Is Fog Drip a Sustainable Water Supply for Coastal California?

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Fog bank rolling in at lighthouse point in Santa Cruz, California

Photo credit: T. Gurdak

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Outline

- Background about Santa Cruz and fog
- What is Fogust?
- What is fog drip?
- Fog is important for local ecosystems
- Impacts of climate change on fog
- Fog drip can be a water source for humans

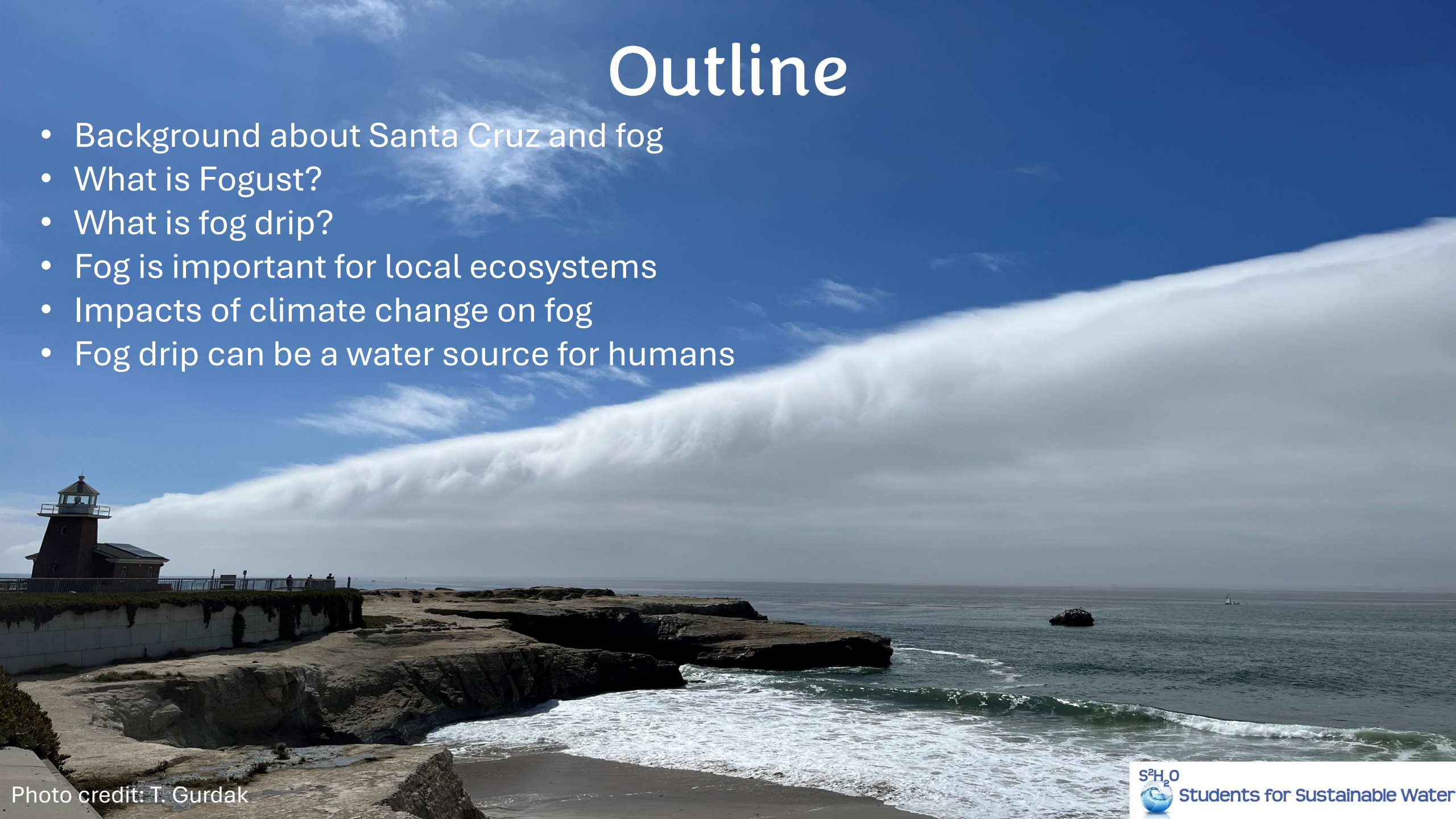

Photo credit: T. Gurdak

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Santa Cruz, California USA

Santa Cruz is known for...

