

The Change Underground System

By Jon Moore

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The Change Underground System

Part 1

Introduction

Growing food is a skill. A skill teetering on the edge of oblivion. As more humans decide to live in cities and megacities, the skill fades deeper into the background.

This presents hazards and opportunities. Whilst the “best and brightest” have mostly been drawn into finding industrial responses to food production, the alternatives have been largely ignored.

Seventy percent of agricultural land on the planet is farmed industrially and produces only thirty percent of the food. The other 30% is managed in a more or less organic fashion to produce the 70%.

Let that sink in for a moment.

Despite the money to be made in monocultural production, it is the small to medium producers using more thoughtful production methods who are keeping most of the world alive.

Presented here is a no-dig, animal-integrated alternative.

We know adding oil-based nitrogen, phosphorous, potassium and trace elements to a growing medium will produce food however the costs to the growing medium, the soil, are not included in the accounting. If we were to systematically investigate a spade full of soil, we would see what appears to be an infinite number of microscopic plants and animals. How these actually interact and how those interactions change through time and seasons, or even how they react in different summers is not fully understood. Dumping oil-based elements into this living system has had unexpected consequences.

Nature developed interconnecting webs of life through trial and error over 4.3 billion years. Who are we to think we can pull a living system apart, interrogate some of its separate components and hope to understand the whole system? Instead, The Change Underground System relies upon using those pre-tested interconnections to provide food, fibre, meaning and purpose to being human.

By designing a system that supports, reinforces and assists those webs of life, we may reap a harvest without destroying those webs. In effect to produce *food fit for human consumption*.

Working with the flows of Nature rather than forcing them into narrow single crop production systems requires us to be information managers as much as land managers. By this I mean we need to understand the signals natural systems produce. Rather

than just reading the plants or animals we are using to produce income, we need to read the soil, weather and terroir. The water content, the colour, the feel, the smell and the unseen but felt. Now this can seem a little esoteric but it is the “unseen”, the “I knew something was wrong before I knew what it was”, that is the cornerstone of the system.

Developing our sixth sense is something seemingly difficult when first confronted. In reality it is not. Simply following the System and keeping an open mind will result in the sixth sense developing. To understand the difference between the System and how the majority of the world produces food is to understand the difference between the past and the future.

To this end, it is worth considering how we humans were domesticated by the cultivation of wheat. On the vast plains of the Fertile Crescent grew and still grows what we might call proto wheat. Hunter-gatherers discovered the seeds of this proto wheat could be harvested by running a hand over the ears and catching the loose seeds in a bowl held underneath. This must have seemed an unending source of food, ready for the taking. This first harvesting was the beginnings of our entrapment by wheat. Over time and over growing numbers of harvests, an evolutionary selection pressure was being applied to the plants. By eating the free falling seeds, the humans were selecting for the reproduction of those seeds that did not fall easily from the seed heads. These were able to reproduce as they always had. The non shedding tendency of these seeds eventually became the norm for certain populations of wheat plants.

The humans relying upon these plants had two choices. 1) Collect the plants and bash the seeds free or 2) Find an alternative food source. Clearly these humans chose the first option. Once the plants have been removed, the seeds needed to be replanted for another crop. Wheat had trapped humans into perpetuating its genes.

Clearly there are advantages for humans in this relationship. Cities, civilization, football and laptops are the current results of this process. However there are also disadvantages. Unless the straw and nutrient equivalent of the harvested seeds are returned to the soil, it will eventually be unable to grow the wheat. In effect, the underground resources are depleted.

It is interesting to note that Australian Aborigines also collected local grains, notably native millets. Their method of harvest, pulling whole plants, stacking them to dry and returning some months later to harvest the grains did not put significant evolutionary pressures on the grains. The piles of millet that provided the food source also left behind sufficient, unselected seed to maintain the population of millet plants in their unaltered state. This is instructive. As wheat was adopted across Europe curious changes appear in the archaeological record. Instead of sampling smallish amounts of many foodstuffs, that is, anything edible that grew upon, crawled, hopped, walked or flew across the landscape, people came to rely upon one staple: grain. Change in skeletal remains as the wave of farming rolled across the

Mediterranean is seen in average male adult heights dropping from 185 cm to 155 cm. That's correct, dropping.

With these examples in mind, the driving ideas behind The Change Underground System are to avoid unnecessary and damaging evolutionary pressures and to return to a much wider hunter-gatherer-inspired diet. Not everyone will want to eat grasshoppers, wrens, mammoth and gazelle but we can all eat a wider variety of vegetables, fruits, grains and herbs. We can also engineer into the system more diverse animal food sources. While the system only discusses five species of animal, there are many breed variations within these species that will add diversity to our diets.

The Change Underground System begins with the premise: Nature has already solved out food production problems. It then develops, based upon observation and contemplation, a series of interlocking systems designed to facilitate this outcome. Continual observation, review and alteration adapt the System to reality.

The Change Underground System

Part 2

Why Am I Doing What I Am Doing?

Why do I want to garden/farm on a small block? What do I hope to achieve? Is it to put food on my family's plates or do I want to make a living from my land? Do I like animals? Could I slaughter them? Could I sell them to someone else knowing they would then slaughter them? Are I prepared to put in my own labour or pay for the energy from elsewhere - fossil fuels, machinery, draught animals?

