CLEAN COOKING ALLIANCE

Climate Action and Clean Cooking Co-benefits

a workshop on balancing practical implementation and science-based methodologies for project monitoring, reporting, and verification.

September 9-11th, 2019

CLIMATE & CLEAN AIR COALITION
TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

Day-1 Agenda 9:00-5:00

- Welcome and introductions
- Setting the stage for the workshop
- Part I—Current applications of research
- Panel discussion with project developers
- Part II—Research update

Day-2 Agenda 9:00-4:30

- Setting the stage and goals
- The role of black carbon
- Part III—Current applications of research: resources, tools, and MRV best practices-ISO standards
- Part III—Current applications of research: resources, tools, and MRV best practices
- Part IV—Where we go from here

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Day-3 Agenda 9:00-11:30

- Setting the stage and goals for the day
- Part IV: Where we go from here
- Close

1

Welcome and introductions

Dymphna van der Lans

CEO, Clean Cooking Alliance

Sophie Bonnard

Climate and Clean Air Coalition

THE CLIMATE AND CLEAN AIR COALITION AND ITS HOUSEHOLD ENERGY INITIATIVE

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ccacoalition.org

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TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

"Modelled pathways that limit global warming to 1.5°C with no or limited overshoot involve deep reductions in emissions of methane and black carbon (35% or more of both by 2050 relative to 2010).

… Improved air quality resulting from projected reductions in many non-CO_2 emissions provide direct and immediate population health benefits in all 1.5°C model pathways."

Summary for Policy Makers of the IPCC Special Report: Global Warming of 1.5°C

ABOUT OUR WORK

- The Climate & Clean Air Coalition is a global, voluntary partnership dedicated to addressing short-lived climate pollutants
- Network of 400+ governments, IGOs, financial institutions & civil society organisations

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ADDRESSING THE MAIN EMITTING SECTORS

AGRICULTURE

BRICKS

HOUSEHOLD ENERGY

HEAVY-DUTY VEHICLES

OIL & GAS

HFCs

WASTE

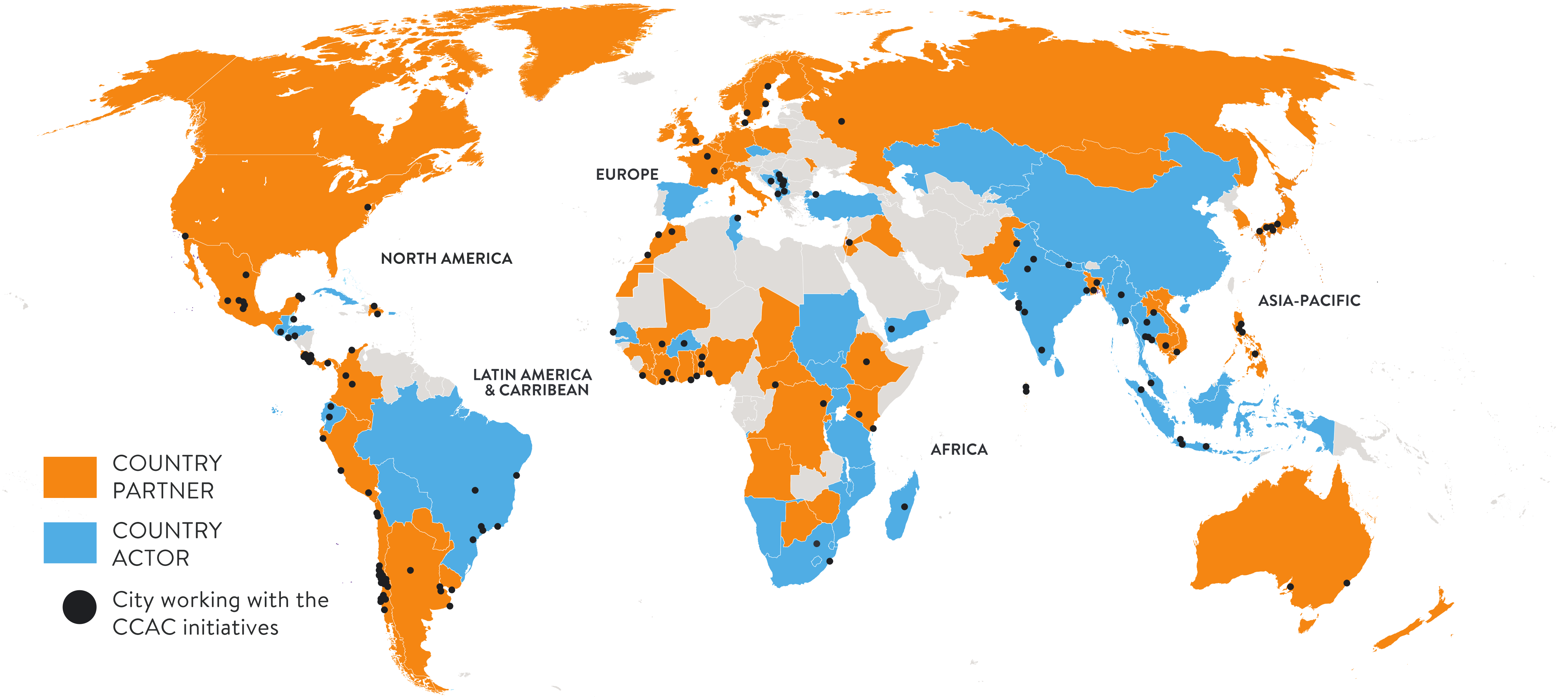
ASSESSMENTS

FINANCE

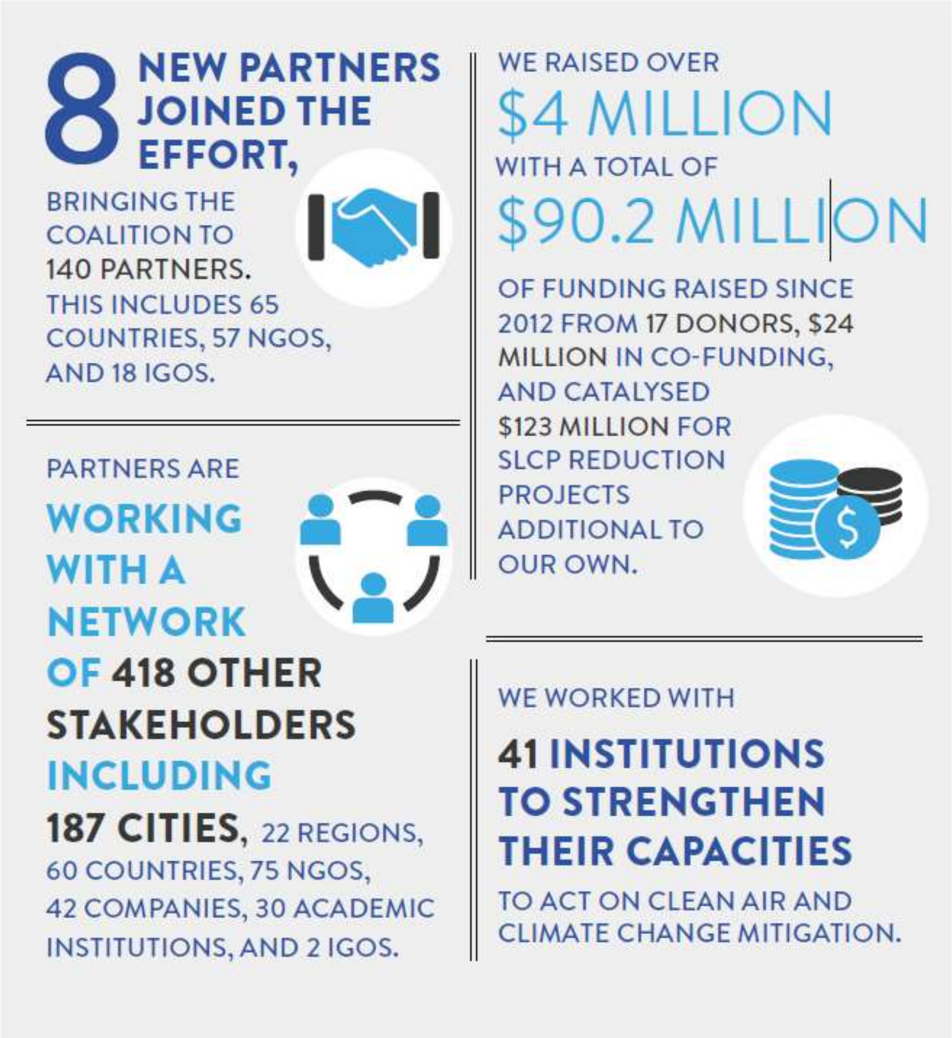
SNAP

HEALTH

WHERE WE WORK



RESULTS AND IMPACTS



ACTIVITIES

Training and capacity building

Expert assistance and resources

Support for developing regulations, laws, policies

Technology demonstrations

Science and research

High level political outreach and awareness raising

HOUSEHOLD ENERGY INITIATIVE

Overall goal

the Household Energy Initiative aim to speed up the reduction of SLCP emissions, especially black carbon, alongside reductions of long-lived greenhouse gases (GHG), from the sector globally, to **mitigate climate change, save lives, improve livelihoods, empower women, and protect the environment in the near-term and the long-term.**

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TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

HOUSEHOLD ENERGY ACTIVITIES

COOKSTOVES:
- Awareness of climate impacts of cookstoves
- Spark Fund projects in Nigeria, Kenya and Tanzania
- Standards development and implementation in Guatemala, Nigeria, Kenya, Uganda, Ghana
- Guidance on BC methodology for ISO standards
- Methodology for quantifying black carbon emission reductions from cookstoves
- BC Field studies in Rwanda, Nepal, Kenya
- Pilot projects on stove adoption and RBF mechanisms in Kenya and Nigeria
- Tools development
- Climate Action and Clean Cooking Co benefits Workshop

LIGHTING
- Minimum energy performance standards in Nigeria for the phase out of kerosene lighting

HEATSTOVES
- Testing protocols for BC emissions from heatstoves released by Arctic council
- Development of a Code of Good Practices to support the Gothenburg Protocol
- Burn right campaign in Vernon, Sweden and Chile
- Combined heat and cookstoves summit in Poland

WHAT WE ACHIEVED SINCE 2013"

$4.76 MILLION allocated

ACTIVITIES IN 11 COUNTRIES AND A NETWORK OF 65 STAKEHOLDERS CONTRIBUTING TO THE WORK

$13.3M of funding catalysed to phase out Kerosene lighting in Nigeria by developing 10,000 solar homes over 5 years

5 COOKSTOVE STANDARDS STRATEGIES AND PILOTS IN GHANA, GUATEMALA, KENYA, NIGERIA, AND UGANDA.

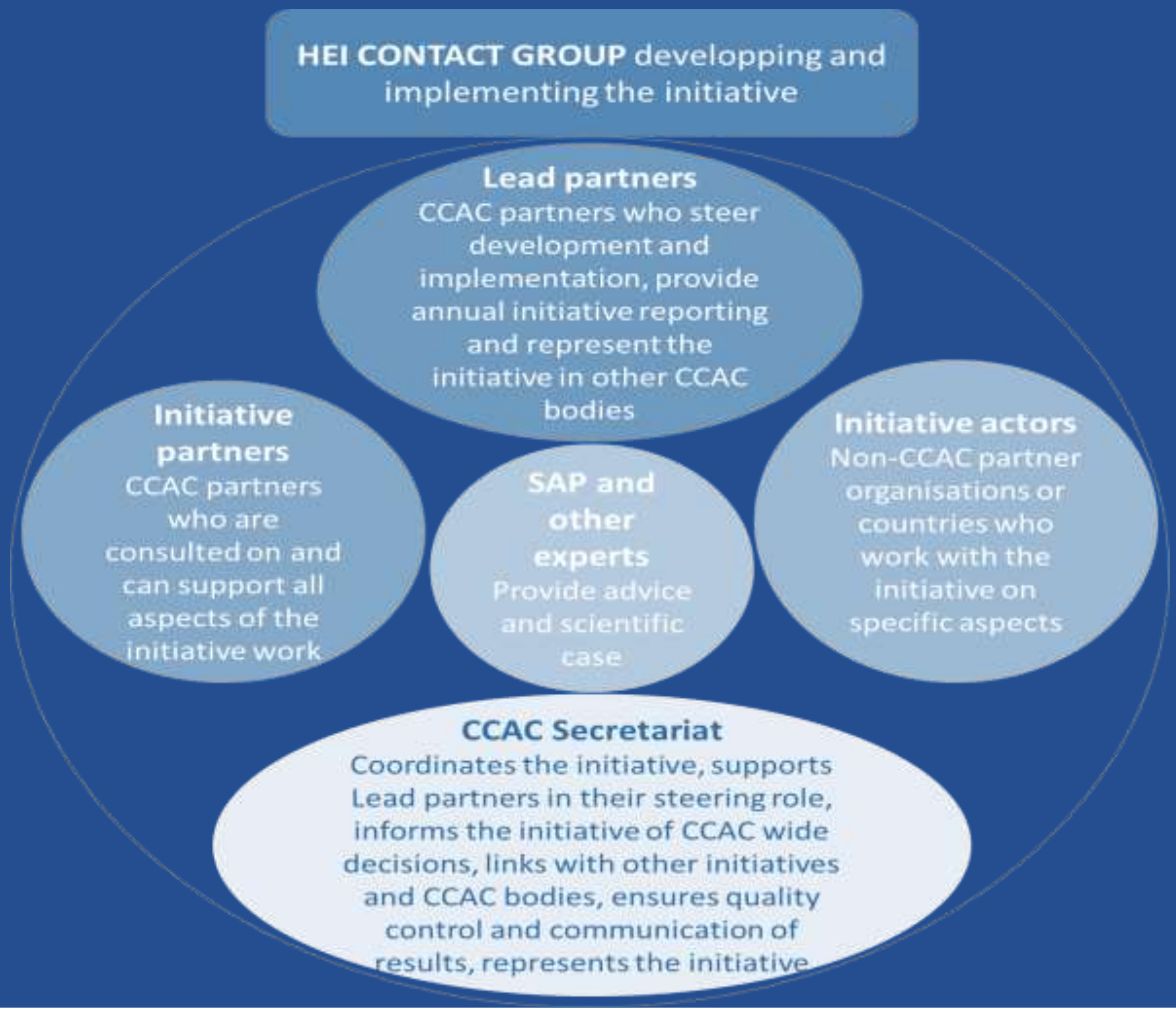
20 INSTITUTIONS STRENGTHENED

11 knowledge resources and tools including the newly released field study on the relationship between cookstove emissions and personal exposure in Kenya

20 POLITICAL OUTREACH EVENTS

617 person-hours of training

HOUSEHOLD ENERGY ACTIVITIES



HOUSEHOLD ENERGY INITIATVE PRIORITIES

SLCP considerations and the integration of health and climate change mitigation approaches are still lacking in the sector.

Priorities going forward:

- **help countries deliver on their full potential of BC reductions** from the sector as part of their climate change and air pollution mitigation efforts and establish linkages between the two.
- **support key organisations** working in the sector, as well as relevant international or regional frameworks and agreements, to **integrate BC considerations to their work.**

ADVOCACY	RESEARCH AND DEVELOPMENT
TAILORED SUPPORT TO EXISTING AND PLANNED LARGE SCALE EFFORTS	PEER TO PEER EXCHANGE

THANK YOU !

As CCAC partners are heading to the SG Climate Summit, preparing for COP25 they are very much looking forward to your recommandations on how we can build common, robust and implementable MRV requirements for clean cooking projects with carbon financing, including on black carbon.

ccacoalition.org

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THANK YOU AND WISHING YOU ALL A GOOD WORKSHOP !

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2

Setting the stage and workshop objectives

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Objectives

The objective of this workshop is to increase the effectiveness of clean cooking programs as sustainable climate action that realize quantifiable co-benefits for the environment and air pollution.

- Day 1 & 2—Disseminating the latest evidence on the relationship between cookstove emissions and health and climate impacts;
- Day 1 & 2—Identifying the regulatory, technological, and financial barriers to the effective implementation of clean cooking projects deployed through climate finance (or with other results-based Finance—RBF—mechanisms); and
- Day 2 & 3—Identifying solutions to address the identified barriers based on the lessons learned from project developers and the most up-to-date science on emissions, technology, measurement, and policy.

Outcomes

1. Harmonized methods and best practice examples in quantifying emission reductions from clean cooking projects based on published standards and up to date science

2. Examples of best practices that balance practical implementation and science-based methodologies for monitoring the long-term use of clean cooking technologies based on published standards and up to date science

3. Workshop report, including recommendations on key elements to be taken into account when developing the new rules for accounting for carbon credits under the market mechanisms including those that will be set up under Paris agreement

Guiding Principles

John Mitchell

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Getting to Know Each Other

- Name, affiliation
- What is your intention for the workshop? What do you want to get out of the next few days?
- Report out your partner's response

3

Part I—Current applications of research

Update from the CDM

Gajanana Hegde and Kenjiro Suzuki, UNFCCC

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Updates on new market mechanisms and current state of CDM cookstoves methodologies

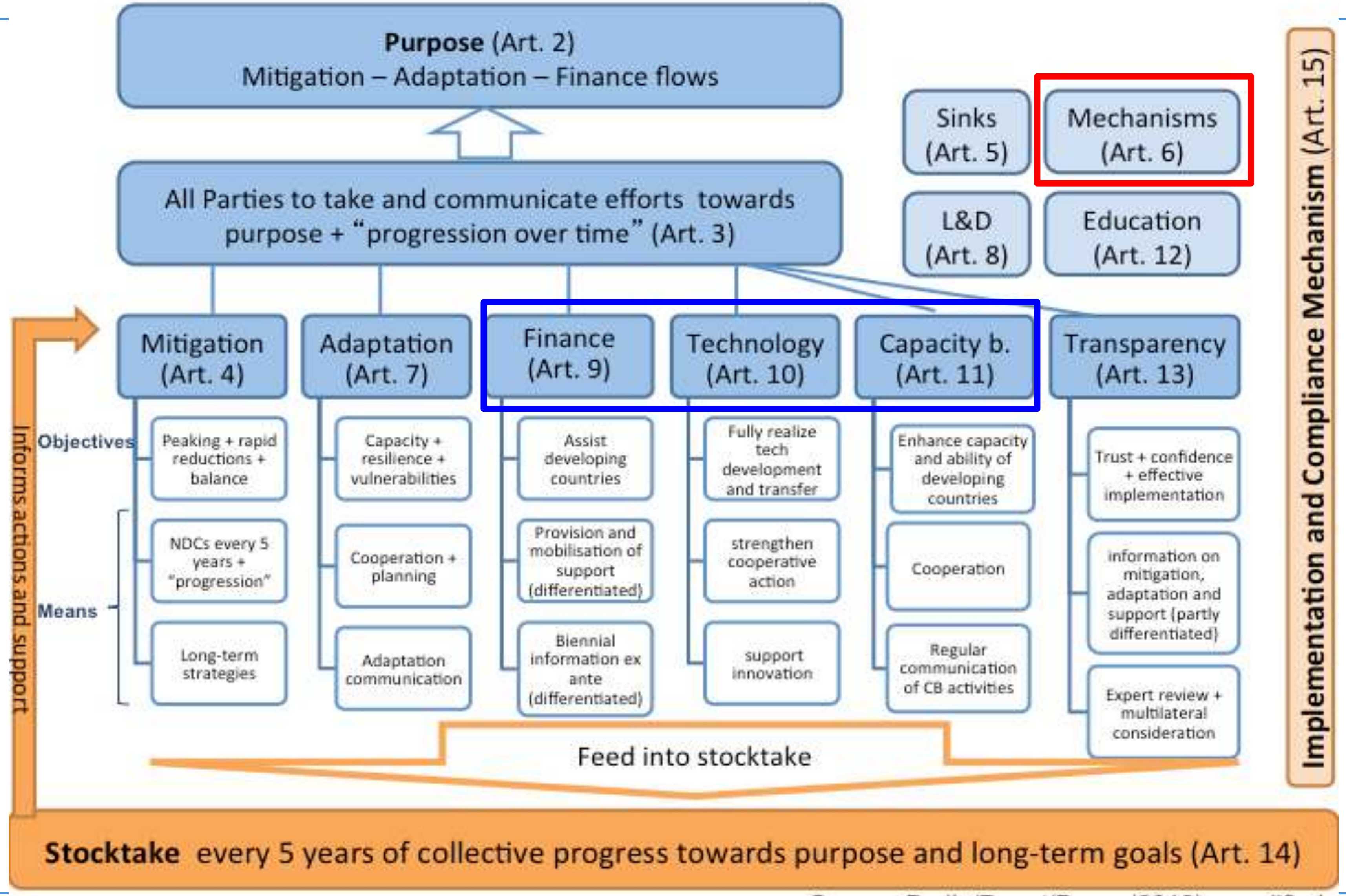
Climate Action and Clean Cooking Co-benefits Workshop

Washington DC, 9 to 11 September 2019

UNFCCC Secretariat

Gajanana Hegde and Kenjiro Suzuki

Structure of the Paris Agreement



Source: Bodle/Donat/Duwe (2016) - modified

Article 6 – co-operation towards NDCs

Cooperative Approaches

Articles 6.2 and 6.3 and decision 1/CP.21 paragraph 36

The Mechanism

Articles 6.4 to 6.7 and decision 1/CP.21 paragraphs 37 and 38

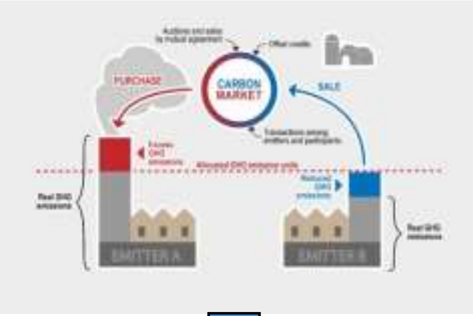
Framework for non-market approaches

Articles 6.8 and 6.9 and decision 1/CP.21 paragraphs 39 and 40

“Cooperative Approaches”

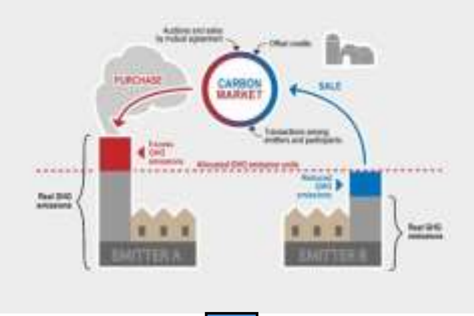
COUNTRY A

COUNTRY B



Source: Quebec

EG: LINKED PROGRAMMES



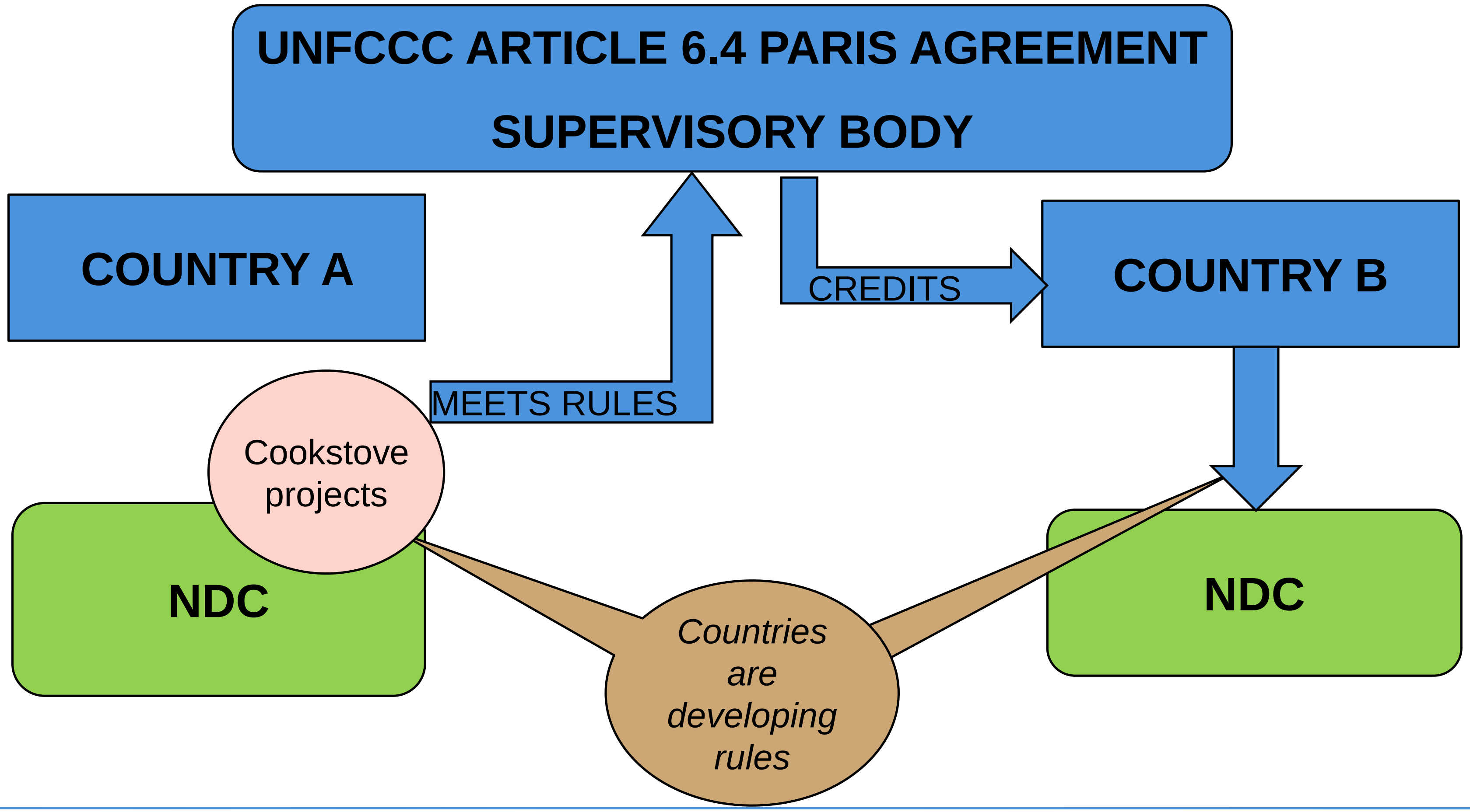
Source: Quebec

NDC

Countries are developing guidance

NDC

“The Mechanism”



“The Framework for non-market approaches”

COUNTRY A

COUNTRY B

EG: Energy Efficiency Programme

SHARE BEST PRACTICE

Countries are developing work programme

EG: Energy Efficiency Programme

Climate Conference - Katowice (2018)

- Adoption of implementing rules for the Paris Agreement
  - Most parts of the Paris Agreement implementing rules were adopted
  - Particularly important is the transparency regime, which sets out how countries determine what they must measure and how and when they report
  - Also decisions on accounting (NDCs) and the Adaptation Fund.

COP24·KATOWICE
POLAND 2018

Climate conference Bonn (2019)

- **Article 6 negotiations ran out of time in Katowice (2018)…**
  - Lot of progress but some areas of strong disagreement still remained

- **Countries returned to Article 6 negotiations in June 2019**
  - Negotiated using last draft documents from Katowice, reinsertion of some positions into those
  - Evolution in June towards compromise plus new thinking

Article 6: key unresolved issues

- **Corresponding Adjustments** (additions and subtractions for transfers)
- Whether corresponding adjustment is required for first transfer of units in Article 6, paragraph 4 **mechanism**
- How to address **mitigation from outside the scope of an NDC**
- Use of internationally transferred mitigation outcomes (ITMOs) for purposes other than NDCs (**CORSIA** etc.)
- **Share of proceeds** – cooperative approaches and the mechanism
- "**overall mitigation in global emissions**"
- **Transition of mechanisms** under the Kyoto Protocol (CDM, JI)
- **Governance** arrangements in the framework for non-market approaches

Article 6 pilots

Energy	Waste
EBRD: *SEMED*	Canada-Chile
Japan: *JCM*	NEFCO: *Peruvian Pilot*
Sweden: *SEA Pilots*	Switzerland: *CCF*
World Bank: *SCF*	Japan: *JCM*
World Bank: *CPF*	
Switzerland: *CCF*	

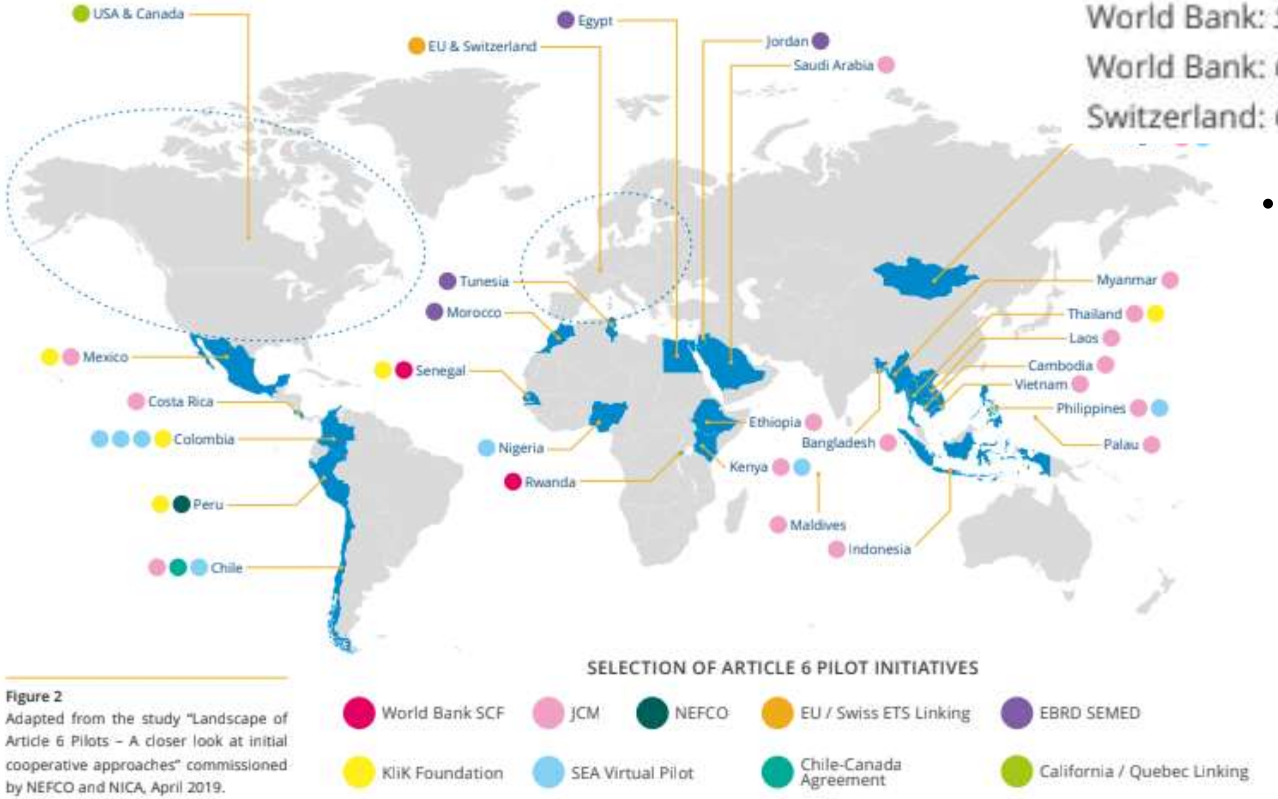


Figure 2
Adapted from the study "Landscape of Article 6 Pilots – A closer look at initial cooperative approaches" commissioned by NEFCO and NICA, April 2019.

- <350 million USD invested

Source: Moving towards next generation carbon markets observations from article 6 pilots, Climate finance innovators (2019)

Article 6 pilot projects- clean cookstoves

Title	Host country	Type	Implementer
Peru (efficient cook stoves)	Peru	Efficient cook stoves (Tuka Wasi stoves)	Klik Foundation
Senegal	Senegal	Domestic biogas	Klik Foundation
The Adaptation Benefit Mechanism (ABM)	Africa: Ethiopia, Uganda, Nigeria, Cote d'Ivoire	Clean cooking, etc Article 6.8: Where adaptation benefits can be delivered	AfDB
The Standardized Crediting Framework (SCF)	Rwanda	Eff cookstoves (Building on Inyenyeri cookstove (CDM PoA with ref=6207))	World bank Ci-Dev
The Standardized Crediting Framework (SCF)	Senegal	Rural energy access (improved cookstoves, etc)	World bank Ci-Dev

Source: UNEP DTU Partnership

Clean cookstove CDM projects/PoAs

- With 63 PoAs registered, clean cookstoves are by far the most popular PoA type. 337 CPAs have been included in these PoAs and, in addition, 42 project activities are registered.
  - More than 6 million CERs have been issued for clean cookstoves

	Number	CERs issued (kCERs)
CDM projects	42	602
CDM PoAs	63	5,775
>> CPAs	337	
Total (projects + CPAs)	379	6,377

Source: UNFCCC and UNEP DTU Partnership

CMP 14 mandate

- CMP 14 (Katowice, December 2018) encouraged the CDM Board to **review methodological approaches for calculating emission reductions** from project activities, resulting in the **reduced use of non-renewable biomass in households**.

CDM ongoing work

- CDM Board (March, 2019) considered the following issues from literature review and stakeholders' submissions.

Issues	Ongoing work
1. **Uncertainty in estimates of emission reductions** have not been included.	Default values, surveying and other monitoring methods are being continuously improved by the Board.
2. **Default factors for biomass consumption** from baseline stoves at the household level has been **developed only for a few countries**.	For some countries, conservative default values has been developed, using the procedure for development of top-down SB.

CDM ongoing work

Issues	Ongoing work
3. **Default factors for fNRB are not conservative**.	Conservative default value of **0.3** is included in the new TOOL30. Almost all of the previously approved national fNRB factors have expired.
4. **Monitoring of retention rates of stoves and stove stacking** is not fool proof. Refined approaches to incorporate the use of data loggers may be required.	The Board has **mandated work to Meth Panel to develop best practice examples** in cookstove methodologies.

CDM ongoing work

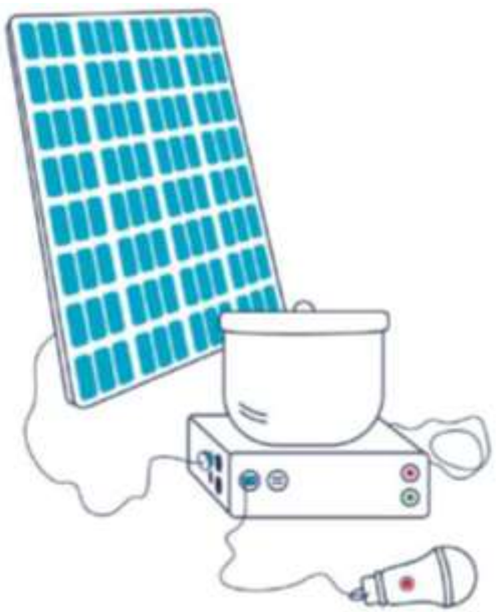
Issues	Ongoing work
5. The **use of fossil fuel CO_2 emission factors** as surrogates for biomass combustion have no scientific basis.	CDM EB 105 (Chile) will consider a proposal for revised default values. Shift to wood default (112 tCO2/TJ) was not accepted
6. Non-CO_2 GHG emissions **(CH_4 and N_2O) are not considered**.	CDM EB 105 (Chile) will consider a proposal for revised default values.
7. Approaches to incorporate **black carbon** are not included.	Not eligible under Kyoto Protocol
8. CDM methodologies **do not cite** up-to-date harmonised **standards for stove test** (e.g. ISO)	Further work mandated to Meth Panel.

Use of ISO standard

- CDM Board and its Meth Panel in principle support the use of ISO standards in CDM meth.
- Stakeholders requested the continued use of the existing protocols (e.g. WBT, CCT, and KPT) some more time (Practitioners workshop in May 2019).
- Meth Panel aims to further consider:
  - ✓ Difference in procedures for thermal efficiency between WBT and ISO;
  - ✓ Comparability of the test results for baseline and project;
  - ✓ Infrastructure for stove test (e.g. accredited laboratories) for ISO 19867-1:2018.

Other developments

- Electric stoves powered by renewable energy are being piloted.
- Electric stoves powered by grid ?
- LPG stoves (unresolved issues on eligibility)



Next steps

- Meth Panel: 23 to 26 September, 2019
- Public consultation on the draft revision
- CDM EB: adoption at EB105 (November 2019, Chile) or early 2020

Conclusions

- Irrespective of the type of RBF, harmonized and credible defaults/methods will be required for:
  a) Baseline biomass consumption
  b) fNRB
  c) Usage/retention rates (IOT, blockchain?)
  d) Accounting for multiple fuel/stove use
  e) Efficiency/emission testing
- New methodology for shift to grid electricity for cooking?
- Sophisticated blending of incentive instruments (e.g. SEA pilot)
  a) Capacity building for countries and project developers

fNRB Baseline Values

Rob Bailis, Stockholm Environment Institute

CLEAN COOKING ALLIANCE

1● aniversario ciga
centro de investigaciones en geografía ambiental · UNAM

A Quick Review of fNRB Baseline Estimations

Rob Bailis – Senior Scientist SEI US
Adrian Ghilardi – CIGA - UNAM

CACCCB Workshop
September 9-11, 2019
UN Foundation

SEI Stockholm Environment Institute

Objectives

- Define non-renewable biomass
- Explain how default estimates were derived

Wood harvesting and land cover change


Charcoal awaiting transport to Nairobi (Narok, Kenya)

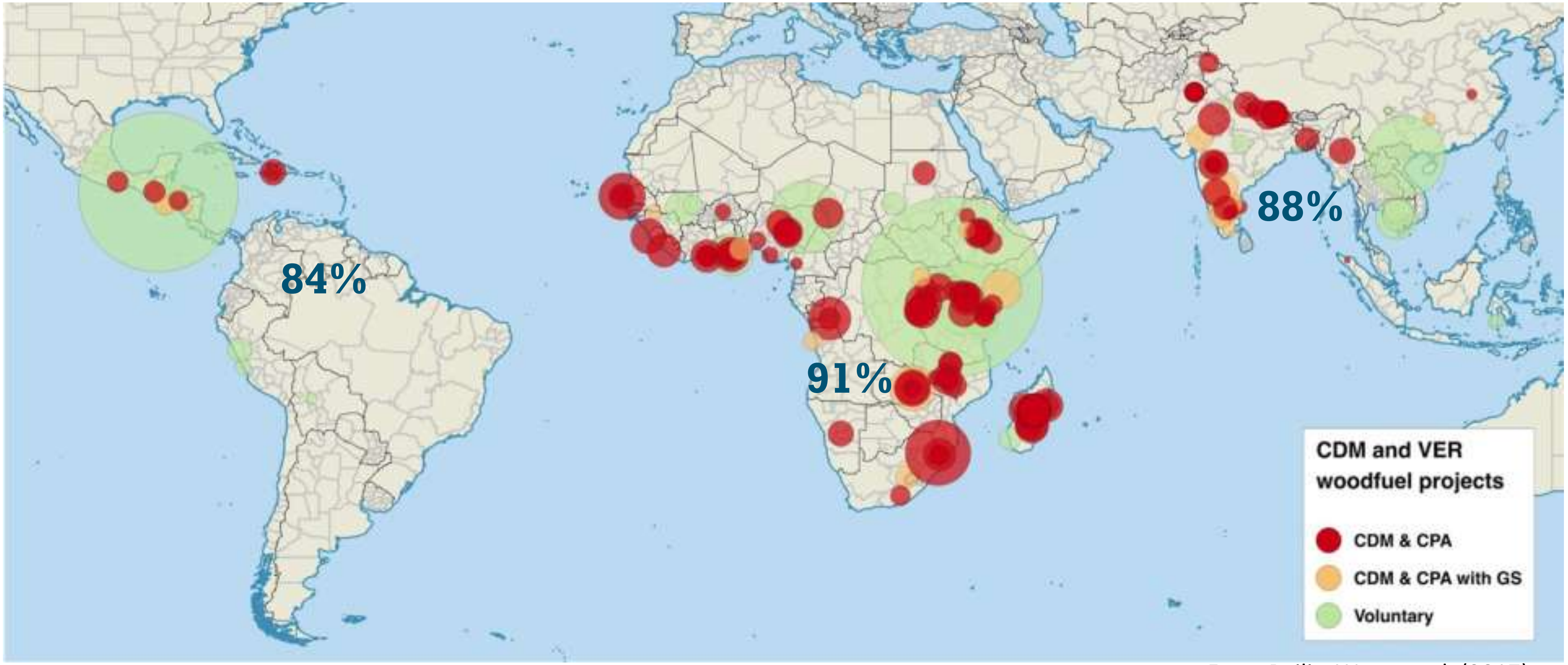
Nearly all landscapes produce a measurable increment of woody biomass. If wood is extracted in excess of that amount, stocks decline and demand is **unsustainable**.

This is "Non-renewable biomass" (NRB)

Burning NRB leads to **net CO_2 emissions**
NRB is an indicator of long-term sustainability, and helps to quantify CO_2 emissions and assess mitigation opportunities.


Leleshwa (T. Camphorata) after harvesting for charcoal (Narok, Kenya)

Project developers have assumed fNRB is very high



From Bailis, Wang et al, (2017)

Global median fNRB of 287 cookstove projects is **nearly 90%**

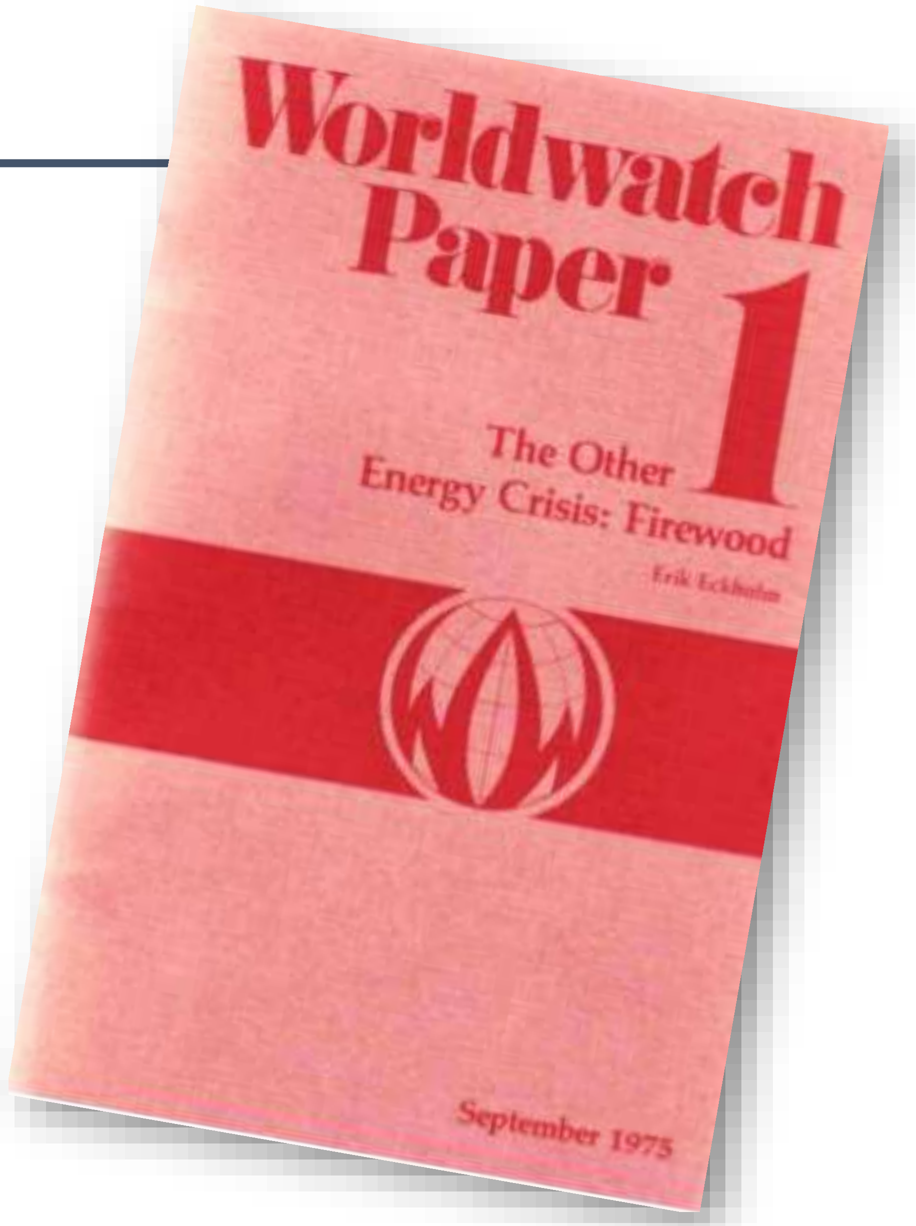
Why?