Welcome to “Fogust” in Santa Cruz

Locals use the term “**Fogust**”.

The Urban Dictionary defines: “**Fogust** (n) The month of August, particularly in an area that gets lots of fog at that time of year.”

Photo credit:
Shmuel Thaler,
Santa Cruz Sentinel

Fog blanketing the Santa Cruz Beach Boardwalk

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Climate Change and Fog Along California Coast?

Science is showing that fog patterns are changing from climate change

- Over the last 60 years, fog has decreased about 30% along the West Coast of the U.S.
- In the 1950s, California coast averaged about 12 hours of fog, but now it is about 9 hours.
- The fog season is shorter now, too. The historic fog season in Santa Cruz was June to October but now it often doesn't start until July.
- But trends in fog are difficult to measure. For example, from 2012 to 2016, there was a slight increase in California fog.
- Fog scientists - working to better understand how fog patterns and trends may be affected by climate change.

Fog flowing through the Golden Gate bridge in San Francisco.

Photo credit: NBC Bay Area

Sources:

1. Bob Berwyn, David Hasemyer, and Mallory Pickett, With a warming climate, coastal fog around the world is declining, Inside Climate News, October 10, 2021, https://insideclimatenews.org/news/10102021/coastal-fog-global-warming/#:~:text=For%20example%2C%20fog%20decreasing%20over,during%20that%20time%2C%20Dawson%20said.
2. Jonathan Bloom, San Francisco's fog could be a casualty of climate change… but it could also be a solution. NBC Bay Area, December 28, 2022, https://www.nbcbayarea.com/news/local/digital-originals/san-francisco-fog-climate-change/3114080/

Fog is an Important Water Supply to the local Ecosystem

Fog drip is a critically important water supply to the Coast Redwood Forest Range and other local ecosystems.

Source: Naturalist Night: Redwood Forest – Santa Cruz Museum of Natural History

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Fog is an Important Water Supply to the local Ecosystem

Fog rolling over the Santa Cruz Mountains

Fog accounts for about 30% of annual hydrologic input to northern California Redwood forest
(Source: Dawson, 1998, Oecologia)

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Photo credit: Ben Gremillion

Fog Drip Can be a Water Supply for Humans

200 to 400 liters per day per collector
(50 to 100 gallons)

With very large, specially designed mesh collectors, fog drip is being collected in large enough volumes to supply water for some small communities in Peru, Guatemala, Colombia, Chile, Ethiopia, Morocco, and Nepal.

Photo credit: Fog Quest https://www.fogquest.org/

What is Fog Drip?

Fog drip is water dripping to the ground during fog events.

- It occurs when water droplets from the fog adhere to the leaves or needles of trees or other objects.
- The water droplets coalesce into larger drops and then drop the ground.

