



Ruminants & Pasture Sward Diversity

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WHY DO WE WANT DIVERSITY IN OUR SWARDS?

Increasing plant diversity is important. It

- often makes the sward more productive
 - increases yield
 - extends the grazing period
- improves soil health, structure, fertility and diversity
 - supports a wider range of different soil microbes and invertebrates
 - increases long-term carbon sequestration
 - legumes increase nitrogen storage and availability
- provides resilience
 - improves water infiltration
 - improves drought tolerance and recovery after floods
 - reduces the impact of plant disease and insect damage
- improves animal productivity
 - broadens their food choice and enables them to self-select a balanced diet from plants with different nutritional benefits
 - provides a range of different minerals and trace elements
 - provides a wide range of phytochemicals (plant compounds) which can be medicinal for example contain anthelmintic (anti-parasitic) properties
 - often reduces vet bills and may reduce the need for bought-in supplements
- provides a wildlife habitat

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FORAGE PLANTS

The plants successfully growing on any piece of land indicate the current and previous management, the soil type and its health status, the underlying geology and recent climatic conditions.

There are several methods of classifying the different species, but a useful way for forage management can be to divide them into grasses (plus sedges and rushes), legumes, forbs (herbaceous broadleaf, flowering plants) and woody species (shrubs and trees). Some examples found in a diverse sward are listed below.

Grasses (plus sedges and rushes)

Cocksfoot
Creeping bent
Fescues
Field wood-rush
Perennial ryegrass

Legumes (nitrogen fixing)

Red clovers
White clovers
Trefoils
Vetches

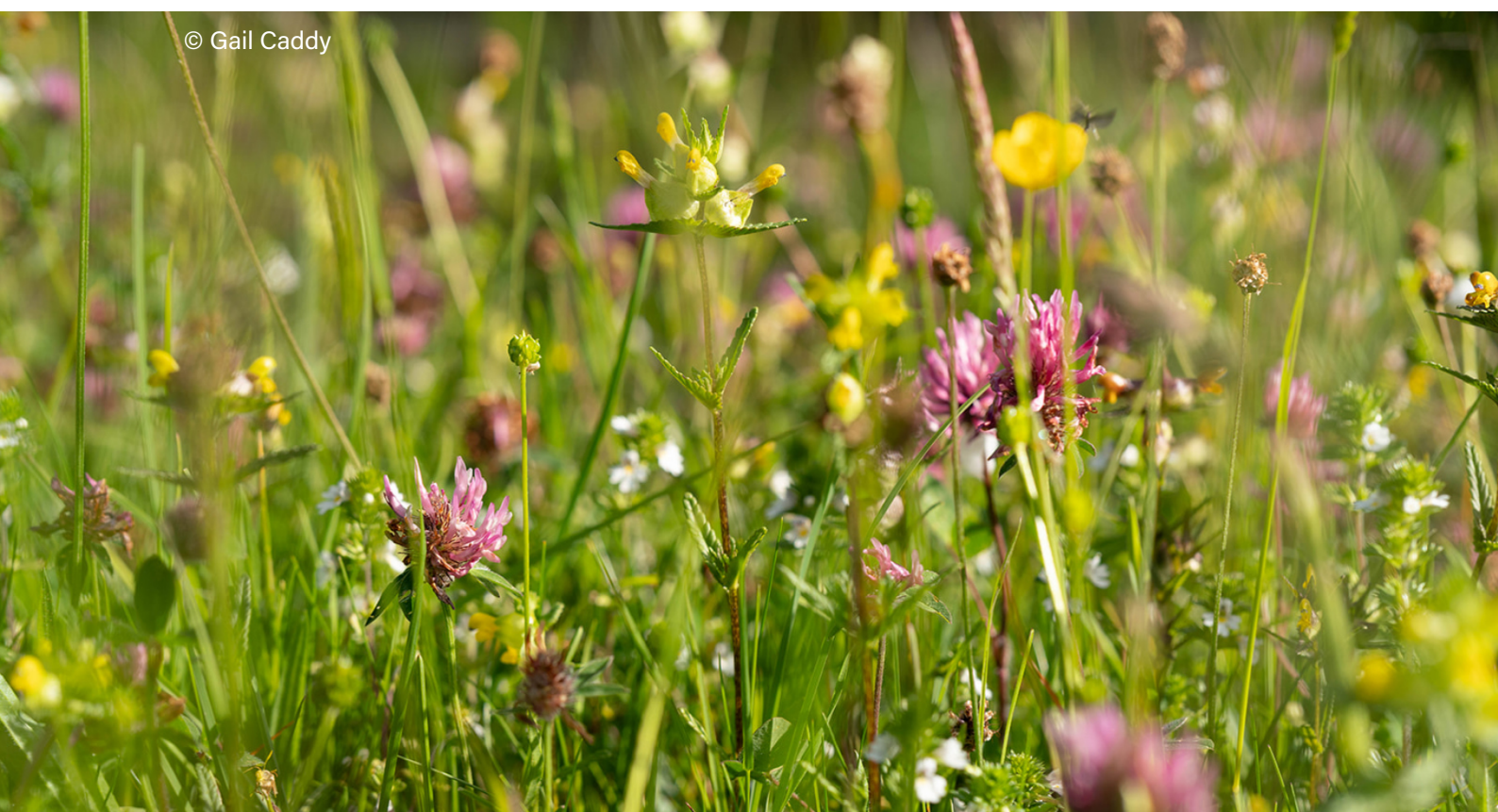
Forbs (herbaceous broadleaf, flowering plants)