Longstanding narratives link woodfuel demand to deforestation & degradation

- The most visible use of trees
- Backwards and primitive…
- “Easy” solutions exist…but not really
- Reinforced by C-offsets methodologies

In reality:

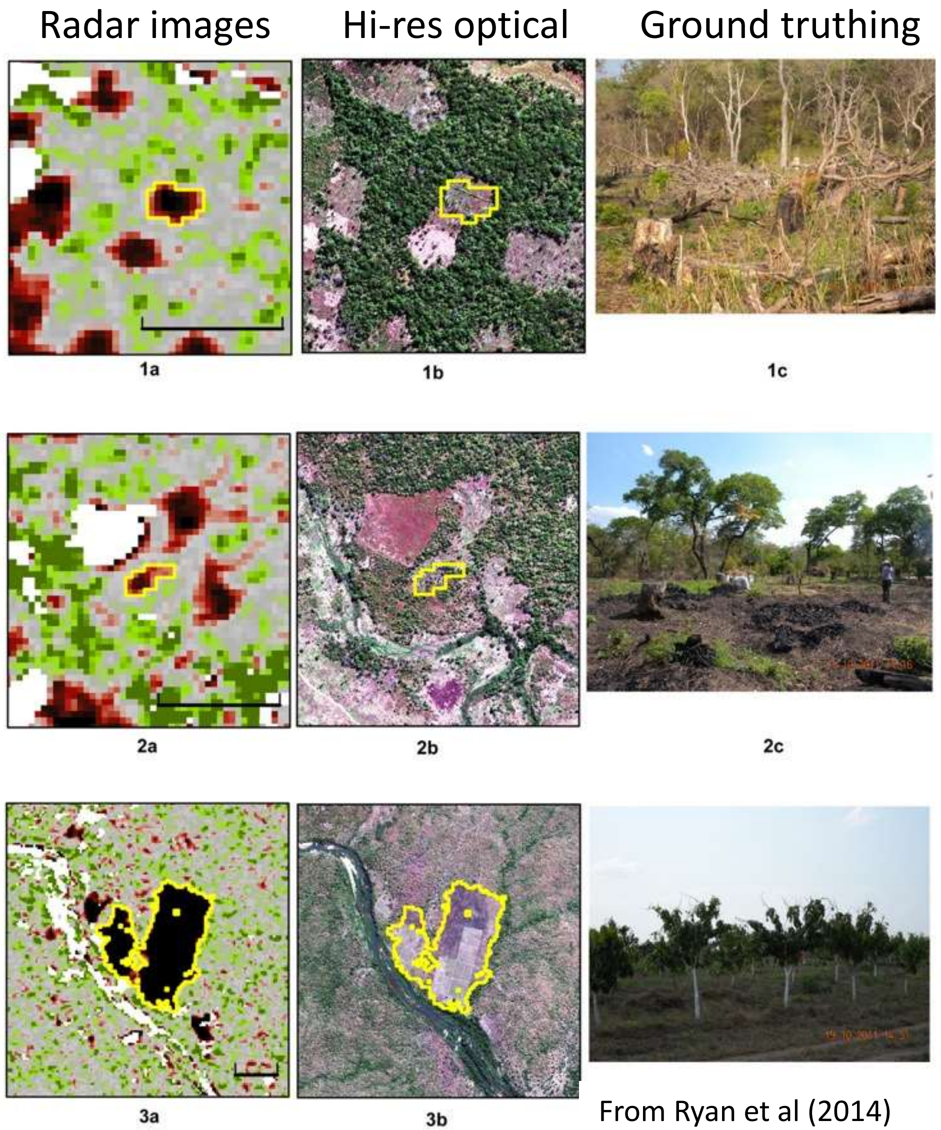
- tree loss is driven by multiple factors
- it’s difficult *but not impossible* to apportion blame to woodfuels (or any other drivers)



Linking activities to tree loss

Example from central Mozambique

- Studied tree loss from 2007-2010
- Combined satellite-based radar, hi-res optical images, and ground truthing
- 7,500 km^2
- Tree cover declined 3% yr^{-1} (1.8 Mt-C
- How much was caused by **charcoal?**



From Ryan et al (2014)

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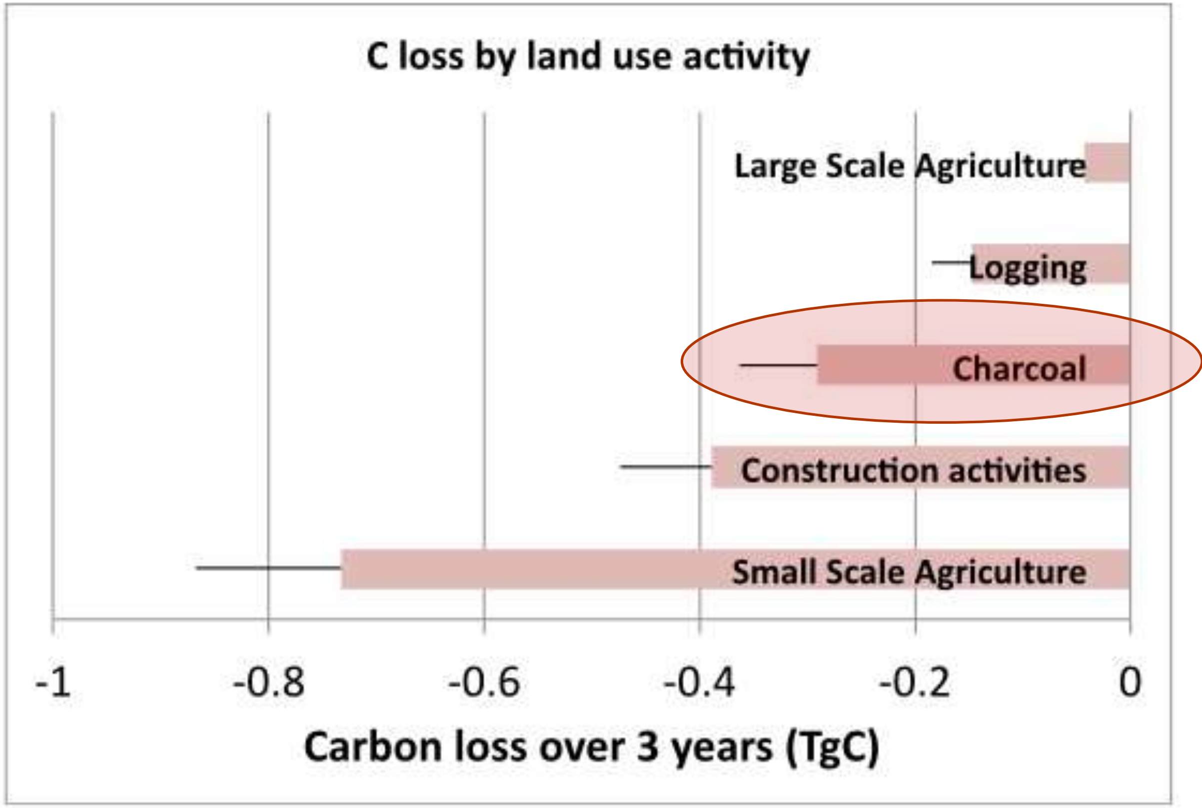
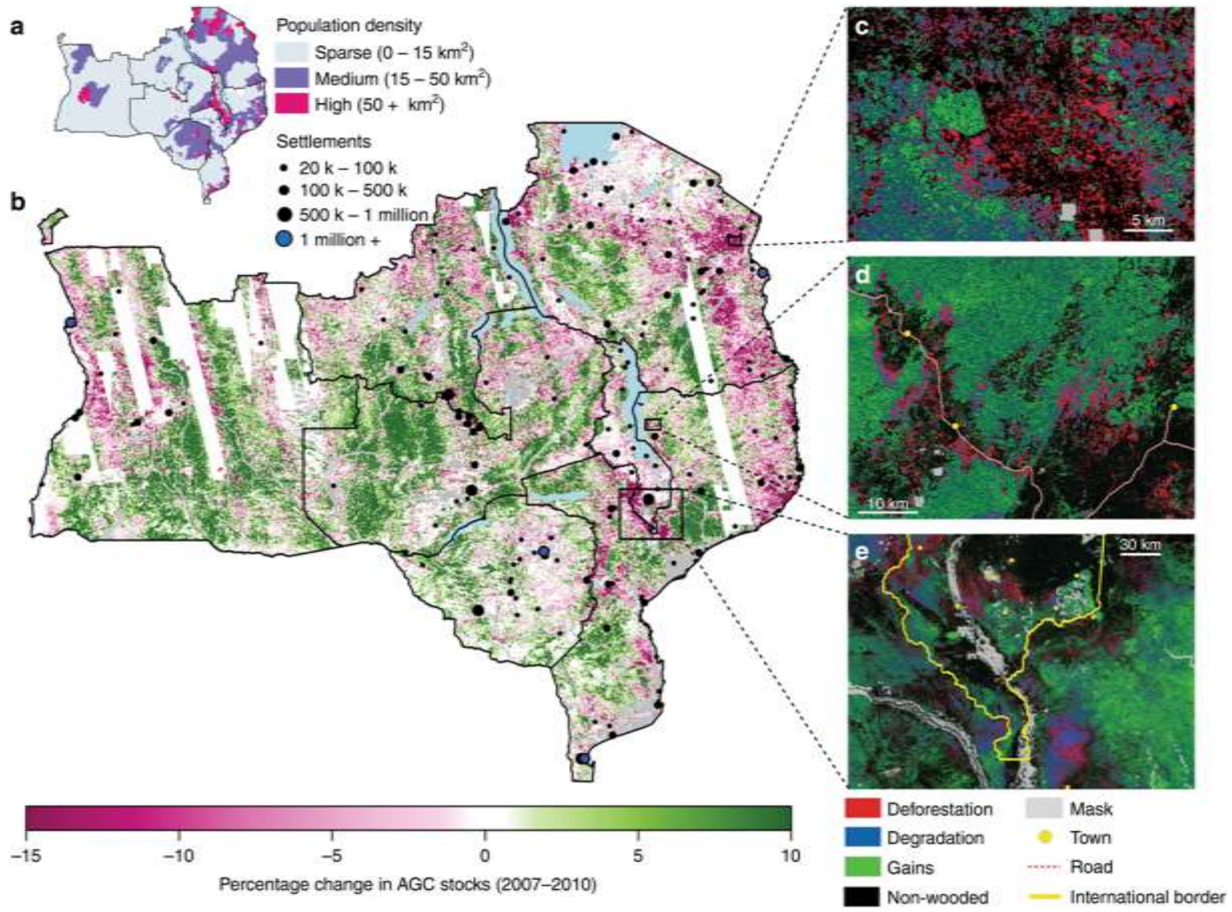
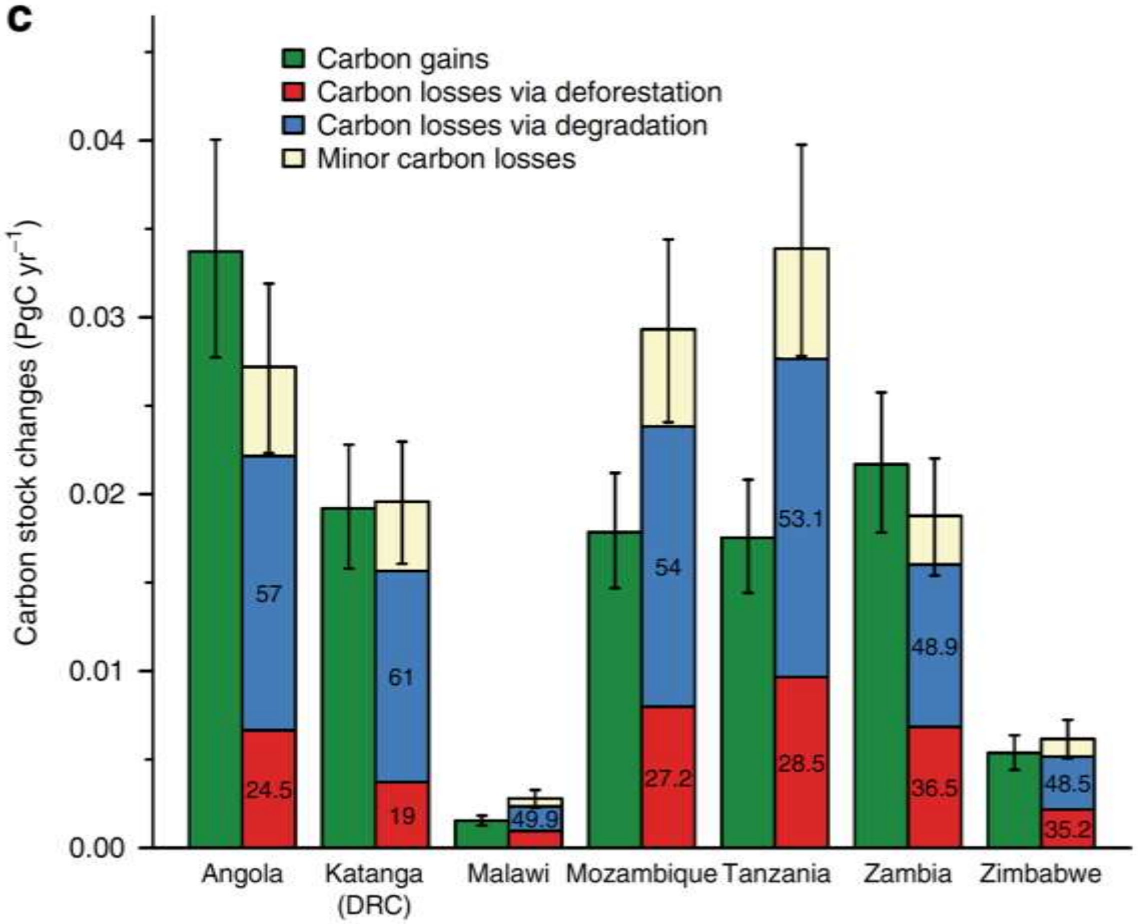
- Combined satellite-based radar, hi-res optical images, and ground truthing
- 7,500 km^2
- Tree cover declined 3% yr^{-1} (1.8 Mt-C
- How much was caused by **charcoal?**
  - **18% of biomass loss**
  - small-scale ag caused nearly half
    - but overlapped w/charcoal



From Ryan et al (2014)

Tree cover also regenerates





From McNicol et al (2018)

Modeling woodfuel and land cover change

1. Quantify demand and accessible supply

and

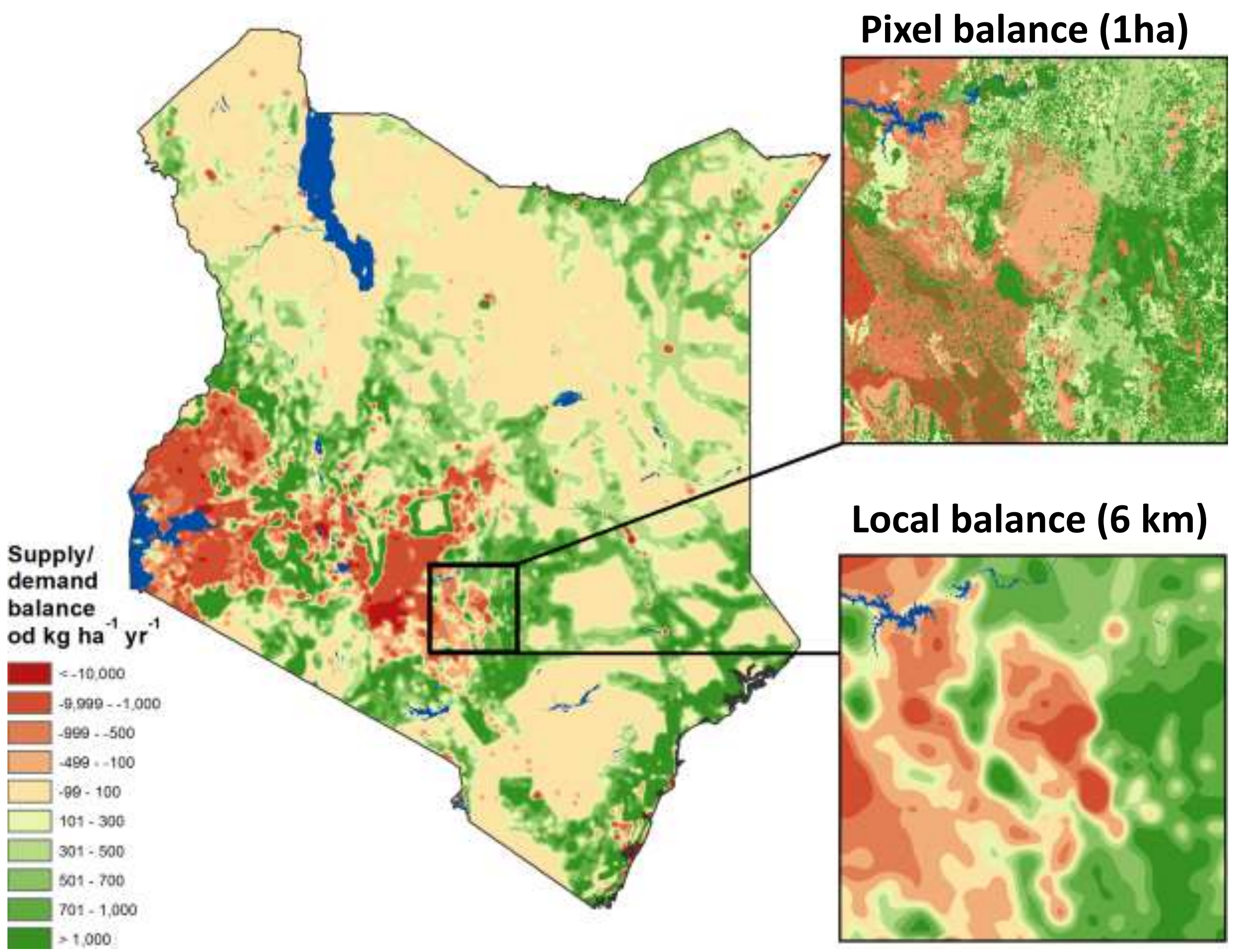
2. Combine local supply and demand to identify surplus and deficit areas

and

3. Quantify commercial extraction

then

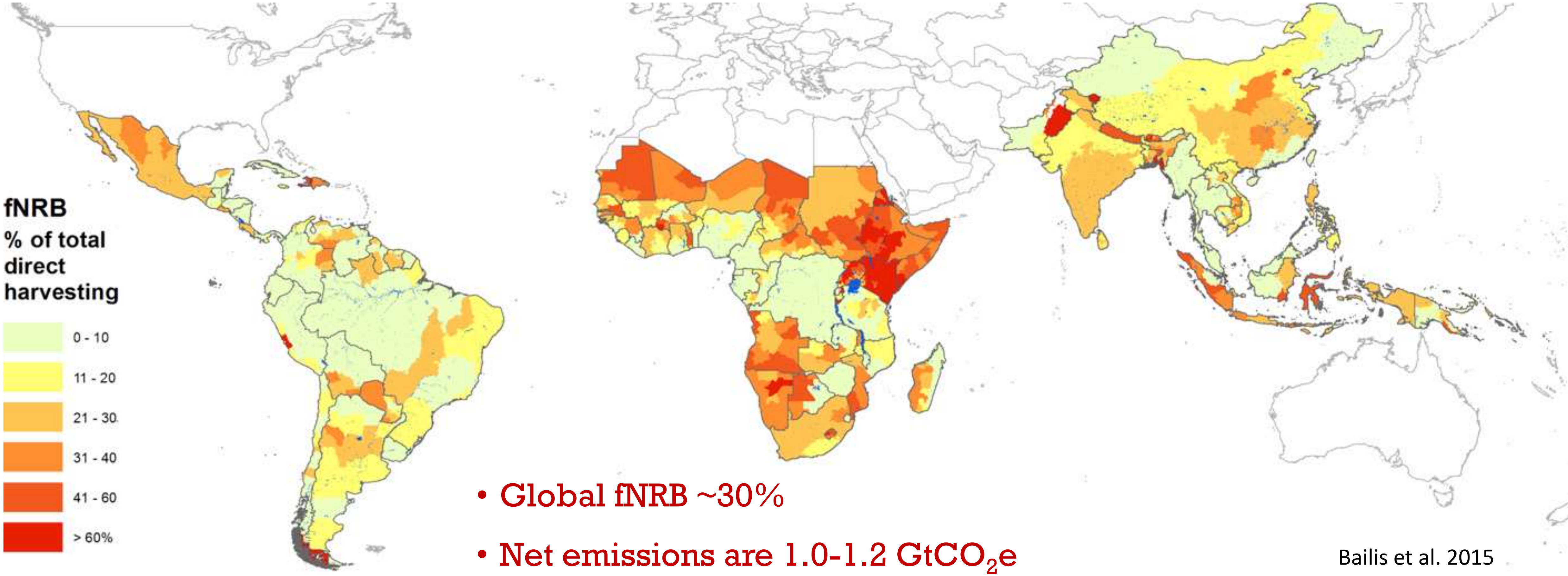
4. Combine local and commercial balances



Drigo et al, (2015)

Results of a global assessment

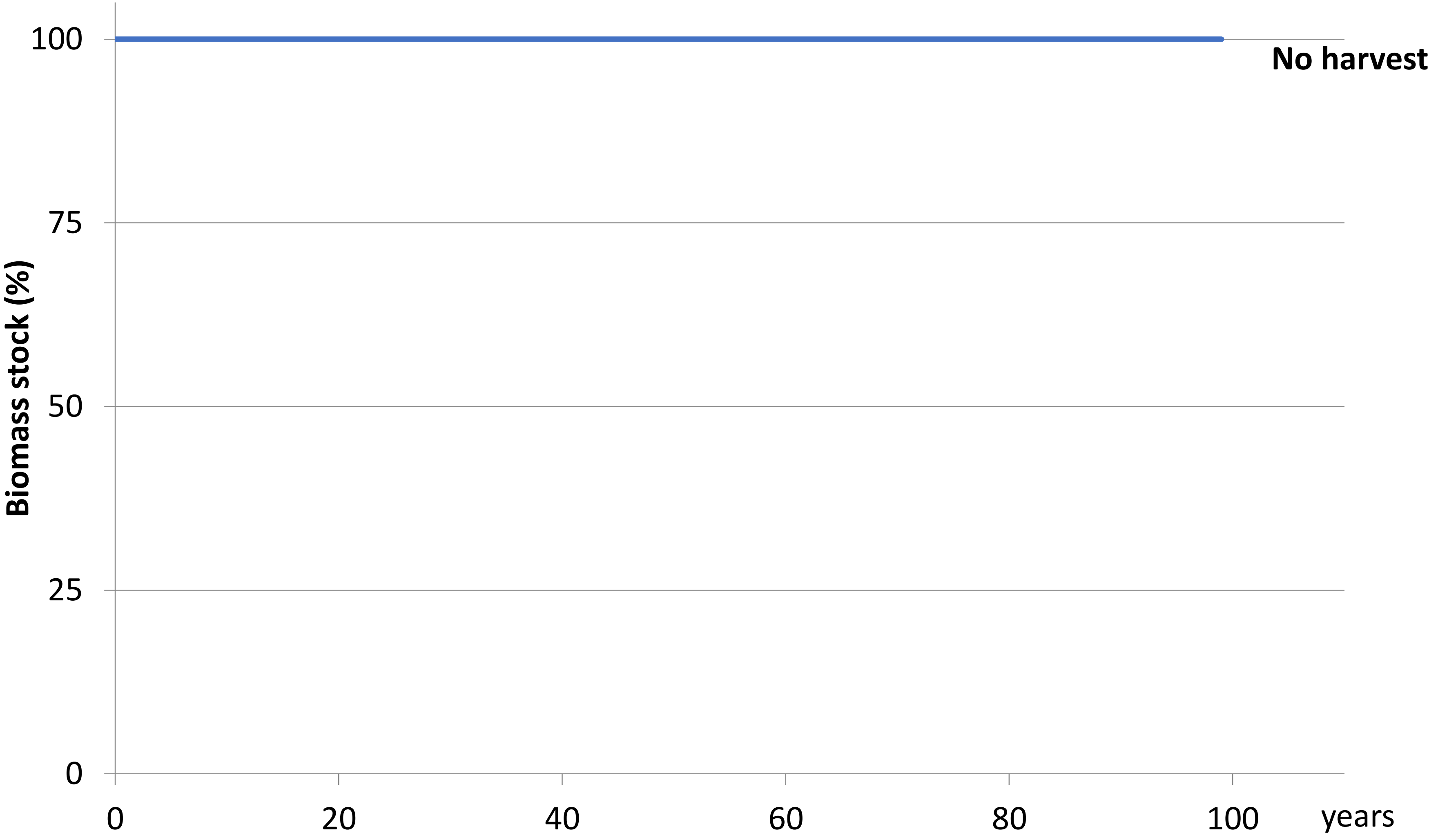
fNRB = NRB ÷ Consumption



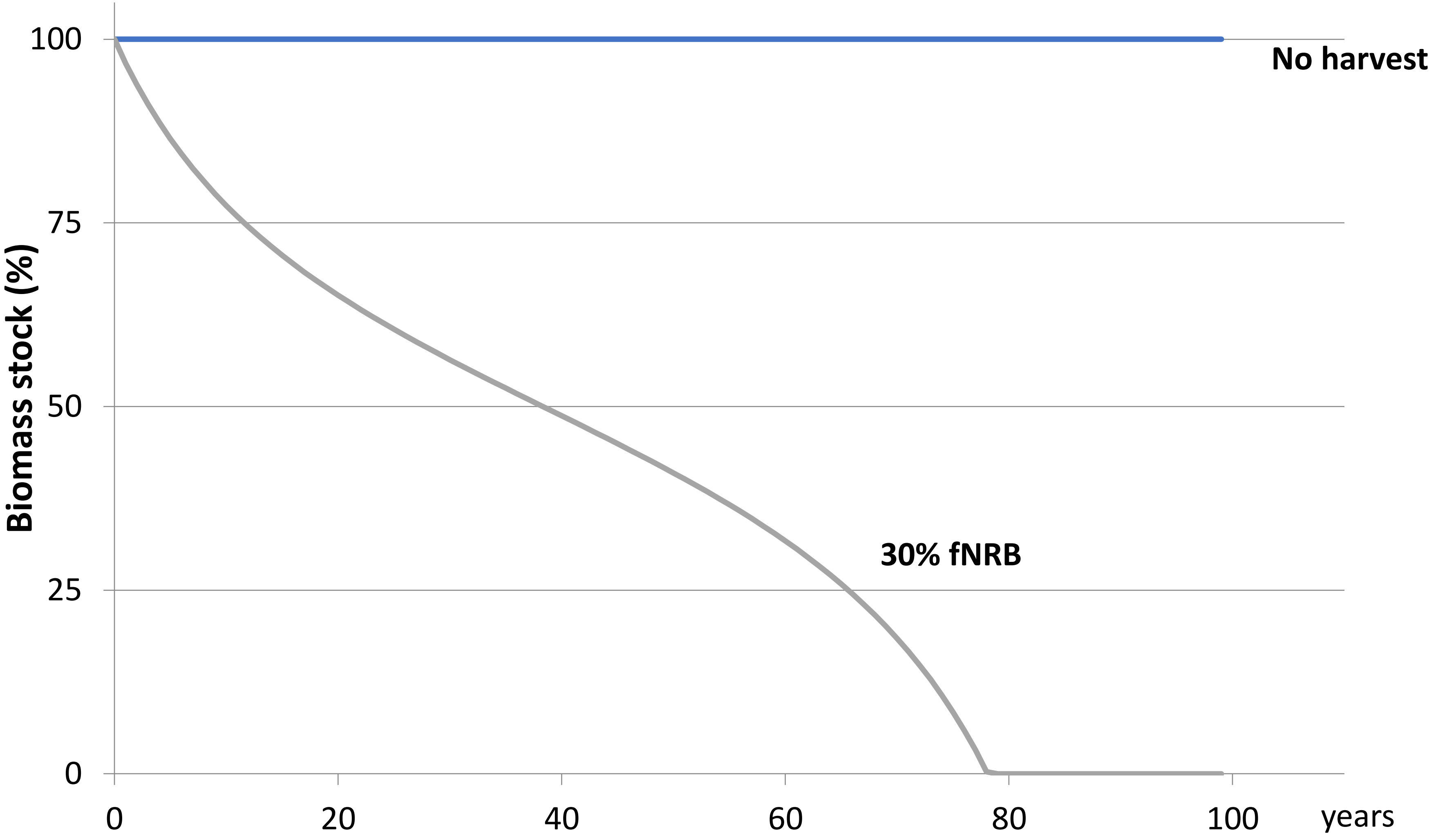
- Global fNRB ~30%
- Net emissions are 1.0-1.2 $GtCO_2e$
- Hotspots: fNRB ~50% in E Africa, S Asia

Bailis et al. 2015

How do 30% & 90% fNRB differ?



How do 10%, 30% & 90% fNRB differ?



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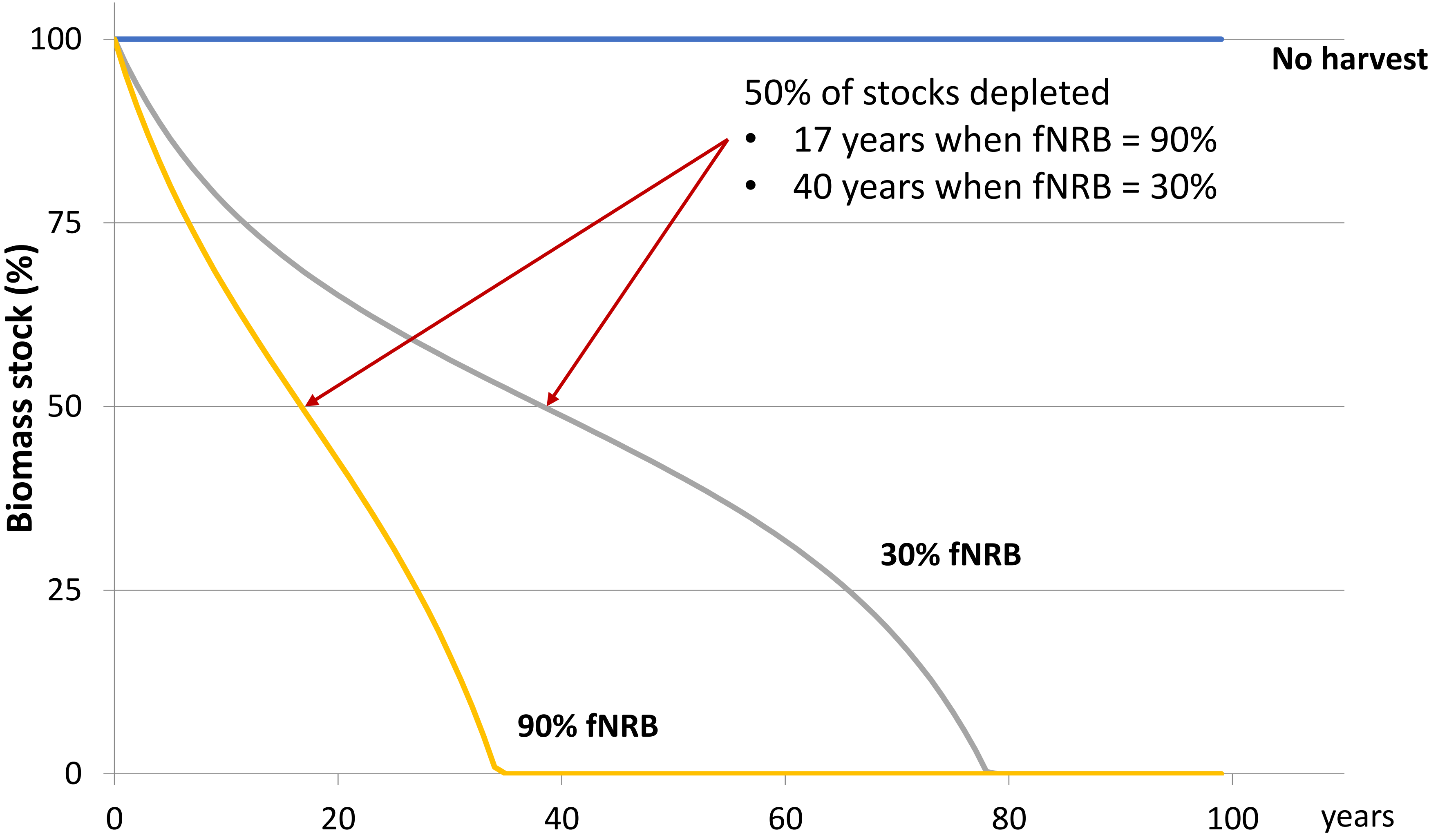
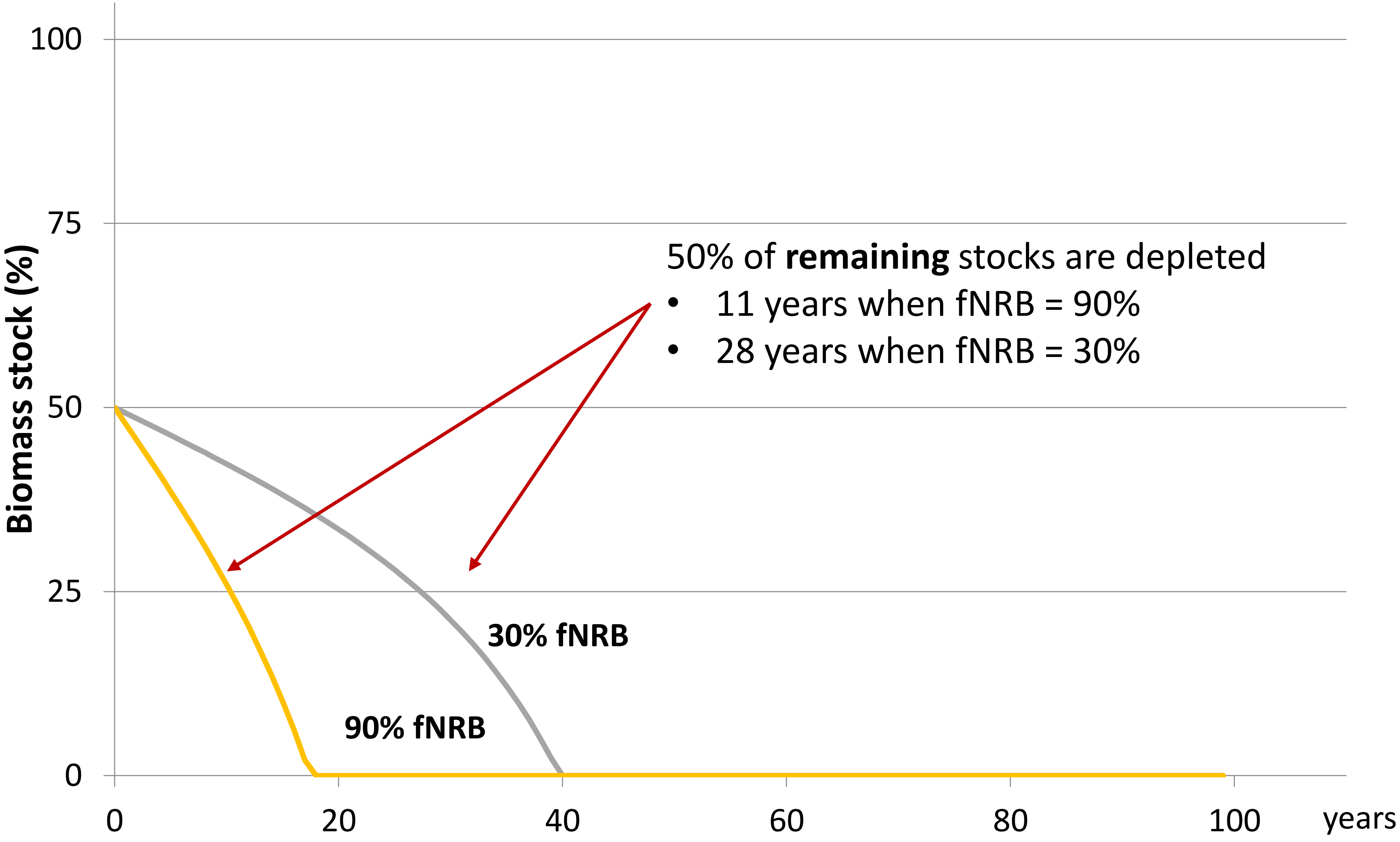


…starting with degraded woodland



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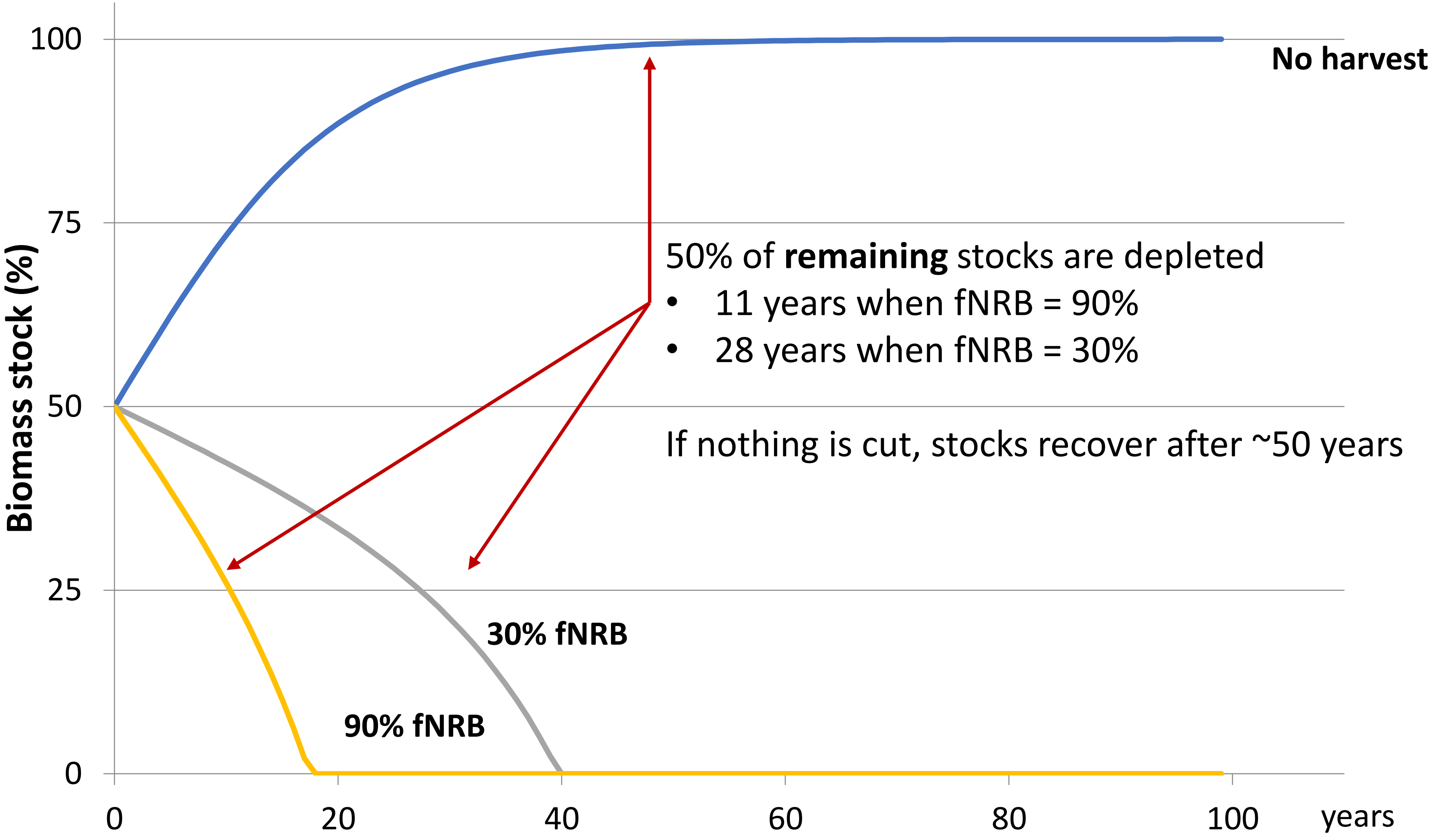
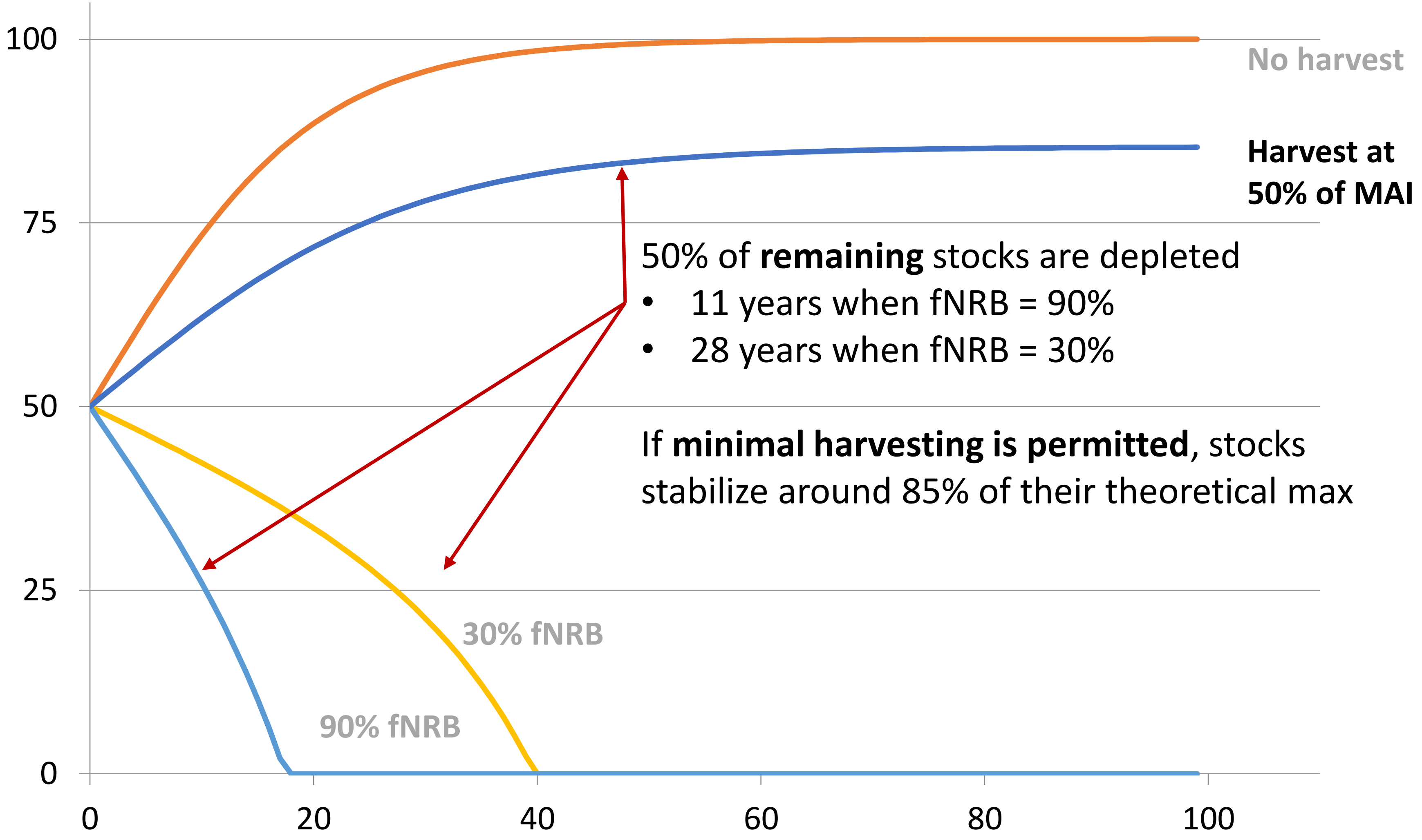


Regeneration is possible…



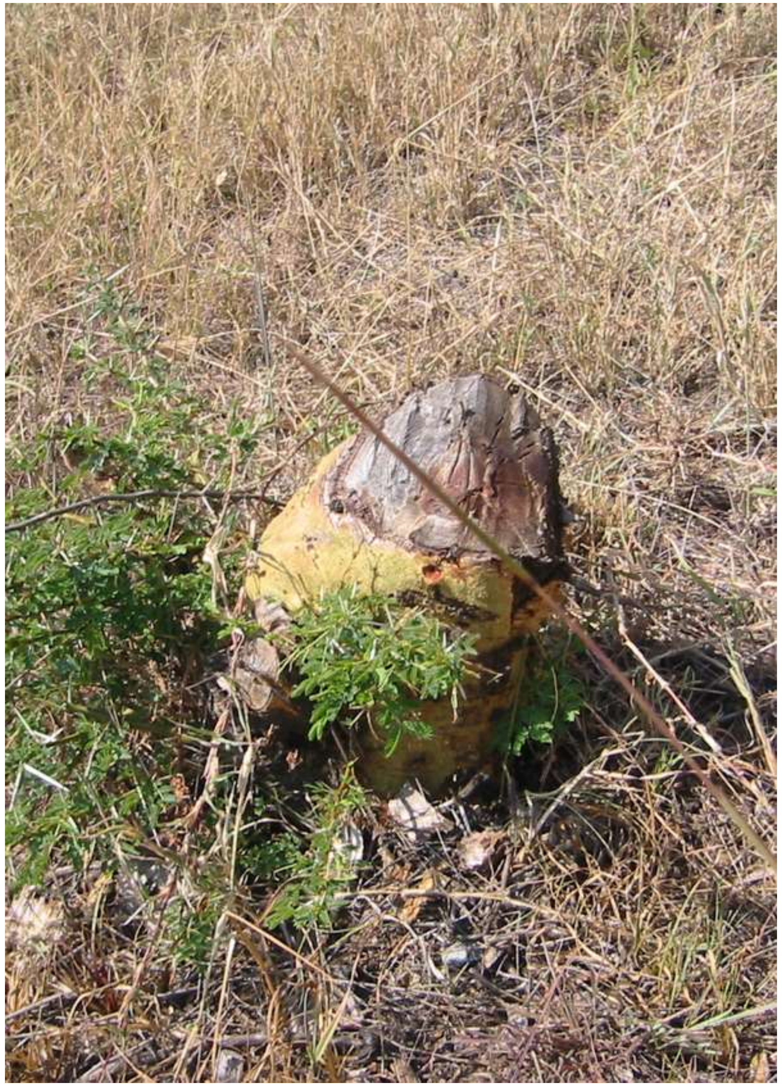
50% of **remaining** stocks are depleted

- 11 years when fNRB = 90%
- 28 years when fNRB = 30%

If **minimal harvesting is permitted**, stocks stabilize around 85% of their theoretical max

3 take-aways for fNRB

1. Trees cut for woodfuel can regenerate
   - **Unlikely** if there's also a **change in land use** *
     - e.g. from woodland to livestock, farming, etc
2. Sustainability of fuelwood and charcoal varies from place to place
   - Current demand is **unsustainable in many places**, but not to the extent that many claim
3. Woodfuel demand **alone** rarely causes **deforestation**, but does lead to **degradation**;
   - **reducing demand** can promote **regeneration** *



R. Bailis

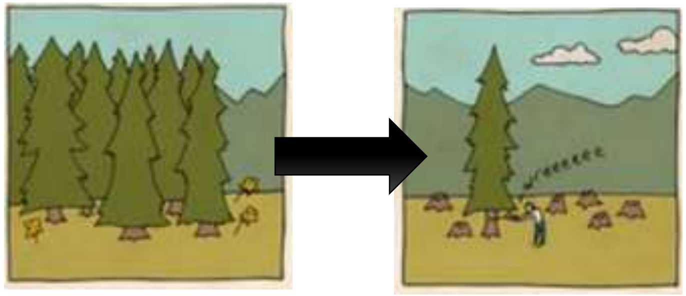
Thank you!

Wood harvesting and land cover change

Processing and Distribution   End-use

Fuelwood pathway

CO_2, CO, CH_4, BC, OC, etc…

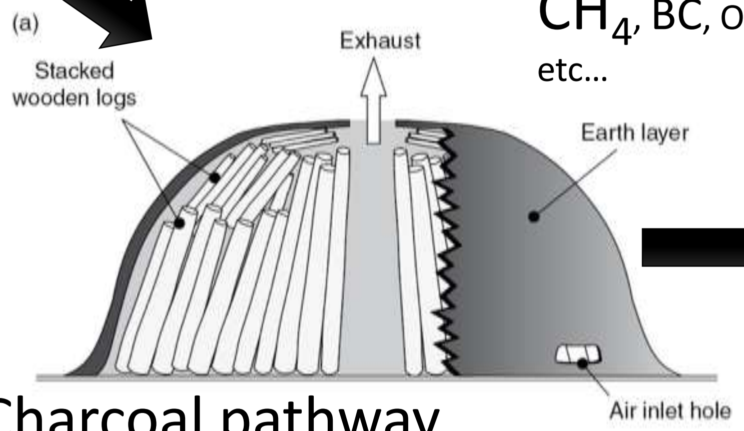


harvest

More…

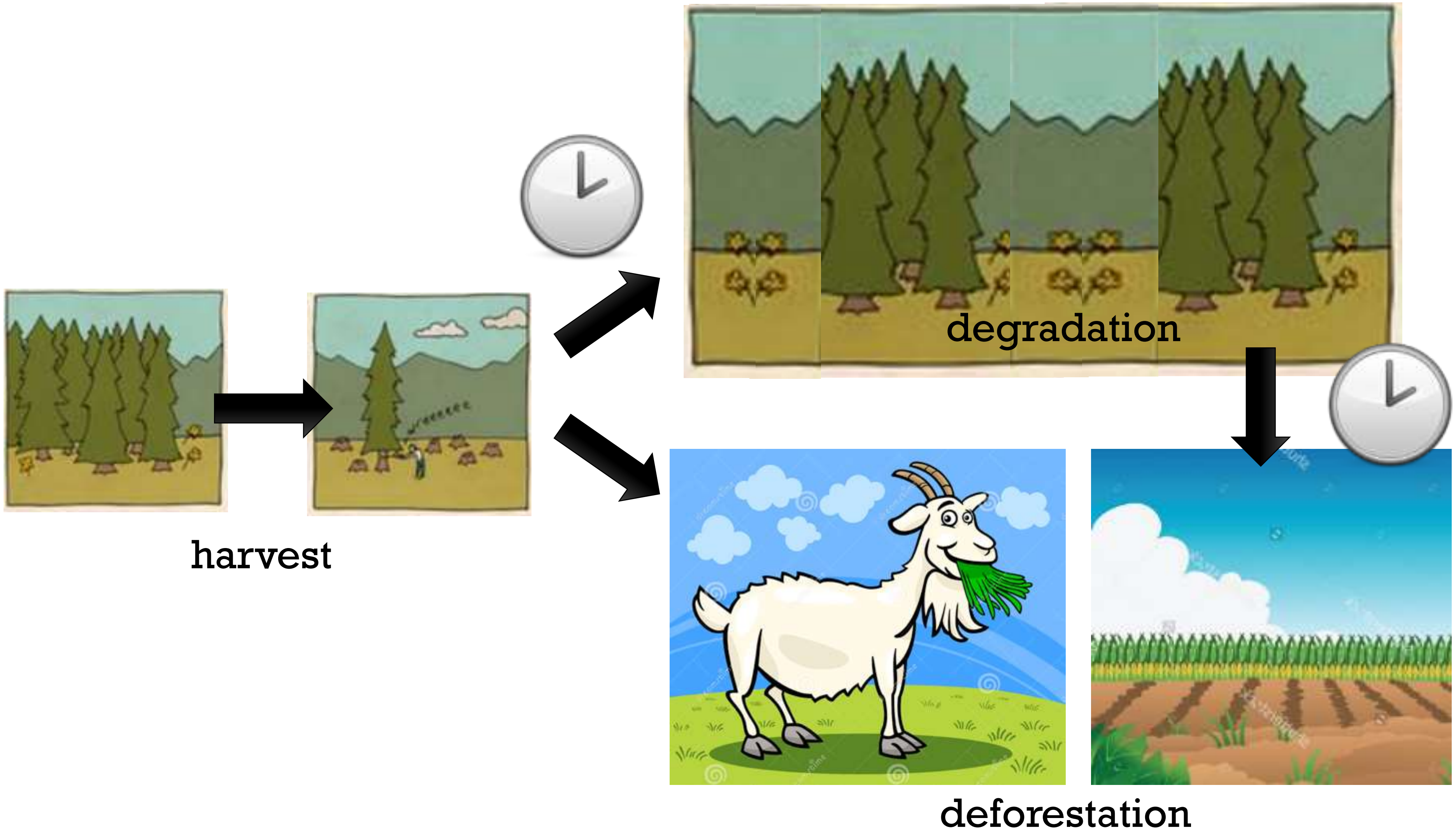
CO_2, CO, CH_4, BC, OC, etc…

CO_2, CO, CH_4, BC, OC, etc…



Charcoal pathway

Wood harvesting and land cover change



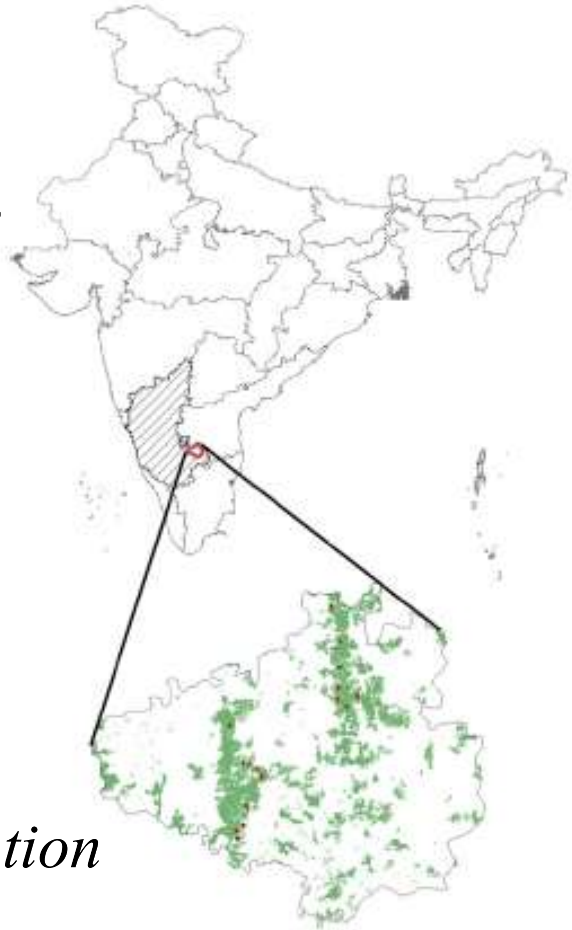
Empirical evidence from S India

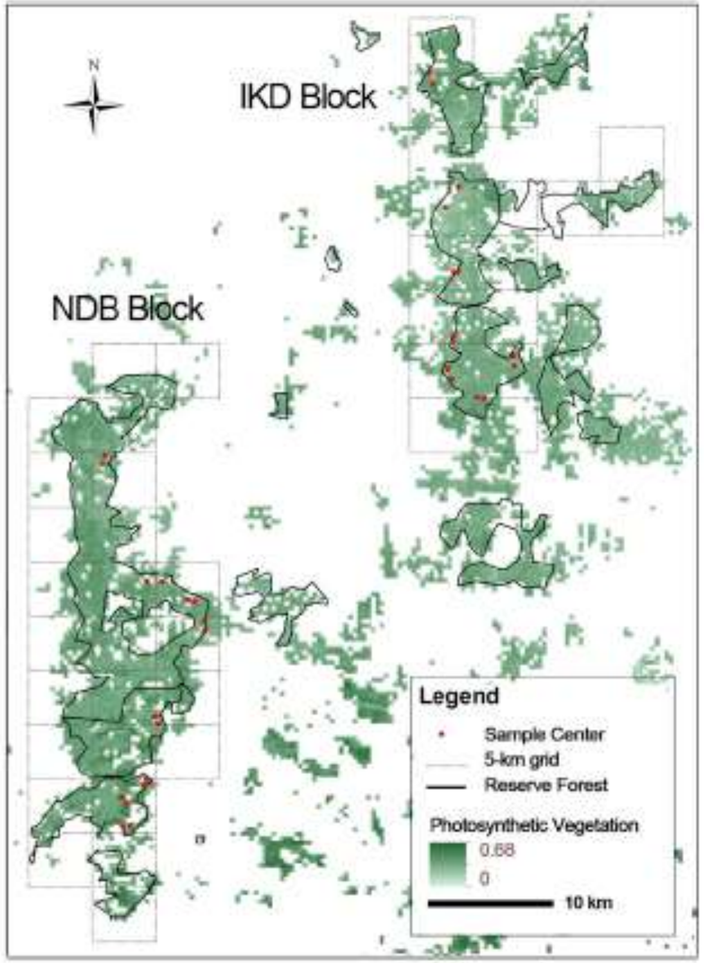
Agarwala et al (2017) found…

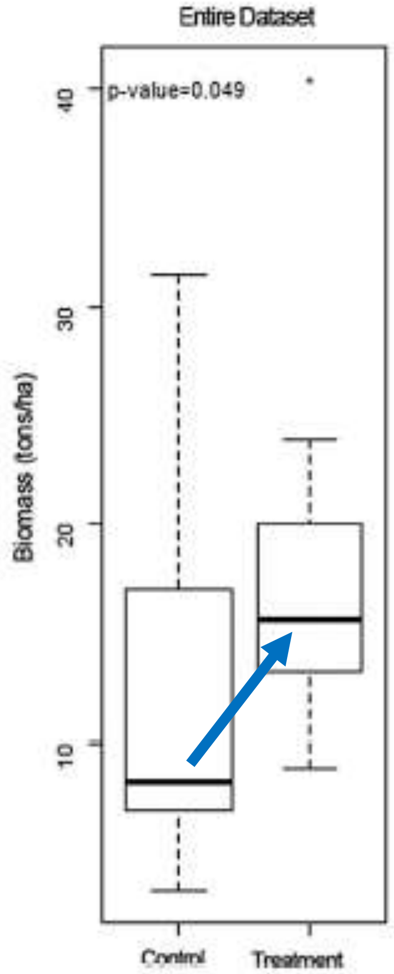
…forest plots in proximity to villages with **biogas interventions** had greater forest biomass than comparable plots around villages without biogas

…[biogas could] **promote regeneration** of degraded forests".

