, honeybees are generalists that feed on many kinds of flowering plants, while mining bees are specialists that prefer to feed on native plant types.

In order to support both generalist and specialist pollinator species, farmers should focus on accommodating specialist species by integrating native plants across the farm, and generalists will also thrive in these environments. Some plants native to Vermont that support a wide variety of native species are red maple, blueberries, willows, and dogwoods. There are great resources online that list plants native to Vermont as well as where to acquire them.

When purchasing native plants, it is important to know where these plants originated from and how they were grown. Some problems you may encounter when attempting to purchase natives are cultivars and seeds that were treated with insecticides. Cultivars are plants that have been crossbred with other plant species by humans for certain visual characteristics, but as a result of this breeding they often lack genetic diversity and nutritious value for pollinators. In addition, some plants may have been treated with insecticides at a young age, and the insecticides may still linger with the plant throughout its lifetime. Therefore, it is important to know where the plants you purchase are from and how they were brought up. However, it can be difficult to find truly authentic native plants in Vermont. If unable to acquire native plants, which are plants that have evolved over time to thrive in a native habitat without human influence, nativars are the next best thing, and then cultivars are a last resort. Nativars are native plants that are altered by humans via the natural genetic variation found in native species.

#### Ways to Integrate Native Plants into the Farm Landscape

 Native Wildflower Field Borders: Planting a diversity of native flowers around farm fields is a great way to attract a variety of pollinators to pollinator-dependent crops. Not only is this functional, but it is also beautiful. These flowers can be harvested and sold for a profit (Xerces Society).



Native Wildflower Field Border in New Hampshire by Eric Lee-Mäder, photograph, located on Xerces Society.

2. Prairie Strips and Insectories: Prairie Strips, or insectories, are diverse rows or plots of native flowering trees, shrubs, wildflowers, and grasses that are strategically arranged together to create a food-rich shelter and nesting habitat for pollinators and other beneficial insects. Once established, they require little maintenance and will last for decades. They can be planted around the perimeter of farm fields or as rows or plots within farm fields (.



Hedgerow in California by Jessa Kay Cruz, photograph, located on Xerces Society.

3. Edge Feathering: Many native species prefer mild transitions in terrain, and edge feathering with native plants to create a diverse plant gradient helps to soften the transition between crops to their surrounding habitat. Edge feathering is when a gradual transition is created between two different habitats.



Edge Feathering with a Riparian Buffer by Dr. Stephanie Hurley, photograph, Department of Plant and Soil Science, University of Vermont.

- 4. Differing flower times: It is important to ensure native plants you select for your farm flower at different points in the growing season. Early flowering plants are especially important in establishing your farm as a safe place for pollinators as this will ensure pollinators have food when they wake up from the winter months. Early flowering plants should be followed by a strategic sequence of flowering plants that bloom in different periods throughout the rest of the season so that pollinators have food sources to support them until the end of the season.
- 5. Minimize Tillage: Many different pollinators establish homes for themselves in the ground. It is important to minimize tillage so as to not disrupt the shelter they build for themselves
- 6. Create shelter for pollinators: As much as pollinators need food, they need shelter to survive farm living. Standing dead trees are great homes for a variety of productive birds and insects. If there are dead trees around the farm, leave them up to support a variety of species. Woody shrubs also serve as great resting places for many pollinators. When planting natives, ensure that you incorporate woody shrubs into the mix. Bee homes and bird boxes also serve as great shelter for pollinators and they are easy to construct. They are also commercially available, however, be sure to clean these man made structures each year to prevent disease from spreading (National Audubon Society).

#### **Helpful Resources**

#### Jason Mazurowski & Margaret Fowle

Jason Mazurowski is a Contracted Ecologist that works on pollinator friendly projects across Vermont. He helps design pollinator friendly solar sites and works with farmers to make their farms more suitable for pollinators. He also teaches courses at University of Vermont. Margaret Fowle works for the Audubon Society and is in charge of coordinating farm demonstration sites to serve as examples of pollinator friendly farming. Jason and Margaret are working together on this farm demonstration project, and would love to speak to any farmers interested in becoming a part of the project. Their contact information is listed below.

- 1. Jason Mazurowski, jason.mazurowski@uvm.edu
- 2. Margaret Fowle, margaret.fowle@audubon.org

#### Natural Resource Conservation Service (NRCS)

The NRCS is an offshoot of the USDA that aids landowners in their efforts to conserve the nation's soil, water, air, and other natural resources. The NRCS receives federal money that goes towards helping farmers execute farm improvement projects that protect natural resources. There are NRCS professionals assigned to various districts across the U.S., and they have often worked with farmers in Vermont to design pollinator friendly projects that qualify for NRCS funding. For example, they have designed riparian buffers that protect bodies of water from runoff while supporting native pollinator species. When working on projects, Jason Mazurowski often runs into NRCS on farms, and the NRCS will work with Jason to sort out the funding for the projects.

#### **Xerces Society**

The Xerces Society is dedicated to protecting pollinators and ensuring their populations thrive into the future. There are tons of detailed guides on their website explaining how to create safe habitats for pollinators on farms.

#### **Pollinator-Friendly Solar**

Not only does Jason Mazurowski work with pollinator friendly farms, but he also works on pollinator friendly solar projects. Pollinator friendly solar utilizes the land on solar farms to create an ideal environment for pollinators. Native plants are planted underneath solar

panels, providing food and shelter for pollinators. Not only does this support pollinator populations, but it also requires little upkeep, saving maintenance costs and avoiding potential damage to solar panels that occurs with ongoing maintenance.

# Part 4 Farm Field Recommendations

Casimiro Cosme Michael Guptill Julie Jones Chelsea Moore Jack Walker Ricardo Almazan Jr.

# **Farm Field Recommendations Sections**

- 1. Locations and Map
- 2. Preparing the Farm for Planting
- 3. Crops, Their Significance, and Why We Chose Them
- 4. Upper Field
- 5. Lower Field
- 6. Equipment

# **Locations and Map**

#### Sections

- 1. Map
- 2. Overview
- 3. Upper "Crop" Field
- 4. Lower "Healing" Field

### Map



# Layout and Spacing of One Section of the Upper Field

| Marigolds 12 incres apart \$2 secas/plant      | [209+  | 800 marigold Sends      |
|--|--------|-------------------------|
| Kale 101-100 + 2 seeds / plant                 | [2F    | 400 rate seals          |
| Intercoopped Chives III 10 11 + 10 seats/plant | IZOFY  | 4000 Chive seeds        |
| African Chili Dit 3 seek / plant               | [2fr   | 300 african Onili seeds |
| wildflowers * scattered                        | [12.F+ |                         |
| Biveberry C3+ 8 Ft 153                         | [8 P+  | 25 Blueberry Plants     |
| Wild-flowers * scattered                       | [12.Pz |                         |
| sweet Peas the Bin prover + 2 seeds   plant    | I2ft   | 600 sweet poor seeks    |
| Radish seeds * intercorport radistes           | TSF+   | 2.400 andisin seads     |
| Squash the in 1 the second plant               | 2.f+   | 402 squarm seeds        |
| Marigoids                                      | I 20Fr | 800 maniqold seeds      |

200Pt

# Layout and Spacing of the Lower Field



#### **Overview**

Based on the previous explanations of the farm, it is important to note the style by which the farm is structured. Each of the plants plays a different and important role within the farm, ranging from preventing pests to providing food for sale or consumption.