These are the questions you need to ask yourself before you even look at a piece of land. Once you decide, be secure in the knowledge that things will change. You may decide you want to make a living from your land through berry sales. To assist you in soil conditioning and manure production you decide to keep sheep. After a couple of seasons you find you are making more from the fleeces than you ever could in berry sales. Naturally you would change to then focus on the fleeces and maybe move the berry production to jam sales. Or the exact opposite may be the case.

Remember, stay flexible, especially in your thinking. Remember that the worms, the vegetables, soft and tree fruits are there to create the conditions for healthy soil. Growing soil each year is the purpose of the system. Any surplus of milk, meat, fleece, cheese, fruit or value added variations of these are your bonuses.

Without the soil, all else is just dreaming.

How To Make Money

Let's take a few examples and see how it could be done. Every piece of land is different and every person's way of doing things will be different. These examples will be how I would do things on reasonably good, relatively flat land.

The key is to avoid one income stream as it is to avoid a monoculture. By having several parallel streams of income, arriving at different times of the year, we are not tied too tightly to the effects of season and the monoculture "big gamble". Growing wheat fence line to fence line, can seem to be going well until unseasonable storms at harvest can wreck the entire crop. Every agricultural/horticultural enterprise is a gamble. True, we can adjust the odds but remember that it is still a gamble.

So which surplus are you looking for? From a sustainability standpoint fruit is hard to beat. In essence, fruit is simply sugar, water and fibre. To make a living from fruit you need to find something a little or a lot different from the run of the mill fruits available in your area. This can be an old fashioned fruit due for a comeback or it could be a novel way of processing a common fruit. For some this may be growing "Cossack Pineapples" or processing standard apples into a fruit "cheese" with distinctive herbal flavourings. Of course, you could go up against the mass producers and sell herbs. Herbs that have been raised organically and delivered direct to households, restaurants or bed and breakfasts.

If animals are your thing, meat, milk and egg production depend upon the local processing laws. You would need to carefully check these before embarking on this sort of enterprise. The easiest, least legislated area is fibre production. Angora, mohair, wool and hair all offer income potential. Fibres can be sold raw, scoured, processed into tops, knitting yarn, felt, cloth, clothing and/or hats and gloves. To process requires more skills than selling raw fibres but every skill and every step up the processing line you move, the greater your potential returns.

Other ideas with animals include, petting farms, school visits and animals as therapy. These may require specialised insurance and permits in your area so tread carefully.

The System

The Change Underground System is designed to produce food that is fit for human consumption based upon one single, extremely powerful premise: healthy soil is the basis of all life. The system focuses on small land areas: from 600m² (0.15 acre) up to 20,000m² (5 acres) with each land size having its own unique challenges, rewards and competitive advantages. By staying small we are able to observe, document and consider what we are doing. Instead of using expensive, large scale mechanical processes, we rely upon information rich systems for decision making and production. In essence we use the natural systems to do the "work" for us. Is it not easier to employ earthworms to constantly aerate the soil than to double dig garden beds annually?

The Change Underground System

Part 3

Philosophical Underpinnings

There are four outcomes from this philosophy:

- No digging
- No weeding
- No bare soil
- A closed system

The philosophy on which The Change Underground System stands is the mimicking of nature. Nature does not dig, weed, allow ground to stand bare nor operate an open system.

This runs counter to 12,000 years of human agriculture but by operating on a small scale we are able to act as system managers rather than using energies (tractors, horses, bullocks, fertilizers) to force the land to provide returns.

To take this to a deeper level, Nature is composed of interlocking webs of energy flow. The microbes in the soil essentially work and stay within the soil. Yet they interact with the atmosphere through the actions of earthworms, plants and vertebrate animals. The plants form a link between the atmosphere and the soils by the actions of their life cycles and vertebrate animals, by consuming plants, indirectly interact with the soils, the atmosphere and the sun.

These interconnections can be identified almost *ad infinitum*.

The aim of The Change Underground System is to purposefully create interlocking systems that will, over time, allow Nature to produce deeper and more complex systems. Any micro niche not part of the design will be filled by opportunistic species. This is the key to the system. The aim is to ensure these opportunistic species are beneficial to your goals and not destructive. Remember, Nature will always fill empty niches and achieve the four outcomes mentioned above.

We need to ensure that the natural balance is maintained after we have removed our “surplus”. There is no surplus in Nature, only exploitable resources or niches. Thus when early farmers started storing grain, they created the ideal conditions for rodents. Relatively minor species prior to the development of agriculture they have thrived ever since. Every action we take will have an effect. Not always the one we intended or considered at the time. According to archaeological evidence, growing and storing grain provided an important source of food for Neolithic farmers, however one of its unexpected consequences was that it also ensured the bubonic plague would sweep through the world due to the explosion of rats who fed on the stored grain. While the spread of disease wasn't a problem for the people of Neolithic times, it highlights the unexpected consequences of actions far into the future.

The two most important things any farmer can do is: sit and watch.

In the watching and observing (Read Sherlock Holmes if you don't understand the difference.) we sense when a problem is arising before it happens. With time we develop the skill necessary to know the correct preventative actions to take long before the system becomes unstable for our needs. By working on a small scale we have access to and can monitor the whole production system everyday. Imagine trying to maintain and nurture 10,000 acres! Weed eruptions, feral animal outbreaks or ill stock could go unnoticed for months. Stay small, stay in touch, and stay close to the ways of Nature.

