

Design Management

Design pulls together all the understanding, mapping and planning. It brings together your goals, business model and available resources. Design should ask the critical questions of what you need from an operation, a tool, a building, in order to draft solutions that do more, better with less. Design should seek to improve time/space/energy efficiency. Design helps avoid costly mistakes by bringing elements together conceptually thus revealing benefits and

hindrances prior to implementing them. In this way we can integrate elements to improve benefits and reduce blockages.

Designing for Whole Systems means we are not isolating anything in our farm design process, but rather designing each as part of the whole. Our garden systems are not isolated from the tools we use in them, nor the farm's building, access roads, ourselves, community and land.



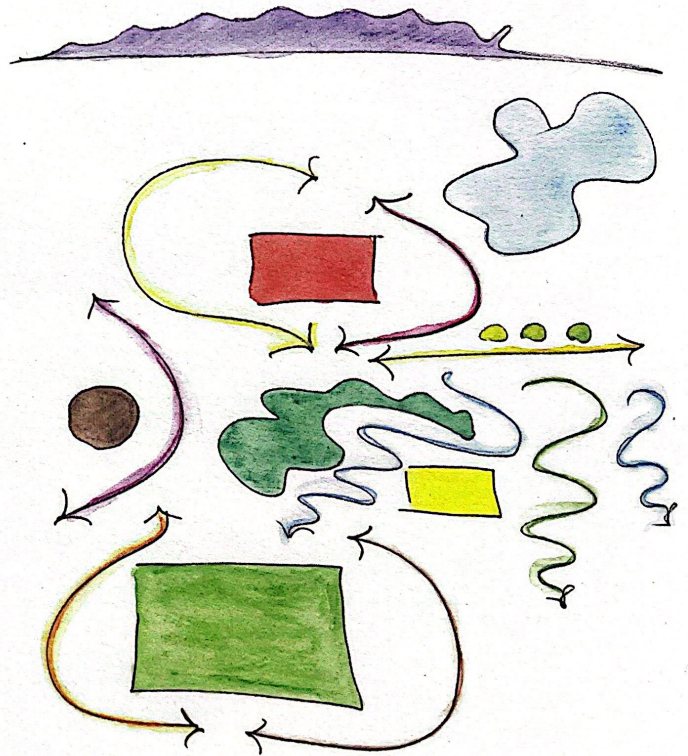
DESIGN TIP

Elements of Design

The patterns in nature can inform design. The following elements of design are easily recognizable in nature. They help us conceptualize our goals and visualize design on paper.

- Flow
- Movement
- Nodes
- Opportunity
- Functions
- Size
- Line
- Color
- Shape
- Value
- Space
- Texture
- Hierarchy/leadership and support
- Time
- Scale
- Space
- Contact
- Interaction
- Direction
- Typography
- Dominance/emphasis
- Balance
- Harmony
- Contrast/similarity

Visualize the Elements of Design

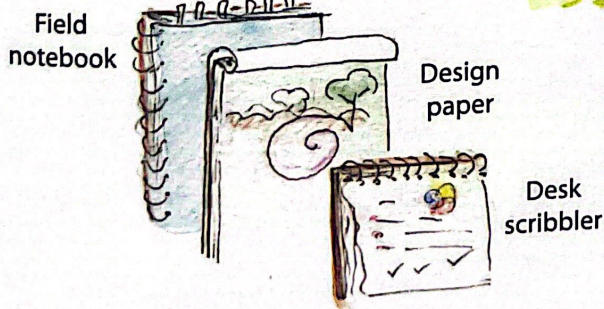
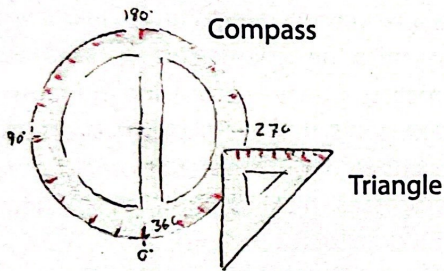
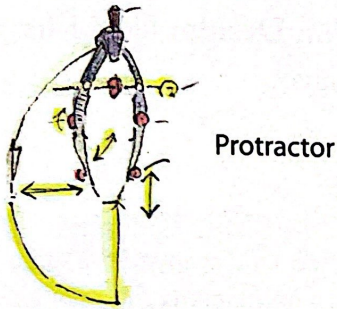
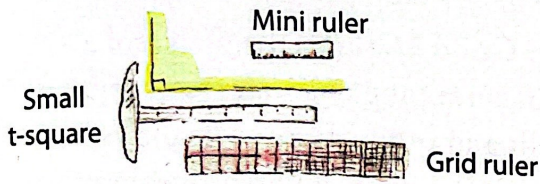


Traditional agriculture was labour intensive, industrial agriculture is energy intensive, and permaculture-designed systems are information and design intensive.

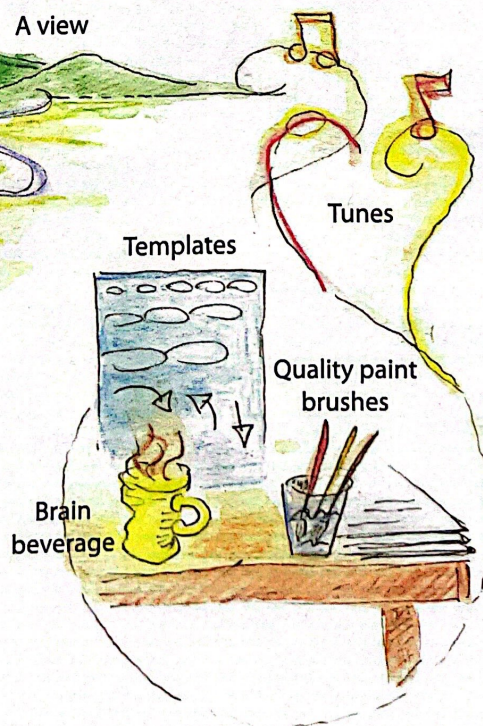
— David Holmgren

DESIGN PROCESS: TECHNIQUES AND TOOLS

My Design Tools



- **Observation:** Seasonal observation of the project
- **Brainstorm:** Good precise design stems from initial free-flowing thoughts
- **Research:** Can provide needed details to improve design
- **Comparison:** To designs from other farms under similar constraints can freshen ideas
- **Technique:** Can give consistency and quality to your designs, making them more likely to be useful
- **Tools:** Help you design more easily and precisely
- **Templates:** I generate templates to improve quality and consistency of designs.
- **Time:** Is needed to go through several drafts of a design to make improvements.



Types of Design

- **Spatial Design:** Relative layout of infrastructure, fields, flows, paths, water movement, irrigation, the big picture's form, function and connectivity.

What is design? It takes many forms, whether in mind, page or laptop, in order to show us how something is made, functions or exists.

- **Specific System Design:** The ice-making system in our root cellar or the seasonal cycle of any crop production system.
- **Crop Guild Design:** The design of a specific grouping of species for common benefit and production: crop analysis, selection, assembly and management.
- **Organization Design:** Field Kits, storage walls, field layout.

You can tell a designer's favorite colors by his pencils stubs.



Writing this book required many of the same design elements used on a permaculture market garden.

I used a production system with a clear design process, organization scheme and spatial layout.

