

Slovenia

Hotspot of biodiversity

Slovenia boasts one of the highest biodiversity in Europe, and trails only countries with tropical rainforests on the global level. Slovenia is home to at least 1 % of all known organisms – of which over 3,500 are plant species – even though it covers only 0.004 % of total surface of the Earth.

Biodiversity (or biotic diversity) is the diversity of living creatures, each with their own indispensable role in the environment. The diversity of pollinators and plants provides us with food.

The Botanic Garden is also an area with exceptional plant biodiversity, and you can find up to 5,000 species and subspecies from across the world – a little piece of nature in the very centre of Ljubljana.

Why is biodiversity so high in Slovenia?

The territory of Slovenia lies on a juncture of four geographic units (the Alps, the Mediterranean, the Dinarides, and the Pannonian Basin) and consequently four climate zones, has diverse rock compositions and therefore very diverse soil. All this results in diverse living conditions and therefore high biodiversity. Another contributing factor for such high biodiversity is the particular development in geological history, primarily during ice ages.



rich biodiversity of plants in the Botanic Gardens



Fleischmann's parsnip (*Pastinaca sativa* var. *fleischmanni*)

Do you know that there are as many as 39 plant endemics in Slovenia?

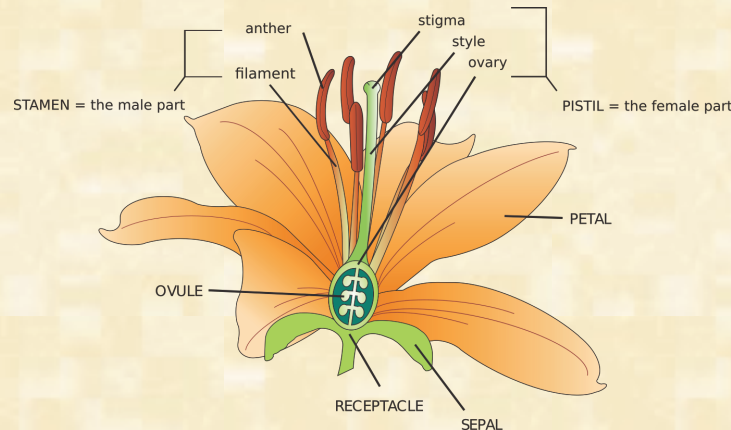
An endemic is an animal or plant that is native to a very limited area of the world. Among over 850 animal endemics, most are ground animals. Among plants, 39 are Slovenian endemics and 34 are endemics that also occur in neighboring countries. The most famous endemics are the olm (*Proteus anguinus*), endemic to the Dinarides, which was first described in Slovenia, and, among plants, the Slovenian endemic, which now grows only in the Botanic Garden and is extinct in the wild - Fleischmann's parsnip (*Pastinaca sativa* var. *fleischmanni*).

What

is pollination?

Pollination is an essential part of **plant reproduction**. Pollen from a flower's **anthers** (the male part of the flower) rubs or drops onto a pollinator. The pollinators then take this pollen to the next flower, where the pollen sticks to the **stigma** (the female part). The fertilized flower later yields fruit and seeds.

Carniolan bee (*Apis mellifera* subsp. *carnica*) on Spring Crocus (*Crocus vernus*)



Do you know why some species of bees, for example bumblebees, buzz?

Some plants like tomatoes and blueberries release their pollen through two tiny spores in each anther. Bees bite the anthers, hold tight, and buzz to shake the pollen out of the flowers. Bumblebees are living tuning forks, using a middle C tone to propel thousands of pollen grains from flower under a second.

When

does pollination happen?

Successful pollination requires year-around efforts. Plants have evolved with differing flowering times that **decrease competition among pollinators**. Continuous blooms throughout the growing season **provide pollinators with a constant food supply**.

Spring: Pollinators need early blooming plants to provide food after hibernation or northern migrations. Bulbs, spring ephemerals and fruit trees are visited during this time.