#### **Upper "Crop" Field**

The upper crop field that we have proposed here will be split into two sections where the field naturally forks near the middle, resulting in a portion closer to the house that spans 200 feet long and 90 feet wide and a latter portion that spans 200 feet long and 80 feet wide. While we outline here the same general crops and layout for both 200 foot sections, a different crop variety of the same plant family could be swapped out for the ones we suggest; for example, the northern section might have a row of African chilis, while the southern one has a row of African eggplants, both belonging to the Solanaceae family and, thus, exhibiting similar interactions with the surrounding crops and plants in the field.

In our plan, each crop row is a standard 2 feet. The space between the two crop rows on either side of the blueberry bushes is 5 feet to allow for ample room for beneficial intercropped plants that can also be harvested for consumption and profit. The blueberry bush crop rows is 8 feet with 12 foot buffers on both sides between the blueberries and crop rows; not only do these buffers give the blueberries ample space to grow, but we also plan to fill them with wildflowers that will attract pollinators, contribute to the farm's overall biodiversity, and may somewhat control pests by increasing species richness.

We propose that the upper field contain four main crop rows, divided in the middle by a row of blueberry bushes. Working from the eastern forested edge to the western forested edge (top to bottom in the above image), our farm plan has a row of East African Kale next to a row of African chilis (or eggplant), with chives intercropped between these two rows. Alliums like chives are beneficial companion plants for brassicas like kale because their pungent aroma deters common predatory herbivores of kale like flea beetles, cabbage loopers, and aphids. Next, there is a row of blueberry bushes. After the blueberries, there are two more crop rows containing sweet peas and winter squash, separated by a row of intercropped radishes. These radishes serve as "sacrifice" plants for herbivores, drawing pests away from the squash and peas; since a large number of

radishes can be planted in the space between the crop rows, there should be radishes remaining spared from pests and available to harvest.

Marigolds will be planted at the western and eastern edges of the crop rows in 20 foot rows in the northern section and 15 foot rows in the southern section of the upper field (which is 10 feet narrower), serving mainly as trap crops to deter pests and leaving space for additional wildflower plantings.

#### Lower "Healing" Field

Speaking to Darnell's vision of truly mixed agriculture on her farm, our farm plan presents the lower field as a beautiful orchard area, intercropped with various medicinal herbs that contribute to this field's name as a "healing" field. The lower farm field will extend 450 feet north to south and be about 100 feet wide. We propose five gala apple trees and 5 honeycrisp apples, as these varieties are well suited to Vermont's climate and are popular and competitive at markets. Including two separate varieties increases the overall diversity of the farm–and thus benefits overall ecosystem health–and allows for the cross pollination necessary for the trees to produce viable fruit. Additionally, we propose 10 Japanese plum trees in the orchard because plums are in the same plant family as apples and are less commonly grown in Vermont, giving them an edge in the marketplace.

With concentric circles of herbs emanating out from each fruit tree's base, we envision the trees and herbs to create a naturally aesthetic and peaceful winding and curvilinear path through the field. We have chosen 10 herb varieties, detailed above. Herbs are a good choice to plant together with trees because they do not require a lot of sunlight and can withstand the shade of the fruit trees' branches. Herbs as companion plants can also deter pests, crowd out weeds, conserve moisture, and can be used as living mulch. Each variety will be planted under two of the twenty total trees. These herbs also offer an important educational opportunity to promote healing, justice, and equity; informational markers or signs could be placed by each herb circle to teach visitors about the benefits and cultural importance of these different herbs.

In order to make this space not only agriculturally abundant, but also a space of rest, relaxation, creativity for everyone, we have added a few non-crop features in our plan for the lower field plan. First, the spacing of the trees leaves ample room for sitting areas like benches and a small gazebo to be placed around the trees and herbs; we hope these spaces may be a beautiful, fruitful, and inspiring setting for artists of color to sit in the healing orchard to paint, write, create music, and more. In order to make the field accessible to all people who visit the farm, we propose that an accessible and educational walkway weave throughout the trees and concentric circles of herbs. Along this pathway, we propose educational signage to be placed near each type of herb, detailing the species' cultural significance and healing powers. This presents an important opportunity for education and knowledge sharing within the lower field.

# **Preparing the Farm for Planting**

#### Sections

- 1. Terracing
- 2. No Till Methods

#### Terracing

Step 1: Find the slope of the fields (University of Tennessee)

- 1. Necessary materials: two wooden stakes that are equal in size, twine or a long nylon rope, a hanging bubble level
- 2. Specific steps to find the slope
  - a. Plant your two stakes into the ground at each end of the plotted area
  - b. Connect the rope between the two stakes while utilizing the hanging bubble level to create a level and taught line
  - c. Take a measurement for which the rope hits the stakes and find the difference between the two units which gives you your change in rise
    - i. \*if using just one stake instead of two, measure the height at which the rope hits the stake and use this value instead
  - d. Divide this rise by the distance between the two stakes (shown by your initial rope) to find the slope of the area
  - e. Multiply this value by 100% to find the percent of slope
  - f. The equations:
    - i. Slope = (Height B Height A) / distance
    - ii. % slope = slope x 100%

#### Step 2: Transform the slopes of the fields into one flat terrace

If the slope of the land is over 15%, the soil has a very high chance of eroding and should be managed through terracing. Terracing is moving soil and organic matter to create flat planting areas for crops using the contour of the environment (Penniman, 2018).

 Find a suitable source of soil and/or organic matter. Pond muck, leaves and underbrush from forests, and topsoil and compost from garden suppliers or municipalities are some examples.
- 2. Deposit this material along the contour lines of the field and compact it down by foot, creating a flattened surface. Cover with several inches of topsoil or compost to encourage healthy soil.
- 3. Build a "wall" of sticks, branches, rocks, or other natural effects, in order to hold your flattened terrace in place and discourage erosion through runoff.

It is best to immediately plant a cover crop after newly terracing a field, as the roots from the cover crop will hold the soil together for enough time for the soil to naturally compact and settle.

### **No Till Methods**

These practices minimize soil erosion, trap carbon, improve soil health, and replenish nutrients (Penniman, 2018).

### Sheet composting

Sheet composting is labor-intensive and works best on small plots of land with slopes of less than 15%.

- 1. Chop grass and shrubs to make them as short as possible.
- 2. Layer organic matter on top of the shortened grass and shrubs to replenish the soil with nutrients.
- 3. Cover the planting area with paper, blocking the sunlight from reaching the ground. Wet the paper.
- 4. Place 2-7 inches of compost over top of the paper.
- 5. Cover the compost with at least 12 inches of mulch.
- 6. Allow the organic matter to decompose over the winter season.
- 7. The bed is ready for planting after winter when the layers are no longer recognizable as their original materials. It should look and smell like fresh soil.
- 8. Then, plant!

### Tarping

Tarping is labor-intensive and works well for growing areas up to  $\frac{1}{2}$  acre.

- 1. Shovel pathways through the fields carefully turning the uplifted soil into nicely-shaped beds.
- 2. Apply one to two inches of compost to the soil.

