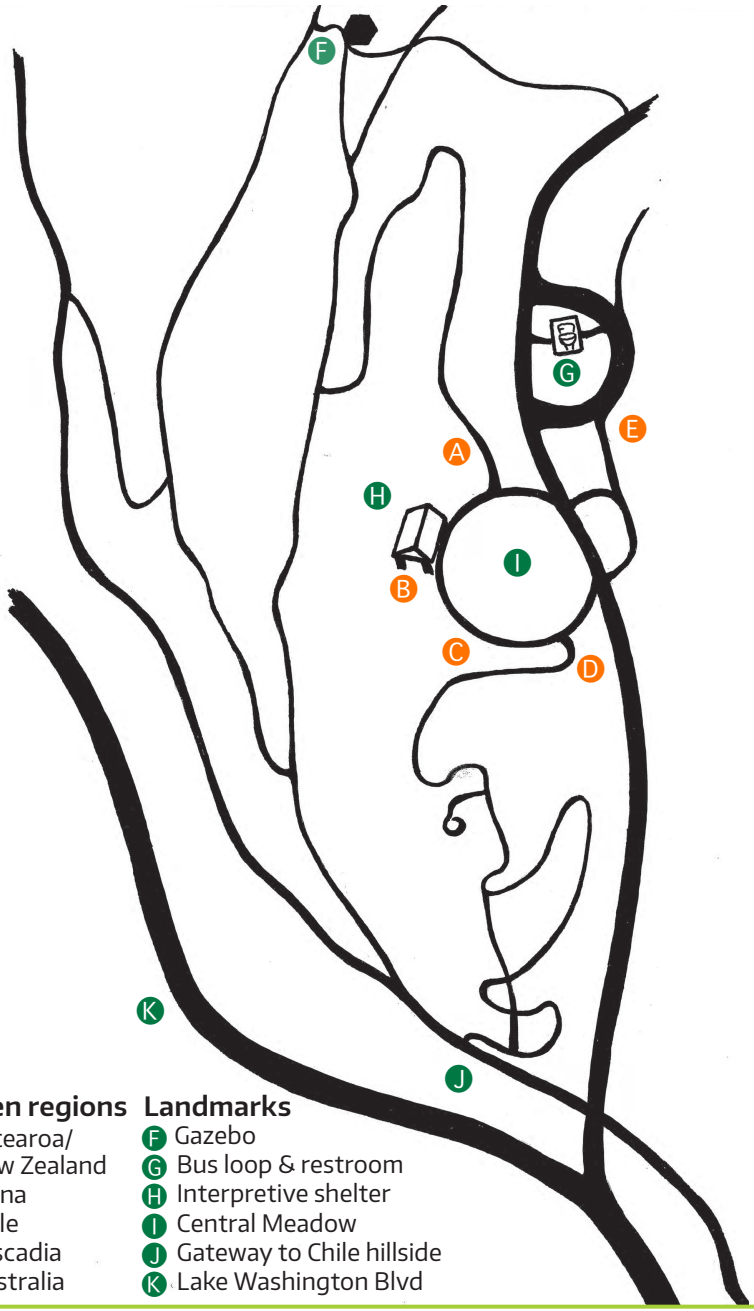
FIELD GUIDE TO THE

PACIFIC CONNECTIONS GARDEN



Garden regions

- A Aotearoa/ New Zealand
- B China
- C Chile
- D Cascadia
- E Australia

Landmarks

- F Gazebo
- G Bus loop & restroom
- H Interpretive shelter
- I Central Meadow
- J Gateway to Chile hillside
- K Lake Washington Blvd

ABOUT THE GARDEN

The Pacific Connections Garden celebrates the web of ecological relationships across the Pacific Ocean and throughout the city of Seattle. Every regional garden within it shows us an ecological history and community of that particular place and how those species adapt to our environment.

Around the meadow at the center of the Pacific Connections Garden, entry gardens highlight iconic plants from each region. These beds aren't meant to be as naturalistic in their representations of each ecosystem, but they are nonetheless living things that show their connections to each other. The forests–two of which are built, and the rest of which are in the works–spread out behind the entry beds, populated by plants of wild origin and cared for in a way that reflects their naturalistic habits.

ABOUT THIS GUIDE

The first step toward learning about these relationships is paying attention to them–learning to observe and appreciate the ever-changing web of life around us. This guide highlights the adaptations and interactions that are characteristic of any ecosystem but especially urban nature–cities, far from being nature-less voids, are constantly-changing patchworks of time, place, and connection as shown through living things.

The Arboretum itself is a living museum. This means its collections are both carefully designed and can't be fully controlled, and as caretakers, we are constantly negotiating our place in this ecological web. Often, this means protecting our plants from harm–as you walk around, notice the short fences guarding young plants from rabbits, or the signs warning people against damaging trees.

But just as often, managing a healthy garden means encouraging and supporting interconnectedness. Visitors often ask our tour guides how we keep away moles and other organisms commonly seen as pests but the truth is we often rely on them. Several years ago, moles expanding their tunnel network saved a large, old tree near the visitor center, where severely compacted soil had been cutting off its supply of water and nutrients. Managing the Arboretum, then, is not a fight against nature but a collaboration with it.

Even if we don't realize it, all of us are integral components of Seattle's ecological web. Use this guide as a starting point to see how we all connect.

HOW TO USE THIS GUIDE

This guide is first and foremost organized by garden region:

CENTRAL MEADOW & COMMON VOLUNTEERS
Holly - Ferns - Moss & lichen

CASCADIA
Red Flowering Currant - Bigleaf Maple & Snags

CHILE
Pehuén/Monkey Puzzle Tree - Ciruelillo/Chilean fire tree

CHINA
Ginkgo - Sweetshoot Bamboo

AUSTRALIA
Wollemi Pine

AOTEAROA/NEW ZEALAND
Korokio/Wire Netting Bush - Mingimingi/Coprosma Propinqua

Throughout the guide, find:

- → Narratives of species' history and relationships
- → Up-close sketches of species' identifying features
- → Descriptions of identifying features like texture, color, size, and growth habit
- → "**Look for**" prompts for close observation on the go
- → Color-coded references to related **plants**, **animals (and fungi)**, **ecological terms**, and **geographic and historical context**
- → Information about the seasonality (aka **phenology**) of different phenomena, highlighted in green boxes
- → Information about where and how to look for these species and their relatives in the city, in boxes with a dark green border (like this one)
- → Space to record your own observations

In the back, find a **phenology key** for what to look for through the seasons and an **urban ecology index** to navigate by:

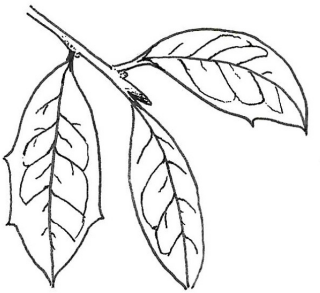
- → Connections across space and time
- → Interactions with other plants and wildlife in the city
- → Thriving in "unnatural" conditions of the city

Above all, take this guide as encouragement to look closer: reach out and feel the textures of leaves and mosses (gently, of course) and crouch down to investigate low-growing plants.

CENTRAL MEADOW & COMMON VOLUNTEERS

This section of the guide covers garden residents that some may see as incidental: remnants of previous plantings before this garden was designed and **volunteers** that appear without us intentionally planting them. In this garden, these plants (and fungi) represent local ecology, shaped by climate and history as it is, as well as the new ecological community of the plants from around the Pacific.

HOLLY



A few yards away from the interpretive shelter is a stand of holly trees with long, drooping branches. We often think of hollies as shrubs, but often their twisted trunks can grow into hardy trees, thriving in our moist, temperate climate.

For many holly species, their iconic spiky leaves only develop as a response to **browsing animals** (animals that eat the leaves and young shoots of trees and shrubs)–**look for** spikier leaves within reach of animals on the ground and smoother ones higher up in the crown. This phenomenon, where differently shaped leaves grow on the same plant, is called **heterophylly**.

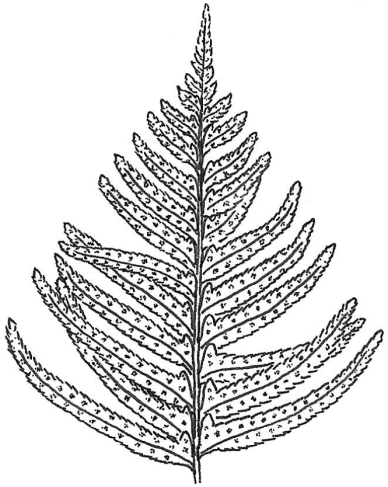
Around the city:

In this central meadow reside *Ilex opaca* (**American holly**) and *Ilex purpurea* **(purple or Kashi holly)**, remnants from when this was the home of the Arboretum's holly collection. Their cousin, *Ilex aquifolium*, or **English Holly**, is what you'll most commonly see around the city, the result of mass plantings from the 1920s and 30s expanding as birds snack on the berries and spread the seeds. The problem is, English holly is so good at spreading and at crowding out other species that it is now listed by the King County Noxious Weed Board as a **"Weed of Concern"**–harmful, but already too widespread and well-established to mandate removal and control.

FERNS

The gift of our grey weather! Ferns evolved roughly 360 million years ago and have thrived ever since because of their affinity for the dank, dim places unpopular with their would-be competitors. Because of our damp, grey climate, ferns from around the world love it here–around the garden and the city, **look for** a diverse array of fern shapes and textures.

Sword ferns (aka pala-pala, *Polystichum munitum*) are Seattle's most ubiquitous fern. They provide food for browsing animals (deer, beavers, and bears, for a few), as well as habitat for **ground-nesting birds** like the **song sparrow** and **spotted towhee**. Many gardeners cut back last year's brown, crispy fronds every spring, but in these more naturalistic garden spaces we leave them so that the birds can still find cover–look at the base of the plants for these fronds, and watch and listen for signs of birds and other wildlife underneath.



The end of a sword fern frond.

At a distance, sword ferns' long, straight fronds can seem smooth or even waxy, but fuzzy, spiky details appear on a closer look.

On each leaflet, look for:

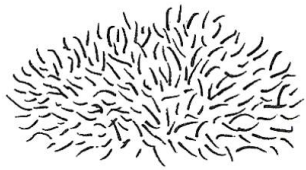
pairs of spores along its full extent, an upward-pointing lobe at its base, and serrated margins.

Meadow & fern notes

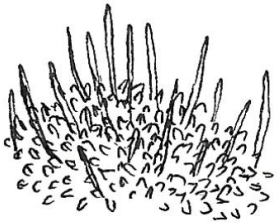
MOSS & LICHEN

Mosses, along with hornworts and liverworts, are **bryophytes**–plants that don't have veins to carry water up a tall stem and so remain low-growing as they absorb moisture through their surfaces.

Each of the hundred-some species of moss that inhabit Seattle has its own preferences for moisture, light, and substrate (growing surface), making a patchwork of colors and textures around the city. In this garden and throughout the city, **look for** these diverse colors and textures among mosses that grow on sidewalks, stones, walls, trees, lawns, fences, and roofs.



Dicranoweisia cirrata thrives on roofs, fences, and all types of wooden substrate



Tortula muralis, also called wall-screw moss, can often be found on concrete and other stone surfaces

On trees, moss helps regulate moisture, storing water that flows down the trunk (**stemflow**) so it isn't lost after the rainfall ends. Stemflow can help explain why moss often grows on one side of a tree trunk more than the other–moss likes shady, wet places, so whatever part of the tree produces those conditions best (on a leaning tree, often the side of the trunk facing upward so it'll catch the rain but is still shaded by the branches) is where the moss will grow.

Around the city:

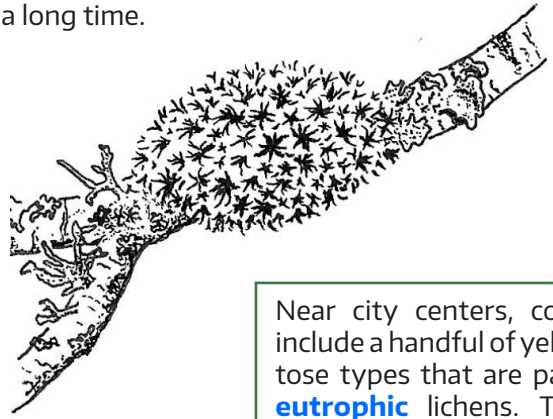
These tough, creative plants are often more diverse in cities than out of them, thriving in the variety of harsh habitats on buildings and sidewalks and spreading their spores via foot traffic. As you walk around the city, think of the life you're ferrying about with each step.

In fact, some ecologists advocate for the **urban cliff hypothesis**, which connects species common in cities today and those native to cliff ecosystems and other rocky slopes (**mosses**, **mice**, **pigeons**, **cockroaches**, and others) and posits that city dwelling has always been a group effort, not a solely human pursuit.

Though not as hungry for city niches as mosses are, lichen fit right in among our crowded buildings. In fact, lichen are like houses in and of themselves–**fungus** forms their outer structure, and **algae** live inside of it, photosynthesizing and sharing the resulting sugars with their fungal host.

Thousands of lichen species can be found around the Pacific Northwest Coast, but no matter where you go, they come in three general shapes: **crustose** (forming a crust flat against the substrate), **foliose** (leafy) and **fruticose** (shrubby, with thin, branching shapes).

Lichens are also excellent indicators of air quality, as both the fungus and algae absorb nutrients–and pollutants–from the air. Healthier air means more diverse and longer-lived lichen, which makes a dramatic difference especially when considering how slowly and carefully lichen grow. As a general rule, when lichen in a particular place have grown into diverse and distinctive shapes, it means they've had the opportunity to thrive there for a long time.



Around the city:

Near city centers, common lichen often include a handful of yellow and orange crustose types that are part of a group called **eutrophic** lichens. These lichens thrive off of high nitrogen content in the air, and so are abundant in places where nitrogen dioxide, a common byproduct of burning fossil fuels, is drifting around on the wind.

