TERRARIUM

generative music in a jar, for monome norns



player's manual

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terrarium is a small world in a jar that makes music. Weather falls on a landscape, and wherever it lands, a note plays: rain on a meadow blooms flowers, lightning strikes crystals, snow settles and hushes the ground, ripples spread across a pond, and the sound drifts up into the clouds. You don't patch anything. You choose what lives in each part of the jar, and you shape it with two knobs.

It's built for long, slow listening. Leave it running and it keeps changing: the phrase drifts, the key turns with the seasons, the weather comes and goes, and day turns into night.

It's a living world of sound, grown from the modules of Mutable Instruments. Plaits blooms in the meadow, Rings rings through the pond and the reeds, Clouds and Beads drift through the sky, and Elements breathes under the ground. Émilie Gillet's instruments, alive inside your norns.

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Foreword

When I started thinking about terrarium, the norns script, I was already inspired by so many scripts that take the nature as their inspiration like fall, flora, and other generative concepts that appear in the natural world.

I'm also a huge fan of plants and terrariums are a perfect ecosystem where you take time to build, care and wait for it to balance. Frustration is part of the process since we make mistakes, plants perish and we learn from it.

I took this terrarium concept and applied it to sound, creating a small ecosystem of generative music by leveraging the incredible work of Émilie Gillet and her Mutable Instruments modules.

I'm not a big DSP expert, so relying on Gillet's work allowed me to focus on the aspects of transformation and interaction between all parts of the instrument.

Finally, since not all have access to the fantastic Monome Norns instrument, I wanted to make terrarium as accessible as possible, so a Web version was made and at the end, a friend asked me for a plugin since he wanted to use it within his DAW.

This is the little story of terrarium: a small world in a jar that makes music.



Hope you enjoy it!
Carlos E.
Founder and creator of glassgarden. / Voltage Foundry Modular

WHAT YOU NEED

- A **norns** (any kind: the original, shield, or fates).
- The **mi-UGens**, the Mutable Instruments sound modules for norns. The first time you open terrarium without them, it offers to install for you.
- Optional: a **MIDI synth** with its audio patched back into the norns input, or anything else to plug into the input, if you'd like visitors in your jar. More on that in visitors.

To install terrarium, type this in the maiden REPL:

```
;install https://github.com/glassgarden/terrarium
```

You can also enjoy terrarium in the browser at https://terrarium.glassgarden.cc

THE FIRST TIME YOU OPEN IT

If the Mutable Instruments modules aren't on your norns yet, terrarium shows a short message instead of the landscape. Press **K3** to download and install them (it needs Wi-Fi), then go to **SYSTEM > RESTART** in the norns menu and open terrarium again. You only do this once. terrarium installs its own norns build of the mi-UGens, which includes Beads.

THE FIRST MINUTES



Open terrarium and just listen for a while.

Rain falls on the meadow. Each drop lands somewhere along the ground, and **that place is the note**: further left is lower, further right is higher, and you hear it from that side too. Where it lands, a flower blooms and the pond ripples. The sound rises into the clouds.

The drops aren't random. The weather keeps a short **phrase** of notes, and plays it over and over, changing a note now and then. You can see the phrase as small puddles along the ground, one for each note. When a note changes, its puddle glows for a moment.

Above it all, a quiet **hum** holds everything together, shown as an aurora across the top of the sky.

PLAYING IT

Terrarium has **five parts**: weather, soil, water, air and hum. You pick a part, then shape it.

E1	choose a part: weather, soil (what grows), water (pond or fog), air (the sky) or hum (always there)
E2, E3	shape that part (each part has two knobs)
K2	swap what lives in that part (meadow → crystals → reeds…)
hold K2 + turn E2	choose its variety (which flowers, which kind of resonance, which NB voice…)
K3	that part's gesture (see below)
hold K1	peek at everything, and change the settings
hold K1 + K3	a new terrarium: everything chosen at random

CHOOSING A PART

Turn **E1**. The part you choose stays bright while the rest of the jar dims for a moment, and its name appears at the top, along with what its two knobs do.



SHAPING IT

E2 and **E3** are the part's two knobs. Their names show at the bottom while you turn: E2 on the left, E3 on the right, where the knobs are on your norns. The bar shows where it is.

