Water Tubes –

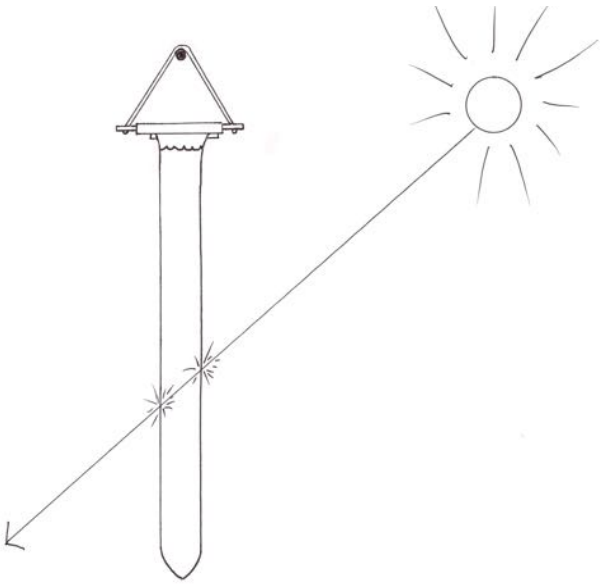
The Holy Grail of Thermal Mass for Solar Greenhouses & Bioshelters

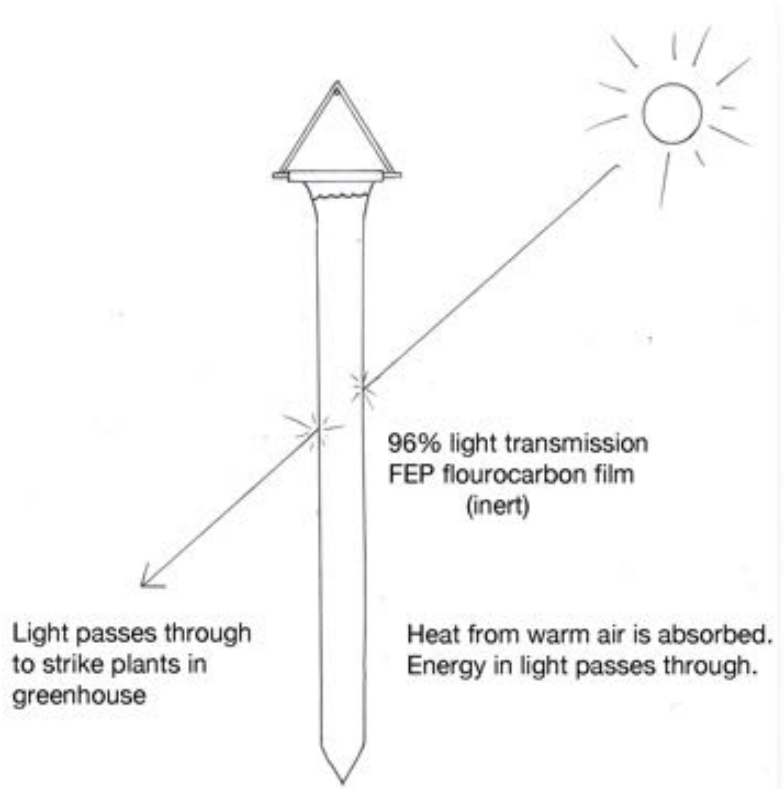
Earle Barnhart 2017

The air in a greenhouse on a sunny day will get hotter and hotter, and usually it is vented out of the greenhouse and wasted.