Summer: Our gardens achieve their peak bloom when many pollinators reach peak populations. The long days of summer allow pollinators the maximum time to forage for nectar.

Fall: Late blooming plants provide many pollinators with needed fuel before hibernation or for the southern migrations of pollinators. Such travelers are monarchs and hummingbirds from America, butterfly Painted lady, moths convolvulus hawk-moth and silver Y from Slovenia.

Winter: Even when there appears to be no activity, pollinators are in the garden. Leave decaying plants alone – they may be sheltering pollinating insects as they overwinter.

At the beginning of each spring, monarch butterflies migrate north from Mexico, following the growth of milkweed. They travel up to 48 km a day, returning to Mexico in the fall.

The painted lady butterfly has the longest migration route among European butterflies. Each spring they migrate from North Africa and Asia Minor to northern Europe and Asia. For example, they can migrate up to 4000 km from North Africa to England, Finland and even to Iceland!

Peacock butterfly (*Inachis io*) on a widow flower (*Knautia*)

Do you know some butterflies travel thousands of miles?

Bird's-eye Primrose (*Primula farinosa*)

Who

pollinates?

Plants and pollinators evolved side by side over millions of years. Natural selection has resulted in **physical adaptations in both plants and pollinators**. Plants have developed many complex ways of attracting pollinators.

Similarly, pollinators have evolved with specialised physical traits and behaviors that enhance their pollination efforts. Each participant, plant and pollinator, **usually gains a benefit from pollination**.



Dandelion flower as humans see them

Dandelion flower as bees see them

Most plants need help from wind, water, or a diverse group of animals called pollinators to **fertilize their flowers and reproduce**. Pollinators have **distinct preferences** for the flowers they visit.

Do you know bees and flowers have secrets?

Bees and a few other pollinators can see the **ultraviolet (UV) part of the light spectrum**. Flowers like dandelion that look uniformly yellow to humans actually have nectar guides that help pollinators quickly locate the center of each flower.

Why

is pollination important?

Pollination is **vital** for a strong ecosystem. Pollination has evolved over millions of years and **benefits both flowering plants and pollinators**.

One in a three bites of food you eat depends on pollinators. Pollination by insects adds **22 billion in value to agricultural crops** in Europe.

Apples, Peaches, Pears, Plums, Cherries, Alfalfa, Blueberries, Cranberries, Tomatoes, Kiwi, Figs, Strawberries, Blackberries, Raspberries, Eggplants, Nectarines, Grapes, Almonds, Oranges, Lemons, Limes, Kumquats, Avocados, Vanilla, Coffee, Cocoa, **and more**.



Do you know which foods depend on pollination?

All of these and MORE!

Where

do pollinators live?

Pollinator habitat **depends on the pollinator and their life cycle stage**. For example, bees can use leaves, mud, sand, plant resins and even abandoned snail shells for their nests, while many butterfly larvae live and feed only on one specific plant.

Pollinators also need **foraging habitat with diverse nectar-providing plant species**.



Farming



Road Construction



Housing Development

Human activities, such as farming, housing development, and road construction, can **fragment a pollinator's habitat**. Disconnecting where the pollinator lives from where it forages for food. Pollinator habitats need to be within easy range of food and clean, shallow water.

Honey bees communicate through a **waggle dance** in which scout bees return to the nest and dance to inform other bees about distance and direction of a newly discovered flower patch.



Do you know how bees find a flower patch?

How

can you help pollinators?

Pollinator populations are at risk. **Decades of stressors** including the loss, degradation, and fragmentation of pollinator habitats; the improper use of pesticides; and diseases, predation, and parasites have all **hurt pollinators**.

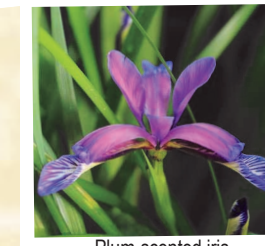
You can help pollinators by **creating a pollinator-friendly habitat** without sacrificing aesthetics. Check out our nursery and bookshop for more ideas and to research the best plants.