…10 years post-intervention







Discussion Questions

- *What are the open opportunities to contribute to refining methodologies that are the highest priority?*
- *What do we see as the key challenges under the Paris Agreement?*
- *What do we see as the key opportunities under the Paris Agreement?*

Update from the Gold Standard

Vikash Taylan, The Gold Standard

CLEAN COOKING ALLIANCE

CLIMATE & CLEAN AIR COALITION

Climate Action and Clean Cooking Co-benefits Workshop

Gold Standard®

Overview of Co-benefits Methodologies

Sep 2019

Gold Standard believes that climate and development go hand in hand. We work to ensure that every dollar creates the greatest impact in climate security and the Global Goals.

- Founded by WWF and other NGOs in 2003
- Swiss non-profit headquartered in Geneva
- Endorsed by broad NGO Supporter Network

350+
Project Developers

1700+
Projects in over 80 countries

103 MILLION+
Tonnes of CO_2e issued

$12.2 BILLION+
Dollars of shared value created

Our Vision

Climate security and sustainable development for all

Our Mission

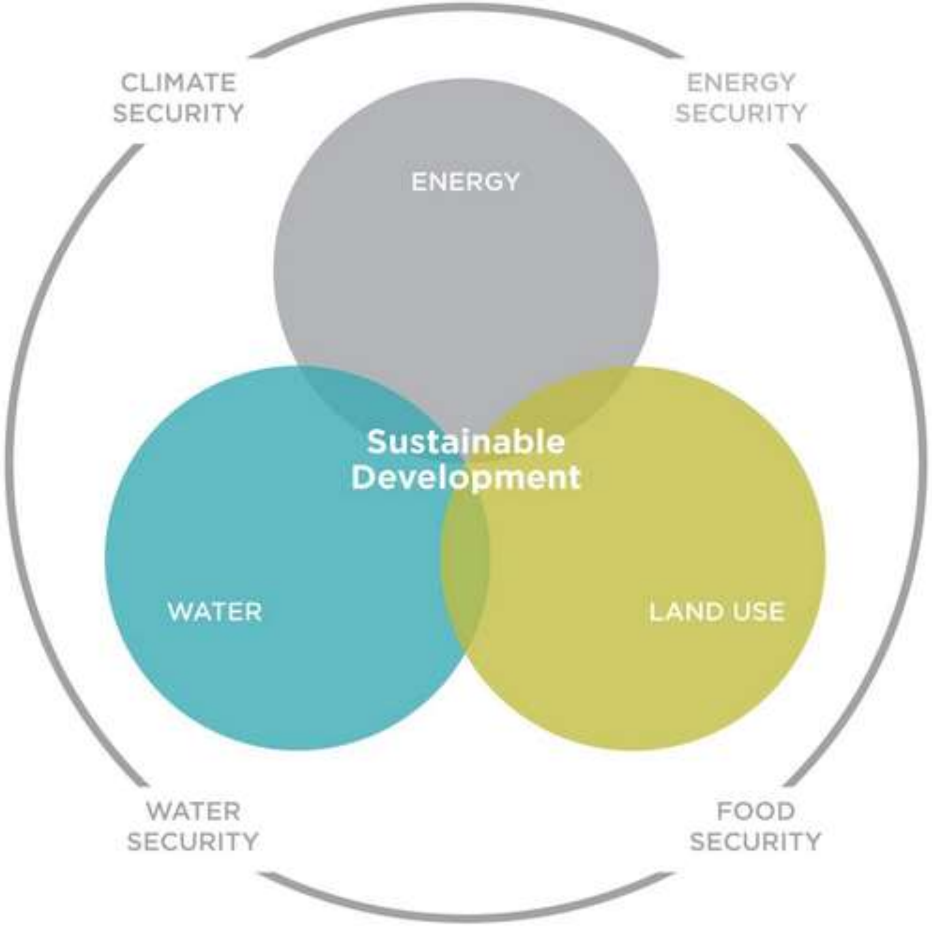
To catalyse more ambitious climate action to achieve the Global Goals through robust standards and verified impacts

A STANDARD TO ACCELERATE PROGRESS

to meet the Paris agreement + the SDGs

Gold Standard®
for the Global Goals

A next-generation standard to quantify, certify and **maximise** impacts toward climate security and sustainable development



APPLICATIONS OF THE STANDARD

ENVIRONMENTAL MARKETS

- Voluntary carbon markets
- Renewable energy Certificates
- Water access certificates

IMPACT + DEVELOPMENT FINANCE

Quantification and certification of SDG impacts for

- Investment funds
- Sustainable infrastructure
- Landscapes

CORPORATE CLIMATE AND SDG RREPORTING

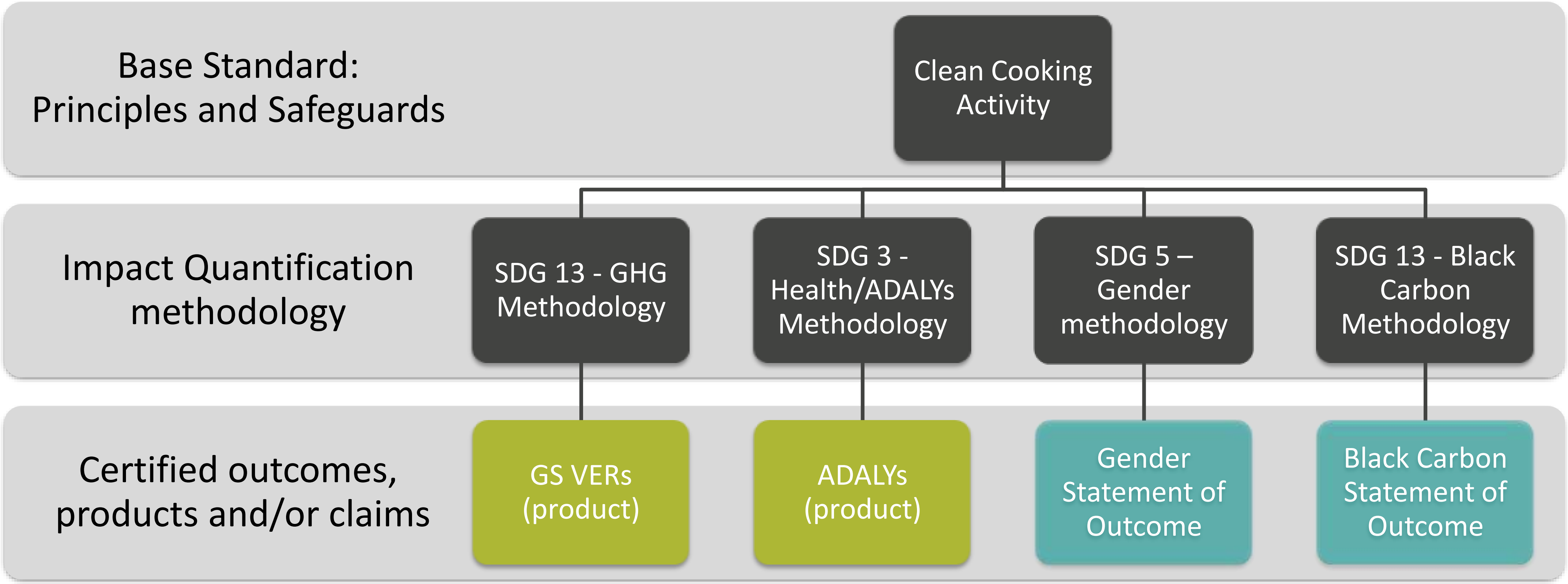
- Value chain GHG emission reduction accounting
- Deforestation-free claims
- SDG impact reporting

PROJECT PORTFOLIO

Gold Standard has led in the certification of clean cooking projects and programmes in the voluntary carbon market

- First clean cooking project certified by GS in 2009
- 40+ Countries
- 400+ clean cooking projects and programmes in the GS pipeline,
- Combined potential for annual GHG reductions exceeding 10M tonnes
- 21+M GS VERs issued to date
- 2.5+M GS CERs labelled to date

Clean Cooking Project Certification



SDG 13: CLIMATE IMPACTS – Carbon Credits

Methodology	Applicability
Technologies and Practices to Displace Decentralized Thermal Energy Consumption	• Integrated methodology for energy efficiency measures in kitchen regime • Improved cookstove including biogas/solar and fuel switch, Safe water supply project types • Most widely used methodology
Simplified Methodology for Efficient Cookstoves	• Improved cookstove • Only for microscale project (ERs capped 10K/yr) • Only fuelwood fuel/technology based project Tool – Emission reduction
CDM methodologies	• AMS IIG • And others

Requirements and guidelines for usage rate monitoring

- Objective of the usage guidelines
  - to improve the robustness and transparency of usage rate monitoring for improved cookstoves
  - to ensure the adoption and sustained use of project technology
  - built upon monitoring practices and findings from published peer reviewed literature and inputs from monitoring experts

- Three levels of monitoring requirements of increasing rigour AND (monitoring cost too)

  Mandatory >….> Best practice

  Surveys >…..> Use of Monitors

- Each level has maximum usage rates that can be claimed by applying them

- Survey require in person visits + kitchen observations by surveyors + interview with primary cook + photographs of the kitchen + GPS coordinates

SDG 3: HEALTH IMPACTS - ADALYS

- Methodology to Estimate and Verify ADALYs from Cleaner Household Air

What

- Averted Disability-Adjusted Life-Years (**ADALYs) -** A unit for measuring health impact representing the **years attributed to premature death and disability due to a certain health impact.**

How

Two step approach to quantify health impact -

- Field monitoring of PM2.5 exposure levels before and after implementation of technology
- Household Air Pollution Intervention Tool (HAPIT) uses epidemiologically derived exposure-response functions to convert the monitored change in exposure to ADALYs

Eligible technologies

- **verifiable reduction** in $PM_{2.5}$ exposure levels
- **change in household energy use and/or emissions** for cooking, heating, lighting

Eligible technologies and practices:

Cooking devices

- Clean cookstoves: biomass, biogas, ethanol based, electricity, liquid a gas (LPG), piped natural gas (PNG) based, solar and alcohol fuel cookstoves
- Space and water heaters (solar and otherwise)
- Heat retention cookers
- Solar cookers
- Safe water supply and treatment technologies

Clean Fuels

- Electricity, LPG, PNG, biogas, solar and alcohol fuels

Practices

- Improved application of eligible technologies such as shift from solid fuel or kerosene to biogas, etc.)

Non-eligible technologies and practices:

- Projects that involve a fuel switch to coal, charcoal, or kerosene: Such projects are not eligible as the Gold Standard does not recommend projects switching over to a fossil fuel despite it having a lower carbon content
- Projects leading to greater efficiency in use of coal or kerosene compared to the baseline: Again, such projects are not allowed as despite a potential reduction in the consumption of coal or kerosene, these fuels are highly polluting and a not eligible.
- Stand-alone ventilation projects

Monitoring requirements

Source	Parameter
Baseline & Project PEM	• Personal exposure to $PM_{2.5}$ before and after the intervention
Baseline household survey	• Household size • Number of adults per household and children <5 • Baseline technology type and fuels being used • Primary cook details
Project household survey	• Household size • Number of adults per household and children <5 • Types and extent of fuels used • Project stove use • Any changes within project boundary • Percentage of population using polluting fuel
Usage survey	• Project technology usage rate
Project Database	• Number of targeted households
CO monitoring	• CO level for charcoal-based interventions only
Training material	• https://globalgoals.goldstandard.org/support-for-methodology-to-estimate-and-verify-adalys-from-cleaner-household-air/

Funders & Partners

Funders

- Goldman Sachs, World Bank, Department of Foreign Affairs and Trade (Australian Aid) and World Vision-Australia

Partners

- C Quest Capital
- Global Alliance for Clean Cookstoves

Contributors

- Expert working group members
- Working group convened by the World Bank
- Prof. Kirk Smith and his team

SDG 5: GENDER EQUALITY

Gender Equality Requirements & Guidelines

What

- Two Level Certification
- **Project Design as “Gender sensitive”**
  - Enhanced safeguards at the project design level, enabling all projects to be labeled “gender sensitive.”
- **Project performance as “Gender responsive” Framework**
  - Certified SDG 5 Gender Equality, including: Women’s social and economic empowerment, Reduction in time poverty, Women’s voice and agency

How

- 6 Step approach
- Step 1-3 require gender safeguards assessment and gender-sensitive stakeholder consultations as part of initial project design and feasibility assessment
- Step 4-6 seek performance certification for gender equality impacts by (i) deeper gender analysis; (ii) gender-targeted project goals and action; and (iii) project-specific gender indicators and parameters

Eligibility

- All project types are eligible for Gender Responsive Certification, though certain types, like community-based projects, may be more obvious candidates.

Gender equality certification

STEP 1: Review gender policy	STEP 2: Safeguard Assessment	STEP 3: STAKEHOLDER CONSULTATION	Step 4: GENDER ANALYSIS AND BASELINE DETERMINATION	STEP 5: ESTABLISH GOALS AND MEASURE CHANGE	STEP 6: PROJECT CLAIMs + CERTIFICATION
• Gender Sensitive design considering the Gender policy requirements • Aligning with align with existing host country policies, strategies and best practices	• Assessment against Gold Standard safeguarding principles which covers – environmental, social and economic aspects – Gender equality, Child labour, No corruption, human rights and others	• Stakeholder consultation following GS requirements	• gender-based inequalities and equality and women's social and economic empowerment aspects	• Project contributions • Gender goals – social, economic empowerment goals • Gender performance indicators and sex-disaggregated project target	• Monitoring and verification of project claims

<u>First certified project</u>

Uganda, Lango sub-region

Baseline - wood fuel on inefficient three stone fires to purify their drinking, cleaning and washing water.

Goal	Outcome
Income and expenditures / Rest and leisure	Average amount of time saved per day (minutes) 122 Domestic work (35%) income generating (26.5%), religious activities (17.9%), social and leisure activities (13.5%) and other (6.5%)
Individual and community empowerment including meaningful participation and leadership, stronger social networks and agency	Ratio of male (54%) and female (46%) members water committee Decision-making for male and female Water Committee members 100%
Gender-based violence	53% reduction in reported incidents of GBV in water collection 35% reduction in reported incidents of domestic violence in water collection

Funders & Partners

- Grand Duchy of Luxembourg, Ministry of Sustainable Development and Infrastructure – Department of Environment

Women's World Banking

UNDP

giz

IUCN

THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

Hivos
people unlimited

GLOBAL ALLIANCE FOR CLEAN COOKSTOVES

SDG 13: CLIMATE IMPACTS – Black carbon

- Quantification of climate related emission reductions of Black Carbon and Co-emitted Species due to the replacement of less efficient cookstoves with improved efficiency cookstoves

What

- Emissions reduction of black carbon and co-emitted species (organic carbon, CO, non-methane volatile organic carbons, sulfates)

How

- Apply with TPDDTEC methodology
- Common monitoring requirements with additional requirements for BC/OC and other co-emitted species
- Monitor the BC&OC emission factor in lab and/or field
- Use BC equivalent conversion factor to estimate emission level for pre and post implementation
- Quantify the emission reduction as BC equivalent (kgBCeq)

Monitoring requirements

Source	Parameter
Fuel consumption tests	• Baseline & Project fuel consumption
Baseline household survey	• Household size • Baseline technology type and fuels being used
Project household survey	• Types and extent of fuels used • Project stove use • Any changes within project boundary
Usage survey	• Project technology usage rate
Project Database	• Number of targeted households
Emission factors	• Black carbon • Organic carbon • Other co-emitted species

Funders & Partners

Funder and Partners

GLOBAL ALLIANCE FOR CLEAN COOKSTOVES

teri

NEXLEAF ANALYTICS

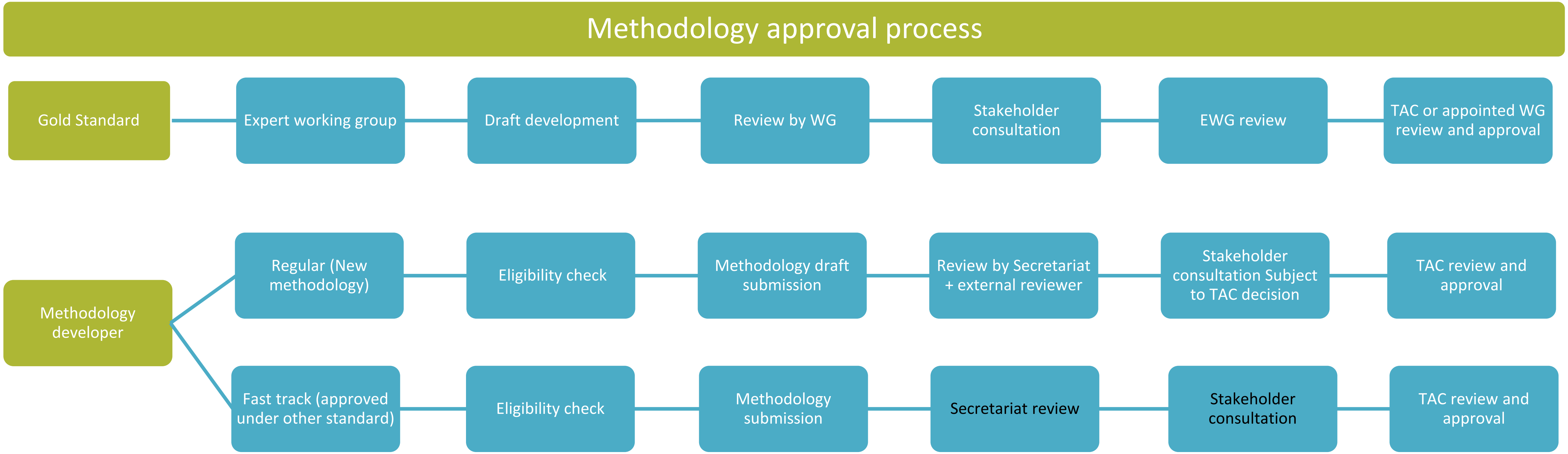
UCSD

project surya
Fighting Climate Change Now

BERKELEY AIR MONITORING GROUP

Methodology approval process

[Impact Quantification methodology approval procedure]



ENVISIONING THE VCM POST-2020

KYOTO

- **Limited coverage**
  → 37 countries with caps
- **Limited ambition**
  → 18% reduction from 1990

PARIS

- **Global coverage**
  → All countries with targets
- **Net-zero ambition**
  → Balance emissions with sinks by mid-century

THE VALUE OF VOLUNTARY CARBON MARKETS IS TO ADDRESS:

1. **Emissions gap**
2. **Finance gap**
3. **Time gap**

ENVISIONING THE VCM POST-2020

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Objectives

1. Consider the role and value of VCM post-2020
2. What do VCM 'units' represent
3. What does this mean for double counting?
4. Groundwork for what usage claims can be made/linking to SBTi (Phase 2)

ENVISIONING THE VCM POST-2020

FUTURE WORK (PHASE 2)

1. **Usage Claims:** Review of appropriate + credible claims associated with use of voluntary carbon credits at organizational level, including “carbon neutrality” and ”net zero”

2. **Best practice framework:** To define preconditions for legitimacy like internal reductions, target setting, credible claims, and best practices for financing beyond boundaries

3. **Explore with SBTi:** To explore linkages between markets and company target setting and reporting

Questions please

Thank you

Discussion Questions

- *What are the different challenges in working with Gold Standard as compared to UNFCCC?*
- *What do you see as the opportunities with Gold Standard and the sustainable development goals?*
- *What do you see as the key gaps in methodologies and/or process and applicable solutions?*

Lunch Break

12:15-1:15

4 Panel discussion with project developers

Panel Discussion

Project developer perspective on the challenges and opportunities

Panelists

- Ken Newcombe, C-Quest Capital;
- Tanushree Bagh, South Pole;
- Sarah Kihuguru, Uganda Carbon Bureau;
- Jeroen Blum, BIX Capital;
- Hilda Galt, Climate Focus; and
- Moderated by Seema Patel, Clean Cooking Alliance

5 Part II—Research update: what we’ve learned so far and what gaps remain

What do people want, what might work, and how to test—India

Subhrendu Pattanayak, Duke University

CLEAN COOKING ALLIANCE

CLIMATE & CLEAN AIR COALITION

Experimental evidence from India: **What do people want, what might work, and how to test?**

Subhrendu K Pattanayak (Duke University)

@subhrendukp || @SETIenergy

with M Jeuland, F Usmani, J Lewis N Brooks, R Thadani, Project Surya, CHIRAG & others

Climate Action & Clean Cooking Co benefits Workshop, 9 Sep 2019

Take Home Messages

- Treat implementation (and questions it poses) as a science
- Consider multi-year, multi-stage (Diagnose-Design-Test)

  Stage I (Diagnose): people want cheap, less smoke & low fuelwood, but there is no One Stove to rule them all!

  Stage II (Design): promise of rebates, finance, marketing, home delivery, type

  Stage III (Test): 50% purchase, reduce fire use, more aware

  - Take supply chain seriously
    - finance, marketing, retailing can go a long way
    - Maintenance, servicing under appreciated
  - Accept poor highly price sensitive; seek creative (carbon?) finance
- Avoid **type III errors** (precise answers to pointless questions), that make implementation even more challenging

Example 2: India (indoor air pollution)

PNAS

Experimental evidence on promotion of electric and improved biomass cookstoves

S. K. Pattanayak[a,b,c,1], M. Jeuland[a,c,d], J. J. Lewis[b], F. Usmani[a,b], N. Brooks[e], V. Bhojvaid[f], A. Kar[g], L. Lipinski[c], L. Morrison[h], O. Patange[i], N. Ramanathan[j], I. H. Rehman[k], R. Thadani[l], M. Vora[m], and V. Ramanathan[n]

[a]Sanford School of Public Policy, Duke University, Durham, NC 27708; [b]Nicholas School of the Environment, Duke University, Durham, NC 27708; [c]Duke Global Health Institute, Duke University, Durham, NC 27710; [d]Climate Change in Developing Countries Research Group, RWI – Leibniz Institute for Economic Research, 45128 Essen, Germany; [e]School of Earth, Energy & Environmental Sciences, Stanford University, Stanford, CA 94305; [f]Department of Sociology, University of Delhi, New Delhi 110007, India; [g]Institute for Resources, Environment and Sustainability, University of British Columbia, Vancouver, BC V6T 1Z4, Canada; [h]Center for Environmental, Technology, and Energy Economics, RTI International, Research Triangle Park, NC 27709; [i]Public Systems Group, Indian Institute of Management Ahmedabad, Ahmedabad 380015, India; [j]Nexleaf Analytics, Los Angeles, CA 90064; [k]Social Transformation Division, The Energy and Resources Institute, New Delhi 110003, India; [l]Center for Ecology, Development and Research, Dehradun 248006, India; [m]Independent consultant, Jaipur 302001, India; and [n]Scripps Institution of Oceanography, University of California, San Diego, La Jolla, CA 92093

Edited by William C. Clark, Harvard University, Cambridge, MA, and approved April 22, 2019 (received for review May 25, 2018)

Improved cookstoves (ICS) can deliver "triple wins" by improving household health, local environments, and global climate. Yet their potential is in doubt because of low and slow diffusion, likely because of constraints imposed by differences in culture, geography, institutions, and missing markets. We offer insights about this challenge based on a multiyear, multiphase study with nearly 1,000 households in the Indian Himalayas. In phase I, we combined desk reviews, simulations, and focus groups to diagnose barriers to ICS adoption. In phase II, we implemented a set of pilots to simulate a mature market and designed an intervention that upgraded the supply chain (combining marketing and home delivery), provided rebates and financing to lower income and liquidity constraints, and allowed households a choice among ICS. In phase III, we used findings from these pilots to implement a field experiment to rigorously test whether this combination of upgraded supply and demand promotion stimulates adoption. The experiment showed that, compared with zero purchase in control villages, over half of intervention households bought an ICS, although demand was highly price-sensitive. Demand was at least twice as high for electric stoves relative to biomass ICS. Even among households that received a negligible price discount, the upgraded supply chain alone induced a 28 percentage-point increase in ICS ownership. Although the bundled intervention is resource-intensive, the full costs are lower than the social benefits of ICS promotion. Our findings suggest that market analysis, robust supply chains, and price discounts are critical for ICS diffusion.

improved cookstoves | technology adoption | Indian Himalayas | supply chain | price subsidies

ducting a multiyear, multiphase study in the Indian Himalayas. Phase I started with a series of diagnostic steps (spanning 18 mo) to uncover the nature of low ICS adoption. In phase II, we implemented a set of pilots to simulate a mature market and designed an intervention that would reduce both supply and demand constraints. Finally, in phase III, we experimentally tested a package of interventions, spanning an additional 18 mo, in a sample of ~1,000 households living in nearly 100 rural Himalayan communities. Our principal hypothesis, derived from insights gleaned from the diagnosis and design phases, was that ICS demand would be highly sensitive to a multipronged intervention combining (*i*) a well-developed technology supply ecosystem (characterized by delivery, demonstration, promotion, and financing) with (*ii*) demand-stimulating subsidies. Additionally, our second hypothesis was that the well-developed supply chain alone would lead to considerable ICS adoption; that is, one of the treatment arms of our randomized

SUSTAINABILITY SCIENCE

Significance

Three billion people rely on traditional stoves and solid fuels. These energy use patterns exacerbate the global climate crisis (via increased carbon emissions) and forest degradation/deforestation (via daily fuelwood collection), and expose billions to toxic air pollution generated by dirty fuels. Widespread adoption of improved cookstoves (which use cleaner fuels or burn solid fuels more efficiently) may ease this "triple burden," but recent research casts doubt on their potential, given low and slow diffusion. We challenge this pessimism based on a multiyear, three-phase field study com-

Implementation can be a science

OPEN ACCESS Freely available online

PLoS MEDICINE

Essay

Implementation Research Is Needed to Achieve International Health Goals

David Sanders*, Andy Haines

Health research needs to focus not just on the growing divide in health status between the world's rich and poor but also on the unacceptable gap between our unprecedented knowledge of diseases (including their control) and the implementation of that knowledge, especially in poor countries. Directed and innovative research is needed to analyse the causes of this situation

most concerned with implementation (Box 1). We identify some of the key obstacles to correcting this gap, and conclude with some suggestions for actions that can be taken to increase the quantity and quality of HSR.

Weak Health Systems in Poor Countries

The gap in infant mortality and life expectancy between rich and poor

as Kenya, South Africa, Zambia, and Zimbabwe losing more than ten years in life expectancy in a short period of time [2]. In many of these countries, this situation is exacerbated by public health services that have been seriously weakened by chronic underfunding and loss of personnel, with an accelerating "brain drain" that is reaching crisis proportions and raising ethical questions regarding recruitment

PUBLIC HEALTH

Implementation Science

Researchers and funders need to use systems approaches that are beginning to translate research not only to the bedside but also to global health programs.

Tomina Madon, Karen J. Hofman,* Linda Kupfer, Roger I. Glass

We face a formidable gap between innovations in health (including vaccines, drugs, and strategies for care) and their delivery to communities in the developing world. As a result, nearly 14,000 people in sub-Saharan Africa and South Asia die daily from HIV, malaria, and diarrheal disease (1), even though scientific advances have enabled prevention, treatment, and, in some cases, elimination of these diseases in developed countries.

Many evidence-based innovations fail to produce results when transferred to communities in the global south, largely because their implementation is untested, unsuitable, or incomplete. For example, rigorous studies have shown that appropriate use of insecti-

health care in low-income countries, recent billion-dollar increases in budgets for global health have provided only limited support for studies needed to ensure maximum impact (9). Instead, planners often assume that clinical research findings can be immediately translated into public health impact, simply by issuing "one-size-fits-all" clinical guidelines or best practices without engaging in systematic study of how health outcomes vary across community settings.

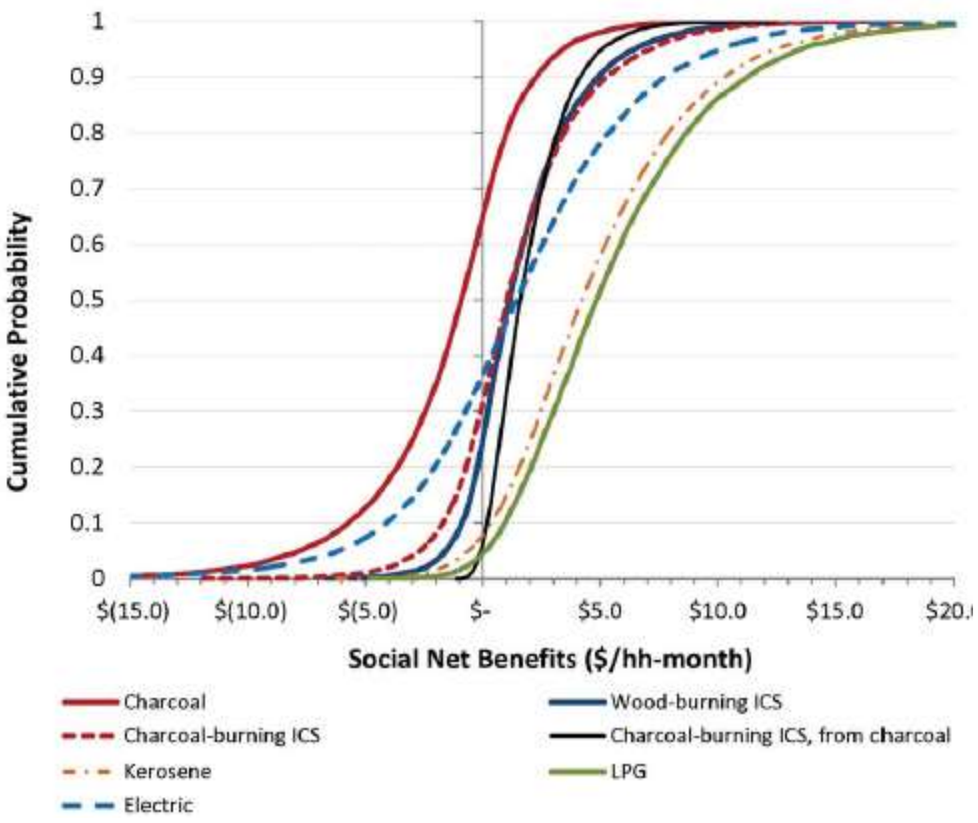
A Framework for Research Translation

- Huge gap between innovation & delivery – because implementation is untested, unsuitable or incomplete and because:
  - Poor people face a bewildering array of constraints – knowledge, access, inadequate infrastructure & health system, environmental exposure
  - Scientists have been slow to view implementation as a dynamic, adaptive, multi-scale phenomenon that can be addressed through research
- Need for
  - **theory & methods adapted to poor countries**
  - **inter-disciplinary problem focused training**
  - **"North-South" collaborations – gov, NGOs,**

Phase I: Diagnose

desk reviews, simulations, focus groups

Do cooking interventions pass the cost benefit test?



Jeuland & Pattanayak 2012. *PLOS One*

- Advocates tend to produce a clear and compelling case for ICS, but such results are too optimistic
- Generally impossible to predict *ex ante* where interventions will work
- **Costs and benefits strongly depend on efficiencies, adoption & use**
- Heterogeneity is a fact of life (e.g., micro-institutions); ultimately development stage (***education, urbanization, electrification***) matters

Environmental Health Economics & Policy

Behavior, Environment, and Health in Developing Countries: Evaluation and Valuation

Subhrendu K. Pattanayak[1,2] and Alexander Pfaff[1]

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Annu. Rev. Resour. Econ. 2009. 1:183–217

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This article's doi: 10.1146/annurev.resource.050708.144053

1941-1340/09/1010-0183$20.00

Key Words

policy interventions, water quality, arsenic, indoor air pollution, diarrhea, malaria, acute respiratory infections, stove, toilets, bed nets, fuel

Abstract

We consider health and environmental quality in developing countries, where limited resources constrain behaviors that combat enormously burdensome health challenges. We focus on four huge challenges that are preventable (i.e., are resolved in rich countries). We distinguish them as special cases in a general model of household behavior, which is critical and depends on risk information. Simply informing households may achieve a lot in the simplest challenge (groundwater arsenic); yet, for the three infectious situations discussed (respiratory, diarrhea, and malaria), community coordination and public provision may also be necessary. More generally, social interactions may justify additional policies. For each situation, we discuss the valuation of private spillovers (i.e., externalities) and evaluation of public policies to reduce environmental risks and spillovers. Finally, we reflect on open questions in our model and knowledge gaps in the empirical literature including the challenges of scaling up and climate change.

CHAPTER 4

Through the looking glass: Environmental health economics in low and middle income countries*

Subhrendu K. Pattanayak*,1, Emily L. Pakhtigian*, Erin L. Litzow†
*Sanford School of Public Policy, Duke University, Durham, NC, USA
†Vancouver School of Economics, University of British Columbia, Vancouver, BC, Canada
1Corresponding author: e-mail address: subhrendu.pattanayak@duke.edu

CONTENTS

*We would especially like to thank V. Kerry Smith for his thoughtful comments on an earlier draft of this work. We would also like to thank the many students who took the Environmental Health Economics course at Duke university from 2009–2018 and provided helpful feedback, which greatly improved the exposition of the arguments presented in this review.

Handbook of Environmental Economics, Volume 4, ISSN 1574-0099, https://doi.org/10.1016/bs.hesenv.2018.08.004

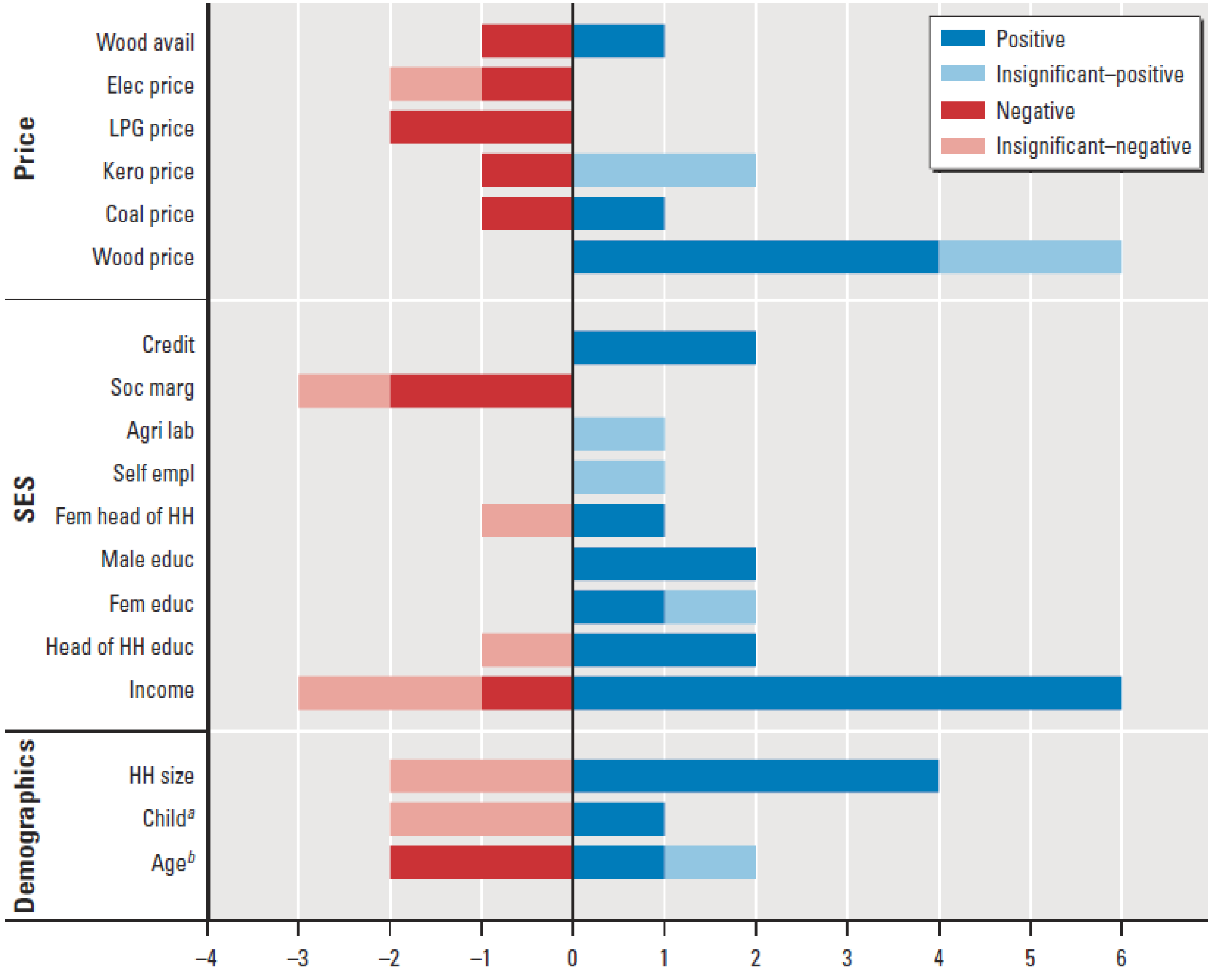
143

Why do so few adopt & use clean stoves/fuels?

can't pay *don't know* *don't care*

selfish **myopic** **risk averse** **conformists** **constrained**

What drives stove & fuel adoption?



(Lewis, JJ and SK Pattanayak. 2012 Environmental Health Perspectives)

- Literature dominated by anecdotes, case studies, and correlations
- SES, HH education, fuel prices, credit – matter
- Information campaigns, social marketing – not studied
- Rigorous (experimental or QE) evaluations missing

Diagnosing through focus groups

International Journal of
Environmental Research and Public Health
ISSN 1660-4601
www.mdpi.com/journal/ijerph

Article

How do People in Rural India Perceive Improved Stoves and Clean Fuel? Evidence from Uttar Pradesh and Uttarakhand

Vasundhara Bhojvaid [1], Marc Jeuland [2,3,*], Abhishek Kar [4], Jessica J. Lewis [5], Subhrendu K. Pattanayak [2,3,5], Nithya Ramanathan [6], Veerabhadran Ramanathan [7] and Ibrahim H. Rehman [4]

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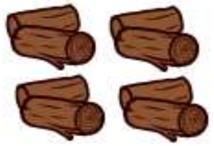
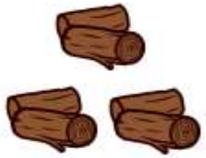
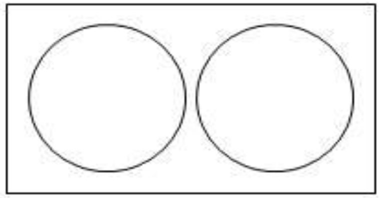
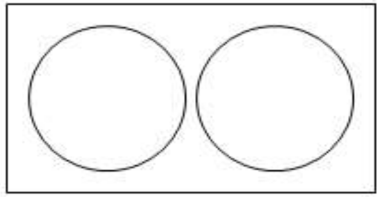
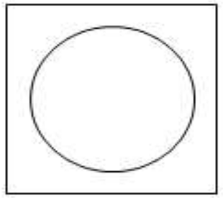
7 Scripps Institution of Oceanography, University of California—San Diego, San Diego, CA 92037, USA; E-Mail: vramanathan@ucsd.edu

Diagnosing through choice experiments

	चूल्हे	उन्नत चूल्हा 1	उन्नत चूल्हा 2	मिट्टी का चूल्हा
Price	दाम	500 रुपए 	2500 रुपए 	0 रुपए
Smoke	धुआं			
Fuel Req.	ईंधन की जरूरत			
# Cook surfaces	चूल्हे के मुंह की गिनती			

Jueland, MA et al. 2015 *Energy Economics*

Phase II: Design

simulate mature market, pilots

Intervention: Stimulate demand for improved cookstoves

1. Information – Fact sheets comparing two improved stoves

Promotional material and product sales plan

Choice of two technologies

Intervention: Stimulate demand for improved cookstoves

1. Information – Fact sheets comparing two improved stoves
2. Personalized household demo

Training & messaging

Field testing & demonstrating

Changing Supply

- complementary infrastructure: roads, electricity; rural banks
- policies & incentives - inter-state commerce, inclusive innovation
- **supply chain**
  - finance & rebates
  - marketing (& demonstrations)
  - home delivery
  - after sales & repair

Lots of piloting (Lewis et al., 2015)

Lewis, JJ et al. 2015. *Journal of Health Communication*

Table 1. Summary of pilot intervention features

	Product			Pricing plan				Place					
Pilot	Forced draft	Natural draft	Electric	Full upfront payment	Installments	Rebates conditional on use	Optional stove return	State	NGO	Near highway?	Promotion: Social marketing/ behavior change communication[a]	Total sales (sales in random sample)	% HH purchase (% purchase in random sample)
A	√	√		√		√		Uttar Pradesh			Basic	0 (0)	0 (0)
B	√	√			√				√		Basic	2 (2)	8 (8)
C		√			√	√			√		Basic Plus	3 (0)	1 (0)
D		√			√	√		Odisha	√		Basic Plus	14 (6)	23 (46)
E		√			√					√	Basic Plus	4 (1)	4 (8)
F		√	√		√	√		Uttarakhand	√		Intensive	19 (6)	40 (38)
G		√	√		√		√		√		Intensive	17 (9)	31 (60)
H		√			√	√			√		Intensive	2 (2)	7 (14)

Note. NGO = nongovernmental organization.
[a]Basic: pamphlets and household demonstration; Basic Plus: pamphlets (in advance), village posters, community and household demonstration; Intensive: new pamphlets and extended household visit (in advance), community and household demonstration.

teri Gram Vikas Central Himalayan Rural Action Group Chirag

Phase III. Experiment

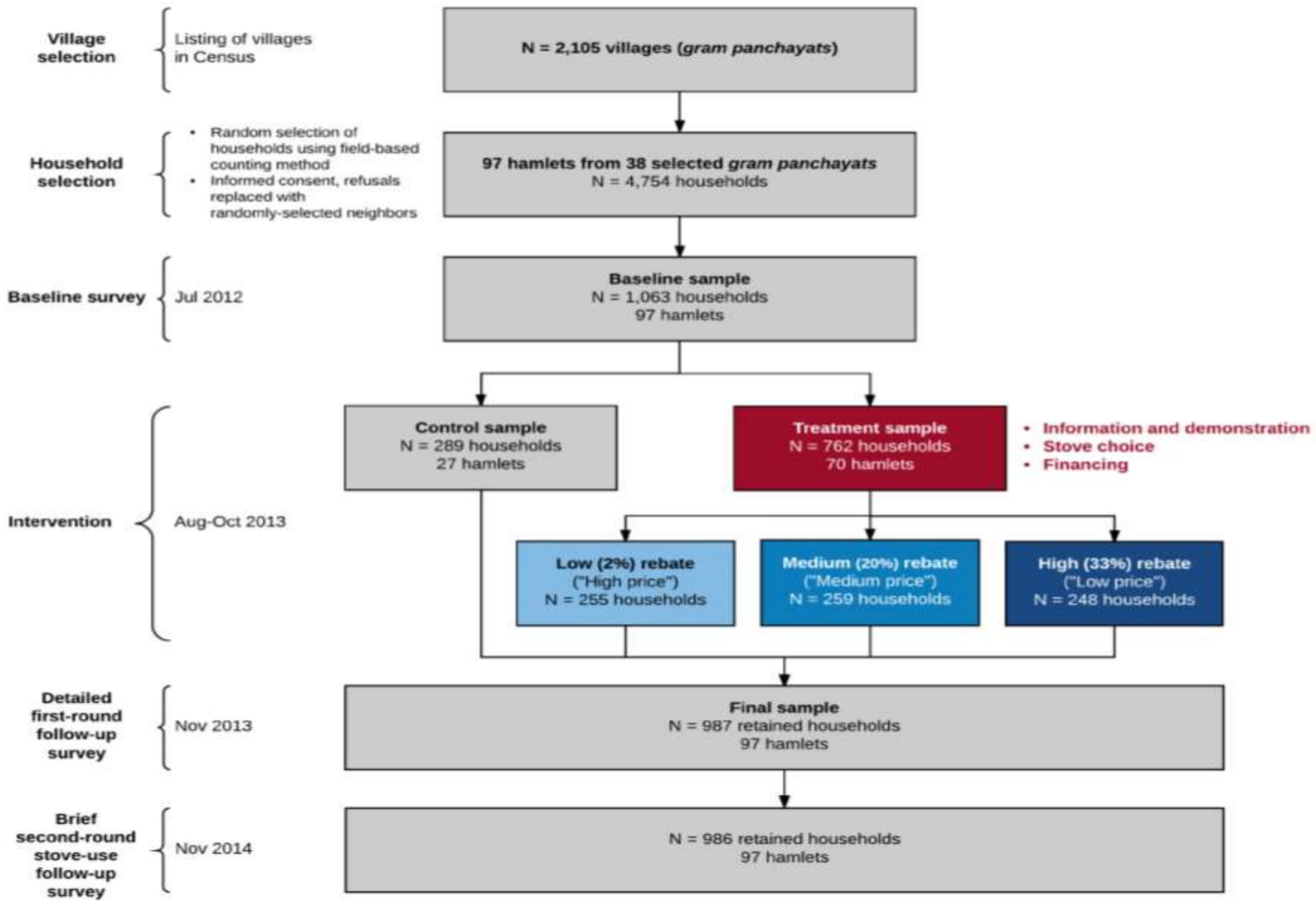
RCT, 1000 hh, 100 hamlets, 3 rounds

Study site: Foothills of the Himalayas

Intervention: Stimulate demand for improved cookstoves

1. Information – Fact sheets comparing two improved stoves
2. Personalized household demo
3. Payment in 3 even installments
4. Rebates randomized at the household level