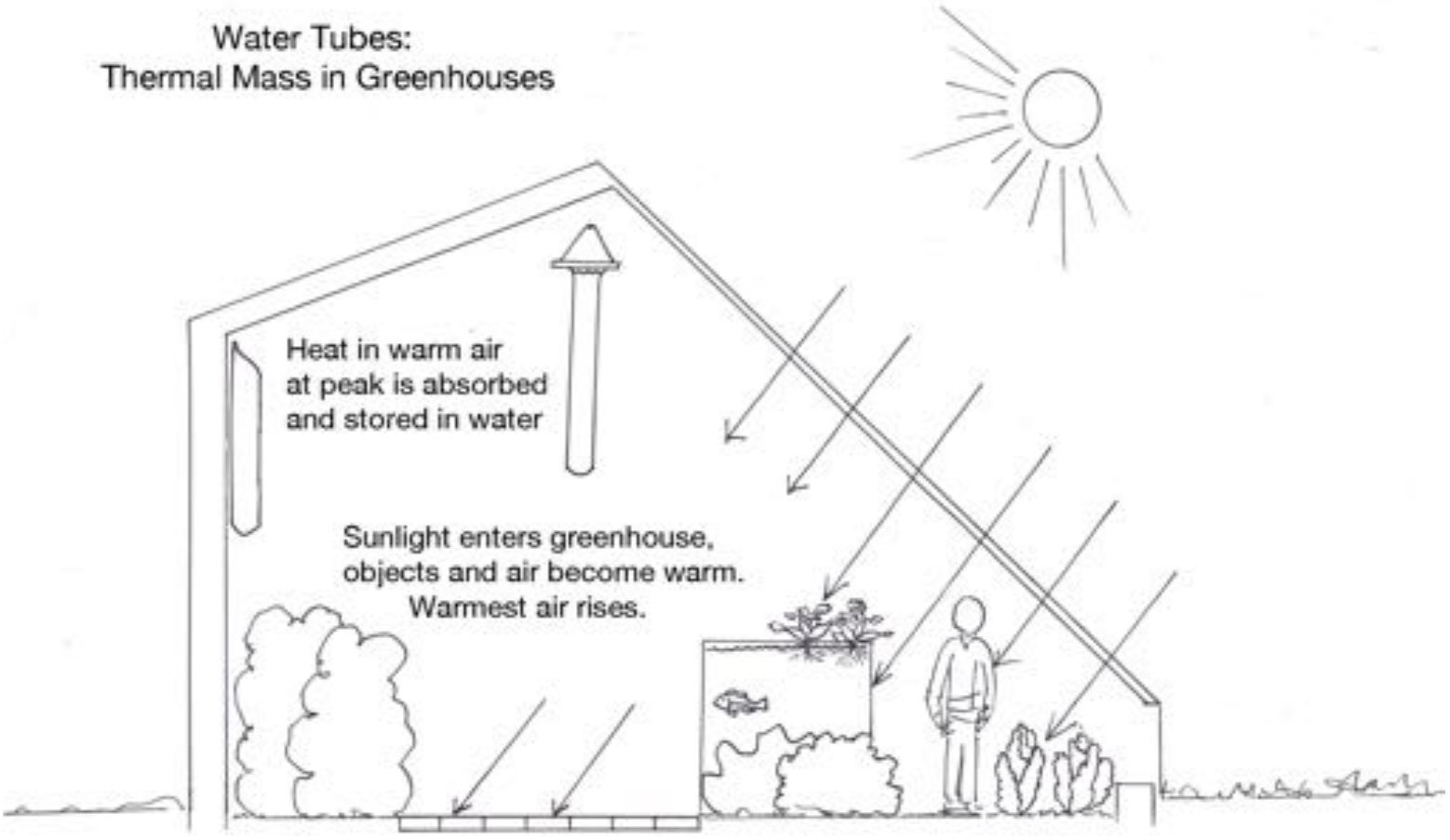
A transparent tube of water hanging in the greenhouse will absorb the heat from the hot air and store it as warm water. Later at night when the greenhouse cools, heat is released from the warm water and heats the greenhouse air.

Water is the best material to store heat; it holds the most heat for its volume.
Water tubes are :
-- automatic; the air and heat move naturally
-- silent; no fans, no power, no fuel, no burners
-- simple, no mechanical or digital controls
-- you can see them working; water condenses on the outside when it is actively storing heat
-- more attractive than ducts and vents



