Weeds as Indicators

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Information collated by Kim Deans, 2023.

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Weeds are plants growing where we don't want them.

Think about how you react when you see weeds in your landscape. We have been trained to kill when it comes to weeds, so many farmers and gardeners spend their lives at war with weeds.

Herbicides were initially developed for use in warfare. The military began researching herbicides for warfare in World War II and herbicides were used in warfare in Vietnam from 1962.

We have a culture where having weeds implies we are a "bad" farmer.
We worry about what the neighbours would think if the weeds are not killed at first sight.

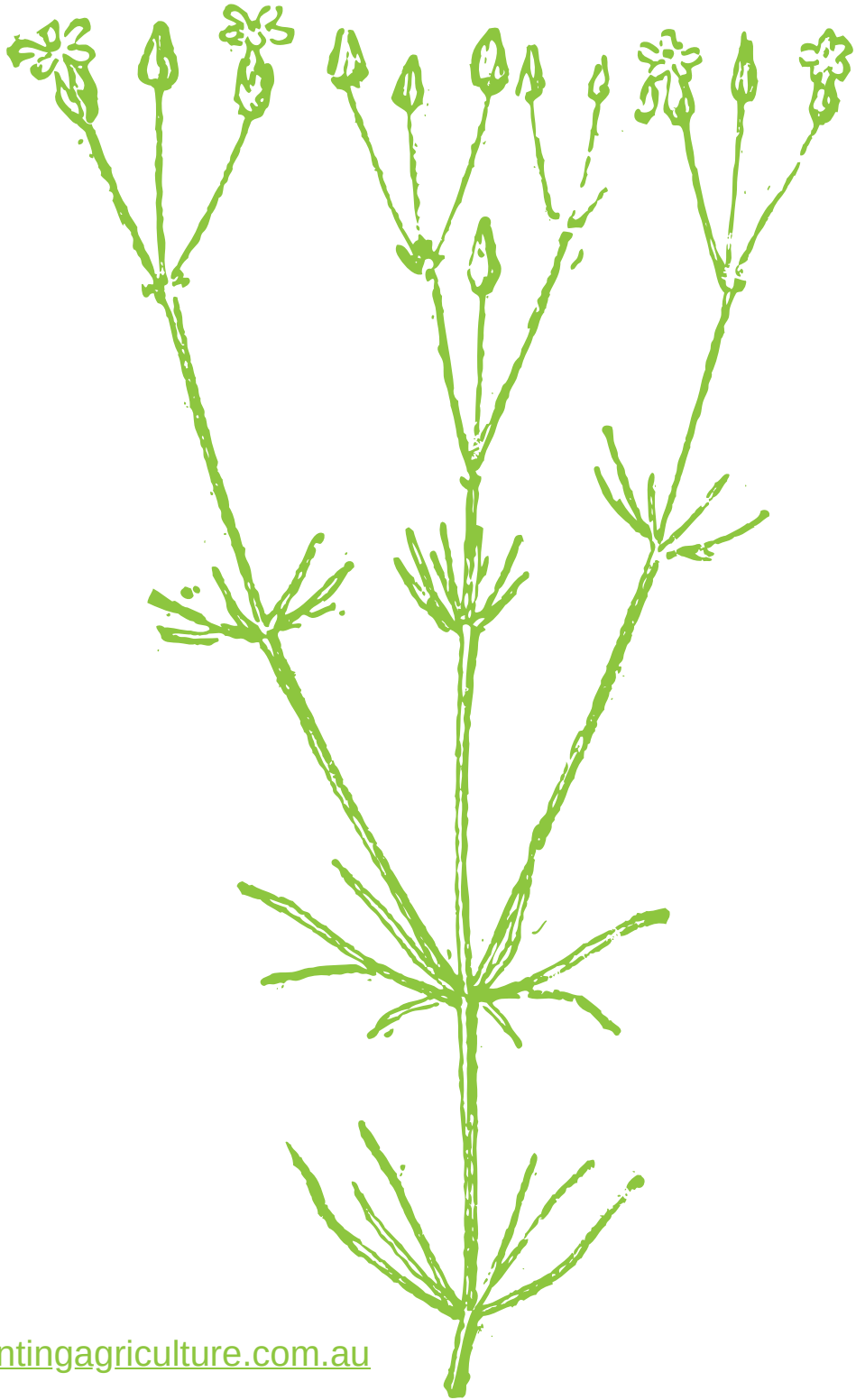
What if we shifted our perspective to see how weeds are telling the story of our land management?
What if we listened to what weeds are telling us about soil health?
What if we appreciated the role weeds have in restoring health to degraded soils?