Finance plan including random rebates conditional on use



Village selection
Listing of villages in Census
N = 2,105 villages (gram panchayats)
Household selection
Random selection of households using field-based counting method
Informed consent, refusals replaced with randomly-selected neighbors
97 hamlets from 38 selected gram panchayats
N = 4,754 households
Baseline survey
Jul 2012
Baseline sample
N = 1,063 households
97 hamlets
Intervention
Aug-Oct 2013
Control sample
N = 289 households
27 hamlets
Treatment sample
N = 762 households
70 hamlets
Information and demonstration
Stove choice
Financing
Low (2%) rebate
("High price")
N = 255 households
Medium (20%) rebate
("Medium price")
N = 259 households
High (33%) rebate
("Low price")
N = 248 households
Detailed first-round follow-up survey
Nov 2013
Final sample
N = 987 retained households
97 hamlets
Brief second-round stove-use follow-up survey
Nov 2014
N = 986 retained households
97 hamlets

Result1. large purchase response

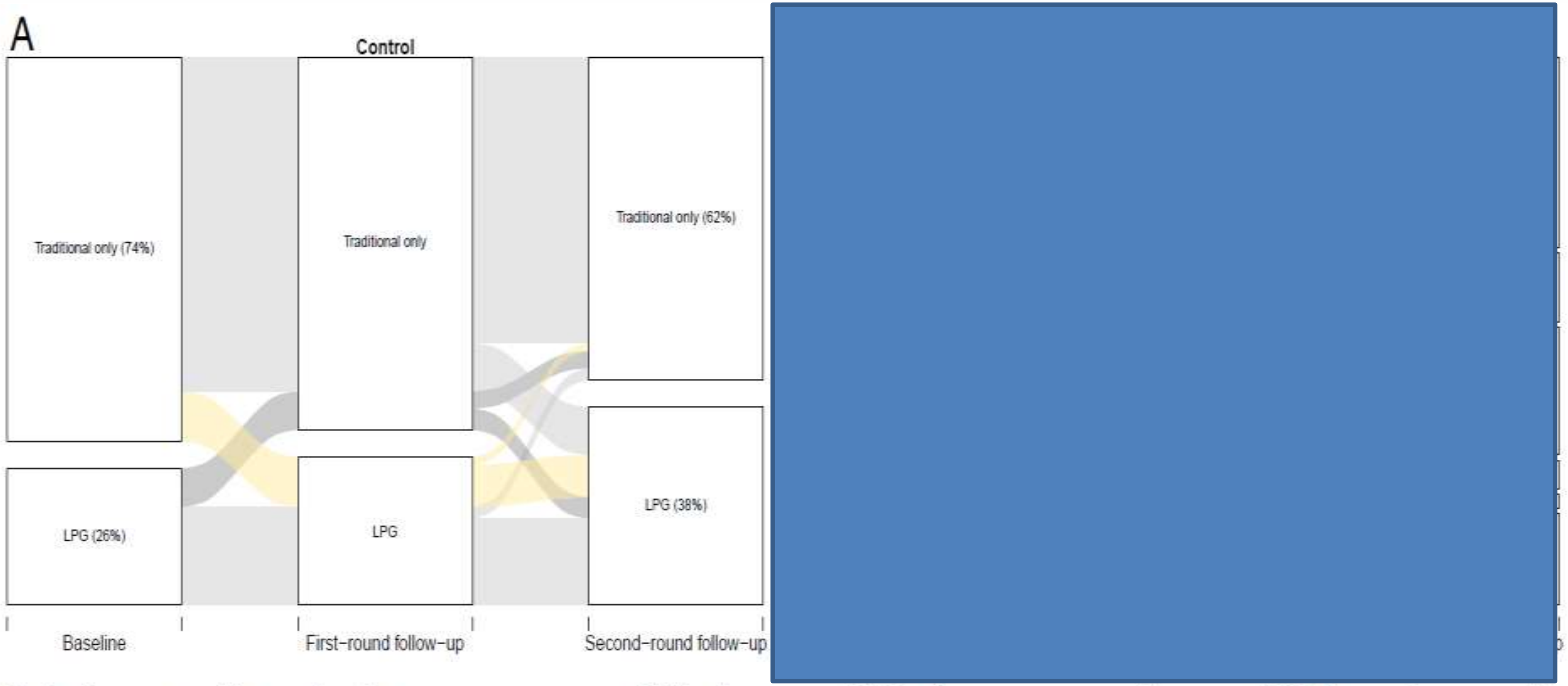
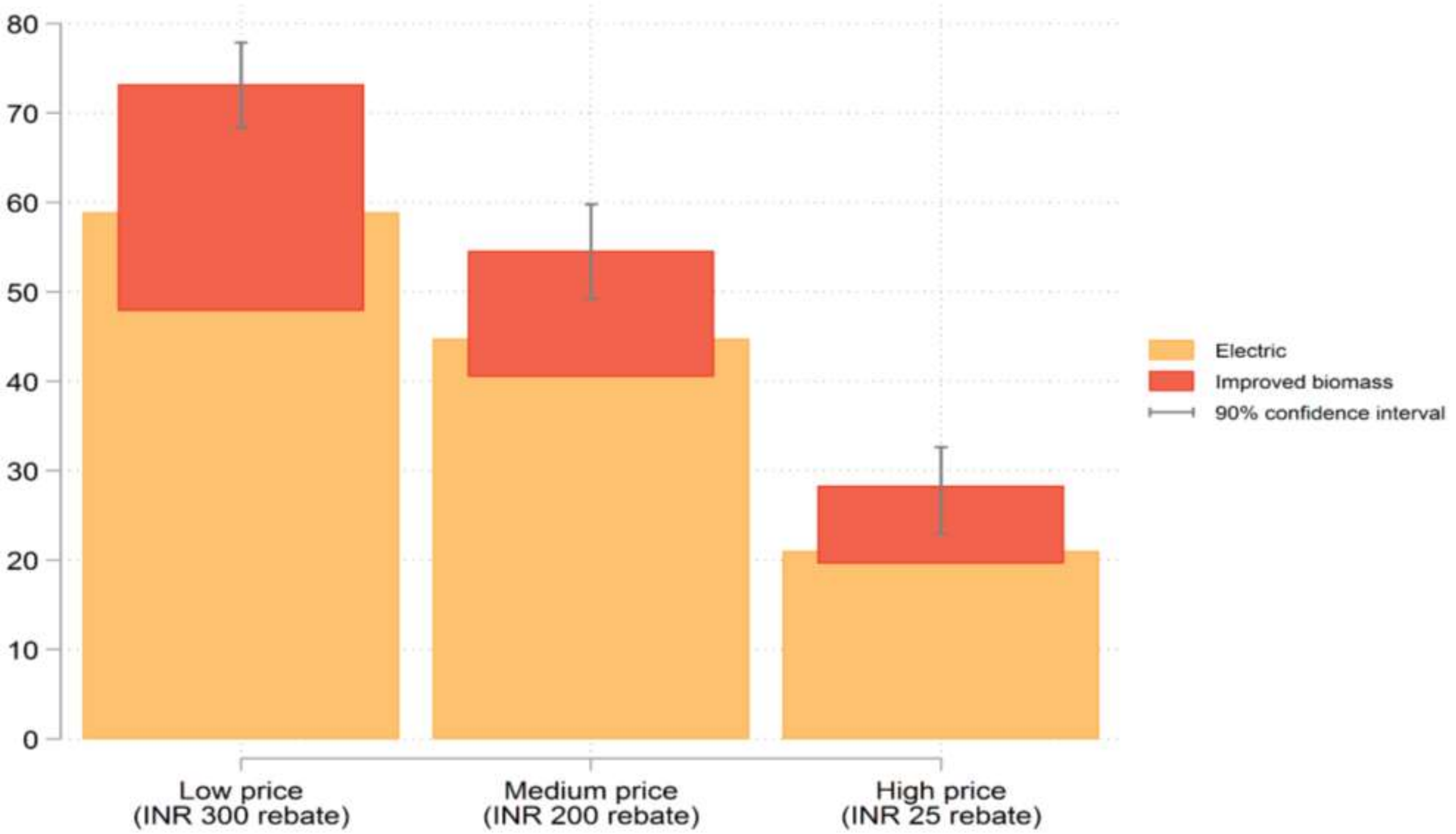


Fig. 3. Stove ownership over time by treatment group: control (*A*) and treatment (*B*). Baseline surveys occurred in summer 2012. Intervention occurred in summer 2013. First-round follow-up surveys occurred 3 mo after the intervention. Second-round follow-up occurred ~15 mo after the intervention.

4 of 6 | www.pnas.org/cgi/doi/10.1073/pnas.1808827116 Pattanayak et al.

Possible to achieve high ownership and use in low income settings!

Result1b. price incentives make big diff



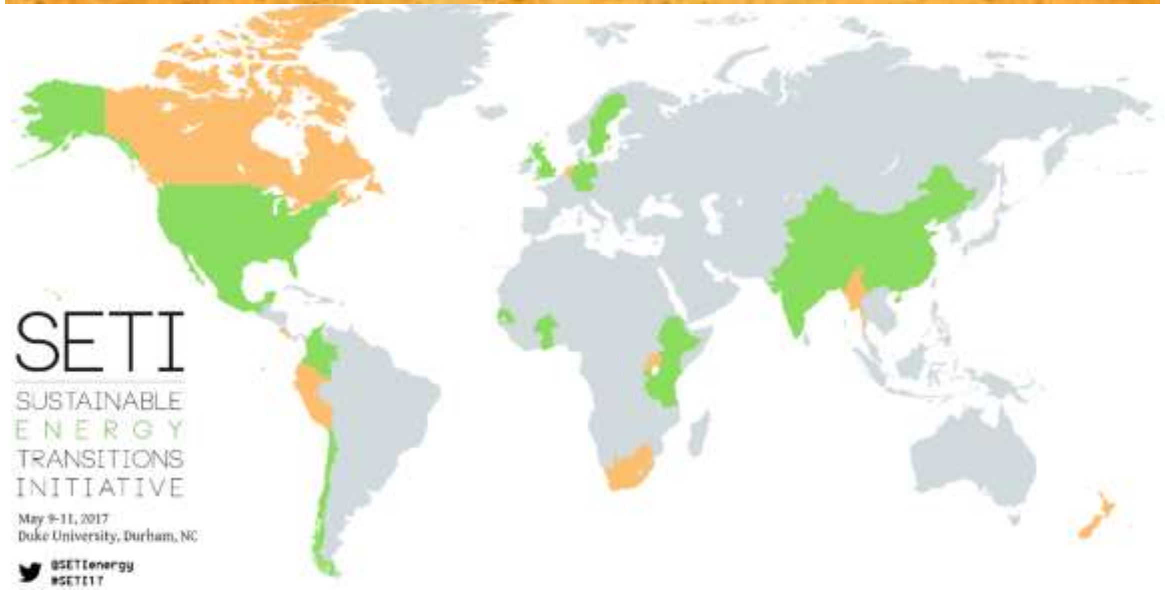
Intervention had positive social NPV: B > C

Table A2. Summary of benefits and costs of the different technologies deployed in the intervention (All costs and benefits are reported in US$/household-month)

	Natural-draft biomass stove	Electric coil stove
Private costs		
Stove cost	$0.99	$0.76
Private learning cost	$0.03	$0.03
Private benefits		
Cooking time savings	$0.36	$0.63
Health benefits	$0.23	$0.49
Fuel savings	$0.73	$2.01
Net private benefits (rounded to nearest $0.1/household-month)	**$0.30**	**$2.30**
Social costs		
Stove cost	$0.09	$0.18
Program and learning cost	$0.51	$0.51
Private learning cost	$0.00	$0.01
Social benefits		
Cooking time savings	$0.05	$0.25
Health benefits	$0.07	$0.42
Fuel savings	$0.11	$0.05
Climate benefits	$0.25	$0.49
Forest benefits	$0.01	$0.07
Net social benefits (rounded to nearest $0.1/household-month)	**-$0.10**	**$0.60**

Sustainable Energy Transitions Initiative

- State of knowledge
- Coordinated research
- Community of practice
- Policy support



Take Home Messages

- Treat implementation (and questions it poses) as a science
- Consider multi-year, multi-stage (Diagnose-Design-Test)

  Stage I (Diagnose): people want cheap, less smoke & low fuelwood, but there is no One Stove to rule them all!

  Stage II (Design): promise of rebates, finance, marketing, home delivery, type,

  Stage III (Test): 50% purchase, reduce fire use, more aware

  - Take supply chain seriously
    - finance, marketing, retailing can go a long way
    - maintenance, servicing under appreciated
  - Accept poor highly price sensitive; seek creative (carbon?) finance
- Avoid **type III errors** (precise answers to pointless questions), that make implementation even more challenging

No one says this is going to be easy

Conve

Black carbon in-field emissions—Rwanda

Andy Grieshop, North Carolina State University

Pellet-fed gasifier stoves approach gas-stove like performance during in-home use in Rwanda

Wyatt M. Champion*, **Andrew P. Grieshop**

Environmental Engineering, North Carolina State University, USA

go.ncsu.edu/grieshop_lab

*now an ORISE postdoctoral researcher at US EPA

Funding:

CLIMATE & CLEAN AIR COALITION TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

CLEAN COOKING ALLIANCE

NC STATE UNIVERSITY

Partner:

INYENYERI A Rwandan Social Benefit Company

9 Sept. 2019 – Climate Action and Clean Cooking Co-benefits – Washington, DC

Full paper: go.ncsu.edu/champion-and-grieshop

Environmental Science & Technology

Article

Cite This: *Environ. Sci. Technol.* XXXX, XXX, XXX–XXX

pubs.acs.org/est

Pellet-Fed Gasifier Stoves Approach Gas-Stove Like Performance during in-Home Use in Rwanda

Wyatt M. Champion[†] and Andrew P. Grieshop[*]

Department of Civil, Construction, and Environmental Engineering, North Carolina State University, Raleigh, North Carolina 27695, United States

Inyenyeri: a focus on fuel, stove and household

Implementer: Inyenyeri, a Rwandan Social Enterprise

- Mimi Moto stoves and **locally-produced biomass fuel pellets**
- Innovative business model: **Pay/trade for pellets, get free stove**
- **Pellets compete with charcoal (purchased) and fuelwood (gathered)**
- Large **emphasis on customer service** and follow-up
- See Jagger and Das, 2018, *ESD* for more…

Stove: Mimi Moto

- Pellet-fed forced-draft cookstove
- Lab tests: ISO Tier-4 for emissions and efficiency measurements (CSU)

Location: Gisenyi, Rwanda (small city)

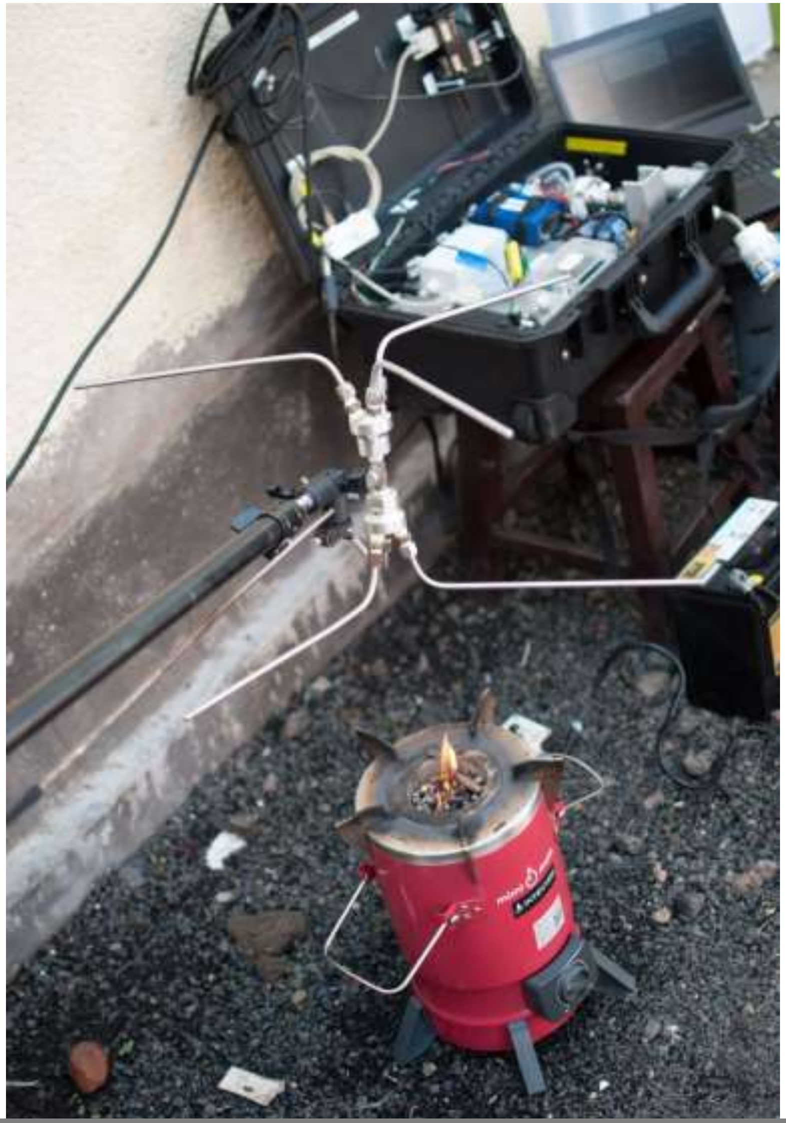
- Headquarters and pilot roll-out

INYENYERI
A Rwandan Social Benefit Company

Photo: trendhunter.com

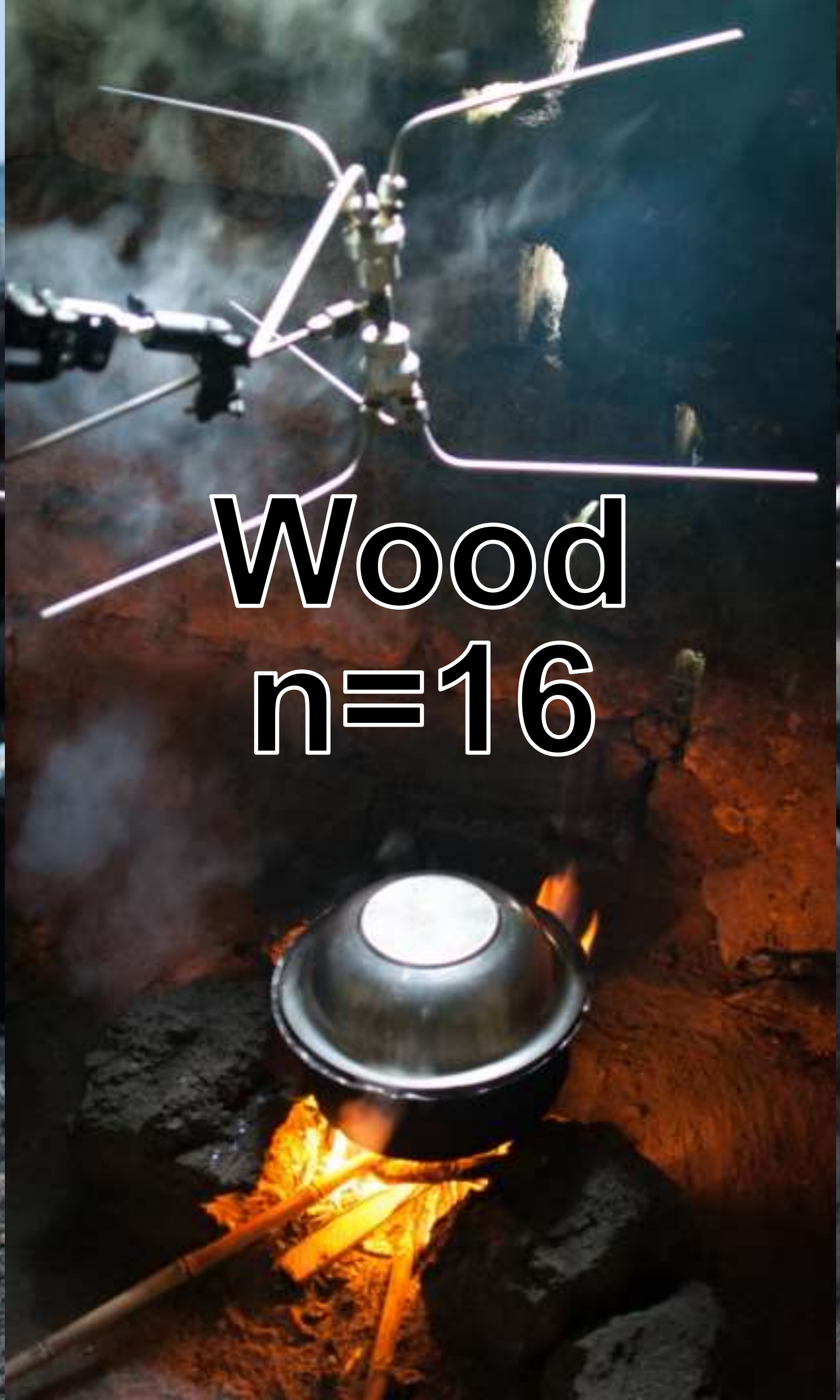
In-home measurements of Mimi Moto and baseline stoves

- ‘Randomized’ Household Selection
  - Pellet (~70% urban, ~30% rural)
  - Wood (100% rural)
  - Charcoal (100% urban)
  - 2 ‘seasons’, testing same households (Dec ‘17, May ‘18)
- Sampling Equipment
  - Stove Emission Measurement System (STEMS)
  - Plume-sampling probe
  - Real-time:
    - CO and CO_2
    - $PM_{2.5}$ Scattering and Absorption (Aethlabs µAeth)
  - Integrated $PM_{2.5}$ filter samples:
    - Mass, and Organic and Elemental Carbon (OC/EC)
- Carbon-balance method for emission factors
- Uncontrolled Cooking Test (UCT)
  - Participant cooks a meal of their choice with (ideally) minimal disruption



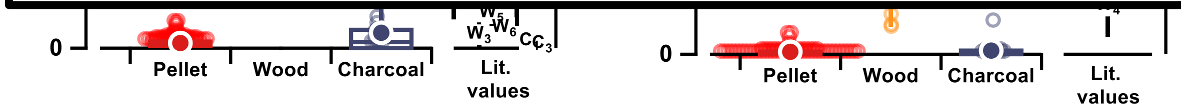
Mimi Moto and Sampling Equipment


Pellet
n=59


Wood
n=16


Charcoal
n=16

Pellet stoves reduce $PM_{2.5}$ emissions by 97% compared to Wood and 89% compared to Charcoal



Mimi Moto medi… …het' ISO T… …in-use …issions

Compared to gasifier stoves with wood, field PM EFs are much lower (0.4 vs 2.5-4.1 g kg^{-1})

5. Global Alliance for Clean Cookstoves, 2018; 6. Garland et al., 2017; 7. Roden et al., 2009; 8. Coffey et al., 2017; 9. Wathore et al., 2017; 10. Rose Eilenberg et al., 2018; 11. Lefebvre 2016; 12. Grieshop et al., 2017

…and CO emissions by 87% compared to Wood, and 96% compared to Charcoal

Mimi Moto ‘met’ ISO Tier-5 for in-use CO emissions

EC emission factors and rates from pellet stoves are extremely low (99% reduction from wood)

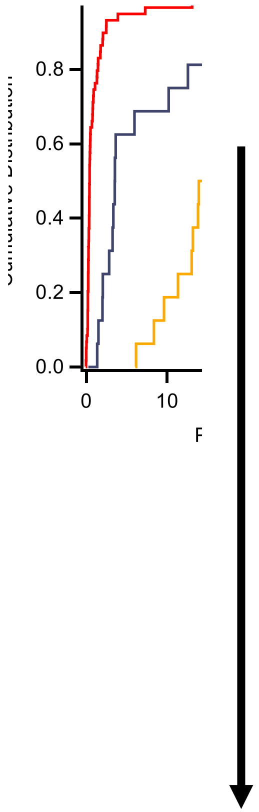
Pellet PM contains greater proportion of elemental carbon (EC) and are more light absorbing

$$SSA = \frac{\text{Scattering}}{\text{Extinction}}$$

EC/TC Ratio

Mimi Moto emits particles that are slightly more absorbing, but <u>much</u> less of them

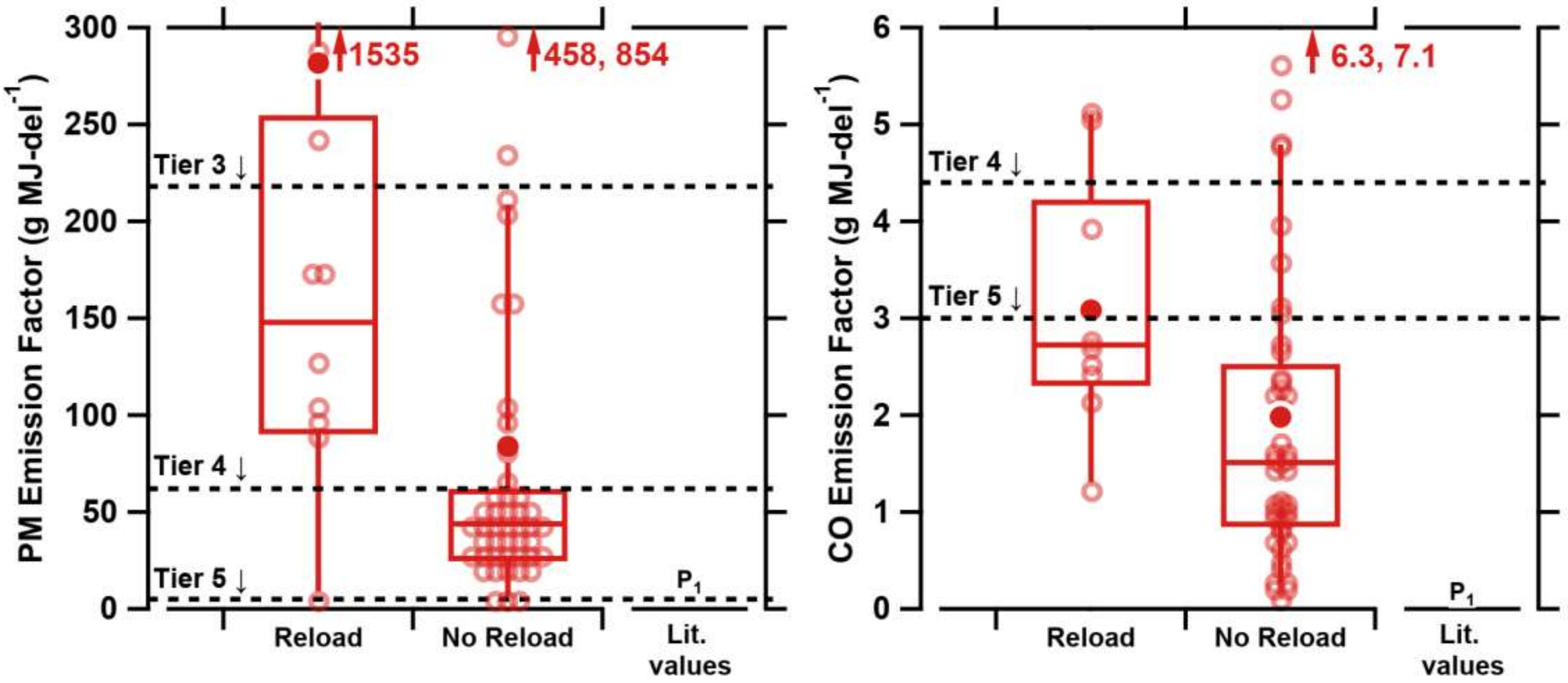
In general, pellet stoves work great, but not always!



$PM_{2.5}$ EF Distribution

CO EF Distribution

Refueling associated with higher PM and CO emissions (also start-up and misoperation)

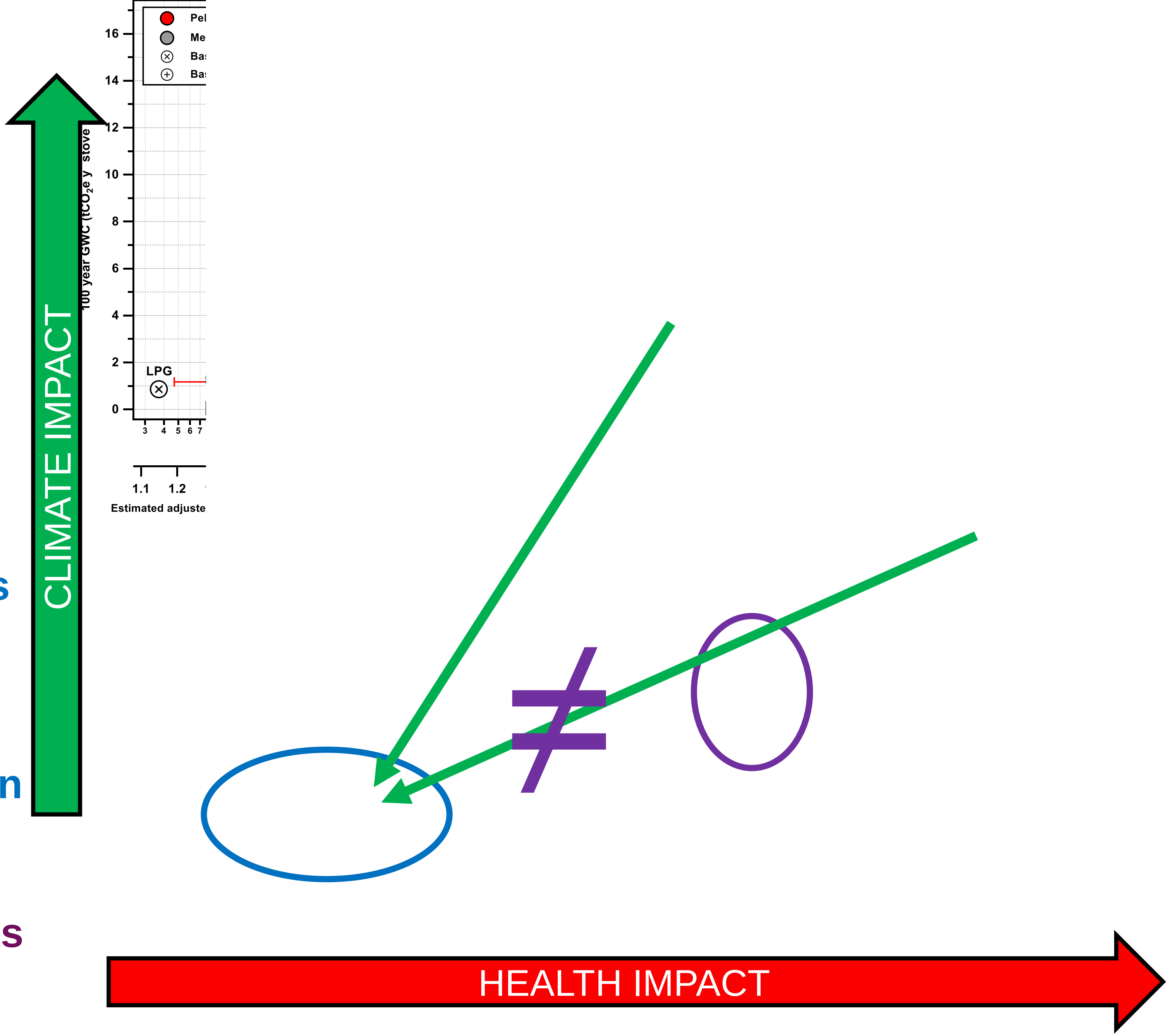


Pellet stoves: some indication of performance degradation over time

Estimated pellet stove health and climate benefits *approach* LPG

<u>Takeaways:</u>

1) Huge <u>potential</u> co-benefits implied by field emission performance of pellet stove relative to traditional stoves/fuels.
2) Climate benefits match/surpass LPG, depending on feedstock renewability and energy for pellet production. Health impacts are slightly greater than LPG.
3) Use of pellets (homogenous fuel) leads to enormous benefits relative to gasifier with 'gathered' biomass.



In summary…

- **Significant** reductions of $PM_{2.5}$, EC, and CO emission factors and rates observed during in-home testing in Gisenyi, Rwanda
- Mimi Moto 'met' **Tier-4 for $PM_{2.5}$** and **Tier-5 for CO**
- However, ~10% of tests were "super-emitters", with emissions **on-par with traditional stoves types**
  - Dead stove battery, refueling, or kindling ignition
- During poor performance, pellet stoves emitted high PM and BC primarily following **ignition**, and near the end of test (**refueling/burnout**)
- Estimated health and climate **cobenefits of pellet stoves approach those from a modern fuel/stove (LPG)**

Thank you!
Questions?

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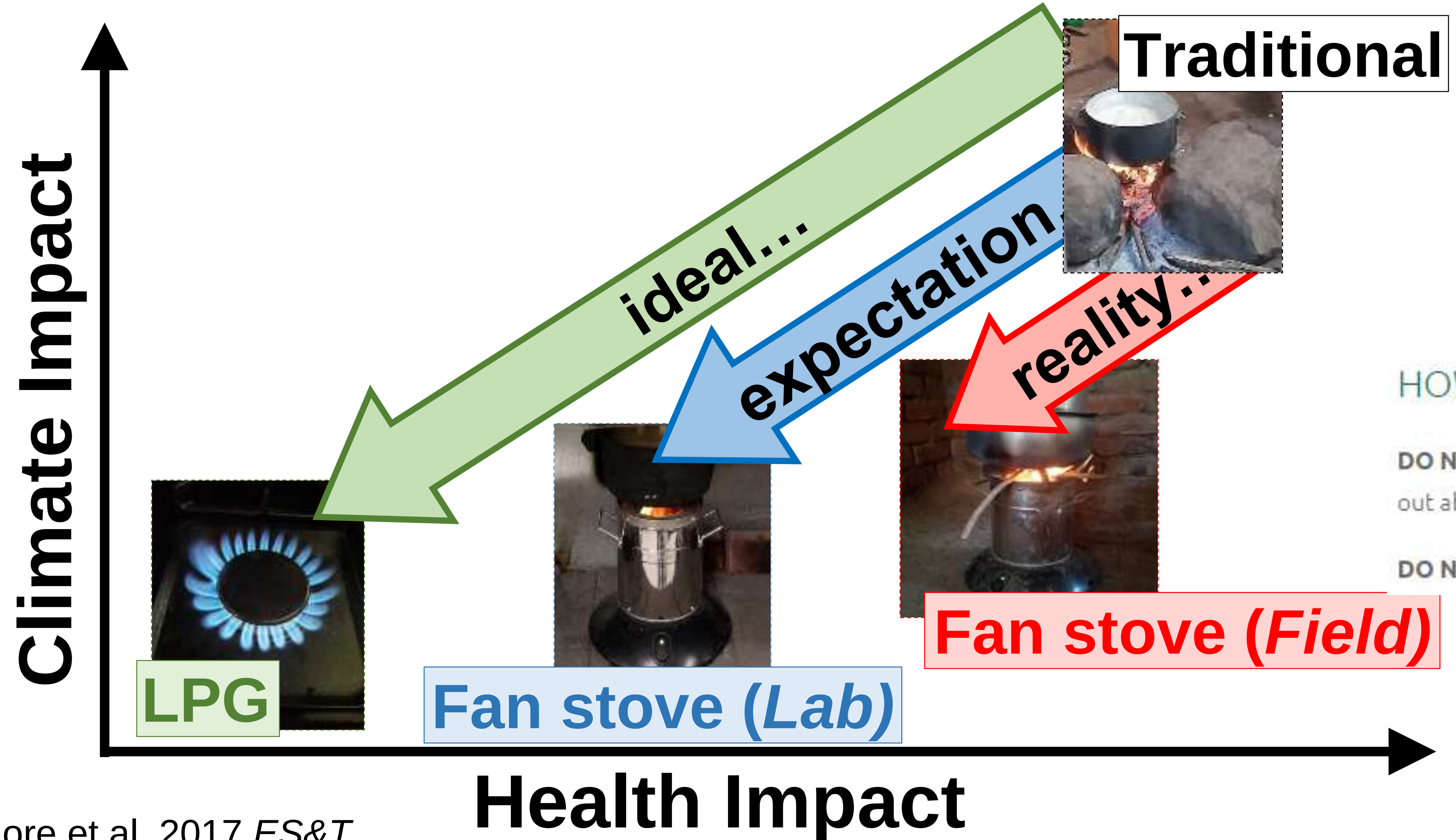
NCSU Lab support: Maksim Islam, Stephanie Eberly, Ky Tanner, Amanda Vejins, and Andrew Whitesell

Web: go.ncsu.edu/grieshop_lab

Extra slides

Ultra-low cooking emissions required for health and climate benefits, but not seen in ‘real-world’ use of biomass stoves



http://www.africancleanenergy.com/

Wathore et al, 2017 *ES&T*

Rwanda, the land of a thousand hills and a million smiles

- Located in East Africa
- Most densely populated nation on the continent
- 95% of population relies on solid biomass for cooking.[3]
  - Wood is dominant in rural
  - Wood and charcoal split in urban
- Lower respiratory infection is the leading cause of disability-adjusted life years lost (DALYs) in Rwanda[4].

Image: smetwits.me

3. Global Alliance for Clean Cookstoves, 2012; 4. Institute for Health Metrics and Evaluation, 2018

STove Emissions Measurement System (STEMS)

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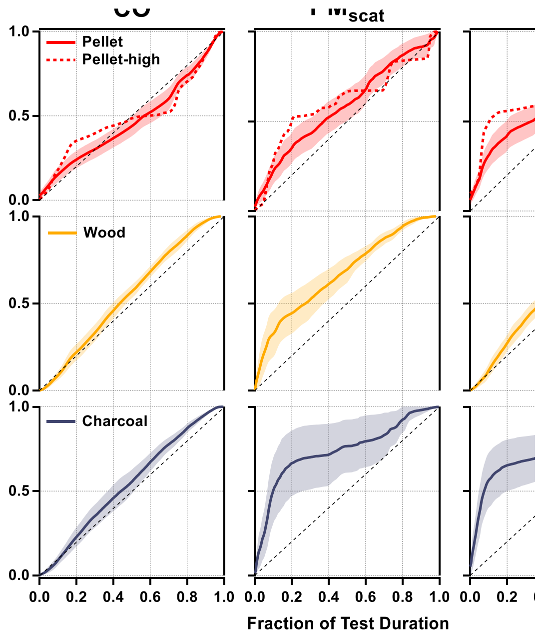
During poor performance, pellet stoves emit in distinct events

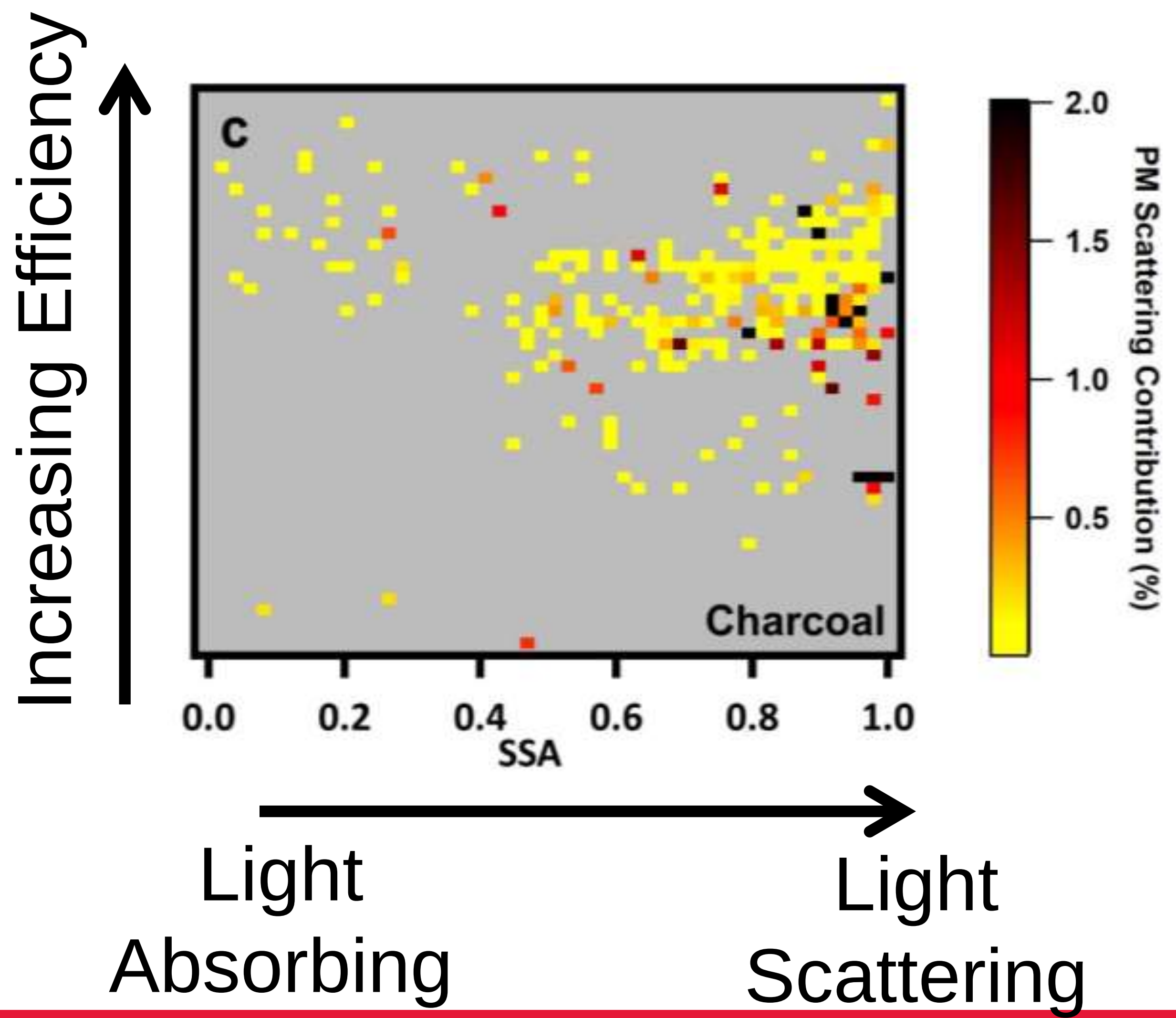


Patterns of Real-time Emissions Data (PaRTED)

2-D frequency plot
- Type of particle
- During what type of combustion event

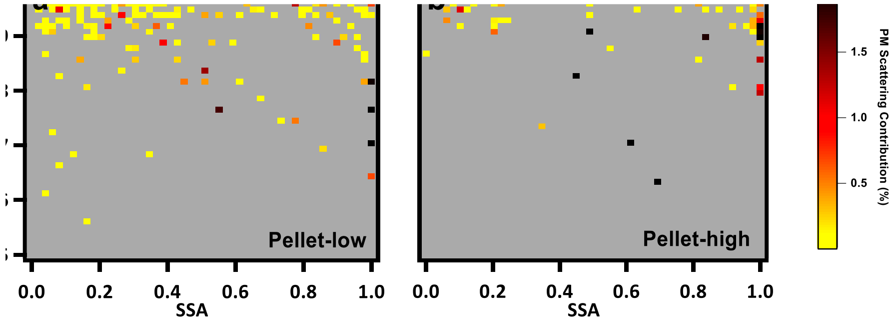
$$MCE = \frac{CO_2}{(CO+CO_2)}$$

$$SSA = \frac{\text{Scattering}}{\text{Extinction}}$$

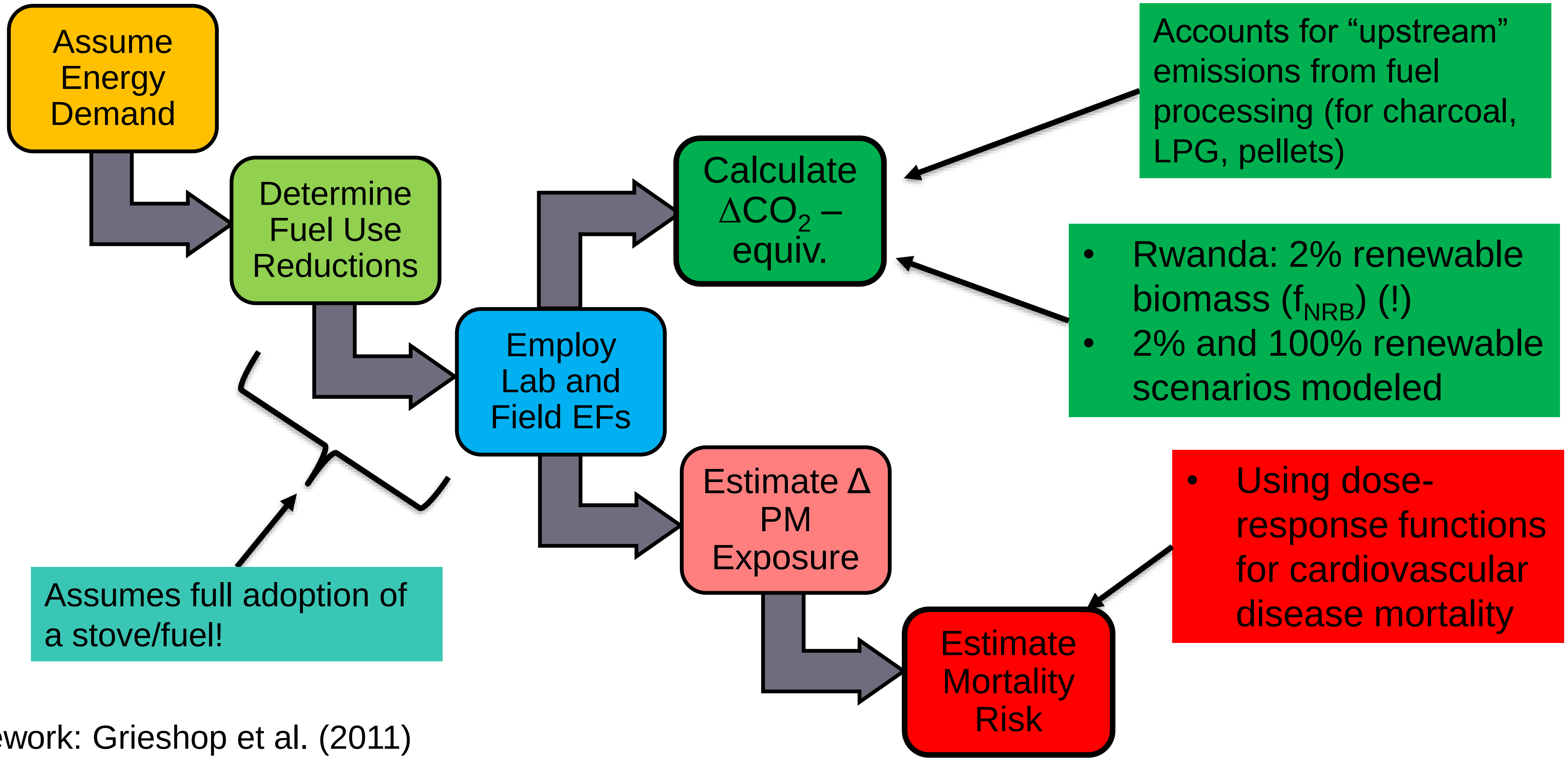


13. Chen et al., 2012

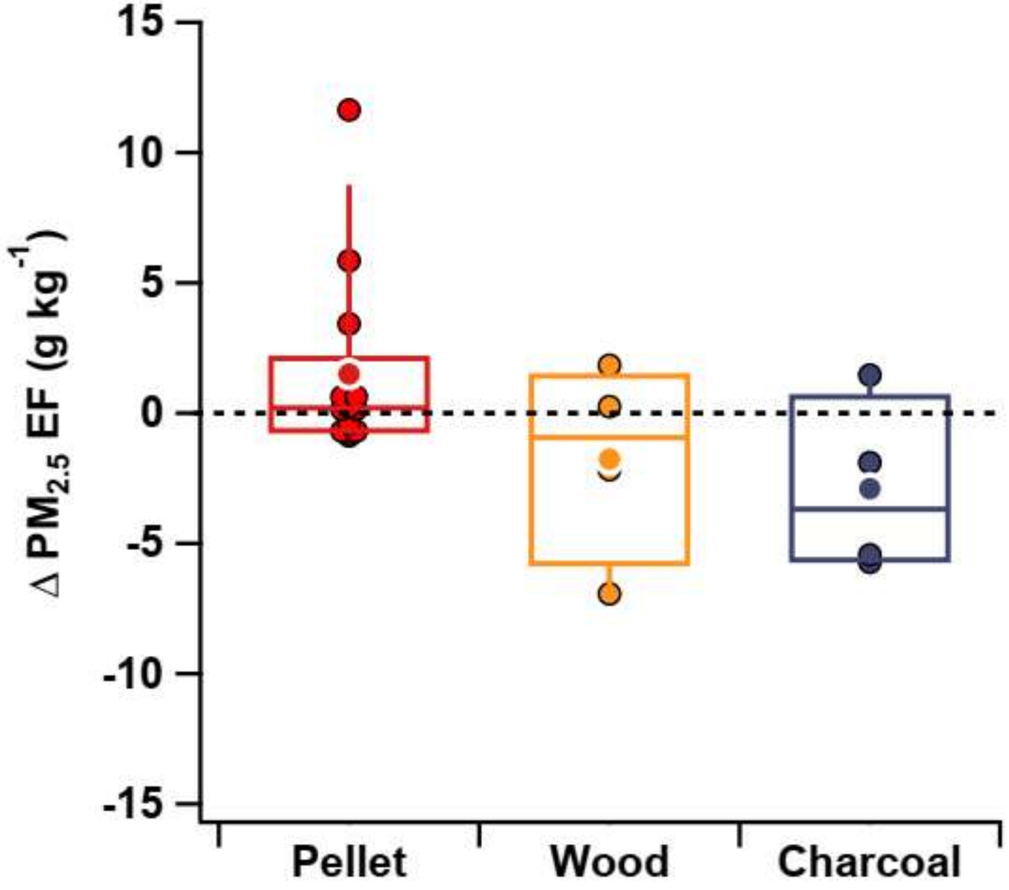
Remember, Pellet stoves have generally lower SSA… Pellet-high stoves emit primarily high SSA PM

