

## Taking a Wind Break

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No matter how you cut it, wind is an essential part of life. Our windy weather can be a blessing or a curse, keeping us cool and comfortable with prevailing northeast trades or blowing out of control and destroying our home and food crops in the process.

But without a light breeze, our weather would be miserable with high humidity and unbearable heat all the time, both characteristics of living in most areas of the deep Tropics. Luckily, we live near the northern edge of the Tropics.

Windbreaks can protect crops 10 to 20 times their height downwind, and can also increase crop yields up to 44%. Windbreaks filter wind-blown soil particles, reduce crop water use, increase the plant's ability to produce food, and improve pollination of flowers that form into fruits.

Windbreaks can create micro-climates that decrease the days to harvest, and we've seen this when in-field windbreaks are used.

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*Tall Ironwood, Casuarina equisetifolia*

For 60% or 220 days of the year, the winds blow from a northeasterly direction, referred to as *tradewinds* so protecting crops for this dominant wind direction is a prerequisite to successful farming.

Each year, we experience destructive 50+ mile-an-hour winds and we've seen the impact of these winds. However, you cannot control or stop the wind, but you can slow it down, filter it, and divert it through the use of plants, trees, or even physical barriers.

Without windbreaks, fruit quality is adversely affected by abrasion and deformation. Wind damage to crops can be subtle at times, with a few misshapen fruit, leaf burn, and frequent plant wilting but in many instances, we cannot see all the effects of wind

damage which manifests itself in low yields and poor shelf life, affecting the bottom line.



*Growth Comparison, Ironwood (L) versus Cook Island Pine (R). Cook Island Pine was transplanted 1-2 years earlier.*

Wind can create wounds that predispose crops to secondary infections such as fungus and, in rainy season, bacteria. Weakened plants are more susceptible to viruses.

Planting lines of windbreaks not only protect crops, but also your home. The time to plant a windbreak is before you need them. Windbreaks need to be managed and nurtured as a crop, and includes providing adequate water and nutrition on a regular basis.

Every windbreak species has its advantages and disadvantages, and it's incumbent on farmers to weigh their options. One of the criticisms of windbreaks is that you can't harvest anything from it. However, you may not be able to harvest from fruit crops on your homestead without windbreaks.

There are two main types of windbreaks for farms; perimeter and infield windbreaks.

As the name implies, perimeter windbreaks are planted along farm borders, while infield windbreaks are planted between fields and sections. Different plant species are used for each situation. Using layers of windbreaks to create a total system of wind protection from many levels and directions of wind is a good strategy.

Comparing the most adapted species for your specific needs includes assessing each windbreak species' advantages and disadvantages, and weighing costs and benefits. The amount of maintenance and care required over the long-term is an important consideration.

On Molokai, only a few windbreaks have stood the test of time by consistently protecting crops from wind damage on a year-round basis.

Two Casuarina species are used as perimeter windbreaks, *Casuarina equisetifolia* and *C. cunninghamiana*. This genus is considered both drought and salt-tolerant, and a wispy sound is produced when wind blows through it, and has a calming effect reminiscent of sitting on a beach.

Cultural management of both Casuarina species is essentially the same.

Both species are considered a high weed risk, according to the Hawaii Pacific Weed Risk Assessment (HPWRA), especially in high rainfall situations.

However, these species have served our windbreak needs in Hoolehua, Molokai well, and has not shown to be invasive with few volunteers popping up in crop fields. Some plantings are over 30 years old.

Ironwood's are allelopathic, or have the ability to prevent other plant seedlings from germinating nearby due to a toxin in their fallen needles or leaves. This characteristic is considered both an advantage and a disadvantage.

Ironwood is considered an invasive weed in the wetter parts of Hawaii, such as the Hamakua Coast of the Big Island, because seeds germinate readily and can create a forest in a short time. However, volunteers do not readily self-seed, germinate, and establish itself in arid farming areas of the state.

There's a creeping type of Ironwood, *Casuarina glauca*, that's been used for erosion and conservation efforts throughout the state in the past. This species *should not* be planted as a windbreak since it will sprout readily from exposed lateral surface roots or when roots are damaged, and is very invasive.