The ultimate aim is to create a closed system with only sunlight added. (See Fractional Farming.) Now this may not always be possible. Added cardboard sheets and newspapers for the gardens, seaweed meal for the animals and packaging for sale items are not likely to be produced from the land. But we can work out energy exchanges to come to an energy neutral system. This means that we have, in effect, a closed system.

The system then becomes self sustaining. By this I mean it does not need any inputs from outside suppliers. Seeds are collected from open pollinated plants. Stock reproduce with careful breeding management. The soil is continually renewed from within. All of this is driven by the sunlight falling upon the land.

The Change Underground System

Part 4

Ethical Considerations

To fully understand this section, we have to comprehend the current dominant food production methods in the western world. While here in Australia, most beef and lamb is still field raised and finished, there is a growing trend towards feed lotting. Once we add in the factory farming of chickens and pigs, major ethical questions arise. Is it right to consume meat from animals raised in such conditions? How does the eating of such flesh affect us in a physical way? How does it affect us in a metaphysical way?

Such meat is produced by trucking large amounts of grain to the stock, grain grown using oil based fertilizer also been trucked to the farms. The beasts are trucked to abattoirs when ready for slaughter. The meat is transported by road to butchers or supermarkets. The animal "effluent", one of Nature's most powerful fertilisers, requires "treatment". Such large concentrations of manures inevitably result in seepage into groundwater or riparian systems. The carbon footprint of each kilo of meat is frightening. When we consider the term "carbon footprint" remember this is simply code for energy used. By using The Change Underground System we immediately remove the transportation and fertilizer costs from the ethical equation.

A basic tenet of the System is to have each producer located nearby the markets they are aiming to supply. Even if this is their own household. This not only reduces the energy use, it also allows the consumer to know the producer, creating levels of interconnection that mimic the soil based interconnections we are enhancing. How many people know the farm their eggs come from?

Because The Change Underground System food has less distance to travel, less protective packaging is required and the food is fresher with no requirements for preservatives. All these actions improve both the lives of the producer, the consumer, the wider community and the biome.

The Elephant in the Room

To slaughter or not to slaughter? There is no avoiding this question. There are individuals who will choose not to slaughter animals in their care, for ethical reasons. However this does not preclude them from using the System. Rabbits, goats and sheep can be kept for fleeces or purely for companionship. This being the case, they still provide warmth and solace while also giving back the necessary manures for regenerating the land.

Personally I have no ethical qualms when it comes to slaughtering animals for food especially when The System allows them to exhibit their natural behaviours. They live full satisfying lives, expressing their chicken-ness, goat-ness or whatever particular "ness" applies to their species. And this is crucial. Happy, expressive animals produce better and healthier food. They are stress free and a joy to be around. By keeping animals this way, we are better people for doing so.

The web of life is based upon the consumption of one life by another. The terms "A happy life", "A fulfilled life" and "A meaningful life." are human. The dilemma arises when we treat other lives as if they don't matter. From Belsen-Bergen to confined animal feeding operations (CAFOs) the effect upon the planet is on a continuum. I seriously doubt a steer has the same understanding of its confinement as an internee in a concentration camp but we cannot know. Certainly the steer is unable to run, interact with a herd and, obviously, reproduce.

When it comes to meat, the choice is a personal one. Make sure you can look at yourself in mirror and sleep well at night.

Surpluses

This is the point of the process. We set up the systems to produce a consumable surplus. Given our limited knowledge of the processes involved deep within the soil,

we are morally bound to treat this surplus with the same respect we afforded the system which created it.

The endpoint of food is human waste. What we do with this is as important as the other stages of the System. This is the point where energy can dissipate from the system. Depending upon where you live, the solution will vary. On a mains sewerage system, some form of organic matter will have to be found to replace the nutrients flushed away. Alternatively you can install a composting toilet which will capture those nutrients at the source.

For those who live in a more rural setting, other methods recommend themselves. From the “long drop” pit toilet to direct composting are options. The benefits of the long drop are time displaced. Once the long drop is full, trees can be planted above and about the pit. The nutrients are retained on site, being converted into fruit. More direct composting of human waste brings its own rewards and potential problems. The material must be composted to a sufficient heat level to ensure dangerous bacteria and viruses are destroyed. This material is best not applied directly to vegetable production but used as a soil conditioner around trees.

Summary

Think deeply in regards to your carbon footprint, the manner in which you keep animals, whether you will slaughter or not and what to do with the human waste produced in your system.

By considering these ideas before planting a single seed, you will be on the path to ethical production. Your impacts upon this planet will be minimal, your surpluses gently gleaned and sleep undisturbed.

The Change Underground System

Part 5

Fractional Farming

This chapter explains the processes of biome creation in the natural world. Understanding the cyclical nature of Nature brings much insight. Such knowledge allows us to better work with Nature in our systems rather than fighting them.

Fractional farming is a way of understanding the process of life creation. If we can retain the free energy of the sun in varying forms on the land of which we are custodians, then we are given the opportunity to increase our sunlight credits. As each unit of feed passes through an action - digestion, composting, plant growth - we

are able to add more of the sun's radiant light to our store of organic matter.

Sunlight energy is predominantly held on farm as soil, it follows then that the more actions we can include in our processes prior to sale or transfer from the farm, the better we will be able to enrich the soil under our care. If we assume it takes 100 units of sunlight in all forms to grow a hectare of wheat, for example, and yet only 50 units of sunlight falls upon that hectare in a growing season, we have two options to make up the difference. We can purchase the 50 extra units needed as chemical fertilisers, which are no more than modified ancient sunlight in the form of hydrocarbons, or we can store up units of sunlight as organic matter and include these in the process.