- Tarp the area: Use black silage tarps to cover the crop area. Use stones or other heavy items to hold down the edges of the tarps as well as tarp areas that cover the pathways.
  - a. We recommend using tarps that are less than 50-100 feet. If tarp size exceeds 50-100 feet, it will be difficult to move by hand.
  - b. If you are unable to acquire silage tarps, you can use old billboards, black garbage bags, camping tarps, landscaping fabric, or any other opaque cover that will not fall apart in UV light.
- 4. Let the tarps rest over the fields for six-plus weeks in cooler weather, or three-plus weeks when the weather is hot. In hot weather, the weeds in the top few inches of soil cook slowly in the heat trapped by the tarp.
- 5. In northern climates, we advise that farmers do not tarp their fields during the winter period if they plan to remove the tarps to plant crops in early spring as this enables perennial weeds to establish themselves.
- 6. Season and climate determine how long farmers should leave tarps on their fields. It is important to test out various lengths of time in different seasons to see what method yields the best results. Ideally, farmers should know the minimum amount of time required to reach a weed-seed-free growing area.
- 7. Once tarps are removed, planting begins.
- 8. Weeds at the surface are killed with the tarping method, but some may still be lurking underneath deeper soils. It is permissible to lightly rake the topsoil, but be sure not to stir up deeper soils which could draw up weed seeds to the surface.

### Cover cropping

- 1. Plant a fast-growing, strong rooted cover crop to prevent soil erosion after the planting season. Ensuring soil stability minimizes runoff that could negatively impact local ecosystems.
- No-till farms are best paired with cover crops that naturally die over the winter season and contain a lot of biomass which allows them to serve as nutritious mulch for crops that will be planted in the following season.
- 3. Examples of great cover crops for no-till systems: buckwheat, oats, field peas, soybeans, and millet
- 4. It is best to plant cover crops in mid- to late summer so they have enough time to mature before winter.

 Over the winter, the cover crops will die and decompose leaving a lovely layer of mulch for spring veggie planting.

## Crops, Their Significance, and Why We Chose Them

### Sections

- 1. Upper Field
- 2. Lower Field

### **Upper Field**

### Marigolds (around perimeter of the field)

Marigolds offer many benefits to agricultural spaces. Aside from being aesthetically pleasing and low maintenance, marigolds attract pollinators, discourage a variety of pests (nematodes, whiteflies), and attract other pests away from the main crops.

Hardiness Zones 2-11. Begin as seeds in the greenhouse, planting 2 seeds in each well. Plant each marigold 12 inches apart in the beds.



"Marigold" by Mani Bhaskar. 2016, photograph, located on flickr.

### African Kale or Collard Greens

Varieties of kales and collard greens grow well in VT, and meet the cultural necessities of this farm.

Hardiness Zones 5-9. Begin as seeds in the greenhouse, planting 2 seeds in each well. Plant each kale seedling 12 inches apart in the beds.



"Collard greens with mint" by garlandcannon. 2008, photograph, located on flickr.

### **Chives (interplanted)**

Planting a row of chives (or any plant in the allium family) in between the leafy greens and Solanacea (eggplants, peppers, tomatoes), attracts pollinating insects, and repels ground and flying pests.

Hardiness Zones 3-9. Directly plant chives in the beds 6 inches apart, with 10 seeds in each well.



"Chives" by Amanda. 2010, photograph, located on flickr.

### African chilis, such as scotch bonnet

Plants in this family grow better in hotter temperatures, and are best transplanted in June. There are many varieties of eggplant and peppers that originate in Africa that can be grown in VT.

Hardiness Zones 2-12. Begin as seeds in the greenhouse, planting 3 seeds in each well. Plant each chili plant 24 inches or 2 feet apart in the beds.



"Scotch Bonnet " by Asheem Gujhador. 2013, photograph, located on flickr.

### **Blueberry Bushes**

Blueberry bushes will be the only perennial plants in this field and will begin producing in only one to two years, and continue producing for decades if well cared for. Will separate the two crop rows. Grow great in acidic soil. Early flowering, which will help attract pollinators to the other crops planted in the upper field.

Hardiness Zones 3-8. Plant blueberry bushes 8 feet apart in the crop row.



"Blueberry Bushes" by Bob Gudas, 2011, photograph, located on flickr.

### Sweet peas

Sweet peas are nitrogen fixing plants, an important type of crop to have in rotation. Sweet peas do not need trellises so less work is needed in comparison to other pea varieties.

Hardiness Zones 2-11. Plant each sweet pea directly in the field 8 inches apart in the beds, with 2 seeds in each well.



"Sweet Peas" by idunbarreid, 2021, photograph, located on flickr.

### Radishes

Radishes are excellent crops for VT, they are cool weather vegetables and tolerate cold temperatures. Mature in 3-5 weeks, so there can be multiple harvests per year.

Hardiness Zones 2-11. Directly plant radishes in the beds 1 inch apart, with 1 seed in each well.



"Radish" by Nand Kishor Singh. 2010, photograph, located on flickr.

### African squash or Acorn squash or pumpkin

Will ripen over the course of the summer and are ready to harvest in autumn. Squash needs a large amount of soil nutrients, so should not be grown in the same row within three years, and should be planted after a nitrogen fixer.

Hardiness Zones 3-10. Begin as seeds in the greenhouse, planting 6 seeds in each well. Plant each squash 36 inches or 3 feet apart in the beds.



"Winter-Squashes" by Farm Fresh To You. 2010, photograph, located on flickr.

### **Lower Field**

### **Apple Trees**

Gala and honeycrisp apple trees will begin on the farm as young trees and take several years before they fully begin to bear fruit. For the first few years (3-5), they may require a stake about the height of the tree for support and more tending to, such as weeding and watering. Apple trees need to be pruned every year in late early or early spring, but it is important to prune minimally with young trees. A common and easy method of pruning is called central leader pruning, where a central main stem or leader is treated as the foundation of the tree, from where side branches extend.

Hardiness Zones 4-9. Acquire and plant in the field as young trees.



"apple trees" by swee-cheng, 2007, photograph, located on flickr.

### **Plum Trees**

Plum trees are generally hardy and do well in most regions across the U.S; however one risk in these fruit bearing trees is that they do tend to be susceptible to frosts, since they flower so early, so a tree wrap or guard around the lower trunks may be beneficial. It is best to plant the trees in the late winter or early spring. They should be heavily watered during the first growing season to promote growth and pruned in the spring while they are young, but midsummer once they are established.



Hardiness Zones 3-9. Acquire and plant in the field as young trees.

"Plum Tree" by Detlef Becher. 2010, photograph, located on flickr.

### **Concentric Circles of Medicinal Herbs**

### Echinacea

This is a category of flowering plants used as a herbal remedy known for fighting the common cold and flu (Penniman, 2018, 186). When gargled it fights throat infections, and eating a tincture or decoction of its roots cure chronic and respiratory infections and skin disorders. This herb has antibacterial properties and weakens the viral ability to enter and take over cells. In spiritual practice, the flowers are given as offerings to river spirits and worn around the neck to bring strength in challenging times.



"Echinacea" by Kaarina Dillabough, 2017, photograph, located on flickr.

### **Bee Balm**

This aromatic herb is part of the mint family. Its foliage can be used in salads and teas and its flowers are also edible (Almanac 2022). When drinken in tea it is known to remedy digestive issues, bloating, nausea, and sore throats. When applied topically it can relieve bee stings, rashes and wounds (Plant Addicts, 2022).



"Likes bee balm" by ilze long. 2020, photograph, located on flickr.