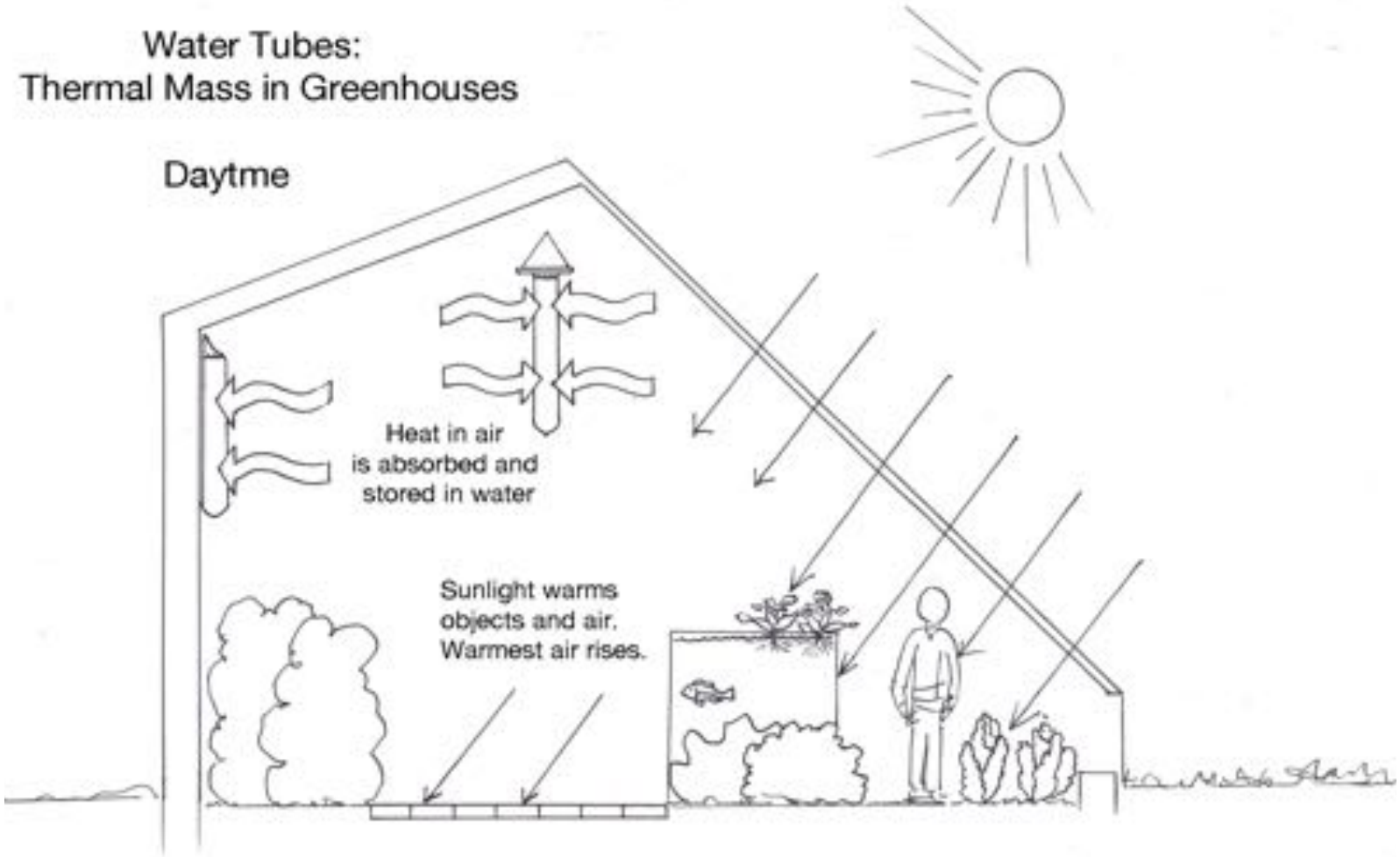


Water Tubes:
Thermal Mass in Greenhouses



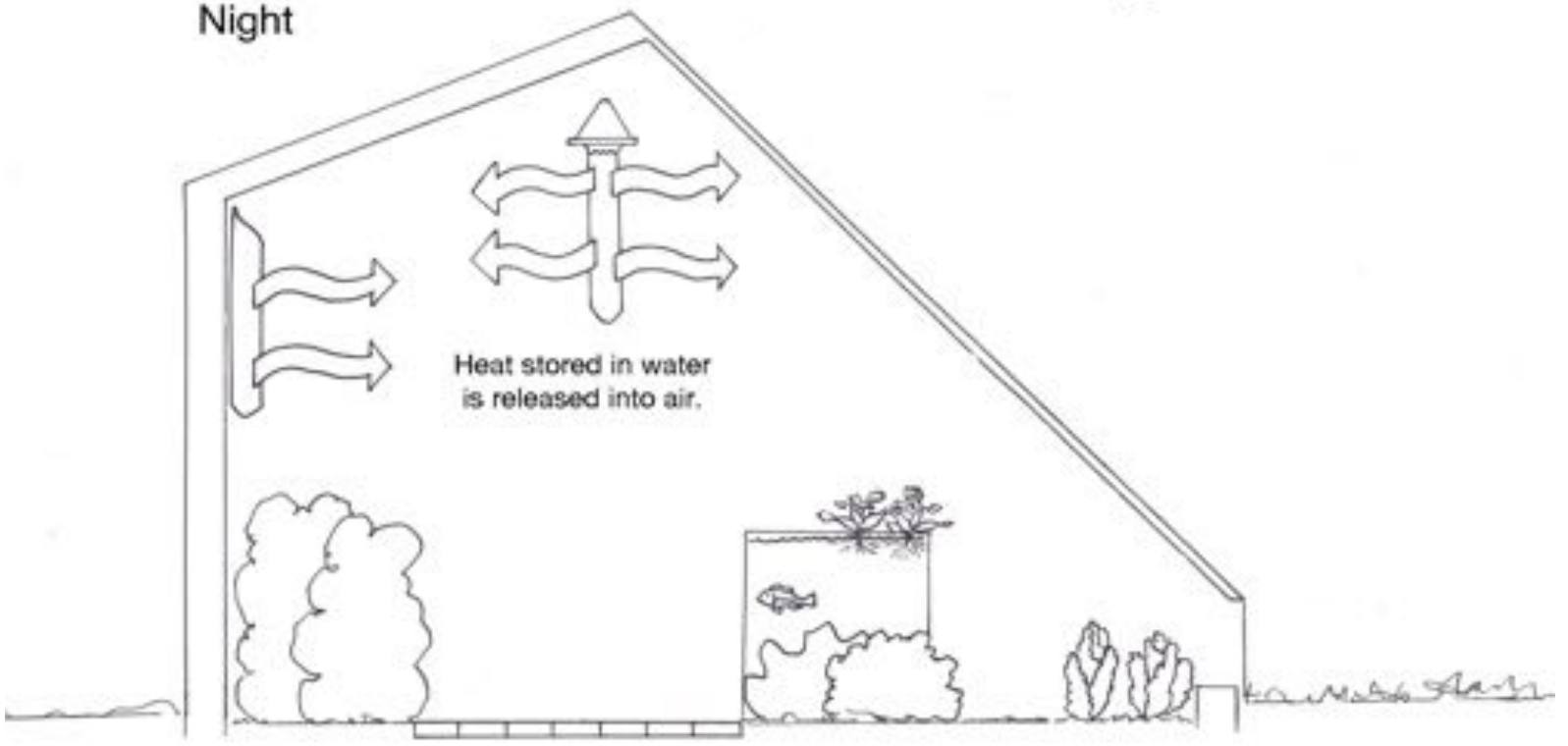
Water Tubes:
Thermal Mass in Greenhouses