After the wheat is harvested we have captured sunlight in both grain and straw. The straw can be used as bedding where it absorbs manures and urine and is then returned to the soil, or it can be simply spread about the land where it was harvested and will break down. By using it as bedding first, we are adding more captured sunlight to the soil by combining it with the animal manures.

To further save sunlight in organic matter, we can grow green manures or create animal manures. Green manures are plants grown traditionally to be turned into the soil with a plough. Alternatively they can be slashed on the surface or grazed off. After all the quickest way to concentrate sunlight is to pass it as vegetation through the body of an animal. The more times sunlight is cycled through animals, the longer it lasts and the more available this energy is to maintain the cycles. The cycles themselves become self sustaining webs of life.

Whenever we combine vegetation with animal manures we are creating habitats for beneficial bacteria and fungi. The more complex the habitats, the greater the diversity equalling greater retention of sunlight. So the longer and more complex the rotational cycle in an enterprise, the greater the savings in energy inputs and the greater the types of energy expressions. This creates a soil more suited to the growing of a cash crop.

A possible set of cycles.

Buying a bale of hay, feeding it to the goats and capturing the droppings makes the dung available to grow maize. The stover is then fed to the goats and corn heads ground and fed to the sheep with the result being more dung collected. This dung is then used to grow vetch. The vetch is grazed by the goats and then over sown to oats.

Meanwhile the sheep are feeding on pasture and returning their dung to that soil. The oat straw is returned to the soil that grew it and the grain fed to the goats. More dung from the goats. All this time the goats are producing milk and sheep growing fleece. Both species are also reproducing and providing meat. The maize, vetch, oat area is now oversewn to peas and pasture and the cycle continues. Meanwhile part of the pasture the sheep were on is used to start a new maize crop utilising the dung of both sheep and goats.

The system is continually growing by this process of energy capture.

So how is this possible in a closed system? We have a closed system - the earth, with an outside energy source - the sun. Provided that we can wait for and can create a return that has high economic and low sunlight value we can set up a self sustaining system that can actually provide almost infinite dynamic stasis. We will not be buying in sunlight, we will be providing converted sunlight energies in complex, varied forms and reducing on farm energy usage.

The role of humans in this system is to monitor, maintain, redirect and harvest.

The cycle described above has but two species of stock. If we add more species the system becomes more complex and hence more efficient at trapping and cycling the sunlight. Limits are imposed upon this system by outside factors:- volume and delivery of sunlight at the location, water availability and soil pH.

Soil pH and trace elements can be adjusted. In the case of trace elements, by either feeding it through animals or spreading directly on the soil. pH can be adjusted over time with applications to the soil or plants can be selected to suit the current pH; a better, less expensive, method. The long term effect of The System is the sweeten to soil and bring it to a neutral state.

Given sufficient sunlight, water then becomes the key determinant with water availability a key limiting sunlight fraction. By retaining and recycling the water as we do the other sunlight equivalents, the decision on which cash rich, energetically low product to produce becomes more important. Following the rotation above, the soil will develop a greater water holding capability. However it is important to note that adequate water must be available at the beginning of the implementation of the system. This is not the available water, per se, but the maximum usable water that will be available in the driest of years. Will the product selected flourish in these dry years? If so, will it also flourish at the other extreme?

Sunlight and water availability are two major limiting factors in the setting up any system. To decide the right mix of crops and stock is the first task of the food producer in The Change Underground System.

Summary:

Understanding the cycling of energy within a series of systems and applying our ethical criteria from Chapter 3, we can begin to construct systems. These are not now nor ever set in concrete but better thought of as starting points. Knowing what we are attempting, why we attempting it and how the systems may work, allows us to respond to reality as it unfolds before us.

The Change Underground System

Part 6

The Mechanics

The Change Underground System relies on certain assumptions. From these flow the mechanics of the System.

These assumptions are:

- Garden beds: 50 foot x 2 foot = 100 foot² Total Area per bed is 50 foot x 3 foot = 150 foot²
- 1 bed = feed for 1 rabbit unit for three months
- 1 bed = feed for 1 rooster and 5 bantam hens for three months

- 1 bed = worm production of 65lbs per annum = 50 foot x 2 foot = 100 foot²
- 1 rabbit unit (Buck cage + 2 doe cages + 2 grower cages) = 15 foot x 2 foot = 30 foot²
- 1 Chicken run (6 hens) = 50 foot x 2 foot = 100 foot²
- 1 Goat run (2 does) = 20 foot x 50 foot = 1000 foot²
- 1 Kid run (up to 6 kids) = 10 foot x 50 foot = 500 foot²
- 1 Buck run (1 Buck) = 10 foot x 50 foot = 500 foot²
- 1 greenhouse. This can be a simple plastic covered frame all the way up to a double glazed, vented glass structure.

These assumptions are the basic building units for each area of land. The animal units are essential. They provide the best and quickest means for trapping and recycling sunlight through the System. I have given unit sizes for goats, rabbits and chickens as a guide only. Other animals could be used, wethered sheep for fleece and manure production, ducks instead of chickens and even a miniature cow or bottle fed calves. To quote John Seymour: The quickest way to create compost is to send it through an animal.