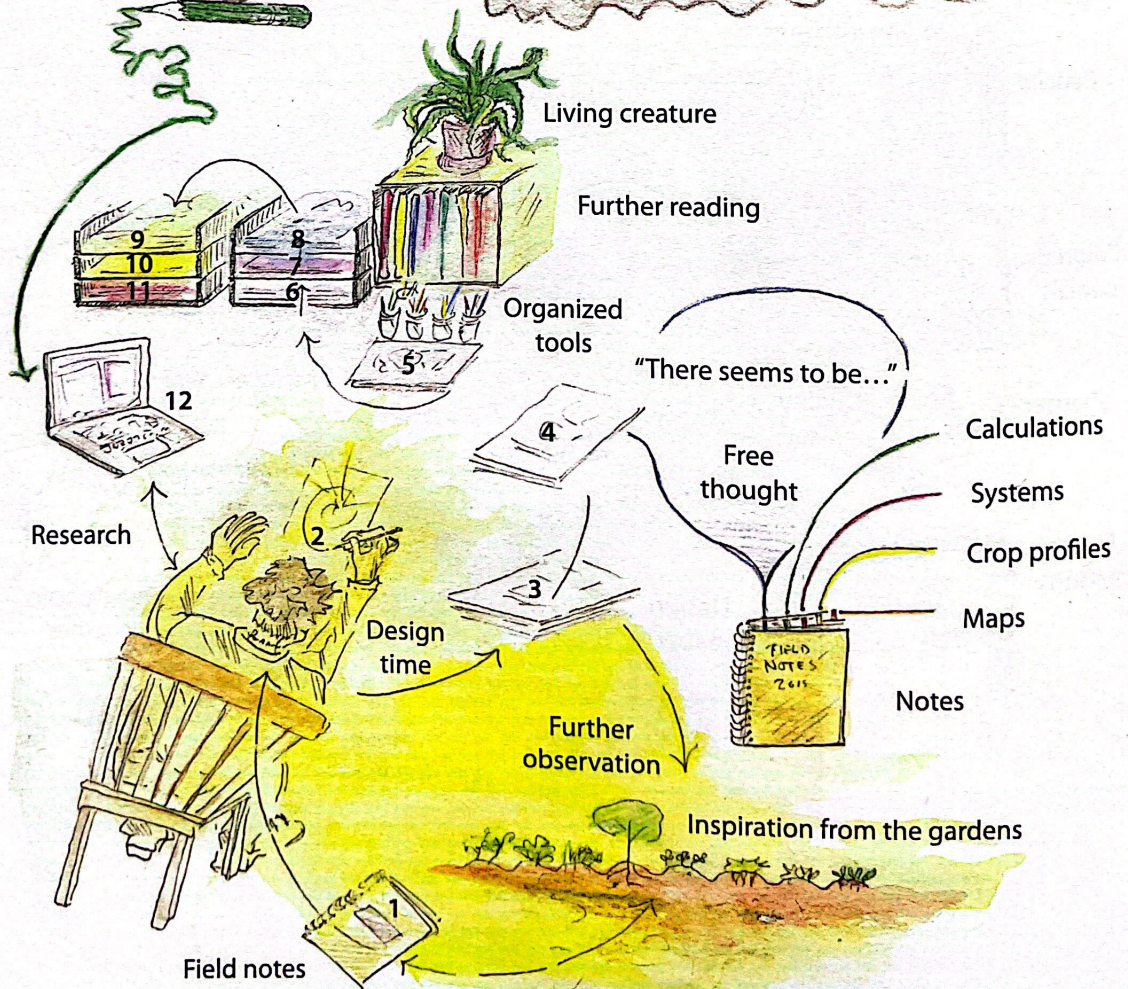
Book process: Observe nature and our farm systems, take notes, make preliminary sketches, review designs & conduct research, draft illustration, pencil in processes, ink illustration, finalize details, colors, input details into computer.

My Design Process

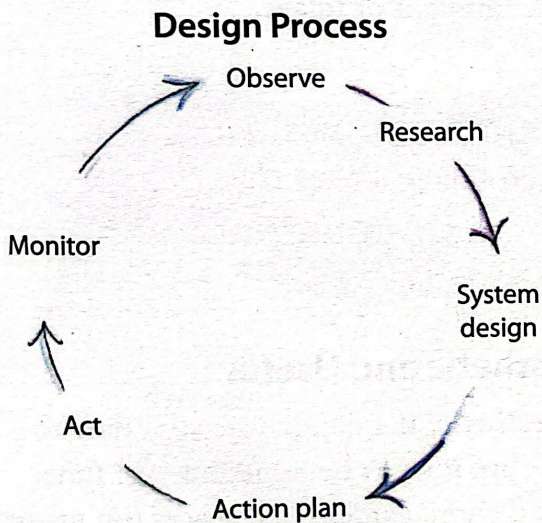
1. Field notes
2. Preliminary design sketching
3. Design template selection
4. Design drafted in pencil
5. Design inking

Storage for:

6. Design templates
7. Drafted designs
8. Inked designs
9. Colored designs
10. Finished designs
11. Scanned designs
12. Design jpg and pdfs, input data into designs

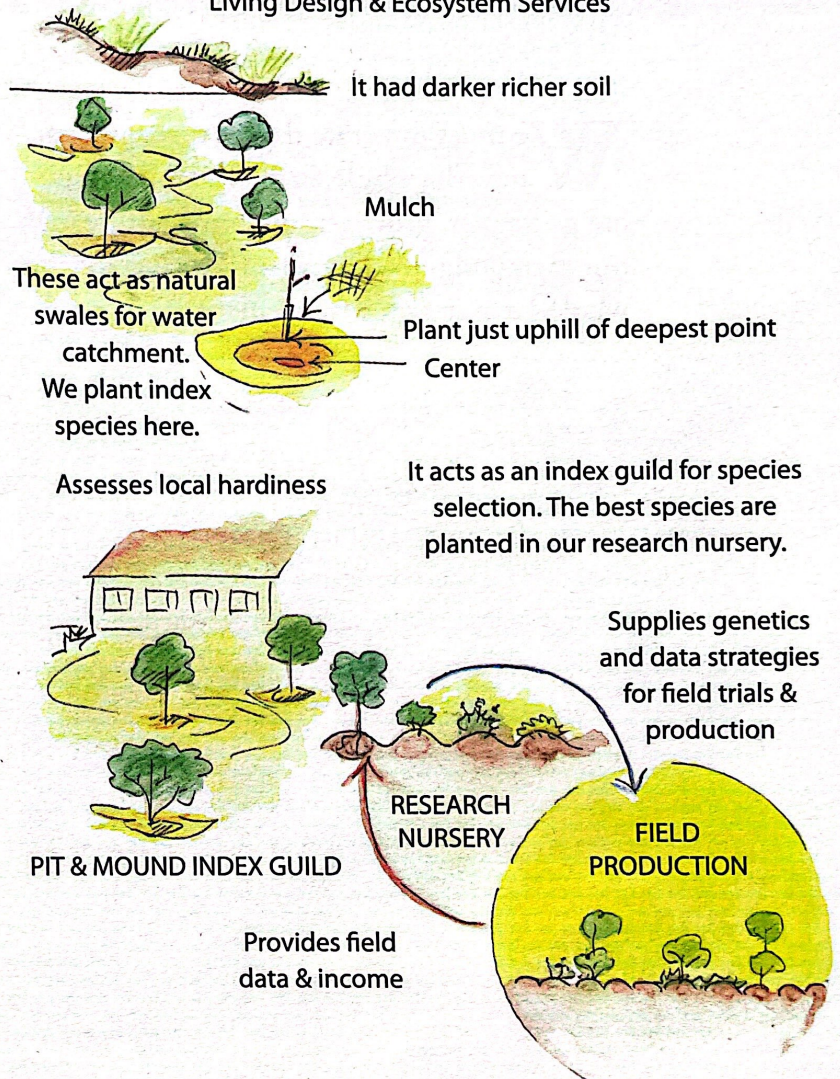


- **Management Design:** Designing how something is directed. Record-keeping systems that inform crop planning produce crop schedules.
- Check out Daniel Brisebois and Fred Theriault's book *Crop Planning for Organic Vegetable Growers*
- **Thought Design:** Designing ways of thinking about farming. For example, creating an "agro-ecological mind set"- considering natural system functions and services when confronted with an obstacle.
- **Design of Design:** We can design for better design. This is part of design management; it is the express management of the design process for consistency, quality and continued evolution for improvement.



Pit & Mound Index Guild

Living Design & Ecosystem Services



We observed the pit and mound terrain: grass grew taller/greener, soil was darker and water collected in the natural depressions. We made use of this by planting fruit trees here. Since this is in zone 1 we developed our Perennial Index Guild here, a planting that helps us test hardiness, grow propagation material and monitor fruit tree cycles of future orchard planted from the chosen successful species.

GREEN THUMB TECHNIQUE

Asking "Why?" 7 times

Asking "Why?" can reveal design solutions. For example: "I want to design a better barn space"
 "Why?" "Because, I want make it easy to find tools."
 "Why?" "Because we have many tools that are

needed." "Why?" "Because every day we do many different jobs." "Why?" "Why?" "Why?" This resulted in designing field tool kits that assemble needed tools and supplies for routine jobs. "Why?"

Principles for Design Management

We must integrate design management into the whole farm. The following are principles, grown from permaculture and our own design management process, for the whole-farm design management.