Broad leaved anemone (*Anemone hortensis*)



Alpine strawberry (*Fragaria vesca*)



Plum-scented iris (*Iris graminea*)



Carniolan scopolia (*Scopolia carniolica*)

Add diversity to your landscape with a beautiful tapestry of native plants that have evolved with local pollinators and thrive under the conditions in your region.

Do you know the importance of bees has been noticed?

Because pollinators are important and endangered, the United Nations General Assembly unanimously adopted the Slovenian initiative on December 20, 2017 and proclaimed May 20th World Bee Day.

Pollinator Profile: bees

Flower nectar provides bees the sugar to **fuel their flights**. The proteins and amino acids in pollen are vital nutrients needed by the young bee larvae back in the nest.

Camolan Bee
(*Apis mellifera* subsp. *carnica*)

Favorite Flowers

- ✓ **Flower Color:** bright white, yellow, or blue, with ultraviolet (UV) patterns
- ✓ **Nectar Guides:** present
- ✓ **Odor:** fresh, mild, pleasant
- ✓ **Nectar:** usually present
- ✓ **Pollen:** limited; often sticky and scented
- ✓ **Flower Shape:** shallow, with a landing platform; tubular

Most bees are not picky and frequently visit a large variety of flowers.

Most bees live solitary lives; only 20 % of the world's 20,000 bee species live in colonies. Most of the over 560 wild bee species registered in Slovenia so far are solitary too.

Bees have little interest in humans and will not sting you if you don't bother them.

Pollinator Profile: Beetles

Beetles are referred to as "**mess and soil**" pollinators. Less elegant than other pollinators, beetles blunder their way through delicate blossoms searching for food, a mate, or perhaps the bathroom.

Favorite Flowers

- ✓ **Flower Color:** dull white or green
- ✓ **Nectar Guides:** absent
- ✓ **Odor:** none to strongly fruity or fetid (stinky)
- ✓ **Nectar:** sometimes present; not hidden
- ✓ **Pollen:** ample
- ✓ **Flower Shape:** large and bowl-like



Cylindrical Leaf Beetle (*Cryptocephalus sericeus*)
Pannonic Thistle (*Cirsium pannonicum*)

Beetles frequently visit flowers in the parsley family and flowers close to the ground.

Do you know beetles are abundant and ancient?

There are almost **four times as many species of beetles** as animals with backbones. Beetles were among the **very first pollinators**.

Pollinator Profile: Butterflies

Butterflies often visit round flowers with flared petals that lead to **narrow throats that conceal nectar**. Butterflies land on the wide petals then **delicately probe the flower's nectary** (the gland that produces the nectar) with their **long proboscis (tongue)**.

Favorite Flowers

- ✓ **Flower Color:** bright, especially pink, light blue, yellow or white, along with red and purple. Butterflies are one of the few insects able to see red.
- ✓ **Nectar Guides:** present
- ✓ **Odor:** faint, but fresh and sweet
- ✓ **Nectar:** ample; deeply hidden
- ✓ **Pollen:** limited
- ✓ **Flower Shape:** narrow tube with spur; wide landing pad



Painted lady (*Vanessa cardui*)
Jacquin's kidney vetch (*Anthyllis jacquinii*)

Butterflies frequently visit salvias, thistles and carnation family flowers.

Do you know caterpillars are picky eaters?

Butterflies find nectar from many plants but caterpillars eat the leaves of very specific trees, shrubs, perennials or annual plants.

Pollinator Profile: Moths

Most moths go unnoticed even though they **outnumber butterflies 10 to 1**. Why? They are often **active at night** and **dull in appearance**. Night-blooming flowers have sweet scents and white or cream-colored blossoms that reflect the moonlight to attract moths after the sun sets.