**Tall or Horse tail Ironwood**, *Casuarina equisetifolia* is the cast-iron of windbreaks, and probably the most

Latin Name	Common Name(s)
<i>Casuarina equisetifolia</i>	Common Ironwood Horse tail Ironwood Tall Ironwood
<i>Casuarina cunninghamiana</i>	Short Ironwood; Cunningham Ironwood; River She-oak
<i>Polyscias guilfoylei</i>	Common Panax
<i>Sorghum bicolor x S. bicolor var. Sudanese</i>	Sudex; Sudax; Sorghum-Sudan Hybrid Grass
<i>Erythrina variegata</i>	Tall Wiliwili
<i>Schefflera arboricola</i>	Dwarf Schefflera Dwarf Octopus tree Dwarf Umbrella tree
<i>Musa acuminata X M. balbisiana</i>	Dwarf Brazilian; Banana Santa Catarina Prata; Hawaiian Apple Banana
<i>Araucaria columnaris</i>	Cook Island Pine

effective in protecting tall crops such as banana and papaya, and also fruit orchard systems. Under ideal conditions, Tall Ironwood can grow 10 feet a year until it reaches a mature height of 100 feet, but this requires adequate irrigation, fertilization, and weed control.

**River She-Oak or Cunningham Ironwood**, *Casuarina cunninghamiana*,

is shorter and broader than its taller cousin, and probably controls lower elevation wind better. It may not handle waterlogged situations as well.

Sowing seeds in 2-3" diameter forestry-type long cells, and transplanting into plastic mulch, weed barrier or mulch is recommended. Row spacing can range from 10-15 feet apart, based on the anticipated mature size of plants.

Windbreak seedlings can benefit from wind protection during the establishment stage. Planting a temporary windbreak, such as Sorghum-Sudan hybrid grass or Sudax, is recommended to protect Ironwood seedlings at planting. This requires planting Sudax a month before transplanting windbreak seedlings, using a seed planter with a beet plate

Planting crops at least 40-50 feet away from Ironwood windbreaks is a recommended practice to keep roots from interfering with nearby crops. Small farms may have difficulty giving up that much land, but these options have to be weighed.

As a survival mechanism, roots of all Ironwood species are known to wander from the tree into nearby plantings in searching of water. This habit can also be considered an excellent survival mechanism.

Ironwood must be managed as a crop. Providing adequate water and nutrients, and also pruning roots to contain them and minimize their zone of influence are important in growing a healthy

windbreak. This includes creating a road on the leeward side of the windbreak, and also managing roots by ripping the middle of the road at least once a year to manage wandering roots.



*Cook Island Pine: Mature seeds are collected after they've fallen and sown fresh*

**Cook Island Pine**, *Araucaria columnaris*, erroneously referred to as Norfolk Pine, is a beautiful pine-like tree, but is slower growing and more of a wind filter compared to Ironwood.

It will grow much slower than Ironwood, but can attain a greater height exceeding 200 feet and should be planted 15-20 feet apart or more when used as a windbreak. It should be planted about two years before it can be expected to protect crops.

Seed cones will form 1-2 times a year, and should be collected as soon as they fall from the tree. Seeds do not store well, so fresh seeds should be sown fresh. Sowing in 3" forestry-type cones works well for starters, but should be transplanted to tall one gallon pots and

grown to height of one foot before transplanted in the field.

### **Dwarf Schefflera or Dwarf Octopus**

**Tree**, *Schefflera arboricola* is a durable indoor ornamental, and also one of the most durable windbreaks. Propagated by cuttings, and planted 2-4 feet apart in rows, it provides excellent wind protection from the ground up.

However, Dwarf Schefflera is a high maintenance windbreak due to its sprawling, open growth habit with weak apical dominance, and requires regular pruning to maintain an upright, columnar growth. Under managed growth, the plants can reach heights of 50 feet or more and are impenetrable by man and deer.

**In-Field Windbreaks:** Tested choices for infield windbreaks include Panax, Tall wiliwili, Sorghum-Sudan Hybrid Grass, and Dwarf Brazilian Banana. Each has its advantages and disadvantages, and has to be assessed based on investments of time and energy to properly manage each species.

