SMOKE: WE MAKE IT AND WE CAN STOP IT

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DO WELL BY DOING GOOD


THIS IS UNFORGIVABLE
AND IT IS ENTIRELY OUR FAULT
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THE MESSAGE: *YOU* CAN STOP THE SMOKE

- The burning season is not traditional.
- Fifty years ago, there was no burning season.

We made the burning season.
You can help to end it.

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WHAT ARE YOU GOING TO LEARN?

- Why we care about the smoke
- Where the smoke comes from
- How much smoke there is
- How smoke kills us
- How it is possible to burn without smoke

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WHO CARES ABOUT SMOKE?

You do because smoke is killing you.

We all do because of the burning:

- We have the highest infant mortality and lung cancer rates in Thailand.

Chiang Mai does because of the burning:

- We lose 10-12,000,000,000 THB in annual tourism revenues

Thailand does because of the burning:

- Our country spends 220,500,000,000 THB on smoke related illnesses alone

We are *all* dying from the smoke

WHERE DOES THE SMOKE COME FROM?

- Burning season smoke consists of tiny carbon particles that are not burned in low temperature fires
- The smoke we breathe is **local**; not our neighbors'
- Our smoke comes from three sources
  - **Forest fires** – a key source, but not the most important
  - **Open field burning** – the most important source of smoke, especially since field fires start many forest fires
  - **"Clean up" fires** – that's right, the millions of daily leaf fires in front yards, at Tambons, police stations, schools – to say nothing of road side fires….

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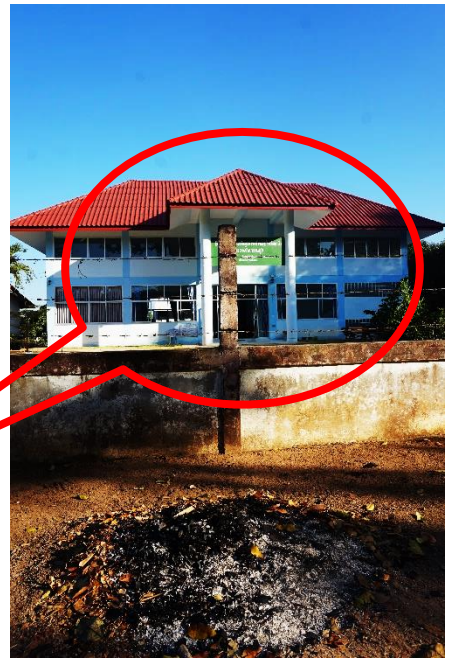
LET'S START RIGHT AT HOME

Do you like a clean yard? Of course you do.

- Consider this: That little pile of leaves you sweep up every morning weighs 2.4 kg
- In North Thailand there are **2,500,000 rural households**



- If 50% of them burn one pile of leaves every day just during the burning season they will burn 3,000,000 kg of leaves – 3,000 tons
- Who cares?

LET'S DO THE MATH

- 1 ton of biomass (leaves) = 6 kg of smoke particulates
- 3,000 tons of burned leaves = 18,000 kg of smoke
- But what the hell is **18,000 kg of smoke?**

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WHAT IS A KILOGRAM OF SMOKE?

- One cigarette = 14 micro grams of smoke
- One kilogram = 1,000 x 1,000 micrograms (1,000,000)
- One kilogram of smoke = 1,000,000 / 14 = 71,429

- **One kilogram of smoke = 71,429 cigarettes**

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THE COST OF CLEAN YARDS

- Burning season clean yards in North Thailand = 18,000 kg of smoke = **1,285,722,000 cigarettes** (18,000 X 71,429)
- Now how important do you think that clean yard is?

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SILLY? LET'S GET SERIOUS

- Chiang Mai Province devotes 638,000 rai to rice and produces 395,000 tons of rice
  - 395,000 tons of rice = ***197,500 tons of rice straw***
  - 627,000 rai of rice = ***80,000 tons of rice stubble***
- ***Let's assume***: 50% of the rice straw – 99,000 tons – is used for feed, mushrooms, garlic, onion, whatever
- No one uses rice stubble. Everyone burns stubble.

Chiang Mai Province will burn 99,000 tons of rice straw and 80,000 tons of stubble this year.
*Rice production alone will generate **1,074,000 kg of smoke**.*

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WANT TO PUT THAT IN CONTEXT?