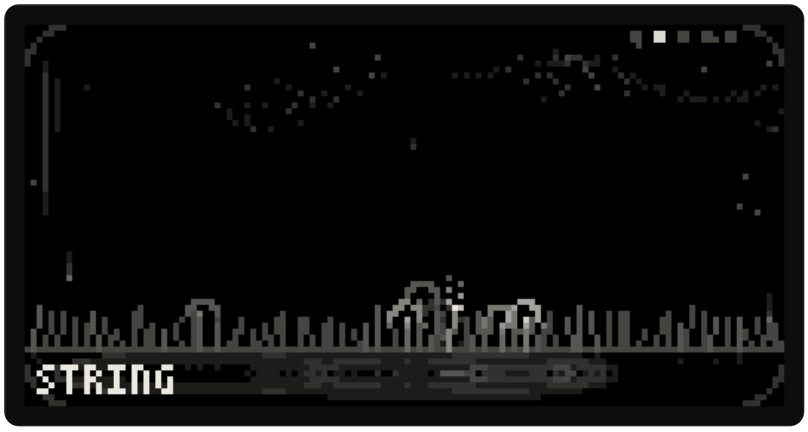


There are no numbers. **The picture is the readout**: turn harmonics and the grass grows taller; turn timbre and the flowers open wider. Every knob changes something you can see.

SWAPPING AND VARIETIES

K2 swaps what lives in the part: the meadow becomes crystals, then reeds, then visitors.

Hold K2 and turn E2 to choose a variety without swapping: a different kind of flower on the meadow, a different resonance in the pond. Its name appears as you turn.



GESTURES (K3)

PART	K3
weather	a new phrase: the weather forgets its notes and starts another
soil, water	strike: play a note right now
air	freeze: hold the sky still (and the jar frosts over); again to thaw
hum	hush: the hum fades out; again to let it rise

PEEKING (HOLD K1)

Hold K1 to see all five parts at once, with both knobs of each as bars. The bottom line is the settings: while K1 is held, **E2** chooses a setting and **E3** changes it. Let go and you're back in the landscape.



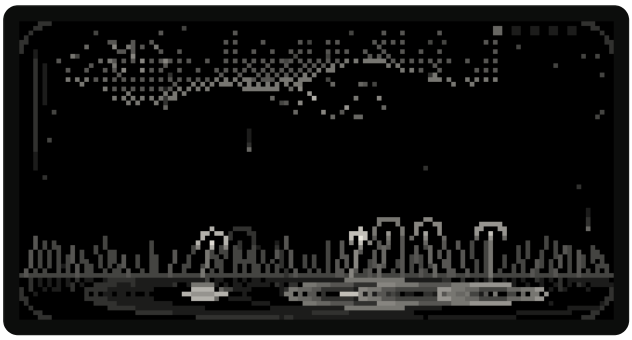
A quick *tap* of K1 opens the norns menu, as usual. Terrarium only uses K1 while it's held.

A NEW TERRARIUM (HOLD K1 + K3)

Hold **K1** and press **K3**, and the jar fills with something new: every part gets a random module, variety and knob settings, the settings change too (key, scale, range, length, seasons, climate, drift, breath and erosion), and a light sweeps along the ground as the new key appears. Press again until something catches your ear, then shape it from there. (It never picks visitors or an empty hum, and leaves the day alone: that one is about your time, not the music. It's also in **PARAMS > randomize the jar**.)

WEATHER

The weather decides **when** notes happen and **which** ones.

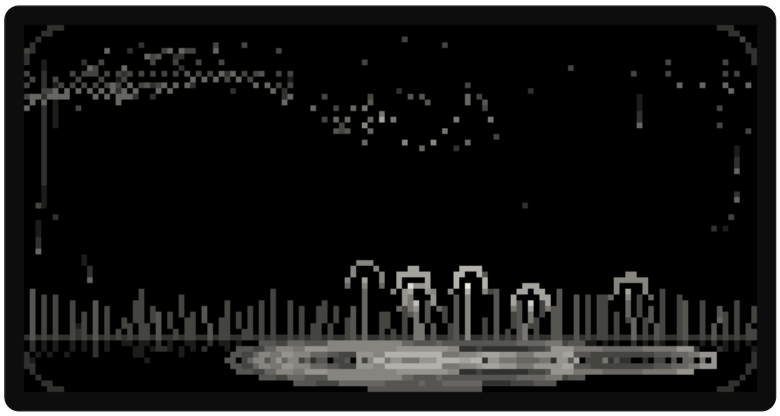


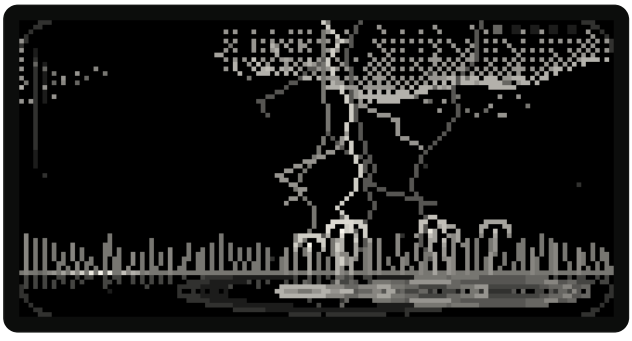
rain

Rain falls in time with the norns clock, so it plays along with other scripts and gear.