### Chamomile

This herb is sweetly aromatic and tasty because of its chemical composition (Penniman, 2018, 186). Because it relaxes aching muscles and decreases stomach pain, it is used medicinally to relieve indigestion, bloating, and irritable bowel syndromes. Its steam can also be used to reduce allergies and itchiness. In spiritual medicine, in tea form it is drunk to foreshadow love, clear up mental confusion and prevent nightmares.



"chamomile" by hichako. 2022, photograph, located on flickr.

### Chives

These are flowering plants that produce edible flowers and leaves. Their stalks are flavorful and often chopped and added to soups, dips or salads. This herb also attracts pollinating insects but repels other insects, discouraging burrowing animals (Penniman, 2018 82). They are also rich in Vitamins, like Vitamin C so if consumed they boost the immune system (Aessence Grows).



"Chives" by Amanda. 2010, photograph, located on flickr.

### Sage

This is an aromatic and curative herb of the mint family. It has strong antiseptic and astringent qualities that make it useful as a gargle for sore throats and irritated mouths (Penniman, 2018, 188). It can also be taken as a tea in which it cures diarrhea, calms the nervous system and stimulates digestion. It also helps the body adapt more efficiently to hormonal change and reduce menopausal pain. If smoked, the dried leaves also relieve asthma. In spiritual medicine, sage is burned to purify spaces, cleanse negativity and enhance wisdom. During funerals, it is traditionally burned to support healthy grieving and put under the pillow to drive away nightmares.



"Sage" by certainly\_possible, 2007, photograph, located on flickr.

### Lemon Balm

Lemon Balm is an aromatic herb from the mint family. Medicinally, lemon balm can be made into a tea to relieve anxiety, depression, headaches, nausea and bloating (Penniman, 2018, 187). In its raw form it can also be chewed to relieve toothaches and cold sores, and made into a salve it can be applied topically to relieve pain. In spiritual medicine, lemon balm is taken to attract love and ward off melancholy.



"Lemon Balm - 11-05-09" by Ema. 2006, photograph, located on flickr.

### Comfrey

This is a flowering herb that can be used to treat wounds on the skin and reduce inflammation from broken bones (Mount Sinai). Their roots and leaves contain a chemical substance that helps the growth of skin cells and heals bodily pains. It used tobe used to relieve stomach pain but now has a toxic chemical that should not be eaten so it is only used topically. Comfrey actively accumulates nutrients as it brings minerals from the subsoil to the topsoil (Penniman, 2018, 83). Its large leaves can also be used to mulch trees.



"Comfrey" by Alyss. 2007, photograph, located on flickr.

### Peppermint

The mint family has about 6000 species and wild mint and wild water mint are native to Africa (Penniman, 2018, 188). It has fragrant leaves and tiny purple, pink or white flowers. Mint can be infused to relieve cramps and gas, increase the flow of digestive juices, and soothe the colon. If it's applied to the skin, mint will relieve pain, and if inhaled, it can relieve headaches and improve breathing. Spiritually it is taken as a tea to revive hope and increase energy.



"Peppermint" by heru44. 2007, photograph, located on flickr.

### Basil (African Blue Basil or West African Basil)

This herb is known as the king of herbs and has strong medicinal and spiritual utilities (Penniman, 2018, 184). When taken as a tea, it is taken to reduce anxiety, alleviate cold and flu symptoms and relieve stress. Basil leaves can also be gargled to lessen sore throat pain, removes bad breath and strengthens gums. Basil is burned to dispel bad spirits from the home and is traditionally used for purification and good fortune.



"African Blue Basil" by Ahd Photography, 2015, photograph, located on flickr.

#### Rue

This is an aromatic herb which is known for its powerful oils (Penniman, 2018, 188). When consumed in any form it strengthens the inner lining of blood vessels and reduces blood pressure. Historically, rue tea has been used to treat mental illness, poisoning, and epilepsy. Infused as an eyewash it also improves eyesight and relieves eye pain. Spiritually, rue is the mother of herbs and is used in sacred traditions in Christianity, Santeria, Islam, and indigenous European communities. As a tea it consecrates sacred objects and creates protection.



"Rue" by Salmon Cabin. 2009, photograph, located on flickr.

### **Upper Field**

### **Sections**

- 1. Overview
- 2. Spring
- 3. Summer
- 4. Fall
- 5. Winter

### **Overview**

A short list of the crops is listed below. These plants are mostly crops that will be used for food purposes on the farm. In particular, this list of plants will be used on the entire large "upper field" that is closer to the house. These crops were decided based on their resilience as well as their historical significance to the communities in Darnell's mission for the farm. The crops are as follows:

- 1. Marigolds
- 2. Kale
- 3. Chives
- 4. African Chilis
- 5. Blueberry Bushes
- 6. Sweet Peas
- 7. Radishes
- 8. African Squash, Acorn Squash, or Pumpkins

In the case of blueberry bushes, there are a variety of species that can be chosen from. Depending on the species that is chosen, it is important to note that different types of fly species will consume the blueberries, so it may be important to use some sort of organic pesticide that will prevent flies and other bug species from consuming these plants.

### Spring

Spring is arguably the most important season in the agricultural process, to have the desired outcome, it's important to begin in a way that will set up the plants for success.

### Step 1: Seed plants in the greenhouse

In early March, it will be time to begin seeding plants in the greenhouse so that they will be ready to transplant by the final frost date. See descriptions of plant seeding above in Overview of Crops, Their Significance, and Why We Chose Them.

### Step 2: Remove tarps if chosen no-till method

Once the agricultural fields have been tarped for the initial six months in order to prepare the land for its primary planting, tarps can be reapplied for shorter periods of time, 3 weeks during the warmer months or 6 weeks during cooler months. Once the tarps are removed, the fields should be immediately ready to plant. Weeds don't take days off, immediately after the tarps are lifted, weeds will take up residence in the new soil.

### Step 3: Plant the crops (never transplant before the final frost date!)

- Marigolds- Begin as seeds in the greenhouse in late April/early May, planting 2 seeds in each well. Once the plants are over four inches tall, transplant each marigold 12 inches apart in the beds.
- Kale/Collards Begin as seeds in the greenhouse in late April/early May, planting 2 seeds in each well. Once the plants have at least 4 leaves, transplant each kale or collard seedling 12 inches apart in the beds.
- Chives Directly seed the chives in the beds after the final frost date, planting 10 seeds every 6 inches.
- 4. African Chilis Begin as seeds in the greenhouse in late May, planting 3 seeds in each well. Once plants are four to six inches tall, usually after six to seven weeks in late June, plant each chili 24 inches apart in the beds.
- 5. Peas/Beans Plant each sweet pea directly in the field 8 inches apart in the beds, in early May, with 2 seeds in each well. Can re-seed in September.
- Radishes Directly plant radishes, in late April, in the beds 1 inch apart, with 1 seed in each well. Mature in 3-5 weeks, so can be reseeded after harvest, there can be multiple harvests per year.
- 7. Winter Squash Begin as seeds in the greenhouse in early June, planting 6 seeds in each well. Plant each squash 36 inches or 3 feet apart in the beds.

### Summer

### Continuously weed!

Weeds don't take days off! After the tarps come off of the fields, weeds will find their way to the fresh earth. Manual weeding is labor intensive, but the most ecologically friendly way to remove unwanted plants from the farm fields. During the

### Watering the fields

During the summer months when the temperatures reach the most extreme of the year, it is crucial to make sure that the plants have adequate water available to them. Making use of the chosen irrigation system, whether that is drip irrigation or a sprinkler system, is paramount.

