Sonoma Biochar Initiative

Growing Healthy Soils
Redirecting Carbon

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SONOMA ECOLOGY CENTER

What is Biochar? How is it Made?

What Solutions Can It Provide? Speed Dating Version!

The Opportunities & Challenges of Agricultural Biomass Utilization Conference

Sonoma Ecology Center What We Do

Environmental Education

Kiln and Conservation Burn Workshops, K-6 Watershed Education, EnviroLeaders, California Naturalist Programs, Nature Walks

Environmental Restoration

Dedicated to restoration, stewardship and ecosystem enhancement, fuels reduction, ecological forestry, kiln and prescribed burns.

Environmental Research

Biochar, Streamflow Stewardship Program, Watershed Health Monitoring, Steelhead Data Analysis

Park Management

Sugarloaf Ridge State Park, Sonoma Garden Park

We Offer Workshops & Collaborate!

- Farmers and ranchers—many wineries
- Large and small local landowners
- CAPCOA / Local air districts / SLOAPCD
- Forestry organizations and businesses/RFFI
- County and local municipalities: San Bernadino Municipal Water District,
- Other non-profits & orgs such as Fire Safe Councils, Open Space Districts, Farm Bureaus, Scott River Watershed Council

What is Biochar?

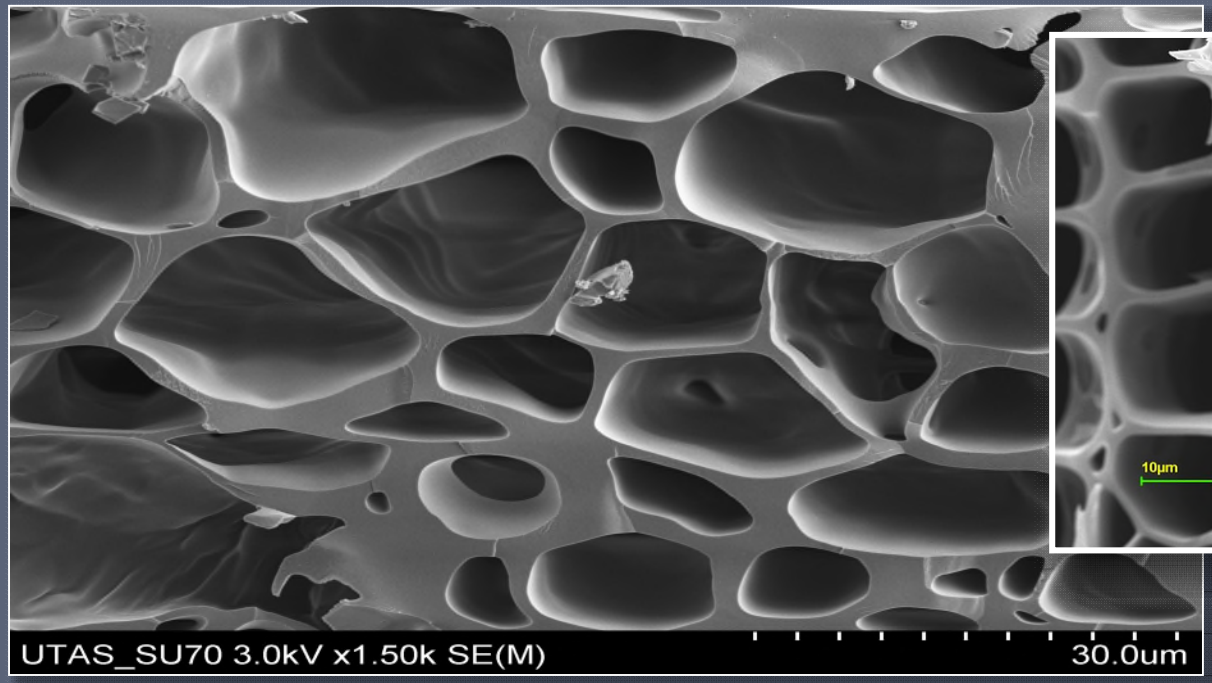
A specialized form of charcoal suitable for use in row crop or greenhouse agriculture, animal agriculture & silviculture.