- **E2 rate**: from a slow drip to a downpour.
- **E3 change**: how often the phrase changes a note. More change brings wind: the rain slants, the grass sways. All the way down, the phrase repeats forever.

Heavy rain beads up on the glass of the jar, and now and then a drop runs down.

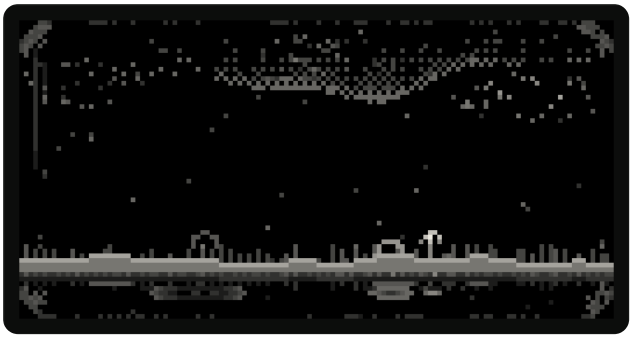




lightning

Lightning strikes at random moments, sometimes twice in a row, and lights up the whole landscape. The same note always strikes with the same bolt.

- **E2 rate**: how often it strikes.
- **E3 change**: how often the phrase changes; more change, a wilder storm.



snow

Snow falls slower than rain, and looser. The flakes set off in time with the norns clock, but each one drifts down at its own pace and plays where it lands, so the notes come a little early or late, and sometimes out of order: somewhere between the rain's steady beat and the lightning's surprises.

It also **settles**. Every flake adds to a layer of snow on the ground, and the snow muffles the soil, as real snow hushes a landscape: the sound grows darker, the notes shorter and softer. The longer it snows, the deeper the hush. Even a light snow builds up, only more slowly. The snow slowly thaws, and when it shrinks the meltwater drips a few soft notes from the phrase. Switch to other weather and the rest of it thaws away.

And slowly, the **cold** comes in. A minute or two behind the snow, the jar grows still: the clouds drift slower and their grains hold their pitch, the fireflies wander less, and frost creeps into the corners of the glass. It never freezes the air; that's still yours, on K3. When the snow thaws, the cold lifts after it.

- **E2 rate**: from a few flakes to a flurry, and the more it snows, the deeper it settles.
- **E3 change**: how often the phrase changes, and how much the wind gusts: the flakes swirl, and the notes land further from the beat.

With the **day** on, the snow lives with it: the night lets it pile up and glow faintly, and the sun thaws it, with most of the dripping in the morning.

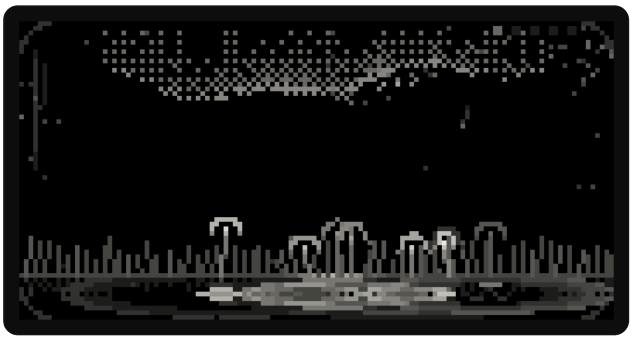
Some things to try:

- **Snow through a whole day.** Snow on the meadow, *day: 20 min*, and leave it. The night grows hushed and close, the morning drips and opens up, and noon is the clearest it gets.
- **Change the weather after a long snowfall.** Let it snow for a few minutes, then swap to rain: the muffled soil slowly comes back to life as the snow thaws.
- **Snow with no change.** E3 all the way down: the flakes land on the beat and the phrase repeats, and all that changes is the slow hush and the cold coming in.

- **Snow with fireflies.** The cold calms them: watch them slow down and listen to the grains settle, then freeze the air (K3) for the last step.
- **A flurry, then a few flakes.** Turn the rate up for a while, then down: the snow thaws back to where the lighter fall keeps it, and the meltwater drips along the way.

SOIL: WHAT GROWS

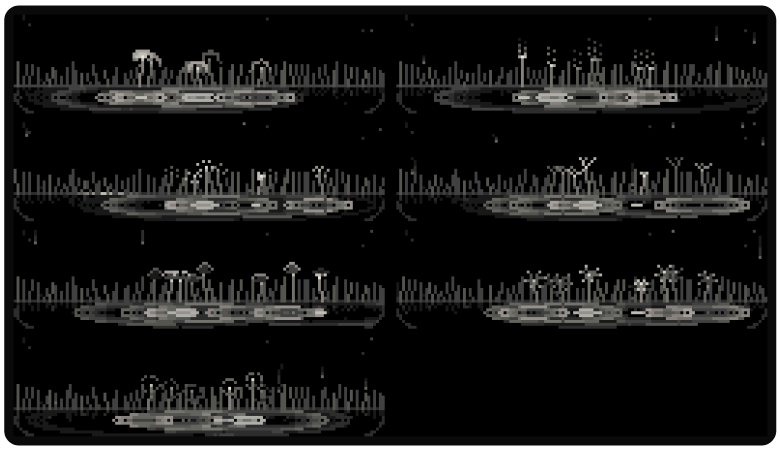
The soil is **what plays** the notes.