In addition to these units you'll need some tools: Wheelbarrow, fork, shovel and a sickle or scythe. As well as these physical tools you'll need an exceptionally sharp mind. (This unfortunately cannot be purchased!)

I have a fork and a shovel. These are used for shovelling goat droppings into the worm beds and for laying out garden beds. The rabbit units sit over the worms and the droppings and urine fall straight into the next phase of their cycle. The chicken runs also sit directly on the garden beds.

The wheelbarrow takes deep litter from stock to new or refreshed garden beds. The traditional farmer's hand tool, the sickle, is used for the harvesting. These can be a little hard to source nowadays given most garden centres' obsession with the internal combustion engine. I was lucky to find mine on eBay, already several generations old when it came to me. Kept sharp and well-maintained and it will last generations

more.

Creating a Garden Bed:

Soak cardboard over night or newspapers for an hour, in water.
Select area of lawn, bare earth etc for creation of a System bed
Slash any existing lawn and say goodbye to it forever.
Lay the cardboard/newspapers out in the 50 foot x 2 foot pattern.
Cover to a height of 8 inches with deep litter.
Add worms at dusk.
Water.
Next morning plant out with seedlings.

Planting Out

Space the plants on an offset grid. For example with corn, put 50 plants 6 inches in from a long edge of the bed; another 50 6 inches from the other edge and 48 in the gap down the middle. Then, once a year as the original litter rots down, top up each bed with deep litter and/or vermicompost and add more worms. Over time this creates more soil each year. You will find the first season will produce a good return though this will not be spectacular as the soil needs time to build up the necessary nutrients and, more importantly, structure.

My own experience was that within one year of planting out a series of beds over yellow clay and sand, the soil had turned a deep rich black to a depth of 1 foot with a huge worm population. Remember the secret is; Don't dig! Don't weed! Keep the soil covered!

Crop Rotation and Companion Planting

If we grow the same plants or plants from the same family, on the same piece of ground, year in and year out we eventually invite onto that land a myriad number of pests. These can be fungal, bacterial or insects. We also deplete the soil of the combination of nutrients the particular plant/family of plants uses in its growth. With the topping up of the garden beds annually, this is alleviated to some extent but not fully. The depletion of the soil leads to weaker plants and these invite pests and diseases to your crop.

To avoid this we need to rotate the crops across the garden beds. This could be done randomly, I've never tried it but it would make a great PhD thesis for someone. The usual practice and the one I advocate is a rational system based upon what the current crop takes, what it leaves and what the next crop will require.

This is old knowledge. The medieval three phase rotation of peas, wheat and fallow is an example. The peas provide nitrogen for the wheat, fodder for stock and food for humans, the wheat provides straw for stock bedding and grain for bread but it depletes the soil. The fallow year rests the land and provided scratchings for pigs and

poultry.

Over time this rotation developed in North Western Europe into a myriad of variations. The Norfolk four course rotation is as good an example as any other. This is a four crop rotation as the name suggests. It could take up to eight years to run through the cycle. This is because grassland is one of the stages in the cycle. The basic system used one year of grassland followed by a root crop, a winter cereal and finally, a spring cereal. To increase the fertility of the system the grassland which is being manured and cut for hay, is usually extended from one year out to five.

The grasslands acted as a collection device for the manures. It was ploughed or cleared with pigs. The fertility was then available for the following crops. The Change Underground System mimics this by collecting the animal manures and feeding them through worms rather than running sheep, goats and cattle across pastures.

Dual Purpose Plants.

Try at all times to use plants which have more than one use. This then means they can be recycled through the System to retain energy or to act as emergency foods in times of scarcity. Listed below is a selection of plants that have, at least, dual uses. That is, they can be used for human food and to feed stock or be value added or all three.

The Change Underground System

Part 7

Vegetables

This class of plants provides food for humans, feed for animals and "waste" for the worms. Quite simply we can live on vegetables alone but it can be a bit tricky balancing protein requirements without meat or dairy products. Mastering the art of vegetable production though, is a vital yet a simple process using The Change Underground System.

The vegetables listed below are the staples. Cultural material is relatively easy to find online. There are a high proportion of large seeded varieties. These are great for the beginner as they germinate well and reasonably quickly.

Vegetables worth considering from a stock feed and human food perspective:

Summer

Beans

These are excellent source of nutrients and very easy to grow. Though frost tender they are very productive. Choose between climbing, bush and perennial. I would

recommend all three, depending on your individual tastes and needs.

Scarlet runner beans are the perennial variety and adapt very well around the edges of the growing areas, taking up little space as do all climbing varieties. Climbing and bush beans are great fresh, dried and pickled.

Lettuce

Easy to grow, quick to mature and eaten by just about everything on earth, including, of course, snails. (Dishes filled with beer fix that problem). Be careful not to over feed stock with lettuce though as too much will cause scours. A large variety of cultivars are available so you can succession plant for continual harvest. Because of their quick-growing qualities and popularity, lettuce can form a large part of your cash income if you wish to plant, for example, gourmet varieties for local restaurants.

Melons

These are trailing plants which will take over if you're not careful. They will run up fences and trellises but require fruit supports if grown this way. Old stockings or netting are good for supports. Generally a hot climate plant, many short season varieties are available. Water melon, cantaloupe (rock melon), honey dew or local variations are available. In cooler climates they can be greenhouse grown but this would seem a less profitable option for greenhouse use.