Rule of Three

Douglas Adams says the meaning of life is 42, I say it's 3

- Three is the first number where there can be complex relationships. It is a balanced unifying number in all our design (DMZs, TRIADS, CROP GUILDS, see Glossary).
- When you give yourself design constraints, it simplifies the design process. The rule of three has greatly enhanced our design management of the farm.
- The number three is quite popular in society and nature. The formula for a good story: beginning, middle and end; the three primary colors: red, blue and yellow; and the natural states of water: liquid, solid and vapor.
- We also use multiples of three — 6, 9, 12 — in our designs.

Use the Full Color Spectrum

- We use the full spectrum of colors to our advantage. For example, an array of colored duct tape helps us differentiate between the field kits we have assembled for all routine jobs. We also use the colored tape for To Do stakes that help us prioritize irrigation movement (blue), seeding and planting (green) and bed preparation (red).

Redundant and Regenerative

- **Redundant:** Design for redundancy to minimize system failure. We have many ways of maintaining important crop needs: soil moisture is obtained through rain, pond pump and gravity irrigation, but we also mulch, improve soil organic matter, and reduce wind evaporation with cover crop intercropping. It's NASA for Farmers.
- **Regenerative:** A healthy soil with balanced organic matter, minerals, air and water pores, biological life and aggregated structure can cycle nutrients quickly for improved production after a disturbance like drought or tillage.

*The more important the function,
the more redundancy is imperative.*

Aesthetic and Useful

- **Aesthetic:** If a design isn't appealing to the eye it won't be respected over time. Structures, gardens and spaces (no matter the budget) can be designed to be appealing and so will be respected by those who pass through a farm and those who become the successors to your efforts.
- **Useful:** A hedgerow between fields may be removed by future farmers. But if it has high-value timber and tasty pears or is a well-tended sugar maple lane for syrup, it will pass the test of time.

Integration

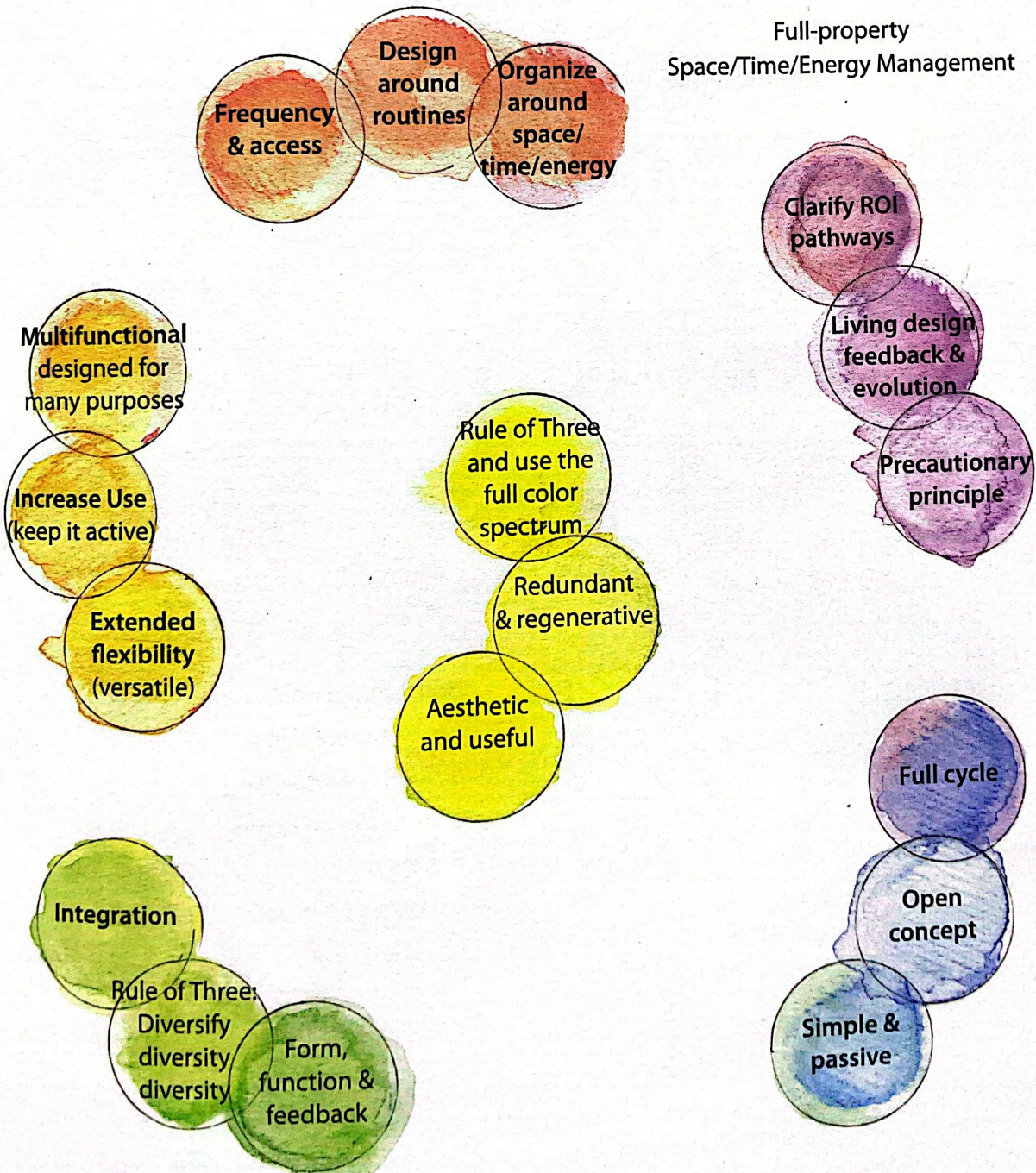
• When we integrate farm production, it means there is potential symbiosis created between cash crops, cover crops, animals and trees for improved agro-ecology.

REMEMBER: Enterprises can be integrated to share resources, cycle outputs/inputs and inform decisions. We call this guild enterprise production. DMZs are a way of organizing space for integration across the farm.

Integrating Flows Between DMZs

- We should design to integrate flows between DMZ.
- Inputs, output and waste integration: waste becomes an input to increase output.
- For instance, our wash station becomes a collection point for water because it is integrated with a pond to catch and use the water.