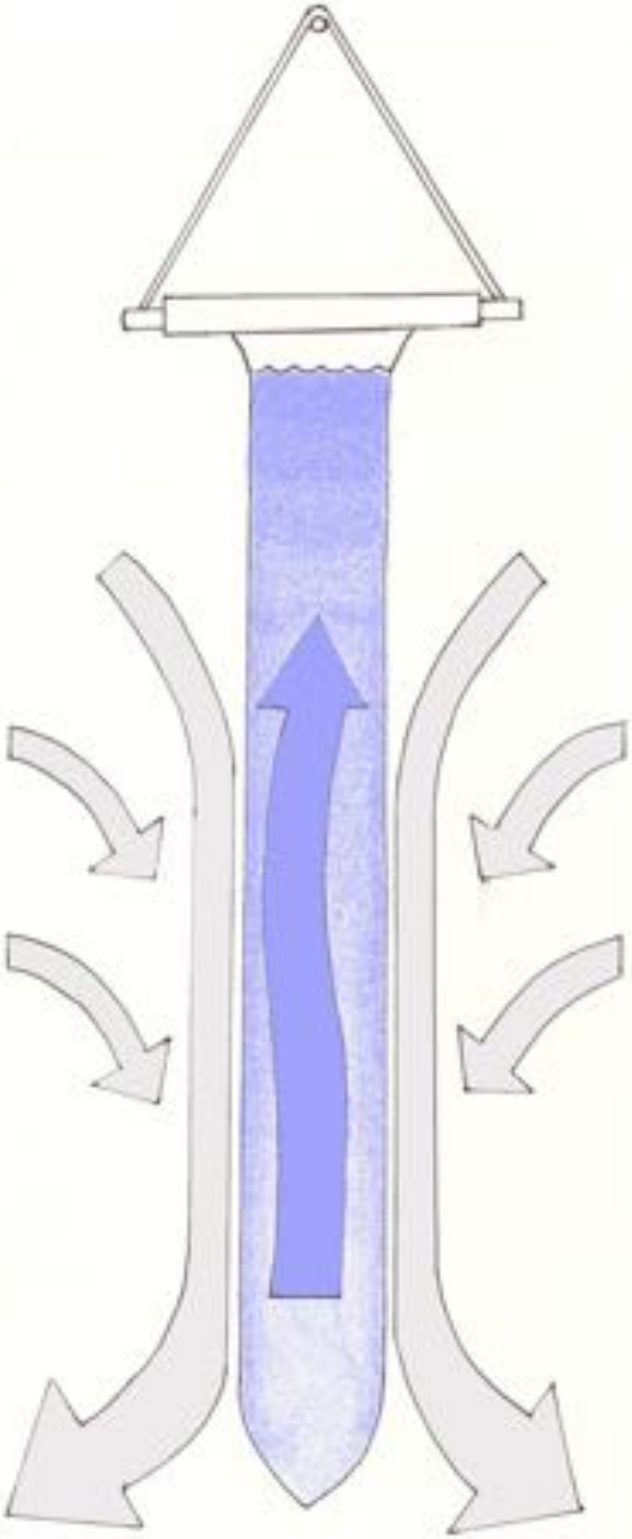
Daytme



Water Tubes:
Thermal Mass in Greenhouses

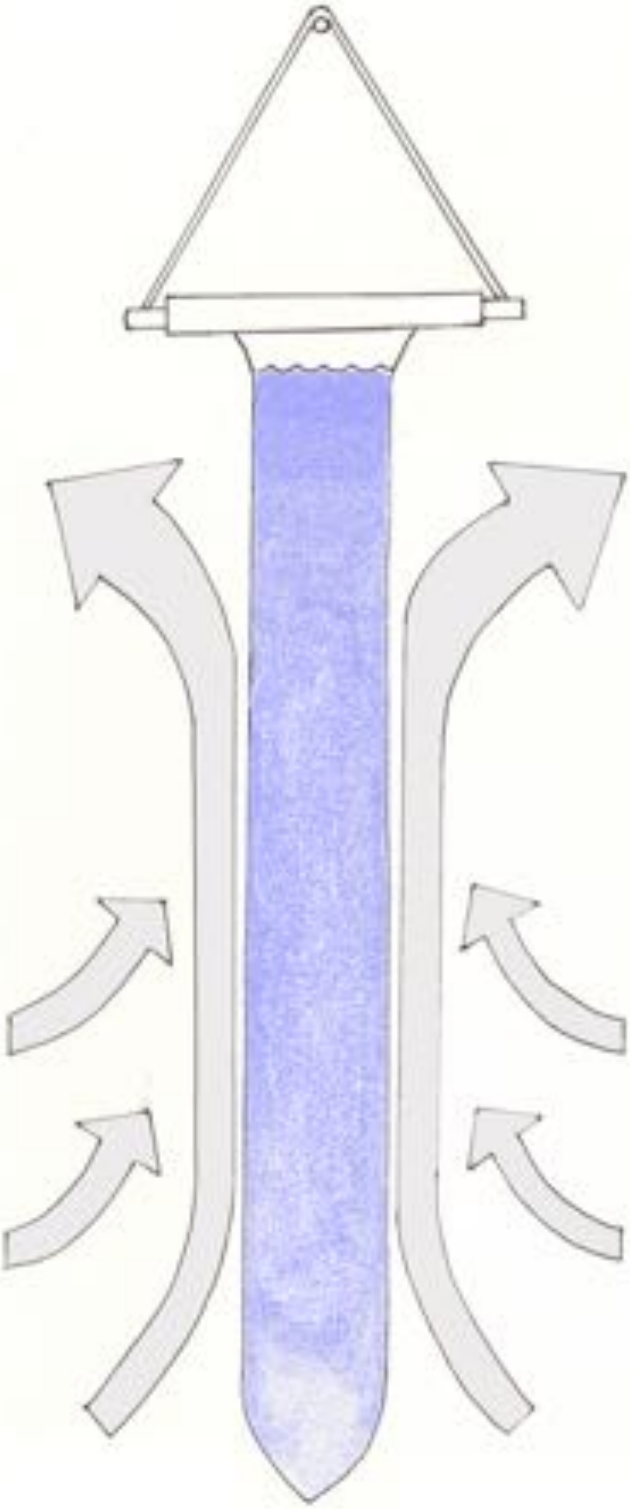
Night





