

Outstanding Issues in Testing Protocol Development

Tami C. Bond¹ & Laura M. Fierce¹

AND MANY OTHER PEOPLE

¹University of Illinois at Urbana-Champaign, USA

ETHOS Conference
Kirkland, WA, USA
January 31, 2010



Outline

1. The Water Boiling Test

- History and Status
- Guiding Principles for Revision

2. Outstanding Issues

How many protocols?; Field → Lab connection



The Water Boiling Test

The Water Boiling Test Version 4.1.2

*Cookstove Emissions and Efficiency
in a Controlled Laboratory Setting*

DRAFT - October 1, 2009
Version 4.1.2: Version for public comment
Please return comments by December 1, 2009

*Responses to comments from technical committee may be found at
methods.bioenergylists.org*

Remaining needs:

- Fill in web pages where data can be submitted
- Describe fuel use benchmarks and critical equations ("Equivalent dry wood consumed", "Effective mass of water boiled", "Thermal efficiency" as in spreadsheet)
- Alter equations—some are now pictures, which makes the Word document very large. Needs donated time from someone with equation skills.



Components of a testing protocol

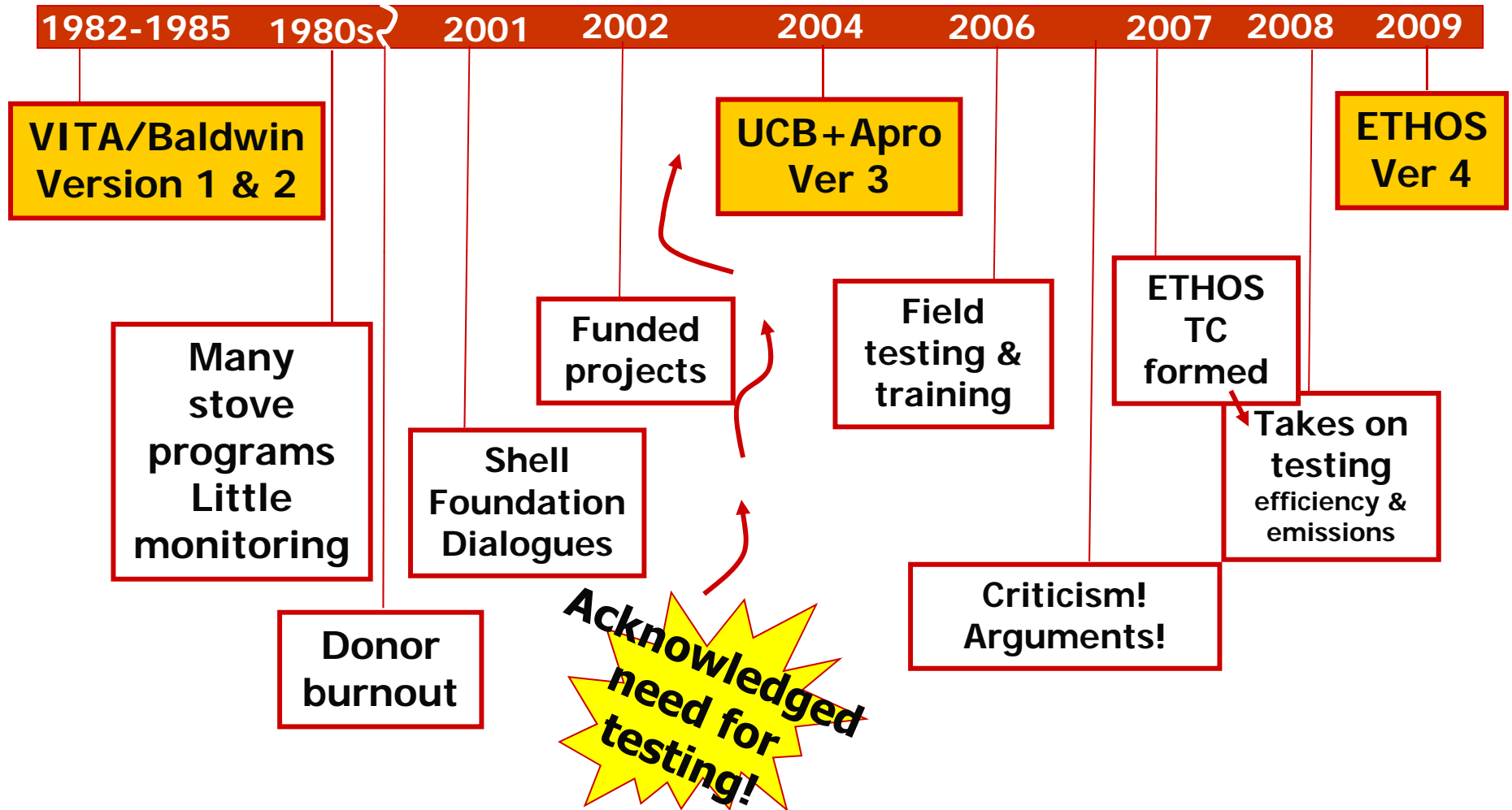
1. Procedure for **operating** the stove
2. Method of **measuring** and recording data
 - Temperatures (for efficiency)
 - Emissions
3. Method of **interpreting** the data