Favorite Flowers

- ✓ **Flower Color:** pale and dull red, purple, pink or white
- ✓ **Nectar Guides:** absent
- ✓ **Odor:** strong sweet; emitted at night
- ✓ **Nectar:** ample; deeply hidden
- ✓ **Pollen:** limited
- ✓ **Flower Shape:** regular; tubular without a lip



Hummingbird Hawk-moth (*Macroglossum stellatarum*)
Sticky sage (*Salvia glutinosa*)

Moths frequently visit morning glory, evening primroses and fringed orchid.

Do you know another nocturnal pollinator?

Though you won't see any bats pollinating plants here, bats are nighttime pollinators in many parts of the world. They pollinate some of our favorite tropical fruits like bananas, and mangoes.

Pollinator Profile: Flies

Some flies act just like bees, visiting sweet-smelling flowers. Others have more disgusting tastes. They are attracted to flowers with **putrid odors, meat-like colors, or fur-like textures** that lure them in by pretending to be the **fresh dung or dead animal** that flies desire.

Favorite Flowers

- ✓ **Flower Color:** pale and dull to dark brown or purple; flecked with translucent patches
- ✓ **Nectar Guides:** absent
- ✓ **Odor:** putrid
- ✓ **Nectar:** absent
- ✓ **Pollen:** modest
- ✓ **Flower Shape:** shallow; funnel-like or complex and trap-like

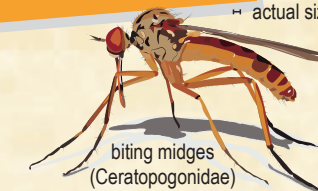


Dasyrhaphis ater
Rue (*Ruta divaricata*)

Flies frequently visit Dutchman's pipe, arum lilies, and some viburnums.

Do you know we can thank flies for chocolate?

Tiny flies called **biting midges** that inhabit the damp, shady rainforest are the only pollinator able to navigate the complex cacao flower.



biting midges
(Ceratopogonidae)

Pollinator Profile: Wind

Not all pollination relies on the animals. Wind pollinates grains, most nuts, many trees and the wild grasses that provide forage for livestock. The odds are small that a pollen grain will find its way to a corn silk but each kernel of corn is a tiny fruit resulting from successful wind pollination.

Typical Flowers

- ✓ **Flower Color:** dull green, brown, or colorless
- ✓ **Nectar Guides:** absent
- ✓ **Odor:** none
- ✓ **Nectar:** none
- ✓ **Pollen:** abundant; small, smooth, and not sticky
- ✓ **Flower Shape:** regular; small and stigmas exerted; petals absent or reduced



Corn (*Zea mais*)

Wheat, corn, rice, barley, oats, rye and millet rely on wind for pollination.

Do you know another element that plays a role in pollination?

Water usually destroys pollen grain. But in some unique cases, water carries pollen from one plant to another.

POLLINATION INVESTIGATION

Plants and their pollinators represent an important part of biodiversity. The educational trail highlights the diversity of their relationships, which have developed in millions of years of evolution. Nearly **90 % of flowering plants** rely on about **200,000 species of animal pollinators** for fertilization. From butterflies and bees to flies and beetles, most pollinators are insects. But in some countries birds, bats, and small mammals also pollinate plants.

The leaflet is part of the 'Pollination Investigation' educational trail, which was created in the Botanical Garden of the University of Ljubljana as part of the project LIFE NATURAVIVA, Biodiversity – Art of Life, in collaboration with the Smithsonian Institution in Washington and the US Embassy in Ljubljana. The panels have been translated to Slovenian and rearranged to show the diversity of plants and pollinators in Slovenia.

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We eat their fruits, grains, and vegetables, and use their wood to build everything from boats to furniture to homes. Medicines come from their eaves, seeds, bark, and flowers. They filter water and buffer coastlines from storms. Their leaves release much of the oxygen we breathe.

Do you know that flowering plants are more than just pretty?