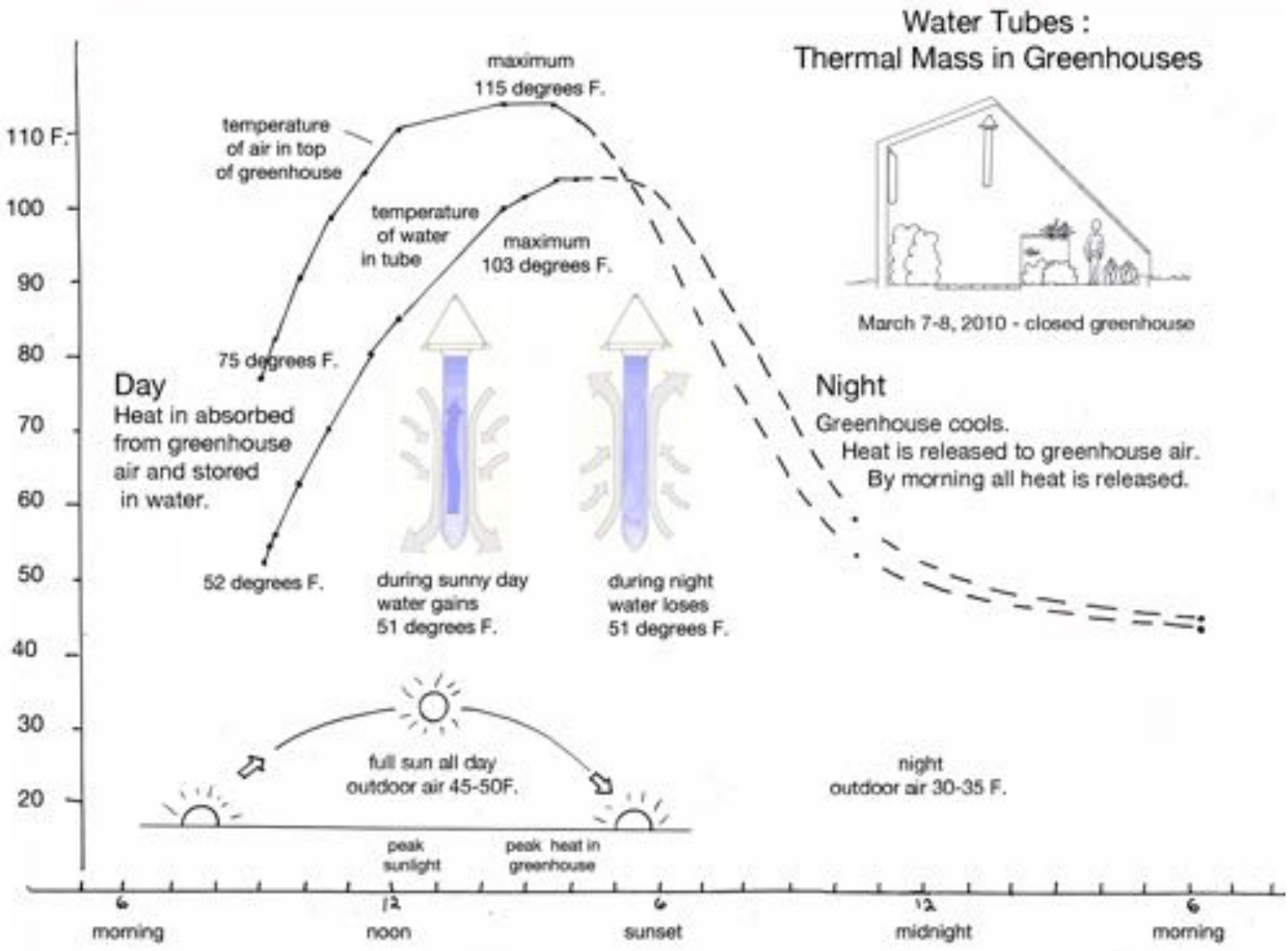
DAYTIME

- warm air touches tube,
- heat moves into water inside,,
- warmest water rises to top,
- cooled air sinks downward