### Summer/Fall

#### Harvest

- 1. Blueberries: Ripe when gray-blue all around; Gently, using your thumb, roll the berry off the stem and into your palm.
- 2. Marigolds: do not harvest; self-seeding so may grow back with a little bit of help and should probably plant some more annually. They are edible in a pinch, excellent for decor!
- 3. Kale (or collard greens): Healthy plants will have upwards of ten leaves, with small ones in the center and larger ones on the outside; can let them grow large or pick them when a bit smaller depending on your preference; gather new greens every 1-2 weeks once the leaves have grown back to the size of a hand.
- 4. Chives: Can be harvested as soon as the leaves are long enough to be of use. The flower isn't tasty, only the hollow stalk.
- 5. African chilis: Every chili is different, it is important to know the peak coloration and desired size for the particular variety of pepper that was planted, usually around 2-3 months after transplant to ripen.

- 6. Radishes: Usually ready after 3-5 weeks, the root (the radish itself) should be at least an inch in diameter.
- 7. Sweet Peas: Should be ready to harvest 3 weeks after the plant's flowers appear, when the pea pods are 3-4 inches long and almost cylindrical in shape. Although, every plant is different, taste as you go.
- 8. African squash or Acorn squash or pumpkin (winter squash): Harvest any winter squash when the outer rind is hard and deep in color, usually late September into October. Most winter squash can be stored in a cool, dark place until needed.

### Post-harvest, clean up the fields

As soon as the annuals (all but the blueberries in the upper field) have been harvested to their full potential, the leftover plant mass should be pulled out of the soil and composted, as the longer they are left in the soil after harvest, the more soil nutrients they will consume without producing harvestable produce.

### Winter

Before the first snowfall, it is important to trim back the perennials (blueberries). Proper pruning before the winter promotes healthy new growth the following spring. Prune dead branches, one-third of older branches, as well as any branches that have crossed from plant to plant, all the way to the ground, this will allow space and encourage new branches to grow.

### Lower Field

### **Sections**

- 1. Overview
- 2. Spring
- 3. Summer
- 4. Fall
- 5. Winter

### **Overview**

A short list of crops that are associated with healing, as well as provide economic and historical importance to the land were decided for the lower field. In this field in particular, these crops were mainly focused on their healing properties as well as their resilience in many cases. These crops were listed above with descriptions of each, however, this will include the timeliness of when to plant and how to take care of them.

The types of crops that should be used on the farm include:

- 1. Apple Trees
- 2. Plum Trees
- 3. Echinacea
- 4. Bee Balm
- 5. Chamomile
- 6. Chives
- 7. Sage
- 8. Lemon Balm
- 9. Comfrey
- 10. Peppermint
- 11. Rue
- 12. Basil

In the cases of both apple and plum tree species, it is important to put up small fencing to make sure that deer do not forage on these trees. If deer are allowed to forage on these trees, it could have devastating consequences on the plants on their long term growth and may even kill the trees. In both of these cases, it is important to get a higher growing species to ensure that they are not eaten by deer, however, if the fields are fenced in around their entirety, this could help prevent grazing onto these plants. This can happen throughout the year, but specifically in the Winter when there are not different types of plants that deer are able to consume.

### Spring

Most of the plants that the farm will need to plant are able to be and encouraged to be planted in the Spring. At the beginning of the Spring a few weeks before the final frost date, it is important to plant Basil within the greenhouse on the farm. Basil plants will grow best if they are germinated within the controlled environment of the greenhouse so that they can grow quickly and efficiently once they are transplanted into the field.

Other plants are able to be planted during the early Spring, well before the last frost date. These include apple trees, plum trees, bee balm, echinacea and plum trees. Echinacea is able to be planted later on in the fall as well. These plants are capable of surviving the harsher conditions of the early Spring, particularly with many of them being able to germinate with these conditions.

There are a few plants that cannot survive the harsh conditions of the early Spring and will need to be planted during the middle to late Spring, within the months of late April to early June. These plants include chives, comfrey, and mint. In particular, these plants will be able to survive some of the frost dates that occur during this time, however, they should not be planted when there are consistent cold temperatures.

On the other hand, there are a few of these plants that should not be planted until after the final frost date. In terms of the frost date, which changes every year, it is important to look at more recent approximations of these dates. In particular, this should be done within the last five or so years before planting them, as the frost dates have changed significantly year from year because of climate change. These plants include chamomile, lemon balm, peppermint, rue, and sage.

### Summer

In the Summer, all of the plants should be already within the garden. Many of these species of plants are unable to germinate when there are extreme temperatures outside, so it is important to have planted all of them well before these temperatures start to appear. In this case, it is important to adequately water each of the plants, however, be

sure not to water the tree species of plants a significant amount because both tree species have increased likelihood of getting diseases as the result of unnaturally moist soils.

On the other hand, it is important to try to still continue to water the plants, particularly on dry days where this could pose a danger for many of the herbs to die. Some of these plants will be able to survive without a significant amount of water, however in the long-term, they will soon die without it.

### Fall

Many of the plants included in our farm plan are perennial and will return every year, however, in some of their cases, they will need to be trimmed. Particularly, it is important to make sure plants like mint do not spread throughout this time.

Both the Apple trees and the Plum trees at this time will be bearing fruit, thus they will be able to provide food for the farm and a source of income for this time. It is important to make sure that any dead or broken branches near the base of each tree are pruned off, as this could make the tree grow in an improper manner. Making sure that there is an area that is four to five feet off the ground that has little to no branches is important to make sure that you do not have to fence in or protect these trees from deer in the long-term. This should only be done, however, once the tree is fully grown and able to bear fruit.

At the end of the Fall, it is important to trim some of the plants and remove the dead plant material from the farm's fields. In many of the plants that are chosen surrounding the trees, they will grow back the following year because they are perennial. These plants will need to be maintained by removing any of the dead material and leaves off of them throughout the season until the winter comes. This will help them grow back faster later, as well as improve the ability for drainage into the water.

### Winter

In the Winter, it is important to make sure that the plants, particularly the perennial plants are trimmed properly, as many of them are able to survive through the frozen and harsh season. These plants, if trimmed properly, are able to thrive every year. The non-perennial plants will have been removed in the fall, and their area will need to be planted again.

### Equipment

### Sections

1. General Equipment Needed

### **General Equipment Needed**

**Hand tools:** Garden hoes, razor hoes, shovels, garden forks, leaf rakes, garden rakes, hand trowels, loppers, cultivators, wheelbarrow, hose.

Power tools: String trimmer, chainsaw.

Field equipment: Trellising or stakes, metal hoops, row cover, drip irrigation system.

Harvest equipment: Serrated harvest knives, harvest crates or baskets.