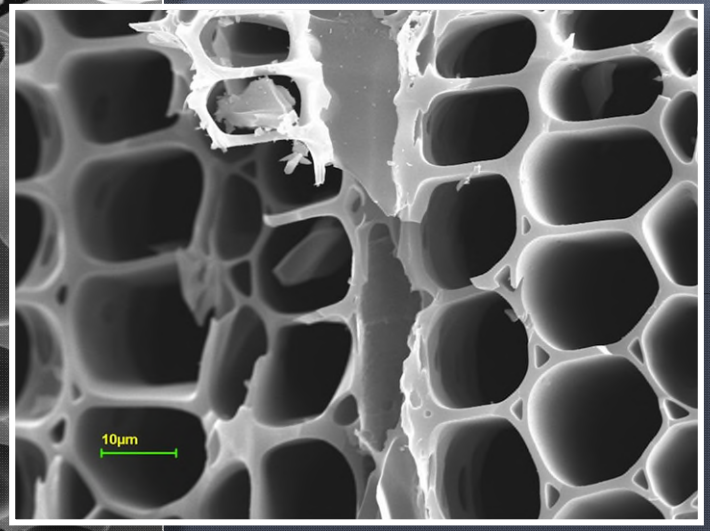
An elemental form of carbon that is recalcitrant & can last for centuries, degrading very slowly—*depending on a number of factors.*

Different forms biochar can also be produced for industrial use, such as for water or air filtration, pollution remediation, as an additive in concrete or other building products, or in many other ways as a non-fossil replacement for activated carbon made from coal.

Biochar is highly porous and adsorptive. It incubates life in soil like a coral reef does in the ocean. It looks like a sponge under a microscope and is a *condo* for microorganisms!