Operating, measuring, interpreting are separate issues.

Emissions & efficiency must be measured together.



History of formal testing





Comments & criticisms addressed *separable* issues

Operating

1. The results of the test are not reproducible.
2. Test procedures do not mimic procedures in stove use (*e.g.* lighting, practice, fuels)
3. The test procedure may result in unfair disadvantages for stoves with different operation (batch, low-power)

Measuring

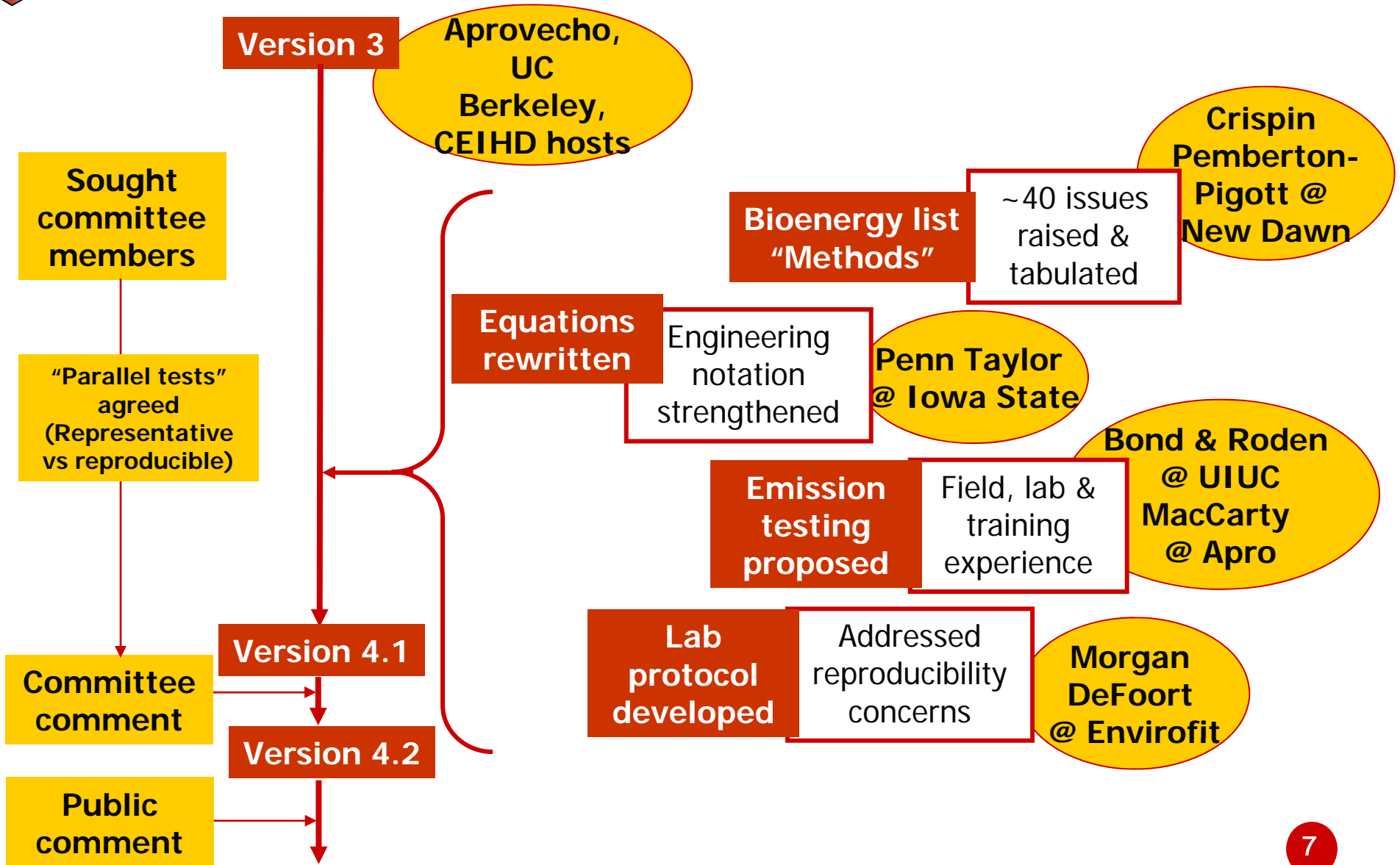
4. Guidance on emissions needed

Interpreting

5. More guidance or perspective is needed when describing the test and its purpose.
6. Equations used to process data do not represent physics or thermodynamics.



WBT Version 4.0 process (1)





WBT Version 4.0: continuing process

- ✦ Formed review panel; addressing all comments
- ✦ Biweekly “webinars” housed at PCIA

Current philosophy:

- Alter existing test when
 - weight of evidence supports change