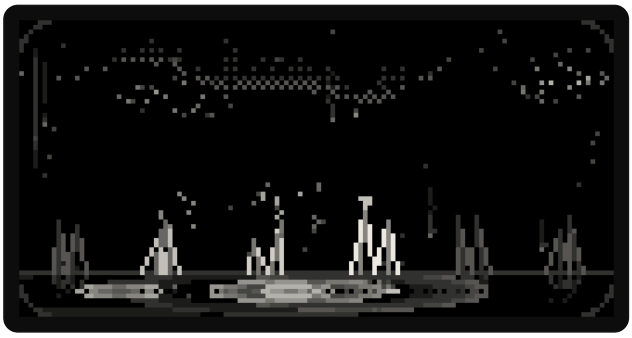


meadow

Every note blooms a flower where it lands.

- **E2 harmonics**: the grass grows taller; the tone gets richer.
- **E3 timbre**: the flowers open wider; the tone gets brighter.
- **Varieties (hold K2 + E2):** twelve different sounds, and each grows its own kind of flower: bells, seed spikes, petals, tulips, umbels, stars and dandelions.

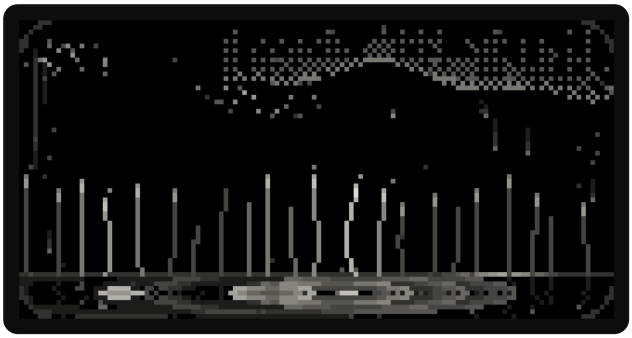




crystals

Glassy, bell-like tones. Each note makes the nearest crystal glint and throw sparks.

- **E2 ratio**: the crystals grow taller and sharper.
- **E3 index**: more sparks, a more metallic ring.
- **Varieties:** three banks of crystal sounds.



reeds

Each note plucks a reed by the water, and you can see it vibrate like a string.

- **E2 structure**: taller, bent reeds; stranger, more bell-like resonances.
- **E3 brightness**: the reed heads light up; a brighter tone.
- **Varieties:** six kinds of resonance. In *sympathetic strings*, the reeds next to the one you pluck start ringing too.



visitors

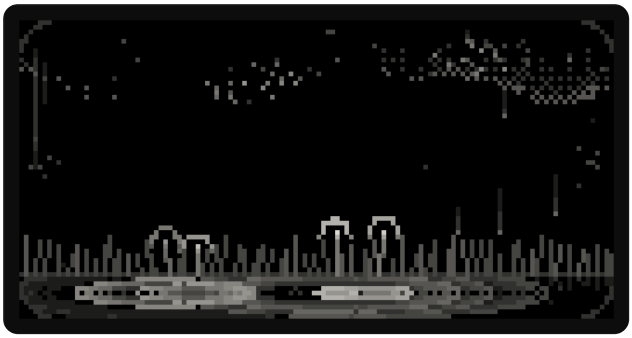
Visitors come from outside the jar. Each note goes out over MIDI to a synth beside the norns, and the synth's sound comes back in through the norns' audio input, where the pond, the fog and the sky shape it like any other soil. Each note also opens the input for a moment, so anything you plug in (that synth, a guitar, a radio) is let in by the weather. Each MIDI device brings its own creatures (ants, beetles or moths), which wander in from the edge. When a note plays, the nearest one hurries over and glows for as long as the note lasts.

Setting it up: plug the synth into the norns over USB (or through a USB MIDI interface) before opening terrarium, and patch its audio output into the norns' inputs. Then turn the **monitor** level down in the norns mixer (**SYSTEM > AUDIO**), or you'll hear the dry input under the shaped one. The MIDI channel is in **PARAMS**, with the visitors.

- **Choose the MIDI device:** hold K2 and turn E2. With "none", no notes go out, but the input still plays: plug in anything and let the weather open it.
- **E2 opening**: how much of the input comes through between notes. All the way down, you hear it only when a note plays; all the way up, all the time.
- **E3 length**: how long each note lasts, and how long it keeps the input open.