Broadleaf dock
Burdocks
Dandelion
Plantains
Sheep's parsley
Thistles
Yarrow

"WEEDS" ARE USEFUL FORAGE PLANTS

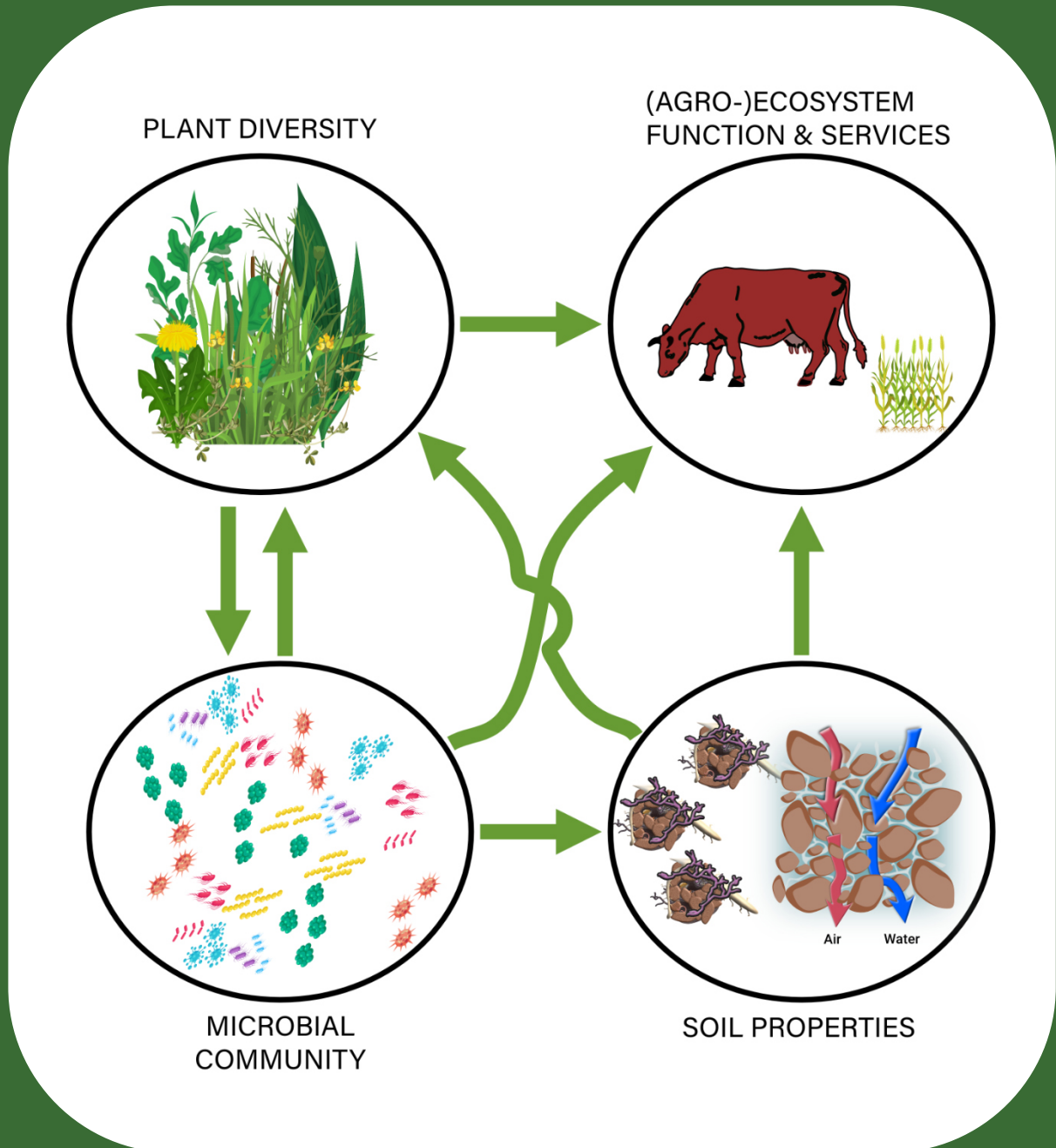
Several pasture plants are considered by some to be perennial "weeds", but many are rich in trace elements, minerals and phytochemicals (plant compounds) that probably provide unique nutritional benefits for our livestock.