Whole Farm Design Management



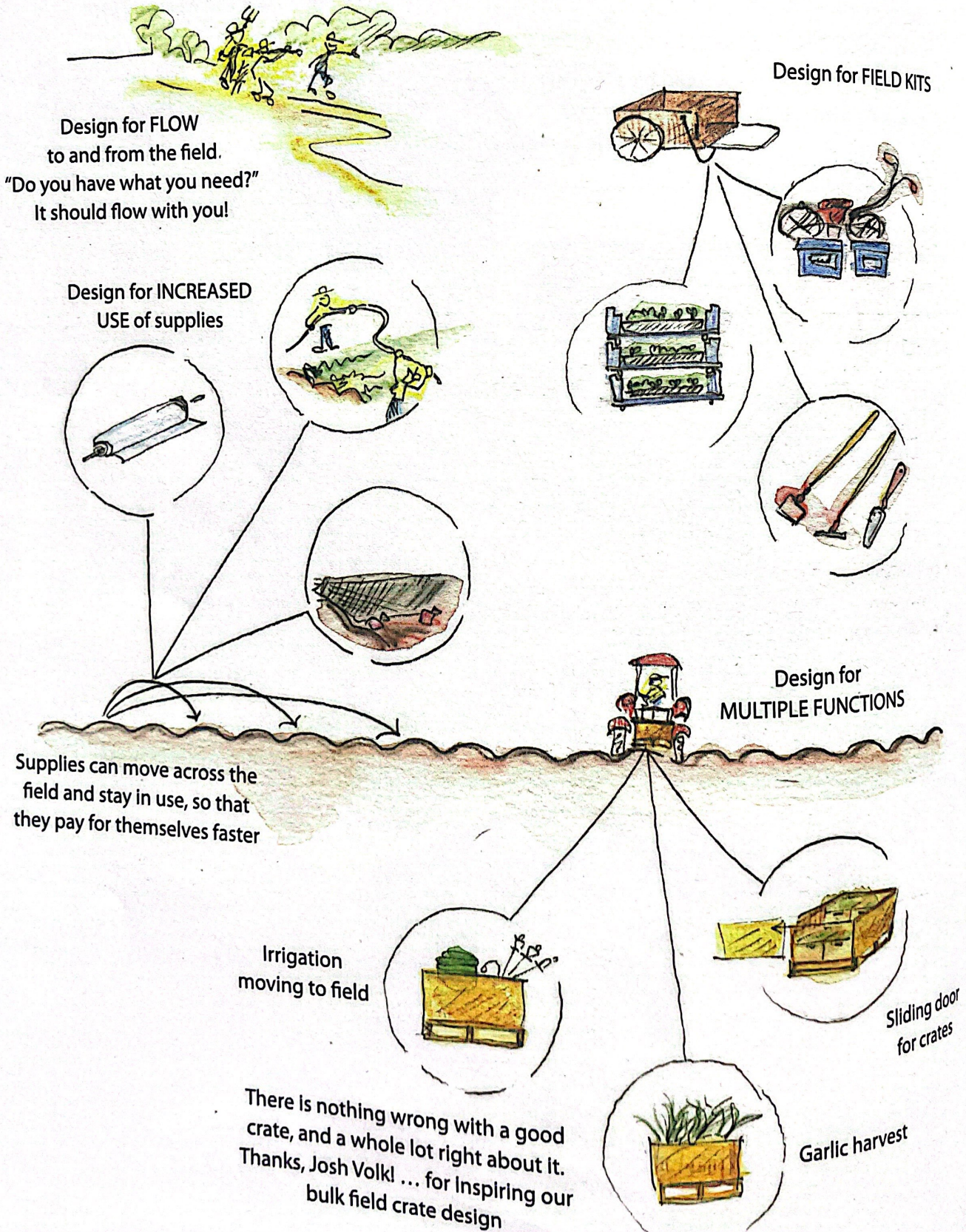
Increase Use

- Plan for a tool or service to be in more constant use. Many tools or infrastructure remain unused for months at a time, like summer production buildings. Our

wash station serves as a space for transplants in spring, vegetable processing in summer and ice-making in winter.

- Some supplies may be unused for periods of time. We move weed barriers and row

What to Design for...



cover across the field over the season, never rolling it up and storing it. If you are rolling row cover up in the middle of summer, you haven't maximized its seasonal use.

Extended Flexibility

Design for unknown uses and future possibilities.

- Make the design fit the space.
 - We designed our root cellar packing table so it could be turned in our packing bays. This way it could be used up against a wall (its intended placement) or turned to run parallel to our main runway. Many years later we found this was a good idea because now we turn it for on-farm community events and use it as a sales counter.

Bagging Station

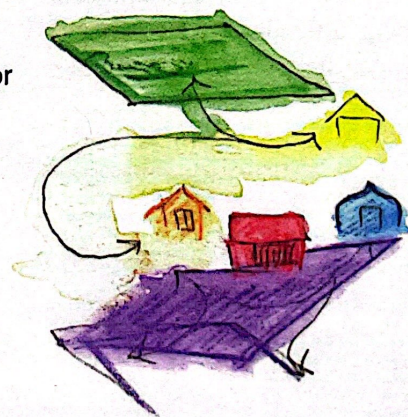


- Keep the design general but useful.
 - Our packing table has many special features; there are boards that can be removed so we can conveniently drop spoiled or C grade root vegetables into crates below. However, it would be easy to cut and screw two 2x6 boards to fill in those spaces. This set up is extremely specialized, allowing us to do a very specific sorting job and yet it remains very simple to return the table to a general state and be repurposed.

Frequency and Access

- Design for improved access. For instance, low-growing or early harvested crops beside larger perennial crops to improve access for perennial harvest. Early crop beds are already harvested and become accessible beds later.
- Design around frequency. Permaculture zones for the property and garden are good examples. We should assign productions or projects that require frequent visitation in zones where personnel already visit frequently.

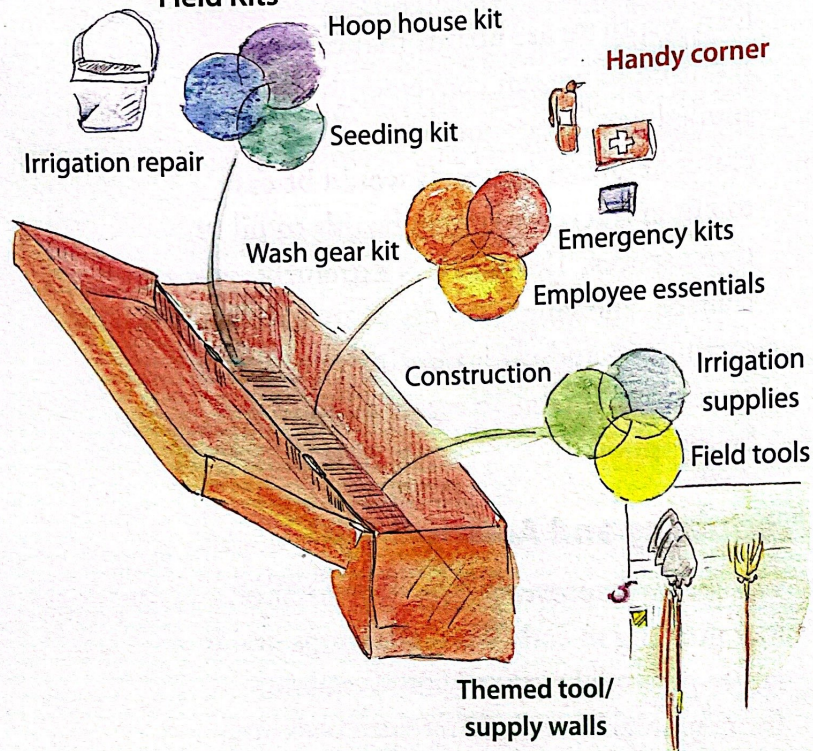
Lay out your farm for frequency and accessibility



Permaculture zones divide up property space according to how often different areas are frequented, and operations are assigned to zones based on how often attention is needed (daily, weekly, monthly, etc).

Kit Organization for Efficient Management

Field Kits

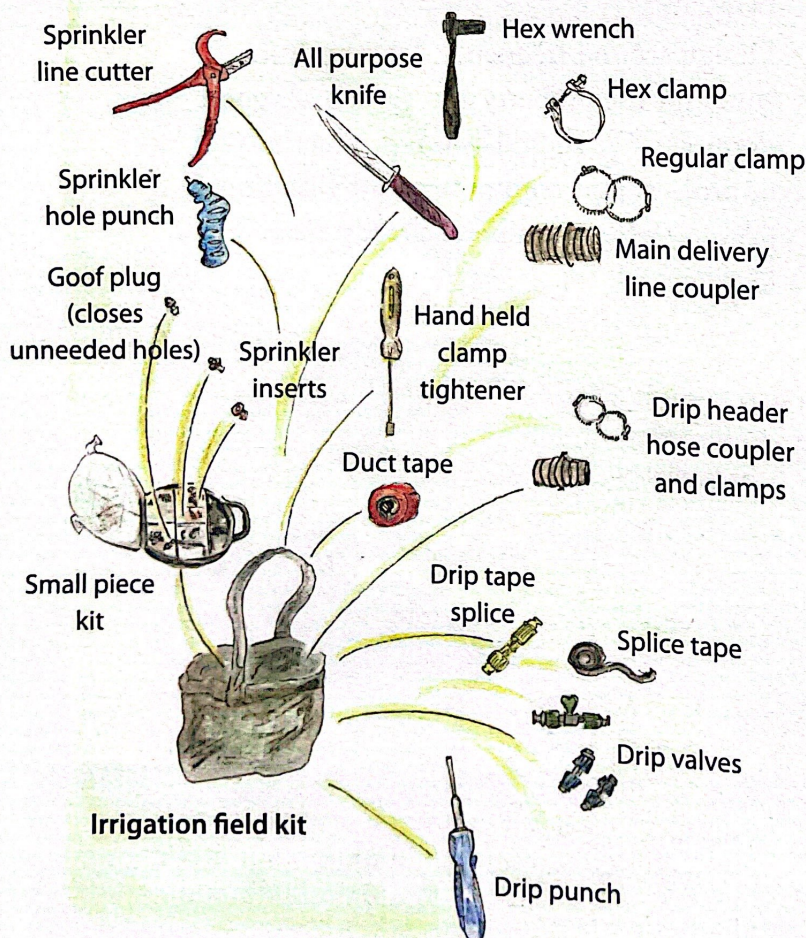


Design around Routines

- Most market garden operations are quite routine. Once you have been producing for three years, you can identify what you do, when you do it and how it is done. As such it becomes a matter of designing around these routines. The following are designed from routine operations:
 - Operational protocols: a sheet that says exactly how it is done
 - Tool kits: a bag with all the needed tools
 - Seasonal schedule: A plan of when everything is done
- Protocols, tool kits and seasonal schedules ensure operations are assembled for efficiency.