WATER: THE POND AND THE FOG

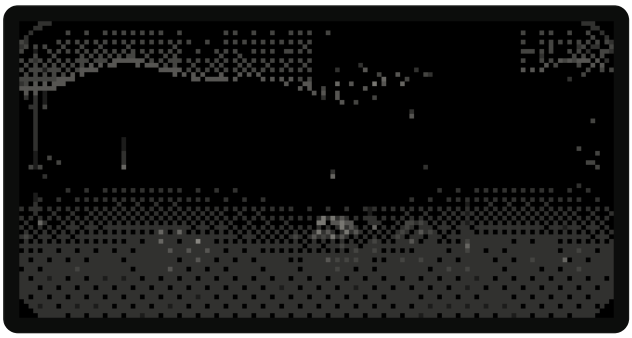
Water is **what shapes** the soil's sound: on the ground or in the air.



pond

Every note sends ripples across the pond and makes it ring in tune. The water mirrors the landscape above it, and the ripples bend the reflection.

- **E2 structure**: more rings, a richer resonance.
- **E3 damping**: how long the ripples last, and how long the pond rings.
- **Varieties:** six kinds of resonance.



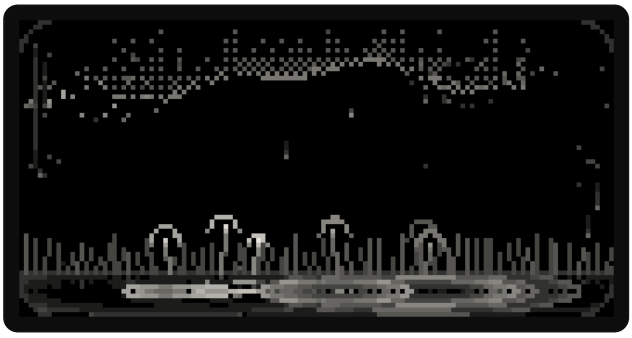
fog

Fog closes in as the sound gets darker, and the whole jar dims with it.

- **E2 clarity**: lifts the fog and opens up the sound.
- **E3 shimmer**: makes the fog waver; the sound gets a resonant edge.

AIR: THE SKY

The air is **where the sound rings out**.



clouds

Clouds made of tiny grains of sound drift across the sky; they flicker when a note passes through.

- **E2 density**: more grains, thicker clouds.
- **E3 size**: bigger, wider clouds.
- **Varieties:** granular, pitch shifter, looping delay, spectral.
- **K3 freeze** holds the sound in the air, and the glass frosts over until you thaw it.





fireflies

Each grain of sound is a firefly, like little beads in the air. The ones nearest a note light up.

- **E2 density**: more fireflies.
- **E3 glow**: longer trails, longer grains.
- **K3 freeze**, as for clouds.



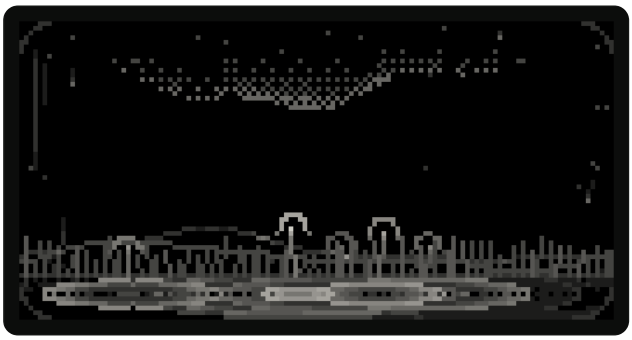
mountains

The bigger the room, the bigger the mountains. Each note echoes back off the far ridge.

- **E2 size**: taller, more distant ranges; a longer reverb.
- **E3 echo**: more of the sound goes into the mountains.

HUM: ALWAYS THERE

A soft drone on the key's root and fifth, under everything else. It holds the music together between notes, follows the key, and glides when the key changes. **K3** hushes it and lets it rise again.



aurora

Curtains of light across the top of the sky. They flare when a season turns.

The hum listens to the weather. Each note makes it step back a little, so the melody has room, and it swells again in the quiet between notes: busy rain keeps it low, a calm spell lets it fill the jar. Each note also lights it up for a moment, a lightning strike most of all, and the curtains glow with it. Now and then, at the end of a phrase, its upper note moves to one the melody has been leaning on (a third, a fourth, a sixth, or back to the fifth); the more the weather **changes**, the more often.

- **E2 glow**: a warmer or brighter hum, and brighter curtains.
- **E3 motion**: how much the hum and the curtains drift.
- **Varieties:** seven sounds.



roots

A bowed and blown drone, drawn as roots under the ground with light flowing down them. Like the aurora, it steps back for the notes and lights up with them.