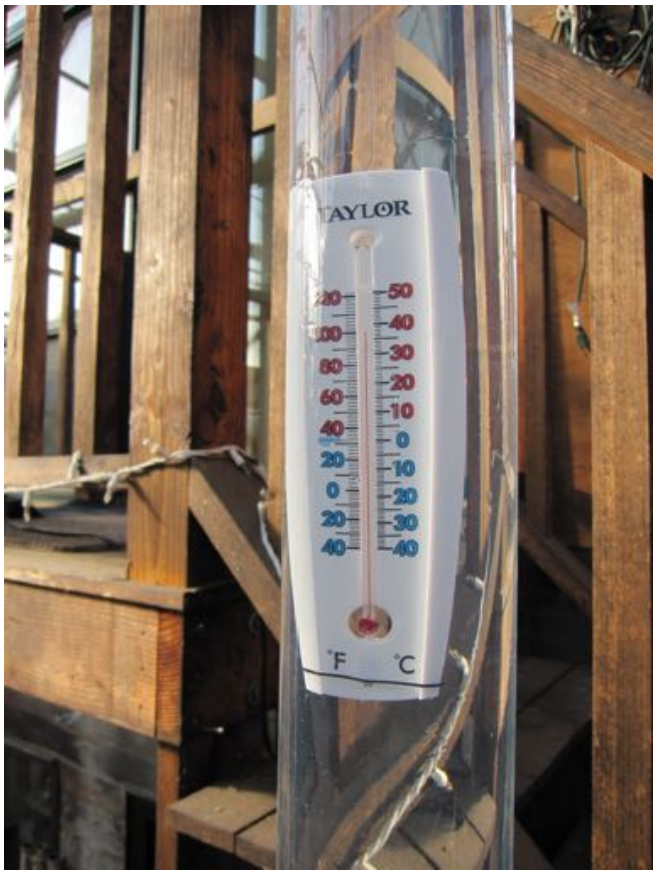
NIGHT

- warm tube radiates heat
- air touching tube becomes warm, rises upward



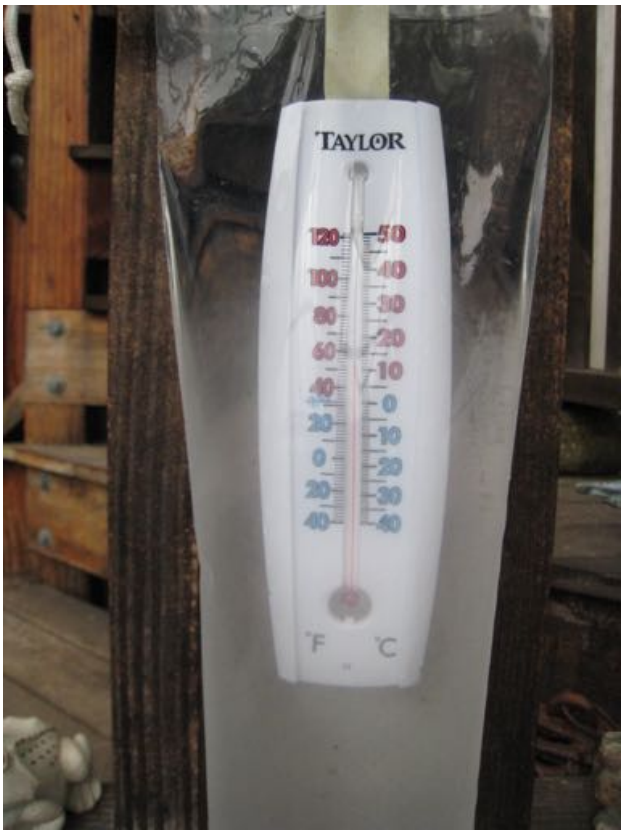
WINTER DAY – WINTER NIGHT March 7-8, 2010

On a sunny day, hot air will rise to the top of a greenhouse. On this sunny day, the air at the peak of the greenhouse reached 115 degrees F. around 3 o'clock. Water tubes absorbed heat all day, starting at 52 degrees and ending at 103 degrees around 3 o'clock.
The sun went down, the greenhouse cooled overhight, and heat moved from the warm tube to the air. By morning, all the heat in the water was released back into the greenhouse air.



END OF DAY:

Thermometer in tube: water 100 degrees F. When warm moist air cools on a cold water tube, drops of condensation will form on the surface. When absorbing heat, the condensation will stay visible. When heat is released at night, it evaporates off and the tube is clear. (lower, right) The water at the top of this tube is very warm and is not cooling any air.



Lessons Learned
- Plastic rods bend and distort; aluminum rods are better.
- 4 inch diameter tubes are very heavy and hard to handle.
- heat-sealed or impulse –sealed bottoms are necessaru.