CASCADIA

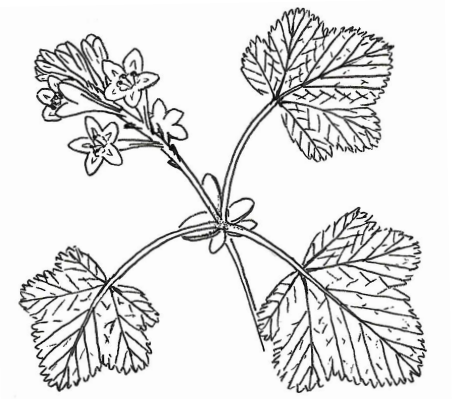
The Cascadia forest mimics the habitat of the **Siskiyou Mountains**, which stretch from southern Oregon to northern California. Incredibly diverse populations of plants thrive in the range's nutrient-poor soil, as species adapted to the temperate Pacific Northwest transition to those who make their home in the hotter, drier climates of California. This population also includes what might be the most varied collection of **conifers** in the world–as you make your way through the forest, **look for** the diverse colors, shapes, and textures of the conifers along the path. Look out, too, for native volunteers like **sword ferns** (tall, straight fronds sprouting out of a central base) and **Oregon grape** (a shrub with holly-like leaves and clusters of round yellow flowers) sharing space with less familiar species.

FLOWERING CURRANT

Also called *Ribes sanguineum*

Find this plant in the Cascadia entry garden, leading up into the forest trail.

Look for hummingbirds dipping their beaks into the center of these flowers, where the nectar is stored.



Clusters of small, trumpet-like flowers bloom **late February to early May**. Usually, *Ribes sanguineum* flowers are a bright magenta (hence the plant often being called red-flowering currant), but multiple white-flowering cultivars appear beside it.

Flowering currant flourishes in dryish woods and human-disturbed sites like roadsides and clearings. Its small, tube-shaped flowers, which bloom from late February to early May, are favorites of hummingbirds (which reliably feed from all colorful, tube-shaped flowers). This native springtime nectar source is supplemented by hummingbird feeders and garden plants from warmer climates, providing a year-round nectar supply that enables the **Anna's hummingbird** to thrive in the city throughout the seasons.

BIGLEAF MAPLE & SNAGS

Look (and listen) for cavity-nesting birds like woodpeckers, swallows, chickadees, and nuthatches, which often make their homes in snags. In Western Washington, their nesting season often falls between **April and July.**

Look out for snags–upright dead or dying trees, often missing their branches. Many of the snags in the PCG are **bigleaf maples**, removed and cut back to make room for Siskiyou Mountains species to get established.

While living, bigleaf maples provide a home to **epiphytic** mosses and ferns–species that grow directly on other plants, not needing to send their roots below ground. For bigleaf maples, this means that they're often covered in a lush blanket of mosses and lichens, forming a substrate thick enough that the rhizomes of **licorice ferns** get a solid foothold. These mutualistic relationships help the trees thrive, and in order to help other plants in the Cascadia forest get a foothold of their own, we have to make some room in such a strong network.

We leave them as snags, though, to support local **bird** species as they roost and feed on the **bugs** that feast on the rotting wood–many people even call snags "**wildlife trees**." Even dead or dying, these bigleaf maples anchor a web of ecological relationships.

Cascadia forest notes

CHILE

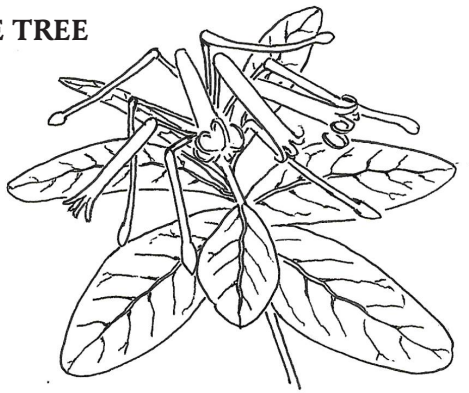
Our Chilean plantings represent the **Valdivian temperate rainforests** of south-central Chile. Like our own temperate rainforest environment, the Valdivian forests reside in a strip of land between coast and mountains, growing lush and mossy as clouds traveling east empty their rain before drifting over the mountaintops

Here, our Valdivian forest stretches out alongside Cascadia, weaving across the path before opening up into the "Gateway to Chile" hillside.

In March, look for the bright yellow-orange flowers of the evergreen **Darwin's barberry** shrub.

CIRUELILLO/CHILEAN FIRE TREE

Also called: Notro fósforo, Chilean firebush, *Embothrium coccineum*



In late spring, Ciruelillo lights up the Gateway to Chile hillside with bursts of red-orange, tube-shaped flowers.

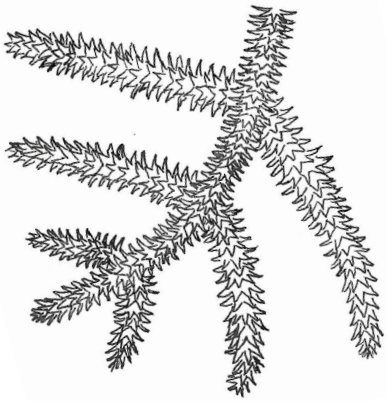
Before it blooms, Chilean fire tree can look very similar to **rhododendrons**. **Look for** differences in leaf texture–Ciruelillo is matte, rhododendron is somewhat glossy.

Ciruelillo can be finicky to grow here, sensitive for its first couple winters and even altering its growth habit based on the climate–it can grow as a dense little shrub or a narrow, tall tree, and can even be either evergreen or deciduous. With lots of care, though, it can flourish, and now thrives in historic gardens like the Carl S. English Botanic Gardens by the Ballard Locks and Kruckeberg Botanic Garden in Shoreline, as well as gardens owned by dedicated hobbyists.

Whenever we negotiate our place in the ecological web, we carry other species and effects along with us. Bright, tube-shaped flowers are favorite nectar sources for hummingbirds, and aren't characteristic of many plants native to the area. But because people plant and care for these tropical species like Ciruelillo, the **Anna's hummingbird**, which originally only migrated here in warmer months, thrives in the city year round.

PEHUÉN/MONKEY PUZZLE TREE

Also called *Araucaria araucana*



Especially **in spring, look for yellow-green cones** at the very ends of each branch. Female cones are round and 6-8 inches across while male cones are smaller and oblong. Both spend 2-3 years maturing, then turn brown and fall to the ground.

Each spiky, scale-like leaf stays on the tree for 10-15 years. **Look for moss** growing in the spaces between them, storing the water that finds its way in.

Iconic for its spiky layers of leaves and bark, Pehuén is often referred to as a "living fossil," remaining virtually unchanged since first evolving 200 million years ago in the **Jurassic Period**. Like with other plants from such ancient times (**ginkgoes** and **ferns**, to name a couple), this means we can see evidence of its bygone ecological relationships and connections even as it develops new ones.

Many ecologists surmise its spiky leaves and armor-like arrangement evolved to protect from browsing **dinosaurs** that could reach up high into the canopy–no doubt effective against brachiosaurus, but less so against **squirrels** and **birds** small and nimble enough to navigate its rough bark and treacherous branches.

Around the city:

The tree became popular here in the mid-20th century as an exotic garden feature–organizers at the **1962 World's Fair** handed out free saplings. Now, due to deforestation and climate change, Pehuén is endangered in its native forests, and the Maritime Northwest is one of the only remaining places it can thrive.

Look for the monkey puzzle tree in residential areas around the city, including fallen branches and cones that can give you an up close look at its scaly, spiky structure.

CHINA

The species featured here grow on the slopes of **Emeishan** (Mt. Emei) in Sichuan Province in western China. Emeishan is one of the most biodiverse places on the planet, with more species residing on its slopes than live in the entire Pacific Northwest.

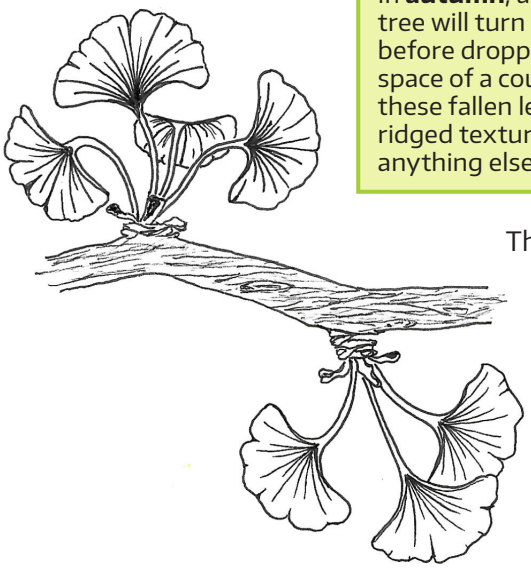
Emeishan and the larger Sichuan Basin region experience a long cool season and a relatively short, rainy summer. For these plants, our cool, wet winters and drier summers are comparable to home but still require some adaptation.

GINKGO

Abundant in cities but extremely limited in the wild, the ginkgo evolved 200 million years ago and is now left without any known living relatives. This also means that the organisms that it evolved to interact with–that would eat it and disperse its seeds, or that acted as pests and preyed on it, or that formed mutualistic relationships with it–were those of the late **Triassic and Jurassic Periods.**

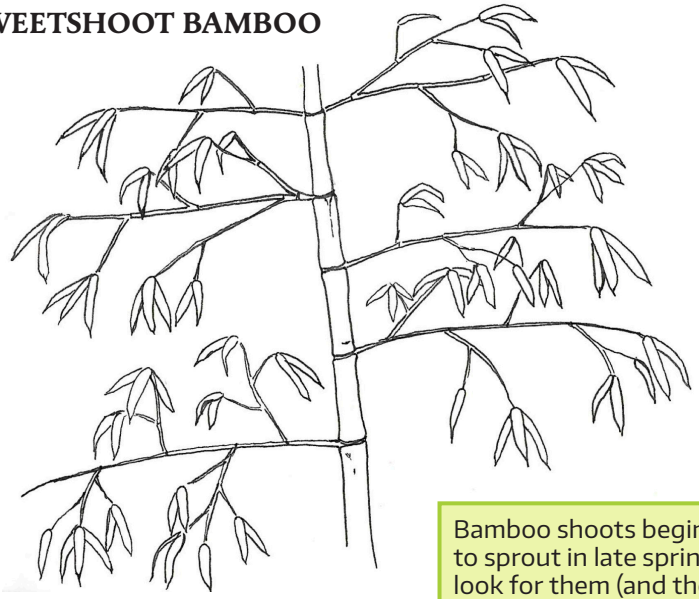
We can see this today in the fact that it is threatened by almost no living pests, and the way that the majority of organisms that now live among them find the distinctive vomit-like scent of their seed coatings repellent (though dogs get curious about it every once in a while).

In **autumn**, all the leaves on a ginkgo tree will turn a vibrant, buttery yellow before dropping to the ground in the space of a couple days. Pick up one of these fallen leaves and feel its soft, ridged texture. Does it feel similar to anything else you know?



The ginkgo is the only living link between ferns and conifers. **Look for** similarities in leaf shape between it and the **maidenhair fern**–a resemblance which sometimes earns it the name "maidenhair tree."

SWEETSHOOT BAMBOO



Bamboo shoots begin to sprout in late spring–look for them (and the cones we use to protect them) in **April and May**

All around this continually-developing garden, you'll see short wire fences we've set up around some young plants. Mostly, they function to deter **rabbits** from snacking on the plants, and often you'll notice the plants we protect have smooth, succulent, lettuce-like leaves. To the right of the interpretive shelter, though, is another animal favorite that our little fences can't protect.

This accurately named bamboo is often grown for its tasty shoots. We at the Arboretum don't harvest our plants for food, but the **squirrels** will always find a tasty meal sitting out in the open. Because the squirrels just climb over the wire fences we put out to deter rabbits, we make cones to cover the bamboo shoots while they're still young.

Look for plants that might make a good snack–to you or to another animal. Why might it be beneficial for a plant to be good to eat?

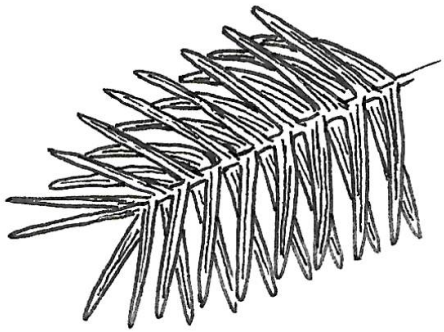
AUSTRALIA

The Australian forest is yet to be developed, but for now its plants can be found in the beds around the bus loop (look out for the permeable paving). When it is expanded, it will represent the **Greater Blue Mountains Area** in Southeast Australia, whose eucalypt forests sprawl across ancient sandstone plateaus long since eroded into towering cliffs and mountains.

WOLLEMI PINE

Also called *Wollemia nobilis*

Find this tree **by the restroom hut in the bus loop.** It grows in a fairly narrow, columnar shape, with a "jumping jack" growth habit: branches near the top of the tree point upward and branches near the ground point down.



Though it's called a "pine", the leaves of a Wollemi pine are closer to those of a **fir**–both fir and Wollemi needles are smooth and flat, while "true" **pines** have long, round needles that sprout in bunches of 2-5. As you see different conifers, **look (and feel) for** the wide variety of leaf shapes and arrangements.

Along with its relatives in the family Araucariaceae, the Wollemi Pine evolved in the **Jurassic Period**. At the time, Earth's landmasses as we know them today had not yet all separated from each other, existing instead as the supercontinents **Laurasia** and **Gondwana** (Araucariaceae evolved on Gondwana).