- **E2 breath**: from bowing to blowing.
- **E3 depth**: a bigger, more spacious sound; the roots reach further.
- **Varieties:** three kinds of resonance.

none

No hum at all, for when you'd rather have silence between the notes.

LETTING IT GROW: THE SLOW SETTINGS

Hold **K1**; **E2** chooses a setting, **E3** changes it. They're all in **PARAMS > settings** too.

SETTING	WHAT IT DOES
key, **scale**	the notes the landscape plays: major, minor, dorian, pentatonic, hirajoshi…
range	how many octaves the land spans, from left to right (1 to 3)
length	how many notes are in the phrase (4 to 16)
seasons	lets the key change by itself, slowly
climate	slow, ever-changing movement of all the knobs
drift	how fast the climate moves
day	a day and night
breath	moments of calm
erosion	the wear of an old recording over everything: wow, crackle, hiss

SEASONS

Now and then the key moves to a close neighbor, changing only one or two notes, so the music shifts gently instead of jumping. The key you set is home: the seasons wander away and keep finding their way back. The new note doesn't arrive all at once: the notes it would move keep their old pitch for a phrase or two and come over one by one, while new notes already play in the new key. A light sweeps along the ground when a season turns, and the aurora flares.

With the **day** on, the seasons follow it: *slow* (how terrarium starts) turns the season at dawn, *steady* at dawn and dusk, *quick* at dawn, noon, dusk and midnight. With the day off they turn every 32, 16 or 8 phrases. *off* keeps the key where you set it.

CLIMATE AND DRIFT

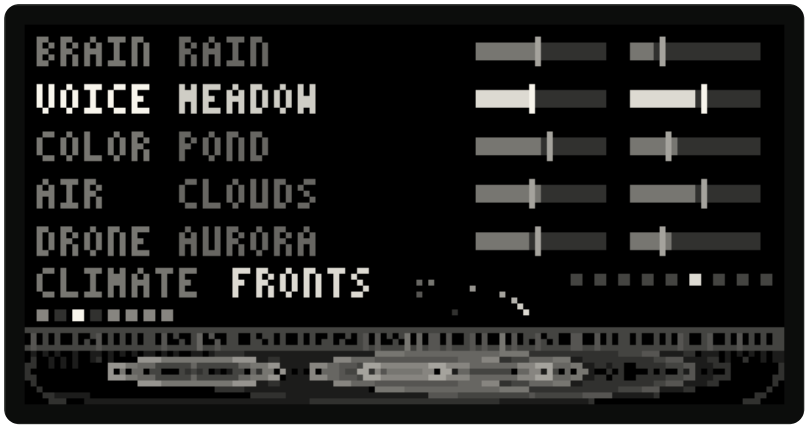
The climate moves every knob a little, all the time, like weather passing through. Your settings stay the center; the climate pushes them around it, never too far. All five parts move together, because they follow the same climate.

There are four climates, each with its own way of moving:

- **fronts**: settles into one mood, then switches to another at unexpected moments
- **gusts**: rolls along smoothly, then suddenly gusts
- **tides**: slow and rolling, like a tide coming in and out
- **squalls**: flips abruptly between two moods

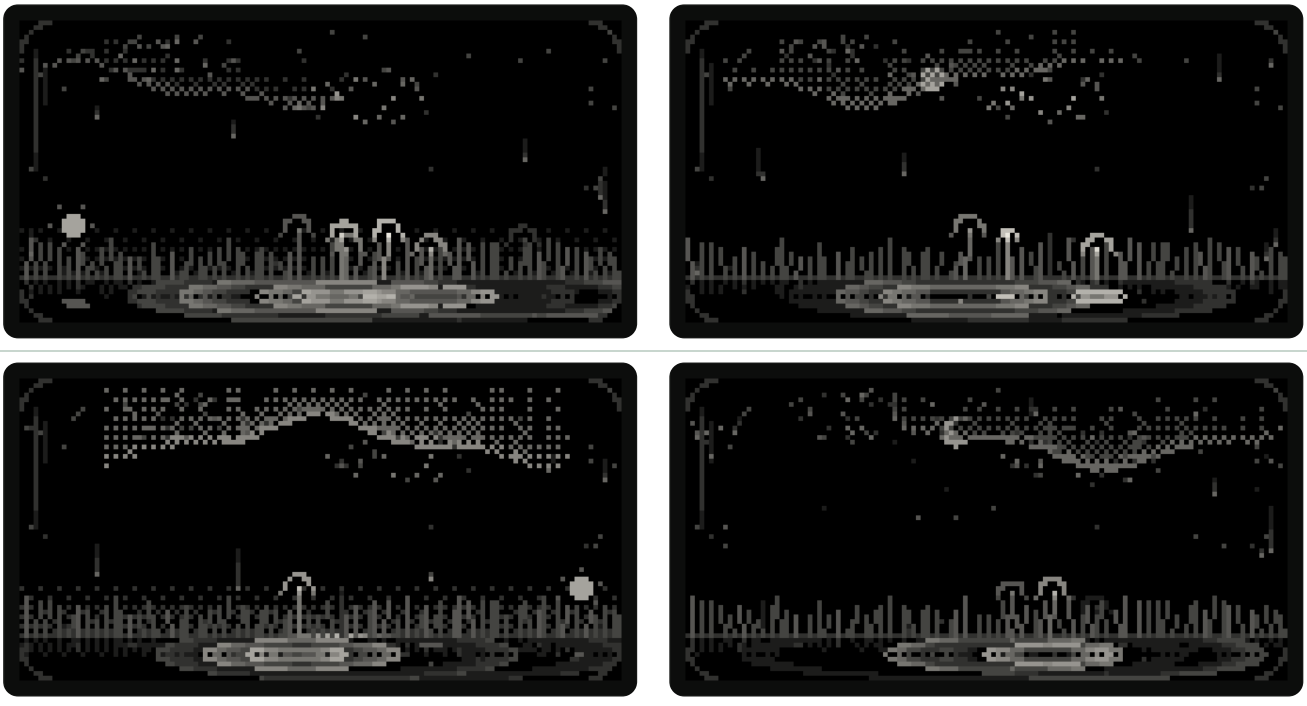
drift sets how fast: *slow* (about 40 seconds per cycle), *medium* or *fast*.