Potato

Quite simply you can live on these. Great source of Vitamin C as well as a staple. To grow potatoes without digging them in the ground try this. If you've grown comfrey, place some leaves on the ground then the seed potatoes, then as much compost as you can find on top.

You can also feed spuds raw or cooked to all stock. Boiled is far more digestible though, so worth the effort.

Squash/Pumpkin/Zucchini

Useful as stock feed and for people. Can be used in a multitude of ways, they are also full of vitamins. The hard skinned varieties can be stored for winter and the soft skins will disappear off dinner plates in no time. The leaves and stems are loved by stock and anything not eaten by them will feed the worms.

Sweet Corn

Another very frost tender plant though the cobs are a perennial favourite with us. However the secondary great resource that is often forgotten is the leaves and stems. These are known as stover and all ruminants and the rabbits will devour this product. Almost for this reason alone, it is worth growing. Note: a layer of wood ash below the

seeds works wonders at planting time.

Tomato

This versatile and useful food is technically a fruit but usually treated as a vegetable. The fruits can be used fresh, bartered with others, pickled, turned into chutney, sauces and relishes. The tomato is a really useful vegetable for storing vitamins for the winter. However the leaves and stems must never, ever be fed to stock. They all go into the worm beds.

Winter

Broad Beans

Like their frost sensitive cousins, the summer grown beans, Broad Beans fix nitrogen in the soil and thus make it available to later crops. The beans can also be feed to stock but will improve if dried for twelve months. Their straw makes a great fodder, relished by all stock. Really a handy filler crop with food/feed bonuses.

Cabbage

Great fodder crop. One of the earliest domesticated species and consequently there are almost endless varieties. Choose as many cultivars as you can and experiment. They mature at different times and will provide both you and your animals with access to fresh greens all through the colder months. Can be pickled but I like them raw.

Carrots

Great source of vitamin A and although slow growing, the large varietal choice means a constant harvest. The tops are loved by stock, rabbits especially. When feeding to anything bigger than rabbits and chickens cut up the roots to avoid choking hazards. Pigs are probably OK but why risk it? Try tossing some in with the potatoes that you cook for stock.

Kale

Closely related to the cabbages, Kale is excellent green feed for stock. Opinion is divided over its merits as human food. To my mind, it is a poor vegetable for human consumption but others love it. Almost as many cultivars as cabbage and so provides feed all winter with the right choices. Can taint milk, as can cabbage, if over fed.

Peas

The King, Queen and all other nobility of vegetables. I love them. Peas can be eaten fresh, dried, frozen or salted and an added bonus is the pea straw. Highish in protein, great in dry matter and loved by all stock from the worms up. I can't sing the praises

of this plant highly enough. With a little careful planning in your Change Underground System, pea straw, cabbage, kale and comfrey will all be available together and your stock will flourish.

The Change Underground System

Part 8

Cereals

These may seem an unlikely option on a small scale but they are needn't be. Grown as part of The System they fit very nicely into the standard garden beds and will, with care, produce abundantly. Birds can be a problem but kites in the shape of hawks will keep most birds well away. Cereals provide food for humans, feed for animals and straw for the collection of manures. I have found a deep connection with the Neolithic first farmers when harvesting small areas of cereals.

Barley

One of the earliest domesticated cereals, barley can be added to soups, bread and is wonderful for stock feed and beer making. Excellent feed grain, the straw is also a much loved feed for goats. Frost and snow hardy, barley is very useful as a winter and summer grain.

Maize

A very frost sensitive plant. Otherwise remarkable and effective. If you can grow maize you should do so. Remember half the feed value of maize is in the stover (the maize straw). Do not waste this! Maize can also be grown just to be cut and fed to stock without it ever flowering. A very useful and versatile cereal.

Oats

People and stock can live on oats and little else for quite a while. Feed the straw and seed heads together. No need for threshing - and your animals will bloom. Ground, milled or rolled they are also good for people. Best grown over winter in most places. A useful, productive grain that can be fitted into most versions of The System.

Rye Corn

Not to be confused with rye grass, a pasture species, Rye Corn prefers a sandier soil than most grains. A great starter grain for, at least, the first few years of the System. Grows well on more mature, enriched beds as well as starter beds. Produces both grain and straw. The latter adored by stock. The grain can be a little unpalatable for some stock but a scattering of seaweed meal mixed in will do the trick.

Wheat

Along with barley, one of the first grains to be domesticated. Wheat is the staff of life and is considered so important, that it has come to represent wisdom symbolically in some middle eastern cultures. The best grain for bread making. As a feed for ruminants it really needs to be ground and soaked in water overnight, otherwise it swells in the rumen and can kill.

Best save it for people, chooks and pigs!

The Change Underground System

Part 9

Herbs

As well as providing nutrition to the householder, this class of plants will allow for quick monetary returns. Some of the more popular herbs worth considering from an income perspective are:

Basil

A great money spinner. Basil can be sold by the bunch direct to restaurants. This can provide a total income in itself. Value adding by making pesto is an even better idea. Basil is easy to grow with lots of varieties, so you can create many different styles of pesto.

Coriander/Cilantro

Work on three cuts per plant about eight weeks apart. These sell for a dollar a bunch in the region where I live (Blue Mountains, west of Sydney, Australia). So a rich soil, tightly packed and in a large enough area can provide a reasonable income using the Change Underground System.

Garlic

There is always a market for garlic. To receive a better price though, it seems almost essential to be registered as organic. However depending upon available space and time, garlic can produce most of your income or a major part there of.