- That 1,074,000 kg of rice waste times 71,429 cigarettes per kg of waste = **76,714,746,000** cigarettes
- That is ***45,126 cigarettes per person*** in the entire population of Chiang Mai, including babies – annually.
- Can you imagine your four year old son smoking 124 cigarettes every day?
- And that's just rice waste.

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ONLY 123 MORE TO GO (EACH)!

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TOO ABSTRACT FOR YOU? LET'S BRING IT HOME

- Chiang Dao burns 5,750 tons of rice waste and at least 20,000 tons of corn waste annually producing **60,000 kg of smoke**
  - **That is the equivalent of 4,285,740,000 cigarettes**
- Phrao burns 22,000 tons of rice waste and 40,000 tons of corn waste annually producing ***252,000 kg of* smoke**
  - **That is the equivalent of 18,000,108,000 cigarettes**

- You can do the math for your own district.
- And do not think that Chiang Mai City is exempt. What do you think happens to all of the leaves from all of the city's beautiful trees?

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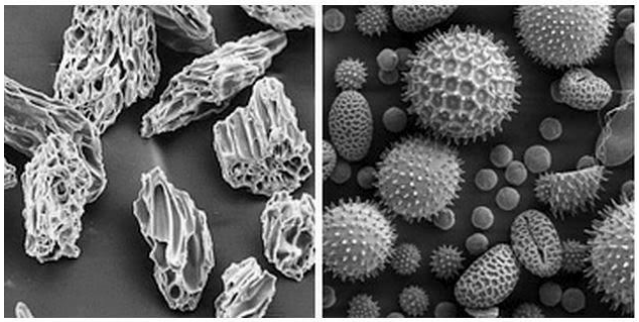
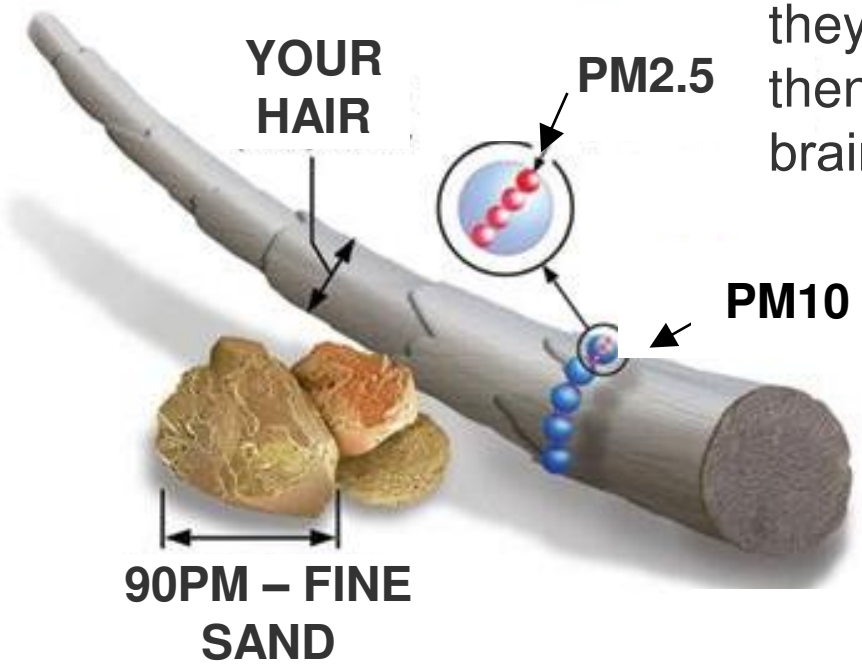
WHAT IS SMOKE?

- This is smoke close up →
- You breathe these tiny particles into your lungs.





The "small" ones – **PM2.5** – are so small that they go from your lungs into your blood and then into every part of your body – heart, brain, liver, kidneys….

The "big" ones – **PM10** – get stuck in the tiny air sacks of your lungs.

HOW DOES SMOKE KILL?