**Tall Wiliwili**, a columnar form of *Erythrina variegata* or Coral Tree has been used extensively in Hawaii for both perimeter and infield windbreaks. A nitrogen-fixing legume, it's adapted to poor soil.

A cultivar selected by the USDA Plant Material Center on Molokai, 'Tropic Coral' has been used extensively in Hawaii, and prior to the accidental

introduction of Wiliwili Gallfly over 10 years ago, over 10 miles of this cultivar was utilized as a windbreak on Molokai.

The Wiliwili Gallfly attacks most of the *Erythrina* genus laying eggs into leaves, causing deformation and early defoliating plants, and eventually killing many windbreak plantings. It has been replaced by other windbreak species.

However, the wiliwili gall fly parasite seems to have taken hold throughout the state and has held the gall fly in check, so we may be able to utilize this species again.



*Gallfly damage is all that's left of a Wiliwili Leaf*

Advantages of Tall Wiliwili include its strong apical dominance, and upright growth in a tight space. It can grow at a rate of 5 feet per year, and its ease of propagation is also a plus. Planting cuttings 2 feet apart in rows, and utilizing plastic mulch, weed barrier, or mulch to control is recommended.

In addition to attacks by the Wiliwili gallfly, other disadvantages include its propensity to drop leaves during cool

winter months providing less than adequate wind protection, and its susceptibility to powdery mildew fungus, also causing early leaf defoliation.

Tall Wiliwili is also a preferred food of the Fruit Piercing Moth, *Eudocima phalonia*, a major pest of tropical fruits. It will defoliate Tall Wiliwili and pierces adjacent fruits with its long proboscis, leaving a wound conducive to the introduction of diseases, and renders the fruit unsaleable.

Parasites and predators are present to control the Fruit Piercing Moth during the majority of the year, but will flare up during the cooler months when its predators and parasites are in short supply due to diseases, predation, and parasitization.



*Xanthemonas Bacterial Leaf Spot on Panax*

**Panax**, *Polyscias guilfoylei* is hedge plant of Melanesian origin with a columnar growth habit comparable to Tall Wiliwili with. Panax is a fast grower,

and can grow about 5 feet a year, and has been used as a replacement for Tall Wiliwili after the accidental introduction of the Wiliwili Gall Fly. Few insects and pest affect it, but a bacterial leaf spot, *Xanthemonas spp.* can be a problem during extended wet, cold periods.

Propagation spacing and methods are the same as Tall Wiliwili. Panax has been used as both a perimeter and an infield windbreak. Axis Deer love it especially when young, and will chomp on its tops or even pull out the young cuttings.

**Sorghum-Sudan Hybrid Grass**, *Sorghum bicolor x S. bicolor var. Sudanese*, also known as Sudax or Sudex is the fastest and easiest infield windbreak to establish.

This infield windbreak has sped up the process of opening up new land for farming to less than two months. In the past, infield windbreaks such as Panax and Tall Wiliwili would only provide adequate crop protection after one year or longer of growth after establishment.

Great for protecting low crops such as watermelon, bush tomatoes, peppers, and eggplant, and will reach heights of 6-8 feet in two months. Most of these crop seeds can be either sown in trays of direct seeded a month after planting Sudax.

Sudax can also be ratooned or cut back to flush the plants back at the end of a crop cycle, when fields are renovated for the next crop. Sudax can also be used

as emergency forage for cattle and horses, or mowed and incorporated into fields to increase organic matter.



*Sudax as a garden windbreak. Note plastic fence to protect from Axis Deer*

Recommended varieties include sterile seed types and long-day varieties that won't produce seed in our tropical daylength of 14 hours or less. Selecting cultivars tolerant to Sorghum Rust is a good move since this fungus can be a problem in wet winter and spring months.

To plant Sorghum-Sudan Hybrid grass seeds, use a beet seed plate with a hand planter such as a Garden Way Seed Planter. Sow seeds  $\frac{3}{4}$  to 1" deep. Birds can be a problem, so some vigilance is required when seeds are germinating and sprouting.

When farming in rain-fed conditions, a single row of Sudax can be sown in a furrow, while in drip irrigated systems, a double row is recommended. .

Weed control can include multiple cultivations before planting, or sterile seed techniques such as irrigating and

killing weeds without disturbing soil through the application of herbicides or flaming.