This does not necessarily mean we will stop controlling weeds in all cases. This shift in perspective empowers us to take a holistic view based on the understanding of the reasons weeds love to grow in our soils rather than continuing to address the symptoms and contributing to the ever increasing rates of herbicide resistance and chemical loads in our environment. In 2018 the annual costs of weeds in Australia were over $5 billion! Globally $26 billion was spent on herbicides in 2016. The more herbicides we use the more the expenses on weed control continue to rise with the costs of weed control continuing to increase.

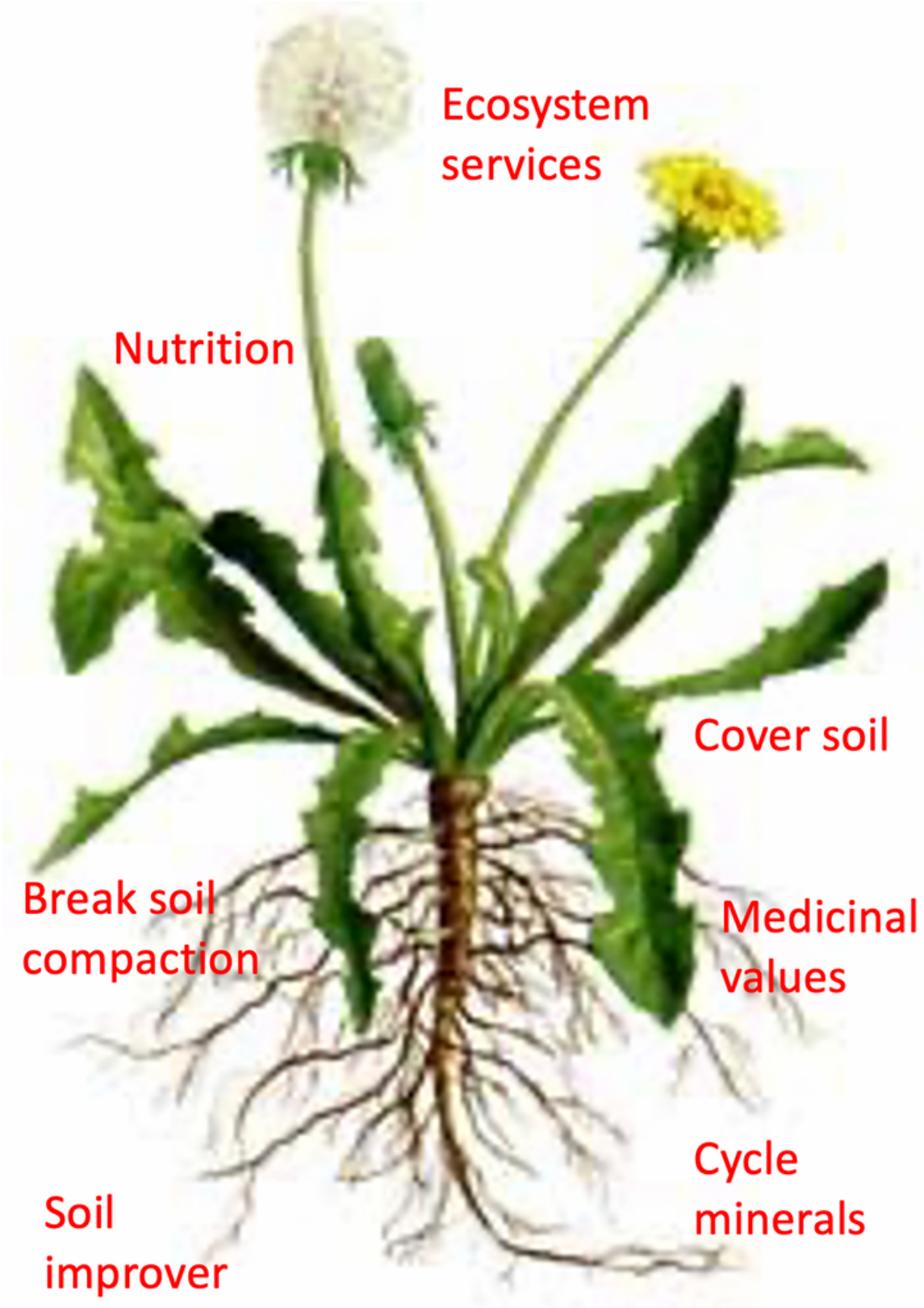
There has to be a better way. It starts with opening our minds to take a different perspective on weeds.