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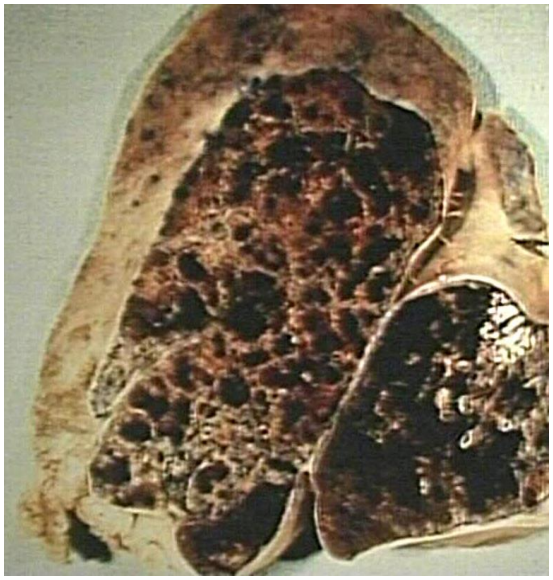
- **World Health Organization (WHO)** reports there is **no "safe level of exposure**…below which no adverse health effects occur."
- **WHO** reports "Long-term exposure to PM2.5 is associated with an increase in the long-term risk of **cardiopulmonary mortality** by 6–13%...."
- Smoke exposure results most often in **lung and respiratory disease (cancer, emphysema), heart attack and stroke**



Pictured is a lung filled with smoke particles.

WHY DO FIRES SMOKE?

Fires smoke when they are not hot enough to burn the carbon particulates that become smoke.

If this fire was hot and contained, all the smoke would burn up.

SO WE SHOULD STOP FARMING?

- Are you kidding?
  - Rice has supported us for generations
  - Increased corn production, especially in the mountains, is the one place we see positive growth
  - Soy, potatoes, lemon grass, peanut carry us between rainy seasons

Beautiful. But what's for dinner?

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STOP MAKING SMOKE

Can you burn without making smoke? Absolutely.

Remember:

- Why do fires smoke? Not hot enough
- What is smoke? Tiny carbon particles not burned because the fire was not hot

Solution

- Contain the burn in a high temperature space

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WHAT'S THE DIFFERENCE?

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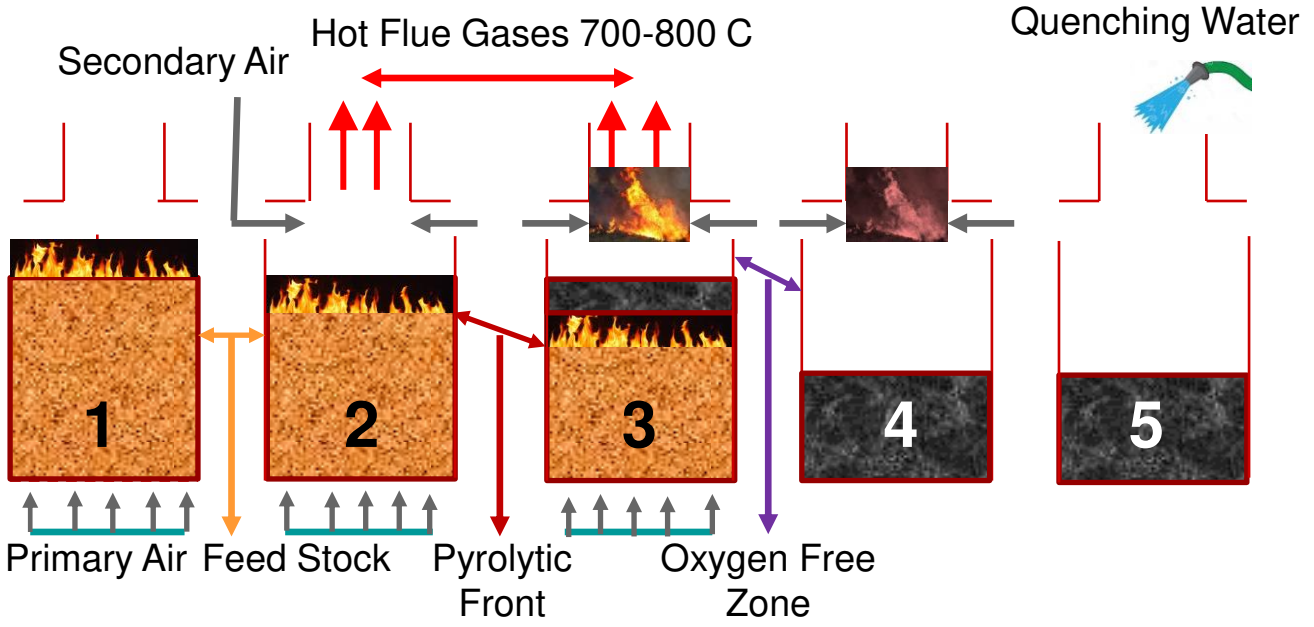
Different feed stock? No. Exactly the same corn stalk in exactly the same location on exactly the same day.