One of these relatives, *Araucaria araucana*, often referred to in English as the **monkey puzzle tree**, grows in the Chilean entry garden and is relatively common around Seattle–especially near big, old houses, as it was a popular garden plant in the mid-century. Another, the **Norfolk Island pine**, is endemic to an island off the coast of Australia and is a popular houseplant. On all three, **look for** rough bark and densely-growing, waxy leaves–here in one city, we can see the familial network of these ancient trees that drifted across the world from each other.

Its (now limited) wild range in Australia is in deep, shaded temperate gorges, making our ecosystem a perfect resource for rehabilitation and reintroduction. Many other species, like **giant sequoia**, share this predicament–as their native ranges become hotter and drier, and thus more prone to fire, our moist, temperate environment becomes a home away from home.

One tool for re-establishing waning populations–for Wollemi pine in particular and for almost any plant– are **mycorrhizal fungi**, which grow in and around plants' root systems, drawing in nutrients from the soil in exchange for sugars from the plant. An estimated 90% of plants worldwide have or can develop relationships with mycorrhizal fungi, and these relationships can be crucial in getting new plants accustomed to new environments.

Mycorrhizal fungi don't have fruiting bodies, meaning they don't create mushrooms as we know them. But still, **look for mushrooms** on or near trees, especially close to the ground–when you see them, they are evidence of a sprawling, complex fungal network beneath the surface.

In this garden, also look for:

Eucalyptus: Like holly, eucalyptus shows **heterophylly**, meaning it grows differently shaped leaves on the same plant. In this case, though, leaf shape varies based on the age of the shoot they grow from: leaves on juvenile shoots are round, as well as horizontally oriented to soak up as much sun as possible; leaves on mature branches are long & vertically oriented to preserve water & protect against damage. Like **Wollemi Pine**, their relationships with **mycorrhizal fungi** may be critical to mitigating climate-related dieback.

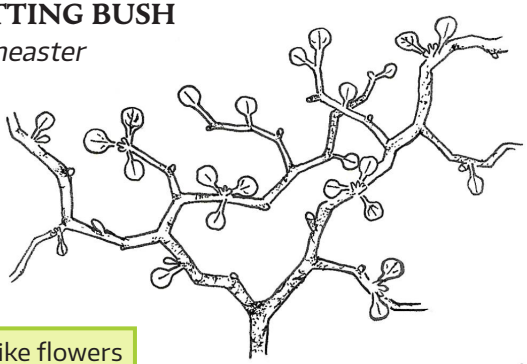
Permeable paving: The permeable paving in the bus loop helps counteract erosion, improve soil health, and reduce stormwater runoff. It also is a place where small, tough plants we often see as weeds can really shine, as they make even the pavement lush and green.

AOTEAROA/NEW ZEALAND

The New Zealand forest rolls down the hill on the north side of the garden (to the right of the interpretive shelter), populated by wild-collected specimens from the **high-elevation tussocklands** of Aotearoa/New Zealand's southern island. **Look for** signage in the garden to illustrate these plants' cultural context, and once you leave the Pacific Connections Garden, look out for these same plants in garden beds around the city.

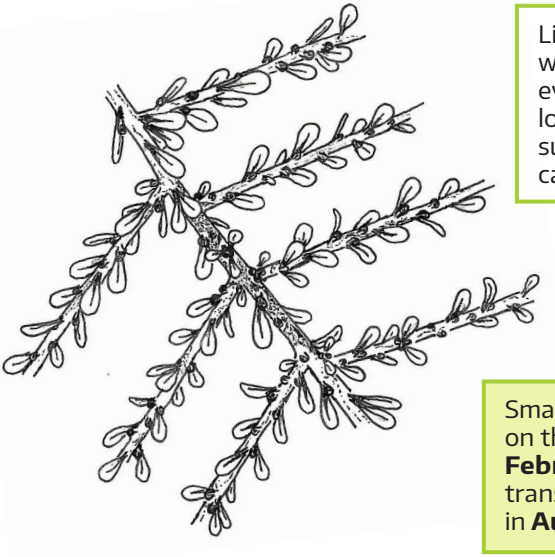
KOROKIO/WIRE NETTING BUSH

Also called *Corokia cotoneaster*



Bright yellow, starburst-like flowers bloom in **April and May**, followed by small, orange-red fruits.

MINGIMINGI/*COPROSMA PROPINQUA*



Like Korokio, this is a large, woody shrub. Its straight, even twigs attach to the long, arching branches at such wide angles that they can look like fish bones.

Small green flowers bloom on the end of each branch in **February and March**, and translucent blue berries ripen in **August and September.**

Like many shrubs native to New Zealand, both Korokio and Mingimingi have evolved **divaricate branching habits**, where their branches split off from each other at wide angles, so that the plant as a whole is a tightly interlaced mass. There are two main theories as to why this is: either these shrubs evolved this way to protect against harsh climactic conditions, or the branching habit is a specific defense against the browsing habit of the **Moa** bird.

Look for: moss and lichen growing more abundantly on the interior branches of the shrub where they're more shielded from the sun

In this garden, also look out for:

Hebes: evergreen shrubs with smooth, waxy leaves arranged neatly in repeating patterns up each stem. If you look directly down the stem, they form an X shape.

Flax/phormium: upright sprays of long, blade-like leaves, often sold as container accents.

Both are common as garden & sidewalk plants around the city, and often live as **"tender perennials"**–not as sure a bet for hardiness through the cold as, say, a pine, but most of the time will survive our milder winters.

New Zealand notes

URBAN ECOLOGY INDEX

CONNECTIONS ACROSS SPACE & TIME

Many of the plants and animals that currently reside in cities first evolved in ancient, far-away ecosystems, forming relationships with organisms that now reside on different continents or are extinct. We can see evidence of these long-ago ecological webs in these plants:

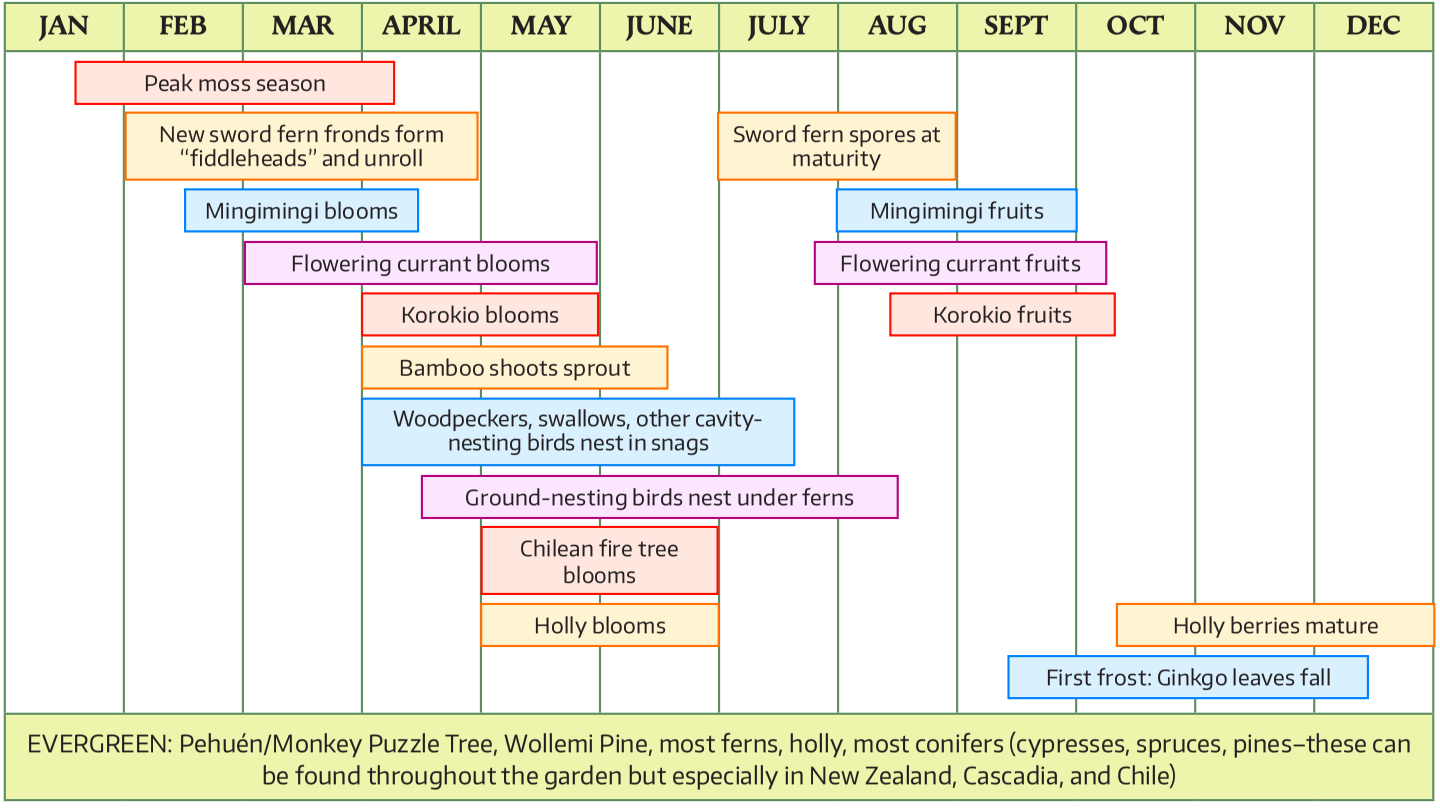
RELATIONSHIPS IN THE LOCAL LANDSCAPE

An ecosystem is less a collection of individuals and more a web of relationships. Rather than passive bystanders or all-powerful arbiters, we as humans are intertwined in these relationships. These plants help us see how the ecological webs of this garden and of the city fit together, and how we continually negotiate our place within it.

THRIVING IN "UNNATURAL" HABITATS

Many city dwellers don't see their homes as being part of nature, but in reality cities are rich and complex ecosystems in their own right. Habitats many of us wouldn't even recognize as such–roadside ditches, concrete walls–are home to thriving populations of hardy, creative plants, bugs, and animals.

THROUGH THE YEAR: PHENOLOGY KEY



FOR ADDITIONAL REFERENCE

The Pacific Connections section at Elisabeth C. Miller Library at the Center for Urban Horticulture for more resources on the regions and ecosystems represented in this garden

Arboretum online interactive map (accessible on the UW Botanic Gardens website under Washington Park Arboretum>Maps & Trails, along with print and mobile versions of this guide) for locations and Latin names of all plants registered in the Arboretum collection

Trees for Seattle (accessible through seattle.gov/trees) for an online map of all known street trees in the city

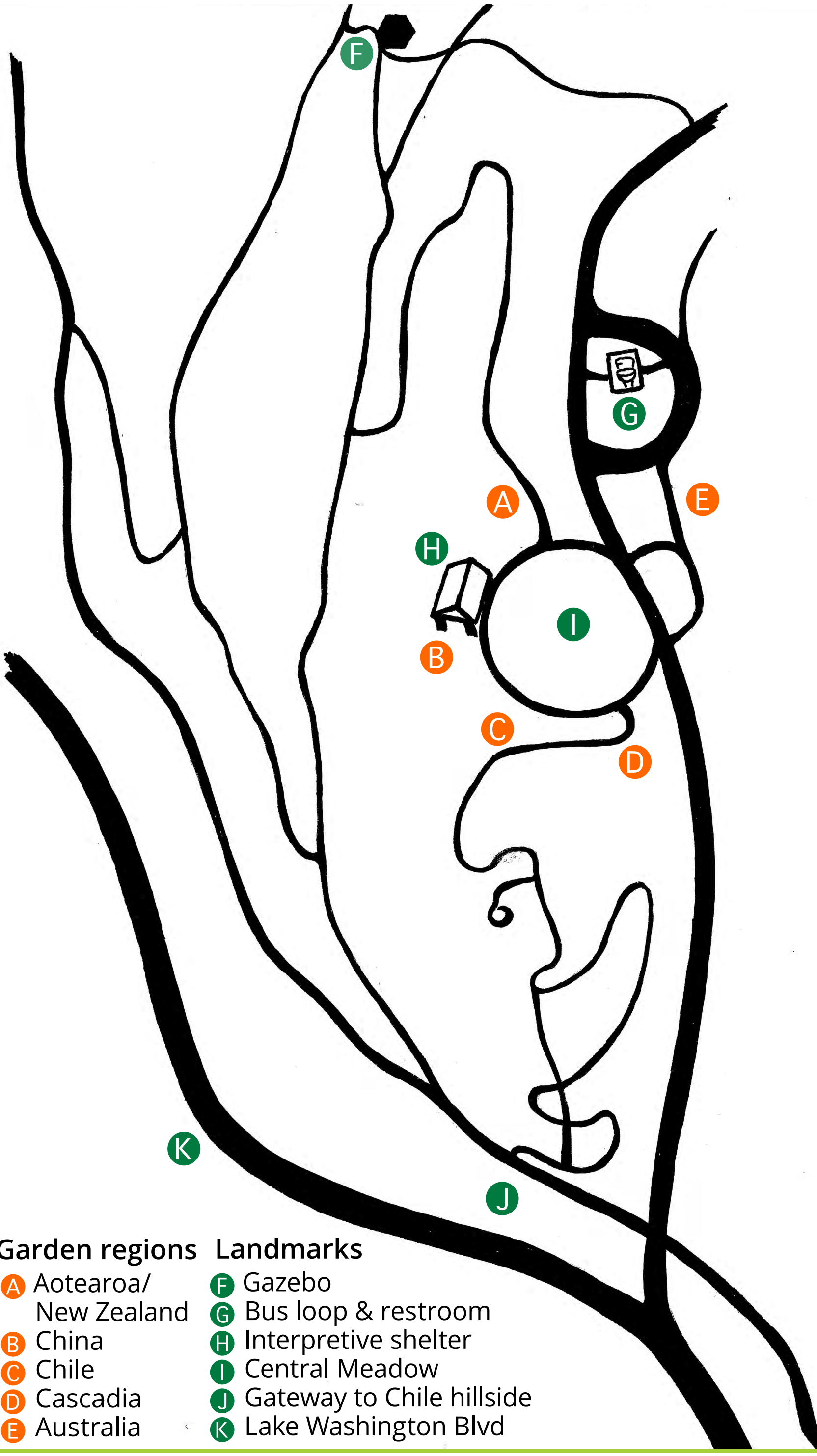
The UW Botanic Gardens, like the University of Washington and all of our lives and institutions, exists on Indigenous land. We acknowledge and honor the Coast Salish peoples of this land, the land which touches the shared waters of all tribes and bands within the Suquamish, Tulalip and Muckleshoot nations.