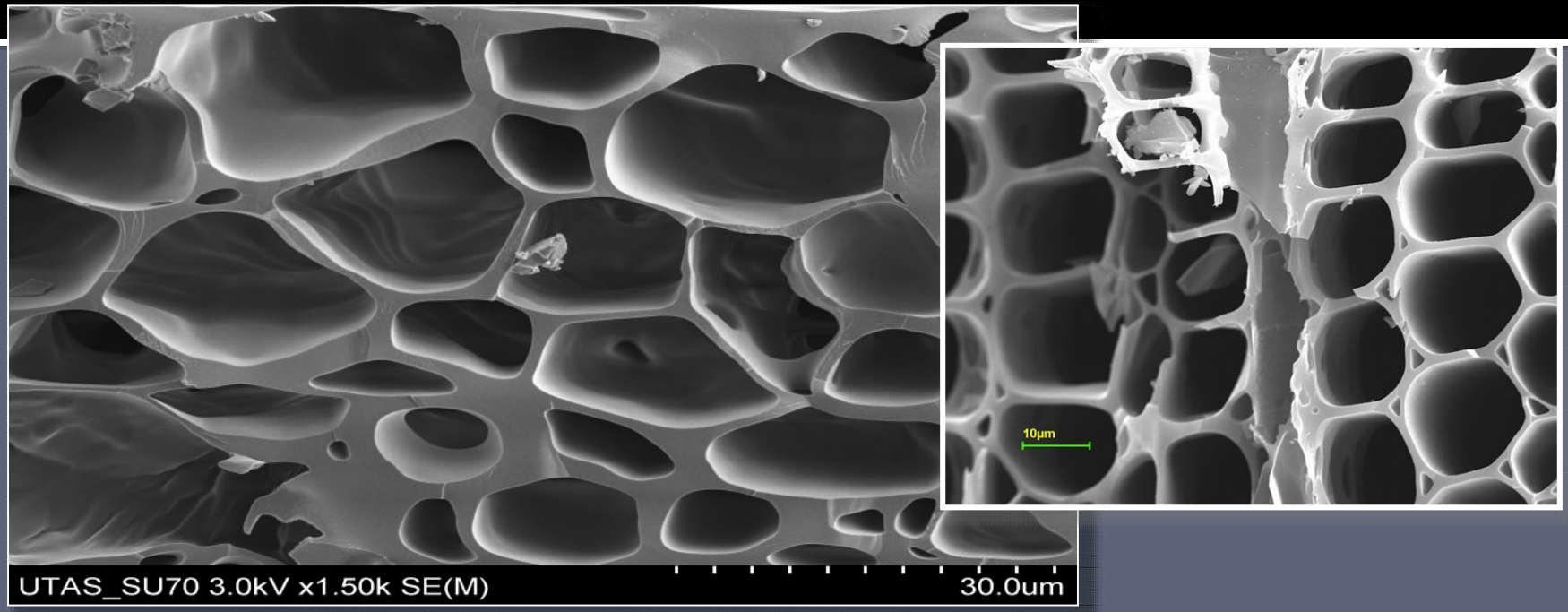
Adsorptive and Absorptive





Ancient, indigenous practice

When added to soil, biochar is a DIRECT DEPOSIT of SOM & (mostly inorganic) SOC, easily measured and accounted for and is much sought after by the emerging voluntary carbon markets.



Biochar is not a fertilizer, though it can contain some nutrients. Think of it as a storage container that can both deliver nutrients and store water for slow release over time.

Pyrolysis and Gasification

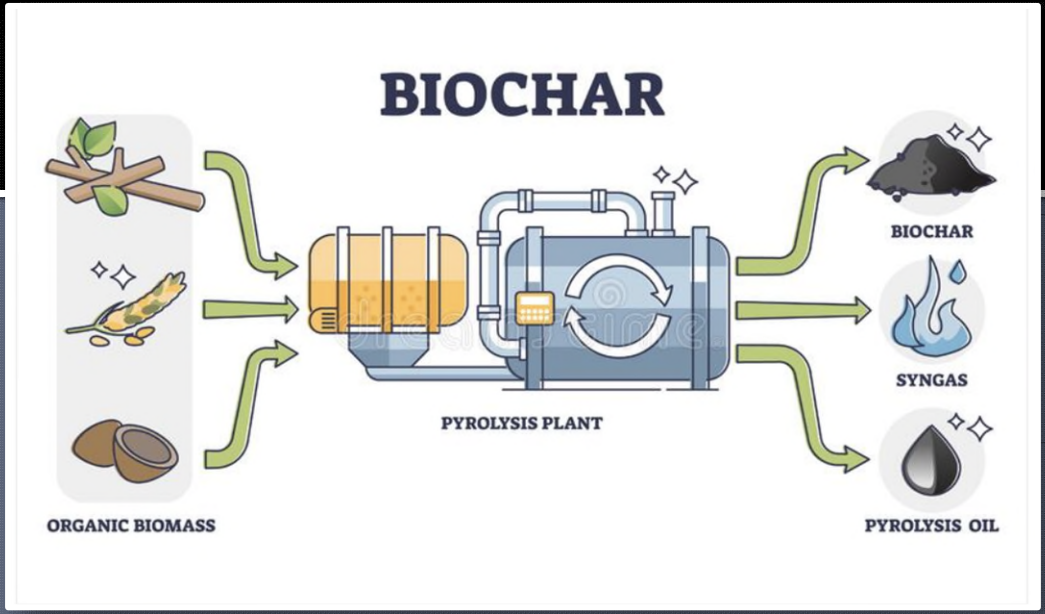
There are two main processes, or process variations, for making biochar:

Pyrolysis (the thermochemical decomposition of organic matter into non-condensable gases, condensable liquids, and a solid residual coproduct, biochar)

Gasification (the thermochemical decomposition of organic matter (primarily) into gases for energy production, with some conversion into a high ash, low-carbon by-product that can be screened into a higher carbon product, biochar)