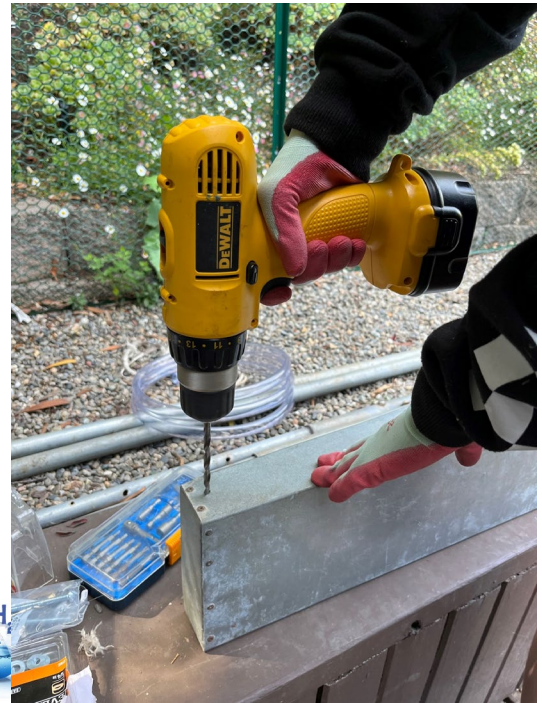
Fog drip collecting on branches

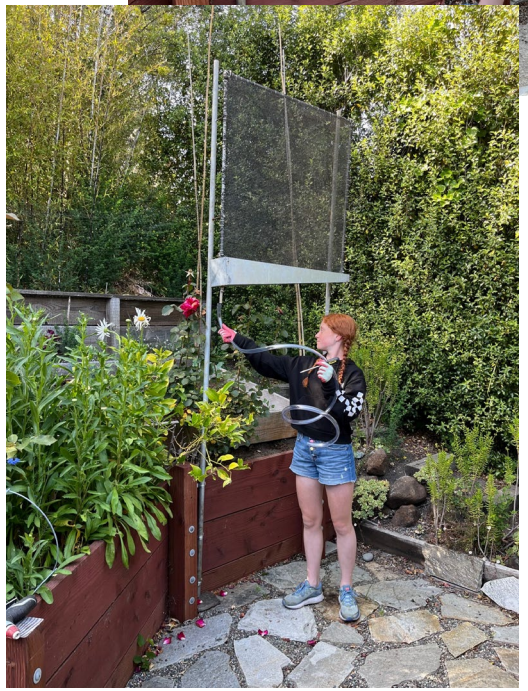
Standard fog drip collector

Source: https://en.wikipedia.org/wiki/Fog_drip

Could Fog Drip be a Viable Water Supply in Santa Cruz?

We built a fog collector to test how much fog drip we could collect and evaluate an appropriate use of that water.