# Part 5 Business Plan

Justin Mon Eleanor Zwart Alayna Kasuri Richie Santry Charlie Little Matt Paul

### **Business Plan Sections**

- 1. Executive Summary
- 2. Timeline
- 3. Industry Analysis
- 4. Customer Analysis
- 5. Marketing Plan
- 6. Operations Plan
- 7. Management Team
- 8. Financial Plan
- 9. Conclusion

### **Executive Summary**

Darnell Martin's farm is a recently purchased farm in Bridgewater, VT with a focus on agroecological techniques. The farm intends to serve as a model of sustainable food production that is designed to "heal the earth," respect traditional ecological knowledge, and most importantly, act as a safe and inspiring community for artists. Beginning with construction of a greenhouse, the farm strives primarily to create a safe and inspiring place for artists of color with opportunity for them to work and reconnect with the land. Additionally, it aims to rehabilitate and maintain a balanced natural ecosystem, create a space for urban youth, and act as a framework for additional projects that connect urban communities directly to natural and Organic food sources. The farm will also act as a business, cultivating healing plants from Africa, the Caribbean, South America, and native healing plants in both the greenhouse and farm fields. The greenhouse will also include passion fruit, bananas, lemons, oranges, heirloom seeds, collard greens, and general greens. The business will focus on selling locally in Bridgewater, VT with the potential to expand sales to New York City, where Darnell calls home. The farm is uniquely gualified to succeed due to its complementary focuses on agriculture, culture, and arts for people of color. Darnell's farm will garner support and lead to potential grant options through its diverse and many components. Darnell Martin's farm is seeking funding in various forms to open its farm. The capital will be used for funding capital expenditures and location build-out, hiring initial employees, marketing expenses, and working capital.

### **Suggested Timeline**

### 1. Begin construction on greenhouse

Estimated Cost: \$10,500 equipment + \$10,000 initial inventory + \$1000/month

Estimated Revenue: \$20,000/year

### 2. Apply for grants

Depending on the stage of the project and what grants are needed for, grant applications can be put in at any of the stages in our timeline.

Estimated Cost/Revenue: see grant options sheet for more details

## 3. Begin inviting artists and introduce them to the greenhouse and start flower project

Before taking this step, it will be important to figure out meal plans for guests. We would estimate around \$10/day/person in cooking supplies. However, this may be paid for by guests themselves. Once the fields are cultivated and harvested, meal plans can switch to center around food that is produced at the farm and will bring down these costs. There will also be a maximum capacity of about 5 at a time to stay in the house, which will change once additional housing is built.

### Estimated Cost: \$10/day/person

# 4. Begin marketing plan (put together brochure, social media platform to increase public awareness and interest) and approach avenues to sell/donate greenhouse produce

More details about our marketing plan can be found in Section V, however, it will be important to decide who will carry out this plan depending on the budget at the time. Options include Darnell, by an intern/student volunteer, or by external marketing consultants.

Estimated Cost: \$0-\$2000

Estimated Revenue: will boost produce revenue

5. Apply for farming grants/loans to construct additional housing

Estimated Revenue: depends on grant

### 6. Construct additional housing

Building new housing will be important when Darnell would like to open up the healing space up to more guests. Yurts are the most cost effective option if shared by more guests, so this could be a good option for the basketball camp. Yurts, however, do not include bathrooms so constructing those will be an additional cost. An outhouse is the most cost effective bathroom option.

Estimated Costs:

1 Bed Yurt: \$8000

8 Bed Yurt: \$15,000

16 Bed Yurt: \$20,000

Outhouse: \$2000

### 7. Renovate barn as a performance space

Estimated Cost: \$500,000

### 8. Hire farm manager

Though hiring a farm manager is a high cost, our research has shown us that having at least one full-time manager to commence production and commerce of farm goods.

Estimated Cost: \$50,000-\$60,000/year

### 9. Begin farming operation

More details on this step can be found in the farm fields report and operations plan. This will be a time, labor and capital intensive endeavor. However, the revenue as well as the emotional reward will be very high.

Estimated Cost: Estimated Revenue:

10. Find WOOFers and interns who can live in the constructed housing

11. Explore other revenue streams (livestock, bees, maple syrup)

### **Industry Analysis**

### Industry Overview

Trends for organic agriculture and organic foods are overwhelmingly positive. During the last few years, in an unprecedented era with far reaching consequences for human, environmental, and economic health, consumers have chosen organic options with even greater frequency. As a result, annual organic sales have been pushed to nearly \$62 billion with a growth rate of more than 12%. For comparison, the total United States market for food and non-food products grew at less than half that rate, 4.9%, in 2020 (U.S.). The market is estimated to reach \$380.84 billion in 2025 at a compounded annual growth rate (CAGR) of 14.5% (Industry).

Much of this gain has been attributed to an increase in the organic foods market, specifically. As the pandemic raised new questions and concerns for personal health and remade daily life to accommodate those working, cooking, and eating at home, organic food sales eclipsed major milestones. Overall, organic food sales surpassed \$56 billion at an increase rate of 12.8% - the highest rate recorded in the organics industry in well over a decade (U.S.). In 2020, nearly 6% of the food sold in the United States was certified organic. The following quotes lend insight into some of the reasons why:

"Increased eating at home, along with concerns about personal health contributed to shoppers being willing to invest in organic and to try new products. The healthy implications associated with organic foods and products made this category more important than ever during a global pandemic, as people looked for ways to find overall wellness".

"We've seen a great many changes during the pandemic, and some of them are here to stay. What's come out of COVID is a renewed awareness of the importance of maintaining our health, and the important role of nutritious food. For more and more consumers, that means organic. We'll be eating in restaurants again, but many of us will also be eating and cooking more at home. We'll see more organic everywhere – in the stores and on our plates".

"The pandemic caused abrupt changes in all of our lives. We've been eating at home with our families, and often cooking three meals a day. Good, healthy food has never been more important, and consumers have increasingly sought out the Organic label. Organic purchases have skyrocketed as shoppers choose high-quality organic to feed and nourish their families."

(Laura Batcha, CEO and Executive Director of the Organic Trade Association (U.S.).)

### **Food Access**

Despite the positive trends across the broader organic food movement, accessibility of healthy produce is not distributed equally. While the prevalence of organics has increased, the demand for and production of fresh produce has not grown uniformly across communities. There is not equitable access to organic food options, and areas of food deserts are prevalent particularly in urban communities.

One of the main goals of Darnell's Farm is to spread the wealth of fresh produce equitably and encourage experiential learning and community revitalization through greenhouse gardening. By introducing organic greenhouse farming into urban communities, Darnell can increase access to healthy food while simultaneously working to stimulate the economic and social health of these communities.

### **Consumers Stocking the Kitchen with Organics**

On the forefront of growth in the organic foods sector was a consumer-driven desire for fresh produce. Sales in fresh organic produce rose by nearly 11% in 2020 to a point of \$18.2 billion. Canned and frozen vegetables and fruits also experienced an increase as their sales rose by more than 28%. Overall, more than 15% of the fruits and vegetables sold in this country are now labeled as organic. The overwhelming main driver of this growth was pantry stocking as bread making and cooking baking markets exploded, causing the sales of organic flours and baked goods to grow by 30%. Furthermore, consumers looked to organic "meal support" products to help them in the kitchen. With this, organic sauce and spice sales rose by 51%, which was more than triple the growth rate of the 1.5% that was experienced in 2019. Additionally, the smallest organics category - meat, poultry, and fish - rose to a market value of \$1.7 billion. This occurred as this category experienced the second highest growth rate of 25% (U.S.). The top 10 organic product categories are shown below (Industry).



### **Constraints in Supply**

"The only thing that constrained growth in the organic food sector was supply," said Angela Jagiello, Director of Education & Insights for the Organic Trade Association. "Across all the organic categories, growth was limited by supply, causing producers, distributors, retailers and brands to wonder where numbers would have peaked if supply could have been met!" (U.S.).

Jagiello also notes that supply chain issues may pose problems for organic distributors. This occurs as packaging - including pouches, bottle lids, cardboard, and bottles - were in short supply as were the drivers and workers needed to transport organic products. This made it difficult to ramp up the processing and distribution activities necessary to sustain an increase in demand.