Organize around Space/Time/Energy

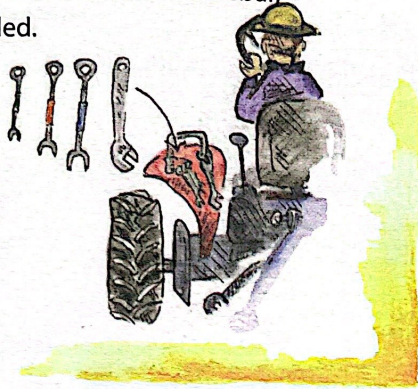
These are interconnected in everything.



- **Space:** Farms can be big, medium or small. It is how we use these spaces that makes the difference. Turn space into place so you can better familiarize yourself with its potential and use it more efficiently.
- Our permabed system organizes land for better production by dividing space and better understanding the ecological character.
- **Time:** It is of the essence on all farms. Design for improved use of time. For instance, we alternate the maturity of crops so as to more easily and rhythmically cover crop our fields. Fast-maturing crops are seeded to summer cover crops and serve as alleys to facilitate harvest of slower maturing crops.
- **Energy:** Our field kits save us time and energy as we move through space with pre-assembly of needed tools for specific jobs. Don't waste calories to run back for a

Keep your tools close and your field tools closer.

We keep the specific wrenches needed for last-minute adjustments of equipment attached to the tractor handlebar, color-coded.



self-tapping screw when repairing your high tunnel.

Clarify ROI Pathways

- It is important to clarify how a project or process returns on its investment (ROI).
- Obviously the sooner it does so, the happier we will be.
- However, we have many ongoing projects that return on a longer-term and in less visible ways. By clarifying their ROI pathways, we can set doubts aside and continue to invest in them.
- For instance, I know planting cedars along my driveway to fill in the gaps in our hedgerow and reduce wind and snowdrifts is a good investment.
- We also clarify that equipment for conservation tillage is improving our yields through soil life conservation. Ex: A power harrow doesn't create the plow pan a rototiller will.

By clarifying ROI for less obvious investments, we make better decisions for a sustainable operation.

Living Design Feedback and Evolution

- Designs must be perfected through use. Until a model design is put into the context of its intended purpose, it remains untried and so cannot be fully designed for maximum system efficiency.
- Observe for feedback from the living design and redesign for improvement.
- Production improves through feedback loops that point out obstacles and successes. Walk your land regularly to watch for system feedback. Anything you do in the garden will provide feedback. How well did it germinate? Why? Is this process working well? Why not?

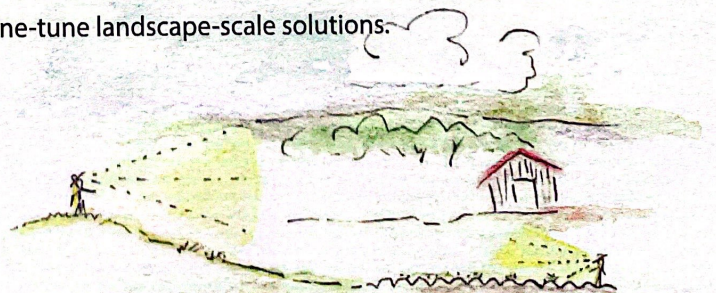
Precautionary Principle

- Exercise precaution in design by trialing ideas first in controlled areas before they are used more fully.
- We trial new varieties of perennial ground covers in research gardens where we easily observe and control them.

Do You Know?

Higher perspective helps find solutions

A different view gives new perspective. Down amongst the beds, it is easiest to learn about crops, weeds, pest, harvest readiness and study bed-scale solutions. However, high up on hillside, a barn loft or rooftop you can better see relationships between your garden and your property, between your property and the surrounding countryside. Here you can better judge the crops rotation in your land and fine-tune landscape-scale solutions.

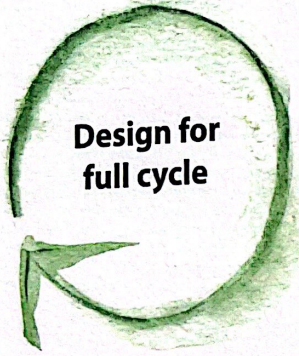


Full Cycle

- Design with the full cycle in mind to improve management of future stages in advance.

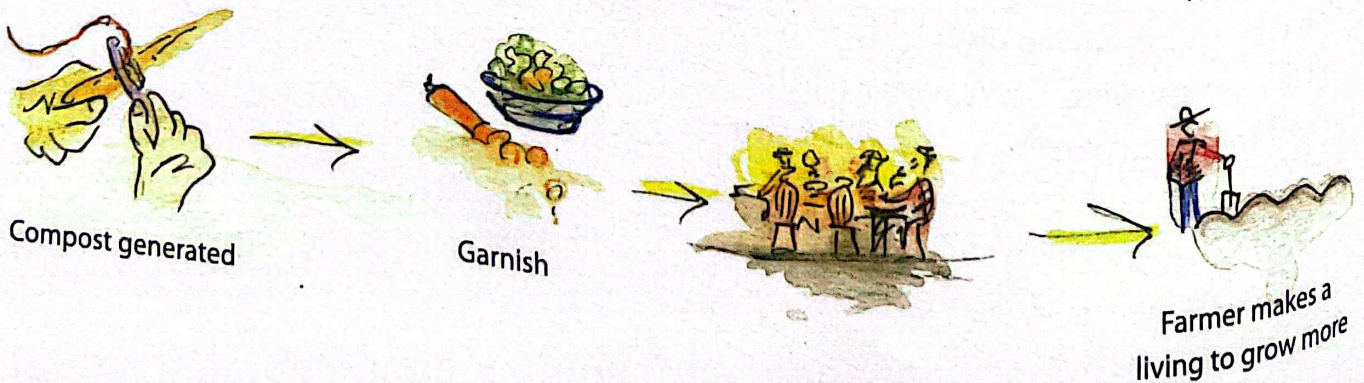
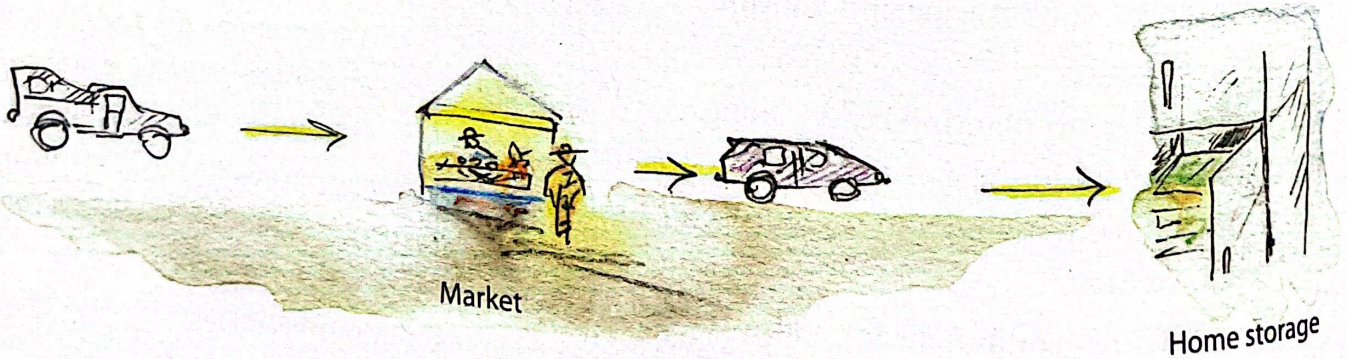
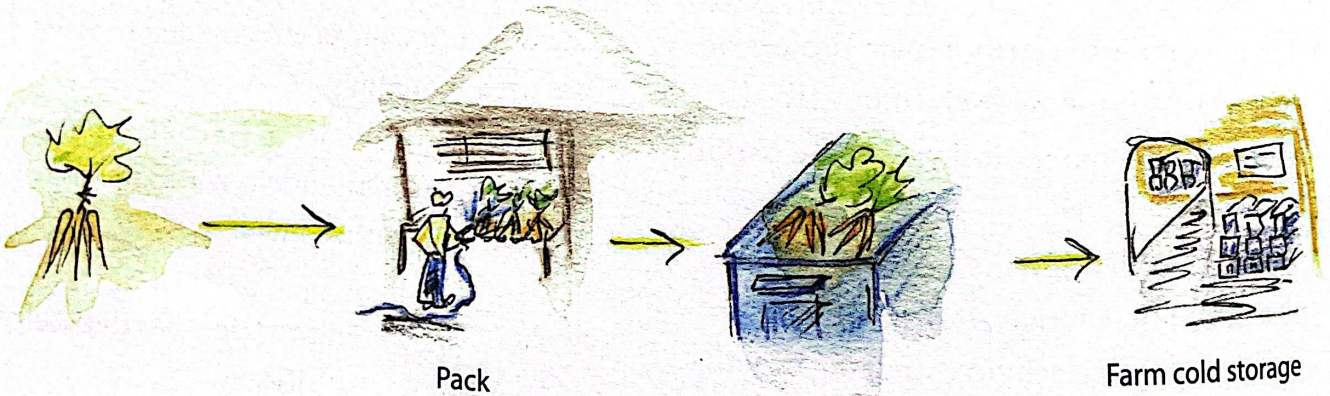
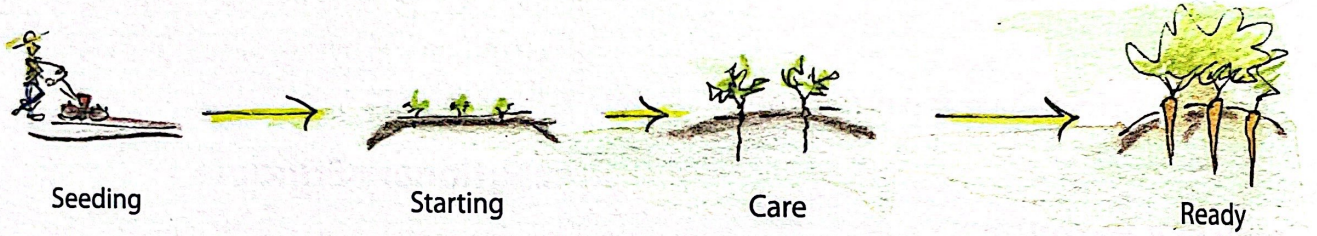
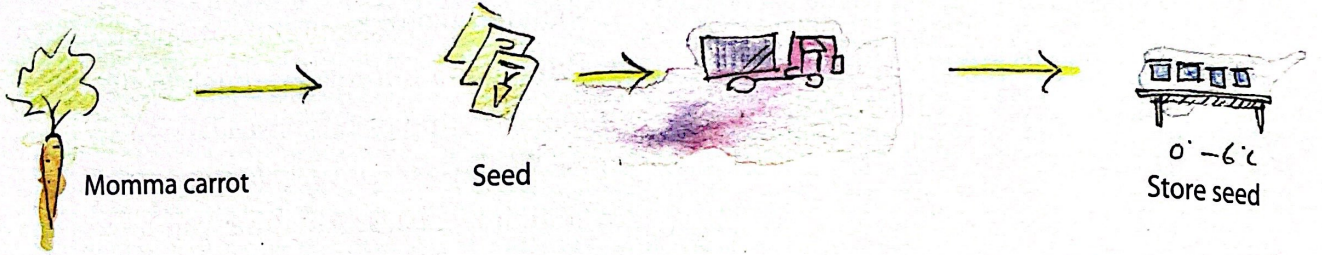
- Understand the crop's full production cycle and also its life cycle when designing for potential crop services.