 - new test is *equally or more representative* of reality
- And we hope: implication for previous tests is well understood

Hot WBT issues

- ✦ Wood type and moisture content
- ✦ Insulation above water/pot lids
- ✦ Thermal efficiency
- ✦ Humidity in ambient air
- ✦ Power required to boil



Where are we?

- ★ WBT 4 will be frozen
 - 2 rounds of comments
 - Hot issues & research will be identified in test
 - Need community commitment
- ★ Need: Targeted testing to investigate causes of variability
 - Major changes in lab = major changes in field?
- ★ Time to move on – *synthesize* data
 - Don't ignore uncertainties; don't let them paralyze community either



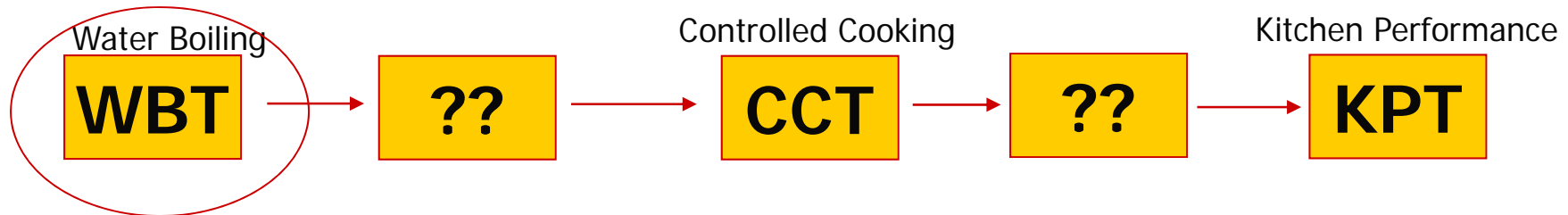
Beyond the Water Boiling Test (please!)



Challenge #1: Refine a sequence of tests & applications of each one

Are stove programs helping?

Sequence conducted with same stove



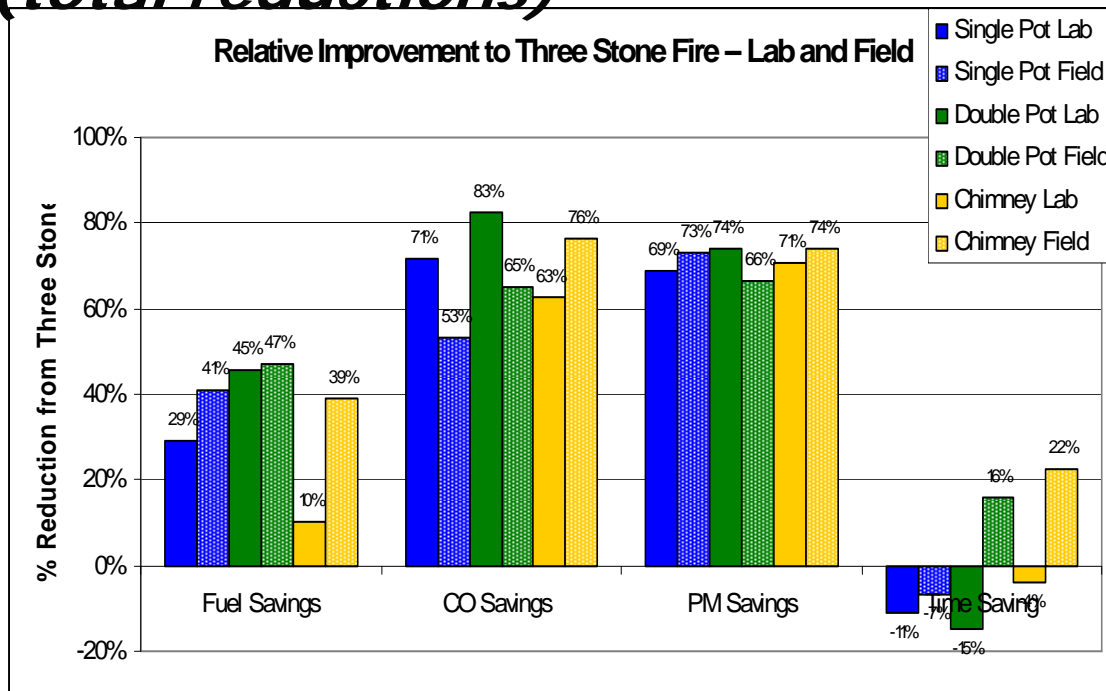
Parametric testing to understand critical factors