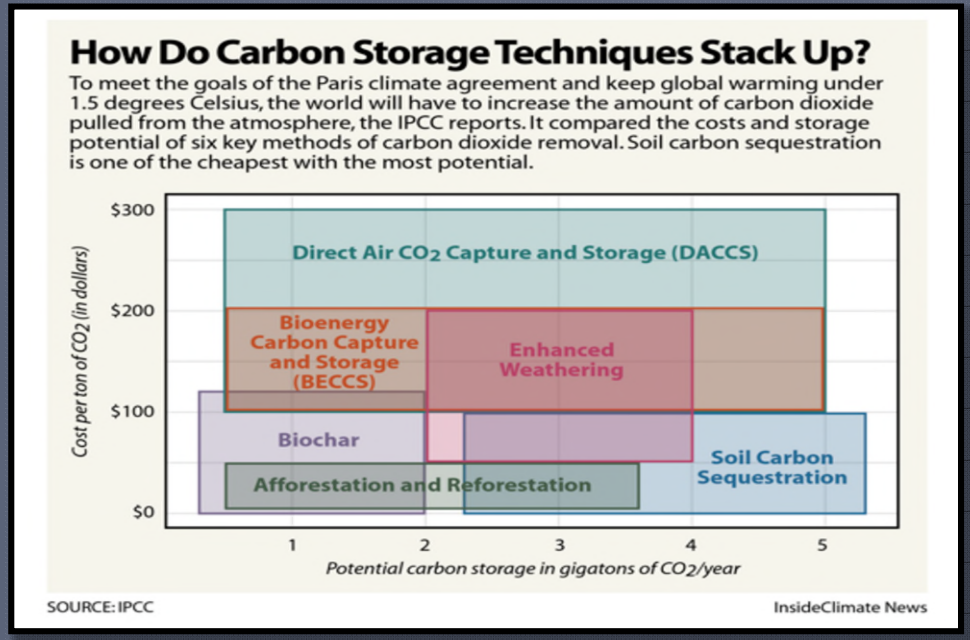
There are both low-tech and high-tech options for how to make biochar.

- Simple field production techniques for making biochar that we consider cleaner “bridge” solutions that should be Best Practices
- More sophisticated (and costly) technologies



Biochar is created using pyrolysis when biomass is *heated, not combusted,* at high temperature in low oxygen environments. Other by-products are also produced during production depending on the type of system, including renewable energy in the forms of heat and syngas and bio-oils that can be used by ag or industry.

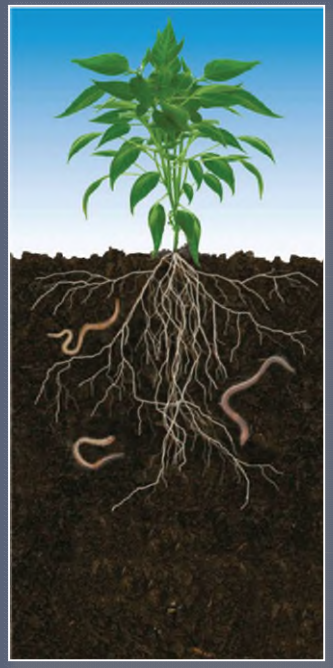
United Nations IPCC Special Report



Biochar use in soil & some industrial products is considered a relatively inexpensive form of carbon sequestration, using existing and emerging technologies. It is a “natural climate solution” that could be scaled with the right policies in place.

Lab and field studies have shown that biochar can*:

- Improve water retention
- Reduce soil compaction
- Improve plant production
- Improve soil porosity & tilth
- Promote root development
- Decrease nutrient leaching
- Improve cation exchange capacity
- Promote growth of mycorrhizal fungi
- Generate additional SOC over time
- Reduce enteric methane when fed in small quantities to cattle



* Biochars should be thought of as a range of products with different qualities offering a range of benefits.

Biochar improves the environment

- **Can reduce nitrous oxide (N20) emissions in soil 50%—80%**
  (Rondon, Ramirez, and Lehmann, 2005)
- **Could reduce and sequester up to 10+% of annual anthropogenic carbon emissions using no dedicated crops, "waste" only**
- **Can reduce phosphorus and nitrogen leeching into groundwater**
- **Can reduce methane release during manure composting and dairy operations—UC Merced study: over 80% methane reduction***
- **Very effective at adsorbing heavy metals; can help regenerate degraded soils**

***https://news.ucmerced.edu/news/2022/research-reveals-easy-way-dairy-farmers-can-dramatically-reduce-their-climate-impact**

Improved Field Burning Techniques

Flame Cap "Ring of Fire" Kiln

Conservation Burn Technique

SLOAPCD, CAL FIRE-funded grant, emissions testing by the USFS Fire Science Lab, Missoula, MT.

