

The Tree in the Net

The Development of Plants and Trees Read Through the Vacuum.Net Theory

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1. Introduction

Plants took three billion years to become trees. The record of that development is well measured. Fossils give the dates. Anatomy gives the forms. Field stations give the flows of water and carbon.

This essay sets that record beside one structure: the net of the Vacuum.Net theory, taken as a balanced tree. It does three things. It states what the net allows, with the arithmetic shown. It states what happened, with sources. It then lays the two side by side.

Section 9 lists which statements are derived, which are measured, and which are a reading.

2. The net

2.1 A balanced tree

Picture a fishnet stretched in water. One strand runs everywhere and crosses itself. At each crossing the strand has one of three states: over (+1), under (−1), or no crossing (0).

Taken as a structure, the net is a balanced tree. Every point is the zero point for three points below it. Those three carry the states −1, 0 and +1. A way through the net is a row of such states. The row is a number in balanced ternary. The way is the address.

Two facts follow at once.

- The three children of a point sum to zero: $-1 + 0 + 1 = 0$.
- Every whole number between $-(3^n - 1)/2$ and $+(3^n - 1)/2$ has exactly one way of n steps. For $n = 3$ that is the range −13 to +13, which holds $27 = 3^3$ numbers.

2.2 Eight cases at every point

A point does not have to use all three children. It may use any subset of $\{-1, 0, +1\}$. There are $2^3 = 8$ subsets.

Children used	Sum	Children not used
none	0	−, 0, +
0	0	−, +
−, +	0	0
−, 0, +	0	none

	0	1	–
–, 0		–1	+
+		1	–, 0
–		–1	0

Four cases are in balance. Four are not, and they form two mirror pairs.

2.3 What happened and what did not

The three children sum to zero. So the sum of the children that are used is the exact opposite of the sum of those that are not. What happened and what did not happen cancel at every point.

This can be set beside the nilpotency of Peter Rowlands. In his algebra a state squares to zero, and a state together with everything else sums to zero. The tree gives the second of these, point by point. It gives a zero sum, not a square that is zero. The algebra that would make the two one statement has not been written down.

2.4 Closure along a way

Three states in a row form a window. A window is closed when its three states sum to zero, counted in threes. Of the 27 windows, 9 close. Three have equal states: $(+1, +1, +1)$ sums to 3, which is zero counted in threes. Six have three different states.

Two results are used below.

- A ring of different states closes only when its length is a multiple of three. Subtract two neighbouring closed windows and each state equals the state three places back. A ring of length 4 or 5 cannot hold that.
- Join two triples into a ring of six. With the same direction, $(-, 0, +, -, 0, +)$, all six windows close. With opposite direction, $(-, 0, +, +, 0, -)$, the six sums are 0, 2, 2, 0, –2, –2. Four windows stay open.

2.5 Two and three

The tree counts in threes. Anything that doubles counts in twos. The two never meet: $2^a = 3^b$ has no solution except $a = b = 0$, because a number has only one factorisation into primes.

They do come close. Since $\log_2 3 = 1.58496$, twelve steps of three give $12 \times 1.58496 = 19.0196$ steps of two. The difference, 0.0196 of a doubling, is a factor $2^{0.0196} = 1.0136$. That is the Pythagorean comma.

Threes	Twos	Ratio
$3^2 = 9$	$2^3 = 8$	1.125 0
$3^5 = 243$	$2^8 = 256$	0.949 2
$3^{12} =$ 531,441	$2^{19} =$ 524,288	1.013 6
3^{41}	2^{65}	0.988 6

3^{53}	2^{84}	1.002 1
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The remainder changes sign and shrinks. It never reaches zero.

3. The record

3.1 Light and the first cells

The oldest layered rocks read as microbial mats are 3.5 billion years old. They do not settle when oxygen-making photosynthesis began. Free oxygen first rose 2.43 billion years ago and became permanent 2.22 billion years ago. The oldest fossil cells with the inner membranes of photosynthesis are 1.78 to 1.73 billion years old.

The work is done in pairs and fours. Every known reaction centre is a pair of two halves. Cyanobacteria alone carry two kinds in series. One molecule of oxygen takes four photons, four electrons and two molecules of water.

The yield is modest. Fixing one mole of CO_2 stores 477 kJ. A mole of photons at 680 nm carries 175.9 kJ. The best measured leaf uses 9.4 photons per CO_2 , which is 1,653 kJ. The stored share is $477 / 1,653 = 29$ per cent of the absorbed light. For sunlight as a whole the theoretical maximum is 4.6 per cent.

These first organisms were single cells and unbranched threads of cells.