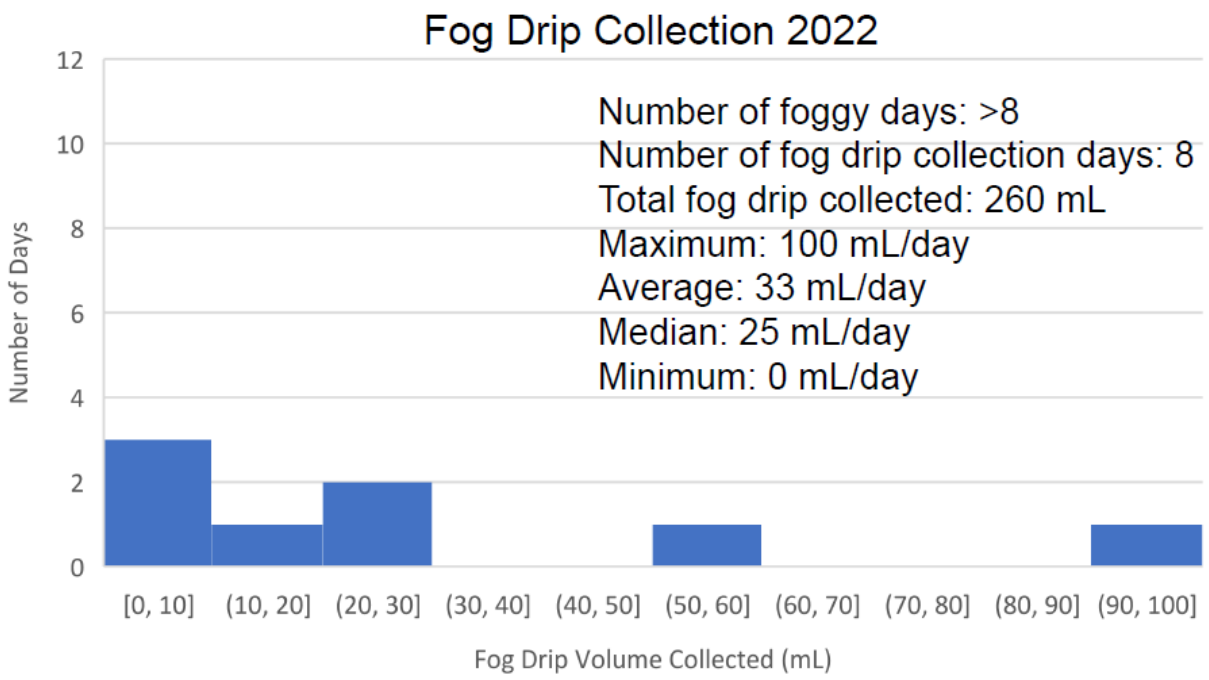




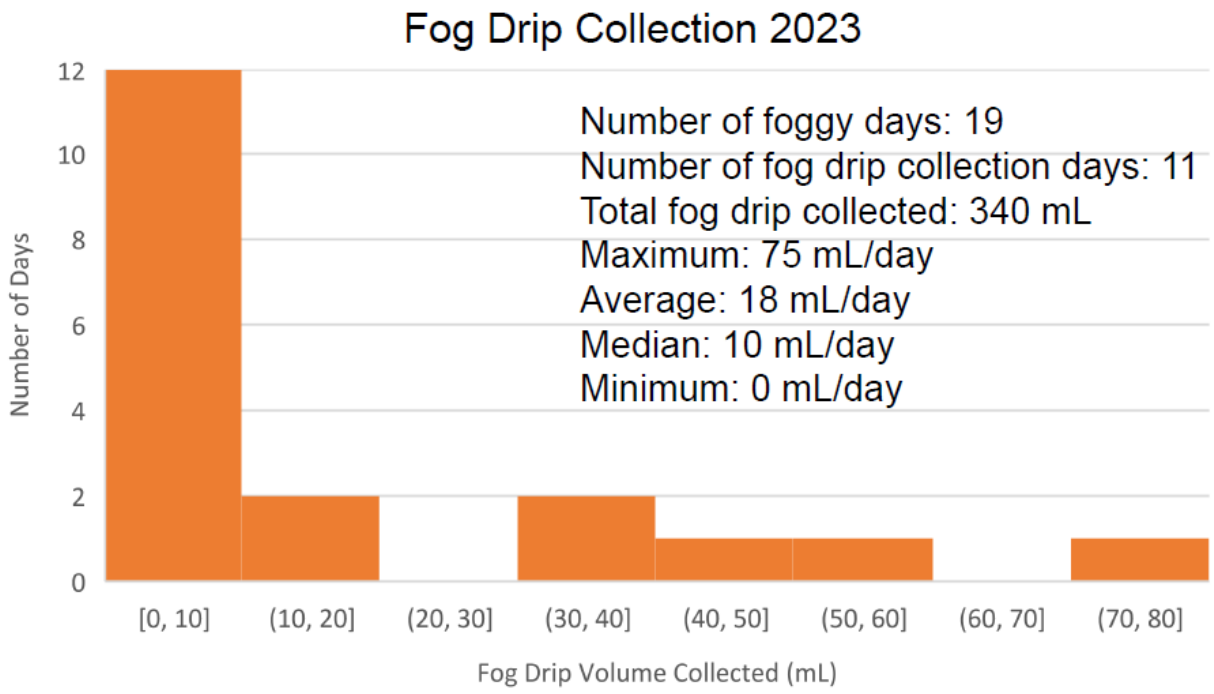
Results

Fog drip volume is dependent on collector location

Leeward side (back yard) of house



Windward side (front yard) of house

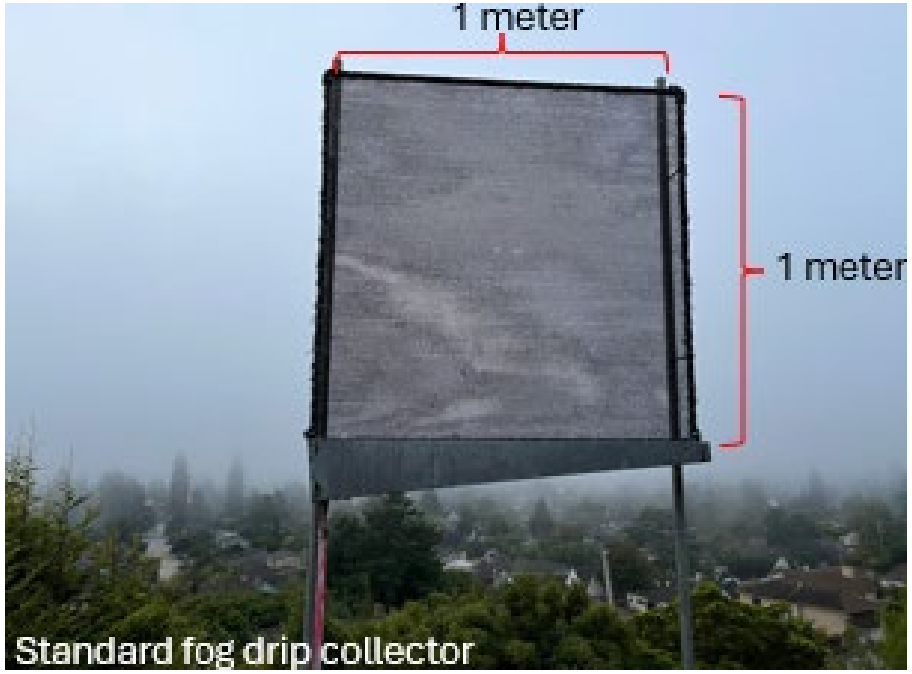


<u>Comparison to other studies</u>:

- 1.2 to 37 mL/day, San Mateo County, California
- 3.5 L/day (average); 0.17 to 13 L/day, San Francisco, California
- 3.86 L/day, Big Sur, California
- 7,200 L/day, El Tofo, Chile (48 m^2 fog collector)

Is this Enough Water for Human Use in Santa Cruz?