Animals often seem to choose different plants to self medicate (see page 6).





PLANT DIVERSITY DRIVES AND STABILISES



Different plant species are associated with different microbial communities.

Soil microbial diversity effects soil properties for example soil aggregation and air and water permeability. This diversity also promotes agro-ecosystem functions e.g. plant growth, animal health and welfare, nutrient cycling, water infiltration and storage, mitigation of greenhouse gas emissions.



PLANT DIVERSITY AND ANIMAL HEALTH

Livestock health tends to improve and they gain weight more efficiently when they are able to graze plant mixtures compared to grazing on monocultures.

Ruminants prefer foods with the correct mix of nutrients that meets their needs. These will vary depending on the physiological state of the animal including pregnancy, lactation and presence of gastrointestinal parasites.

Animals use their senses (smell, taste and sight) and their previous experience to decide what to eat. An animal learns from (a) watching and imitating her mother and her herd mates plus (b) internal feedback sensations from plant nutrients and toxins that tell her whether she has eaten something pleasant or unpleasant.

Animals that know their environment, have experience eating a range of plants and have sufficient dietary choice rarely seem to get poisoned. However, poisoning can occur if an animal is inexperienced, or has little choice (e.g. in winter) or the palatability has altered (e.g. fallen Yew brash) or the plant compounds do not produce an immediate internal feedback sensation to warn her of its toxicity.

© Olly Walker





MINERAL LEVELS IN DIFFERENT PLANTS

Deep rooted plants are thought to be able to draw-up nutrients that are not available in the topsoil. However, the level of nutrients, trace-elements and phytochemicals in any particular plant will depend on what species it is, the soil type and health status, the underlying geology, the weather conditions and the time of year.

Mineral status of some “weeds” compared to perennial rye-grass

	Ca	Co	Cu	K	Na	Mg	P
Broad-leaved dock	+	+	+	++	+	+++	++
Common chickweed	+	+	+	+++	+++	++	+++
Creeping buttercup	+++	+	+++	+++	+++	+	+++
Common nettle	+++	+	+++	+++	+	+++	+++
Creeping thistle	+++	-	+	+++	++	++	+++
Dandelion	+++	+	+++	+	++	++	+
Sorrel	-	N/a	-	++	++	++	++
Spear thistle	+++	+	++	++	+	+++	++
Yarrow	+++	N/a	++	++	++	+++	++

Ca calcium; Co cobalt; Cu copper; K potassium; Na sodium; Mg magnesium; P phosphorus
 +, ++, +++ greater than rye grass; - less than ryegrass; N/a not available

Adapted from SRUC Technical Note TNL643

NATURAL WORMERS

A number of plants contain phytochemicals, in particular condensed tannins and saponins, with anthelmintic (anti-parasite) properties. These include plantain, birdsfoot trefoil, willow, chicory, and sainfoin.