When the climate is on, the peek view shows a small tick on each bar, where the climate has pushed that knob right now. On the climate setting, you can see the climate's path.



DAY

A day and a night pass in the jar: in **20 min**, **1 hour**, or following your norns' **clock**, so that night in the jar is night outside. By night the weather slows, the sound darkens, the sky opens up and the hum comes forward. By day, the reverse. Snow piles up by night and thaws by day.



BREATH

Music needs space. With breath on, the weather sometimes calms for a phrase or three: notes rest, their puddles dim, and then it breathes in again. The phrase isn't lost; the notes come back when the calm passes. *gentle* (how terrarium starts) calms now and then; *deep* calms more often, and deeper; *off* never pauses.

EROSION

Everything the jar plays wears away a little on its way out, like an old recording: a slow wow and a fine flutter in the pitch, a little crackle and hiss, the top gently rolled off, a touch of warmth. It's the glue that makes the notes, the hum and the sky sound like one recording.

faint (how terrarium starts) is just a hint; *worn* and *deep* have more and more character; *ancient* sounds like a reel found in the attic; *off* leaves the sound clean. As the erosion deepens, more dust settles on the jar's glass, and now and then a speck pops with the crackle. (Visitors play outside the jar, so the erosion doesn't touch them.)

SAVING WHAT YOU LIKE



Terrarium remembers the jar you leave. Open another script or put the norns to sleep, and the next time you open terrarium it's just as you left it. To start again from the plain jar, go to **PARAMS > reset the jar**. (Pulling the power skips this: the jar comes back as you last left it properly.)

To keep more than one, norns keeps presets for you. In the norns menu (a quick tap of K1), go to **PARAMS**, and **PSET** is at the top: *save*, *load*, *delete*. A preset remembers everything: which modules live in each part, their varieties, every knob, the settings, and even whether the air is frozen or the hum hushed.

A FEW PLACES TO START



These are starting points. Set one up, then let it grow, or hold **K1 + K3** until something surprises you.

Rain on the meadow (how terrarium opens): rain, meadow, pond, clouds, aurora. Just listen: the key turns now and then, and the weather pauses to breathe. Then try *day: 1 hour*.

Night pond: lightning with a low rate, reeds, pond with low damping (long ringing), mountains with a big size, roots. Settings: *day: clock*, *breath: deep*. Best late at night.

Glass garden: rain with a little change, crystals, fog with some shimmer, fireflies with long glow, aurora. *climate: tides*, *drift: slow*.

Still air: anything you like, then freeze the clouds (K3 on air) and let the frost come in. Swap what grows in the soil while the sky stays frozen.

First snow: snow with a low rate and a little change, meadow, fog with some clarity, mountains, roots. Settings: *day: 1 hour*, *erosion: worn*. Listen to it close in through the night and open up as the morning thaws it.

A visitor: connect a MIDI synth and patch it back into the input, choose visitors on the soil, pick the synth (hold K2 + E2), and watch the creatures come in. Try it with the hum hushed.

IF SOMETHING SEEMS WRONG



It shows "terrarium needs mi-UGens". The sound modules aren't installed yet, or an older set without some of them is (Beads and Elements came later). Press K3 (with Wi-Fi), then **SYSTEM > RESTART**. If you copied a `mi-UGens-norns*.tar.gz` into `dust/` yourself, press K2 instead.