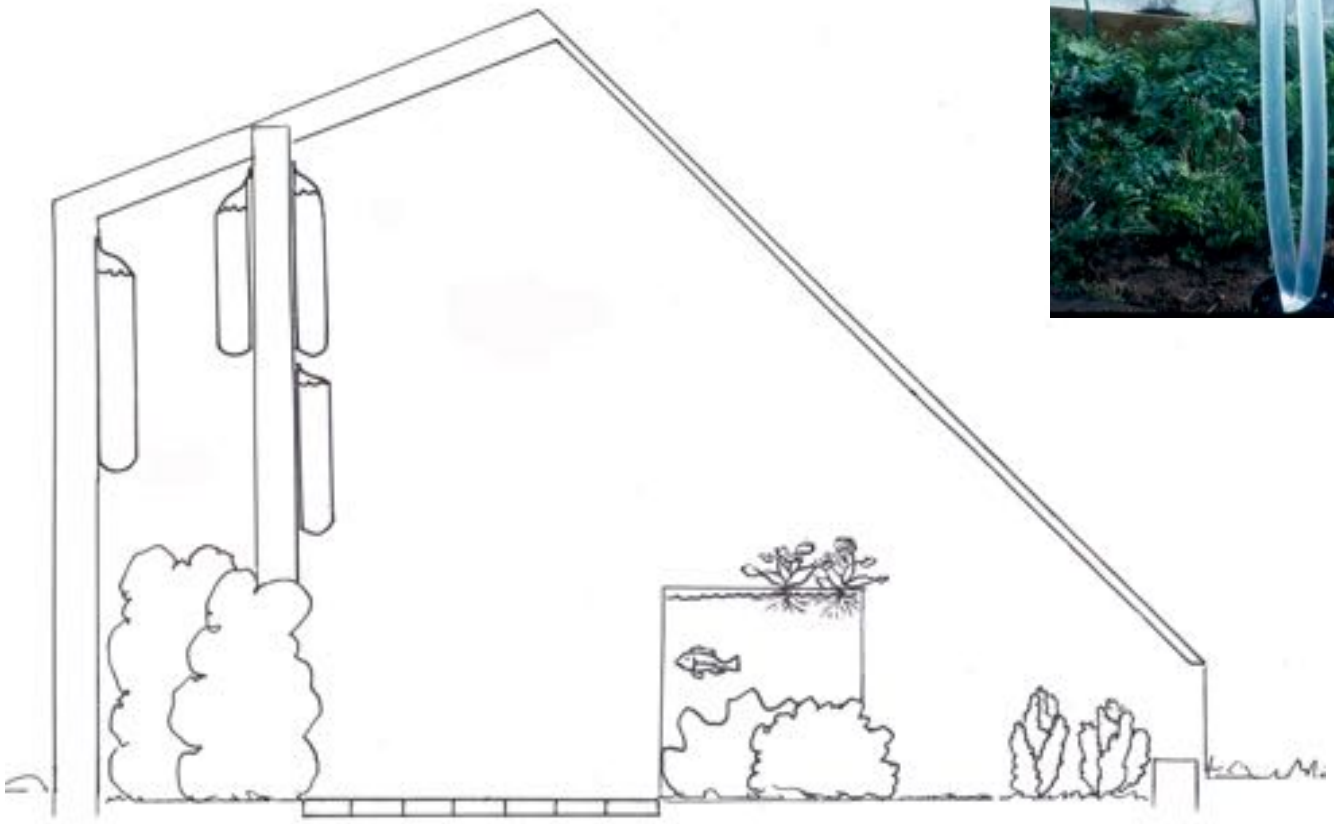
TRIAL AND ERROR

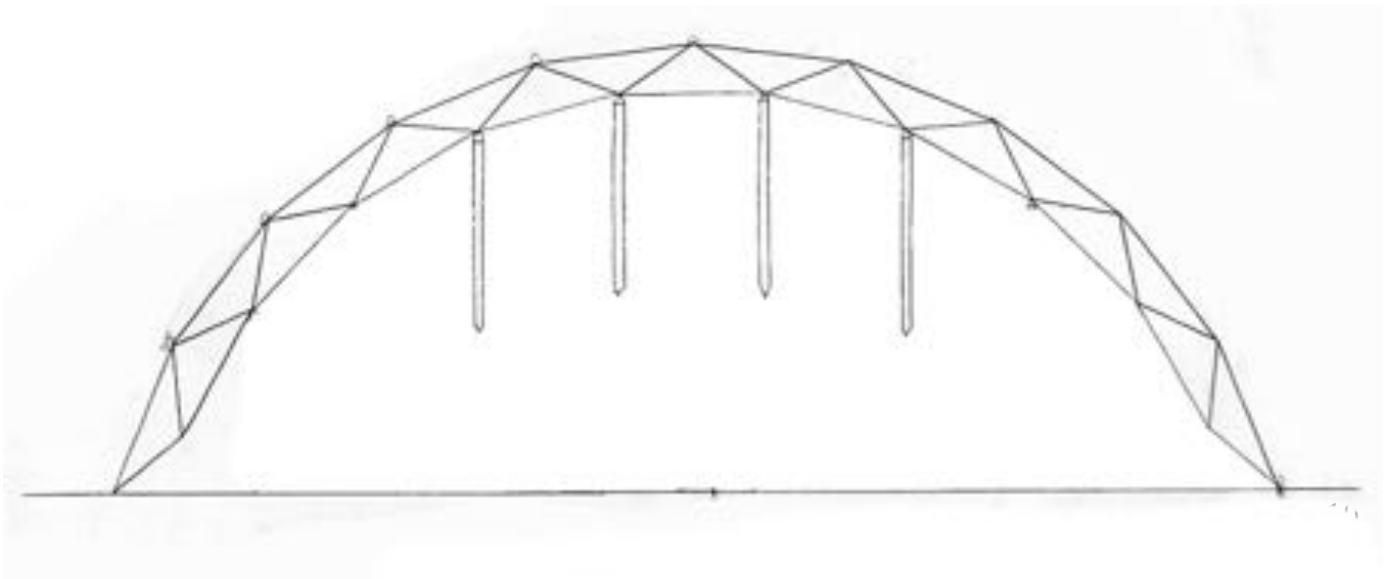
- 2 polyethylene tubes
  2" and 4" diameter
  - fails in 1-2 years

(lower left)
2 teflon tubes (front)
- inert, clear, stable shape
2 nylon tubes (rear)
- cloudy, bulges at bottom
- catastrophic failure after 3 months

VARIATIONS

Water tubes are more effective if they are placed high in a greenhouse and distributed in many places.