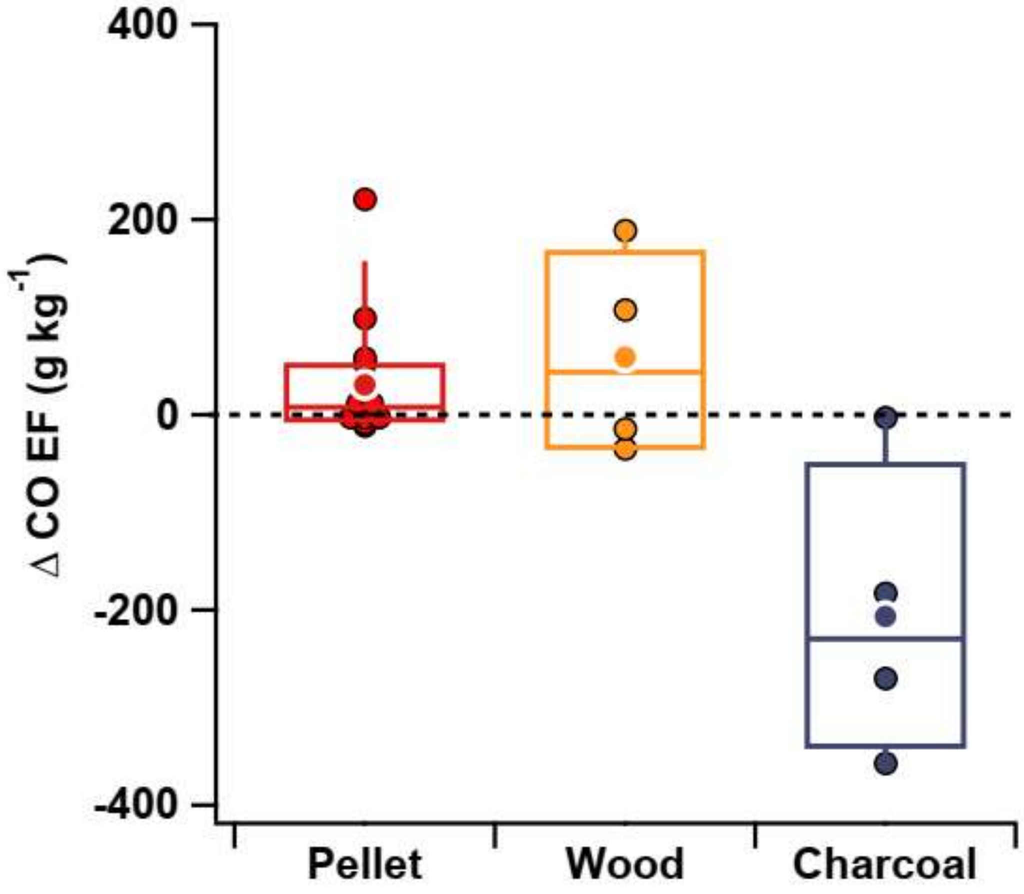


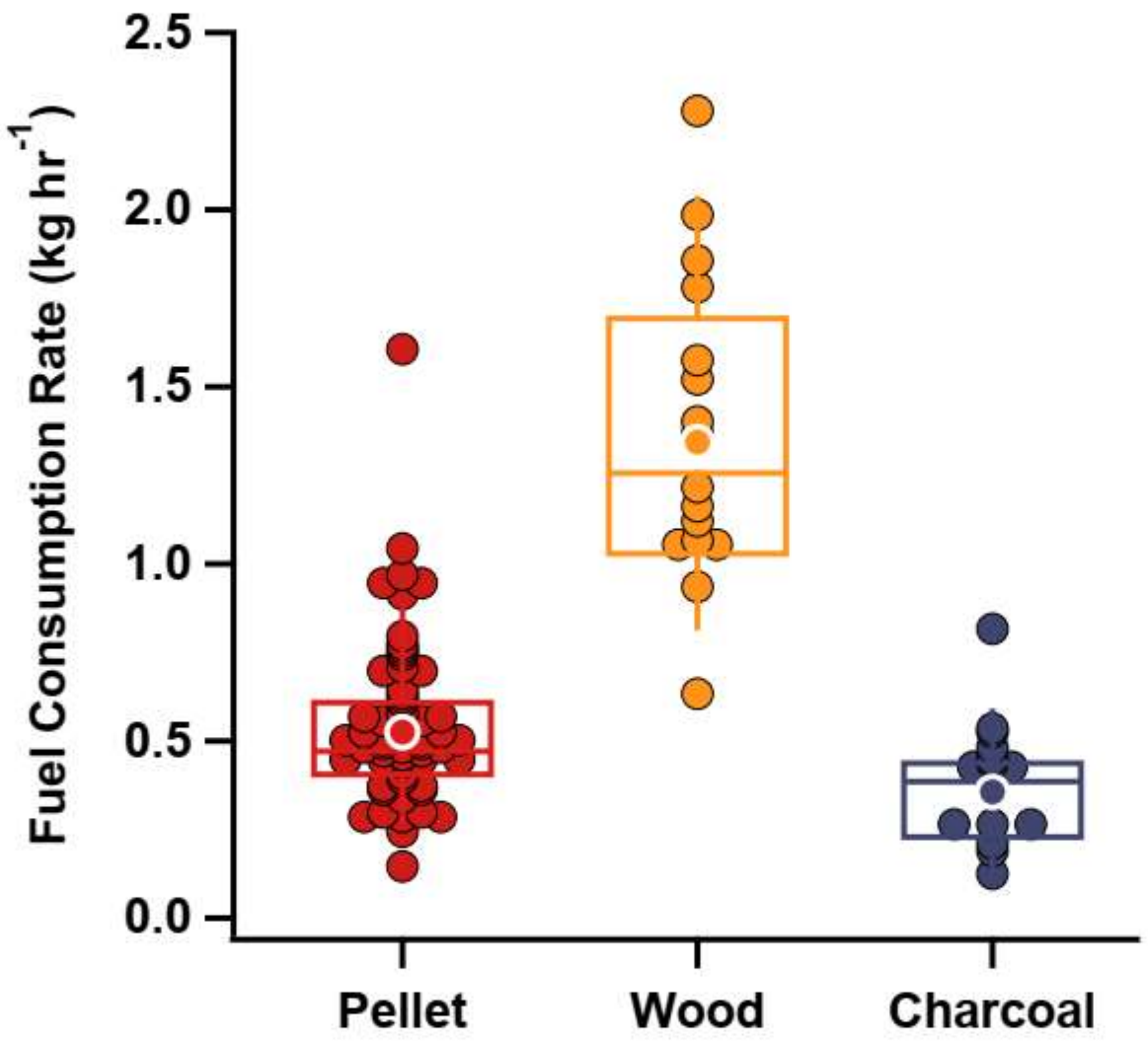
Apply a framework to estimate *potential* climate and health impacts and (co)benefits from stove options

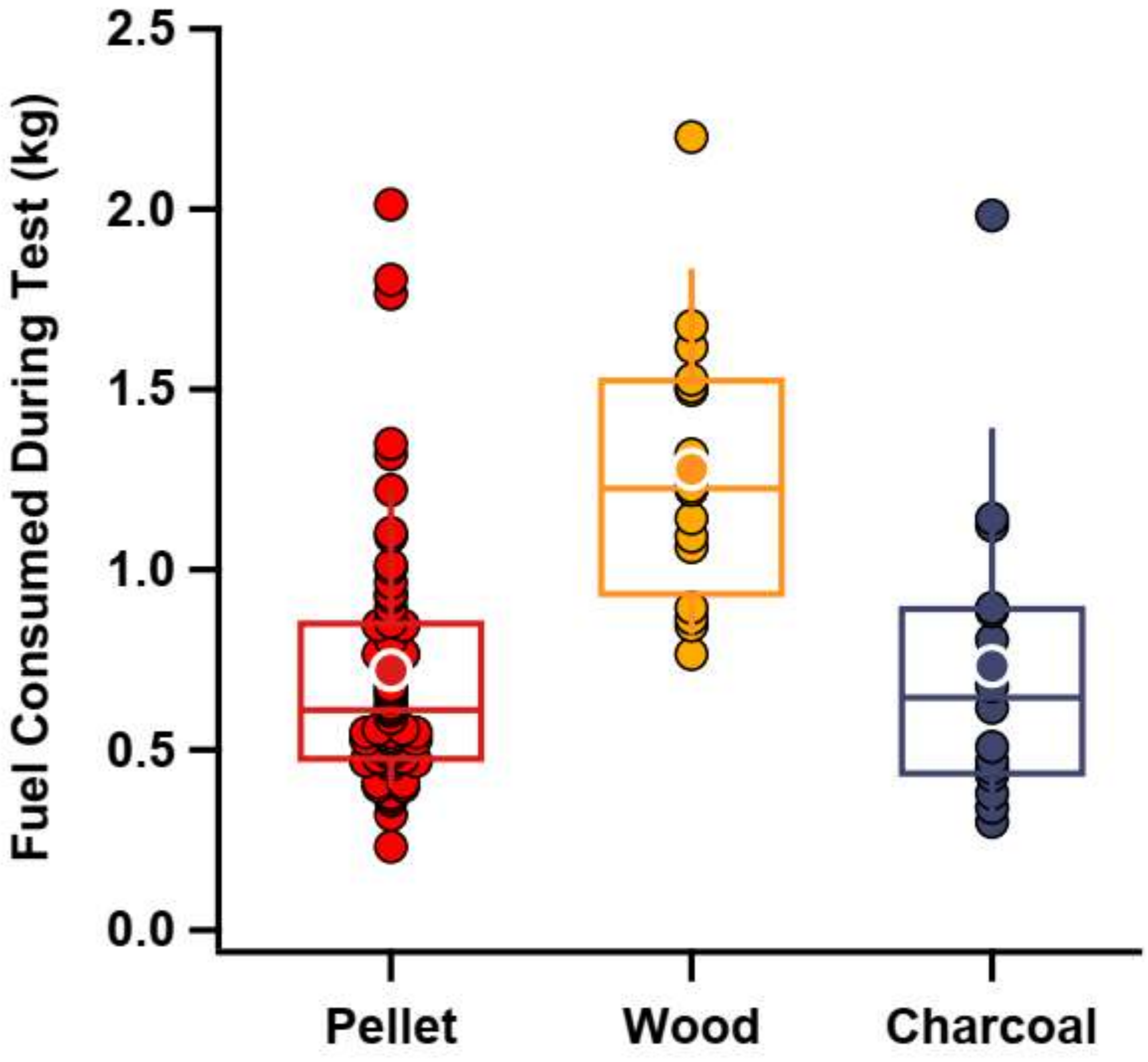


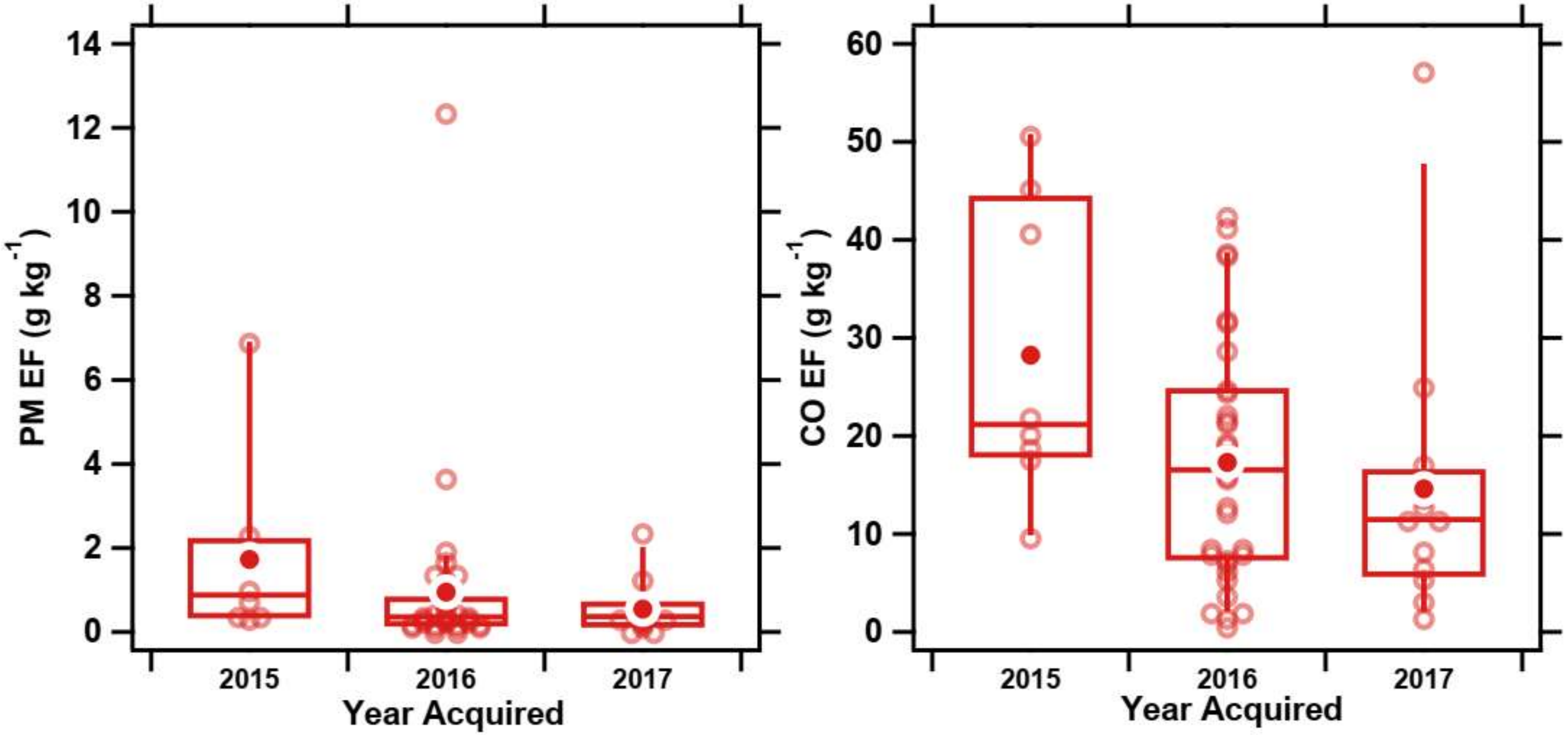
Framework: Grieshop et al. (2011)


15
10
5
0
-5
-10
-15
Δ PM2.5 EF (g kg-1)
Pellet
Wood
Charcoal

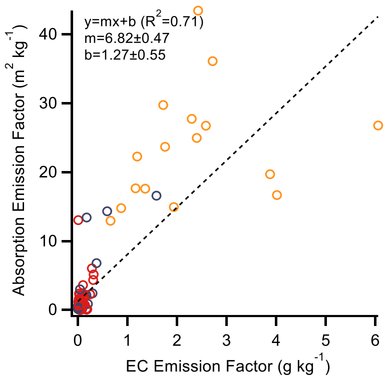

400
200
0
-200
-400
Δ CO EF (g kg-1)
Pellet
Wood
Charcoal

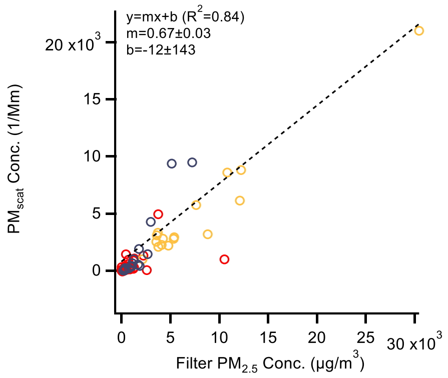

Fuel Consumption Rate (kg hr^{-1})
2.5
2.0
1.5
1.0
0.5
0.0
Pellet
Wood
Charcoal

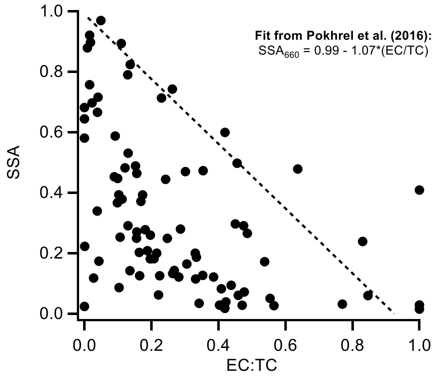

Fuel Consumed During Test (kg)
2.5
2.0
1.5
1.0
0.5
0.0
Pellet
Wood
Charcoal



14
12
10
8
6
4
2
0
PM EF (g kg^{-1})
2015
2016
2017
Year Acquired
60
50
40
30
20
10
0
CO EF (g kg^{-1})
2015
2016
2017
Year Acquired


y=mx+b (R^2=0.71)
m=6.82±0.47
b=1.27±0.55
Absorption Emission Factor (m^2 kg^{-1})
EC Emission Factor (g kg^{-1})


y=mx+b (R^2=0.84)
m=0.67±0.03
b=-12±143
PM_{scat} Conc. (1/Mm)
Filter $PM_{2.5}$ Conc. (μg/m^3)


Fit from Pokhrel et al. (2016):
SSA_{660} = 0.99 - 1.07*(EC/TC)
SSA
EC:TC

Black carbon in-field emissions—Nepal

Ryan Thompson, Mountain Air Engineering

Biogas Stove Emissions in Kavre, Nepal

Cheryl Weyant, Ryan Thompson, Nicholas L. Lam, Basudev Upadhyay,

Amod Pokhrel, Prabin Shrestha, Shovana Maharjan, Kaushila Rai, Chija Adhikari, Maria C. Fox

Mountain Air

CLEAN COOKING ALLIANCE

CLIMATE & CLEAN AIR COALITION

Objectives

Measure emission factors of health and climate relevant emissions

- Including black carbon (BC), organic carbon (OC), particulate matter ($PM_{2.5}$) , and carbon monoxide (CO)
- From biogas, LPG, and wood stoves
- During uncontrolled field settings

Project Partners

- Mountain Air Engineering – Ryan Thompson
- University of Illinois – Cheryl Weyant, Tami Bond, Maria Fox
- Basudev Upadhyay (Independent contractor)
- Humboldt State University – Nicholas Lam
- LEADERS Nepal – Amod Pokhrel
- Center for Rural Technology, Nepal (CRT/N) - Prabin Shrestha, Shovana Maharjan, Kaushila Rai, Chija Adhikari
- Climate and Clean Air Coalition
- Clean Cooking Alliance

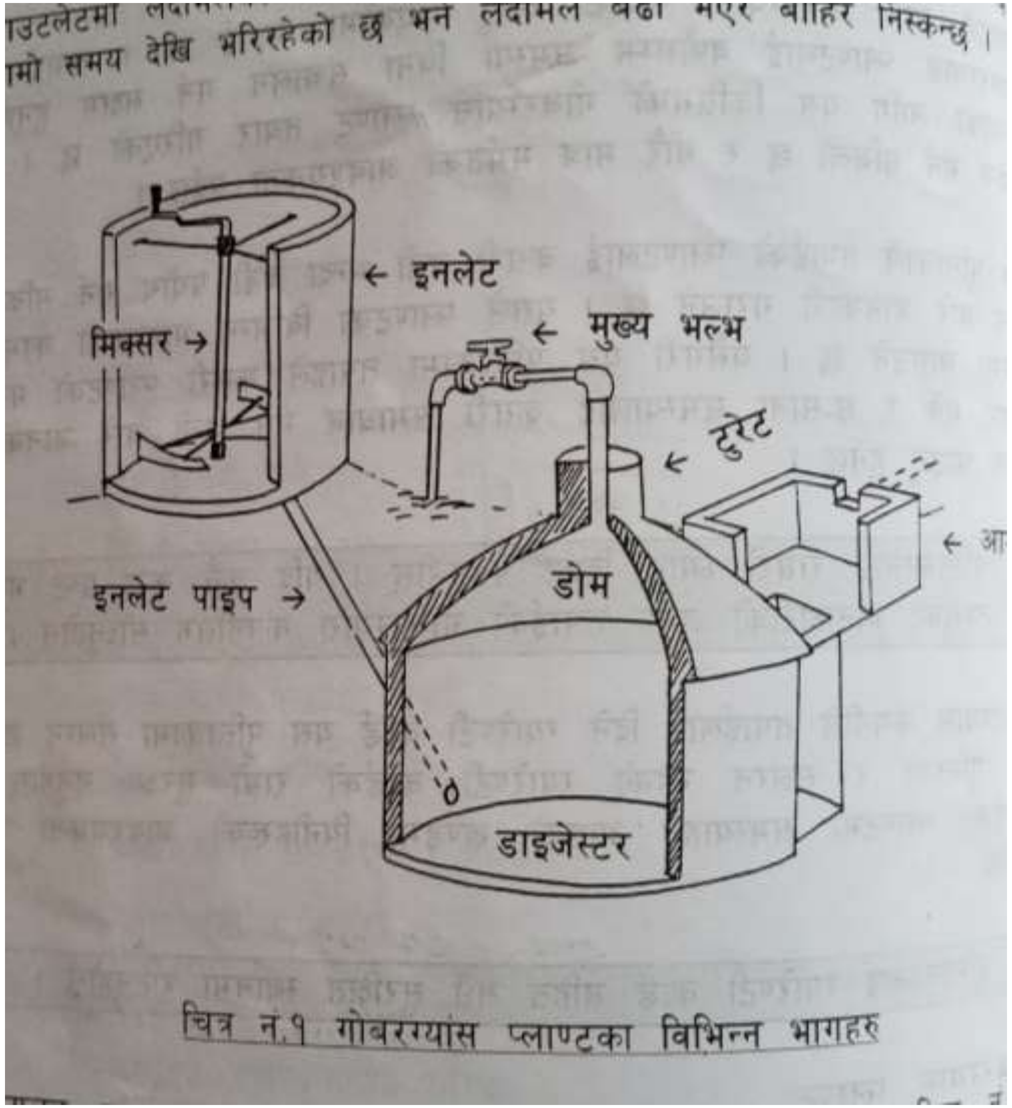
Region: Panchkhal, Nepal

Kavrepalenchok District

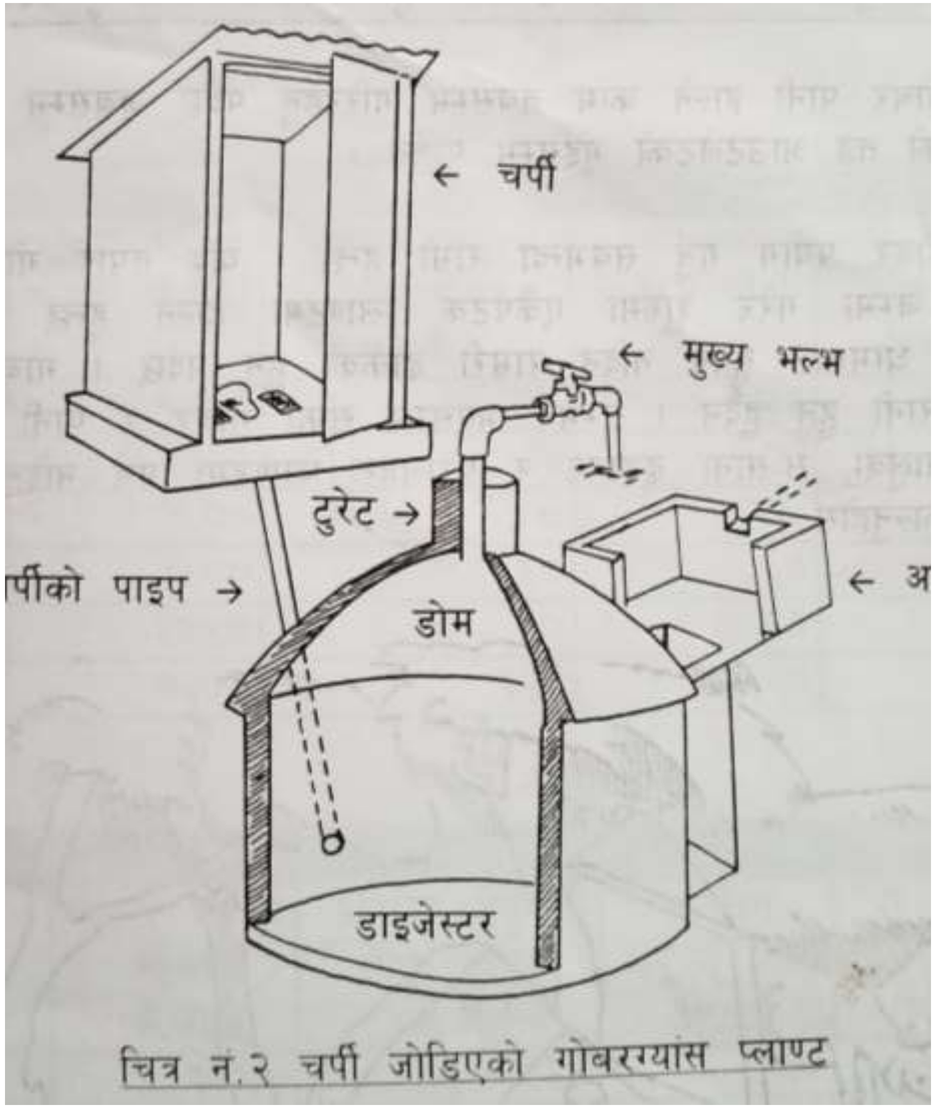
Stoves: Wood

Stoves: Biogas and LPG

Biogas System



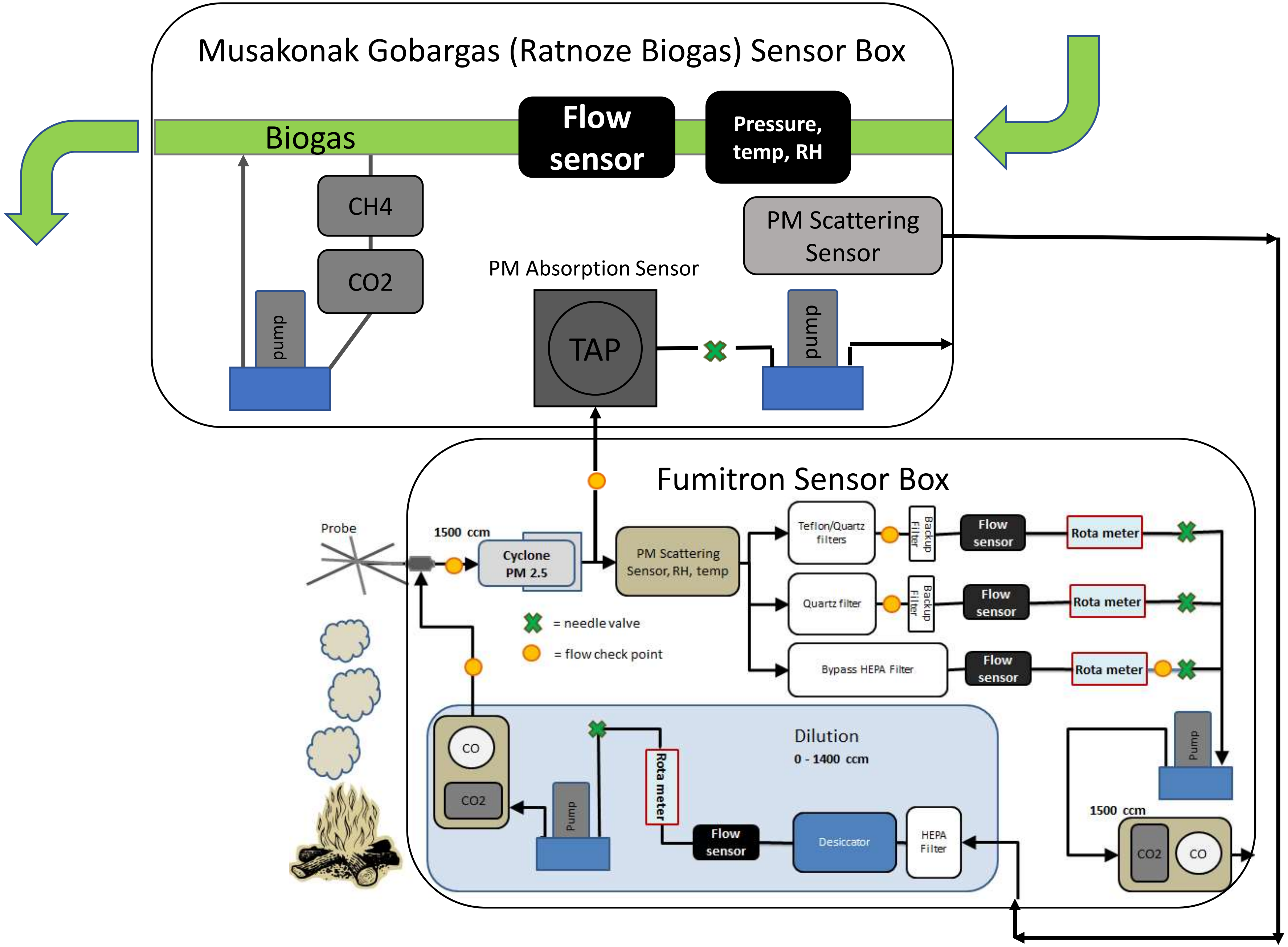
चित्र नं.१ गोबरग्यांस प्लाण्टका विभिन्न भागहरु



चित्र नं.२ चर्पी जोडिएको गोबरग्यांस प्लाण्ट

Biogas System

Measurement Equipment



Equipment

Sampling Plan

- 3 seasons (Monsoon, Spring, Winter)
- 20 homes

- 79 Cooking events measured:
  - 57 biogas
  - 16 wood
  - 6 LPG

- Variety of cooking tasks: rice, lentils, tea, boiling milk, heating water, frying vegetables, etc.

Results: Biogas Properties

	mean	standard deviation
CH_4 (%vol)	59.0	3.3
CO_2 (%vol)	26.7	4.1
C mass fraction %	41	2.0
LHV (MJ/kg)	20.9	1.8

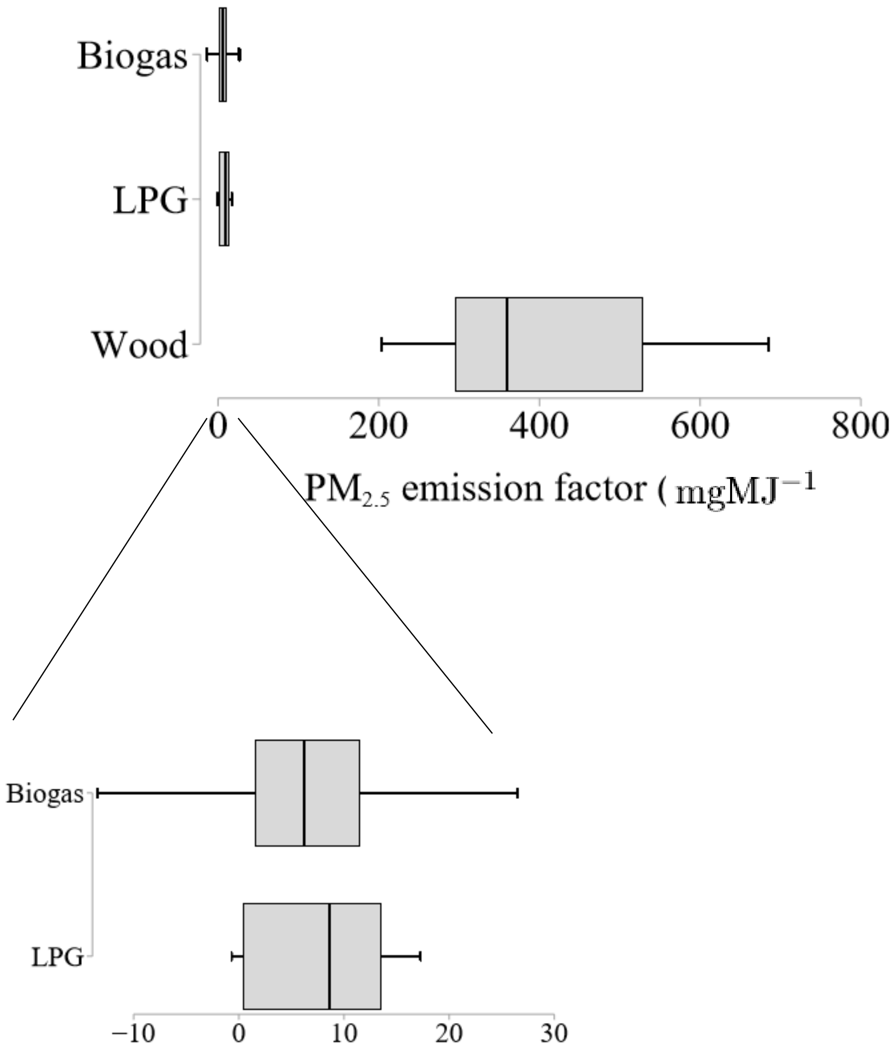
n = 57 (3 seasons, 19 samples per season)

Biogas properties were not significantly different between seasons

Results

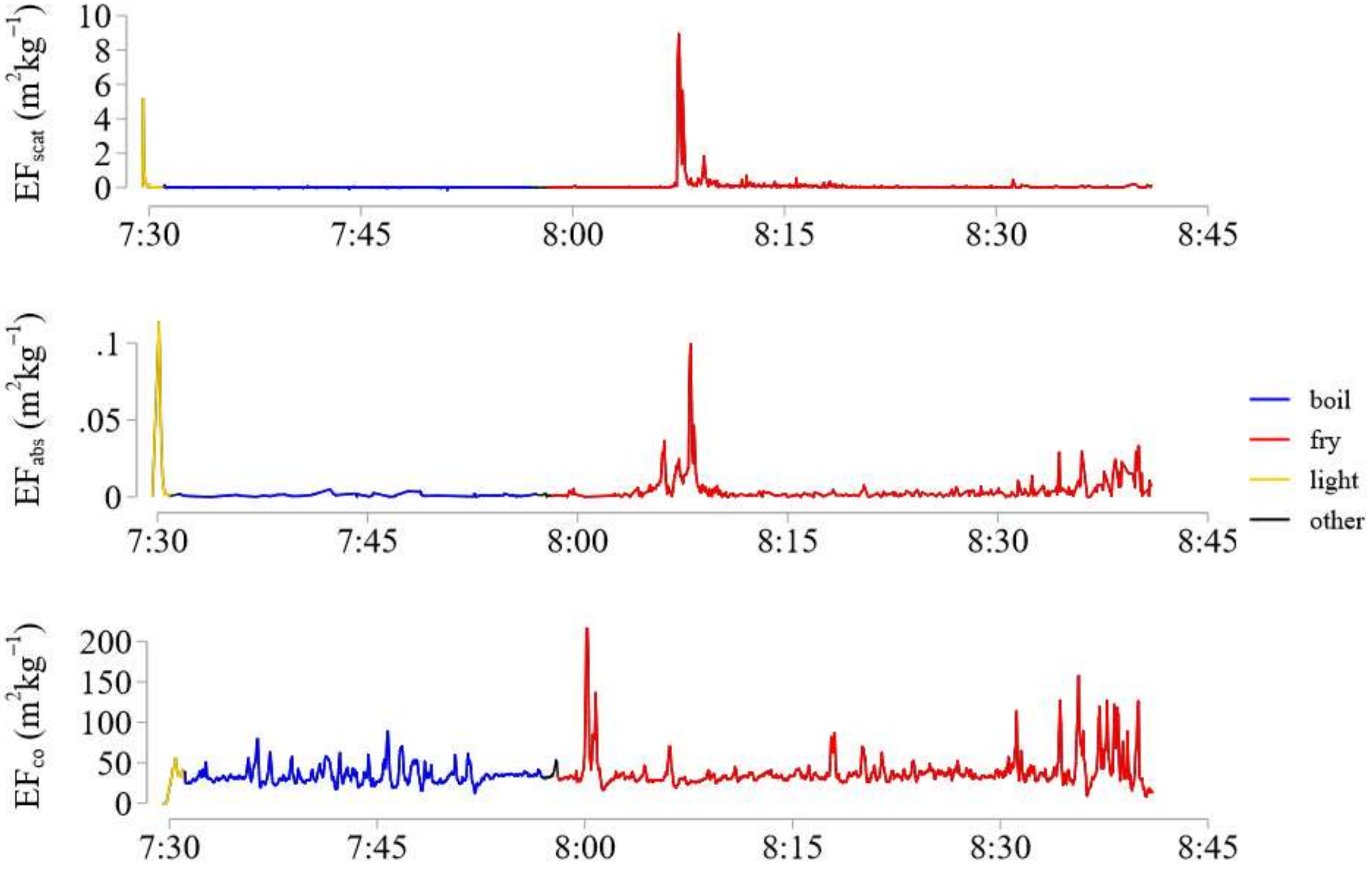
- $PM_{2.5}$ emission factors of gas cooking events are 50 times lower than wood cooking events
- EC emission factors of gas cooking events are 200 times lower than wood cooking events
- Seasonal variability – no significant difference

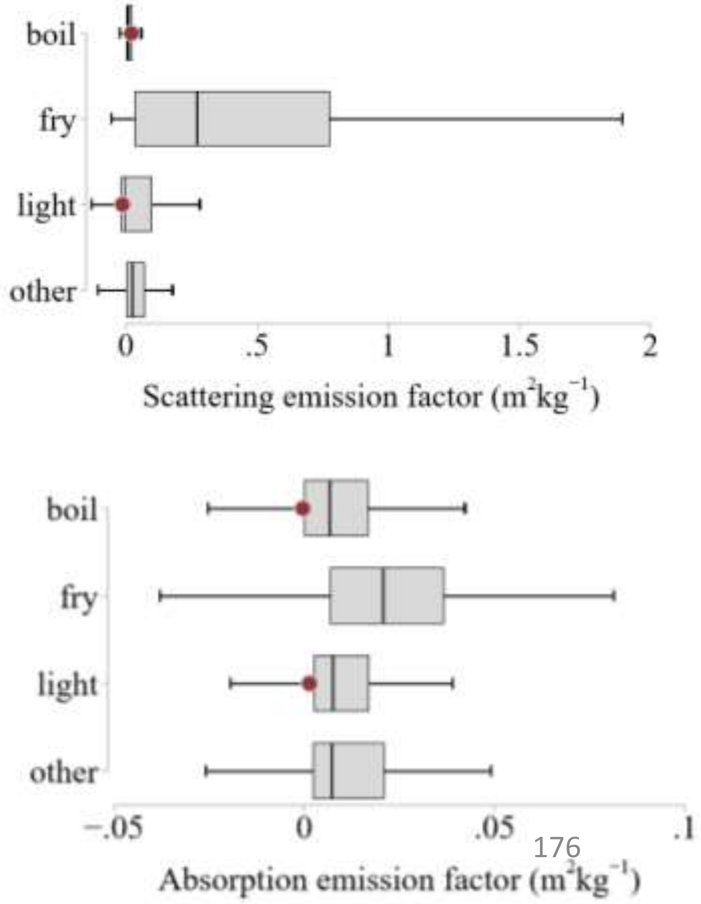
Fuel	N	EF_{CO} gMJ^{-1}	$mgMJ^{-1}$ EF_{PM} gkJ^{-1}	$mgMJ^{-1}$ EF_{EC} gkJ^{-1}
Biogas	57	1.1 (0.5)	7.4 (10.9)	0.19 (0.30)
LPG	6	0.4 (0.2)	9.5 (6.8)	0.29 (0.25)
Wood	16	5.1 (1.3)	408 (160)	45.6 (24.5)



Results: Cooking Emissions

- About 90% of $PM_{2.5}$ emissions were attributed to frying
- About 30% of EC emissions were attributed to frying
- Black carbon was a small fraction (3%) of particle emissions

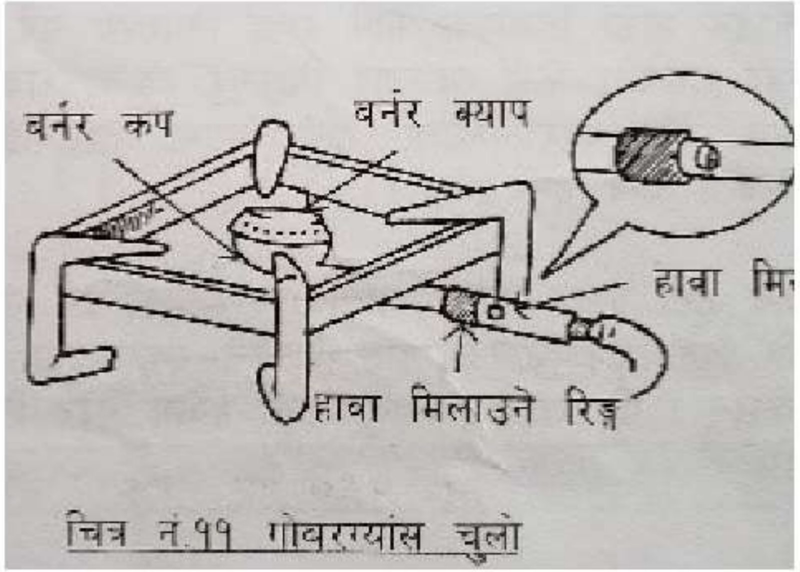




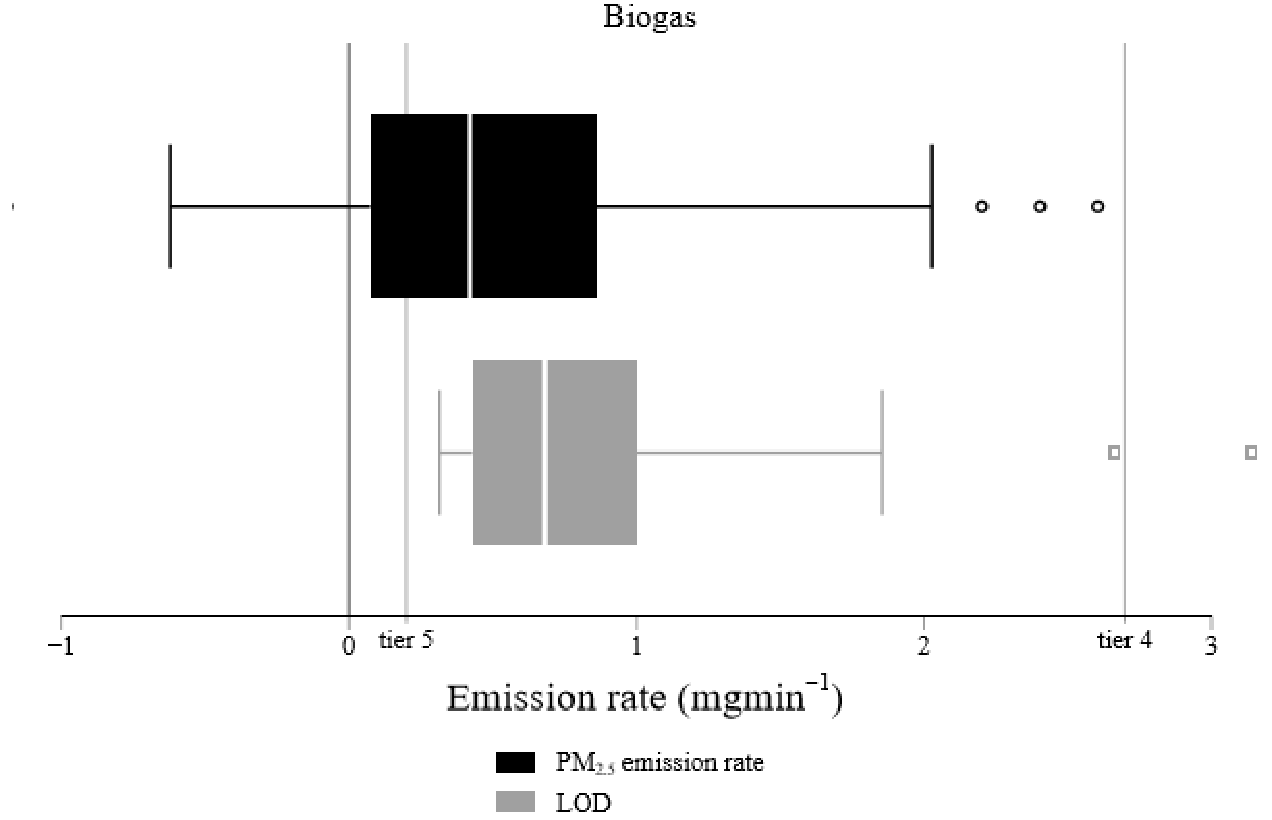
Results: CO Emissions

- Biogas stove CO emissions were approximately double LPG (not significant)
- Biogas stove CO emissions were influenced by primary air adjustment: more air = lower CO
- During a controlled lab test, CO emissions were 3 times higher when the primary air valve was closed

CO emission factor (g/kg)	mean	standard deviation
Biogas – valve open	16	4.0
Biogas – valve half open	17	4.1
Biogas – valve closed	33	9.0



Comparison with ISO Performance Targets



Performance Tiers from (International Standards Organization) ISO/TR 19867-3:2018 Clean cookstoves and clean cooking solutions -- Harmonized laboratory test protocols -- Part 3: Voluntary performance targets for cookstoves based on laboratory testing

Assumption: Thermal Efficiency of biogas and LPG stoves = 0.5

Conclusions

- Biogas and LPG stoves are clean in real-world settings
- Majority of $PM_{2.5}$ emissions are from frying food, not from the fuel
- Gas stoves do not meet all household energy needs – wood remains a major household energy source

Thanks

Contact:

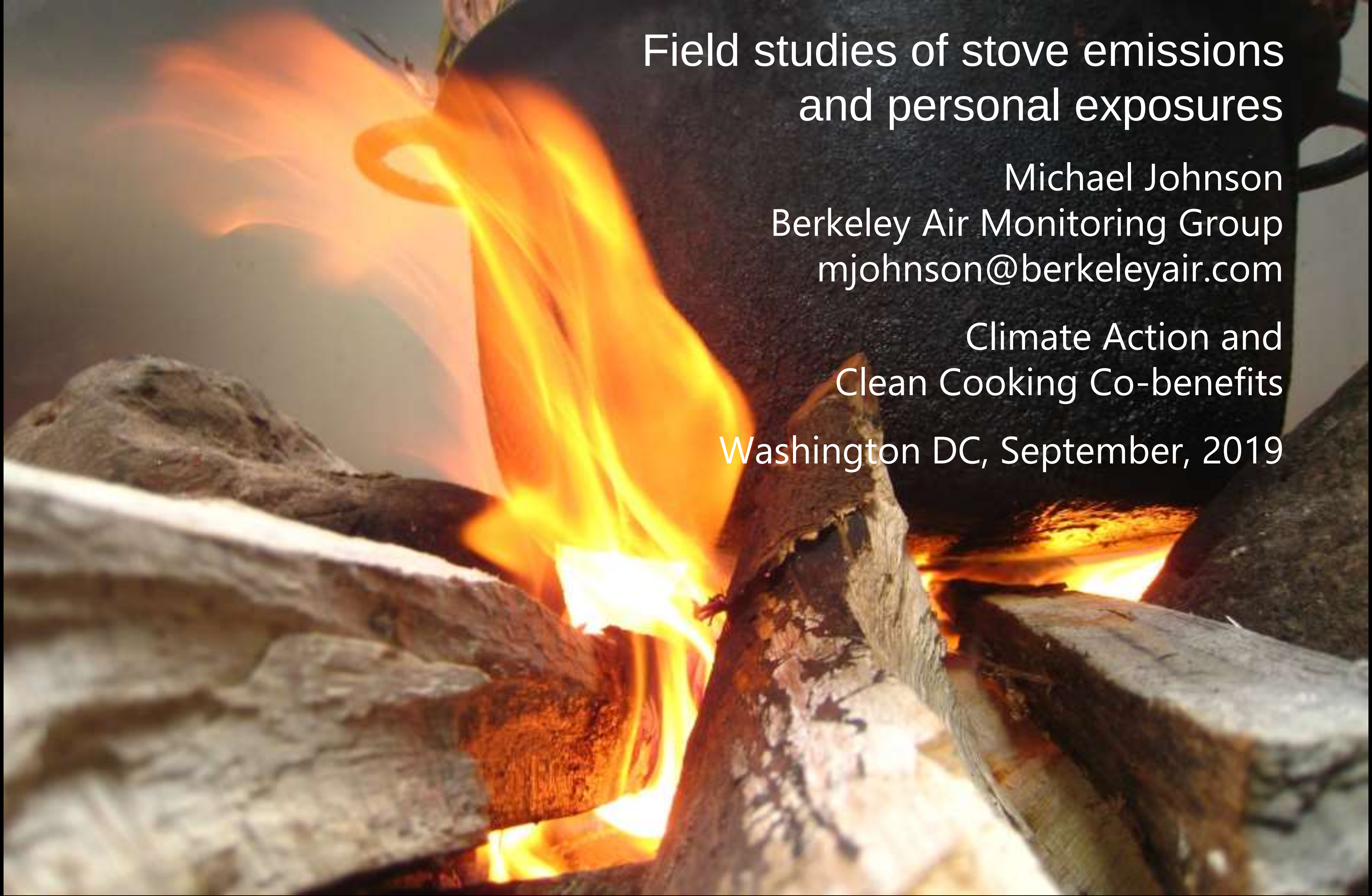
ryan@mtnaireng.com

Emissions-to-Exposure and In-home Emissions Performance, Multiple Geographies

Michael Johnson, Berkeley Air Monitoring Group

CLEAN COOKING ALLIANCE

CLIMATE & CLEAN AIR COALITION



Field studies of stove emissions and personal exposures

Michael Johnson
Berkeley Air Monitoring Group
mjohnson@berkeleyair.com

Climate Action and
Clean Cooking Co-benefits

Washington DC, September, 2019

BERKELEY AIR
MONITORING GROUP

Results from two papers (and many field studies)

atmosphere MDPI

Article

In-Home Emissions Performance of Cookstoves in Asia and Africa

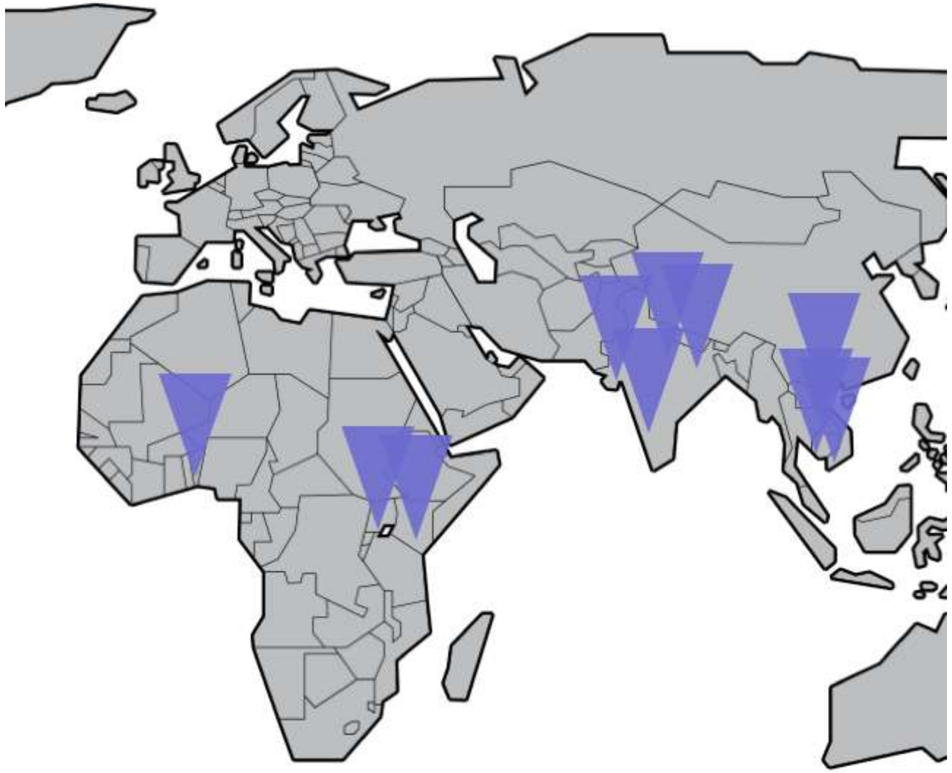
Black carbon cookstove emissions: A field assessment of 19 stove/fuel combinations