→ See guild crop rotation later.



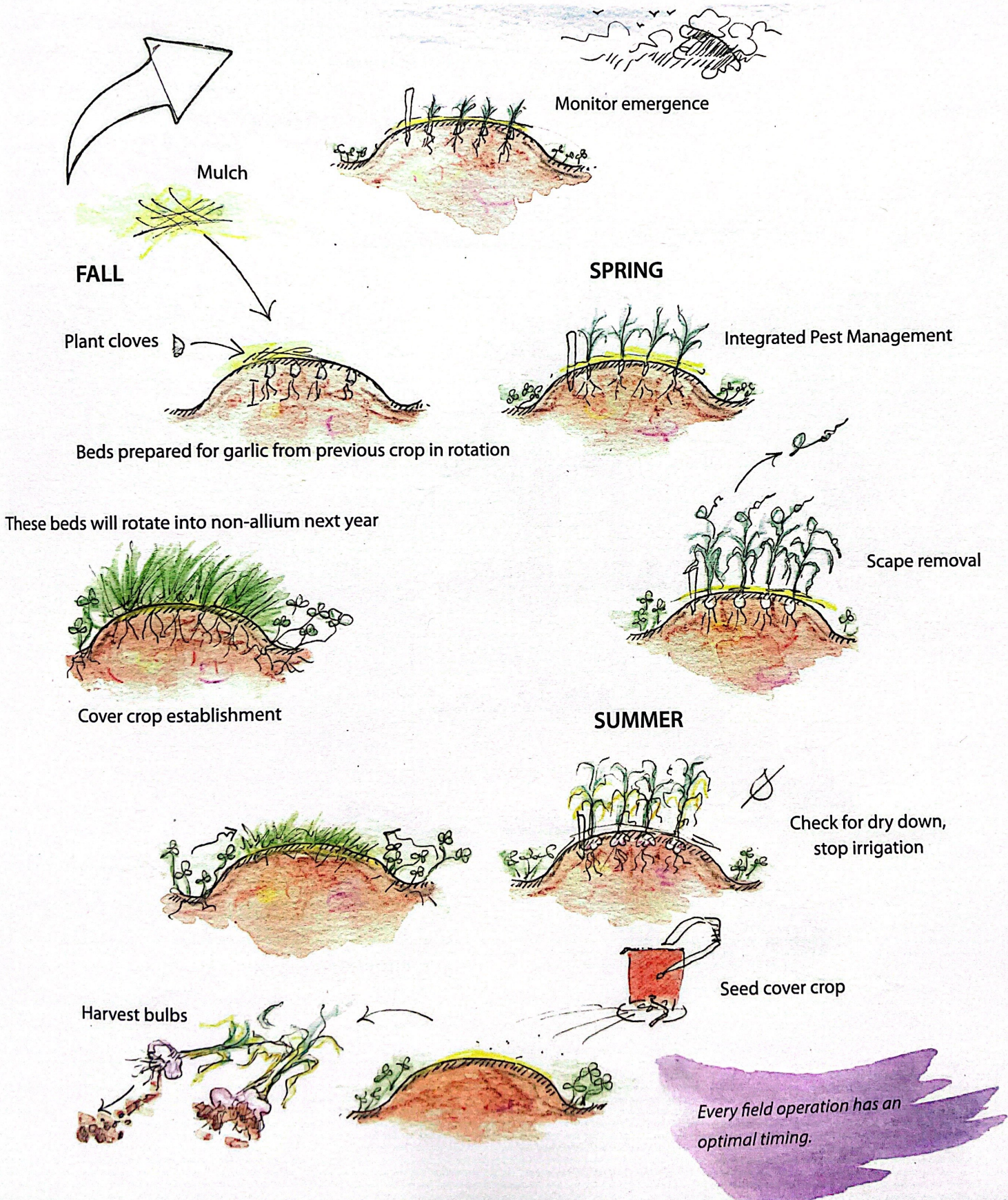
Seed to Salad

Understand the cycle, the order of operations, the stages of production

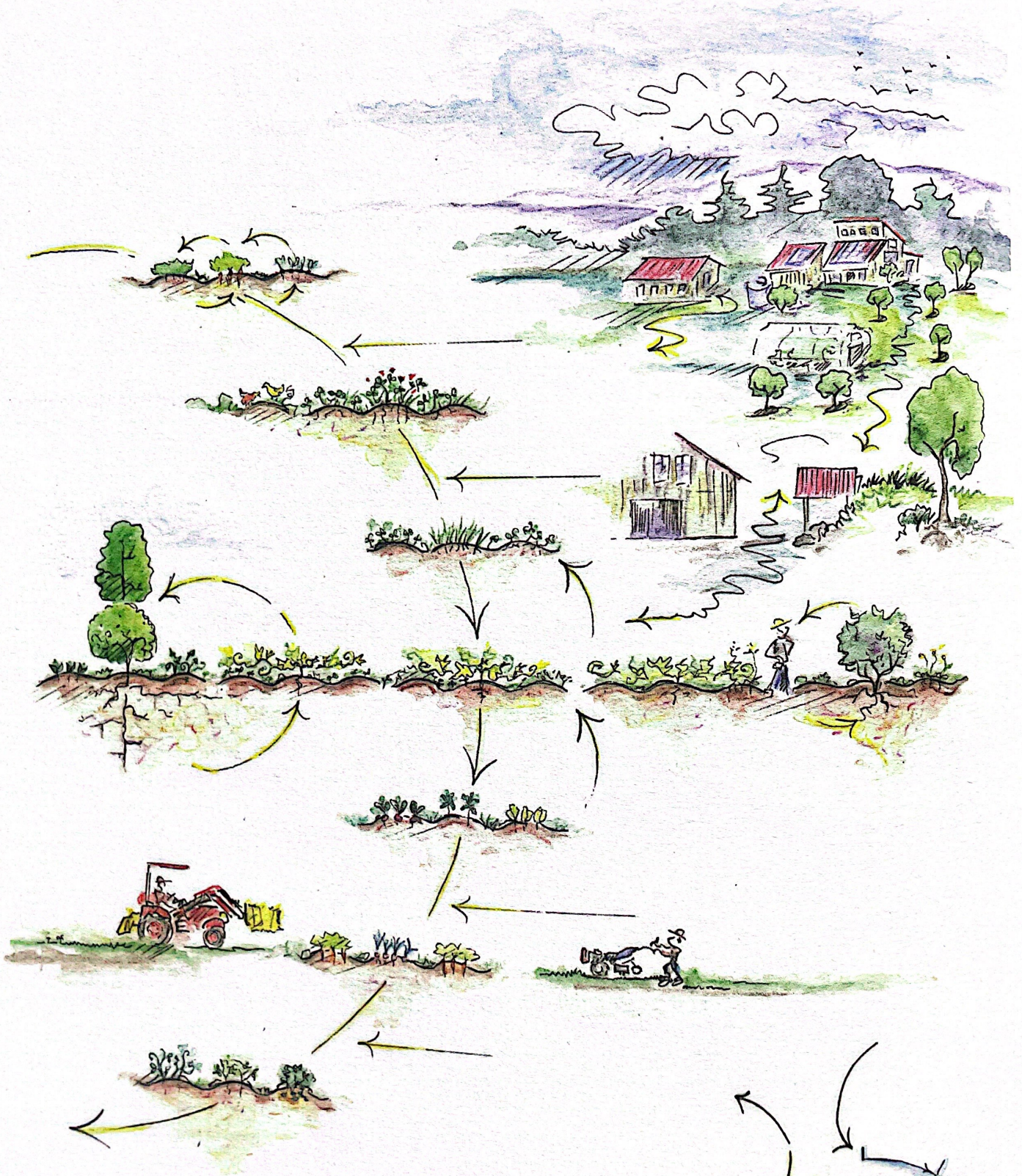


Garlic Crop Production Cycle

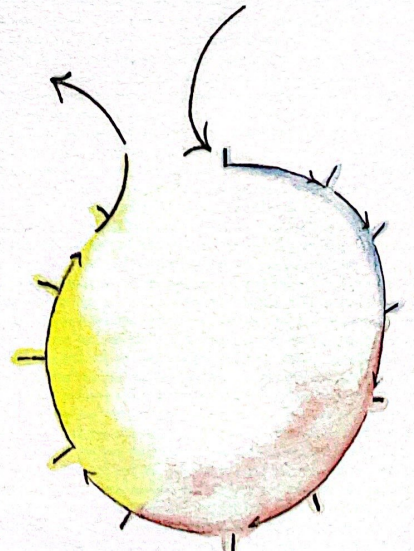
Design systems to be full cycle



Full-cycle, Multifunctional & Integrated Design



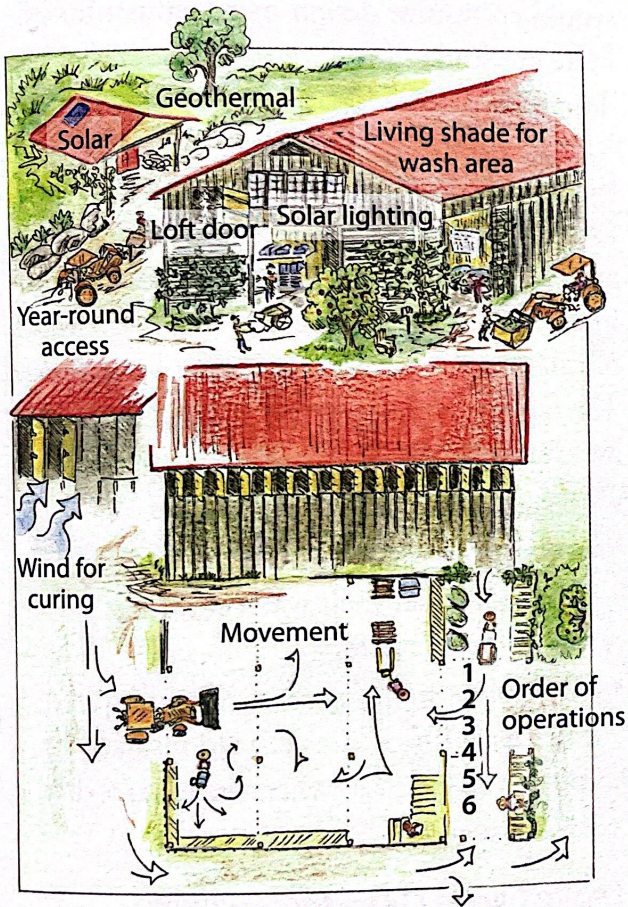
Our permabed system is designed for operational rhythms, considers crop and ecosystem services and integrates productions with crop guilds and garden patterning.



Open Concept and Flow