Fog Drip:
Maximum: 100 mL/day
Average 33 ml/day
Total: 340 mL



2021 Water Use (per capita per day):

- Santa Cruz County = 182 liters (48 gal)
- San Francisco County = 151 liters (40 gal)

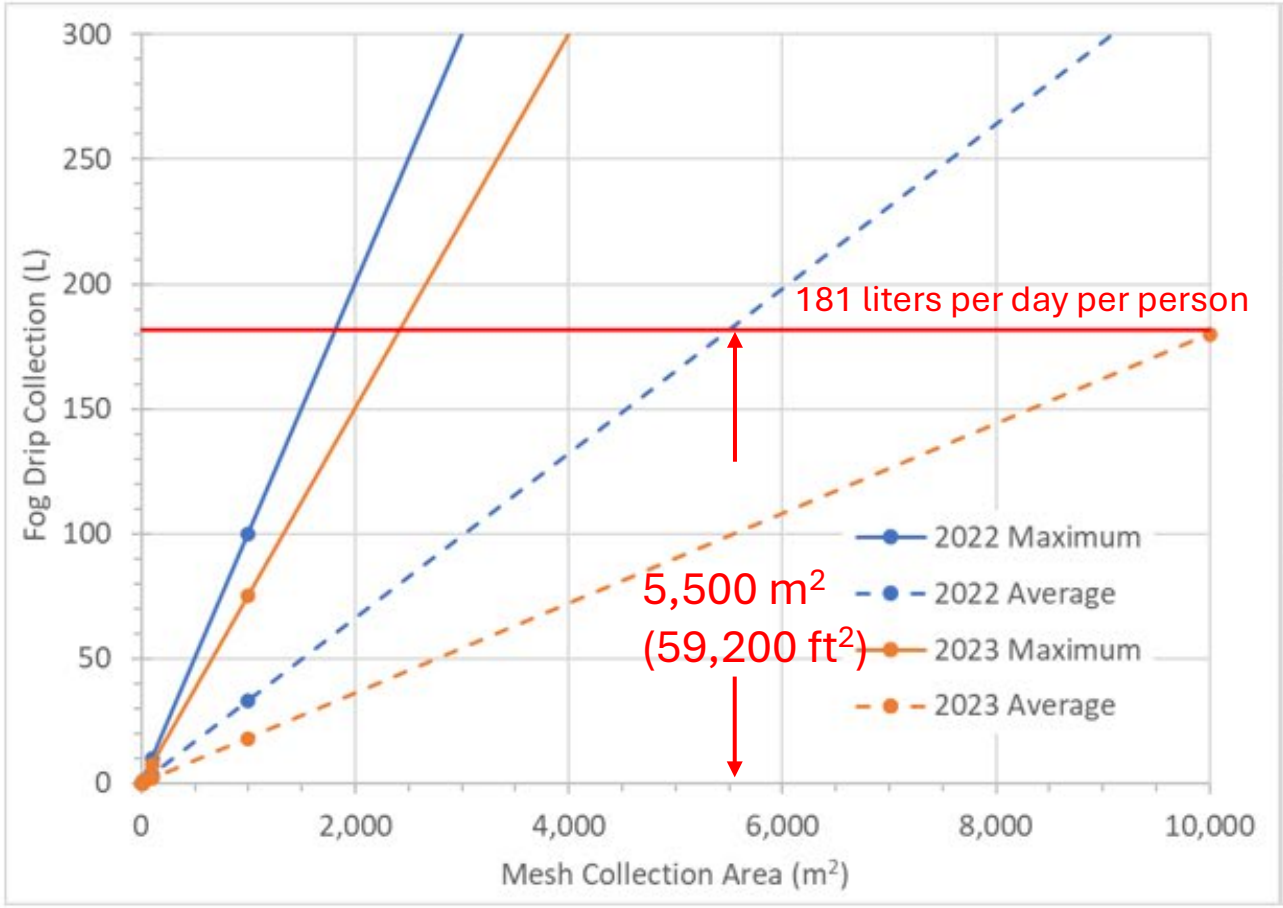
➢ **Answer: No**

But what if we used a much larger mesh collector?