3.2 The cell within the cell

About 2.1 billion years ago one cell took in a cyanobacterium and kept it. The guest became the chloroplast. It still divides on its own. It kept about 120 genes of more than 1,500. Some 4,500 genes moved to the host.

The oldest green alga is one billion years old. It is two millimetres long and branched. The closest living relatives of land plants are simpler: single cells and unbranched threads. That line split off about 550 million years ago.

Algae that form closed colonies count their cells in powers of two. *Gonium* has 4 to 16, *Pandorina* 8 to 32, *Eudorina* 16 to 64, *Pleodorina* 64 to 128. The count follows from the way they divide: n rounds give 2^n cells. *Pleodorina californica* takes 6 or 7 rounds, *Volvox carteri* 11 or 12.

3.3 Land

Spores of land plants appear 472 million years ago. The oldest plant itself is *Cooksonia barrandei*, 432 million years old. Its axis is 1 to 1.5 mm wide. It forks into two equal axes, again and again. Every tip ends in a spore capsule. It has no leaf and no root.

At Rhynie, 411 million years ago, the forms have multiplied. *Rhynia* stands 20 cm tall. *Asteroxylon* stands 40 cm, with a main axis, side branches, and rooting axes that leave the stem and reach 20 cm down. Fungi already live inside the plants.

3.4 Wood, leaf, tree, seed and flower

The first wood is 407 million years old. It sits in plants of 10 to 20 cm. Its finders read it as serving water before it served height.

Height followed quickly. The trees of Gilboa, 385 million years ago, stood at least 8 m. The oldest known forest is 386 million years old.

The broad leaf came slowly. The first is 2 to 5 mm wide. Broad leaves became common only 360 million years ago, and they arose up to nine times in separate lines.

The first seed-like organ is 385 million years old. Flowering plants appear in the rocks 135 million years ago, grasses between 113 and 101 million years ago.

The leaves of these lines differ in one countable way.

Line	Veins
Clubmosses, conifer needles	one vein, unbranched
Ferns, Ginkgo	forking, ends free
Flowering plants	meshes

Vein density stayed near 2 mm per mm² for 380 million years. In flowering plants it is 8.

4. The plant as a part of the net

A plant can be read as a part of the balanced tree. The state 0 is the axis that runs on. The states +1 and −1 are what leaves it to either side.

Each of the eight cases then has a plant form, and each form is found.

Children used	Plant form
none	tip, spore capsule
0	unbranched thread
−, +	equal fork
−, 0, +	axis with two opposite side organs
0, + or −, 0	axis with one side branch or leaf
+ or −	axis stops, a side branch takes over

The order in time is the telling part.

Age	Measured form	Case	Not used
before 550 million years	unbranched thread	0	−, +
432 million years	equal fork	−, +	0
411 million years	main axis with side branches	0 with + or −	the mirror side

The thread uses the middle and leaves both sides. The fork of *Cooksonia* uses both sides and leaves the middle. It is exactly what the thread did not do. *Asteroxylon* then takes the middle and one side together.

One limit is built in. A point has three children at most. A whorl of three or more side organs with the axis running on needs four. It does not fit on one point. Of 650 plant families, half are spiral throughout and 15 per cent are whorled throughout. That count includes pairs, so it does not yet say how common whorls of three or more are.

5. The remainder

The tree counts in threes. A plant grows by division, and division doubles. Section 2.5 says the two counts cannot coincide. The record shows where the difference sits.

In the cells. Closed colonies hold 4, 8, 16 or 32 cells. No colony of 3, 6 or 9 cells is known as a rule.

In the leaves. A leaf arrangement that closes in two steps has an angle of 180° . One that closes in three has 120° . Most plants do neither. Of all spiral arrangements, 92 per cent follow the fractions $1/2$, $1/3$, $2/5$, $3/8$, $5/13$. Trees show the whole row: elm and linden $1/2$, beech and hazel $1/3$, oak and apple $2/5$, poplar $3/8$, willow and almond $5/13$.

Each fraction is the mediant of the two before it:

- $(1 + 1) / (2 + 3) = 2/5$, or 144°
- $(1 + 2) / (3 + 5) = 3/8$, or 135°
- $(2 + 3) / (5 + 8) = 5/13$, or 138.5°

The row begins at closure in two and closure in three. It runs to 137.5° , which lies between them and equals neither. Drops that repel each other on a dish order themselves the same way: first 180° , then 150° , then 139° .

The leaf does not close in two and does not close in three. It keeps the remainder open, and it grows.