Johnson, M.A., Garland, C.R., Jagoe, K., Edwards, R., Ndemere, J., Weyant, C., Patel, A., Kithinji, J., Wasirwa, E., Nguyen, T., Khoi, D.D., Kay, E., Scott, P., Nguyen, R., Yagnaraman, M., Mitchell, J., Derby, E., Chiang, R.A., Pennise, D., 2019. In-Home Emissions Performance of Cookstoves in Asia and Africa. Atmosphere, Real World Air Pollutant Emissions from Combustion Sources 10. https://doi.org/10.3390/atmos10050290

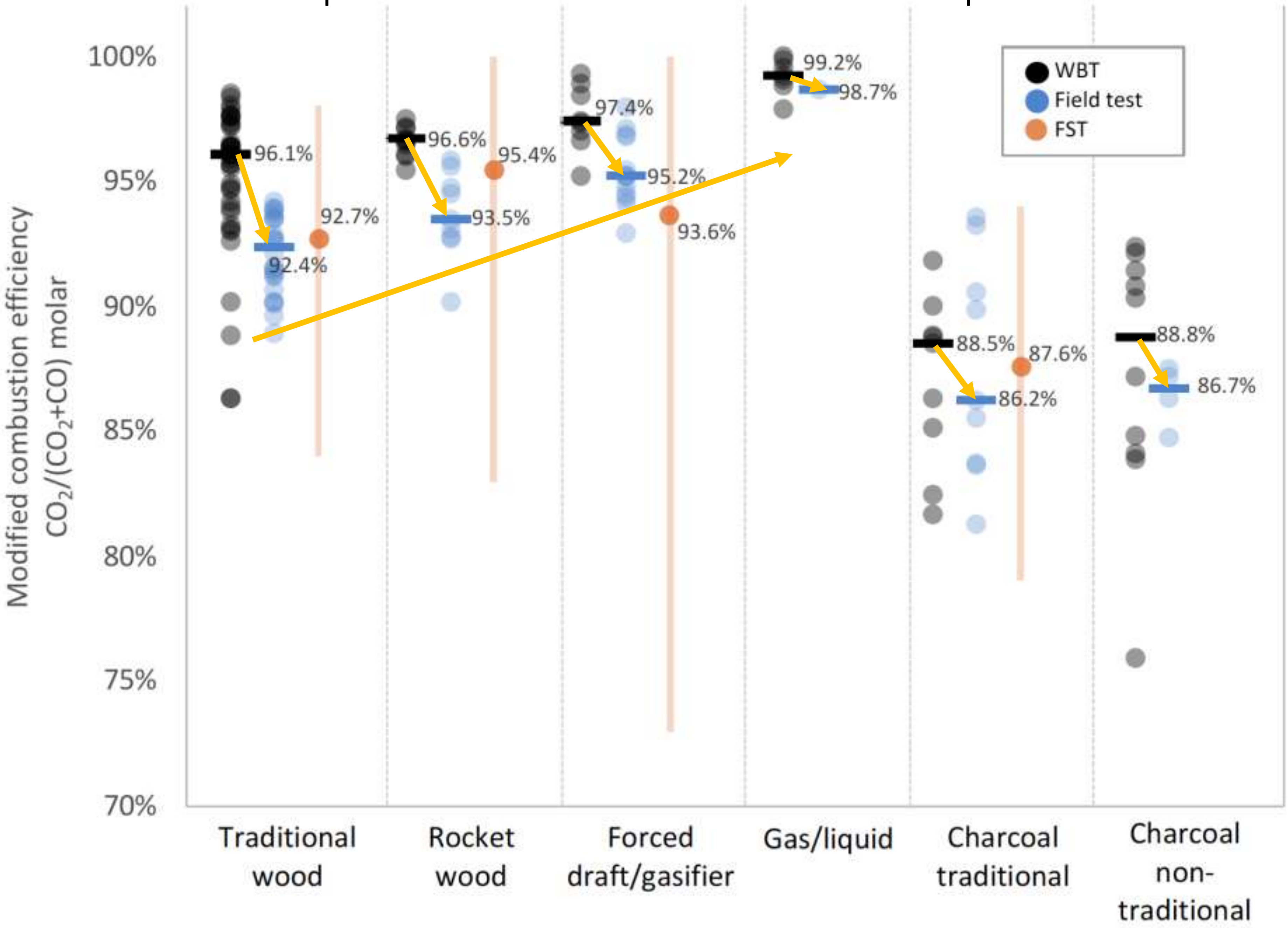
Garland, C., Delapena, S., Prasad, R., L'Orange, C., Alexander, D., Johnson, M., 2017. Black carbon cookstove emissions: A field assessment of 19 stove/fuel combinations. Atmospheric Environment 169, 140–149. https://doi.org/10.1016/j.atmosenv.2017.08.040

Overview

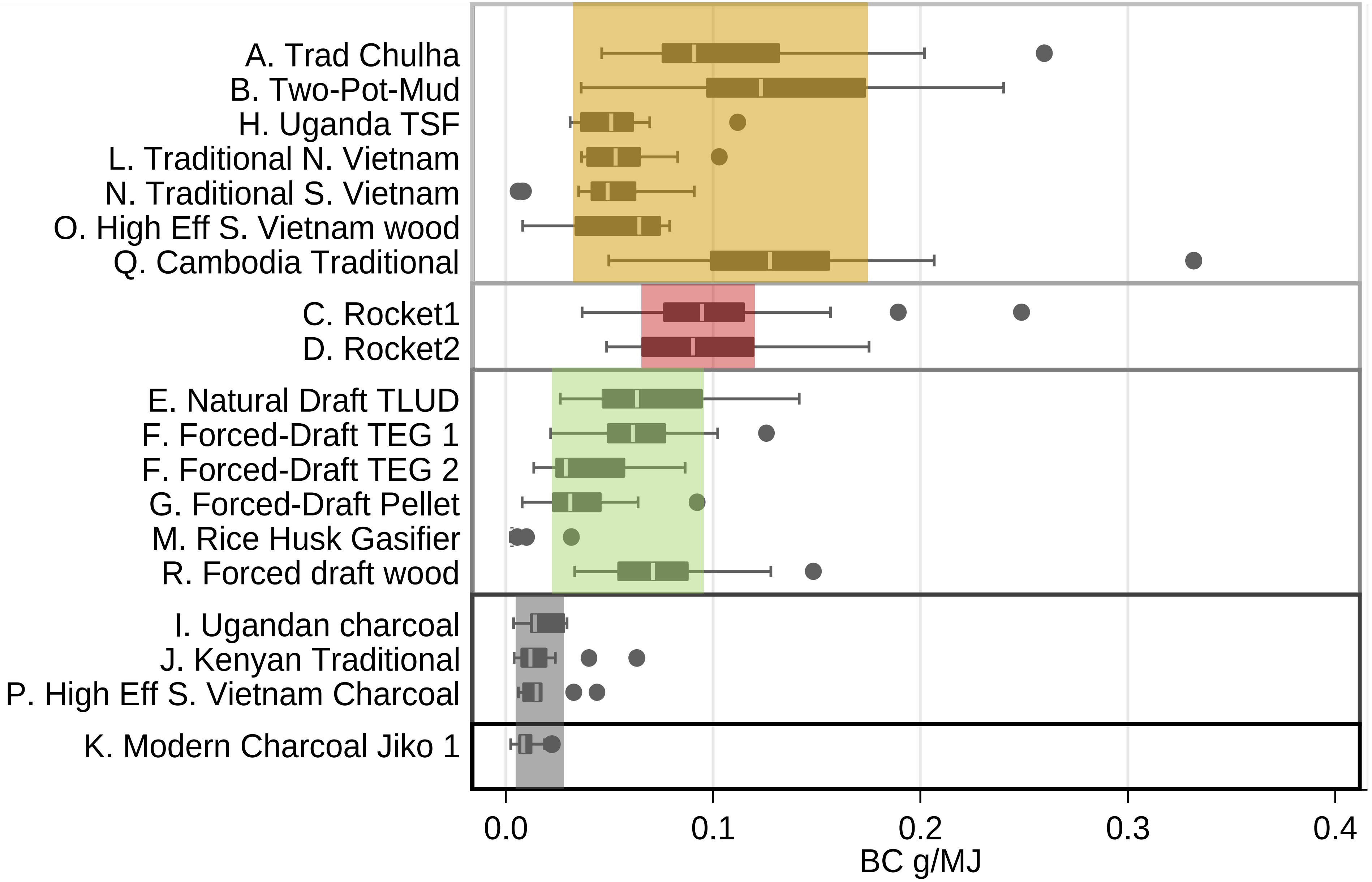
- Uncontrolled cooking tests in homes (single events)
  - Over 500 samples from 19 stove/fuel combinations
- Emission factors estimated using the partial capture/carbon balance method
- CO_2, CO, BC, CH_4, TNMHC
- Per event fuel consumption
- Stove/fuel categories
  - Traditional wood
  - Natural draft wood
  - Forced draft wood/pellets
  - Traditional charcoal
  - Modern charcoal
  - LPG



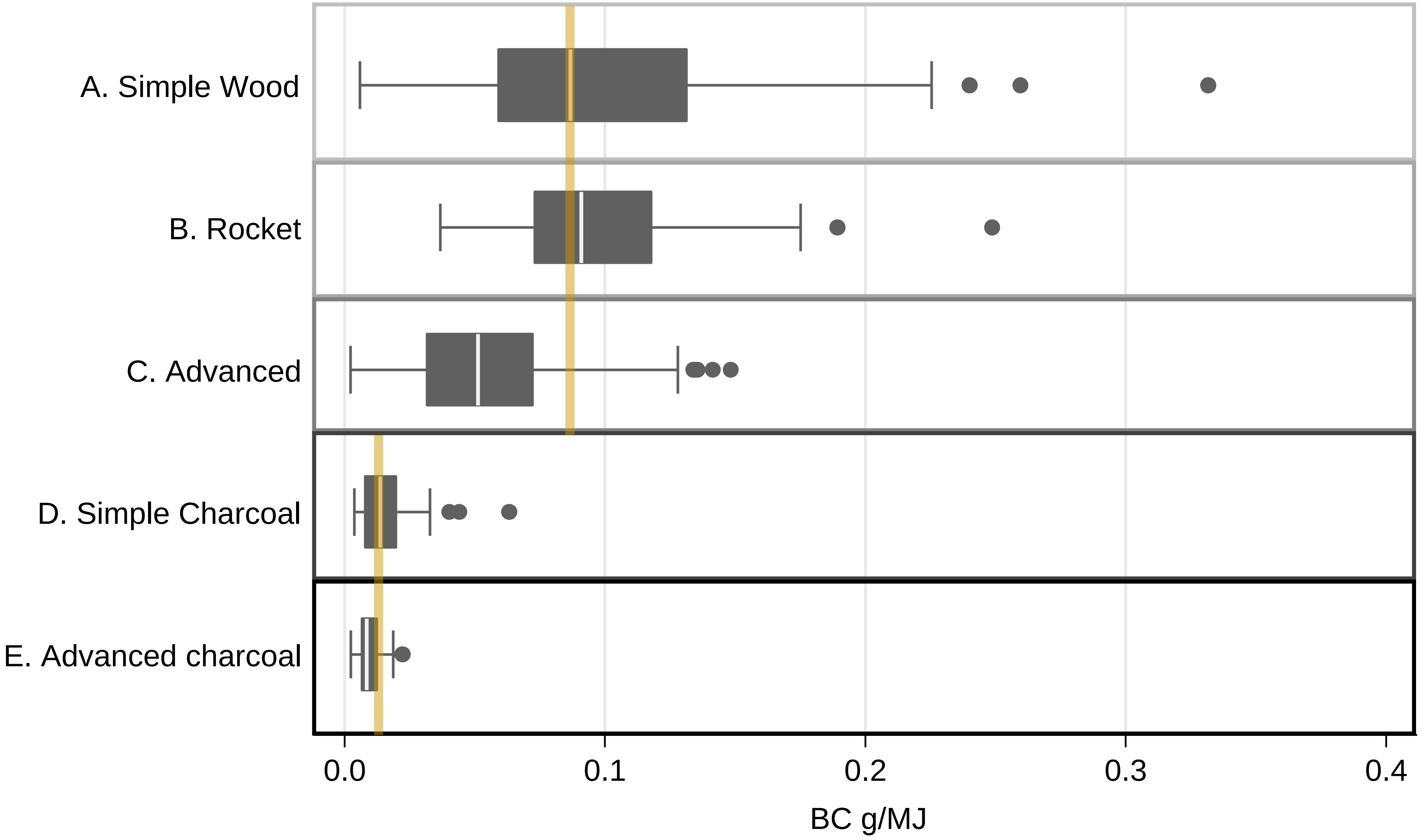
Field and lab performance…. and newer lab performance

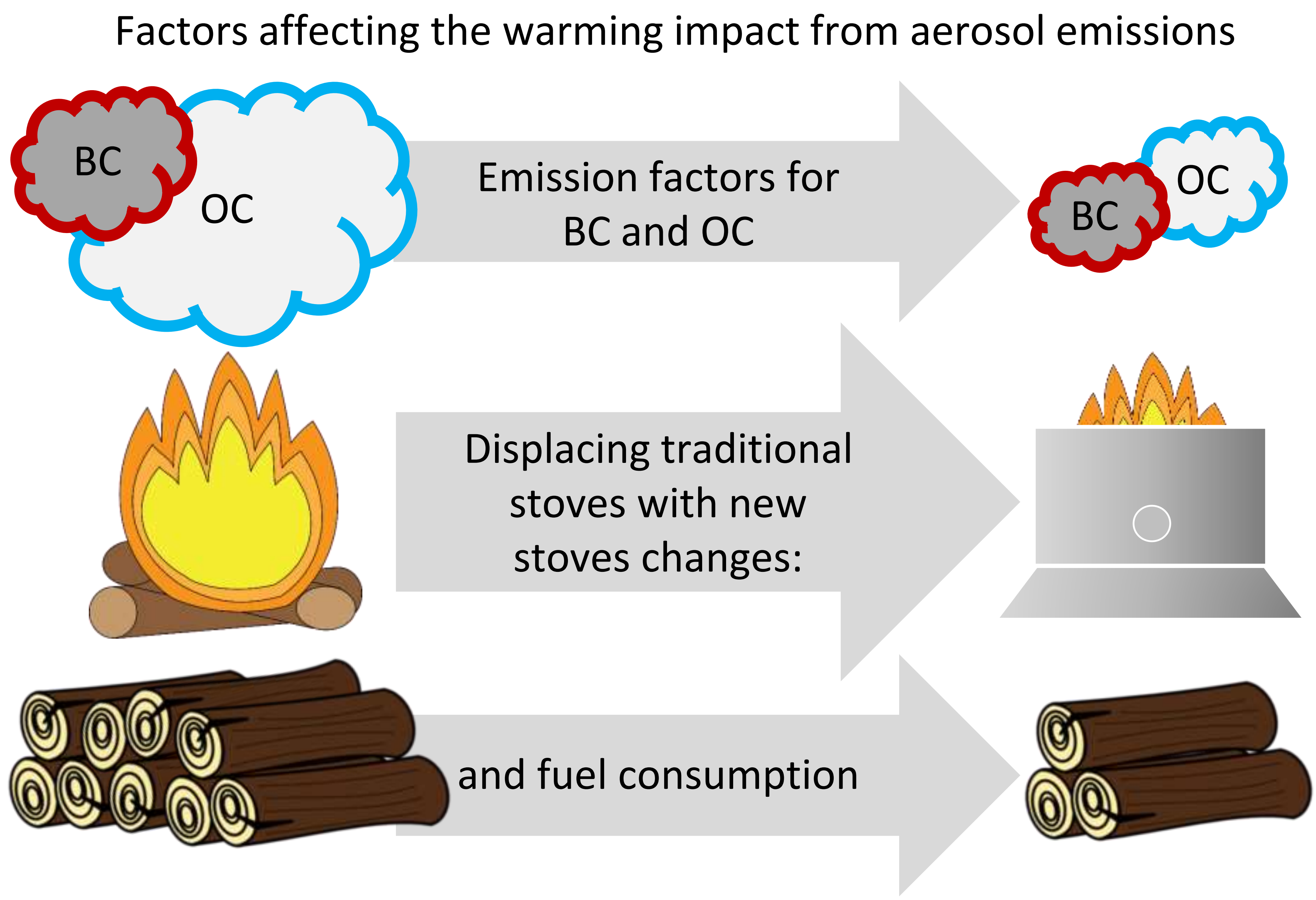


Black carbon emission factors

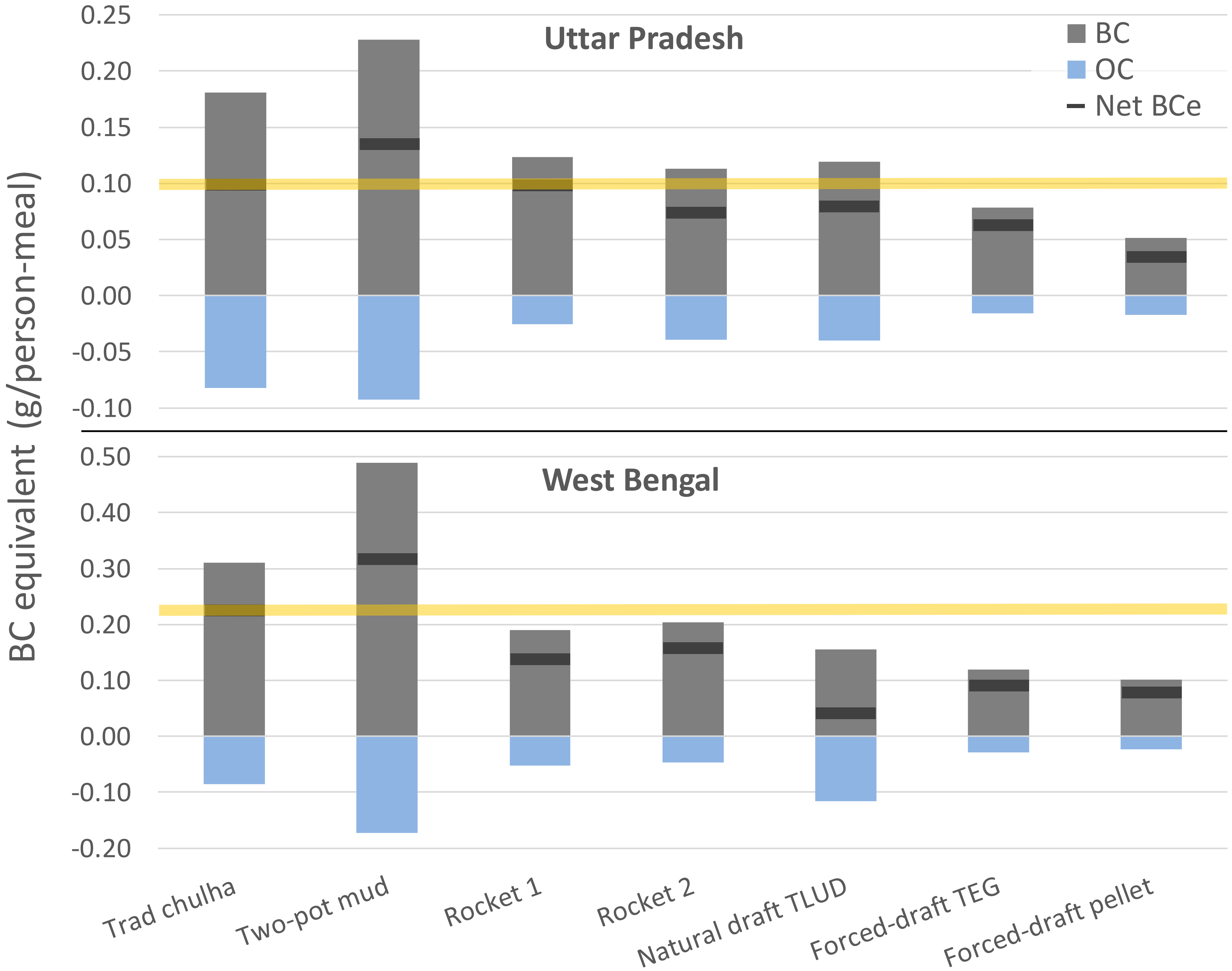


BC emission factors by stove class



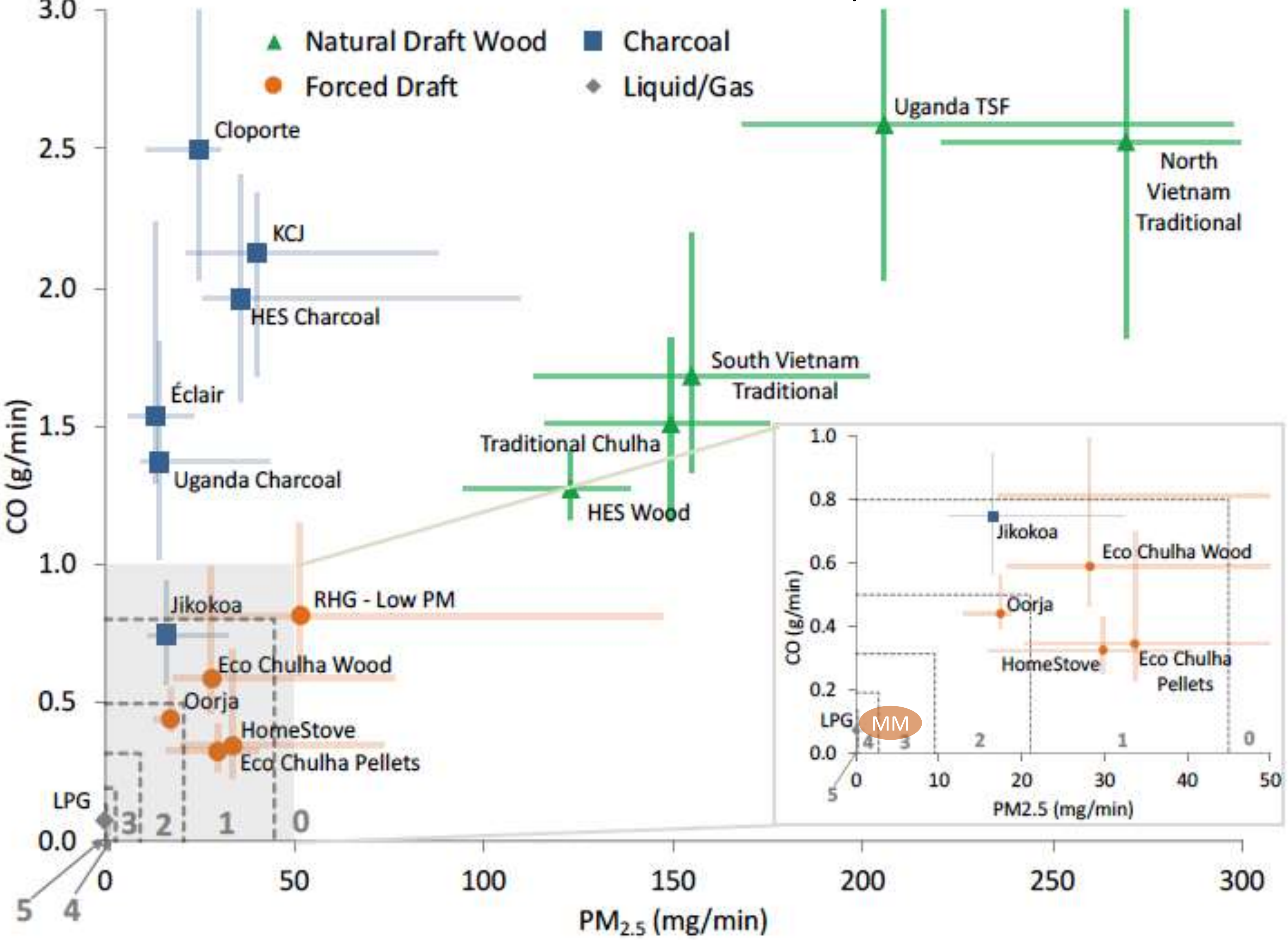


Other factors impacting climate forcing: Extent of displacement, geography, weather, modeling assumptions, co-emitted pollutants, brown carbon, fuel renewability, etc…



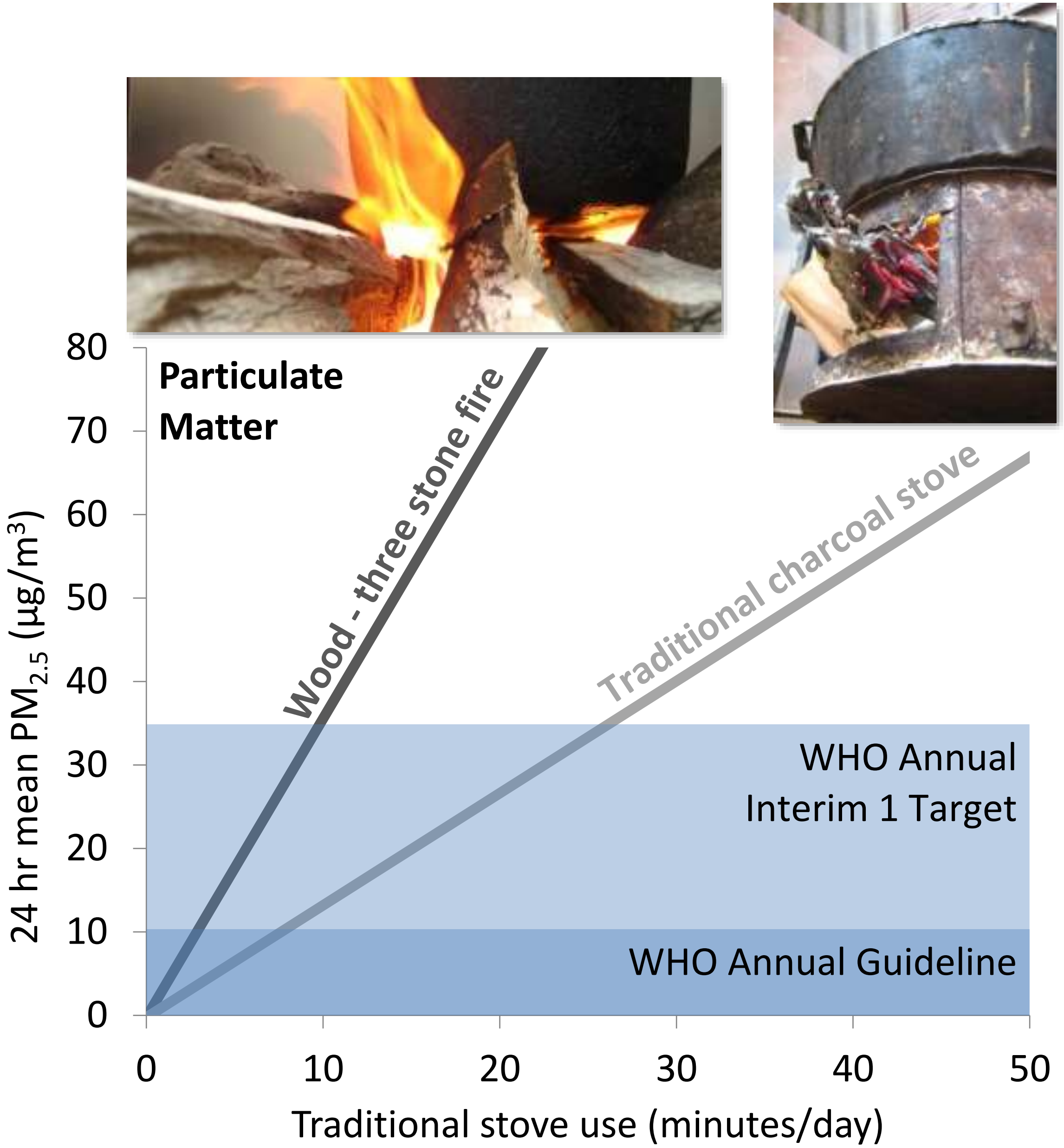
BC equivalent (g/person-meal)
Uttar Pradesh
BC
OC
Net BCe
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
West Bengal
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
Trad chulha
Two-pot mud
Rocket 1
Rocket 2
Natural draft TLUD
Forced-draft TEG
Forced-draft pellet

Emissions and health implications



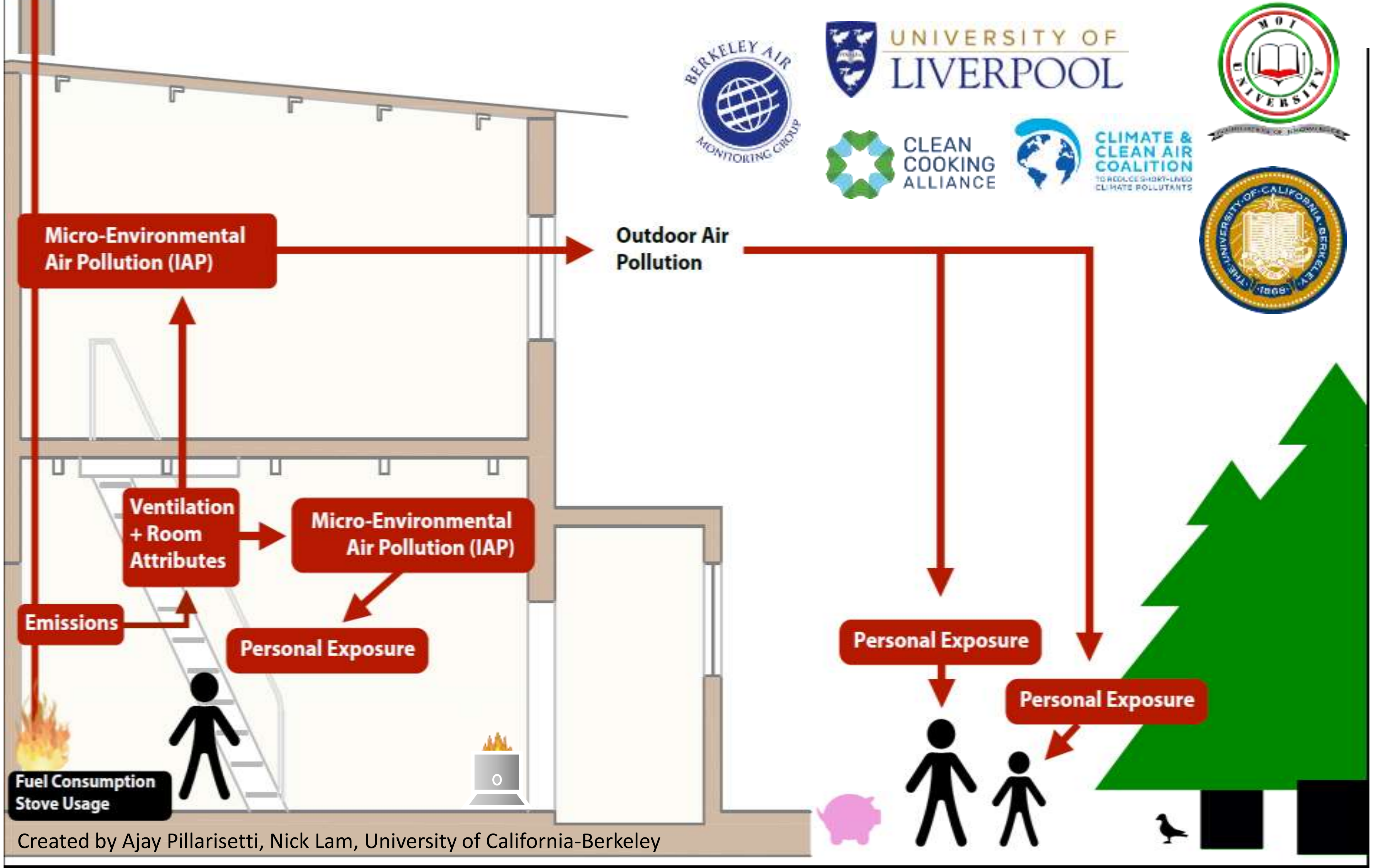
Need to account for how much the baseline technology is displaced

And other factors which impact personal exposure…

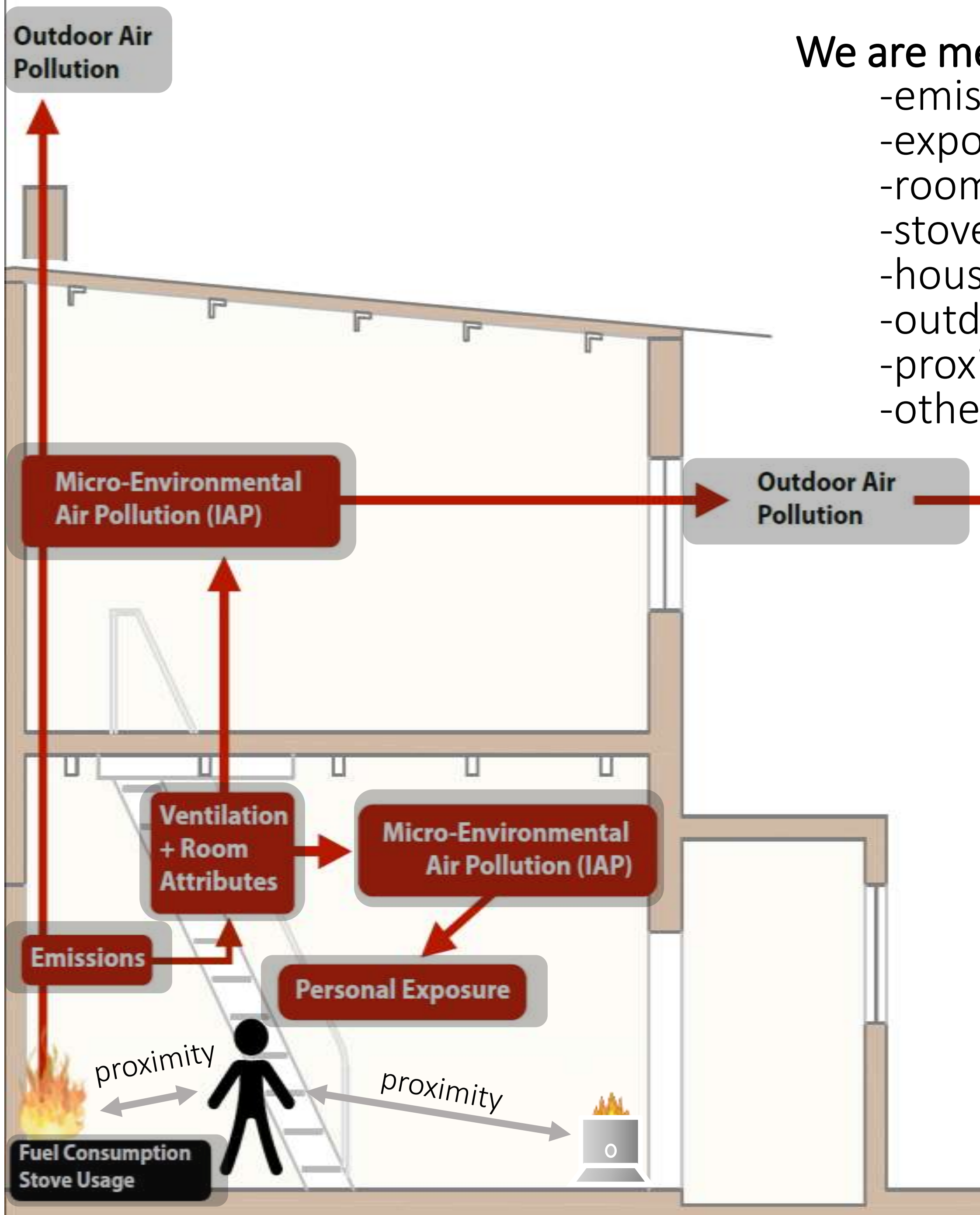


Johnson, M.A., Chiang, R.A., 2015. Quantitative Guidance for Stove Usage and Performance to Achieve Health and Environmental Targets. Environmental Health Perspectives. https://doi.org/10.1289/ehp.1408681

Emissions-to-Exposure (E2E): How can we better and/or more simply model personal exposure?



Created by Ajay Pillarisetti, Nick Lam, University of California-Berkeley



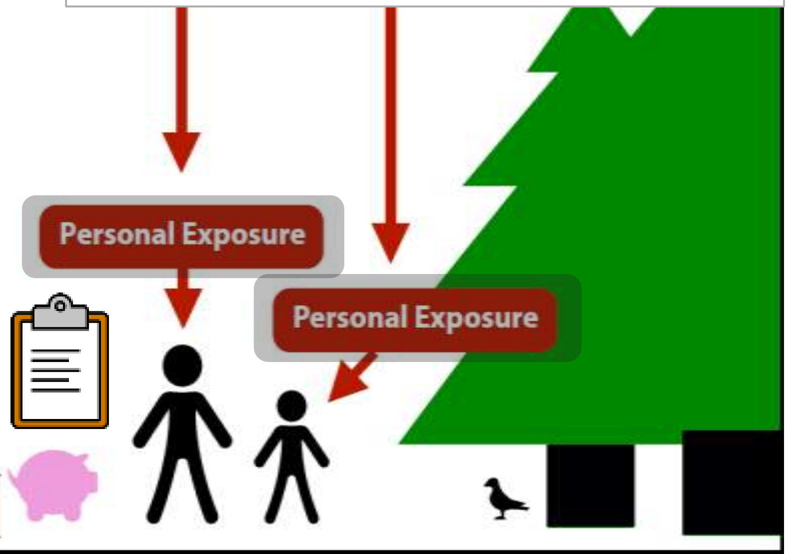
Created by Ajay Pillarisetti, Nick Lam, University of California-Berkeley

We are measuring:

-emissions (multiple sources)
-exposures
-room characteristics
-stove usage
-household concentrations
-outdoor concentrations
-proximity to emissions sources
-other observations/behavior (survey)

Modelling approaches:

- Build on the ISO/WHO box model (physical model)
- Mixed-model (regression)
- Computer learning model



New lab protocols may better predict lab performance

There are well-performing stoves/fuels, but displacement of traditional technology is critical

Hope to soon have new tools/models to more cost-effectively estimating exposures

mjohnson@berkeleyair.com
www.berkeleyair.com

BERKELEY AIR
MONITORING GROUP

Discussion Questions

- *What did you hear that surprised you?*
- *Based on what you've heard, are there things that you would consider doing differently?*
- *What kind of support would you need to apply these changes?*
- *What gaps remain as it relates to carbon finance and/or RBF?*

Coffee Break (15 mins)

3:30-3:45

5 Part II—Research update continued: what gaps are being filled

Drudgery Methodology

Ken Newcombe, C-Quest Capital

Drudgery Reduction and Other Co-Benefits Monetization

CQC Focus: Women's and Children's Health

- Carbon Finance is a means to an end.
  - With Global Carbon Market collapse in 2011 CQC looked to monetization of Co-Benefits for business continuity:
- **Health**:
  - **Reduction exposure to HAP (ADALYs):** proof of concept work in Laos with World Bank 2012-2015; co-managed Gold Standard ADALY methodology 2016-2017;
  - **Drudgery Reduction:** "unspoken" Health damages (spinal, muscle tissue, physical risk) plus rural women's most valuable resource- time; baseline and intervention research underway for SDVista methodology;
  - **Burn reduction**: a collateral benefit
- **Adaptation**:
  - reduction of land and watershed degradation; integration of efficient stoves in conservation agriculture (Ongoing).

CQuestCapital

200

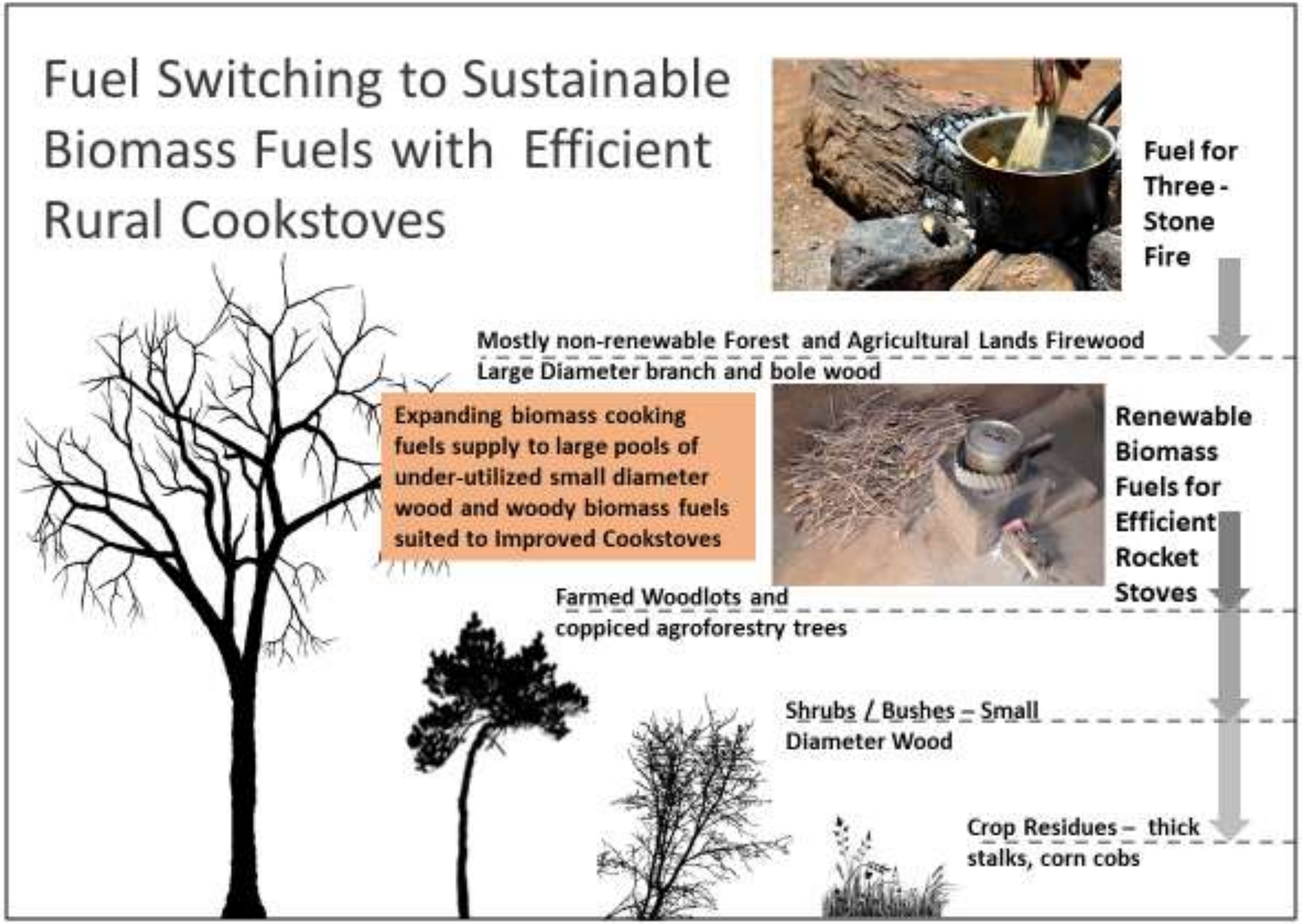
CQC's Drudgery Reduction Methodology

- **Objective**
  - Create a pool of flexible capital at the household level for improving women and girl's health, well-being and economic prosperity.
- **Method**
  - Forward sale of projected time savings from sustained use of a durable efficient cookstove replacing open-fire cooking;
- **Basis**
  - independently assessed annual time savings over 7 years assuming declining stove use fleet-wide of 15% per annum
- **Opportunity**
  - ~ 730 hours per year reduction in time spent cutting, carrying and cooking. Discounted value ~2800 hours saved over 7 years sold at $0.05-0.10/hour.
- **Delivery Agents**: NGOs, small enterprises. Services unique to local agents (energy, health, education, new products/markets, transport) e.g. COMACO

CQuestCapital

201

Switching to small-diameter twigs and crop residues virtually eliminates the burden of gathering firewood over long distances, reducing the risk of muscle and spinal damage, and reducing risk of physical abuse. Women can regain ~2 hours per day that can be used for other productive activities of their preference.



Switching from large diameter firewood harvested from live trees to finger-sized twigs and crop residues from sustainable resources helps Sub-Saharan Africa countries meet their renewable bioenergy goals under the Paris Agreement NDCs.

CQuestCapital

The TLC-CQC stove enables cooking to be fueled with small-diameter branches, twigs and crop stalks and corn cobs that are fast growing, readily available and 100% renewable. Stacking fuel behind the stoves against walls that reach 150-170 degrees F dries them further and helps with near smokeless combustion.