SHEEP AND RED CLOVER

Recent research by Innovative Farmers and ADAS has shown ewes grazing a mixed sward containing an average of 18% red clover had increased pregnancy rates compared to controls. This contradicts 50 year old research from New Zealand and Australia. The difference is probably because ewes in the older study were fed exclusively on clover. The improved fertility in the new study may have been due to the range of nutrients the sheep were receiving from the mixed sward.



ANIMAL IMPACT



Herbivores do more than just graze.

- They disturb vegetation by trampling plants, breaking stems and branches as they move through the landscape. This lets more light reach ground-level plants which are then able to photosynthesise more efficiently. Depending on the season and extent of browse, this action can reinvigorate less productive trees (similar to manual tree pruning).
- They will introduce or move plant seeds around a site — either on their coats, in their hooves or through their dung. Their hooves can push seed down into any small bare patches of soil that has been revealed by optimal grazing and trampling. This type of grazing will also reduce dominant grasses that may otherwise out-compete young seedlings.
- They will introduce and move beneficial microbes (bacteria, fungi, archaea and protozoa) around a site. These microbes play fundamental roles in developing healthy ecosystems both above and below the soil.
- Dung and urine add nutrients, including nitrogen, to grassland which enhance the production of new plant material. Dung also provides an important habitat for dung dwelling invertebrates.
- Optimal impact will provide appropriate signals and conditions for the resident dormant seed bank to start germinating.



GRAZING CONSIDERATIONS

"It's not the cow, but the how" i.e. it is the way we manage our livestock that determines whether they have a positive benefit or whether their presence is destructive.

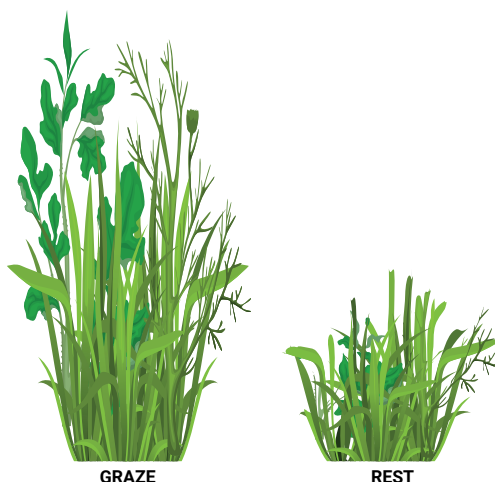
Different grazing regimes will produce different results. It helps to have clear goals from the outset. However, you may need to compromise on what you theoretically consider to be "best" in order to adapt to any site-specific issues for example infrastructure and water supply, local terrain, public access etc.

Optimal grazing management requires ongoing, careful observation and the willingness to adapt the grazing to match the conditions.

Base your management decisions on forage growth and not on a particular calendar date. Growing conditions will vary throughout the year and between different years. A number of factors can significantly impact the pasture. These include drought, heavy rainfall, ambient temperature, and loss of forage to wildlife.

It is important not to overgraze and to give plants time to recover.

- Not leaving sufficient rest and recovery period can greatly reduce the diversity – especially if the sward is grazed down to the ground and then re-grazed too soon.
- Plants grow at different rates throughout the year. Deciding when the pasture is ready to be grazed should be based on the stage of plant development not the height of the plant (plant height can be effected by weather and soil conditions).
- A simple rule of thumb, is that if the tips of the grasses are not pointed, but still show evidence of the previous grazing event, then it is too soon to re-graze.



Be flexible

Do not graze your land the same way every time. Varying how you manage your pastures will increase plant diversity. Aggressive grazing over winter or early spring followed by a prolonged rest throughout summer can reduce dominant grasses and encourage forbs. However, this approach may also slow how much, and when, forage starts growing at the start of the growing season and so will not suit every farm. Other things to consider include

- rest periods. Both when paddocks are rested in the year and for how long. Significantly increasing the rest period for some pastures – perhaps extending it to a year or more, can have profound positive effect
- the pasture grazing height that animals are put on and taken off. Allow some plants set seed.
- stocking density. This can vary the amount that is grazed versus amount that is trampled. Trampling is not "wasted" forage. It is doing an important job protecting the soil and feeding the soil fauna.
- paddock shape. Thin rectangular paddocks results in more trampling, while square paddocks encourage animals to graze more.
- the order that different species graze a paddock (if keeping multiple livestock species).