Mint

So easy to grow if not contained it can become a weed of real nuisance value. Fresh sales are possible but so too are value added sales. Mint sauce is the obvious choice but there are others. Google mint recipes and experiment.

Parsley

Just about every meal served in just about every restaurant will have parsley as a garnish. Easy to grow and therefore not highly priced unless you are organic registered. Still it can form a reliable income stream with sufficient effort.

Rocket

A brassica and therefore cold hardy, rocket can take over from basil and coriander/cilantro when the cooler weather finishes them for the year. As good quality rocket is loved by chefs, this can be a profitable crop.

The Change Underground System Part 10 *Soft Fruit*

A great source of vitamin C, a feeling of opulence, a good income and an efficient use of land are the attributes of this class of plants.

Some soft fruit ideas:

Blueberries

These are good sellers but they require an acid soil. The Change Underground System will sweeten the soil over time. However this can be counteracted by adding pine needles or eucalyptus leaves to the mulch placed around the plants. Cultivar options allow for a longer harvesting period and value adding by processing is also an option.

Brambles

These can become weeds and are declared so in some regions. Blackberries are the obvious and usual culprit but the thornless varieties are generally acceptable. Loganberry, raspberry, youngberry are all good sellers and excellent for jam making. The only problem you may face is eating more than you bring into the packing shed!

Currants/Gooseberries

These two are closely related. Gooseberries require more winter cold than most soft fruit which will limit the location but these "old fashioned" fruits are due for a come back in our shops and restaurants. Will need some care though being a small producer means you have the time to deal with gooseberries and currants in a proper fashion. Quality is the key to The System and these fruits will fit perfectly into the plan.

Grapes

For warmer climates these fruits are wonderful. Dried, fresh, juiced or turned into

wine. A long term planting, so be careful where you place your grapes, as they will be there long after you have returned your nutrients to the soil. Try planting a few different varieties, and your soil type will determine which type suits your System best.

Strawberries

Using The System, the soil as the basis of everything, you can grow the best tasting strawberries in the world. Plant for a continuous harvest, eat the very best yourself, sell the second best and turn the others into jam, preserves and sauces. Strawberries are plentiful but great strawberries are hard to find. You can provide them!

The Change Underground System

Part 11

Tree Fruit

A long term, design feature of the property, Tree Fruits take time to provide a return. Once established though they are relatively maintenance free. They are especially good espaliered along fences and walls where their productive density is amazing. Depending upon climate and plan these trees are great.

Citrus

A warmer climate fruit group with many more varieties than one would think. If you live in a citrus friendly area, do some deep research. The odd, the quirky, the different should be your selling point. Marmalades, pickles, chutneys and fresh fruits are all possible sales areas.

Nuts

These are a difficult proposition on the smaller blocks though Hazel nuts produce well in hedges. On a larger holding, almonds, espaliered, along fence lines make great display and will provide good harvests. Walnuts, macadamias, pecans, chestnuts and acorns need too much room and therefore aren't suitable for anything other than a block over 2000 m² (half an acre).

Pome

Apples, Crab Apples, Pears, Quinces and Loquats are the main pome fruits. You can't grow too many of these trees! Windfalls feed all stock, the pulp from juicing is good feed and the leaf fall in autumn provides high mineral content feed. With so many size options, everyone using The System should grow at least some of these fruits!

Stone

Peaches, plums, cherries and nectarines are the main stone fruits. As versatile as Pomes but more prone to disease, stone fruits can be a good source of food, feed and income. Again, many size options and chilling requirements allow you grow at least some of these fruits on the smallest of holdings.

The Change Underground System

Part 12

Additional Useful Plants

These plants are more for product creation rather than feed or food.

Comfrey

Comfrey was the wonder plant of the hippies! Do not let this put you off. A perennial, it requires permanent beds but these can easily be worked into The System. Excess feeding of this plant to stock causes mineral imbalances but fed to no more than 30% of the diet and combined with stover or other cereal straws it makes a complete feed. The leaves can be placed under potatoes at planting for truly remarkable results. Fed to worms it accelerates the whole decomposition process to a remarkable degree.

Woad

A brassica, woad is grown primarily for its blue dye. Other plants produce a lot more of the indigo, that is the chemical extracted from woad for the dye, but woad is the easiest to grow. However beware!! It is a declared weed in some parts of the world because of its free seeding nature. Woad can be a useful plant to grow if you are hand dyeing fibre. Blue is especially hard to create organically, particularly if you live in a temperate climate. Other colours can be achieved from many natural sources but blue is basically impossible without woad/indigo.

Willow

Local councils have been poisoning this plant and successfully clearing it from waterways for a decade. Denigrated as a dangerous weed, I suggest it has a place in The System for a few reasons. Pollarded and cut yearly, it produces wonderful raw material for basketry and wreath making. The leaves make excellent stock feed and I've even dried them to create a sort of willow hay that is relished by stock during winter. Twisted willows also add a touch of variety to basketry and wreaths as well as forming the basis of Celtic Christmas trees.

Willows are easy care plants that produce a raw material that can be stored to fill in those long winter nights and produce high quality/high income products.

Duckweed

Needs still water, nutrients and a temperature range of 18° to 30° Celsius. This is quite a productive aquatic plant that can become a weed in waterways. Can be fed to fish, stock or used in compost or as a mulch. It is relatively high in protein and is loved by chooks and ruminants. Smothers algal blooms by floating on the surface and denying light to the algae. Harvest by simply skimming the surface with a pool skimmer or kitchen sieve, depending upon the size of your system. Duckweed may also be useful as an input for ethanol production.