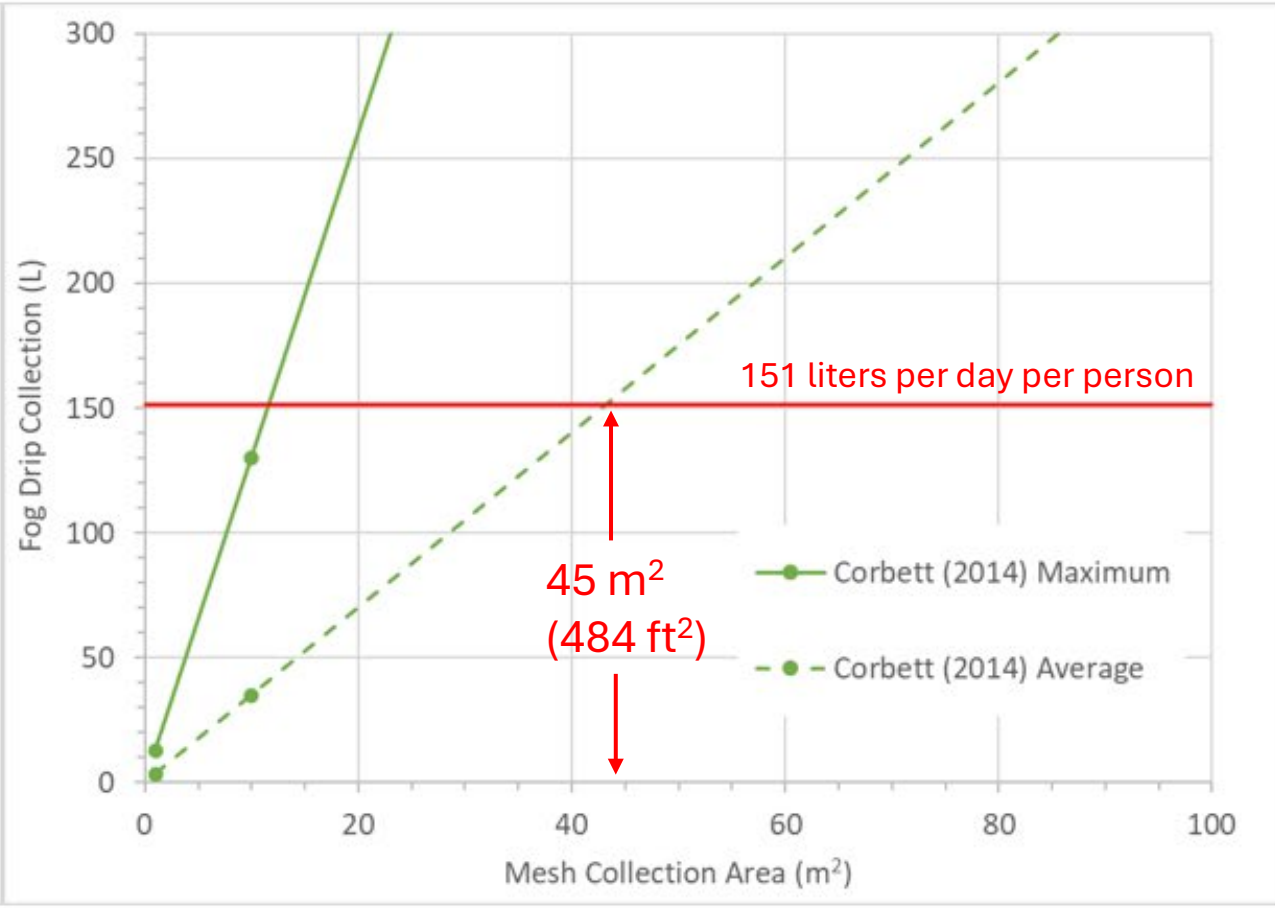
How Large would the Mesh Need to Be?