When planting perimeter windbreaks, such as Ironwood, Cook Island Pine, or even Panax, Sudax can act as a windbreak to protect and establish young windbreak transplants, especially in windy areas.

### **Dwarf Apple or Dwarf Brazilian Banana, *Musa paradisiaca X***

*balbisiana*, is a dual purpose windbreak and fruit crop. Brought to Hawaii in the early 1980's, it's a dwarf mutation of the Brazilian Banana discovered in Santa Catarina, Brazil.

Probably the most wind-tolerant of the Banana family, it has a wide-based trunk to resist toppling, although leaves will be shredded in strong winds. Plants can reach a height of 12-18 feet depending on the amount of irrigation and fertilization.



*Dwarf Brazilian Banana used as a windbreak to protect dryland taro. Hoolehua, Molokai*

Dwarf Apple Banana grown as a crop has a different plant spacing than when use as windbreaks. As a windbreak, banana keiki should be planted 6-8 feet apart, while for banana production, spacing can range from 12' X 12' to 15' x15'. Although better suited as an infield windbreak, Apple Banana is also used as a perimeter windbreak.

If grown as a windbreak, bananas must also managed as a crop and harvested on a regular basis to minimize rat, bird and insect populations.

Axis Deer are a recent problem, aggravated by long-term drought, and will probably feed on many windbreak species, especially Panax, Tall Wiliwili, and Sorghum-Sudan Hybrid Grass. However, Axis Deer have the uncanny ability to adjust to situations, including changing their food preferences.



*Invader's tracks in our homestead, Axis Deer*

Strategies to minimize windbreak damage include fencing fields, exerting constant pressure on deer by trapping or hunting them for food, and planting windbreaks during winter months when water and alternative food sources are

in adequate supply for them to survive elsewhere.

Identifying and establishing the most adapted windbreak species to protect your crops is a must, and a vital part of farm planning that many overlook. One option is to draw a layout of your farm, and identifying all the 'what ifs'.

Focus on windbreak needs and how they will look when mature. Plan out roads and special areas of your farm, and also plans for expansion. It's easier to plan on paper than making costly structural changes in the field.

***The utilization of windbreaks as part of a holistic farm production system cannot be overemphasized!***

### ***Windbreak Resources:***

Care for your garden - use plants suitable for windbreaks, green manure, and cover crops

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/GHGS-40.pdf>

Care for your garden—use windbreaks  
<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/GHGS-38.pdf>

Trees and shrubs for windbreaks in Hawaii

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/C1-447.pdf>



# Hot Hawaiian Chile

## Peppers

For many local folks, chile pepper water is an indispensable addition to a great local feast, and can add pizzazz to meat, fish, and soup dishes. There are many variations of this condiment combining water, shoyu, different kinds of vinegar, and even garlic with lots of chiles.

Christopher Columbus misnamed chiles as peppers, mistaking them for black peppers due to their 'heat'. The name 'peppers' or 'chile peppers' stuck with this plant, and is commonly used today.



*Hawaiian Chile Peppers*

*Capsicum frutescens* is the Latin name for Hawaiian chiles, and is also called Bird Chiles for good reason. Birds are known to strip plants clean of the red-orange .22 bullet-sized fruits.

The Hawaiian Chile is not native, but was actually introduced to Hawaii around 1815, and was called 'nioi, by the Hawaiians, a generic name given to

all chiles with second names based on its shape such as 'nioi kamakahala' for round or 'eye shaped' types. Some were even used in leis, and also concocted into salves or creams to treat arthritis.

Hawaiian Chiles are considered 'hot' by any scale. The 'heat' or capsaicin content in chile is measured in Scoville Heat Units (SHU), with Hawaiian chiles hitting the scales from 50,000 to 100,000 SHU.

Contrast this with the hottest chile, Bhut Jolokia from India at 1,000,000 SHU, and Habanero types at 250,000 SHU. But it's not just about heat; it's also about sweetness and flavor, and this is where the Hawaiian chile tops the scale.