Roughly 50% of a plant is made up of carbon. With these techniques the pile or kiln is lit from the top with a small amount of propane (or newspaper and a match if well seasoned) and water is applied at a certain point to conserve as much carbon as possible.

Proposal to Quantify Life Cycle GHG, Dioxin & Criteria Pollutant Reductions and Carbon Sequestration Potential from Low Emissions Agricultural Burn Techniques Relative to Traditional Open Burning

SLO COUNTY apcd | Air Pollution Control District San Luis Obispo County

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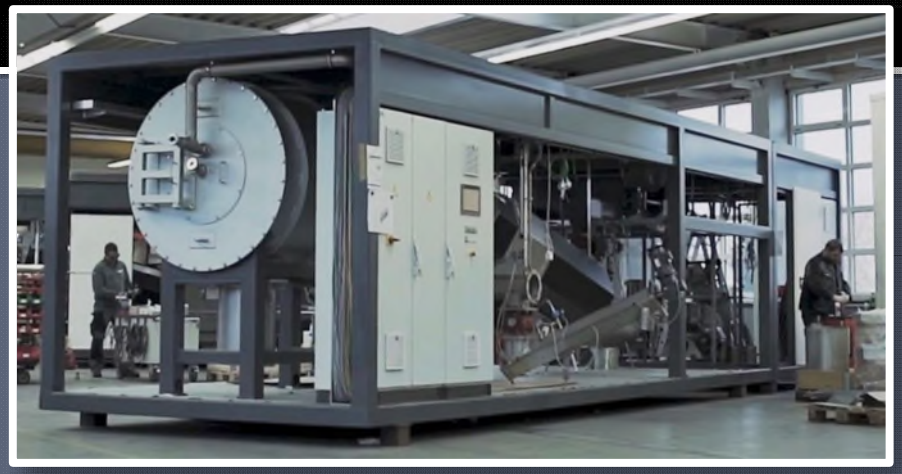
Center for Sustaining Agriculture & Natural Resources
WASHINGTON STATE UNIVERSITY

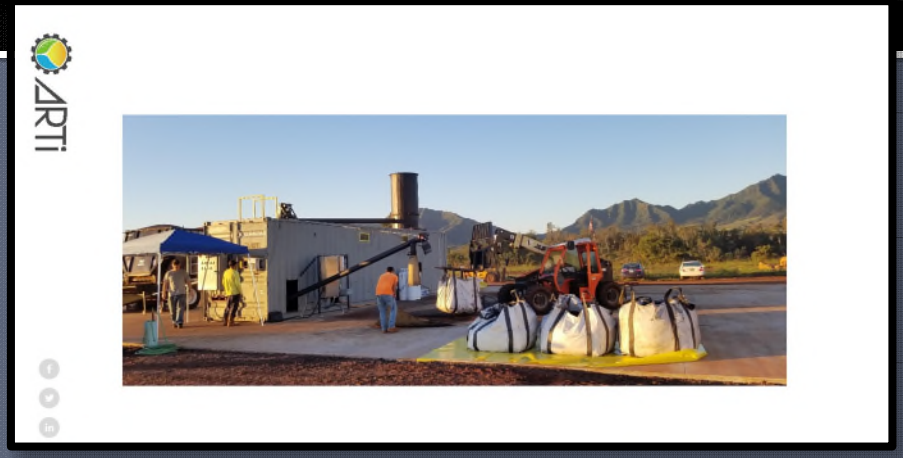
Dan Falk, RPF /Falk Forestry

- Purchased a Carbonator air curtain-style & movable biomass processor in 2019 for use on his family's 8,000-acre property near Cazadero
- 10+ TPH of raw wood, no chipping, low particulate release, produces biochar
- Dan leases the machine and can provide a crew and equipment to operate the system

Small-Scale Production Via Containerized, Moveable Systems



Pyreg Pyrolysis



Advanced Renewable Technologies International

- Over the mid to long term we advocate for regional and community-based biomass processing technologies.
- These systems have modern pollution control devices and produce very low emissions. Relatively low price $1 million to $5 million, depending on infrastructure needs. Moveable, low volume inputs—up to 40 TPD biomass in and 10 TPD biochar output. Most are fussy about moisture content and particle size, but workable. Can be difficult and expensive to permit, depending on location.
- Larger scale options like multiple SynTech systems and West Biofuels are viable options as well depending on budget and feedstock volumes.