We are grateful to respectfully live and work as guests on these lands with the Coast Salish and Native people who call this place home and have stewarded it since time immemorial. This land acknowledgement is one small act in the ongoing process of working to be in good relationship with the land and the people of the land.

WRITTEN AND DESIGNED BY LOREN STEPHENS

with many thanks to Meena Selvakumar and the UW Museology M.A. program, Cindy Thomashow and the environmental education scholars and practitioners who have taught me and Olivia Price and many others at the Arboretum. Thank you all for making this project possible.

FIELD GUIDE TO THE
PACIFIC CONNECTIONS GARDEN



Garden regions

- A Aotearoa/ New Zealand
- B China
- C Chile
- D Cascadia
- E Australia

Landmarks

- F Gazebo
- G Bus loop & restroom
- H Interpretive shelter
- I Central Meadow
- J Gateway to Chile hillside
- K Lake Washington Blvd

ABOUT THE GARDEN

The Pacific Connections Garden celebrates the web of ecological relationships across the Pacific Ocean and throughout the city of Seattle. Every regional garden within it shows us an ecological history and community of that particular place and how those species adapt to our environment.

Around the meadow at the center of the Pacific Connections Garden, entry gardens highlight iconic plants from each region. These beds aren't meant to be as naturalistic in their representations of each ecosystem, but they are nonetheless living things that show their connections to each other. The forests–two of which are built and the rest of which are in the works–spread out behind the entry beds, populated by plants of wild origin and cared for in a way that reflects their naturalistic habits.

ABOUT THIS GUIDE

The first step toward learning about these relationships is paying attention to them–learning to observe and appreciate the ever-changing web of life around us. This guide highlights the adaptations and interacts that are characteristic of any ecosystem but especially urban nature–cities, far from being nature-less voids, are constantly-changing patchworks of time, place, and connection as shown through living things.

The Arboretum itself is a living museum. This means its collections are both carefully designed

and can’t be fully controlled, and as caretakers, we are constantly negotiating our place in this ecological web. Often, this means protecting our plants from harm–as you walk around, notice the short fences guarding young plants from rabbits, or the signs warning people against damaging trees.

But just as often, managing a healthy garden means encouraging and supporting interconnectedness. Visitors often ask our tour guides how we keep away moles and other organisms commonly seen as pests but the truth is we often rely on them. Several years ago, moles expanding their tunnel network saved a large, old tree near the visitor center, where severely compacted soil had been cutting off its supply of water and nutrients. Managing the Arboretum, then, is not a fight against nature but a collaboration with it.

Even if we don’t realize it, all of us are integral components of Seattle’s ecological web. Use this guide as a starting point to see how we all connect.

HOW TO USE THIS GUIDE

Read section by section to progress through different regions of the garden, referring to the guide for a few specific interactions to look out for in each one. These include:

Throughout the guide, find:

- Narratives of species' history and relationships
- Up-close sketches of species' identifying features
- Descriptions of identifying features like texture, color, size, and growth habit
- "**Look for**" prompts to help with close observation on the go
- Color-coded references to related **plants**, **animals (and fungi)**, **ecological terms**, and **geographic and historical context**
- Information about the seasonality (aka **phenology**) of different phenomena, highlighted in green boxes
- Information about where and how to look for these species and their relatives in the city, in boxes with a dark green border like this one
- Space to record your own observations

In the back, find a **phenology key** for what to look for through the seasons and an **urban ecology index**, which helps you navigate by:

- Connections across space and time
- Interactions with other plants and wildlife in the city
- Thriving in "unnatural" conditions of the city

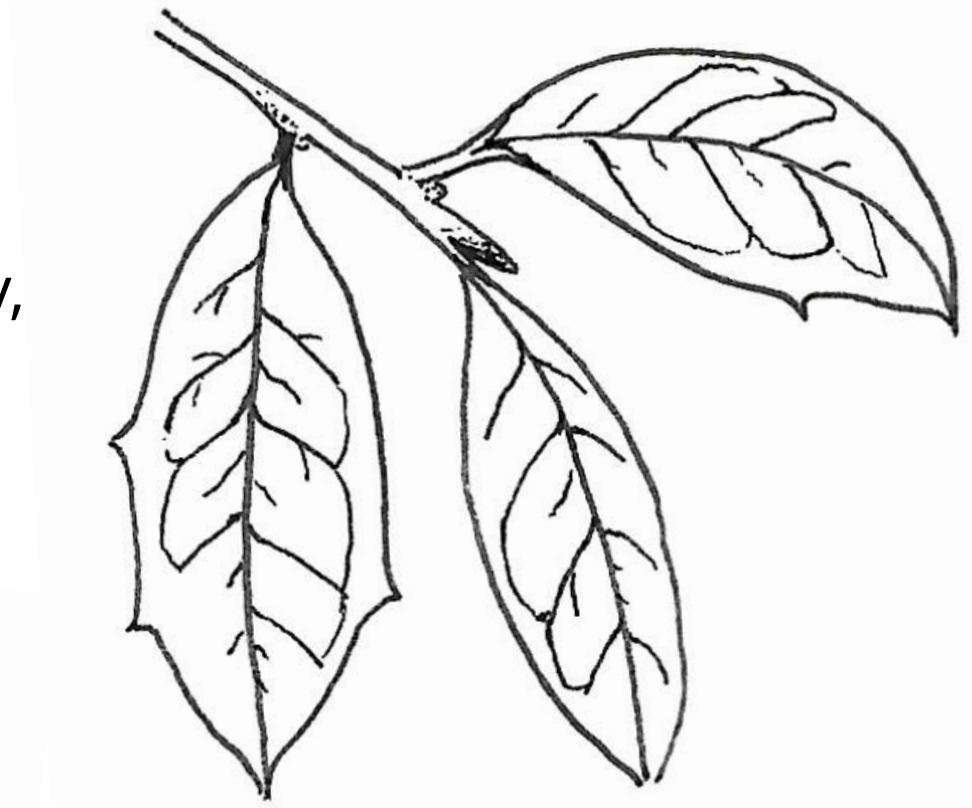
No matter how you decide to navigate the garden, be curious! Take this guide as encouragement to look closer: reach out and feel the textures of leaves and mosses (gently, of course) and crouch down to investigate low-growing plants.

CENTRAL MEADOW & COMMON VOLUNTEERS

This section of the guide covers garden residents that some may see as incidental: remnants of previous plantings before this garden was designed and volunteers that appear without us purposefully planting them. In this garden, these plants (and fungi) represent local ecology, shaped by climate and history as it is, as well as the new ecological community of the plants from around the Pacific.

HOLLY

Also called American Holly, *Ilex opaca;* Purple Holly, Kashi Holly, *Ilex purpurea*



Holly **flowers in late spring and fruits in winter.** Depending on the variety, the flowers and berries can vary in color–in this garden and around the city, look for purple or white flowers and classic red berries.

In the central meadow are two stands of hollies with long, drooping branches. We often think of hollies as shrubs, but often their twisted trunks can grow into hardy trees.

For many holly species, their iconic spiky leaves only develop as a response to browsing animals (animals that eat the leaves and young shoots of trees and shrubs)–**look for** spikier leaves within reach of animals on the ground and smoother ones higher up in the crown. This phenomenon, where differently shaped leaves grow on the same plant, is called **heterophylly**.

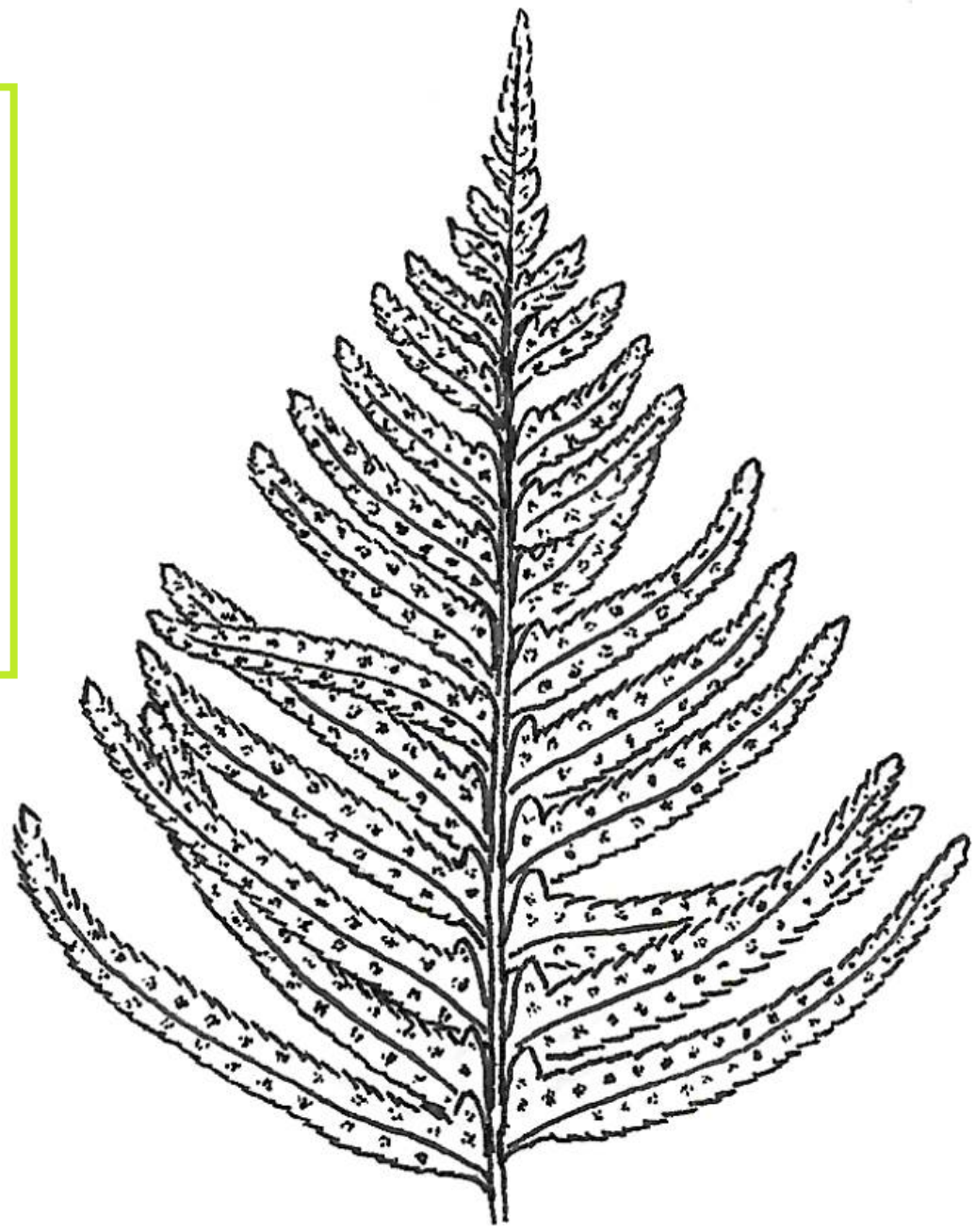
Around the city:

In this central meadow reside **American Holly** *(Ilex opaca)* and **Purple Holly** *(Ilex purpurea),* remnants from when this was the home of the Arboretum's holly collection.

Their cousin, *Ilex aquifolium*, or **English Holly**, is what you'll most commonly see around the city, the result of mass plantings from the 1920s and 30s expanding as birds snack on the berries and spread the seeds. The problem is, English holly is so good at spreading and at crowding out other species that it is now listed by the King County Noxious Weed Board as a "**Weed of Concern**"–harmful, but already too widespread and well-established to mandate removal and control.

FERNS

The end of a sword fern frond. From a distance, sword ferns' long, straight fronds may seem smooth or waxy, but fuzzy, spiky details appear on a closer look.



On each leaflet, **look for** serrated edges, pairs of spores that run its full length, and an upward-pointing lobe at the base.

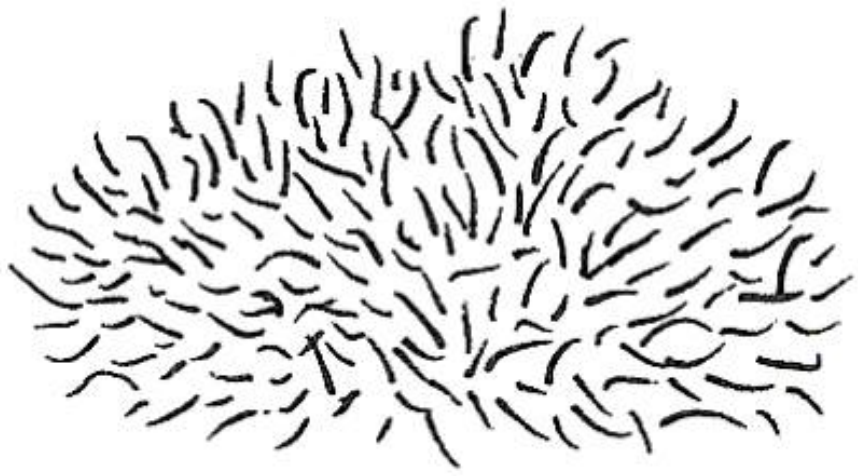
Ferns evolved roughly 360 million years ago and have thrived ever since. Their affinity for the dank, dim places unpopular with other plants gives them a reliable ecological niche and means they are the lush, green gift of climates like ours.