- We designed our barn with open concept; you can drive around it, right through it and move easily within its open bays. This building could be used for many purposes. The open concept and flow increases its usability and gives it extended flexibility.

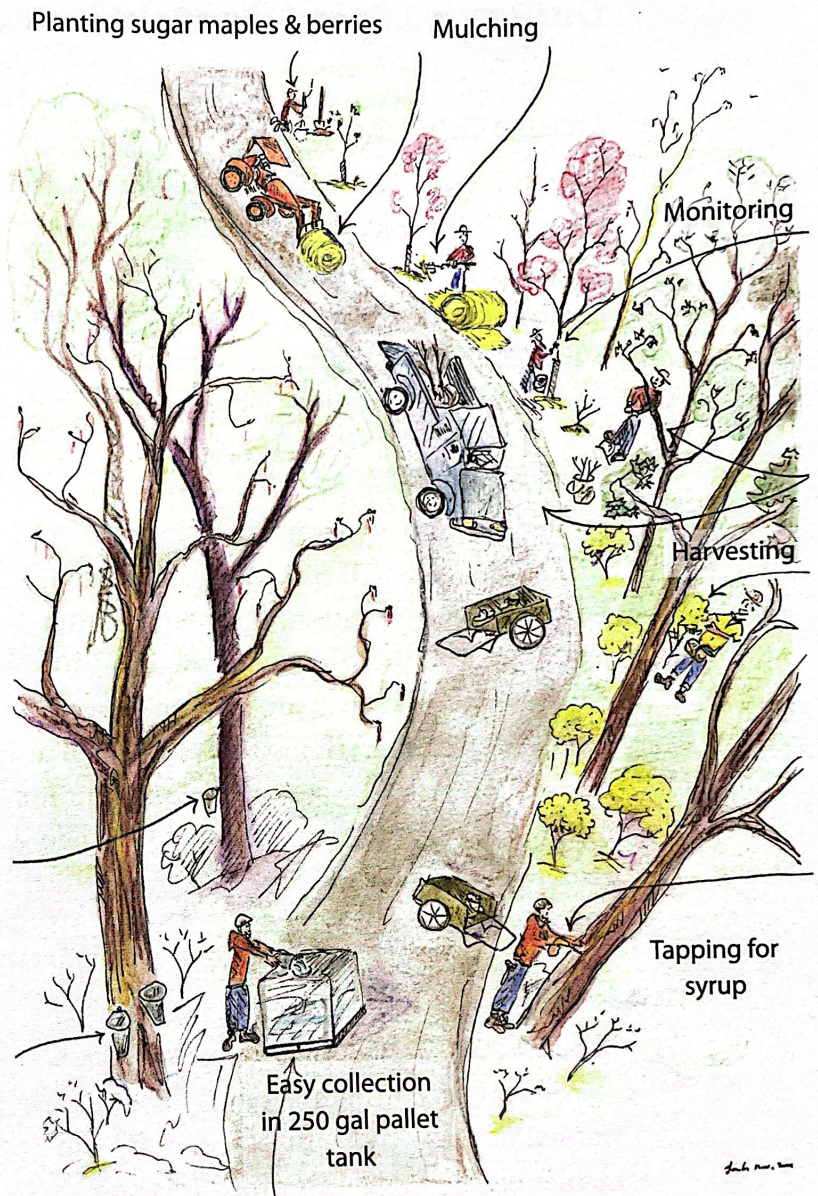
Root Cellar & Barn Design Management Zone



Simple and Passive

Simple is best. Simple and passive systems don't fail and cost less to operate. Our root cellar is kept cold using ice from the winter which we store at the back. This ice melts causing cooling. If the weather gets hotter, the system adjusts automatically, increasingly cooling as the ice melts in response to warmer weather.