Bird Chile cousins include *Tabasco*, used to make a famous hot sauce, and the wild *Malagueta*, the most common chile in Brazil. Another cousin is the Filipino variety *Siling Labuyo* translated from Tagalog as 'wild chile', whose fruits have a blackish cast, and its leaves are fuzzy, and used in soups, such as tinola or chicken papaya.

Hawaiian Chile is late maturing and is not adapted to most short season areas of the US mainland. Plants can attain heights of 4 feet or more, bear fruit for several years, and can also be pruned back and flushed again.

Diseases and insects can affect them, but the key is to 'know when to hold them and know when to fold them.' As the plants age, they weaken and harden, and are more susceptible to

diseases and insects. At that point, it's prudent to start new seedlings.

Major diseases include powdery mildew fungus where a whitish powder on leaves that will cause premature leaf drop. Many races of Bacterial Leaf Spot or *Xanthomonas* spp. can be a problem in wet weather. Viruses, such as Tobacco Mosaic Virus (TMV) and Potato Virus Y (PVY), create a mottled look to the leaves and will stunt and weaken plants, and also affect fruits.

The most serious insect is the Pepper Weevil. It lay eggs in the flower and burrows into fruits, and also cause premature fruit drop in early fruit formation. Sanitation is the key; pick up all dropped fruit and dispose of them.

Broad mites will deform newer leaves, but can be controlled with a sulfur spray.



*Hawaiian Chile Peppers in Vinegar*

Plant hoppers, clusters of little insects with spines on them, will congregate on stems and usually attack weak, older plants by sucking on plant juices. The

mature stage of these plant hoppers are green with pointed heads.

The use of Neem, an organic insecticide can control them. In order to keep one step ahead of pests and diseases, move plants around the yard and don't plant in the same area consecutively.

Start with good soil high in organic matter, and a pH of 6 or more. Keep plants actively growing starting with 10-30-10 or comparable fertilizer at planting. Light doses of a balanced fertilizer (1:1:1 ratio) will keep them actively growing until they flower and fruit. Chiles will be hottest when the weather is hot and when plants are under water stress. Conversely, those growing in cool wet areas will not be as hot.

You can create vintage chile pepper water since, if properly made, it can last for years if you don't drink it up sooner. Get creative and add other flavors such as garlic or ginger to expand the taste range. A growing food trend is adding layers of flavor to hot sauce, similar to Sriracha.

## Speaking Mandarins

A cold, sweet, juicy mandarin is just the fruit for a hot day, and is high in Vitamin C. But what exactly is a mandarin? Mandarins are a group of closely related citrus crosses, including tangerines, tangors, tangelos, and tantangelos. Tangerine is a type of Mandarin and the most popular in Hawaii.

Tangelos are created by crossing a grapefruit or pomelo with a tangerine, while a tangor is a cross between a tangerine and an orange. A tantangelo is a tangerine crossed with a tangelo or between two tangelos. A mandarin crossed with a lemon is a lemandarin. Beyond that, it gets very complicated, so the rest are called citrus hybrids.



*Molokai-Grown Tangerines*

Many mandarin varieties grow well on Molokai, but only by growing them will you know which cultivars grow best in your area.

Most mandarin varieties are seedy, but it's dependent on what's pollinating them. Many mandarins do better with a pollinizer, including tangelos and some tangerines, so it's best to plant more than one variety. Clementine and Orlando are considered good pollinizers, and bees can help to spread the pollen around.

Mandarins will impart a seedy character to its citrus relatives, even so-called seedless oranges, if planted nearby.

Many mandarins are alternate bearers, bearing a heavy crop every other year.

There's a lot of confusion regarding the origin of Mandarins and its genetics. They're believed to have originated in India.

The following are some of the important groups/cultivars:

**Mediterranean or Italian, also known as Willowleaf**, has small fruit with a distinctive flavor. Plants have a drooping habit. Adapted to hot, dry conditions, and has an alternative bearing habit.

**Ponkan** from India is the most tropical in adaptability, but doesn't adapt well to hot arid conditions.

**King or King of Siam** group is from Vietnam, and has among the largest fruits.

**Satsuma or Unshu** originate from Japan, and prefer cooler conditions.

**Clementine** or Algerian is an important tangerine. A small fruit with many excellent qualities, Clementine is a parent of many excellent tangerines adapted to Hawaii conditions. This is the most important group in Hawaii, and originates from North Africa, around Tangiers, Morocco where the name 'tangerine' comes from.