### The "New Normal"

While the pandemic presented a unique opportunity for unprecedented growth in the organic foods sector, it is expected that this upwards trend is here to stay. It is anticipated that the organic industry will experience an "afterglow effect" from the pandemic as many consumers continue to cook and eat at home.

### **Customer Analysis**

### Demographic and Target Audience

Darnell's farm will primarily serve a community of visiting filmmakers and artists of color. This community needs a sanctuary to escape the public eye in order to create. Although we aim to maintain sustainable revenue streams, Darnell's Farm is not mass-profit oriented. We are not seeking a wealthy customer base and will not compromise the mission of the farm in order to bring in greater profit. Urban Communities are a primary focus, as the farm wants to promote the importance of organic farming to urban communities, with an emphasis on urban youth.

### **Customer Segmentation**

The farm will primarily target the following customer segments:

*Artists of Color:* Darnell's Farm will act primarily as a spiritual retreat for visiting creatives as a safe space to reside, volunteer labor hours, and take time to develop their creative visions.

*Urban Communities:* Darnell's Farm will provide opportunities for urban communities, with particular focus on youth living in the inner city. The aim is to provide them the opportunity to travel to the farm and gain first-hand experience working with and living among the farm. Programs geared towards this user group include basketball retreats and creative workshops.

*Local Community Members:* Residents of Bridgewater and surrounding Vermont communities will benefit from Darnell's Farm as a source of fresh produce and specialty goods, and as an education site.

### **Marketing Plan**

### Social Media

Through social media platforms like Instagram and Facebook, Darnell's Farm should emphasize the story behind the farm and the individuals there. With attention-grabbing visuals, consistent content, and engaging stories, social media outreach can increase awareness and provide financial support from around the world, even beyond the farm's range of physical product distribution.

### In-Person Experiential Advertising

In-person interaction is often the most effective means of advertisement, so we recommend that Darnell utilize this form of self-promotion to raise awareness of the farm and her broader mission. Through three avenues, Darnell can use community engagement and interpersonal interaction to spread awareness for her farm.

- Farmer's Markets in Vermont
  - On a local scale, Darnell should plan to attend farmers' markets to sell her produce and introduce herself to local community members. Doing so would help to spread word about her farm and garner a customer base for a potential CSA program. By engaging with community members in the Upper Valley, Darnell will put a face to her name and increase public awareness.
- Farmer's Markets in New York
  - Beyond the scope of rural Vermont, Darnell can target farmers' markets in her home city of New York. Due to the logistics of transporting fresh produce, she will have a smaller volume of sellable produce at these markets and will have to pay higher transportation costs, but can use the opportunity to increase interest about the farm and her other business operations like farmers of color coop. Prices in New York are also higher, so better profit margins can be achieved.
- Storefronts: VT & NY
  - In both Vermont and New York, Darnell can target boutique specialty shops as vendors through which to sell her goods. Particularly at shops located in neighborhoods of higher socio-economic status, she can market her goods (honey, syrup, artists' creations), as "fresh," "natural," "organic," and "small

scale" and sell them at a higher price point than at farmers' markets and in less wealthy neighborhoods.

### Branding

Darnell's farm will be branded as a retreat for BIPOC artists and as a model of sustainable farming for BIPOC farmers. The farm will host community engagement events as well as workshops for people in the Upper Valley and individuals from cities to better understand the importance of organic farming.

### **Rewards & Loyalty Program**

If Darnell chooses to pursue a CSA program, she can offer a bulk discount deal for signing up for multiple years at a time. For example, if a customer decides to sign up for 2 seasons of the CSA (i.e. 2 years), she can offer a discount of 10% for both years. This will help retain customers, attract customers to sign up and provide the upfront capital that Darnell might need to start the farming operation.

It is also possible to do a similar program for the products of the greenhouse. Customers can sign up to receive two or more shipments of the produce native to Africa and receive a discount. This may help to provide capital for the geothermal system and greenhouse itself.

Lastly, another rewards system that may work for the goals of Darnell's farm is to host an event for all of her customers to learn about the cultural significance of the greenhouse and the missions of the farm. Not only could this be a learning opportunity, but a way to attract customers by having an on-site educational event. Darnell may also choose to allow people to pick their own produce as a hands-on learning experience.
## **Operations Plan**

Our timeline, which can be found at the start of this report, outlines the order in which operations at the farm will take place. Making the decision about when to commence each of these steps will depend on a combination of factors including financial resources, disposable time, and interest in expanding the farm's capacity.

#### **Getting Started**

The first major step is to begin construction on the greenhouse and carry out the plan developed for the greenhouse. The detailed guide to both construction and operations includes guidance on layout, climate control, irrigation, lighting, equipment and harvesting. See the greenhouse plan for more detailed information.

#### Farm Labor

Artists will come to the farm and will serve as the first set of laborers in the greenhouse, and eventually in the farm fields. However, it may become necessary to bring on additional labor to ensure that these projects are being monitored in a sustainable way.

Various models exist for laborers on farms of this size. Farm workers can consist of interns, local volunteers and WWOOFers. WWOOFers, or individuals who work on farms in exchange for lodging and food, can be found through various online platforms and are an economical form of labor which can help minimize costs. It is important to set a minimum stay for all short term laborers to ensure that there is a return on the time invested in training them at the beginning of their stay. Additionally, we would suggest bringing short term laborers to the farm in cohorts so that each cohort can have one designated training period. Given Darnell's stated goals and principles, we recommend these array of workers because they will be consuming the produce as a way to connect the farm workers to the land.

Especially once Darnell is ready to begin cultivating the field, we stress the need of hiring a full-time farm manager based on suggestions received during our interviews with other local, small-scale farmers. They recommend that hiring a full-time farm manager is critical for running the setup of a farm and its day-to-day operations which are detailed in the farming guide section of this report. This farm manager will be responsible for scheduling and assigning work to the farmhands, sourcing supplies, keeping track of the farm's books, organizing outreach and issuing progress updates to Darnell. Farmhands will be responsible for carrying out the farm manager's plans, including cooking meals for volunteers and guests, preparing fields for planting, harvesting produce, packaging legumes, tending to the greenhouse and feeding the rescued livestock. These tasks should be designated by the farm manager, but it will be important to keep track of the training and expertise of the farmhands when designating these tasks. In addition, farmhands can help carry out workshops and manage children's camps when they are taking place. For this, additional training may be required, especially if farmhands are responsible for children, to ensure a safe and inclusive space for all workshop and camp participants. Darnell and the farm manager may also choose to seek out labor with specific experience to organize and facilitate such specific programs.

To prepare the farmland to be cultivated and to further carry out operations, we will need important equipment. It will be necessary for the farm manager to understand how to operate all of this equipment.

#### Selling Produce

Once the farm begins to yield enough produce to harvest for consumption, the surplus produce can be sold. Some decisions to be made at this stage include the type and design of packaging, pricing and where to sell. We suggest simple, eco-friendly packaging that highlights the mission of the farm by incorporating themes of heritage, connection and art. It would be ideal if a visiting artist could design the product packaging during their stay.

See our above marketing plan for more information on how to begin marketing the farm and its produce. Once there is awareness about the farm, different selling avenues can be explored and items can be sold.