Laneway Farming



Design management is better for the farmer's wallet and your farm's ecological footprint.

CASE STUDY

Our Passive Root Cellar/Cold Storage

Passive Cold Storage

Our root cellar is a year-round passive cold storage. It is cooled by ice which we generate naturally during the winter months. We make 1,000 cubic feet for an annual cost of \$500. It maintains our desired temperature and humidity conditions all year.

Multiple Functions

1) Stores summer vegetables, 2) becomes a winter root cellar, 3) provides geothermal temperature moderation, 4) stores and uses ice cooling, 5) thermally regulates itself 365 days a year, 6) serves as an on-farm store, 7) is a nursery tree storehouse in spring, 8) is a research project, 9) water collection point for our soaker-pond research nursery, 10) underground dance hall, 11) hobbit hole, and 12) apocalypse shelter.

Design

When we began planning our root cellar, we placed various constraints on its design. We wanted to avoid damaging the century-old maples on the ridge into which it is dug. We wanted a space that was large enough for future yields of root vegetables through the winter and that could be cooled using

We need quality design management to help build local solutions from a global knowledge base. Model designs exist all over the world, ready to be adopted by you and adapted to your situation.

alternative technologies because we are off-grid.

Thanks to Chris Chiasson at Whole Farm Services, countless brainstorm sessions and much trial and error we began a journey that would epitomize design management for us. Here are some of the ways our root cellar has done this.

Cycling Energy and Matter

Production processes have Inputs, Outputs and Waste. The projects and operations within a DMZ work to integrate these. The waste of one process becomes an input for another. The output of one process is benefiting from another's design.

- We solar-pump water to make the ice that cools our cellar all summer
- Our root cellar melt water feeds our soaker-pond nursery
- We mulch the nursery with small square bales used inside the cellar to insulate the top of the ice mass when the ice is melted in October.

Leave Cycles Open for Flexibility

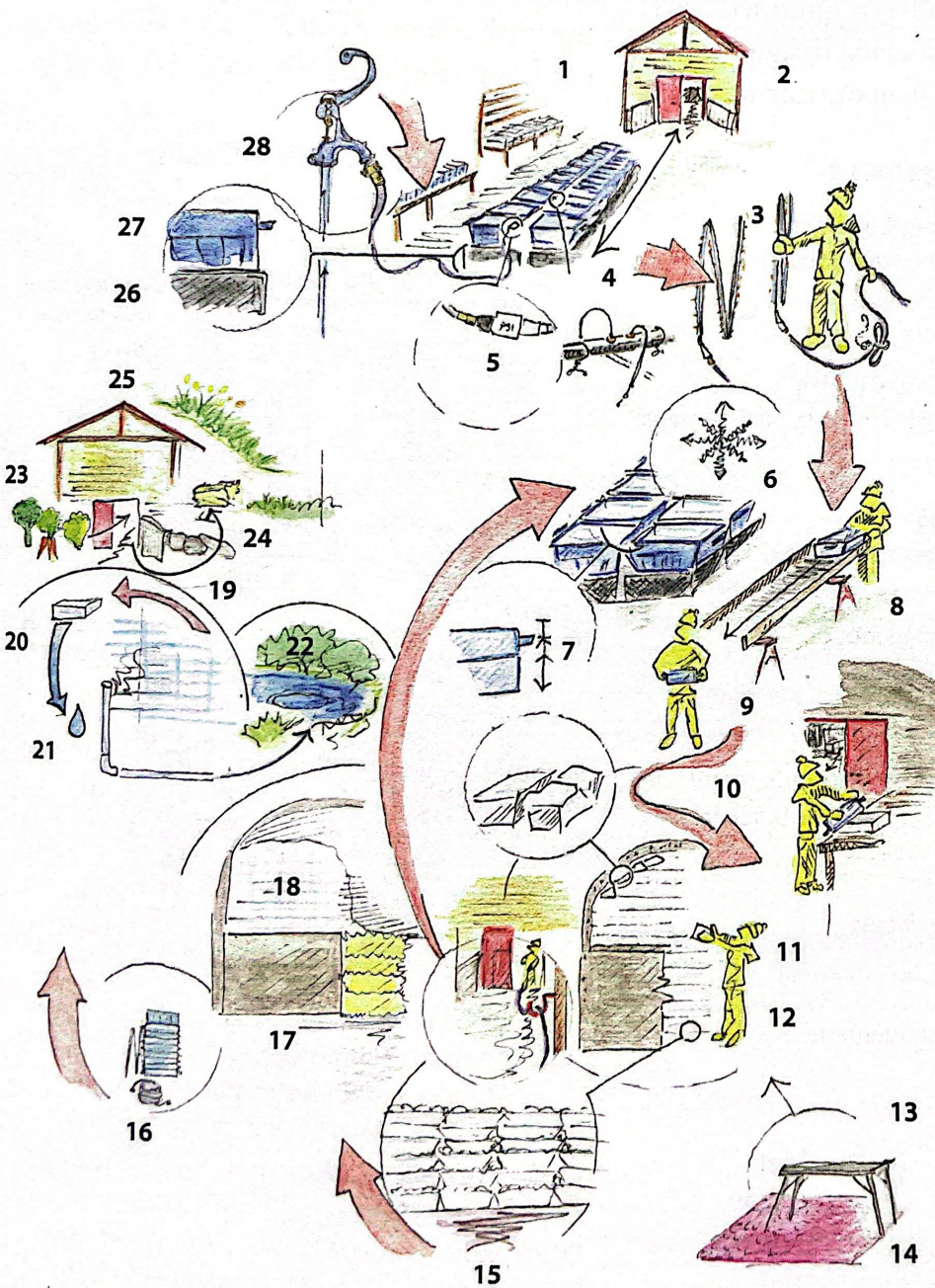
The melt water from our root cellar's ice chamber, the rain catchment from our barn roof and the wash water from the wash station under the barn are all collected and run to a catchment pond, which slowly feeds the moisture to our soaker-pond nursery. When we built our cellar and barn we didn't know where the water was going to be used. We understood that it should be captured,

stored and eventually connected. When the time came, we began to develop our soaker-pond that feeds our nursery. A little design forthought meant we were able to connect and use this resource later. Leave cycles open for future uses through flexible design.

Managing the Design

It took many years of trialing, observing and reworking to come up with a design that allows us to cool our cellar passively and affordably. Here is a breakdown of our ice-making system.

Ice-making System



1. Wash tables become ice shelves
2. First-in carrot storage bay becomes ice chamber
3. Ice filling accordion (drip irrigation) is easy to move
4. Drip filling is a breeze
5. Pressure regulator optimizes bin filling
6. -15 to -35°C is best
7. Fill to 3" below lip
8. Roll 'em in!
9. Move 'em on!
10. Pop 'n flip!
11. Stack 'em up! Don't make them heavier than you like to lift
12. Start at one end and build consecutive wall to the top
13. Step up when needed
14. Anti-slip mat
15. Layer snow as mortar
16. Clean up
17. Small square bales seal the entrance to ice chamber
18. Tarp cover
19. Reducing heat
20. Melting ice
21. Collecting water
22. Research nursery pond
23. Veggies in
24. Small square bales mulch the roof
25. Living insulation
26. Harvest crates used to elevate ice
27. Rubbermaid bins become ice buckets
28. Frost-free hydrant can be used at -35°C