Why or why not?



Challenge #2: Understand in-use vs lab

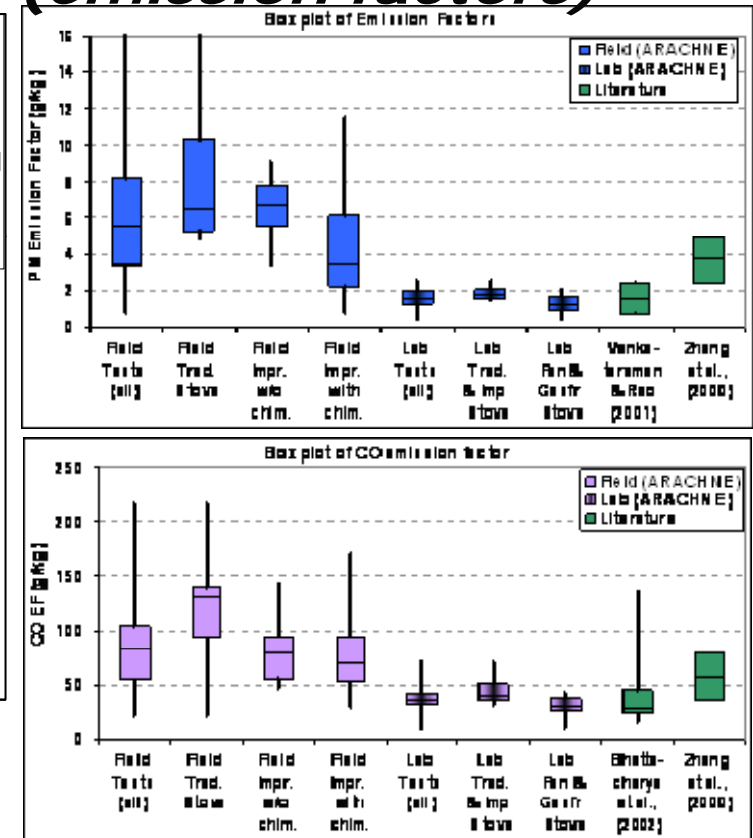
*Sometimes lab & field agree
(total reductions)*