CQuestCapital

Before and After Impact Assessment Analysis

- **Research Design and Management:** Berkeley Air Monitoring Group
- **Funding**: CQC 80%, KfW Foundation 20%
- **Location**: Eastern Province, Zambia (2 villages, 75 households of 100 converted to CQC's stove)
- **Status**: Baseline completed in August; intervention stoves built; two-month intervention phase started; new focus groups and surveys in November, results December, 2019;
- **Summary of Baseline Results**:
  - Most disliked tasks: gathering firewood, working on land
  - Hours a week spent collecting, cutting and carrying (CCC) : ~5 hrs
  - Cited risks of CCC: snakes, insects, falling and men.
  - Cooking is moderately favored task; 3 hours/day (but as expected, no indication tat smoke is a health hazard in attending open fire cooking)
- **CQC Guess of outcomes**:
  - ~80% reduction in CCC, 40% reduction in cooking time. Overall, ~2 hours a day reduction

CQuestCapital

205

Summary of CQC Rural Cookstove Project Benefits

Reduction in Competition for Firewood with industry (brick-making, tobacco)

Fuel Switching to sustainable crop residues and small diameter branches/twigs on-farm wood

Climate Benefits

Gender Benefits

Improved Health Outcomes for Women and children (PM 2.5, spinal, muscle damages and burns)

Climate change mitigation from avoided CO2, Black Carbon , N2O & Methane

Time-savings,d Drudgery Reduction for women and girls

Adaptation to climate change and improved climate resilience

Health Benefits

206

Planned Study on Reviewing Available Methodologies

Zijun Li, The World Bank

Korean ETS

Kyunghwa Jeon, Ecoeye

ECOEYE

www.ecoeye-int.com

The State of the Korea ETS :

the Novel Opportunity for Cooperation

Kyunghwa Jeon (Kay)

Project Portfolio Manager

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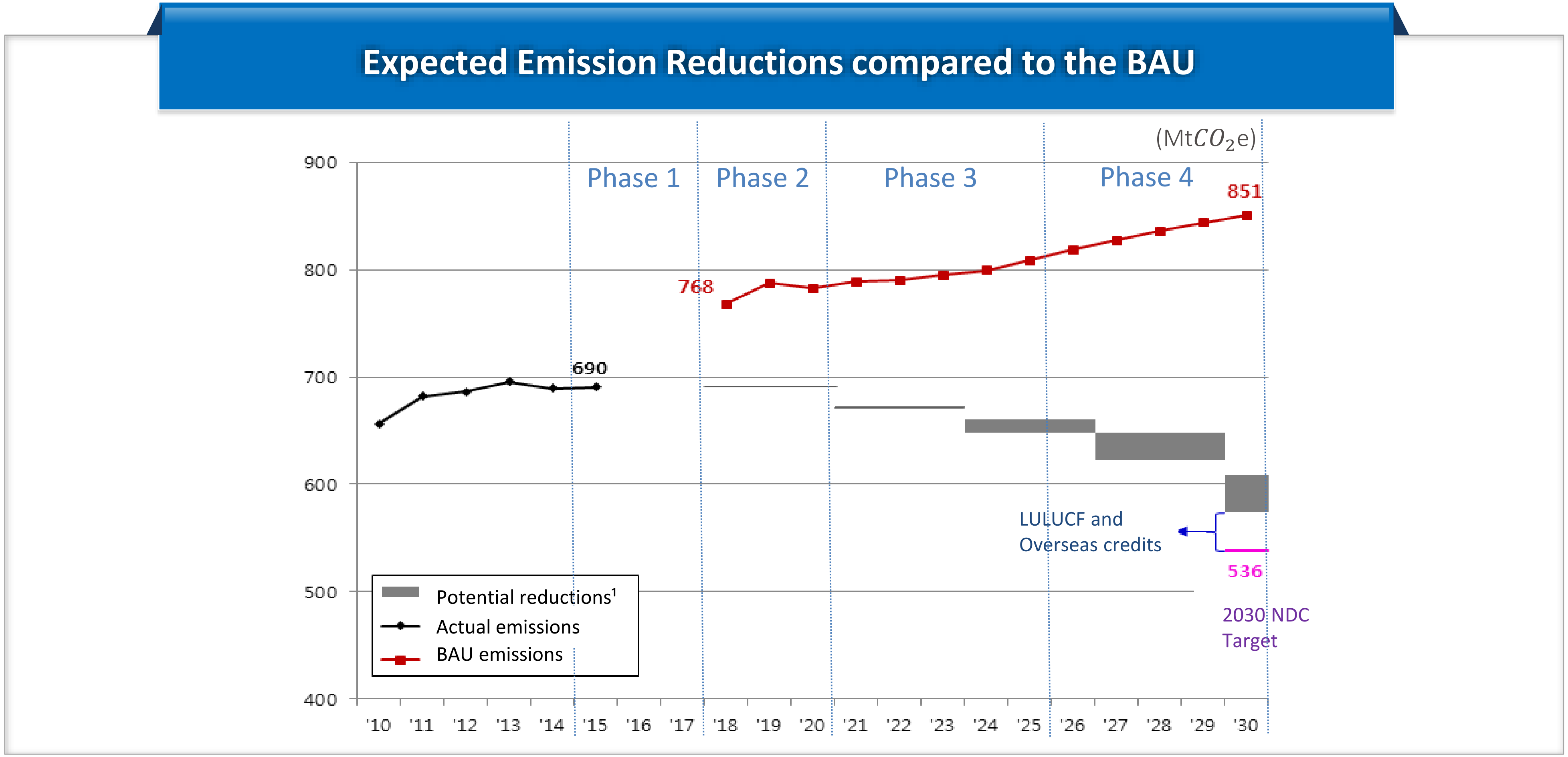
CONTENTS

01 2030 GHG Reduction Roadmap

- **Limit the 2030 GHG emissions to 536 Mt, or 37% below BAU**



1) Additional potential reduction amount for the Energy Sector

02 Phase 1 Market Analysis

- **Both KAU and Emissions has increased 2-5% annually, net balance was 37 Mt surplus**

Phase 1 Allocation & Emission Trend

($KtCO_2e$)

	Phase 1			
	2015	2016	2017(E)	Total
Allocated 'KAU' (A)	540,730	559,766 (+3.5%)	590,032 (+5.4%)	1,690,527
Emissions (B)	542,641	554,399 (+2.2%)	571,894 (+3.2%)	1,668,934
Offsets 'KCU' (C)	8,833	3,261	3,295	15,389
Balance (A-B+C)	6,921	8,628	21,433	≒ 37,013

Considering unconverted 6 Mt KOCs, total surplus was more than 43 Mt

- KAU: Korean Allowance Unit
- KCU: Korean Credit Unit
- KOC: Korean Offset Credit

03 Phase 2 Supply & Demand Forecasts

- **Anticipating 12.3 to 27.8 Mt Shortfall, 42% of the net balance during the first phase**

Estimated Surplus in Phase 2 by Scenarios

($MtCO_2e$)

Classification		2018	2019	2020	Total
Supply (A)	Pre-allocation[1]	572.2	538.6	538.8	1,649.6
	Carry-over (Phase 1)	37.0	-	-	37.0
	Offset Credits[2]	10.67	3.36	4.86	18.9
	Other Reserves (Power/Conversion)	20.9	20.9	20.9	62.7
Estimated Emissions (B)	Optimistic	602.0	603.1	591.0	1,796.0
	Reference	599.4	600.5	588.4	1,788.3
	Pessimistic	596.8	597.9	585.9	1,780.5
Balance (A-B)	Optimistic	+38.8	-40.2	-26.4	-27.8
	Reference	+41.4	-37.6	-23.9	-20.1
	Pessimistic	+44.0	-35.0	-21.3	-12.3

1) Phase 2 of the ETS (2018 ~ 2020)
2) Based on KOC's domestic / overseas projected volume (2018.06) analyzed by Ecoeye

04 Phase 2 Price Forecasts

- Expecting gradual growth, with the price range between KRW20,000 to 30,000 (USD17~27)

Phase 1 Actual Prices and Phase 2 Expected Prices

05 Eligibility of Foreign Offsets

▪ An overseas CDM project directly implemented by "Korean domestic enterprises"

1. Korea ETS compliance entities
2. Enterprises registered under the Commercial Act in Korea
3. Foreign subsidiaries that are wholly-owned by domestic enterprises(1,2)

❖ A Korean Entity shall be a PP on a PDD or CPA-DD, or FP of the MoC at the first registration point of the UN CDM project

Case of A	Case of B	Case of C	Case of D
▪ Own at least 20% equity stake in the reduction facility	▪ Own at least 20% voting shares in the project owner/operator	▪ Sell/distribute a reduction technology for at least 20% of the total project cost	▪ Co-fund a reduction project with the Korean central/local government or foreign governments ▪ LDCs or LIEs only

❖ Eligible Credits & Volume

CERs issued only after June 1, 2016

Eligible Volume = total emission reduction x contribution ratio

06 Potential Risks

- Uncertainty regarding the rule changing in the Post 2020 (Paris Agreement Article 6.4)

Predictable Threats

❖ Korean Offset Rule
- Changing the rule
- New eligibility for using international offset credits
- Priority of a project for NDC achievement

❖ Risks about the transition from CDM to Article 6.4
- Ceasing CDM after 2020
- Stopping CER issuance after a certain point
- New criteria for the transition

Hedging Points

- Once a CDM project is registered as an offset project under Korea Offset Registry System (ORS), it could be secured the conversion of the CERs from the project to KOCs

The End

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Discussion Questions

- *What are the current opportunities?*
- *What are the challenges?*
- *How does this differ from biomass fuels?*

Reception at Alliance Offices

5:00-7:00

Day-2 Agenda 9:00-4:30

Setting the stage and goals

The role of black carbon

Part III—Current applications of research: resources, tools, and MRV best practices-ISO standards

Part III—Current applications of research: resources, tools, and MRV best practices

Part IV—Where we go from here

CLEAN COOKING ALLIANCE

CLIMATE & CLEAN AIR COALITION

1 Setting the stage and goals

Objectives

The objective of this workshop is to increase the effectiveness of clean cooking programs as sustainable climate action that realize quantifiable co-benefits for the environment and air pollution.

- Day 1 & 2—Disseminating the latest evidence on the relationship between cookstove emissions and health and climate impacts;
- Day 1 & 2—Identifying the regulatory, technological, and financial barriers to the effective implementation of clean cooking projects deployed through climate finance (or with other results-based Finance—RBF—mechanisms); and
- Day 2 & 3—Identifying solutions to address the identified barriers based on the lessons learned from project developers and the most up-to-date science on emissions, technology, measurement, and policy.

2 The role of black carbon

CLEAN COOKING ALLIANCE

CLIMATE & CLEAN AIR COALITION

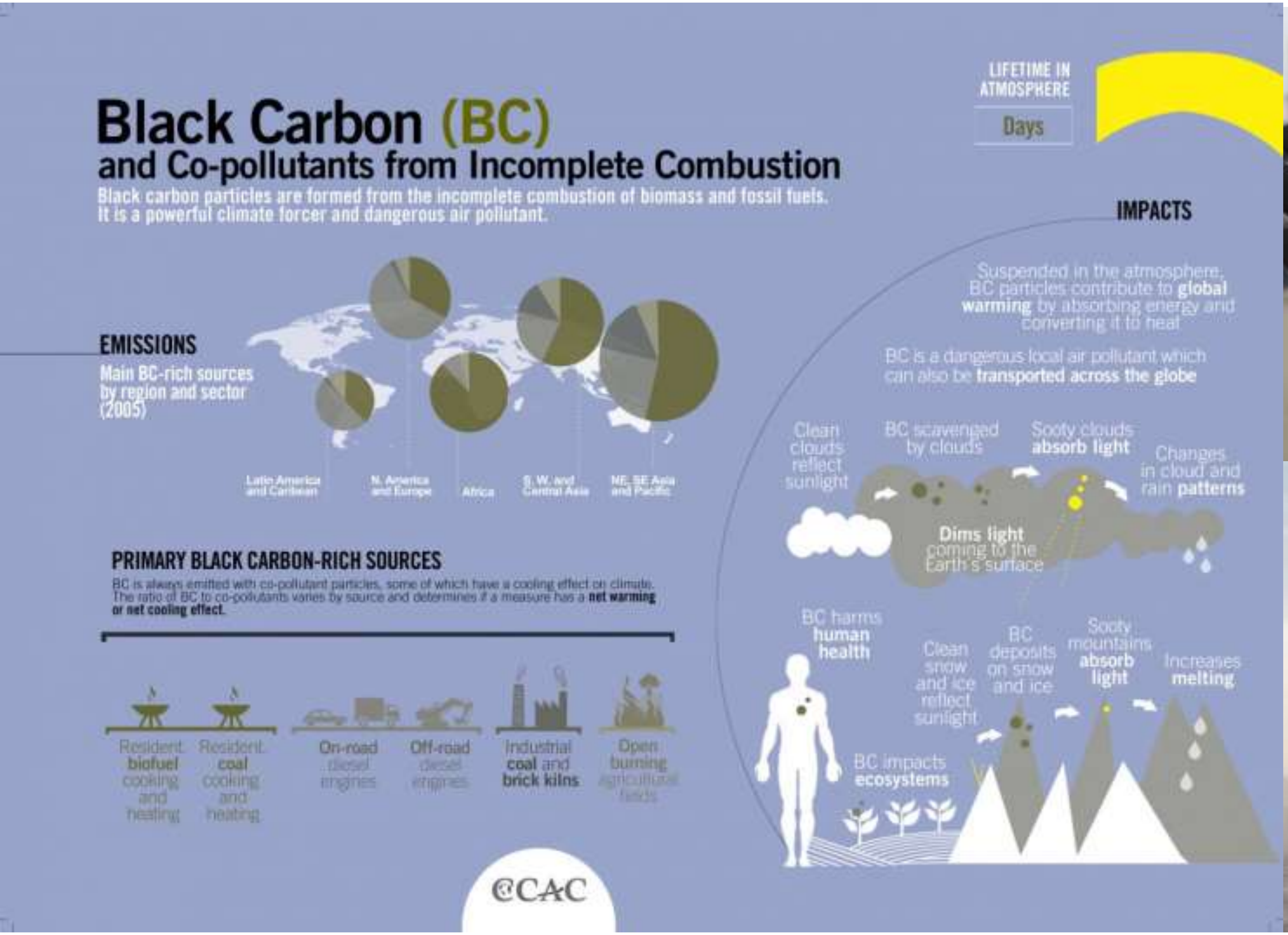
THE ROLE OF BLACK CARBON

Sophie Bonnard
Special Advisor, Climate & Clean Air Coalition
Sophie.bonnard@un.org

ccacoalition.org

CLIMATE & CLEAN AIR COALITION
TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

THE ROLE OF BLACK CARBON



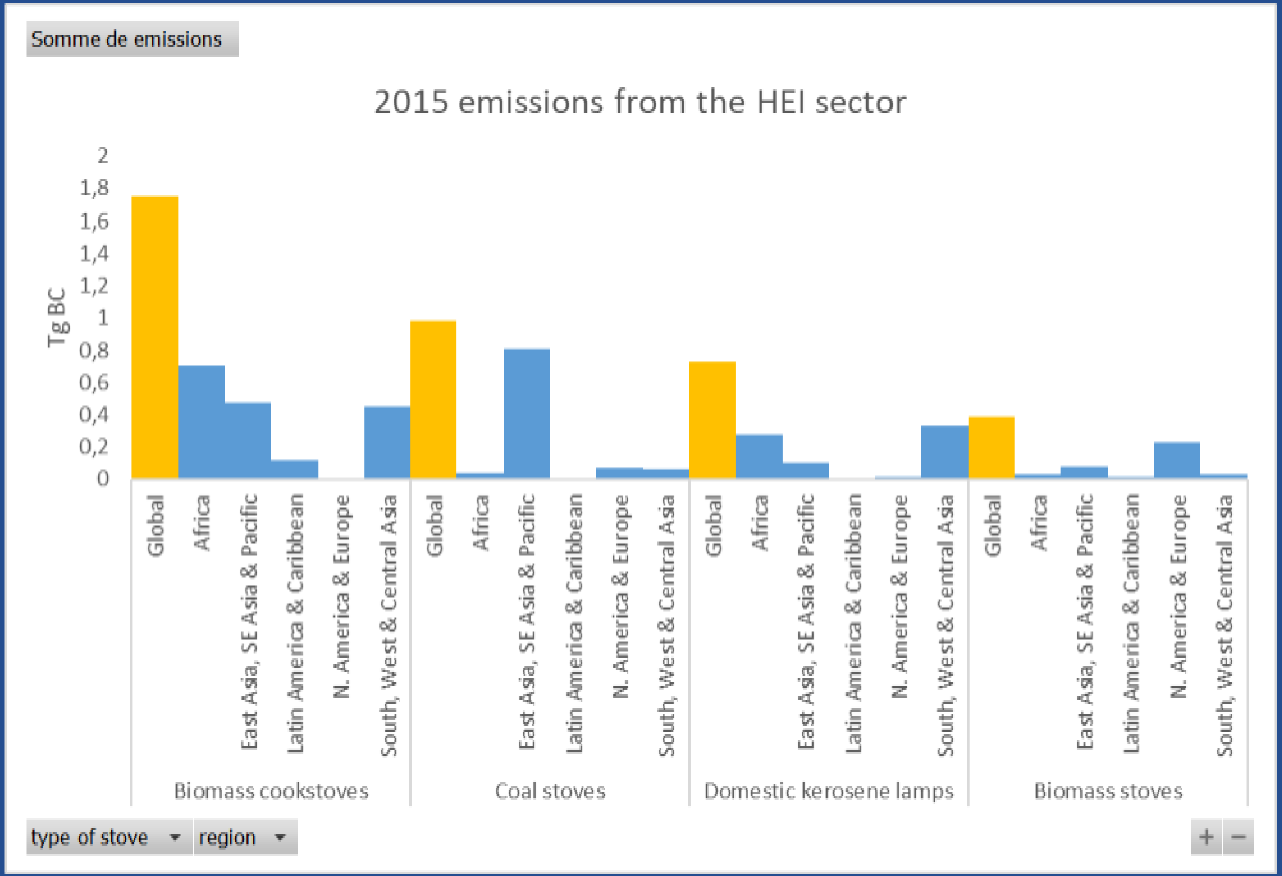
CLIMATE & CLEAN AIR COALITION
TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

BLACK CARBON IN THE HOUSEHOLD ENERGY SECTOR

The household energy sector is the **single most important controlable source of black carbon**, accounting for up to 58% of emissions caused by human activities.

BC emissions in the sector are due to the use of polluting cooking, heating and lighting technologies powered by solid and kerosene fuel by almost 3 billion people.

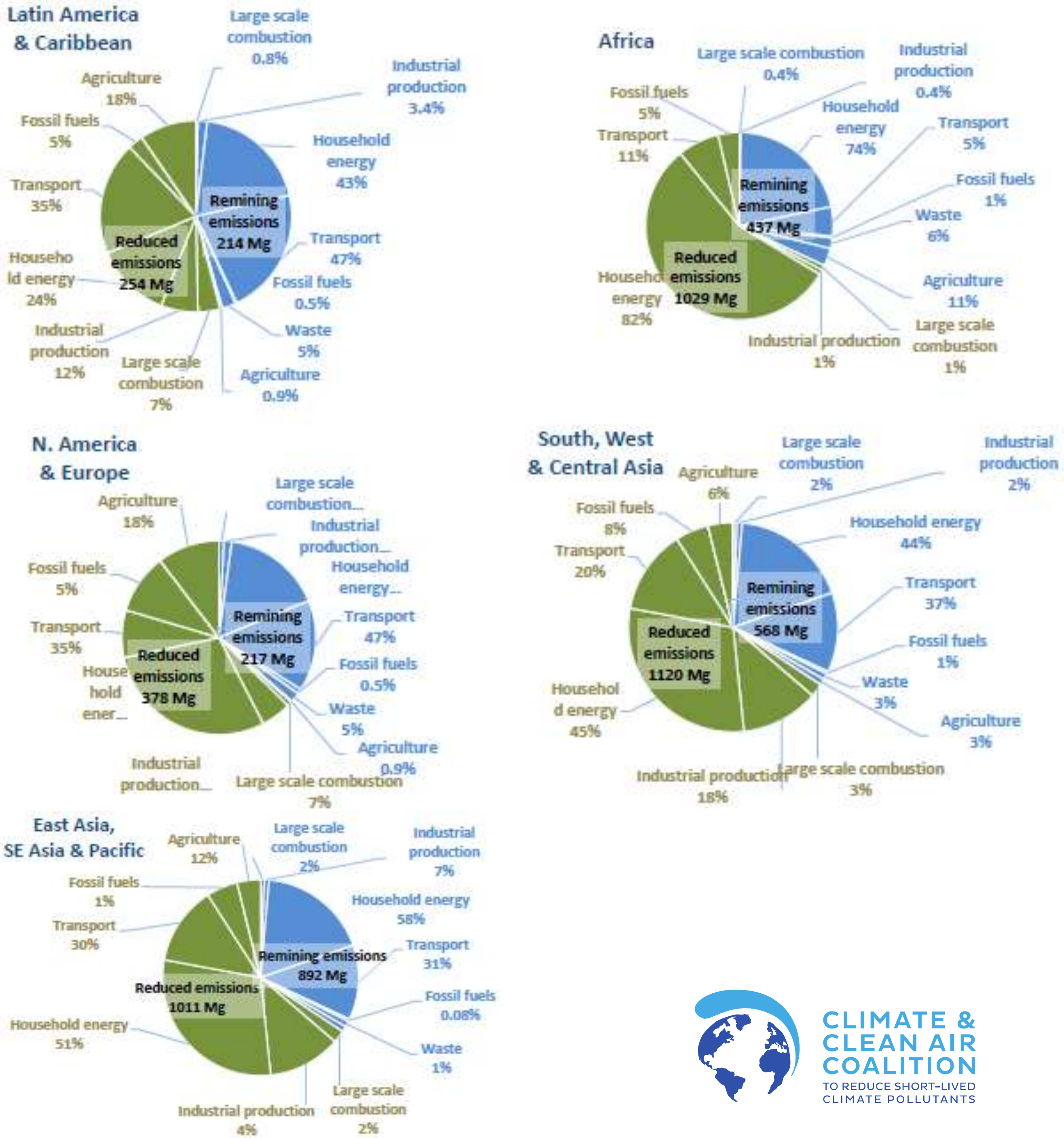
These BC emissions, are responsible for important health and climate impacts.



IIASA GAINS, 2017

MITIGATION POTENTIAL

- The most recent GAINS model analysis indicates that about 3.8 Tg black carbon per year could be reduced by 2030.
- By region, black carbon mitigation is mainly from Africa (1.1 Tg), East and South East Asia (1.0 Tg), and South West and Central Asia (1.1 Tg), which is about 90% of global mitigation.
- **55% of potential global black carbon mitigation is from household energy.**
- The mitigation differs by region. **Household energy contributes the most in all regions except Latin America & Caribbean**, where mitigation is mainly from the transport sector.

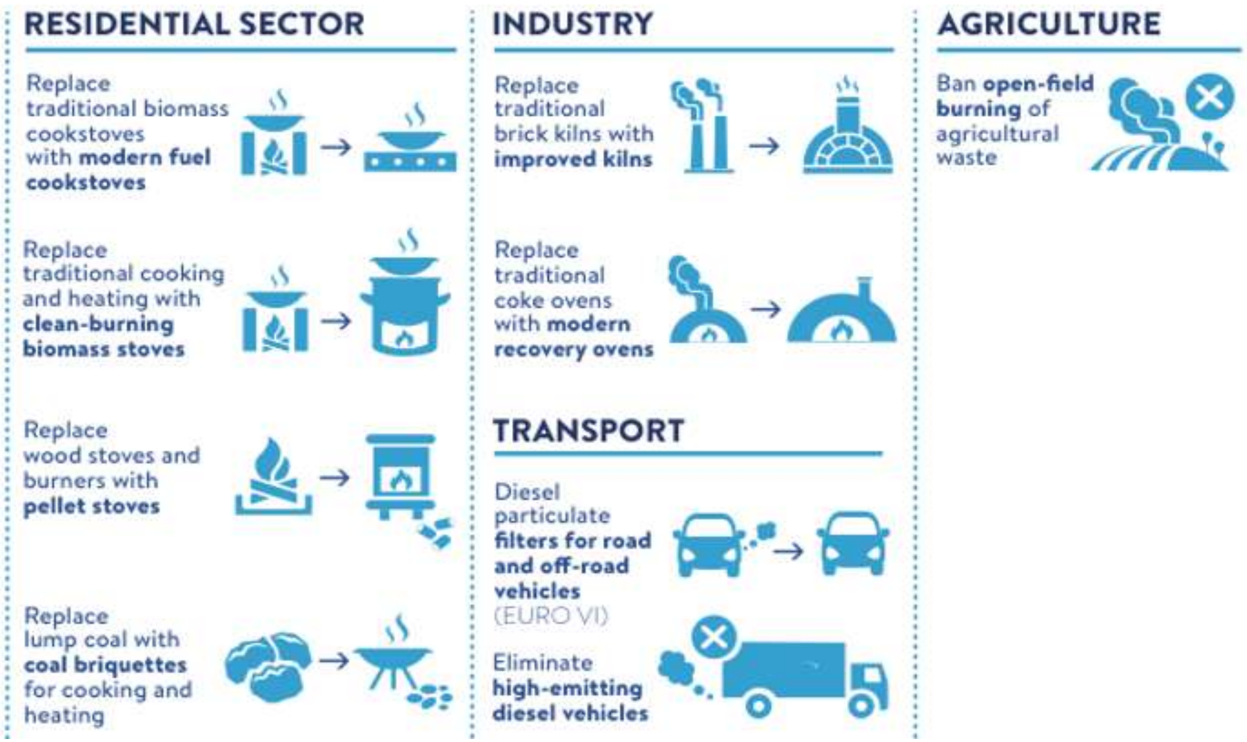


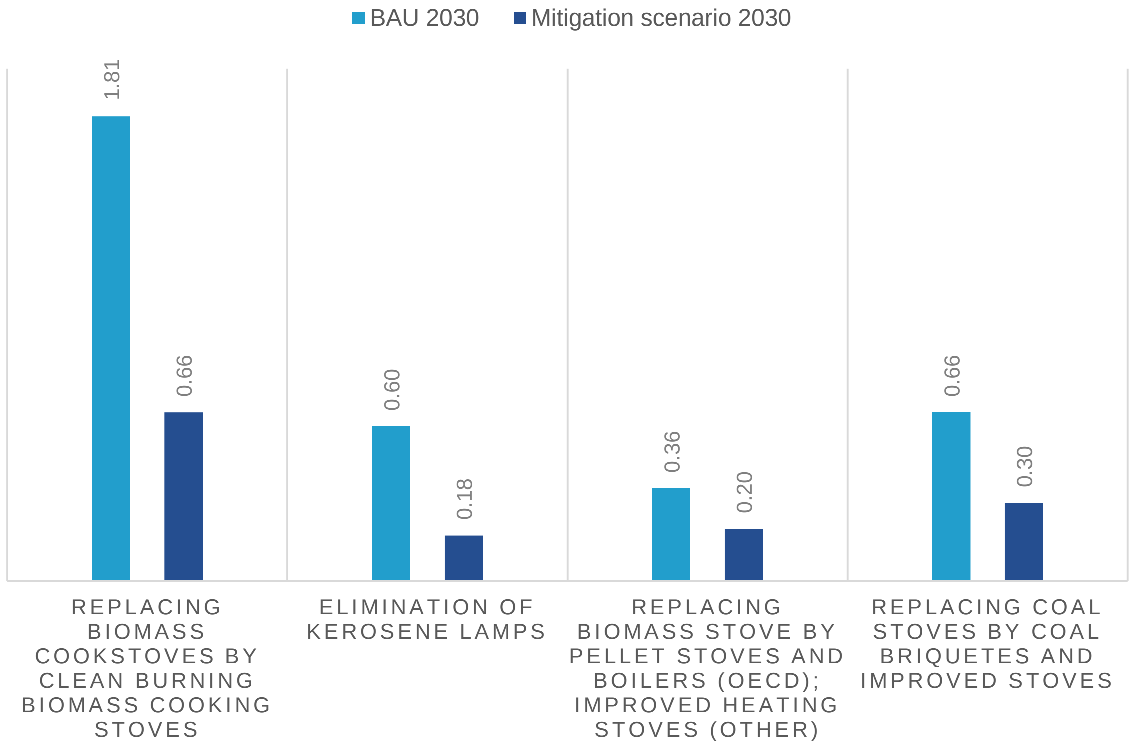
CLIMATE & CLEAN AIR COALITION TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

SOLUTIONS EXIST

↓80%
BLACK CARBON

RESIDENTIAL SECTOR





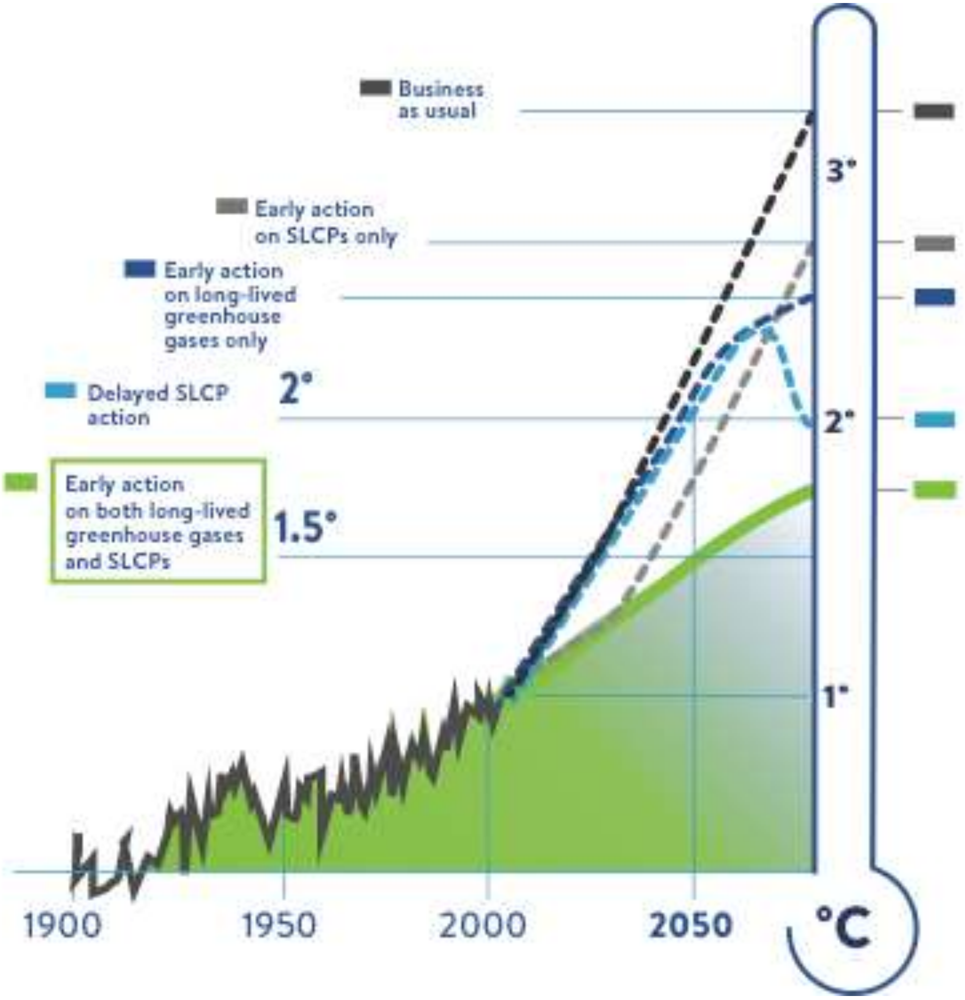
Reductions of black carbon from the household energy sector offer a unique opportunity for countries to meet their NDCs commitments, advance toward realizing the SDGs, and while doing so integrate / establish linkages between their climate change and air pollution mitigation strategies.

IIASA GAINS, 2017

THE SAFEST PATH TO 1.5°C

CLIMATE MITIGATION PATHWAYS

Avoided global warming by 2050



CLIMATE
0.60C avoided warming by 2050

HEALTH
2.4 million avoided premature deaths annually from outdoor air pollution

FOOD SECURITY
52 million tonnes of avoided crop losses from 4 major staples per year

SUSTAINABLE DEVELOPMENT GOALS
Contribution to meeting the SDGs related to air quality, health, and food security

CLIMATE & CLEAN AIR COALITION
TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

THANK YOU!

Sophie Bonnard
Special Advisor, Climate & Clean Air Coalition
Sophie.bonnard@un.org

CLIMATE & CLEAN AIR COALITION
TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

3

Part III—Current applications of research: resources, tools, and MRV best practices

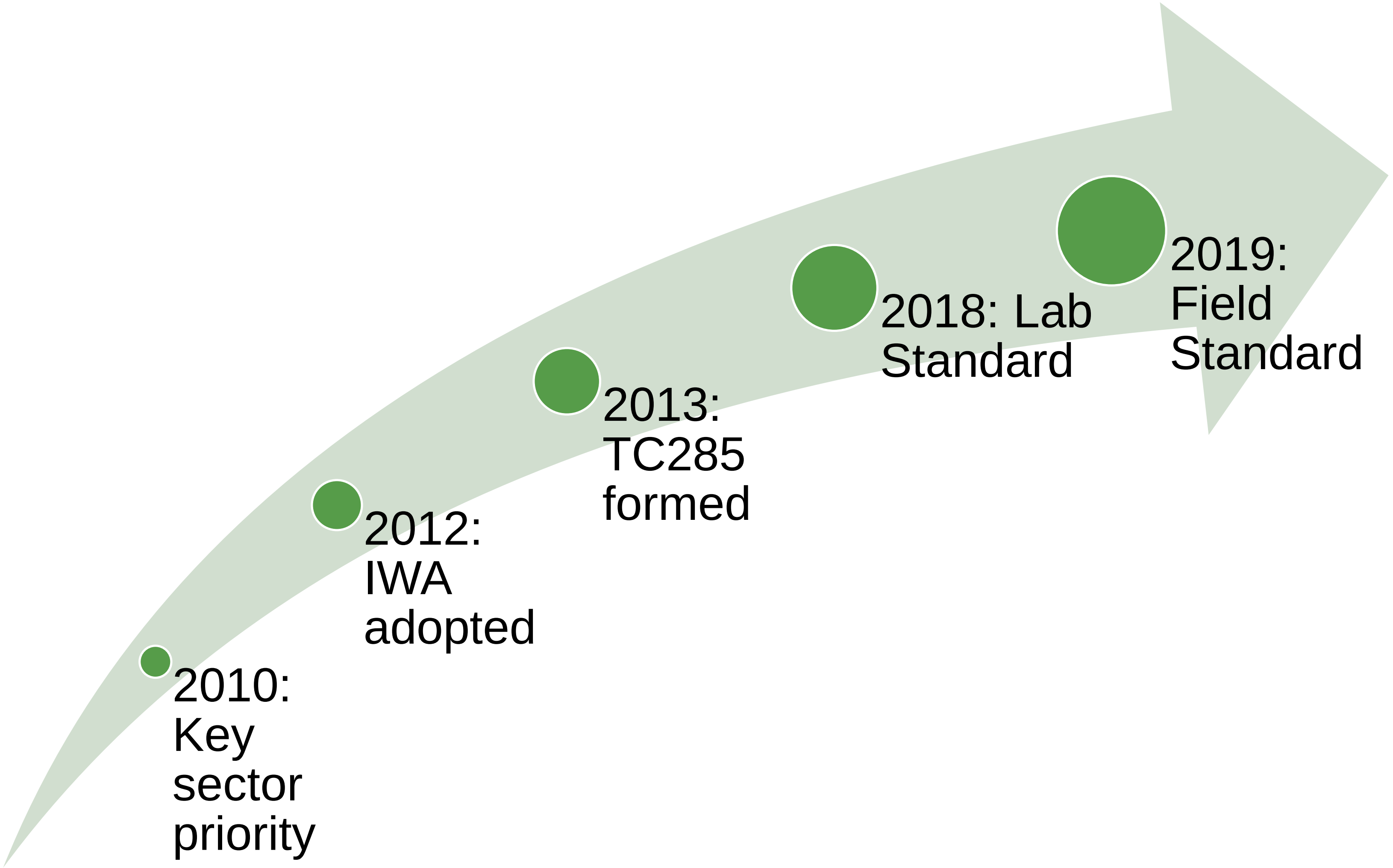
CLEAN COOKING ALLIANCE

CLIMATE & CLEAN AIR COALITION

Introduction to Testing

Neeraja Penumetcha, Clean Cooking Alliance

International Standards Development for Cookstoves



ISO is built on consensus

New work item proposal

Build expert consensus
- Committee Draft

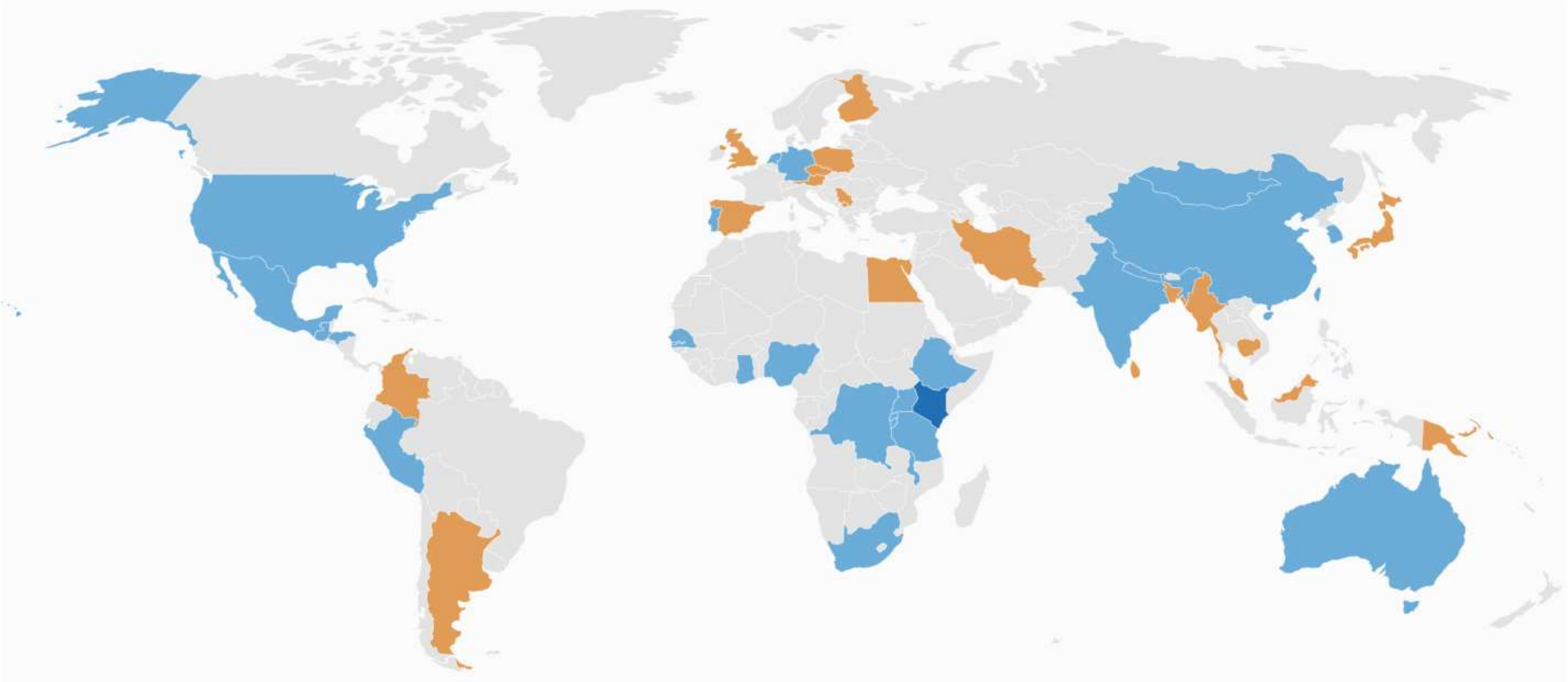
Consensus building within TC
- Draft International Standard (DIS)

Enquiry on DIS
- Final text for processing as Final Draft International Standard

Formal vote on FDIS
- Final text of International Standard

Publication of International Standard
- ISO International Standard

45 countries, over 200 experts



Lab testing or field testing?

Lab Testing	Field Testing
Controlled conditions	Less controlled
Comparing models	Context-specific
Regulation	Consumer preferences
R&D	Impacts

Ideally:
Lab and field testing are distinct but complementary tools

Practically:
Answer your questions within available resources

WBT to ISO Lab Standard

Michael Johnson, Berkeley Air Monitoring Group

CLEAN COOKING ALLIANCE

CLIMATE & CLEAN AIR COALITION

ISO Laboratory Standard Overview

Michael Johnson
Berkeley Air Monitoring Group
mjohnson@berkeleyair.com

Climate Action and
Clean Cooking Co-benefits

Washington DC, September, 2019

ISO testing standards

ISO laboratory standard (19867-1) and voluntary performance targets technical report (19867-1) are final and available.

Provides guidance on laboratory test protocol and associated performance targets (analogous to the WBT and ISO International Workshop Agreement tiers of performance)

Store › Standards catalogue › Browse by ICS › 97 › 97.040 › 97.040.20 › ISO 19867-1:2018

ISO 19867-1:2018

Preview

Clean cookstoves and clean cooking solutions -- Harmonized laboratory test protocols -- Part 1: Standard test sequence for emissions and performance, safety and durability

This document is applicable to cookstoves used primarily for cooking or water heating in domestic, small-scale enterprise, and institutional applications, typically with firepower less than 20 kW and cooking vessel volume less than 150 l, excluding cookstoves used primarily for space heating. For solar cookstoves, the provisions of this document are applicable only for evaluating cooking power, safety, and durability. Solar cookstoves have zero on-site emissions, and their cooking power can be determined according to ASAE S 580.1. Thi
evaluation of electric stoves can be found in IE

This document specifies laboratory measurem

a) particulate and gaseous air pollutant emiss

b) energy efficiency,

c) safety, and

d) durability of cookstoves.

TECHNICAL REPORT

ISO/TR 19867-3

First edition
2018-10

Clean cookstoves and clean cooking solutions — Harmonized laboratory test protocols —

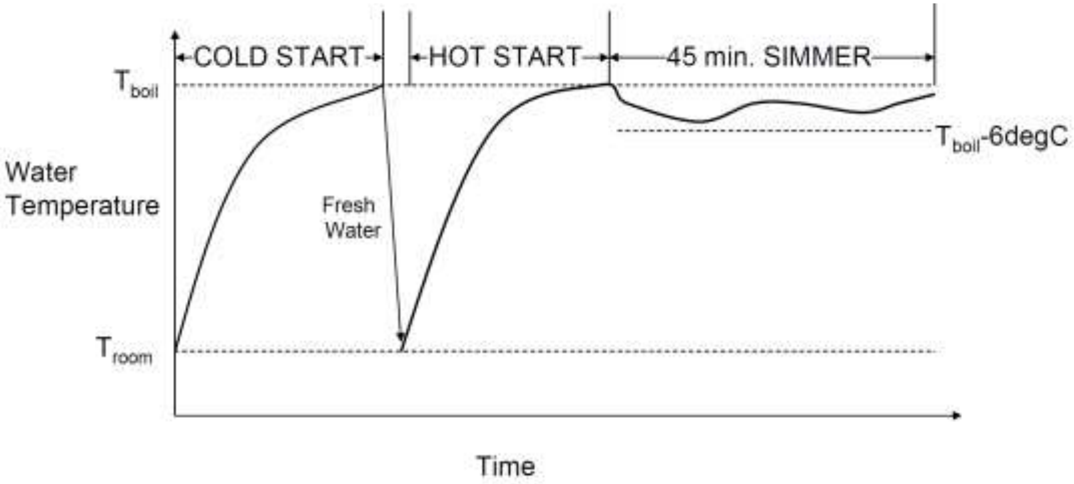
Part 3:
Voluntary performance targets for cookstoves based on laboratory testing

Fourneaux et foyers de cuisson propres — Protocoles d'essai en laboratoire harmonisés —

BERKELEY AIR MONITORING GROUP · CLEAN COOKING ALLIANCE · World Health Organization · ISO

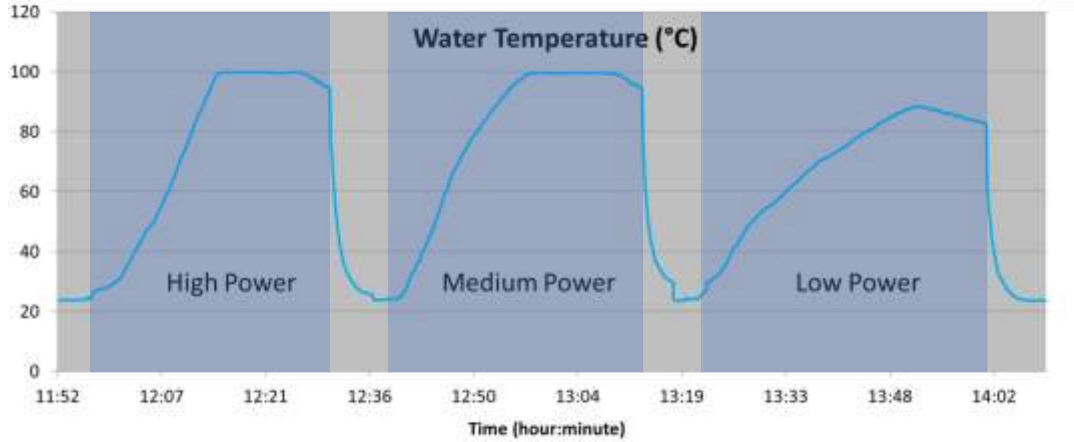
New ISO test protocol

Water boiling test sequence
- High power cold start
- High power hot start
- Simmer



ISO test sequence
- High power
- Medium power
- Low power

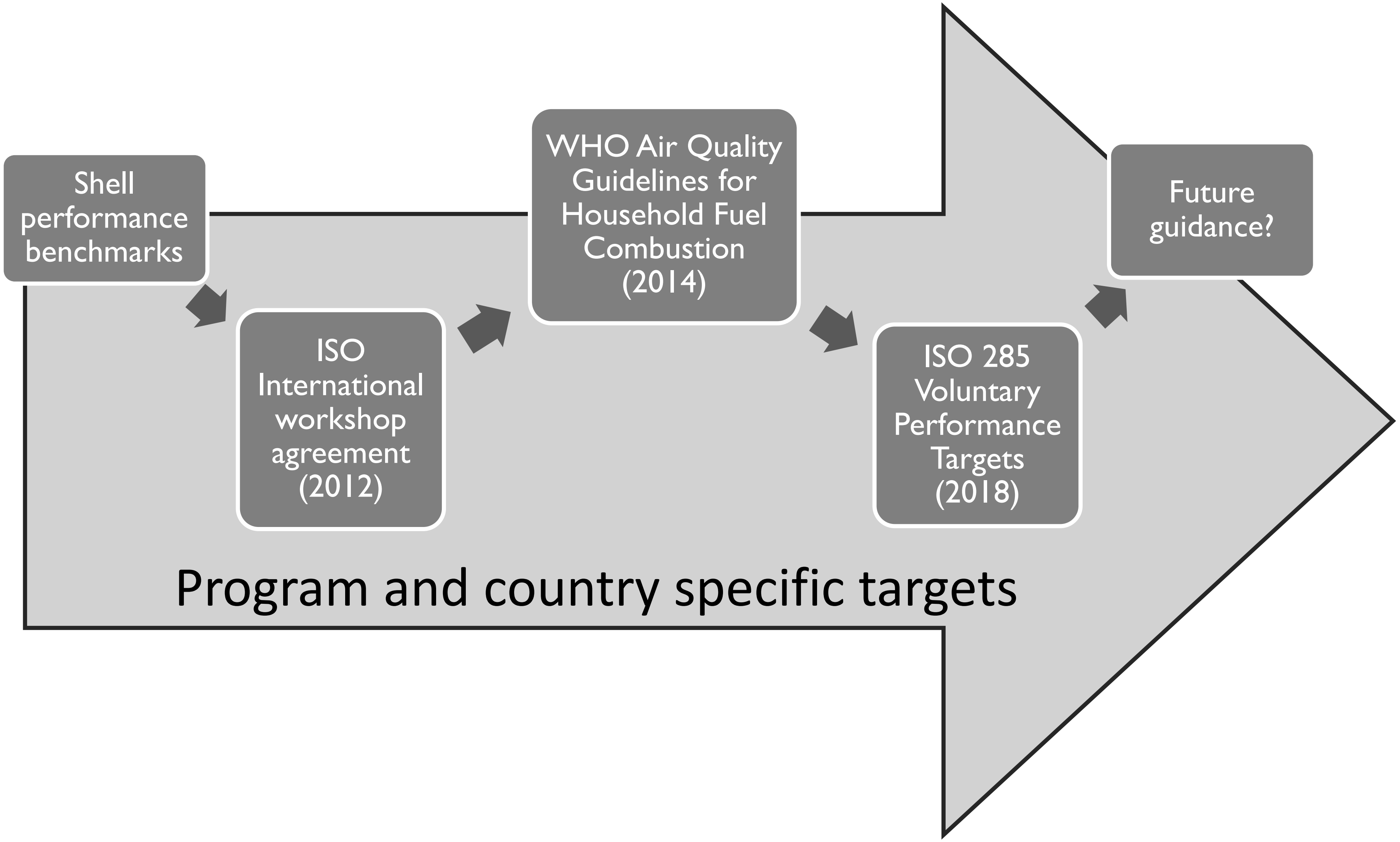
(no simmer phase)



Standard includes protocols for safety and durability

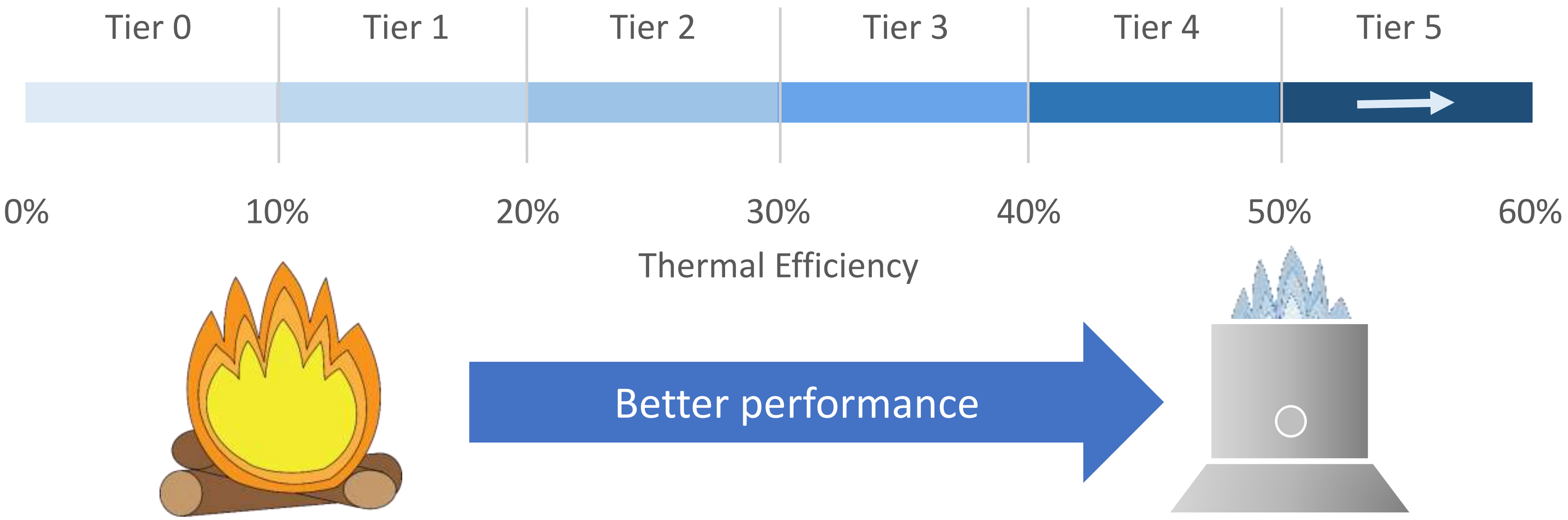
BERKELEY AIR MONITORING GROUP · CLEAN COOKING ALLIANCE · World Health Organization · ISO

Brief history of performance standards

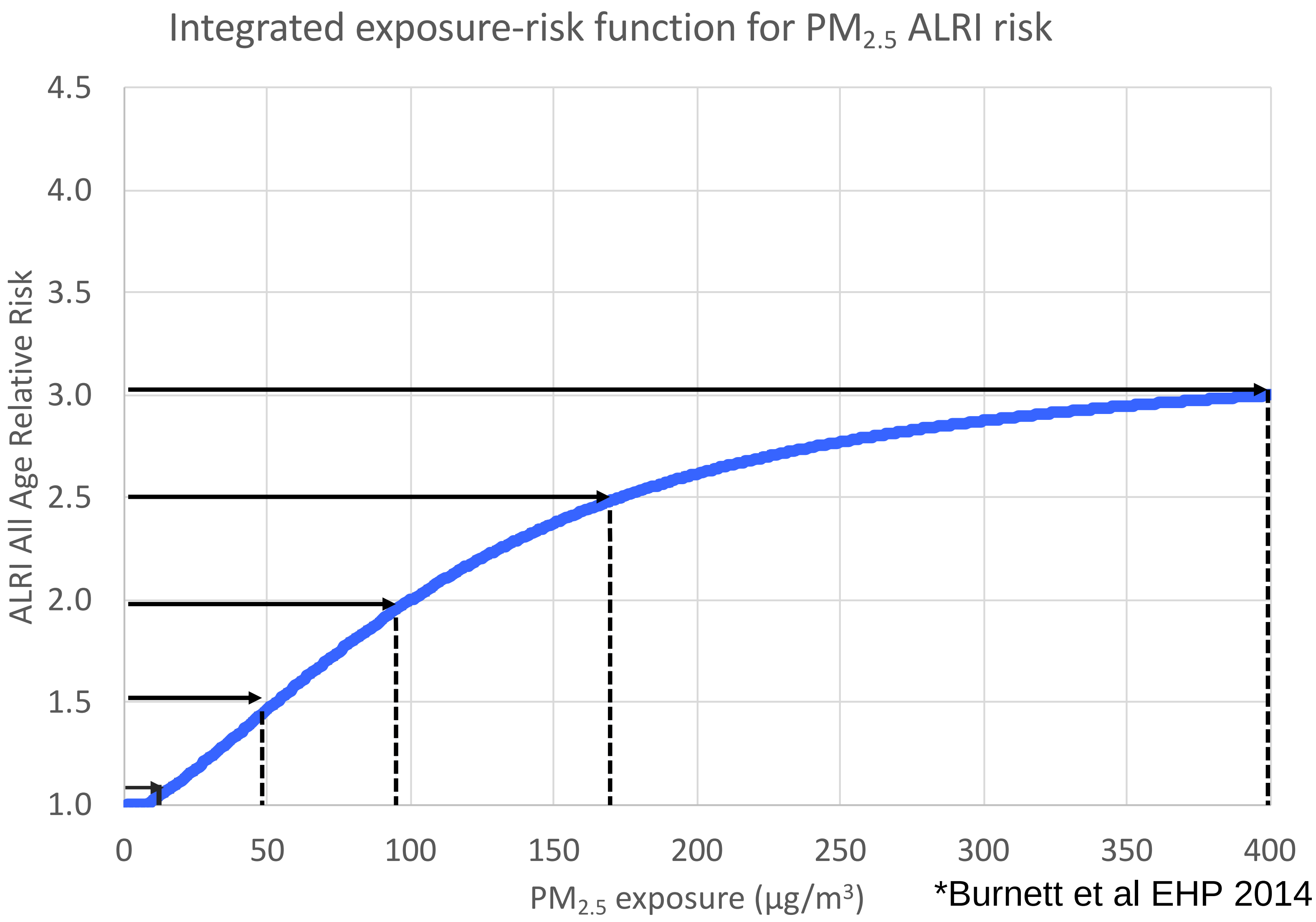


ISO 19867 Tiers

	Tier[b]	Thermal efficiency %	Emissions		Safety (score)[c]	Durability (score)[d]
			CO g/MJ[d]	$PM_{2,5}$ mg/MJ[d]		
Better performance	5	≥50	≤3,0	≤5	≥95	<10
	4	≥40	≤4,4	≤62	≥86	<15
	3	≥30	≤7,2	≤218	≥77	<20
	2	≥20	≤11,5	≤481	≥68	<25
	1	≥10	≤18,3	≤1030	≥60	<35
	0	<10	>18,3	>1030	<60	>35



For PM2.5 emissions performance, the relationship with acute lower respiratory infections was used to determine the targets



*Burnett et al EHP 2014

Considerations for the laboratory testing

- Laboratory testing protocol could be used as WBT is currently applied (ratios of thermal efficiency used to determine fuel savings)
- Simple or weighted averages of the three test phases (high, medium, low powers)
- Emissions guidance only provided for PM2.5 and CO (CO2 measured as a QA/QC practice)
- Flexibility for using local fuels/pots and weighting results based on firepower measured in the field
- Protocol has not been used substantively in practice
- Laboratories are upgrading equipment and adapting to new protocol
- Cost per test should be comparable to WBT (minimum of 5 replicates)

Additional thoughts

- Laboratory testing protocol should provide a better approach for measuring thermal efficiency and be comparable to the WBT in terms of cost/resources
- Regional testing laboratories are being updated to apply the new laboratory protocol
- In-home stove use event and/or KPT measures of fuel consumption provide more scientifically justifiable estimates than lab tests, but are more expensive.