Characteristics of plants we call weeds:

- Hardy & resilient, natures survivors
- Ability to thrive in disturbed, degraded areas with out care
- Survive and persist despite our efforts to eradicate them
- Pioneer plants that colonise bare, degraded & disturbed soils unsuitable for other plants (early succession)
- Fill gaps in the ecosystem, protecting the soil from sun & erosion
- Reintroduce nutrients and organic matter as they grow and decay
- Break up soil compaction
- Tend to be bitter, thorny or poisonous allowing them to be left alone by foraging animals to do their work healing the land
- Many are medicinal



The role weedy plants have in the ecosystem:



6 main reasons weeds grow:

- Colonise bare soil
- Low soil organic matter
- Open up compacted soils
- Mineral imbalances
- Microbial imbalances
- Safety valve for toxins

Reference: Masters, Nicole. (2019) For the Love of Soil.

Soil biological succession relates to plant succession.

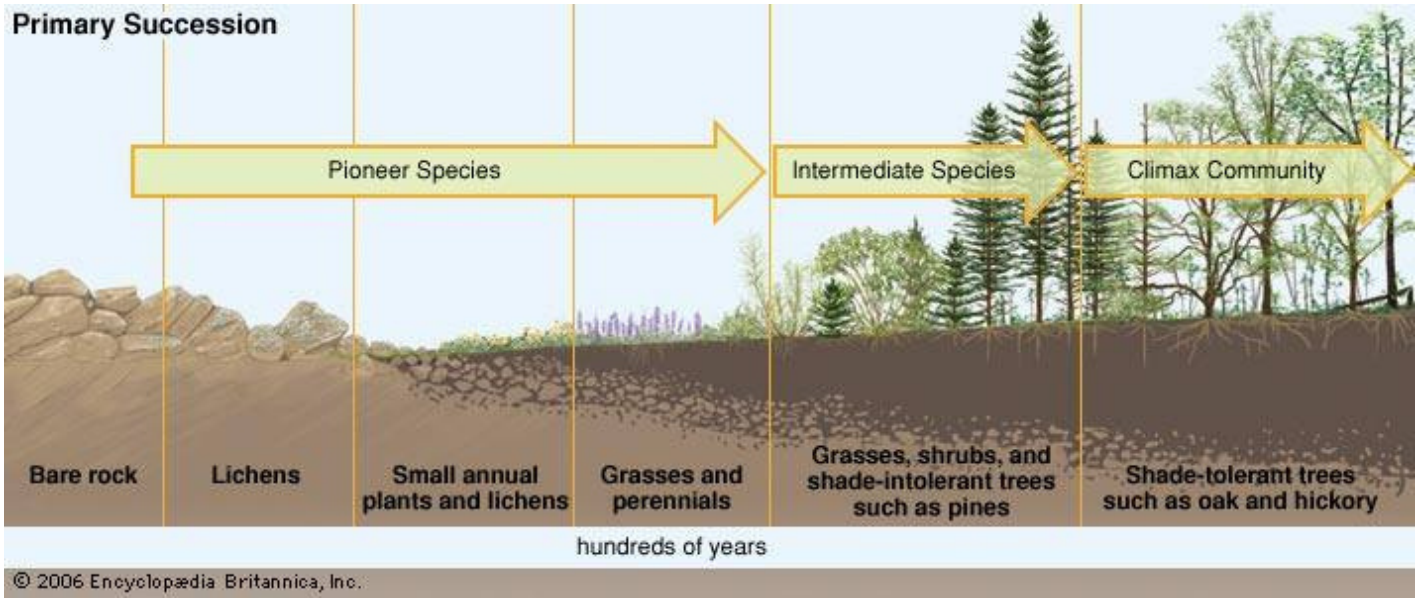


Image credit: Dr Elaine Ingham.

Living communities are dynamic and always evolving towards increasing complexity and stability. Succession is natures process of building up species diversity and biomass as the environment changes, moving from simplicity to ever increasing complexity.