6. Meshes and joining

A tree has no loops. Two ways that part never meet again. A mesh is therefore more than a tree. It is a place where the net closes on itself.

Plants reach that form late. Forking veins with free ends dominate the record for 380 million years. Meshes occur in some ferns and seed ferns. They become the common form in flowering plants.

Joining happens in two other places, and in both it keeps to its own kind.

- Fungal threads fuse into networks. Within one isolate, 34 to 90 per cent of contacts fuse. Between three pairs of species, none of 90, 140 and 232 contacts did: 0 of 462. Between isolates of one species none fused either. Host plants make no difference: networks of one fungus growing from leek and from cotton fused in 49 per cent of contacts.
- Tree roots graft. In stands of jack pine, 21 to 71 per cent of the trees are joined, and for other species up to 90 per cent is reported. Between species it is rare.

The closure rule has the same shape. Two triples of the same direction join with no window open. Two of opposite direction leave four open.

7. The tree as a passage

Every vascular bundle holds two tissues, down to the minor veins of a leaf. Wood carries water up. Bast carries sugar away from the leaf. In the root the two alternate around the centre. At the last vein ending the wood runs a little further than the bast.

The plant is a double passage. Water goes from ground to air. Carbon goes from air to ground.

- Plants pass $62,000 \pm 8,000 \text{ km}^3$ of water into the air each year. Of the water a plant takes up, more than 95 per cent goes straight through.
- Land plants fix 123 ± 8 billion tonnes of carbon each year. In crops 21 per cent of what is fixed goes below ground, in grasses 33 per cent. Fungi on the roots receive 13.12 billion tonnes of CO_2 a year, which is 3.58 billion tonnes of carbon.

The two streams can be set against each other. $62,000 \text{ km}^3$ is $6.2 \times 10^{16} \text{ kg}$, or 3.44×10^{18} moles of water. 123 billion tonnes of carbon is 1.025×10^{16} moles. That is 336 molecules of water upward for every atom of carbon taken in. The figure sets two world estimates against each other.

One tree shows the scale. A tropical canopy tree passes 42 to 785 kg of water a day. Evaporating a kilogram takes 2.45 MJ. The large tree therefore carries off $785 \times 2.45 \text{ MJ} / 86,400 \text{ s} = 22 \text{ kW}$, averaged over the day.

Height has a ceiling. The water column hangs under tension, and its own weight adds 0.98 MPa for every 100 m. The tallest living tree measured 116.07 m in 2019. The computed limit is 122 to 130 m.

8. What stands on the land

There are 3.04 trillion trees on Earth, in 73,000 species. Plants hold 450 of the 550 billion tonnes of carbon in all living things.

The number of trees has fallen by about 46 per cent since farming began. More than 15 billion are felled each year.

Section 7 says what goes with them. A felled tree is a closed passage. The water it lifted stays in the ground or runs off. One millimetre of evaporation a day carries 28.4 W off every square metre. Where the trees go, that heat is no longer carried off the ground where people live and crops stand. The carbon that went down to roots and fungi stops going down.

A village that keeps its trees keeps shade and a cooler summer. Across the continents, about 40 per cent of the rain comes from the land itself.

9. Status

Derived. The sum of the three children. The single address. The eight cases and their balance. Used plus unused equals zero. Rings close only on multiples of three. Joining gives 0 or 4 open windows. Powers of two and three never coincide. The table of near meetings. The mediant row and its limit.

Measured or estimated. Every date, size, count and flow in sections 3, 5, 6, 7 and 8, as given in the references. Fossil ages and sizes are measured on specimens. The world totals for water, carbon and trees are estimates from models and carry the margins stated.

Computed here. The 29 per cent yield. The 336 molecules of water per atom of carbon. The 22 kW of one tree.

Read. The plant as a part of the balanced tree, with 0 as the axis. The order thread, fork, main axis as used and unused children. The whorl as the form that does not fit on one point. Direction in the closure rule set beside kind in fungi and roots. The form of nilpotency in the tree.

Open. The count of points per layer in the net, 1, 3, 10, 33, 109, has not been derived; if its extra term counts the ways that close, meshes and joining belong there. No measurement on a plant has yet been set beside the depths of section 2.5. Light itself has no place yet among the derived statements, so the first stage of the record is described here and not read.

Annotated references

The net

Konstapel, J. (2026). "The Balanced Three, the Balanced Tree and the Vacuum.net-Theory." *constable.blog*, 29 August 2026. *Why read?* States the net as a balanced tree: every point the zero for three below it, the way as the address. *Reading advice:* the passage on the rest zone, and the row 1, 3, 10, 33, 109.

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The passage

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The land

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