Biochar Scaling Challenges

Education: Most Ag producers and potential stakeholders have at least heard of biochar but are still not aware of its many benefits; More collaboration is needed with RCD's, Farm Bureau's, large producers.

Affordability: Until recently it has been too expensive but recent demand for biochar in the European carbon offset credit market has completely changed pricing. This market is offering producers up to $200 per ton biochar ($400 to $600 ton C02e) allowing them to price the biochar more affordably. 2010: $2000/ton / 2023/$270-$600/ton in truckload quantities, delivered.

Current Biochar Pricing, Large Distributor

Biochar Scaling Challenges

Availability and Quality Control: Until recently biochar of a consistent quality in large quantities has not been available. That is changing with sources like Pacific Biochar and Oregon Biochar Solutions that provide truckload quantities of high-quality biochar.

Permitting: Current Roadblock USEPA Permitting Rule Subpart EEEE: From BAAQMD: We are looking at the definitions as per §60.2977 of 40 CFR Part 60, Subpart EEEE, which seems to show that "Municipal Solid Waste" refers to various wastes consisting of paper, wood, and yard wastes, and the definition of "Wood Waste" appears to fit the description of the operation as well."

Markets Still Developing: Soil amendment, compost additive, stormwater filtration, soil remediation (heavy metals), cattle feed, inputs for high tech industrial and building products like graphene and concrete, bioswales, tree planting, many others emerging.

OPR Biomass Aggregation Centers Pilot Program

Goals

Strategic development of *community* biomass *campuses* where integrated (rather than siloed facilities) that can upcycle “waste” ag and forestry materials into a range of products including renewable energy, food, biochar, fuels, mass timber, furniture, etc.

- Circular Economy
- Regenerative Agriculture
- Collaboration

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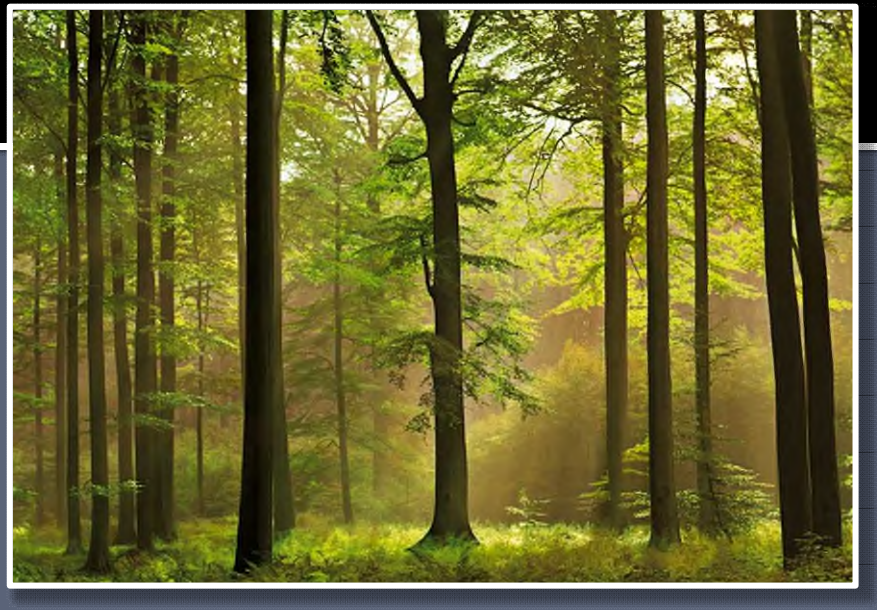

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www.sonomaecologycenter.org

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