Open air, low temperature (as low as 80 C at ground level) smolder after fast top burn

Contained, high temperature (750 C) burn, no smoke after ignition

BASIC PYROLYSIS: SMOKELESS FIRE



1. Feed Stock is lit from the top, drawing air in from the bottom.
2. Heat produces very hot pyrolytic front.
3. Heat of downward moving pyrolytic front releases gases (volatiles) from feed stock which mix with secondary air and burn orange. Burning eliminates particulates, smog precursors and greenhouse gases
4. Process continues in almost completely oxygen free environment until volatiles are consumed. Flame changes to blue/purple.
5. We quench finished biochar with water.

CRITICAL IMPROVEMENTS WITH PYROLYSIS

Environmental

- Virtual elimination of smoke (particulates)
- Virtual elimination of smog precursor gases
- Virtual elimination of long-term greenhouse gas emissions

Economic

- Produces “biochar” not ash
- Biochar is valuable, useable and sellable
- Because we use only waste materials, biochar production is sustainable

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A SUSTAINABLE, LONG-TERM SOLUTION BECAUSE IT IS PROFITABLE

- **Question:** Why waste time making biochar instead of just burning the stuff?
- **Answer**: Because biochar is worth money, to farmers, fertilizer companies, feed companies...
  - Biochar can reduce agrochemical costs, increase crop yields and raise income in agriculture
  - Biochar can make farm animals fatter and chickens lay more eggs, make all farm animals healthier, and get rid of their smell
  - Biochar can save all of us from pesticides – although that is a topic for another day

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LOW-COST, LOW-TECH PRODUCTION

- Making biochar – and eliminating smoke – is easy
- Warm Heart Foundation will provide drawings and trainings free. Just call or email. (See detail at end.)
- Warm Heart biochar machines are designed to be:
  - **Affordable** – All materials available at local recycling yards
  - **Locally sourced** – No motors, switches, controllers or other parts that cannot be made locally
  - **Simple to make and maintain** – No tools a local mechanic would not have, no special training, minimal maintenance
  - **Easy to use** – No special training, light, limited labor needs
  - **Portable** – Can be moved easily in a small pickup
  - **Effective** – Smokeless, efficient, produces quality biochar
  - **Safe** – Must not require safety equipment or pose fire hazard
  - **Sustainable** – Designed to char renewable waste materials

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Beautiful it is not, but it works like a dream.

- Assembly time: 2 hours
- Materials: scrap
- Tools: grinder/cutter, drill, bits, screw driver, string, marker, tape measure
- Cost: $28.50 / 1,000 THB

Note: Match your machine to your feed stock! This simple unit is great for some but terrible for others. Contact Warm Heart for designs to char, for example, tree branches, corn stalks, and rice straw.

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LEARN MORE

- Do you have questions?
- Do you want to learn more about biochar?
- Do you want plans to make your own biochar machine?
- Would you like to organize a group training in the greater Chiang Mai area?

Warm Heart Foundation is here to teach and share

We are ready to serve you – and our trainings are free to the public and NGOs

Call **Aom** to ask for help or to arrange your Warm Heart training

085-716-5117

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This PowerPoint is brought to you by **Warm Heart Publications**.

Warm Heart is a grassroots community development organization serving the world's 2.5 billion poorest people – rural small farmers.

In addition to publications such as this one for developed world audiences, Warm Heart Publications' Educational Program publishes a wide range of simple but accurate materials for small, rural farmers. This program begins from the assumption that rural people are interested in the big issues affecting their lives and want to understand them.

Publications in the Warm Heart Educational Program for Small Farmers cover issues as diverse as the basics of soil health and plant nutrition to mitigating the consequences of climate change and how biochar works.

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