Extrapolated our results

Santa Cruz



San Francisco



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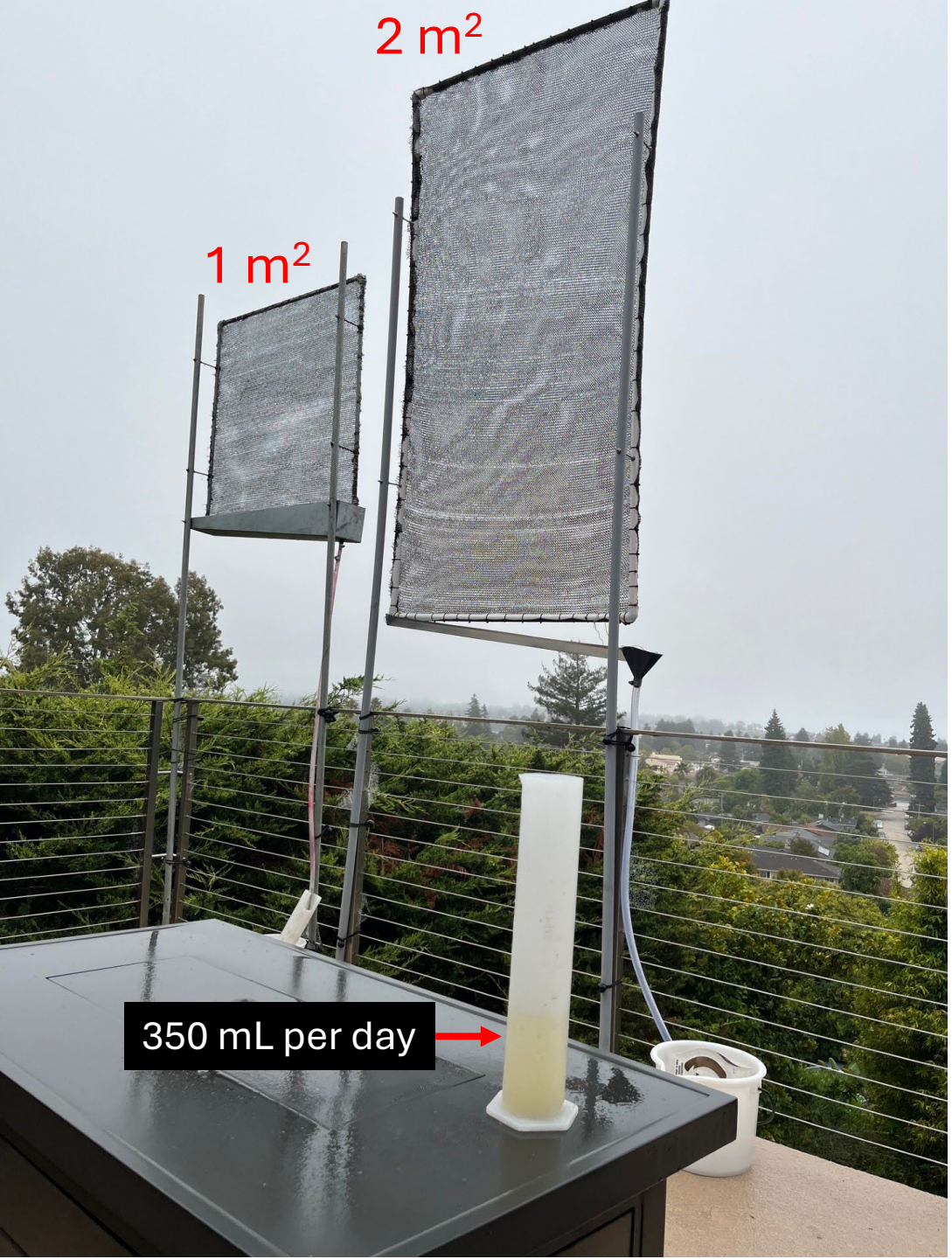
Large Mesh Collectors would NOT be Favorable

Bigger than most houses and obstruct views



Year 3:
Doubling Mesh Collector Area

11 days of fog drip (30 foggy days from Aug to Oct)

1 m²	2 m²
Total: 101 mL	**Total**: 525 mL
Avg: 9 mL per day	**Avg**: 48 mL per day
Max: 50 mL per day	**Max**: 350 mL per day

7x more fog drip with double the area!

Conclusions:

- Fog collection not feasible to meet all water use, but…
- Moderate size fog collectors (<10 m²) could supplement outdoor water use for gardens and plants
- Next steps – explore innovative mesh geometries to maximum fog drip with minimal footprint

Thank You!

Please join us at Students for Sustainable Water and share your local stories!

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Photo credit: T. Gurdak

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