Landscape succession starts when bare ground is colonized by simple algae/lichen/mosses who can handle extreme environments without soil. As they trap moisture and dust the soil building processes commence. Gradually other organisms join the community as moisture is retained longer and the microenvironment begins to suit them. Early colonising plants move in with shallow root systems and scrambling growth patterns to gain a foothold. As dust, debris and organic matter accumulate brassicas and primitive grasses appear. Deeper rooted species open up the soil and release nutrients, as disturbance decreases the advanced grasses move in and soil building processes accelerate. As soils become less disturbed they tend towards more fungal biomass and in come woody weeds. With even less disturbance these soils provide the germination signal for shrubs which lead the way for trees to establish over time.

This successional process over time moves ecosystems from primitive, hardy, colonizing weedy plants towards grasslands, brushlands then forest. Complexity, productivity and stability increase as succession unfolds.

Agricultural practices disturb and set back the ecosystem by increasing simplicity, sending the system in the reverse direction to the increasing complexity direction nature is taking it. Increasing simplicity creates the perfect conditions for weeds and pests to thrive and we spend billions of dollars annually each year on actions which continue to send the successional processes backwards, creating the perfect conditions for what we don't want. Understanding successional community dynamics opens the door to working with these natural ecosystem processes for improved outcomes.

Plant:Biology Relationships

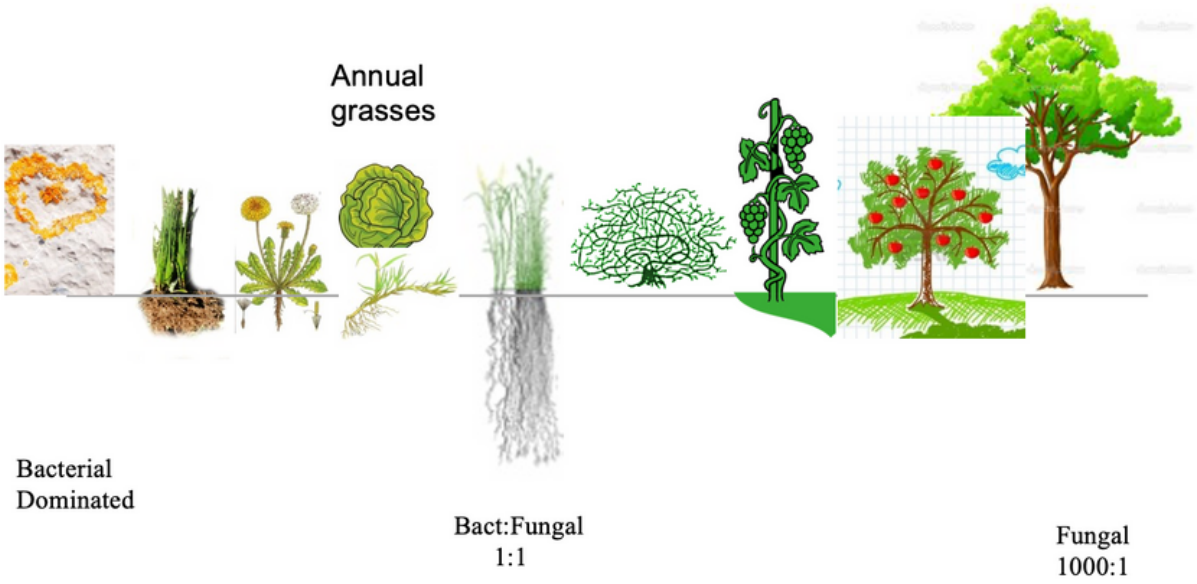


Image credit: Nicole Masters, Integrity Soils

There is a soil biological succession that occurs underground alongside the plant succession process we see above the ground. Primitive soils with early colonising species prefer and support bacterially dominant environments. Perennial grasslands thrive when the bacteria:fungi ratio in the soil food web is balanced. Soil disturbances always shift soils back towards a more bacterially dominant state more suitable for weedy annual plants to thrive. When there is a lack of disturbance soils move towards more fungal dominant states.

Ecological communities can be altered rapidly through natural or man-made disturbances.
Once an undesirable species has become established Allan Savory's Holistic Management approach encourages taking the approach that we are better off managing for the overall health of the whole community rather than spending large sums of money trying to eradicate one problem plant.

Managing for what we want.

When problem plants appear to be outcompeting other plants and taking over, closer observation usually illustrates how management has created the ideal conditions for the offending plants and less than ideal conditions for the desired plants. When management results in bare ground we open the door for undesirable, weedy plants to establish.