Sword ferns (aka pala-pala, *Polystichum munitum*) provide food for browsing animals (deer, beavers, and bears, for a few), as well as habitat for **ground-nesting birds** like the **song sparrow** and **spotted towhee**. Many gardeners cut back last year's brown, crispy fronds every spring, but in these more naturalistic garden spaces we leave them so that the birds can still find cover–**look for** these brown fronds at the base of each plant, and watch and listen for signs of birds and other wildlife underneath.

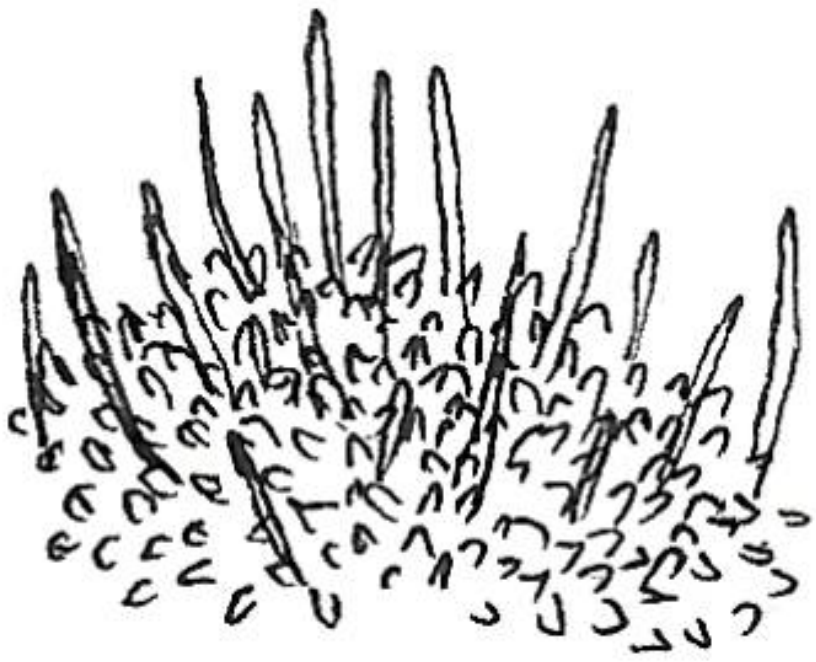
MOSS & LICHEN

Mosses, along with hornworts and liverworts, are **bryophytes**–plants that don't have veins to carry water up a tall stem and so remain low-growing as they absorb moisture through their surfaces.

Dicranoweisia cirrata thrives on roofs, fences, and all types of wooden substrate



Each of the hundred-some species of moss that inhabit Seattle has its own preferences for moisture, light, and substrate (growing surface), making a patchwork of colors and textures around the city. In this garden and throughout the city, **look for** these diverse colors and textures among mosses that grow on sidewalks, stones, walls, trees, lawns, fences, and roofs.



Tortula muralis, also called wall-screw moss, can often be found on concrete and other stone surfaces

On trees, moss helps regulate moisture, storing water that flows down the trunk (**stemflow**) so it isn't lost after the rainfall ends. Stemflow can help explain why moss often grows on one side of a tree trunk more than the other–moss likes shady, wet places, so whatever part of the tree

produces those conditions best (on a leaning tree, often the side of the trunk facing upward so it'll catch the rain but is still shaded by the branches) is where the moss will grow.

Look for the areas on a tree, log, or rock where the most moss grows. Are those the places where water collects? Where the surface is protected from the sun?

Around the city:

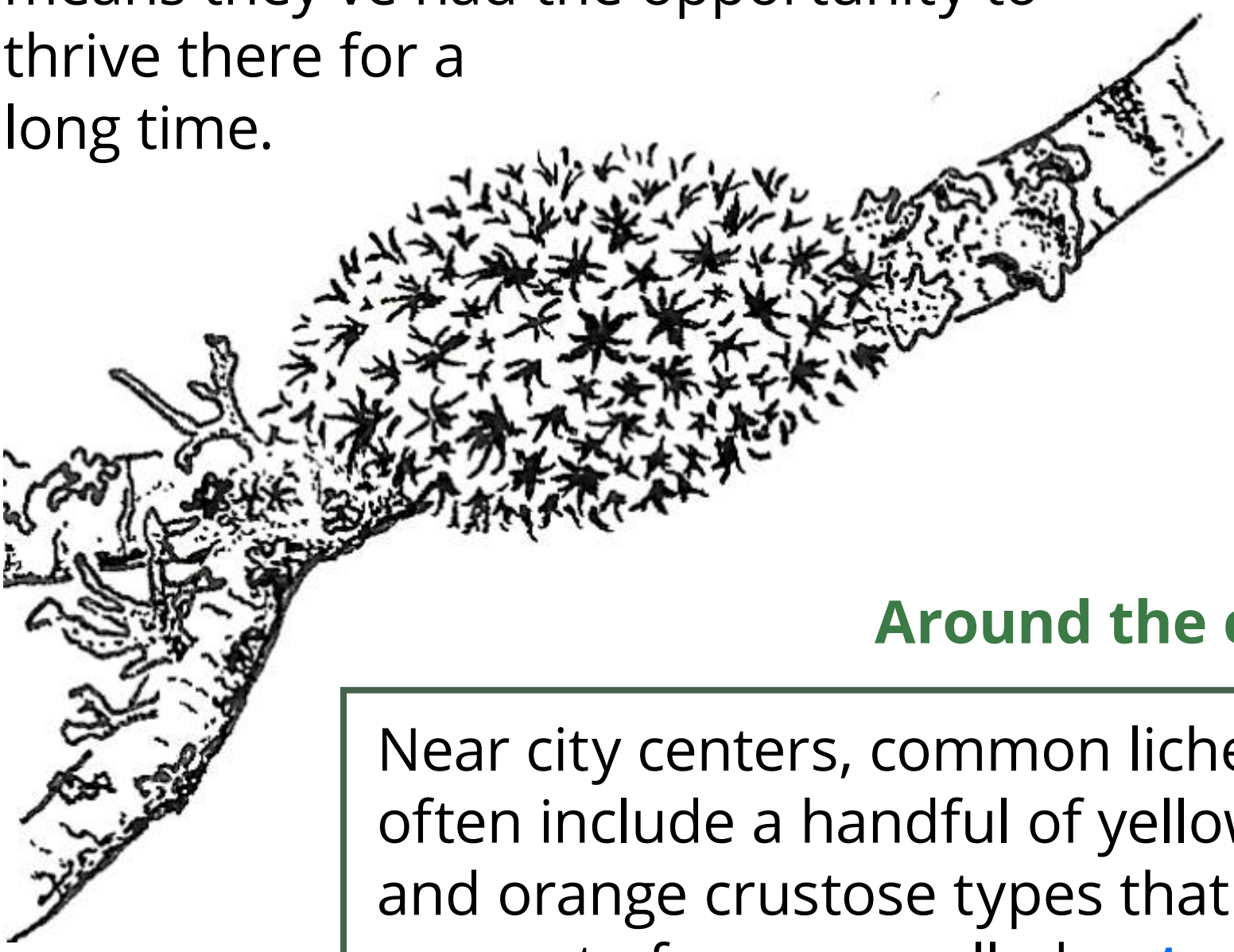
These tough, creative plants are often more diverse in cities than out of them, thriving in the variety of harsh habitats on buildings and sidewalks and spreading their spores via foot traffic. As you walk around the city, think of the life you're ferrying about with each step.

In fact, some ecologists advocate for the **urban cliff hypothesis**, which connects species common in cities today and those native to cliff ecosystems and other rocky slopes (**mosses**, **mice**, **pigeons**, **cockroaches**, and others) and posits that city dwelling has always been a group effort, not a solely human pursuit.

Though not as hungry for city niches as mosses are, **lichen** fit right in among our crowded buildings. In fact, lichen are like houses in and of themselves–**fungus** forms a protective outer structure, and **algae** live inside of it, photosynthesizing and sharing the resulting nutrients with their fungal host. When a lichen is wet, the color of the algae can show through the outermost fungal cells–on wet days, **look for** vibrant colors on rocks and trees.

Thousands of lichen species can be found around the Pacific Northwest Coast, but no matter where you go, they come in three general shapes: **crustose** (forming a crust flat against the substrate), **foliose** (leafy) and **fruticose** (shrubby, with thin, branching shapes).

Lichens are also excellent indicators of air quality, as both the fungus and algae absorb nutrients–and pollutants–from the air. Healthier air means more diverse and longer-lived lichen, which makes a dramatic difference especially when considering how slowly and carefully lichen grow. As a general rule, when lichen in a particular place have grown into diverse and distinctive shapes, it means they've had the opportunity to thrive there for a long time.



Around the city:

Near city centers, common lichen often include a handful of yellow and orange crustose types that are part of a group called **eutrophic lichens.** These lichens thrive off of high nitrogen content in the air, and so are abundant in places where nitrogen dioxide, a common byproduct of burning fossil fuels, is drifting around on the wind.

CASCADIA

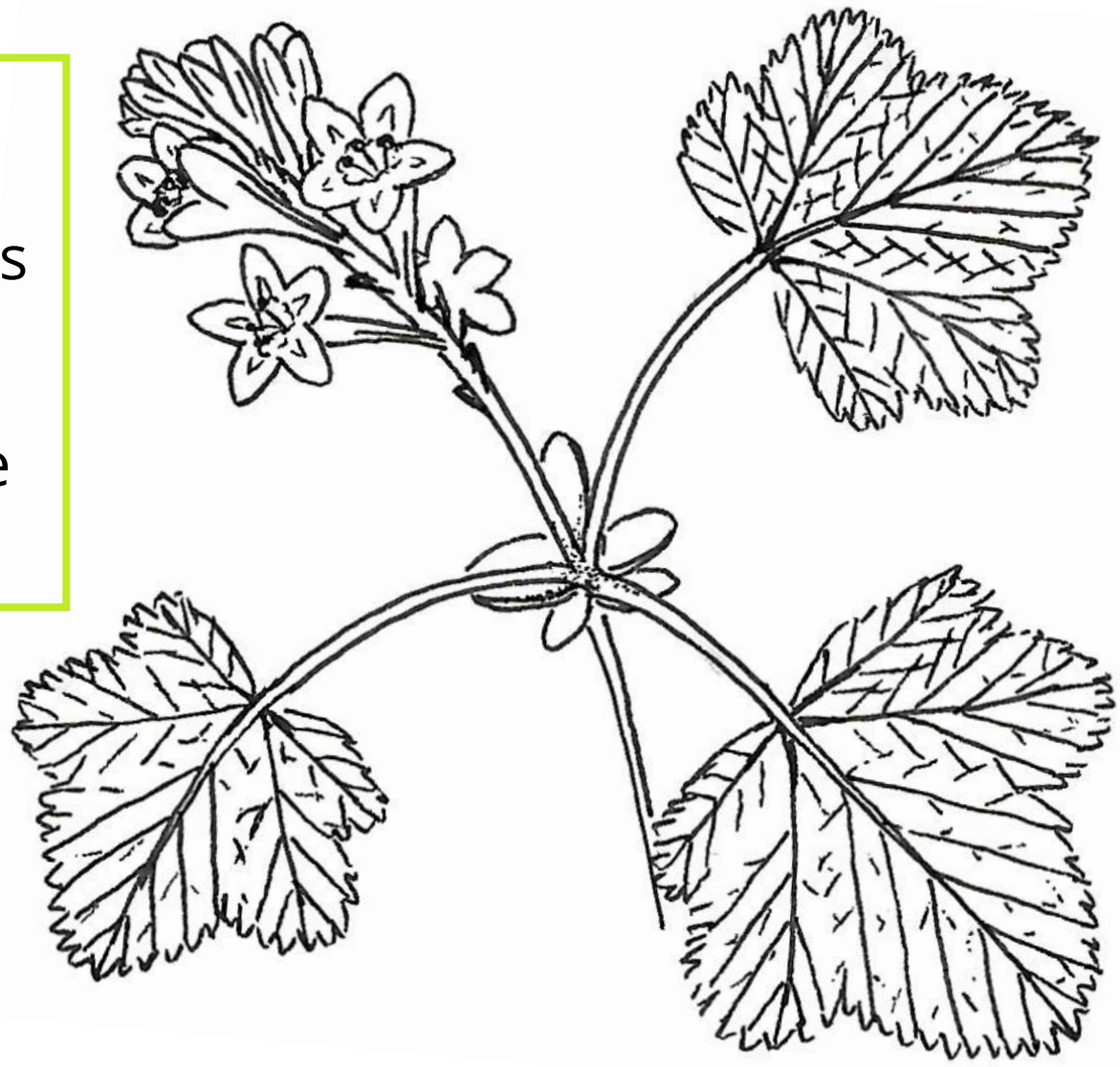
The Cascadia forest mimics the dry, rocky habitat of the **Siskiyou Mountains**, which stretch from southern Oregon to northern California. Incredibly diverse populations of plants thrive in the range's nutrient-poor soil, as species adapted to the temperate Pacific Northwest transition to those who make their home in the hotter, drier climates of California.

This population also includes what might be the most varied collection of **conifers** in the world–as you make your way through the forest, **look for** the diverse colors, shapes, and textures of the conifers along the path. Look out, too, for native volunteers like **sword ferns** (tall, straight fronds sprouting out of a central base) and **Oregon grape** (a shrub with holly-like leaves and clusters of round yellow flowers) sharing space with less familiar species.

FLOWERING CURRANT

Also called: Red-flowering currant,
Ribes sanguineum

Look for hummingbirds dipping their beaks into the center of these trumpet-like flowers, where the nectar is stored.



