

ALFALFA INSIGHTS

VIRENXIA'S NEWSLETTER ON ALFALFA, THE QUEEN OF FORAGES

ALFALFA, BIODIVERSITY'S BEST ALLY

VIRENXIA strives to harmonize the need for food with that of protecting natural resources through the development of an integrated approach to sustainability across forage production. Although Biodiversity is crucial to all forms of life on Earth, its importance is often neglected. VIRENXIA is in the process of promoting biodiversity in Oman through large scale sustainable Alfalfa farming, utilizing natural resources in harmony with the environment, and avoiding the use of chemical fertilizers through innovative eco-friendly technologies.

In this issue, we focus on the crucial role of biodiversity in the food chain and the environment, to see how our commitment to better Alfalfa farming practices can contribute to promote and sustain biodiversity.



BIODIVERSITY, EARTH'S BIGGEST TREASURE IS IN DANGER

A major factor in overcoming the global challenges we face is safeguarding and using biodiversity, the variety of life on our planet. Biodiversity is integral to our global ecosystem's health, essential to the sustainable increase of food production and necessary to build resilient livelihoods. However, the alarming pace of biodiversity loss today poses devastating consequences for humankind if it goes unchecked. While changes to the climate may be reversible in time, **there is no going back once species become extinct.**

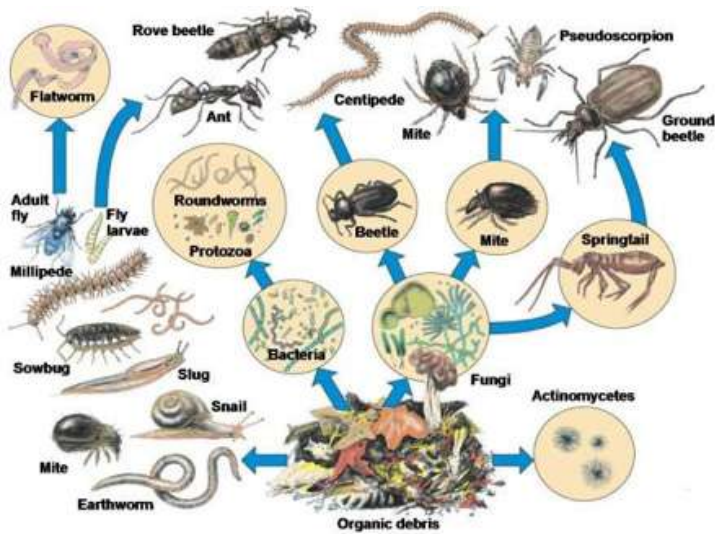


Safeguarding natural resources and biodiversity is critical to people's health and planetary wealth.

Biodiversity is the variety of plant and animal life in the world, including their genetic diversity and the variety of species and ecosystems. **When there is a rich diversity of species, habitats and genetics, ecosystems are healthier, more productive and can better adapt to challenges such as climate change.** More than variety, biodiversity holds the secret of life in the way that different species, plants and animals connect, interact and depend on one another. Forests provide homes for animals. Animals eat plants. The plants need healthy soil to grow. Bacteria and fungi help fertilize the soil. Bees and other insects carry pollen from one plant to another, enabling the plants to reproduce. Loss of species, whether animal or plant, weakens these connections and can alter the performance of an entire ecosystem. Biodiversity is the sum of all terrestrial, marine and other aquatic ecosystems, species and genetic diversity. It includes the variability within and among living organisms and the ecological complexes of which they are part. Biodiversity is understood at three levels: Ecosystem diversity refers to different habitats such as temperate or tropical forests, mountains, cold and hot

deserts, oceans, wetlands, rivers and coral reefs. Each ecosystem is characterized by complex relationships between living components such as plants and animals and non-living components such as soil, air and water. Species diversity refers to the variety of different species such as honeybees, tuna, wheat and yeast. Genetic diversity corresponds to the variety of genes contained in plants, animals, fungi and microorganisms.

Agricultural biodiversity can play a role in sustaining soil health, food and habitat for important pollinators and natural pest predators that are vital to agricultural production.



Soil Ecosystem

Agricultural sectors are major users of biodiversity but also have the potential to contribute to the protection of biodiversity.

Sustainable agriculture is a key to reversing trends that lead to biodiversity loss, damaged ecosystems, deforestation and the overall deterioration of our natural resources. If terrestrial, freshwater and marine ecosystems are managed sustainably, agricultural sectors can contribute to the provisioning of ecosystem services. These include maintenance of water quality, nutrient cycling, soil formation and rehabilitation, erosion control, carbon sequestration, resilience, habitat provision for wild species, biological pest control and pollination.