#### **Building a Community**

At the center of operations, as well as at the center of Darnell's farm, is the community that it creates. Within the framework of the day-to-day operations of a greenhouse and farm, the community events menu provides a detailed description of how to involve the local community, as well as how to build a community of people from outside of Vermont. This includes farm workdays, BIPOC farming workshops, and artist workshops and retreats.

### **Management Team**

The management style of the farm will greatly depend on our client, Darnell Martin, and how involved she wants to be in the day-to-day operations. She may choose to be in charge of overseeing the overall direction of the farm and how each segment comes together, or she may choose to hire a manager to do so on her behalf. Either way, we have identified the need for a few different roles that will manage four segments of the daily operations: the greenhouse, the farm fields, the farm systems and the farmers of color coop.

Long-term, we are recommending 2 to 4 full-time employees given the acreage and the amount of work that is needed to maintain the land. These full-time employees will have the titles, "Greenhouse Manager", "Farm Fields Manager" and a manager of the technical aspects of the engineered geothermal system. These managers will be responsible for their own sector of the farm and will have part-time employees working for them. They can be in charge of setting the hours of their assistants and managing long-term projects like planting new crops, handling harvest seasons and general maintenance and upgrades. They will report to Darnell or the farm manager, who will synthesize the work of these full-time employees.

Underneath the managers, we are recommending 3 to 5 seasonal interns. Being close to Dartmouth's campus, we suggest that Darnell post job listings on the Dartmouth Center for Professional Development website, the Dartmouth Employment Office, and send postings through the Environmental Studies department to source labor. She may also choose to post in local community centers, churches, and public forum websites like the town's Facebook page. Moreso for hiring Dartmouth students, we recommend she post at least "one term" in advance, meaning that she posts job offerings 3 months ahead of her desired start date. This is because students tend to find job opportunities ahead of their quarters away from school (or "off-terms") so they can plan their next move accordingly. Like we mentioned earlier, the farm also presents an opportunity for live-in WWOOFers who can work in seasons of high work demand like planting or harvest season.

## **Financial Plan**

This section includes estimates for costs and revenue for each of our proposed revenue streams. These include maple syrup production, beehives, chickens and eggs, field farms for agriculture, and the greenhouse. Keep in mind that these are estimates based on other nearby farms producing the same products and include expected costs. Other possible avenues for capital include grants, which will be included in a separate document and crowdfunding, which is common for other farms in both New Hampshire and Vermont.

| Greenhouse        |          |              |          |
|-------------------|----------|--------------|----------|
| Costs             |          | Fixed Costs  | \$20,500 |
| Equipment         | \$10,500 | Annual Costs | \$12,000 |
| Initial Inventory | \$10,000 | Break even:  | 2 years  |
| Monthly Upkeep    | \$1,000  |              |          |
| Revenue           | \$20,000 |              |          |

| Field Crops    |         | Fixed Costs  | \$21,340 |
|----------------|---------|--------------|----------|
| Costs          |         | Annual Costs | \$0      |
| 10 Apple trees | \$8,520 | Break even:  | 3 years  |
| 10 Plum tree   | \$8,520 |              |          |
| Equipment      | \$4,300 |              |          |
| Revenue        |         |              |          |
| 10 Apple Trees | \$1,950 |              |          |
| 10 Plum Trees  | \$6,900 |              |          |
| Revenue        | \$8,850 |              |          |

| Chicken / Eggs    |         | Fixed Costs  | \$571  |
|-------------------|---------|--------------|--------|
| Costs             |         | Annual Costs | \$950  |
| Соор              | \$500   | Break even:  | 1 year |
| Lamps             | \$50    |              |        |
| Waterer           | \$6     |              |        |
| Feeder            | \$15    |              |        |
| Bird Costs for 25 | \$950   |              |        |
| Revenue           | \$2,600 |              |        |
| Profit            | \$1,079 |              |        |

| Maple Syrup          |         | Fixed Costs  | \$13,800  |
|----------------------|---------|--------------|-----------|
| Costs                |         | Annual Costs | \$1,075   |
| Sugar Shack          | \$5,000 | Break even:  | 7-8 years |
| Arch + Finishing Pan | \$5,000 |              |           |
| Taps / Buckets       | \$3,800 |              |           |
| Labor                | \$800   |              |           |
| Packaging            | \$275   |              |           |
| Revenue              | \$2,800 |              |           |

| Bees           |       | Fixed Costs  | \$600  |
|----------------|-------|--------------|--------|
| Costs          |       | Annual Costs | \$0    |
| Beehive        | \$200 | Break even:  | 1 year |
| Smoker         | \$40  |              |        |
| Gear           | \$160 |              |        |
| Nucleus Colony | \$200 |              |        |
| Revenue        | \$600 |              |        |

The figure below breaks down the possible revenue streams into the percentage that they contribute to the total upfront costs for starting this farm. Again, these costs are not all encompassing and require assumptions; however, this chart should offer an estimate of the impact each revenue stream will have on start-up costs. This is intended to provide an understanding of the costs of these options in relation to one another.



Breakdown of Upfront Costs

# Glossary

**Agroecology:** Applying ecological sciences and their principles to agricultural systems with emphasis on biodiversity, plant-soil health, biological control systems, and socially equitable food networks. Agroecology movements across the world push agroecology practices forward as the means of establishing just, equitable, and sustainable food and agriculture systems.

**Allelopathy:** Plants that release chemicals into the soil that have effects on other plants and or the soil, particularly for the purposes of germination or other plant growth inhibition.

**Companion plants:** Plants that when grown together, have a positive effect on each other and each other's growth; these plants can also provide a form of protection against pest plants or pest organisms.

**Crop rotation:** The practice of planting different types of plants each growing season on the same plot of land to enhance or change the soil chemistry, while also helping maintain the long-term ecological balance of the soil.

**Industrial agriculture:** Typically involving large-scale agricultural production and an intensive and economically efficient farm that has adverse environmental and moral impacts on the land and individuals involved. This often includes the use of man-made fertilizers, herbicides, and pesticides, as well as typically using genetically modified organisms on the farm.

**Intercropping:** Planting two or more crops adjacent or near one another that can have both positive and negative effects on the farm depending on the species involved.

**Monoculture:** The use of a single or small number of species of plants or animals on a single farm or farm field. This is often repeated from season to season which can have negative effects on the soil and the biodiversity of the region, as well as put the farm at a risk of disease or increased pest species.

**Organic agriculture:** Farms that use fertilizers, pesticides, and herbicides of organic origin, particularly making sure to not use man-made materials that have been produced within factories or labs.

**Plant diversity:** Also known as crop diversity, is the act of planting different types of plants or species on the same farm or plot of land.

**Pollination:** The act of transferring pollen from a male plant to a female plant's stigma, typically done through pollinators attaching themselves or interacting with a plant and moving to another plant.

**Polyculture:** The use of multiple types of species of plants on a farm and changing them throughout each growing season to ensure higher quality soil as well as prevent increased pestilence on a farm as the result of producing a single type of plant.

**Regenerative agriculture:** Agricultural practices that have the goal of maintaining or improving biodiversity on a farm, particularly through improving the farm's soil quality, water quality, and increasing the resistance that the farm has to climate change. This commonly leads to leaving an area or plot of land with higher biodiversity than was previously found in the area or plot of land before.

Tillage: Turning soil over to control weed species and to help prepare seeding.

**Riparian Buffer:** Row of plants bordering a body of water that protects the body of water from runoff.

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