Clusters of small, trumpet-like flowers bloom **late February to early May**. Usually, *Ribes sanguineum* flowers are a bright magenta (hence the plant often being called red-flowering currant) but multiple white-flowering cultivars appear beside it.

Flowering currant flourishes in dryish woods and human-disturbed sites like roadsides and clearings. Its small tube-shaped flowers are favorites of hummingbirds (which reliably feed from all colorful, tube-shaped flowers). This native spring-time nectar source is supplemented by hummingbird feeders and garden plants from warmer climates, providing a year-round nectar supply that enables the **Anna's hummingbird** to thrive in the city throughout the seasons.

BIGLEAF MAPLE & SNAGS

Look out for snags–upright dead or dying trees, often missing their branches. Many of the snags in the PCG are **bigleaf maples**, removed and cut back to make room for Siskiyou Mountains species to get established.

While living, bigleaf maples provide a home to **epiphytic** mosses and ferns–species that grow directly on other plants, not needing to send their roots below ground.

For bigleaf maples, this means that they're often covered in a lush blanket of mosses and lichens, forming a substrate thick enough that the rhizomes of **licorice ferns** get a solid foothold. These mutualistic relationships help the trees thrive, which can sometimes mean creating a thick canopy with too much shade for shorter, sunlight-craving species. In order to help other plants in the Cascadia forest get a foothold of their own, we have to make some room in such a strong network.

We leave them as snags, though, to support local **bird** species as they roost and feed on the **bugs** that feast on the rotting wood–many people even call snags "**wildlife trees**." Even dead or dying, these bigleaf maples anchor a web of ecological relationships.

Look for: signs of life in and around the snags. What could live in the different holes and crevices? Why would they choose to live there?

Cascadia notes

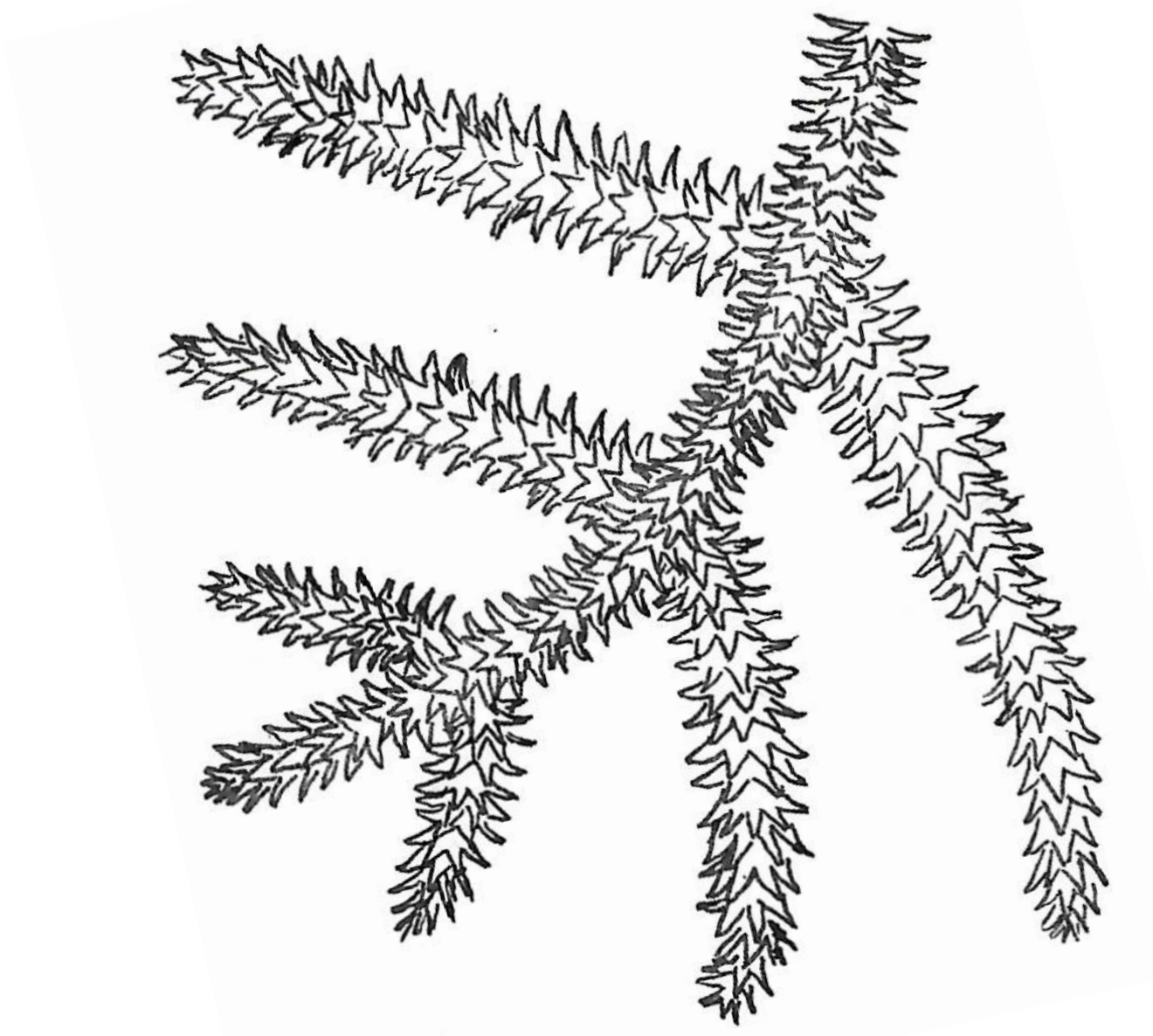
CHILE

The Chilean forest represents the **Valdivian temperate rainforests** of south-central Chile. Like our own temperate rainforest environment, the Valdivian forests reside in a strip of land between the coast and the mountains, growing lush and mossy as clouds traveling east empty their rain before drifting over the mountaintops.

Here, our Valdivian forest stretches out alongside Cascadia, weaving across the path before opening up into the Gateway to Chile hillside.

PEHUÉN/MONKEY PUZZLE TREE

Also called *Araucaria araucana*



Especially in spring, **look for yellow-green cones** at the very ends of the branches. Female cones are round and 6-8 inches across while male cones are smaller and oblong. Both spend 2-3 years maturing, then turn brown and fall to the ground.

Iconic for its spiky layers of leaves and bark, Pehuén is often referred to as a “living fossil,” remaining virtually unchanged since first evolving 200 million years ago in the **Jurassic Period**. Like with other plants from such ancient times (**gink-goes** and **ferns**, to name a couple), this means we can see evidence of its bygone ecological relationships and connections even as it develops new ones.

Each spiky, scale-like leaf stays on the tree for 10-15 years. **Look for moss** growing in the spaces between them, storing the water that finds its way in.

Many ecologists surmise its spiky leaves and armor-like arrangement evolved to protect from browsing **dinosaurs** that could reach up high into the canopy–no doubt effective against brachio-saurus, but less so against **squirrels** and **birds** small and nimble enough to navigate its rough bark and treacherous branches.

Around the city:

The tree became popular here in the mid-20th century as an exotic garden feature–organizers at the **1962 World’s Fair** even handed out free saplings. Now, due to deforestation and climate change, Pehuén is endangered in its native forests, and the Maritime Northwest is one of the only remaining places it can thrive.

Look for the monkey puzzle tree in residential areas around the city, including fallen branches and cones that can give you an up-close look at its scaly, spiky structure.

CIRUELILLO/CHILEAN FIRE TREE

Also called: Notro fósforo, Chilean firebush, *Embothrium coccineum*

In **late spring**, Ciruelillo lights up the Gateway to Chile hillside with its bursts of red-orange, tube-shaped flowers.

Before it blooms, Chilean fire tree can look very similar to **rhododendrons**. To tell the difference, check for the texture of the leaves (Ciruelillo is matte, rhododendron is somewhat glossy)

Ciruelillo can be finicky to grow here, sensitive for its first couple winters and even altering its growth habit based on the climate (it can grow as a dense little shrub or a narrow, tall tree, and, reportedly, can even be either evergreen or deciduous), but because people love it and put so much care into cultivating it, it can be found in gardens around the city, including the **Carl S. English Botanic Gardens** by the Ballard Locks and **Kruckeberg Botanic Garden** in Shoreline.

Whenever we negotiate our place in the ecological web, we carry other species and effects along with us. Bright, tube-shaped flowers are favorite nectar sources for hummingbirds, and aren't characteristic of many plants native to the area. But because people plant and care for these tropical species like Ciruelillo, the **Anna's hummingbird**, which originally only migrated here in warmer months, thrives in the city year round.

In this garden, also look out for:

Pinque, also referred to as the **Alpine water fern** or *Blechnum penna-marina*, in the Chilean entry garden as well as gardens around the city

In March, look for the bright yellow-orange flowers of the evergreen **Darwin's barberry** shrub in the entry garden.

Chile notes

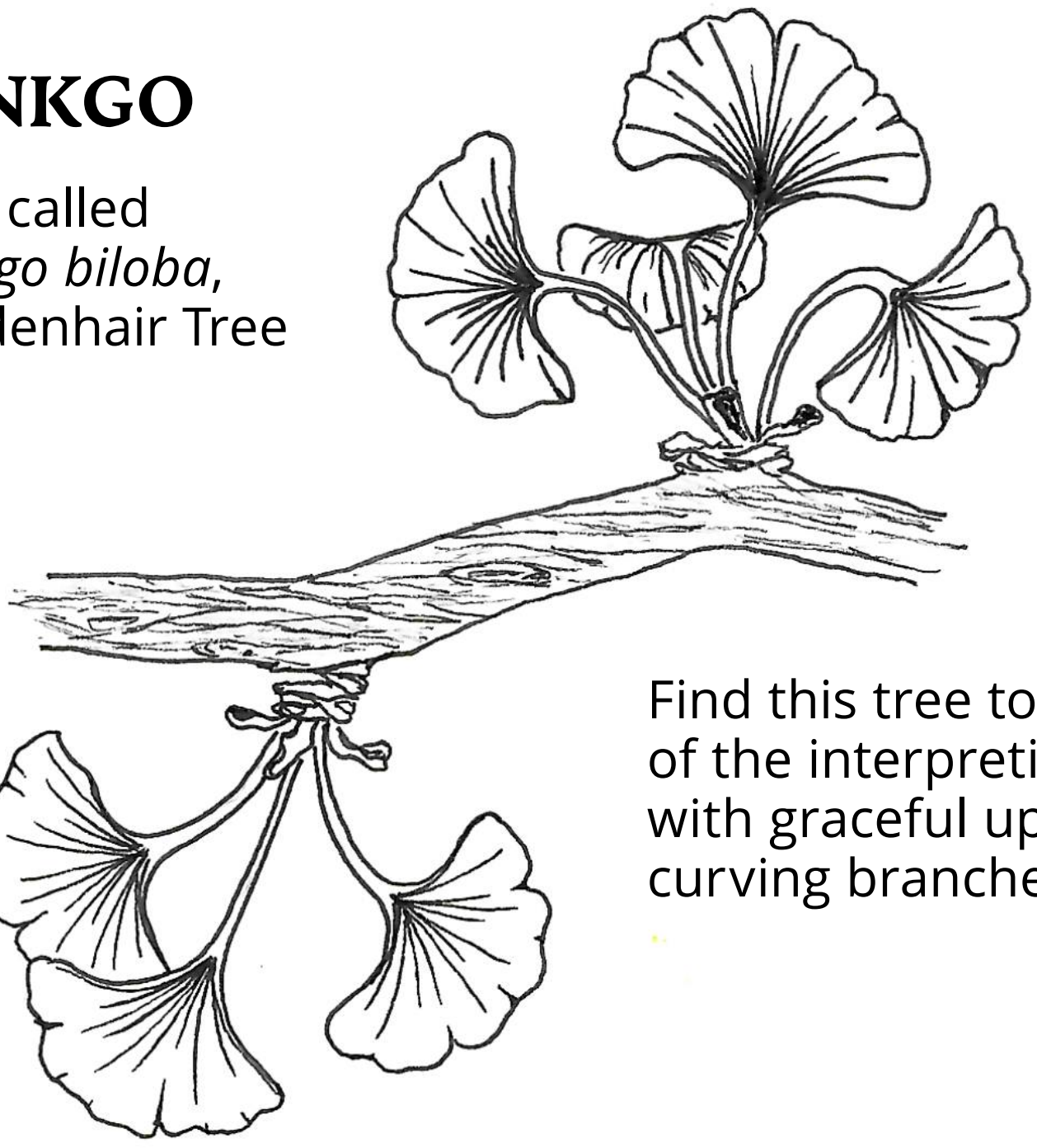
CHINA

The species featured here grow on the slopes of **Emeishan** (Mt. Emei) in Sichuan Province in western China. Emeishan is one of the most bio-diverse places on the planet, with more species ranging across its steep, rocky slopes than live in the entire Pacific Northwest.

Emeishan and the larger Sichuan Basin region experience a long cool season and a relatively short, rainy summer. For these plants, our cool, wet winters and drier summers are comparable to home but still require some adaptation.

GINKGO

Also called
Ginkgo biloba,
Maidenhair Tree



Find this tree to the left of the interpretive shelter, with graceful upward-curving branches.

In **autumn**, all the leaves on a ginkgo tree will turn a vibrant, buttery yellow before dropping to the ground in the space of a couple days. Pick up one of these fallen leaves and feel its soft, ridged texture. Does it feel similar to anything else you know, or is it unique?

Abundant in cities but extremely limited in the wild, the ginkgo evolved 200 million years ago and is now left without any known living relatives. This also means that the organisms that it evolved to interact with–that would eat it and disperse its seeds, that acted as pests and preyed on it, or that formed mutualistic relationships with it–were those of the late **Triassic and Jurassic Periods**.