Globally, there are almost 400 000 plant species, of which just over 6 000 plant species have been cultivated for producing food. Of these, fewer than 200 plants were the sources of global food production in 2014, with only nine – sugar cane, maize, rice, wheat, potatoes, soybeans, oil palm fruit, sugar beet and cassava – accounting for over 66 percent of all crop production.

→ Three out of four crops around the globe producing fruits or seeds for human use as food depend, at least in part, on pollinators.

→ Pollinators affect 35 percent of the world's total crop production by volume, supporting the production of 87 of the leading food crops worldwide.

→ The volume of agricultural production dependent on pollinators has increased by 300 percent in the past 50 years

ALFALFA – THE BEGINNING OF A FOOD CHAIN

While most people see an alfalfa field as simply a uniform horizontal green mass, of benefit only to the farmer, **an alfalfa field is teeming with many forms of life that enrich us all.** To many species of wildlife, alfalfa fields provide an oasis of green in landscapes of tilled fields or dry brush. Alfalfa is a 'primary producer' that supports many types of insects and vertebrate herbivores. In turn, songbirds, migratory birds, birds of prey, hunting mammals, snakes, and lizards feed upon the herbivores. Deer, antelope, and elk commonly feed in alfalfa fields, especially in times of drought. Foxes can be seen hunting rabbits and gophers, which feed on alfalfa fields. Many raptor species, including Swainson's Hawk and bald eagles, can be found hunting in alfalfa fields. **Alfalfa is the beginning of a food chain that supports not only millions of farm animals and human beings, but many forms of wildlife that are important to the Earth's ecosystems.**



Alfalfa Enriches Wildlife Habitat...

It's an effective cover for many species for feeding, sleeping, nesting, or escaping predators.

- **Below-Ground Diversity.** There is considerable below-ground biological activity in alfalfa fields, including earth worms, insects, and other organisms. Gophers and other rodents frequently make their homes under alfalfa fields.
- **Insect Diversity.** There is a wide range of insects, both herbivores and predators, that are present in large populations in alfalfa fields.
- **Frequent Irrigations.** The presence of irrigation water in alfalfa fields during hot periods is important to wildlife species as well as to the crop. In some environments, alfalfa irrigations are a welcome respite for thirsty animals. Irrigation also flushes insects and rodents to the surface, which are food sources for birds, snakes, and raptors, such as eagles and hawks. Irrigation and a closed canopy creates a humid microclimate desirable for insects and bird eggs.
- **Open Spaces for Hunting.** Raptors are frequently found soaring above alfalfa fields, or awaiting prey from nearby posts. Some growers have planted trees, provided raptor poles, or built owl boxes to encourage raptor habitat in an otherwise horizontal landscape. Around the field margins animals can easily find trees, shrubs and weeds in which to nest, coupled with access to a plentiful supply of water nearby. Of all the animals that use alfalfa (not including insects or reptiles), 10% use it extensively for breeding and reproduction, 4% find it highly suitable for cover, and 57% use it for feeding.



Alfalfa – the wildlife Food Chain.

The alfalfa wildlife food chain begins with alfalfa itself – a high quality, palatable crop to foragers. Next there are the smallest, and most abundant creatures – the insects, of which there are hundreds of species. Each successive re-growth of alfalfa creates an environment that teems with insect life. Depending on these insects for feed are a large number of species, including songbirds, swallows, bats, and many types of waterfowl and migratory birds. Feeding directly on the alfalfa are mammals such as gophers, mice, and rabbits. Larger herbivorous mammals, such as deer, antelope, and elk, frequent alfalfa fields, especially during dry or cold seasons. Hawks, eagles, migratory birds, coyotes, and mountain lions feed on the birds and rodents that feed on the alfalfa. Finally scavengers such as coyotes and vultures feed on the carrion to complete the food chain.

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re-growth of alfalfa
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Alfalfa – an Incredible Insectary

Less than 1% of these arthropods inflict damage to alfalfa farming.

A field side view of an alfalfa field may show little apparent activity – simply a mass of green. But look a little closer – alfalfa teems with insect life! The diversity of insects in alfalfa fields have been described as ‘incredible’ by researchers – it is a great resource for insect diversity.

Researchers from California have identified over 1,000 arthropod species (insects, spiders, mites, and other relatives) that inhabit alfalfa fields.