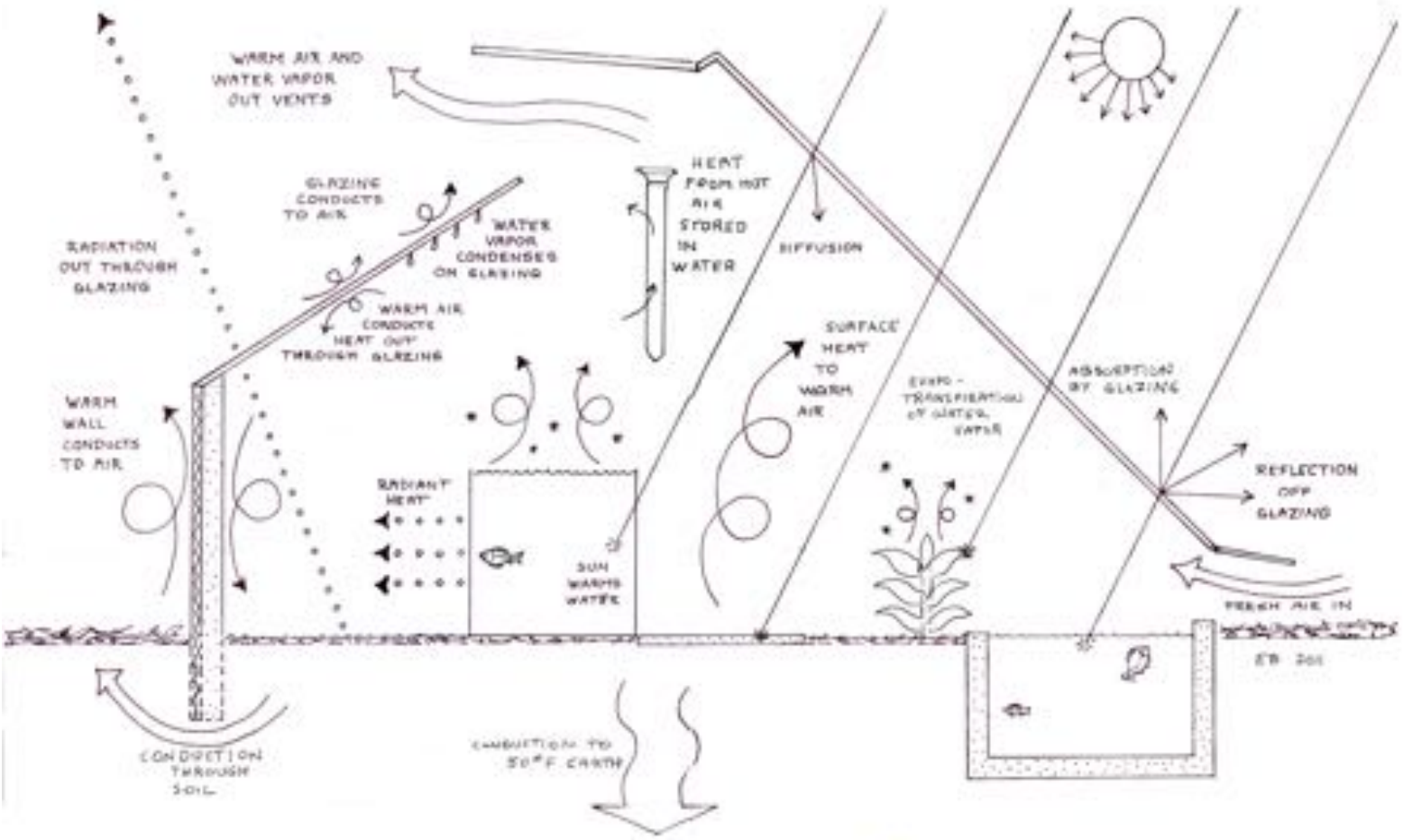




"Alchemical processes depend on the maintenance of steady temperatures, and much experience is needed in the design of furnaces to precisely regulate the heat and draft ...."

quote from old alchemy

OTHER ENERGY FLOWS



OTHER THERMAL MASS

Plant leaves are 95% water; they also store heat during the day and release it at night.
Solar fish ponds hold 700 gallons of water. They warm up 5 degrees F on a sunny day, and can release heat for several sunless days while slowly cooling .
Water stores twice as much heat as cement.
Bottles of water work well, are cheap, can last years.

The Green Center, Inc.

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"Among our major tasks is the creation of ecologically derived human support systems – renewable energy, agriculture, housing and landscapes. The strategies we research emphasize a minimal reliance on fossil fuels and operate on a scale accessible to individuals, families, and small groups. It is our belief that ecological and social transformations must take place at the lowest functional levels of society if humankind is to direct its course towards a greener, saner world."