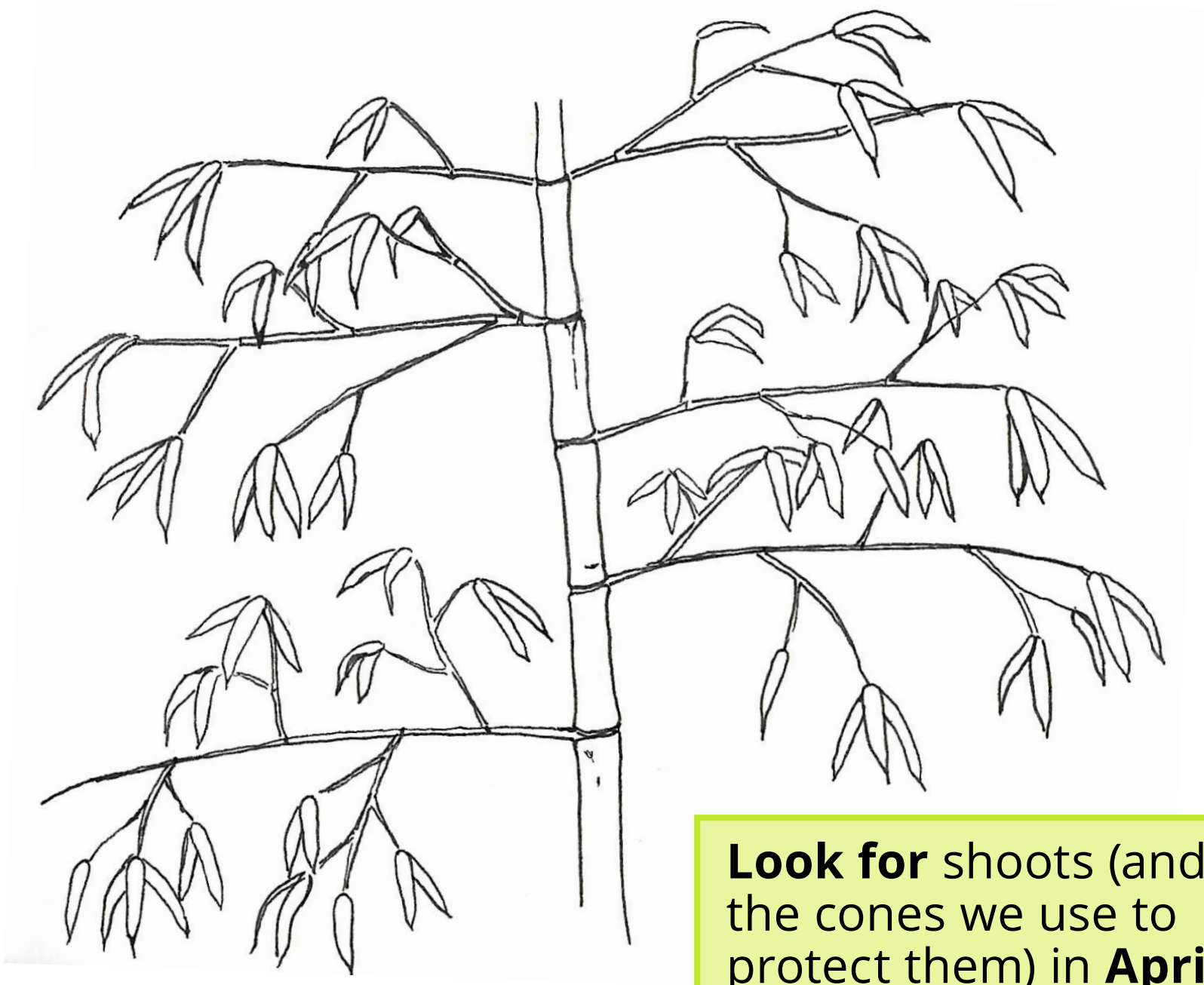
We can see this today in the fact that it is threatened by almost no living pests, and the way that the majority of organisms that now live among them find the distinctive vomit-like scent of their seed coatings repellent (though dogs get curious about it every once in a while).

Around the city:

Ginkgoes are common as street trees across the world because of their hardiness, stress tolerance, and resistance to pests and disease. In Seattle, **look for** them near Green Lake and scattered throughout the city, particularly on busy streets.

The ginkgo is the only living link between ferns and conifers. **Look for** similarities in leaf shape between it and the **maidenhair fern**–a resemblance which sometimes earns it the name “maidenhair tree.”

SWEETSHOOT BAMBOO



Look for shoots (and the cones we use to protect them) in **April and May**

All around this continually-developing garden, you'll see short wire fences we've set up around some young plants. Mostly, they function to deter **rabbits** from snacking on the plants, and often you'll notice the plants we protect have smooth, succulent, lettuce-like leaves. To the right of the interpretive shelter, though, is another animal favorite that our little fences can't protect.

This accurately named bamboo is often grown for its tasty shoots. We at the Arboretum don't harvest our plants for food, but the **squirrels** will always find a tasty meal sitting out in the open. Because, unlike the rabbits, they just climb over our wire fences, we make cones to cover the bamboo shoots while they're still young.

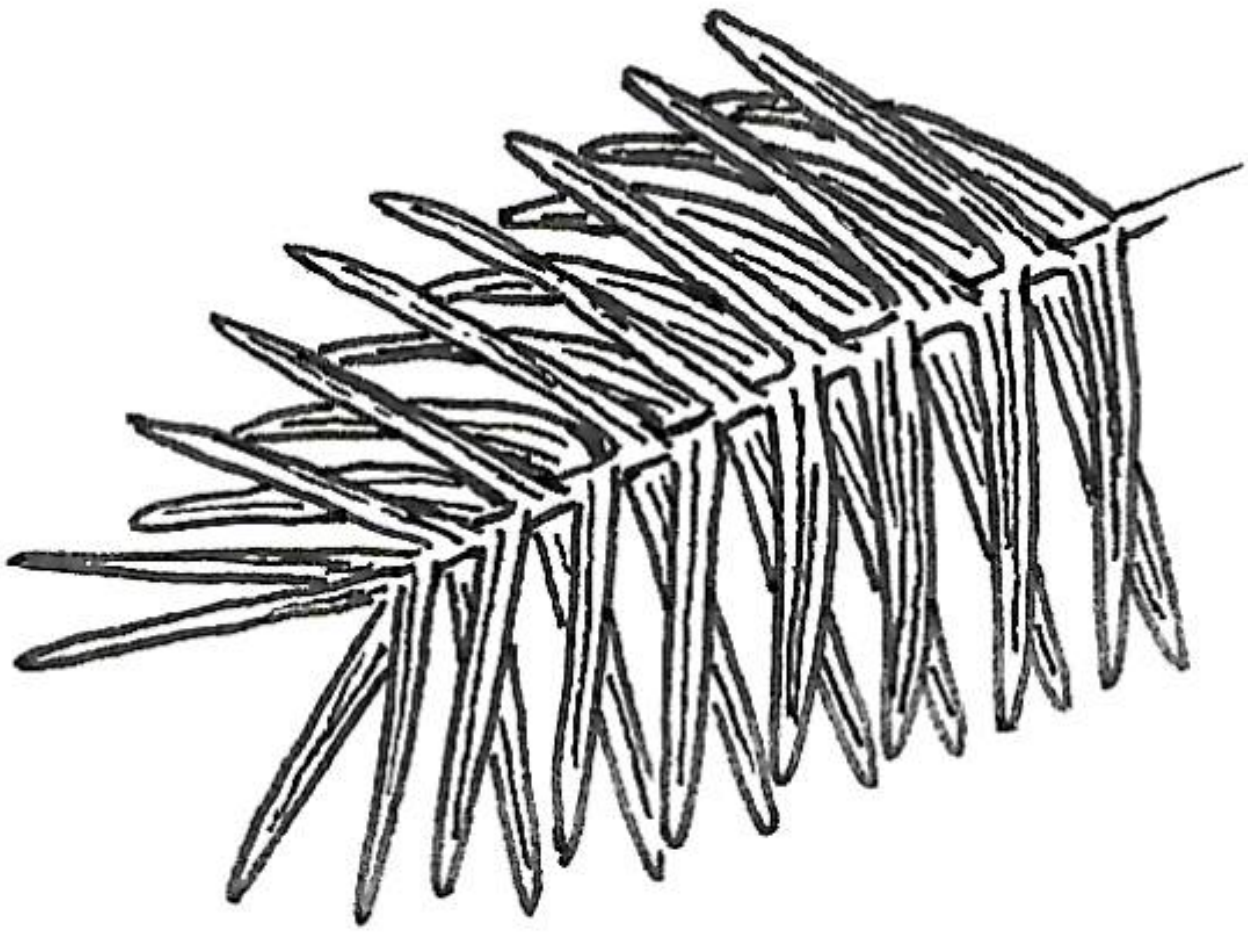
Look for plants that might make a good snack–to you or to another animal. Why might it be beneficial for a plant to be good to eat?

AUSTRALIA

The Australian forest is yet to be developed, but for now its plants can be found in the beds around the bus loop (look out for the permeable paving). When it is expanded, it will represent the **Greater Blue Mountains Area** in Southeast Australia, whose eucalypt forests sprawl across ancient sandstone plateaus long since eroded into towering cliffs and mountains.

WOLLEMI PINE

Also called *Wollemia nobilis*



Find this tree **by the restroom hut in the bus loop.** It grows in a fairly narrow, columnar shape, with a growth habit like a jumping jack: upper branches point up, lower branches point down.

Along with its relatives in the family Araucariaceae, the Wollemi Pine evolved in the **Jurassic Period**. At the time, Earth's landmasses as we know them today had not yet all separated from each other, existing instead as the supercontinents **Laurasia** and **Gondwana** (Araucariaceae evolved on Gondwana).

One of these cousins, *Araucaria araucana*, often referred to in English as the **monkey puzzle tree**, grows in the Chilean entry garden and is relatively common around Seattle, especially near big, old houses, as it was a popular garden plant in the mid-century. Another, the **Norfolk Island pine**, is endemic to an island off the coast of Australia and is a popular houseplant. On all three, **look for** rough bark and densely-growing, waxy leaves–here in one city, we can see the familial network of these ancient trees that drifted across the world from each other.

> Though it's called a "pine", the leaves of a Wollemi pine are closer to those of a **fir**–both fir and Wollemi needles are smooth and flat, while "true" **pines** have long, round needles that sprout in bunches of 2-5. As you see different conifers, **look (and feel) for** the wide variety of leaf shapes and arrangements.

Its (now limited) wild range in Australia is in deep, shaded temperate gorges, making our ecosystem a perfect resource for rehabilitation and reintroduction. Many other species, like **giant sequoia**, share this predicament–as their native ranges become hotter and drier, and thus more prone to fire, our moist, temperate environment becomes a home away from home.

One tool for re-establishing waning populations–for Wollemi pine and for many other plants–are **mycorrhizal fungi**, which grow in and around plants' root systems, drawing in nutrients from the soil in exchange for sugars from the plant. An estimated 90% of plants worldwide have or can develop relationships with mycorrhizal fungi, and these relationships can be crucial in getting new plants accustomed to new environments.

Mycorrhizal fungi don’t have fruiting bodies, meaning they don’t create mushrooms as we know them. But still, **look for mushrooms** on or near trees, especially close to the ground–when you see them, they are evidence of a sprawling, complex fungal network beneath the surface.

In this garden, also look for:

Eucalyptus: Like **holly**, eucalyptus shows **heterophylly**, meaning it grows differently shaped leaves on the same plant. In this case, though, leaf shape varies based on the age of the shoot they grow from: leaves on juvenile shoots are round, as well as horizontally oriented to soak up as much sun as possible; leaves on mature branches are long & vertically oriented to preserve water & protect against damage. Like **Wollemi Pine**, their relationships with **mycorrhizal fungi** may be critical to mitigating climate-related dieback.

Permeable paving: The permeable paving in the bus loop helps counteract erosion, improve soil health, and reduce stormwater runoff. It also is a place where small, tough plants we often see as weeds can really shine, as they make even the pavement lush and green.