A small percentage (less than 1%) of these arthropods inflict damage to alfalfa and cause concern to alfalfa growers. Several of these insects function as predators and parasites. From a crop production standpoint, these are considered beneficial organisms. However, most of the arthropods in the alfalfa system are neither beneficial nor detrimental; their populations simply reside in alfalfa fields. Though not highly visible, they add to overall biodiversity of the landscape. **Why is alfalfa such a desirable habitat for many insect species?**

Alfalfa has unique attributes. The dense foliage of alfalfa during much of the year, retention of moisture, and high availability of food resources meet the major requirements of these organisms. Annual cropping systems are too short-term to function well for insect biodiversity. Other perennial crops such as orchards and vineyards fulfill the stability requirement, but they often have barren soil. Barren soil is needed for orchard production during portions of the year but does not favor insect survival. In addition, natural areas such as the foothill vegetation may not adequately maintain moisture for some organisms.

Properly managed alfalfa fields can aid in the management of crop pests in other cropping systems. This was recognized some 40 years ago and is becoming an increasingly important tool in Integrated Pest Management (IPM) systems. These types of natural control measures may reduce the reliance on insecticides and benefit birds, mammals and reptiles. Alfalfa fields are known as insectaries because of the high number of beneficial insects residing within them.



Farmers utilize alfalfa as a pest management tool in several ways including:

- Planting strips of alfalfa within other crops, such as cotton, to aid in managing cotton pests such as plant bugs and spider mites,
- Managing alfalfa cutting cycles to maintain growth and habitat for insect predators and parasites,
- Leaving a few strips of un-harvested alfalfa within fields at the time of cutting to allow for insect survival.

Conserving these populations of helpful insects and allowing them to move into fields of vegetables, cotton, and other crops saves growers money and helps to protect the environment. Further research is underway to better understand and define the role of alfalfa in insect pest management.

Going Batty in Alfalfa

A colony of several hundred bats can consume millions of insect pests each growing season.

Bats are one of the most under-appreciated wild species that use alfalfa. Some bat species use alfalfa fields extensively for feeding, but bats also may play a role in controlling insect pests. Their preferred objects of prey are moths, including important yield reducing pests such as cutworms or armyworms (moths in larval form).

Bats also “chase” insects away with their echolocation calls – this effect can be seen up to 130 feet away. A colony of several hundred bats can consume millions of insect pests each growing season. A number of growers have installed bat houses on their farms to attract bats to aid in insect pest control.



Barn Owls in Alfalfa

Barn owls feed almost exclusively on rodents. They use alfalfa significantly for feeding when their nests are located near alfalfa fields. Growers like to see barn owls on their farms since rodents can significantly harm alfalfa fields if populations go unchecked. During the spring and summer, barn owls eat mostly gophers, then switch to voles and mice during winter. A pair of nesting barn owls will eat an average of almost one gopher per day. Barn owls are limited by the availability of nesting cavities and readily use artificial nest boxes, so some growers have built nesting boxes on their ranches. Barn owls exhibit a low degree of territoriality, so several houses may be concentrated in a small area, such as around a barn.

BIRDS REDUCE ALFALFA INSECT PESTS BY 33%

THIS EFFECT WAS CONSISTENT ACROSS ALL FIELDS, BUT FIELDS WITH TREES ALONG THEIR EDGES HAD LOWER ABUNDANCES OF WEEVILS TO START WITH, ESPECIALLY NEAR THE EDGE.

Alfalfa is grown on 800, 000 - 1 million acres across California each year, with an annual value of over \$1.2 billion. Alfalfa weevils are a key pest, often requiring farmers to spray insecticides to control them. This experiment was conducted in 32 alfalfa fields over 2 winters to find out if birds are providing alfalfa farmers with pest control services.



Just the presence of woody vegetation along field edges resulted in significant biodiversity benefits. Fields with at least 2 trees had over 13 species of birds, whereas fields with just weeds or dirt roads had only 5 species of birds. Avian diversity increased as the complexity of edge habitat increased. Retaining or planting woody vegetation in the un-cultivated margins between fields can therefore greatly benefit over-wintering birds, which in turn provide pest-control services.

The presence of birds helps in reducing pest occurrence substantially.



**Planting trees nearby
Alfalfa fields will help
attract a beneficial
bird population.**



Enclosures (cages meant to keep birds out) were used to measure the amount of weevils consumed by birds and other large vertebrates. Enclosures were made of PVC pipe and bird-netting, so stopped birds, but not insects, from moving through them.

Savannah sparrows, red-winged blackbirds, pipits, swallows, crows, and meadowlarks were the most abundant birds in our fields - and all were more abundant in fields with trees along their edges. All of these species are likely to eat insects during winter.

Simple conservation measures can benefit biodiversity and provide ecosystem services.

Source: Publication of California Alfalfa & Forage Association

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