Our management sends the signals for the weeds to germinate. Weeds tell us the story of how our agricultural practices are impacting the ecosystem which we are part of.

Some examples of weeds as indicators:

Low available Ca and low humus

Calcium function is driven by water and active fungi (many weeds indicate a breakdown in fungi)

- Thistles
- Bathurst burrs
- Castor oils
- Paddy melons
- Nutgrass

Compaction

- Dock
- Bathurst burrs
- Mallow
- Thistles
- Rushes & sedges

Low Phosphorus or High Potassium

Broadleaf weeds often prefer low P or high K

- Dandelions
- Scotch thistle
- Fleabane

Nitrates

Due to soil food web lacking protozoa & nematodes to cycle N contained in bacteria. These higher order soil microbes disappear due to compaction, low soil carbon and pesticides (note: only 5% of nematodes are harmful).

- Nightshades
- Capeweed
- Nettles
- Fathen
- Milk thistle

Bare soils

Soil protectors

- Caltrope (cat head)
- Bindweed
- Purslane
- Invasive grasses
- Shallow rooted annual grasses

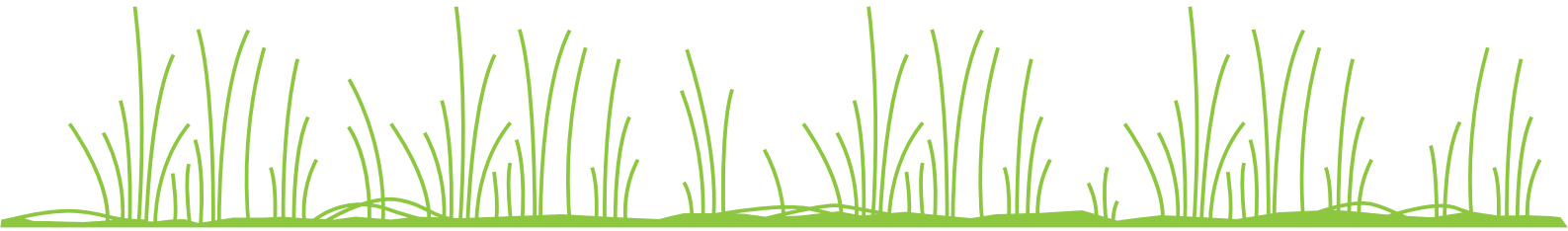
Fungal/sleepy soils

When grazing impact is low soils become less disturbed and tend to move towards more fungal biomass. In come the woody weeds. With even less disturbance these soils become sleepy providing the germination signal for shrubs.

- Briars
- Blackberries
- Mullein
- Bracken

Low biological activity/bacterial dominance/early successional

- Kikuyu
- Johnsons grass
- Couch grass



Non-mycorrhizal weeds:

Disturbed environments
Low competition
High soil Phosphorus

- Pigweed
- Lambsquarters
- Sedges
- Brassicas

Alternative ways to manage weeds

- Let them grow to fulfil their soil restoration potential and observe the changes in community dynamics over time. Check out what can happen when we leave weeds alone to do their job.
- Slashing/mulching prior to seed set
- Green manures
- Compost material
- Grazing management: smaller paddocks, moving stock more often, longer recovery
- Cover crops (volunteer plants can provide the benefits of a free green cover crop)
- Weed teas/extracts
- If you use herbicide buffer with fulvic acid (refer to For the Love of Soil by Nicole Masters)
- Balance soil minerals, guided by soil & leaf tests
- Feed fungi - humates, fish, fungal dominant composts
- Humates – mop up nitrates
- Innoculate soil with protozoa using a protozoa tea
- Brix your weeds and your pastures/crops to see if your management is favouring your weeds and monitor changes over time

BUT don't weeds take soil moisture?