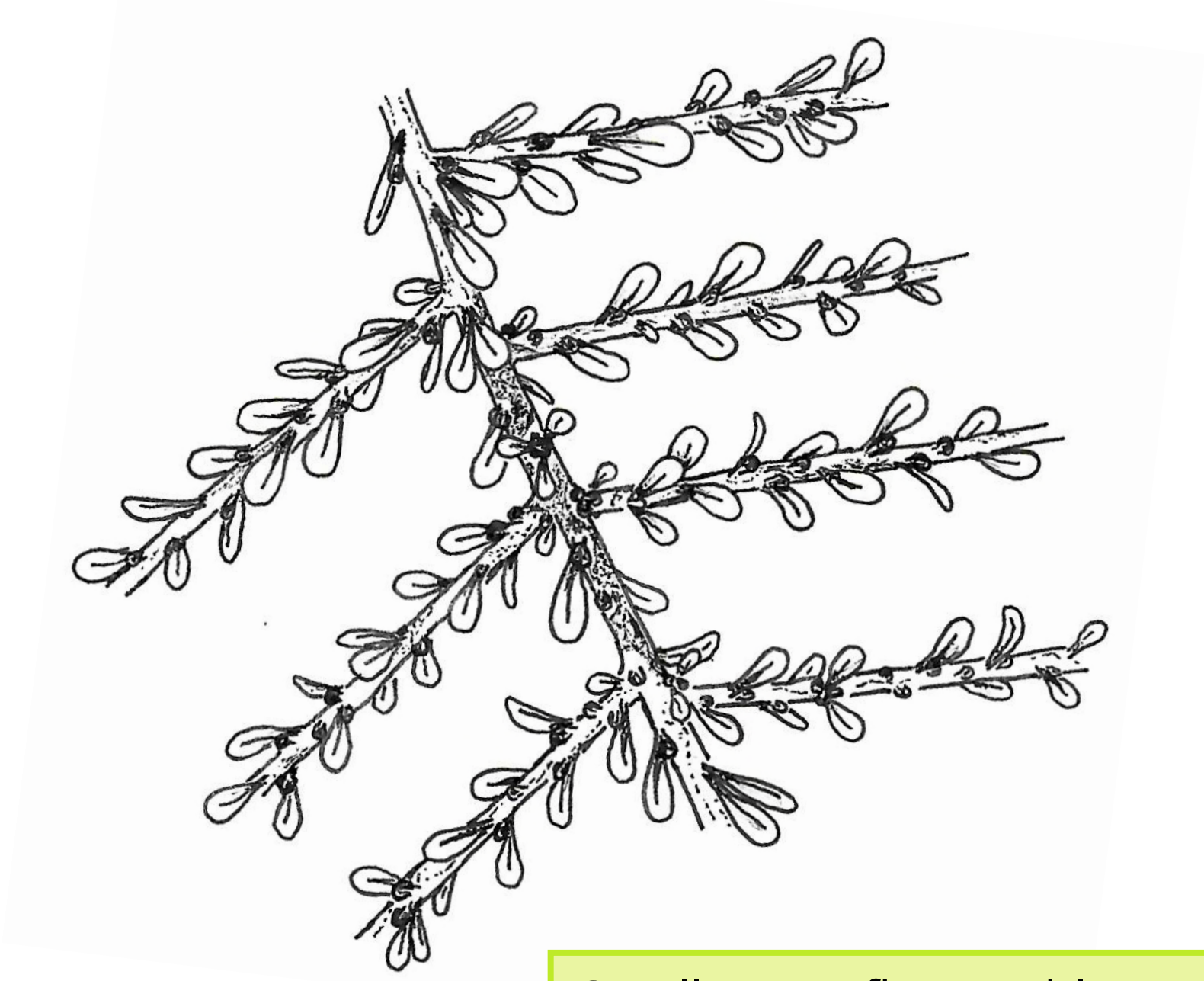
Australia notes

AOTEAROA/NEW ZEALAND

The New Zealand forest rolls down the hill on the north side of the garden (to the right of the interpretive shelter), populated by wild-collected specimens from the **high-elevation tussocklands** of Aotearoa/New Zealand's southern island. Look for signage in the garden to illustrate these plants' cultural context, and once you leave the Pacific Connections Garden, look out for these same plants in garden beds around the city.

MINGIMINGI/*COPROSMA PROPINQUA*

This large, woody shrub can be found along the path. Its straight, even twigs attach to the long, arching branches at such wide angles that they can look like fish skeletons.

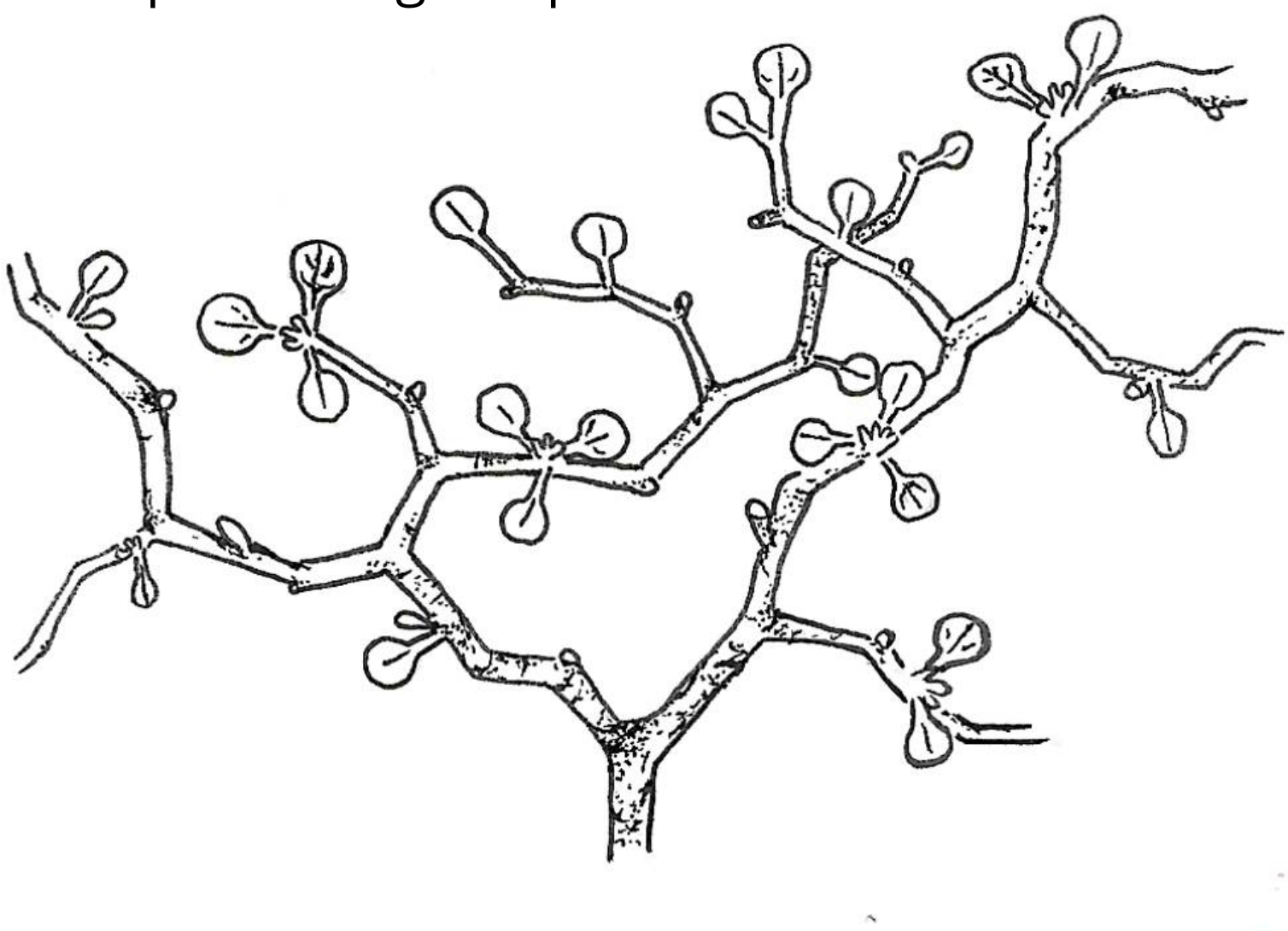


Small green flowers bloom on the end of each branch in **February and March**, and translucent blue berries ripen in **August and September**.

KOROKIO/WIRE NETTING BUSH

Other names: *Corokia cotoneaster*

Find this large, woody shrub in several spots along the path.



Bright yellow, starburst-like flowers bloom in **April and May**, followed by small, orange-red fruits.

Like many shrubs native to New Zealand, both Korokio and Mingimingi have evolved **divaricate branching habits**, where their branches split off from each other at wide angles, so that the plant as a whole is a tightly interlaced mass. There are two main theories as to why this is: either these shrubs evolved this way to protect against harsh climactic conditions, or the branching habit is a specific defense against the browsing habit of the now-extinct **Moa** bird.

Look for: moss and **lichen** growing more abundantly on the interior branches of the shrub where they're more shielded from the sun.

In this garden, also look out for:

Hebes: evergreen shrubs with smooth, waxy leaves arranged neatly in repeating patterns up each stem. If you look directly down the stem, they form an X shape.

Flax/phormium: upright sprays of long, blade-like leaves, often sold as container accents.

Both are common as garden & sidewalk plants around the city, and often live as "**tender perennials**"–not as sure a bet for hardiness through the cold as, say, a pine, but most of the time will survive our milder winters.

Aotearoa/New Zealand notes

URBAN ECOLOGY INDEX

CONNECTIONS ACROSS SPACE & TIME

Many of the plants and animals that currently reside in cities first evolved in ancient, far-away ecosystems, forming relationships with organisms that now reside on different continents or are extinct. We can see evidence of these long-ago ecological webs in these plants:

MONKEY PUZZLE TREE GINKGO

WOLLEMI PINE WIRE NETTING BUSH

RELATIONSHIPS IN THE LOCAL LANDSCAPE

An ecosystem is less a collection of individuals and more a web of relationships. Rather than passive bystanders or all-powerful arbiters, we as humans are intertwined in these relationships. These plants help us see how the ecological webs of this garden and of the city fit together, and how we continually negotiate our place within them.

FERNS SNAGS HOLLY BAMBOO

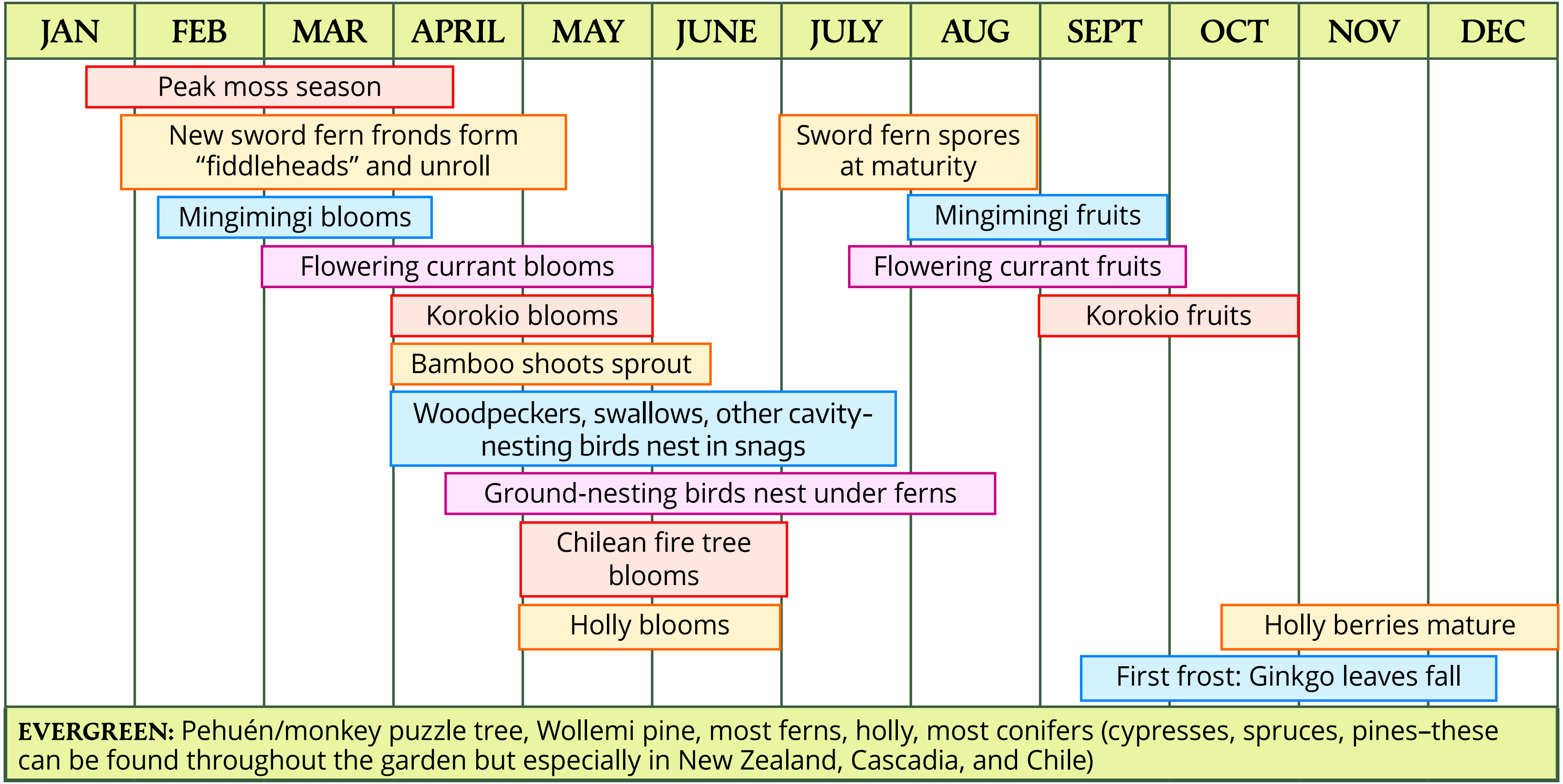
FLOWERING CURRANT CHILEAN FIRE TREE

THRIVING IN "UNNATURAL" HABITATS

Many city dwellers don't see their homes as being part of nature, but in reality cities are rich and complex ecosystems in their own right. Habitats many of us wouldn't even recognize as such–roadside ditches, concrete walls–are home to thriving populations of hardy, creative plants, bugs, and animals.

MOSS & LICHEN FLOWERING CURRANT

THROUGH THE YEAR: PHENOLOGY KEY



EVERGREEN: Pehuén/monkey puzzle tree, Wollemi pine, most ferns, holly, most conifers (cypresses, spruces, pines–these can be found throughout the garden but especially in New Zealand, Cascadia, and Chile)

FOR ADDITIONAL REFERENCE

The Pacific Connections section at Elisabeth C. Miller Library at the Center for Urban Horticulture for more resources on the regions and ecosystems represented in this garden.

Arboretum online interactive map for locations and Latin names of all plants registered in the Arboretum collection.

Trees for Seattle for an online map of all registered street trees in the city.

The UW Botanic Gardens, like the University of Washington and all of our lives and institutions, exists on Indigenous land. We acknowledge and honor the Coast Salish peoples of this land, the land which touches the shared waters of all tribes and bands within the Suquamish, Tulalip and Muckleshoot nations.

We are grateful to respectfully live and work as guests on these lands with the Coast Salish and Native people who call this place home and have stewarded it since time immemorial. This land acknowledgement is one small act in the ongoing process of working to be in good relationship with the land and the people of the land.

WRITTEN AND DESIGNED BY LOREN STEPHENS

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