The Change Underground System

Part 13

Small Animals

Earth Worms

Worms are the one animal that are essential to The Change Underground System. These underground beasties provide the oomph to all the gardens, processing all waste and producing a high voltage fertilizer/soil conditioner that underpins the fertility of the whole enterprise. For this reason other stock exist in the system to feed the worms. We could simply feed the worms excess vegetation but by putting this material through a vertebrate animal first we concentrate the nutrients. This allows the worms to feed on "pre-digested" matter, considerably speeding up the system.

Worms also provide feed for chickens and other poultry. They represent the protein fraction of the poultry diet.

Selection of the correct worms though is critical.

The most commonly farmed worms around the world are:

- Tigers (*Eisenia foetida*)
- Reds (*Lumbricus rubellus*)
- Blues (*Perionyx excavatus*)
- African Night Crawlers (*Eudrilus eugeniae*)

These worms reproduce rapidly, under the right conditions, and can develop populations of up to 440,000/m³. This is quite remarkable and extremely useful. The worms represent a much better form of protein for poultry than any grain. They are the "natural" protein with which poultry evolved. This releases much grain for human and other animals.

Poultry

- Quail
- Chickens
- Ducks
- Geese

These are simple stock with simple needs, yet vital to the running of The System. So long as they have room to scratch, somewhere to roost and an egg laying box, poultry will be happy and feeding them within the System is easy with the abundant earthworms in the System providing the protein in their diet supplemented by cereals and any scraps from the kitchen.

Poultry provide eggs, meat and manures. While much has been written about the strength of poultry manures, the Change Underground System uses a deep litter over any poultry manures. The vermicompost or deep litter from the ruminants/rabbits neutralises the propensity of chicken manures to burn roots. Each species is kept in a manner that allows them to exhibit their natural instincts and concentrates a percentage of their manures. For further reading, websites from the FAO (United Nations Food and Agriculture Organization) provide much in the way of useful information.

Rabbits

Known for many years as the poor man's pig, the rabbit's small size and characteristics makes it seem like it was designed for the Change Underground System. Quick to reproduce, and a reliable converters of non-human food into high quality, low fat protein. Other outputs include manures, fur and angora wool.

These animals are kept primarily for their manures in The System. The meat, fur and angora are supplemental, though useful. These can be significant income producers. Angora, in particular, offers much in this regard with a raw wool price of \$100 a kilo with the potential to increase this to \$400 - \$500 a kilo with value adding. This would include carding, spinning, felting, knitting and/or weaving. To value add successfully you must have the necessary skills to transform the raw wool into the finished product. These skills are quite learnable and need not eat into gardening time.

There is also potential for stud breeding. Depending upon your location, this can be the primary or adjunct activity.

Goats come in a variety of forms. One or a combination of types can be found that will suit your needs and temperament. These include:

- Miniature
- Dairy
- Meat
- Fibre
- Pet

These wonderful creatures are the reason why I farm. Now I understand that not everyone takes to goats, for one reason or the other, however I have found the key to keeping goats, indeed the key to all good animal husbandry, is good fences. The Change Underground System relies upon a zero grazing system that provides 45 m² per adult animal. They are housed, as a minimum, in pairs. You have to watch for bullying early on but goats tend to sort out hierarchies fairly quickly and settle down to life. They also thrive on routine. This is particularly true at milking time.

Dairy goats are available in standard and miniature, meat goat lines vary in size and are probably not an option for the smaller block of land. Cashmere and, more particularly, Angora wethers for fibre production would be better suited. Wethers are reasonably docile, especially if handled daily, and goats have more personality than sheep.

Sheep

Sheep may not seem an obvious choice for The Change Underground System, yet with some thought, (you will recall that thinking is a vital component of the System) and prior preparation, sheep can be slotted in to very good effect. They will start to come into their own with land areas of one hectare and above. To begin with, you will need good strong soil that is productive but you will also find that the sheep, once added to the System will improve productivity.

They have many things going for them: manure, wool, milk and meat. If your location is a small area, miniature sheep would be an obvious choice. If these are not available, standard sheep are still workable though. On smaller blocks of land, wethers are the obvious choice. Products would be wool, manure and possibly mutton.

However with such small numbers, these sheep would be more pets than stock which would of course, rule out mutton. The other possibility would be milk sheep if you have access to a ram.

Sheep are easier to fence and control than goats, come when called if bottle raised and their milk is of a high quality. You just need to define what you are doing and why.

Pigs

Smart, quick, trainable and built to turn the inedible for humans into food while producing huge quantities of manure, the pig is a useful component of The Change Underground System. Not everyone will have the space to breed pigs but one or two can be fattened with milk and excesses from the gardens. The System can be structured around the pig. Weaner to slaughter would be about six months.

Two pigs a year would fit nicely with the seasonal production of fruit, vegetables, grains and herbs. This would require the construction of a small sty but this could be built out of straw bales and cycled through the system after each pig has been slaughtered. Remember waste is always an input somewhere in the Change Underground System.

The Change Underground System

Part 14

Conclusion

And there you have it. Whilst all this may seem overwhelming right now, it is not. Remember The System is designed around the core principles of no digging, no weeding, no bare soil and a closed system. Keep this in mind, start small and build upon your successes.

mrjonmoore