OTHER WAYS TO INCREASE PLANT DIVERSITY

A number of other management strategies can be used to increase plant diversity. Some rely on just using livestock and planning how the land is grazed. Others require more intervention (and usually more cost). For links to more information about these methods see page 11.

- “Biology makes Biology”: Start with areas that already have some plant species diversity for example “neglected” or difficult areas that haven’t been treated with fertilisers or herbicides for some time. Rest these during the main flowering season (usually May – early August) so they can flower and set seed. Graze or mow from late summer onwards.
- “Shut the Gate” and introduce longer plant rest and recovery periods. If you do not wish to introduce a rotational mob grazing system then try restricting animals at any one time to part of the farm. Leave other areas to rest – preferably for weeks or even months. If you are unconvinced with this method then trial it in a small low productive area of the farm.
- Low density, extensive grazing systems has been used for many years on many conservation grazing and higher stewardship sites. This usually result in patchy removal of material with some areas subjected to higher grazing pressure than others. The degree of patchiness depends on the relative palatability of the different plants. This creates a mosaic effect with taller denser tussocks surrounded by shorter inter-tussock areas. The removal of material by the stock allows light to better penetrate the sward so that less competitive plant species (mainly forbs) can grow alongside more vigorous species (mainly grasses).
- Traditional hay meadow management
- Introducing new seed. A number of different methods are available including
 - Use animals to transfer seed around a site.
 - ◇ When planning grazing rotations, move the animals from a more diverse area that has set seed into a less diverse one.
 - ◇ Put seed at the gateways so animals have to tread through it as they move onto a fresh grazing area.
 - ◇ Put seed on mineral licks. The animal will ingest the seed which may pass through to her dung. This method probably works better for hard-coated seeds e.g legumes. It may also be more successful with cattle than with sheep and goats
 - Feeding multi-species hay e.g for bale grazing. A on-going study by Innovative Farmers is finding that this increases plant diversity at the feeding sites. The participants of this study are finding that bale grazing has a number of other benefits.
 - Scattering green hay.
 - Over-seeding or re-seeding a pasture.
 - Herbal leys

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ADDITIONAL RESOURCES

There are many resources available for farmers who wish to increase biodiversity on their land. The following is just a small sample

Pasture for Life

PfL website - <https://www.pastureforlife.org/>

PfL Biodiversity case studies - <https://www.pastureforlife.org/biodiversity/>

PfL Youtube channel - <https://www.youtube.com/@pastureforlife7448>

Identifying pasture plants

Field Study Council guides - <https://www.field-studies-council.org/shop/>

Pl@ntNet app for smartphones (free) - <https://plantnet.org/en/>

Meadow creation and maintenance - web resources

Plantlife - <https://meadows.plantlife.org.uk/>

Magnificent Meadows - <http://www.magnificentmeadows.org.uk/advice-guidance>

Floodplain Meadow Partnership - <https://floodplainmeadows.org.uk/advice/>

Using green hay or harvest seed - Defra SFI pilot guidance - <https://defrafarming.blog.gov.uk/harvest-seeds-or-take-green-hay-to-restore-other-grassland-sites/>

Wilkinson et al: Herbal Ley Farming System: Why its lasted over 100 years - <https://agricology.co.uk/resource/herbal-ley-farming-system/>

Innovative farmers - Sheep and clover study -

<https://www.innovativefarmers.org/news/farmer-led-research-disproves-red-clover-fears-on-sheep-fertility/>

Innovative farmers - Bale grazing study -

<https://innovativefarmers.org/field-labs/how-does-bale-grazing-affect-forage-quality-and-soil-health/>

at ORFC 2024 - <https://www.youtube.com/watch?v=zr5pbpahAh>

Animal Behaviour and Feed Preferences

Fred Provenza. Nourishment. What Animals Can Teach Us about Rediscovering Our Nutritional Wisdom (2018; Chelsea Green Publishing)

BEHAVE Utah State University Extension - <https://extension.usu.edu/behave/>

Grazing management

Wilkinson et al: Mob Grazing : A farmers guide -

<https://www.cotswoldseeds.com/articles/214/mob-grazing-guide>

Understanding Ag - <https://understandingag.com/resources/>

OnPasture - <https://onpasture.com/>



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