Visitors: no notes go out. Hold K2 and turn E2 on the visitors to pick the MIDI device, and check the channel in **PARAMS**. A device connected after opening terrarium shows up the next time you open it.

Visitors: silent. The sound comes in through the norns input: patch the synth's output into it, and turn E2 up to hear the input between notes.

Visitors: I hear the synth dry, too. That's the norns monitor: turn it down in **SYSTEM > AUDIO**.

Crackles or dropouts. Some combinations are heavier than others: reeds with the pond and roots is the heaviest. Swap one of them, or choose *none* for the hum.

The sound got darker and duller, all by itself. If the weather is snow, that's the snow settling: it muffles the soil. Turn the rate down, let the day thaw it, or switch to rain.

The little dots at the top right disappeared, or the picture moved a pixel. That's on purpose, to look after the screen: the norns screen is an OLED, and anything that never moves can burn into it over hours. When you leave it alone for a minute, the dots fade out and the ground line dims; every few minutes, the whole picture shifts by a pixel. Touch any knob and the dots come back.

I tapped K1 and the norns menu opened. Terrarium only uses K1 while it's *held*. A tap is the norns menu, as usual.

APPENDIX: HOW IT WORKS

THE IDEA

terrarium is a semi-modular synthesizer drawn as a landscape. Free patching on a 128×64 screen with three knobs would be miserable, so the routing is fixed, like a semi-modular: you choose what sits in each slot, and two macros per slot move several parameters at once along hand-picked ranges. The scene is the only readout.

THE SIGNAL PATH

```
weather (rain | lightning | snow)   when and which notes; no sound of its own
   | notes (pitch = where they land)   (snow's cover muffles the soil)
   ▼
soil (meadow | crystals | reeds |   visitors: notes out over MIDI,
      visitors)                       the audio input back in
   ▼
water (pond | fog)
   ▼
air (clouds | fireflies | mountains)  ◄── hum (aurora | roots)
   ▼
erosion
   ▼
output
```

WHAT'S INSIDE

PART	MODULE	MUTABLE INSTRUMENTS MODULE	E2	E3	HOLD K2 + E2
weather	rain	(norns clock)	rate	change	—
weather	lightning	(random timing)	rate	change	—
weather	snow	(norns clock, drifting)	rate	change	—
soil	meadow	Plaits (12 melodic engines)	harmonics	timbre	Plaits engine
soil	crystals	Plaits (6-op FM banks)	ratio	index	FM bank
soil	reeds	Rings (internal exciter)	structure	brightness	resonator type
soil	visitors	(MIDI out, the audio input)	opening	length	MIDI device
water	pond	Rings	structure	damping	resonator type
water	fog	Ripples	clarity	shimmer	—
air	clouds	Clouds	density	size	mode
air	fireflies	Beads	density	glow	—
air	mountains	MiVerb (Clouds' reverb)	size	echo	—
hum	aurora	Plaits ×2 (root and fifth)	glow	motion	Plaits engine
hum	roots	Elements	breath	depth	resonator type

The phrase works like a Turing Machine: a loop of notes and rests where **change** sets the chance that a step mutates as it plays. **Seasons** move between keys that share all but one or two notes, and each place on the land is a fixed semitone, so shared notes stay where they are; the notes that do move cross over one at a time.

The four climates are chaotic attractors, the same kind of slowly unfolding, never-repeating motion found in weather and electronics: **fronts** is the Lorenz attractor (Edward Lorenz found it while modeling weather), **gusts** is Rössler's, **tides** is Thomas', and **squalls** is Chua's circuit. Their three outputs are linked, so the parts move together.

TUNING

Each module's knobs are a small table of ranges. In the maiden REPL, `tune()` changes one while terrarium plays and prints the table, ready to paste back into the script:

```
tune("clouds")                          -- see clouds' table
tune("clouds", "rvb", 2, 0.1, 0.6)      -- clouds' E3 (size) also opens its reverb
```

PARAMS > levels sets the balance between the soil, water, air and hum. The full sound map and tuning notes are in SOUND.md; the design decisions are in DESIGN.md.

IN A BROWSER

terrarium can run in a web browser for development: `make web` in the repository, then open http://localhost:8800/. It's the same Lua code, and the same Mutable Instruments code makes the sound, compiled for the browser. In the browser, visitors come with one simple built-in voice ("web synth"). See tools/norns-web.

CREDITS

terrarium is made by **glassgarden**, a project by Carlos Eduardo and Voltage Foundry Modular, : Eurorack modules, mostly, and adventures into anything else that makes sound.

Its sound is built on Émilie Gillet's Mutable Instruments modules, brought to SuperCollider by Volker Böhm's mi-UGens, and runs on monome's norns. Thank you all.

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