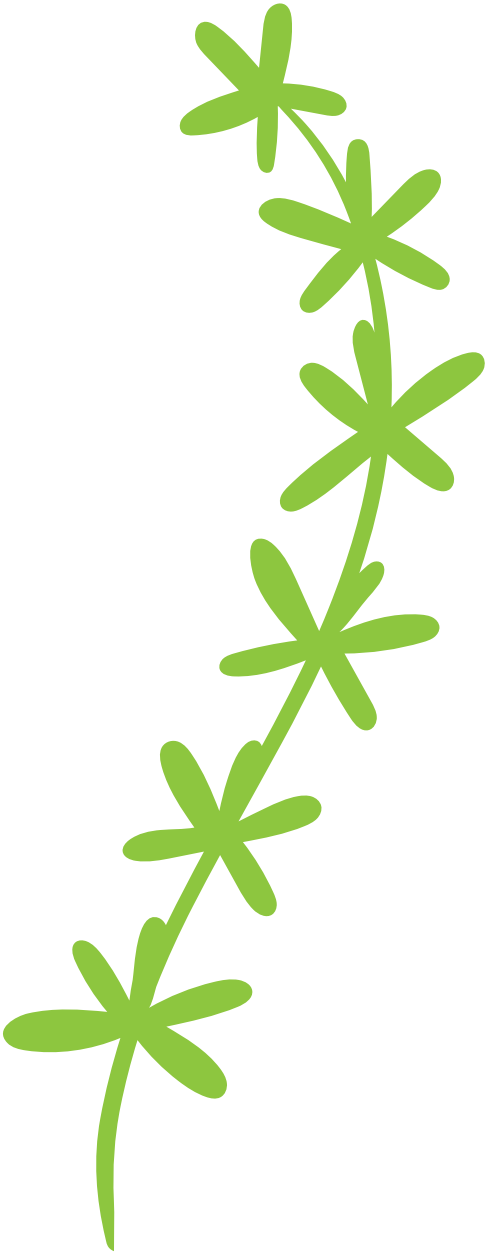
In a degraded soil with no soil organic matter/carbon poor soil health leads to the the water cycle becoming broken. Water infiltration is reduced as is soil moisture holding capacity. (1 % soil carbon stores 140,000 litres of water per ha).

If we can set aside an area to patiently observe and monitor soil health and moisture holding capacity we can watch how by letting plants grow and cover the ground they slow the evaporation of soil moisture, improve water infiltration, keep the soil cooler for microbes and work to restore soil carbon which improves water holding capacity in our soils.

Set aside a let it grow area and patiently watch and observe your soil come back to life.

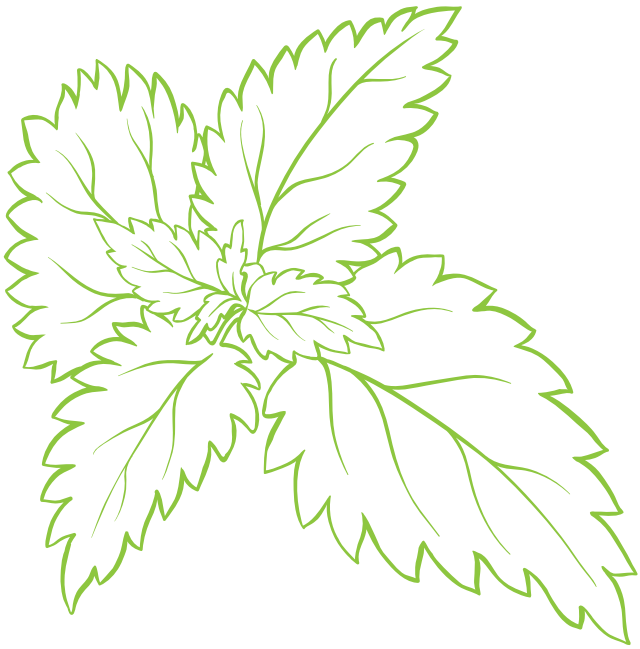
Could weeds be a resource instead of the enemy?

- Weeds are story tellers, they reflect the story of your land management decisions on soil health.
- Indicators of soil biological, physical and mineral health.
- Free diversity. Weeds perform many roles we can pay for in cover crop mixes.
- Some weeds are suitable for livestock fodder.



Is your management creating the perfect conditions for weeds to thrive?

- Bare ground
- Dead fallows allowing light to stimulate germination
- Grazing management
- Soils with declining soil organic matter
- Compacted soils
- Mineral imbalances
- Disturbances creating bacterial soils
- Low grazing impact creating fungal soils



Weeds role in the ecosystem is to help move the ecosystem towards a more biodiverse/complex state of being. Our desire to see a landscape constantly remain in the same state of simplicity that it is in now creates the problems we call weeds. Nature is always moving from rock to dirt to soil with “weeds” to grassland to shrubland to forest to climax forests.

Further reading

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Savory, Allan & Butterfield, Jody (1999). Holistic Management. A new framework for decision making.

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