UH-recommended Mandarins for Hawaii are categorized into three groups, and these selections are based on decades of field testing at UH Research Stations across the state, but not on Molokai.

**Recommended tangelos include Minneola and Orlando.** Minneola is a cross of Duncan grapefruit and Dancy tangerine, and has a characteristic nipple on the top of its fruit. Minneola has a large, very juicy, bright red-orange flesh. It's peelable, firm but tender, and performs well on most rootstock. Sibling to Minneola, Orlando is hard to peel.

**Recommended tangors include Murcott or Honey, and Ortanique,** both of which are crosses between tangerine and an orange or a tangor of unknown background. From my experience, Murcott or Honey is a very prolific fruiting variety on Molokai, but is smaller than most tangerines grown.

**Recommended tangerines for Hawaii include Fairchild, Fremont, Lee and Nova.** Fairchild is a cross between Clementine and Orlando tangelo, and grows best on Cleopatra rootstock.

Fremont is a cross between Clementine and Ponkan, and has medium to small fruit, with a rich flavor, tender and juicy, easy to peel, and early bearing. However, Fremont is susceptible to citrus scab found in wetter areas, and also sunburn. At low elevations, it seems to bear a little fruit several times a year. Both Lee and Nova are crosses between Clementine and Orlando tangelo and are technically tantangelos.

One of the most serious diseases of citrus, including Mandarins, is Citrus Tristeza Virus, called 'Quick Decline'. There are probably many strains of this

virus, including a stem pitting strain that's very common on Molokai.

This virus is spread by aphids. A novel strategy has been to infect plants with a weak strain of this disease which protects plants from the more virulent strains. Cultivars of rootstocks and scion show a wide variation in susceptibility to this virus.

**Susceptibility of Citrus Cultivars to Citrus Tristeza Virus (CTV)**

Disease Severity	Citrus Varieties and Types Exposed to CTV at Poamoho Research Station, Oahu
Severe	Lime: 'Mexican'
	Limequat (cross between Key lime and kumquat)
Moderate	Lime: 'Kusaie,' 'Rangpur'
	Mediterranean sweet orange
	Navel orange: 'Golden Buckeye,' 'Washington,' 'Carter'
Mild	Grapefruit: 'Marsh,' 'Davis,' 'Bowden,' 'Sunshine'
Unaffected (asymptomatic)	Kumquat: 'Nagami,' 'Nippon'
	Lemon: 'Eureka,' 'Villafranca,' 'Meyer,' rough lemon
	Lime: Tahitian lime
	Mandarin orange: 'Wase,' 'Kara'
	Orange: Hawaiian (Kona), 'Valencia'

Source: *Tristeza Virus in Hawaii*  
<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/PD-77.pdf>

A recent citrus bacterial greening disease called Huanglongbing or Yellow

Dragon Disease arrived in the U.S. from China recently, but has not been detected in Hawaii. It causes a dieback and stunting of plants leading to their slow decline. This disease is expected to cause major losses in citrus production there.

Keeping fruits within reach, and harvesting with pruners prevents skin from breaking near the stem when pulling off fruit.

Keeping plants healthy with proper nutrition and adequate irrigation is an important strategy in warding off diseases, and this starts by collecting a soil sample and following recommendations.

Pests include mealybugs and scales causing sooty mold. Controlling ants through the use of ant baits, sticky traps such as Tanglefoot, and also using fatty acids such as Impede and Safer's Soap to kill mealy bugs and scales by clogging their spiracles or breathing holes.

Citrus Swallowtails look like lighter colored Monarch Butterflies and will feed on leaves. The caterpillar resembles bird droppings on leaves, and can be controlled by picking them off.

In rainy areas, a fungus called Citrus scab can be a problem. Otherwise, tangerines are a super backyard fruit that can supply your daily Vitamin C needs.

***Thought for the Month:***

Experience is not what happens to you; it's what you do with what happens to you.  
*Aldous Huxley*

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*Well, that's it for this month. The dog days of summer are upon us. Happy farming and enjoy the long days. Don't forget to take some time off to enjoy your surroundings!*

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