Courtesy Nordica MacCarty

~~It's interesting~~
imperative
to know why

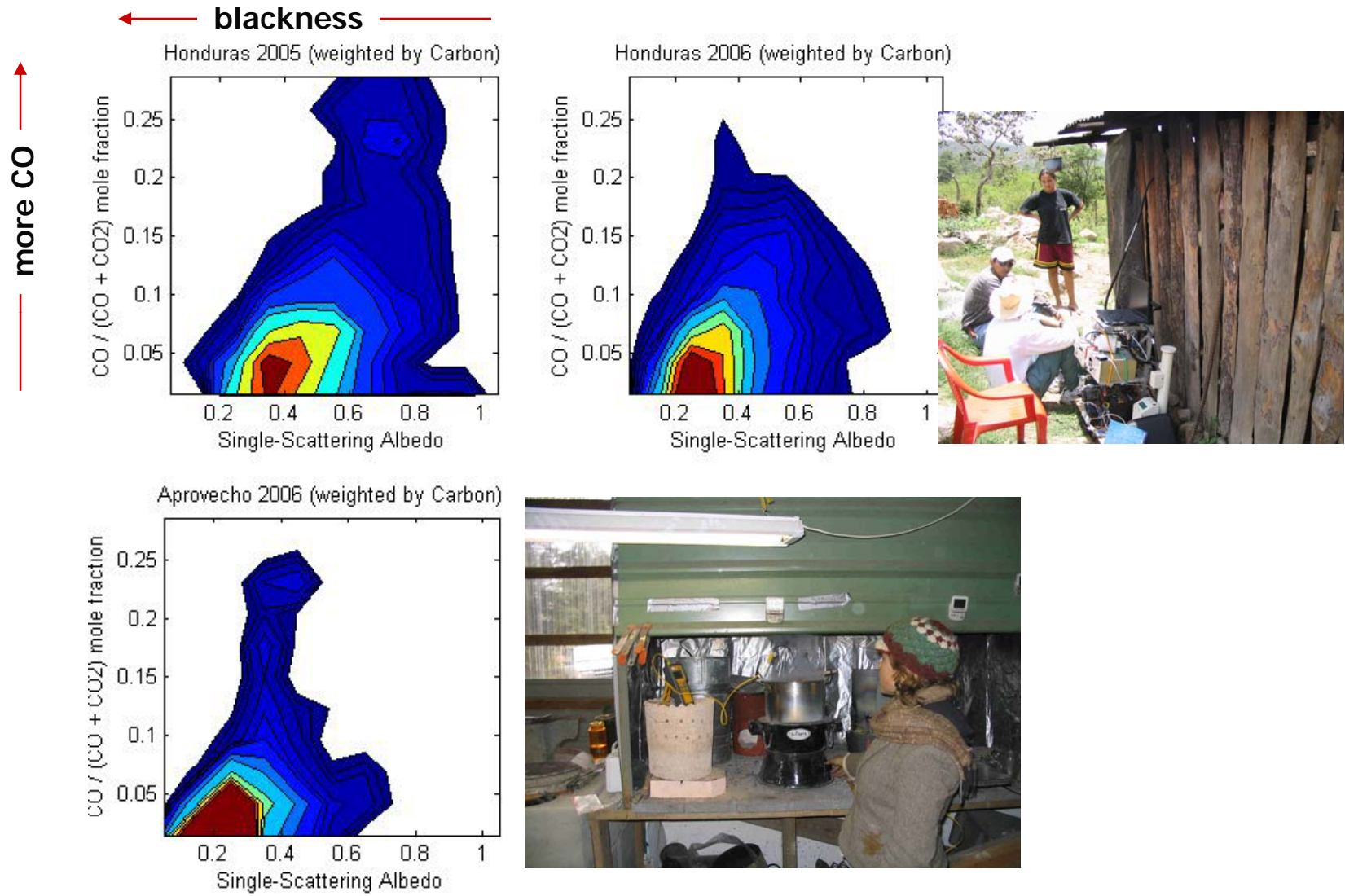
*Sometimes they don't
(emission factors)*



Roden, Bond, Conway, Osorto, MacCarty & Still, Atmospheric Environment, 2009



Possible solution: Expand understanding of combustion events



Averages bury key performance characteristics



Challenge #3: Create data streams

With full awareness
of uncertainty &
emerging needs

- ✦ Desired: Understanding of...
 - Baseline in various regions, fuels, food
 - Appropriate interventions
 - Robustness of technology
- ✦ Mine loads of data for statistical “fingerprints”?

“Speculation is worthless” -- plaque at Aprovecho

For many open questions, we are just speculatin’!



Challenge #4: Performance curves

For techies who want something to do:

- ✦ Characterize stove + fuel + pot (+user!) performance over a range of conditions
- ✦ Vary power settings– beyond boiling & simmering
 - Addresses many WBT open questions (use lids? pot insulation? what does simmer mean?)
- ✦ Vary fuel types & feeding rates
- ✦ Collect, share and synthesize information



Challenge #5: Set and stick to priorities

**Tests are: Tools for designers improving stoves,
and for programs evaluating user benefit**

- ✦ **Opportunity cost** of excessive focus on WBT:

Wasting technical ability needed to tackle bigger problems

- Physical variability in WBT must receive attention
- BUT, is it greater than unnamed factors causing lab-field variation?

- ✦ **Opportunity cost** of unresolved disagreements:

Appearance of poor understanding

- Places community at a disadvantage for competitive funding

“keep your eye on the ball”



THANK YOU!

Sam Baldwin, who started it all

Dean and Nordica, for years spent pounding WBT3
into a trainable field tool

Rob Bailis and Kirk Smith, for starting the ball
rolling

Crispin, for careful and persistent evaluation

Everyone who participated in the ETHOS process
to refine the WBT

John Mitchell, Brenda Doroski, and Mark Bryden,
for cheerleading and organization