Thank you!

Questions?

Michael Johnson
mjohnson@berkeleyair.com

Berkeley Air Monitoring Group

ISO Field Standard

Ryan Thompson, Mountain Air Engineering

Overview:
ISO 19869: Clean cookstoves and clean cooking solutions – field testing methods for cookstoves

ISO TC285 Working Group 3

- Clause 1: Scope
- Clause 2: Normative references
- Clause 3: Terms and definitions
- Clause 4: Symbols and abbreviations

Clause 5: Field study development

- Testing strategy
- Assessment levels
- Sample selection
- Study design considerations
- Statistics and reporting

Clause 6: Usage and usability

- Observational, interview, and survey measurement methods
- Stove use monitors
- Metrics:
  - Changes in time use
  - Average number of cooking events per day
  - Average cooking duration (hours per day)
  - Displacement: fraction of cooking on one stove
  - Number of stoves stacked
- Usability survey

Clause 7: Fuel measurements

- Specific energy consumption measurement (CCT) (MJ/kg food) (relative difference)
- Household energy consumption measurement (KPT) (MJ/person/day) (relative difference)
- Fuel measurements required for emission measurements by carbon balance
  - Fuel carbon fraction
  - Fuel heating value (MJ/kg)

Clause 8: Emission Measurements

CLEAN COOKING ALLIANCE

CLIMATE & CLEAN AIR COALITION

- Emission metrics:
  - MCE (modified combustion efficiency)
  - Fuel mass based emission factors (g/kg)
  - Fuel energy based emission factors (g/MJ)
  - Emission rates (g/min)
- Emission species:
  - CO
  - $PM_{2.5}$
  - OC
  - EC
- Method: Partial capture sampling with carbon balance

Clause 9: Power measurements

- Cooking power (MJ delivered)
- Average firepower

Clause 10: Safety assessment

- Household risk factor survey
- Physical tests for:
  - Stove stability
  - Containment of liquid fuels
  - Flames exiting the stove
  - Surface temperature
  - Cookstove shutdown
- Hazard likelihood matrix

Clause 11: Durability assessment

- Frequency of failure of stove parts over time
- Frequency of failure of cookstoves over time

Clause 12: Exposure to Airborne pollutants

- Informative guidance, points to other references
- Area concentration measurements
- Personal exposure measurements

Breakout Groups

Breakout I: Troubleshooting application of ISO process with project developers

Board room

Breakout II: Identifying research gaps with researchers and best practices for translating research into project implementation and policy

Room 1203

Breakout I—Discussion Questions

- *Are there obvious challenges on how to implement this?*
- *What tools/guidance would facilitate more efficient adoption of the ISO standards?*
- *Clarifying questions?*

Breakout II—Discussion Questions

- *How could researchers/academics respond to the identified challenges from the first day?*
- *What are the critical research questions that need to be answered?*
- *How could we be doing a better job of translating research to project implementation, policy, business, investment, etc.?*

Report Out and Discussion

11:10-11:45

MRV for clean fuels (LPG, biogas, and electricity)

11:45-12:15

Lunch Break

12:15-1:15

4

Part III—Current applications of research: resources, tools, and MRV best practices continued

HAPIT

Ajay Pillarisetti, University of California, Berkeley

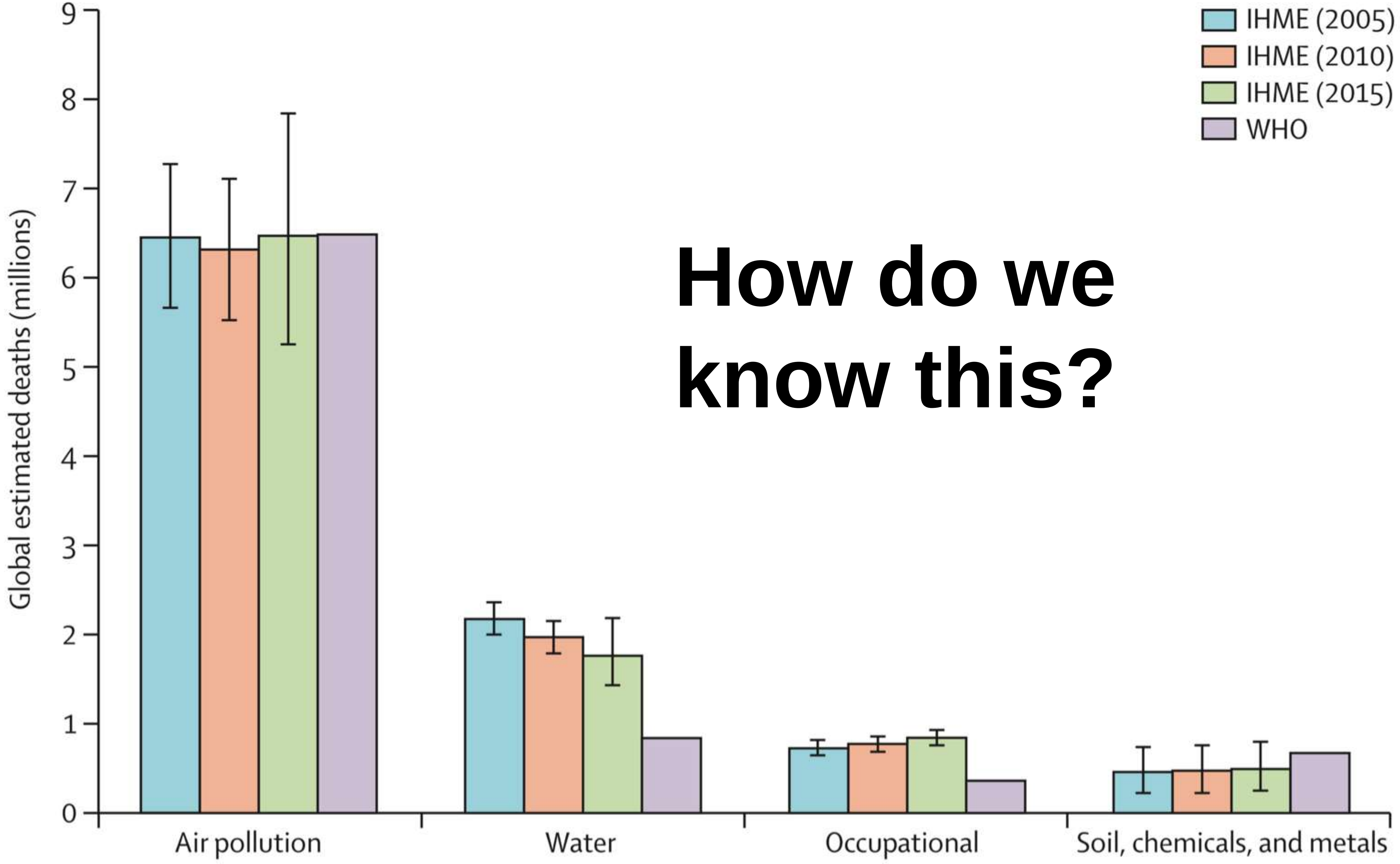
Modeling the health impacts of household energy interventions

HAPIT, the Household Air Pollution Intervention Tool

HOUSEHOLD ENERGY, CLIMATE, & HEALTH RESEARCH GROUP
UNIVERSITY OF CALIFORNIA, BERKELEY

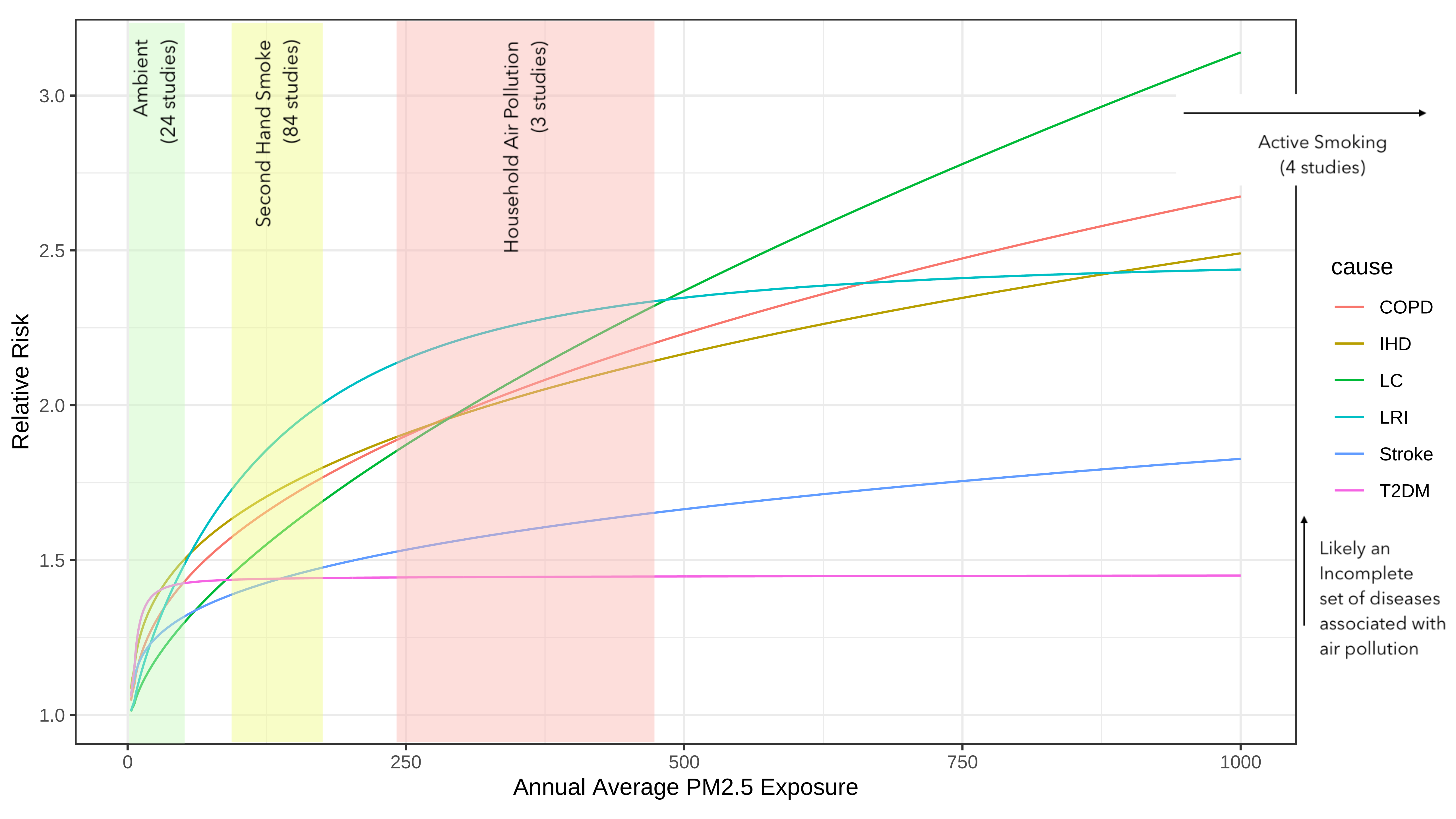
Ajay Pillarisetti, MPH, PhD

Background

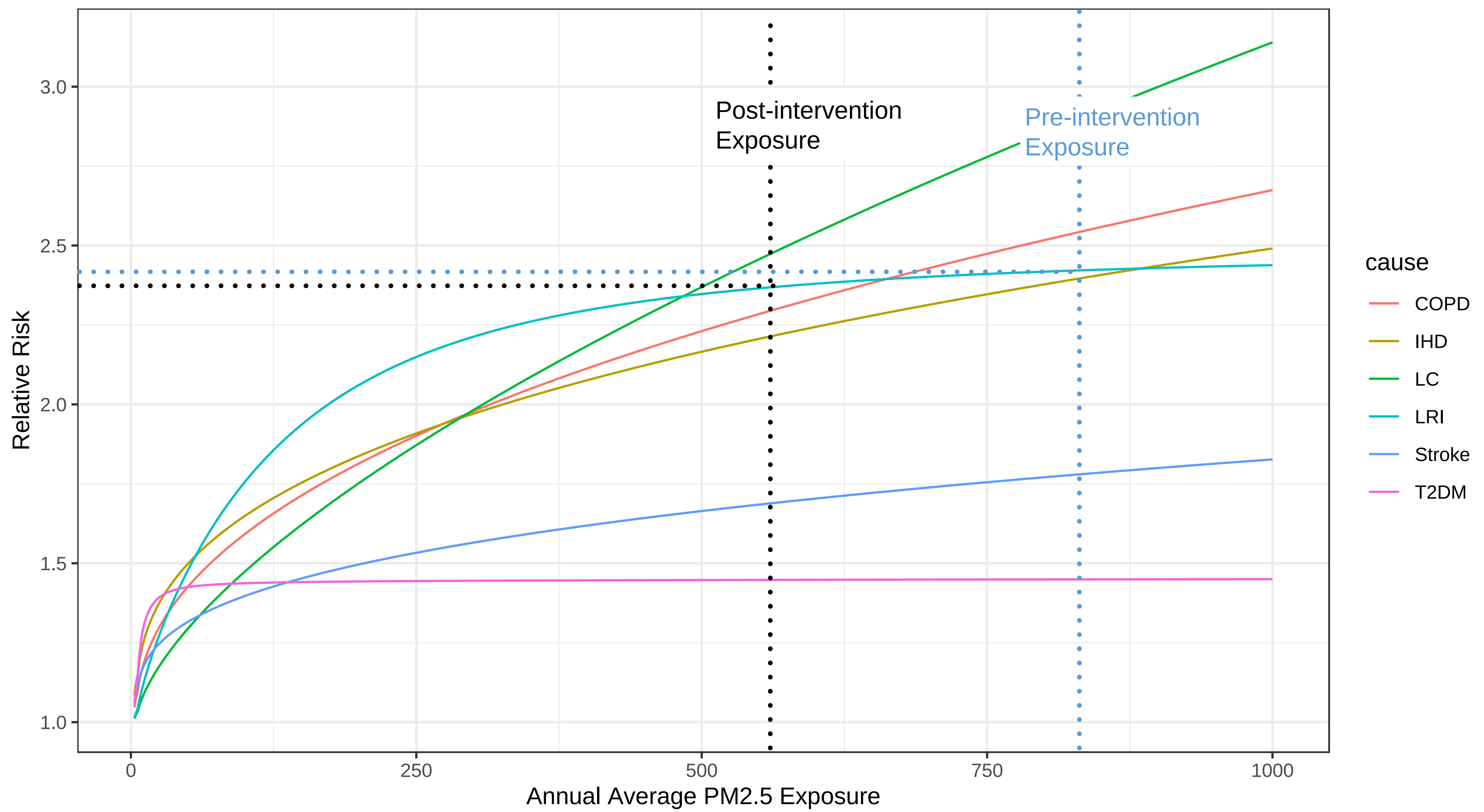


How do we know this?

Landrigan P, et al, Lancet Commission on Pollution and Health, *The Lancet*, Published online Oct 19, 2017
http://dx.doi.org/10.1016/S0140-6736(17)32345-0

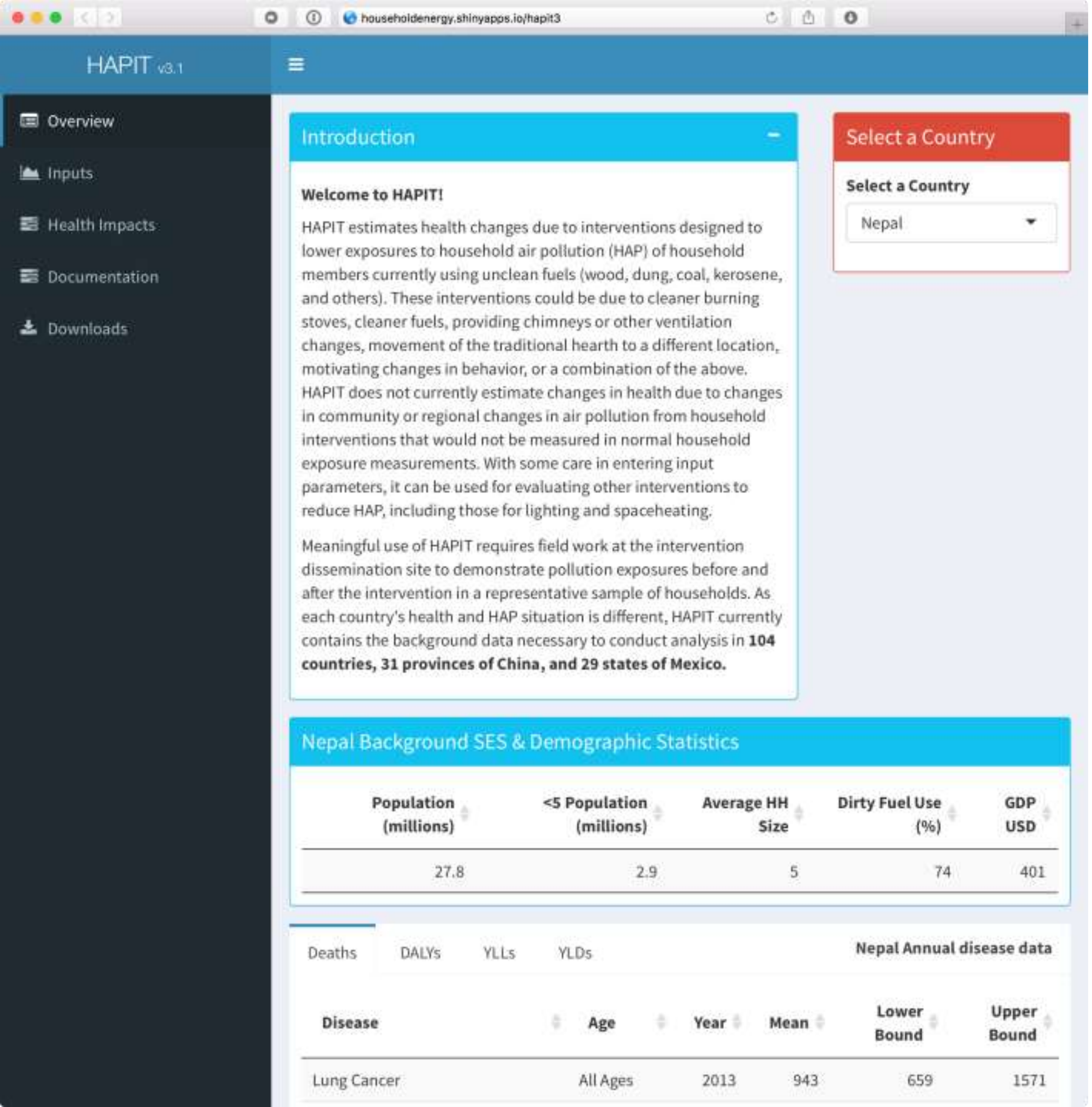


Ambient
(24 studies)
Second Hand Smoke
(84 studies)
Household Air Pollution
(3 studies)
Active Smoking
(4 studies)
Likely an
Incomplete
set of diseases
associated with
air pollution
Relative Risk
3.0
2.5
2.0
1.5
1.0
0
250
500
750
1000
Annual Average PM2.5 Exposure
cause
COPD
IHD
LC
LRI
Stroke
T2DM



Relative Risk
Annual Average PM2.5 Exposure
3.0
2.5
2.0
1.5
1.0
0
250
500
750
1000
Post-intervention
Exposure
Pre-intervention
Exposure
cause
COPD
IHD
LC
LRI
Stroke
T2DM

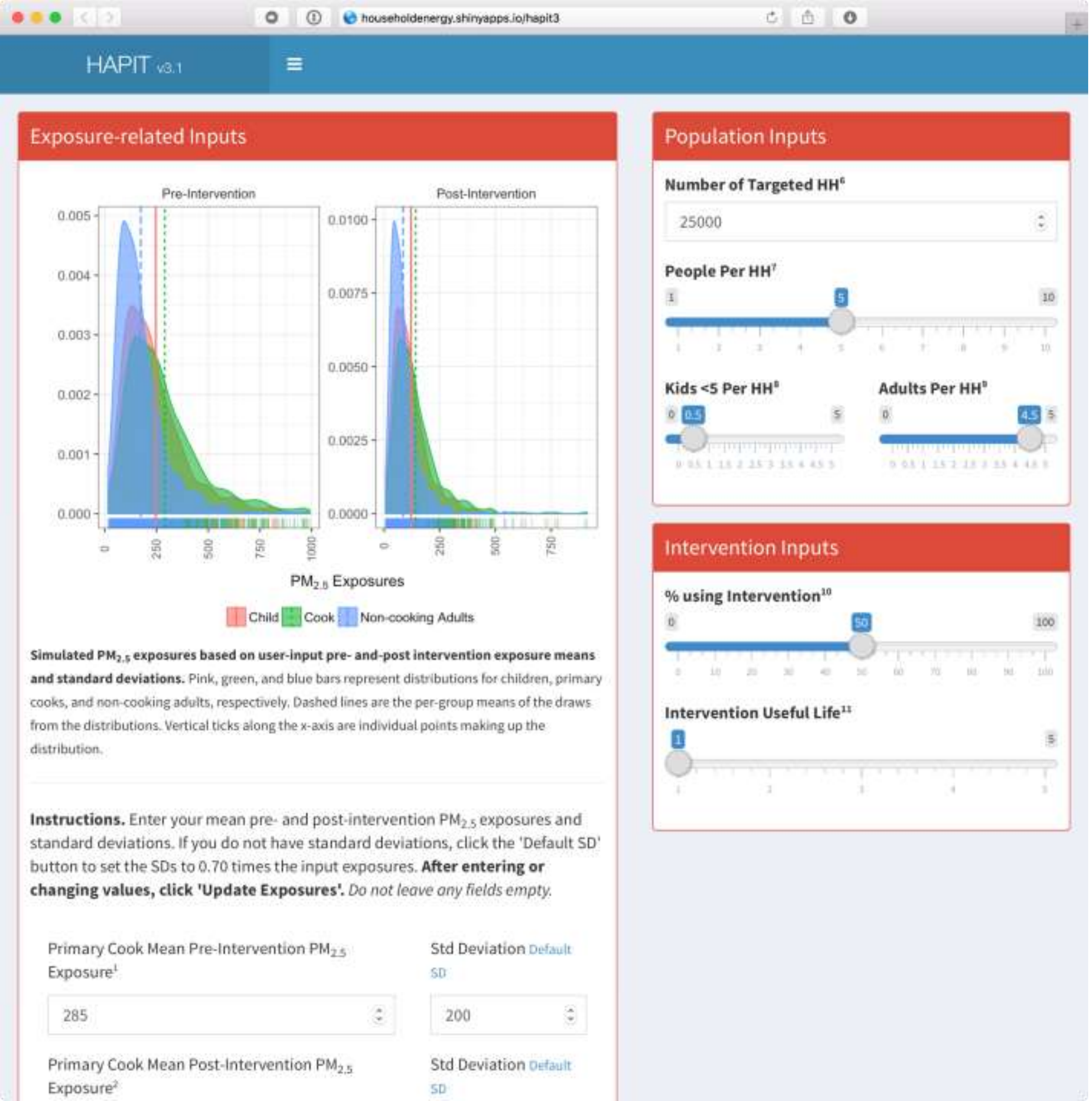
HAPIT 3



An easy-to-use tool to estimate the health benefits of household energy interventions from COPD, LRI, Lung Cancer, IHD, and Stroke

Benefits by default are estimated for countries

- Based on the best available health effects evidence from the Global Burden of Disease
- HAPIT estimates the approximate morbidity and premature mortality reductions for user-created scenarios
- As the evidence improves, these estimates of deaths and DALYs averted will change



HAPIT requires inputs that should be based on field observation and exposure measurements

- mean and SD of $PM_{2.5}$ exposures pre-intervention
- mean and SD of $PM_{2.5}$ exposures post-intervention
- usage fraction of intervention
- # interventions deployed
- population parameters
- intervention lifetime

Audience

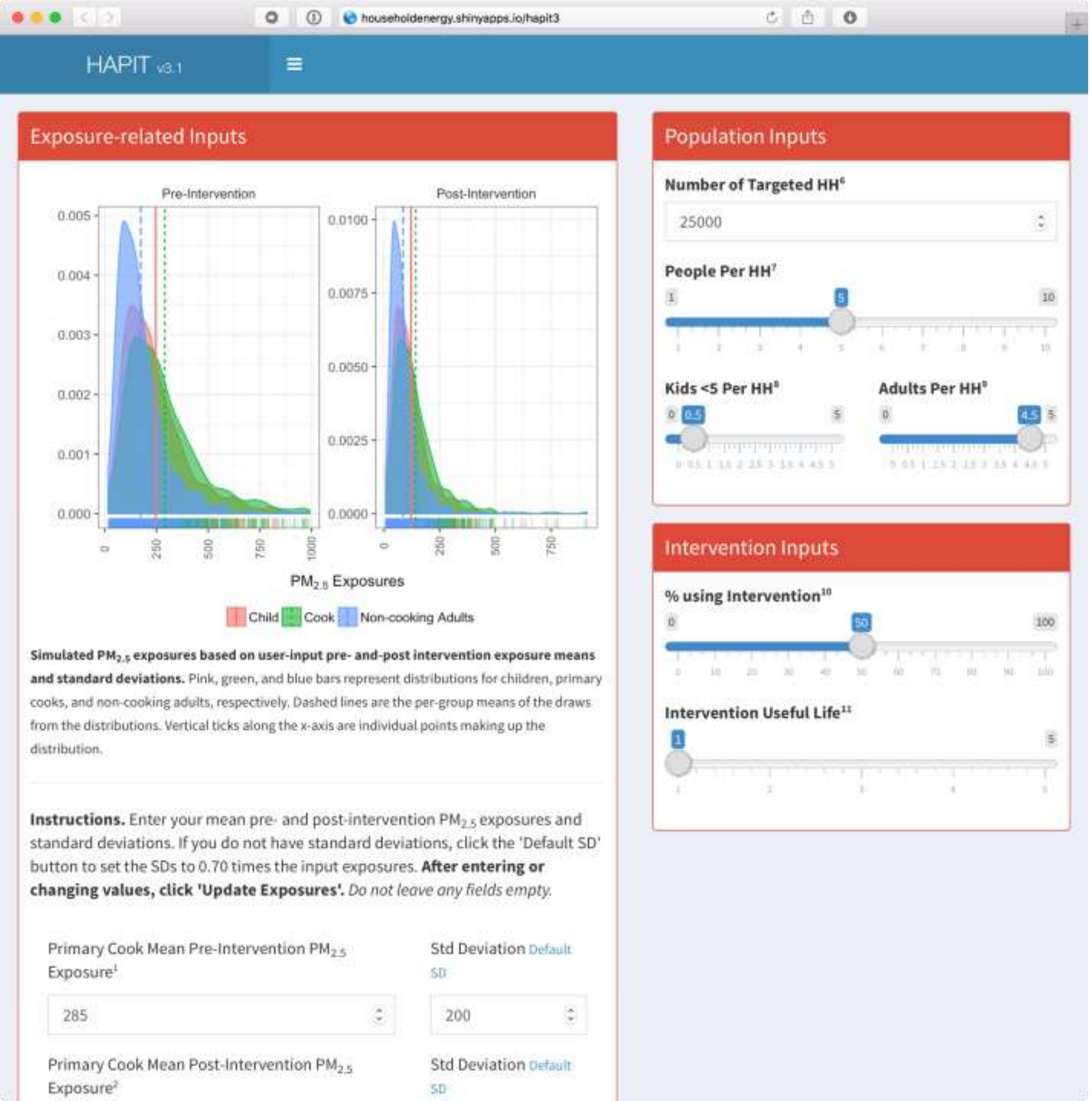
Targeted to policymakers, NGOs, project implementers, academics

Uses best available data (at the time) to estimate the potential impact of HAP interventions

May enable results-based financing of HAP interventions, though this will be complicated:

- RBF will require significant monitoring and evaluation efforts, repeatedly, to verify benefits
- Changes to underlying HAPIT data may invalidate results from previous versions of HAPIT
- Conveying uncertainty clearly to potential investors will be both essential and challenging

Used in Gold Standard Foundation's ADALY methodology - "Estimate and Verify Averted Mortality and Disability Adjusted Life Years (ADALYs) from Cleaner Household Air"



Issues with HAPIT 3

- Background disease data is now out of date (IHME updates their models every year, and soon will update every six months)
- Missing Type 2 Diabetes and adult LRI as outcomes
- There are now newer versions of the integrated exposure response functions
- HAPIT3 doesn't allow for estimation of the impact of changes in OAP that result from changes in HAP
- IHME changed their data outputs; non-trivial to reshape/reform data to get HAPIT to ingest it

HAPIT 4

Household Air Pollution Intervention Tool

Codename Chupacabra

HAPIT 4

Household Air Pollution Intervention Tool

Codename Chupacabra

ABODE

Air Pollution Burden of Disease Expolorer

*Codename Chupacabra**

** a legendary creature in the folklore of parts of the Americas, with its first purported sightings reported in Puerto Rico. The name comes from the animal's reported habit of attacking and drinking the blood of livestock, including goats. HAPIT 3 was codenamed Tailypo, HAPIT 2 was codenamed bigfoot.*

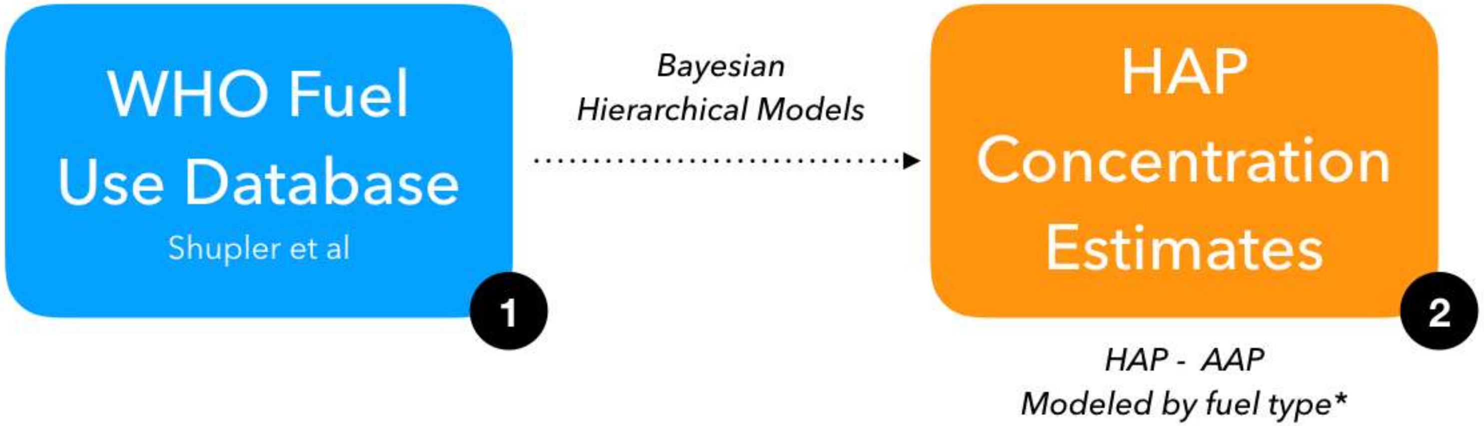
Current IHME HAP Exposure and Burden Estimation

WHO Fuel Use Database

Shupler et al

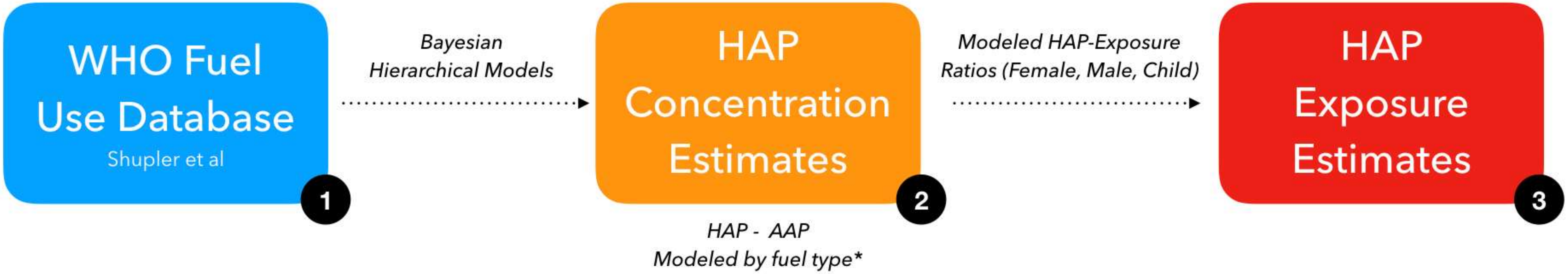
1

*not for burden estimation

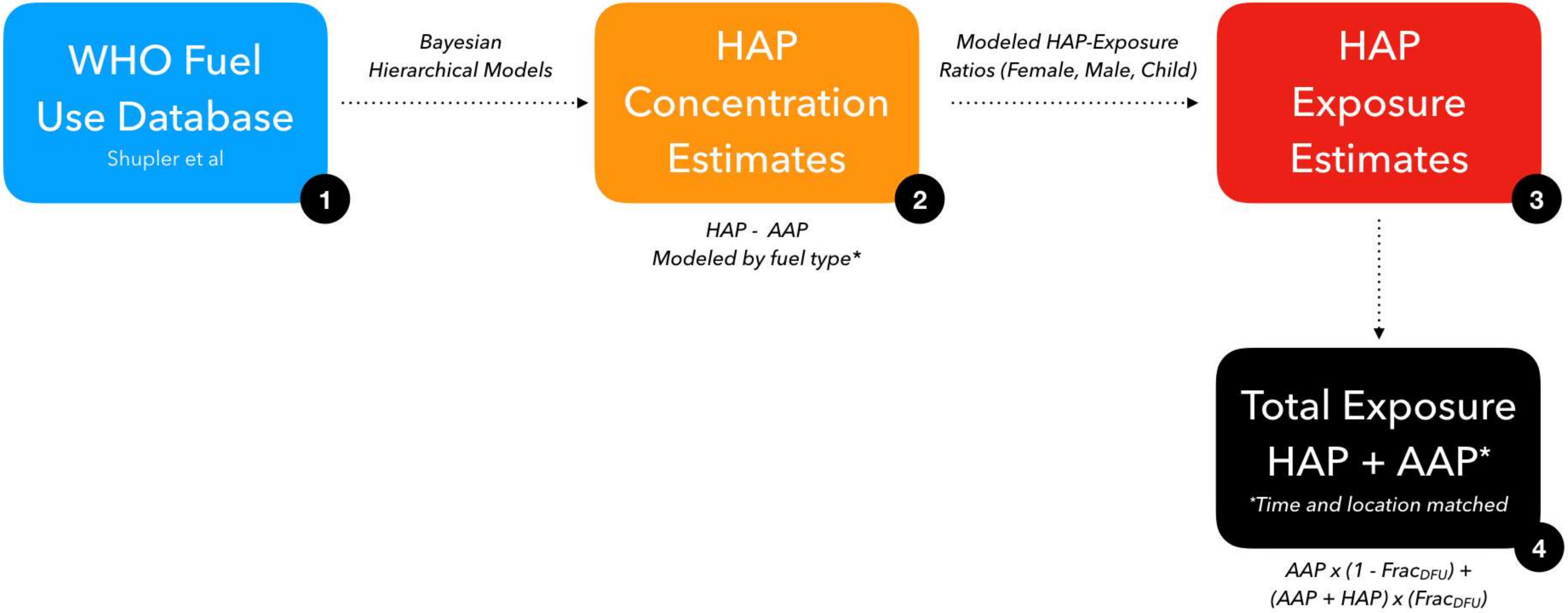


*not for burden estimation

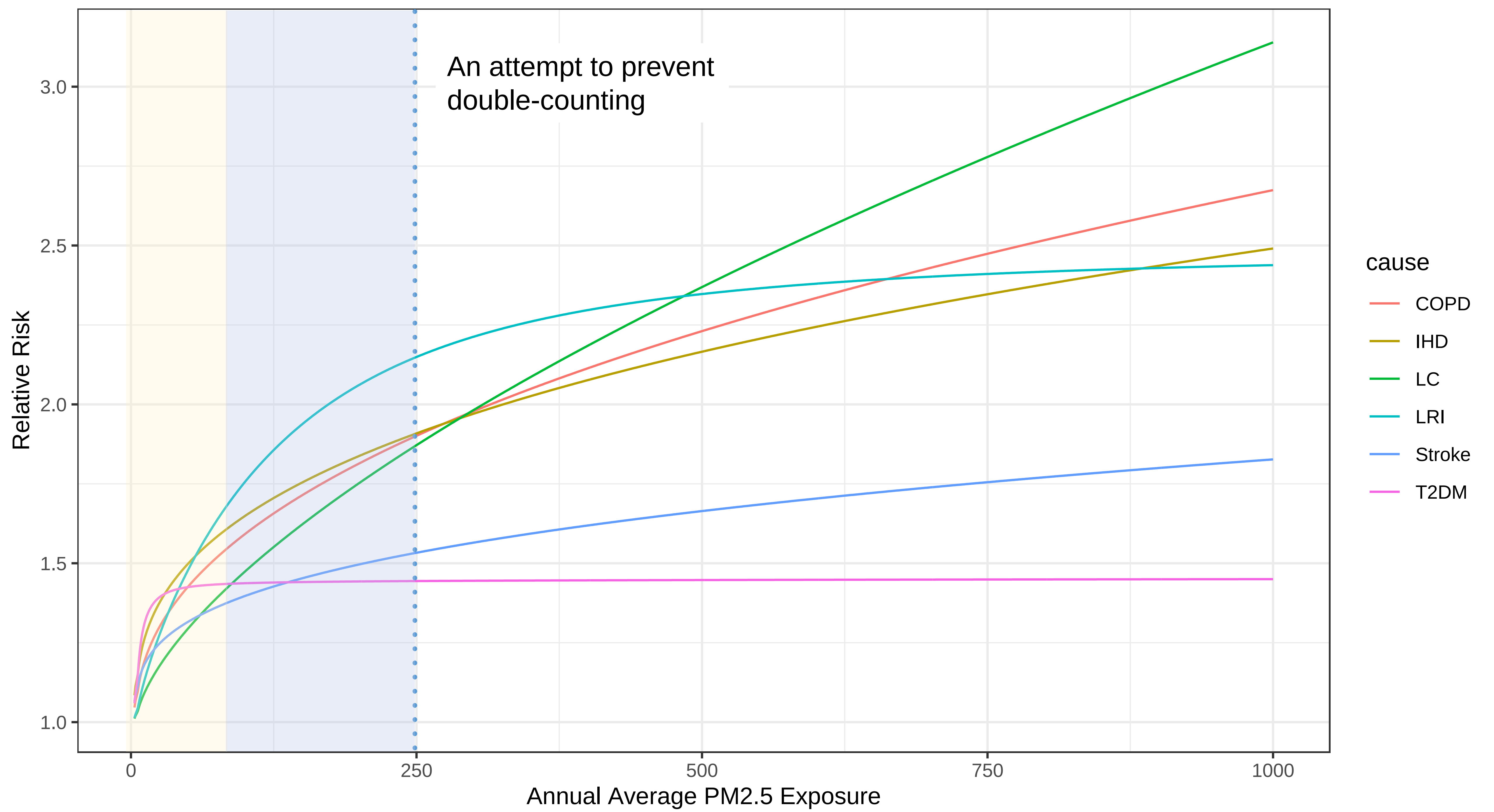
Country	GBD Region	SDI	HAP-PM2.5 Kitchen Concentration					HAP-PM2.5 Female Concentration				
			Wood	Dung	Gas	Coal	ICS	Wood	Dung	Gas	Coal	ICS
Afghanistan	North Africa and Middle East	0.28	632	1532	166	510	402	258	625	38	208	632
Algeria	North Africa and Middle East	0.68	352	854	93	284	224	144	348	54	116	352
Angola	Central Sub-Saharan Africa	0.43	506	1227	133	408	322	206	500	33	167	506
Argentina	Southern Latin America	0.76	310	752	81	250	197	126	307	34	102	310
Bahrain	North Africa and Middle East	0.74	321	778	84	259	204	131	317	67	106	321
Bangladesh	South Asia	0.51	877	2127	231	708	421	256	621	45	207	877
Benin	Western Sub-Saharan Africa	0.35	511	1239	134	412	328	172	418	60	139	511
Bhutan	South Asia	0.59	782	1896	206	631	375	228	554	30	184	782

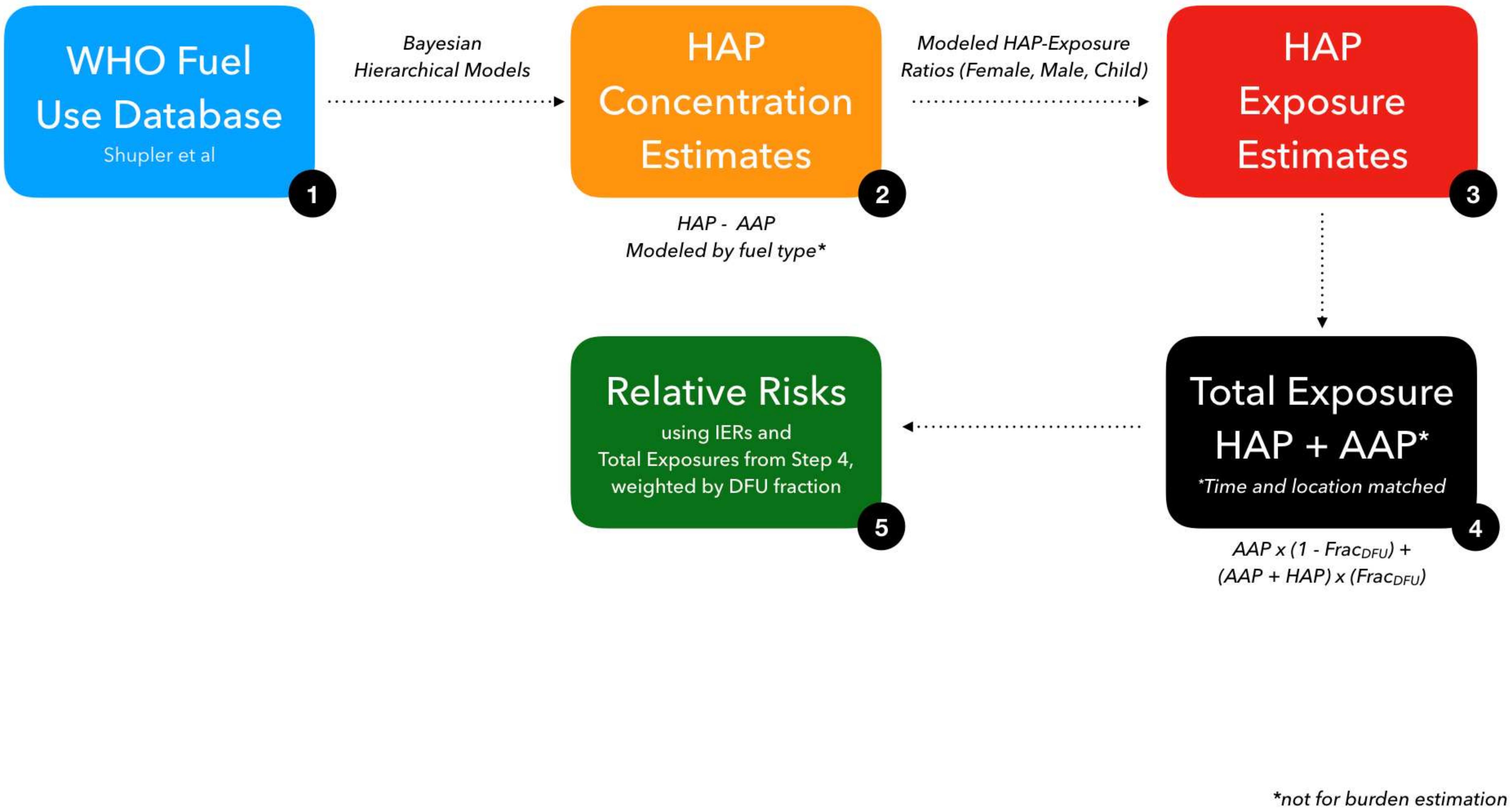


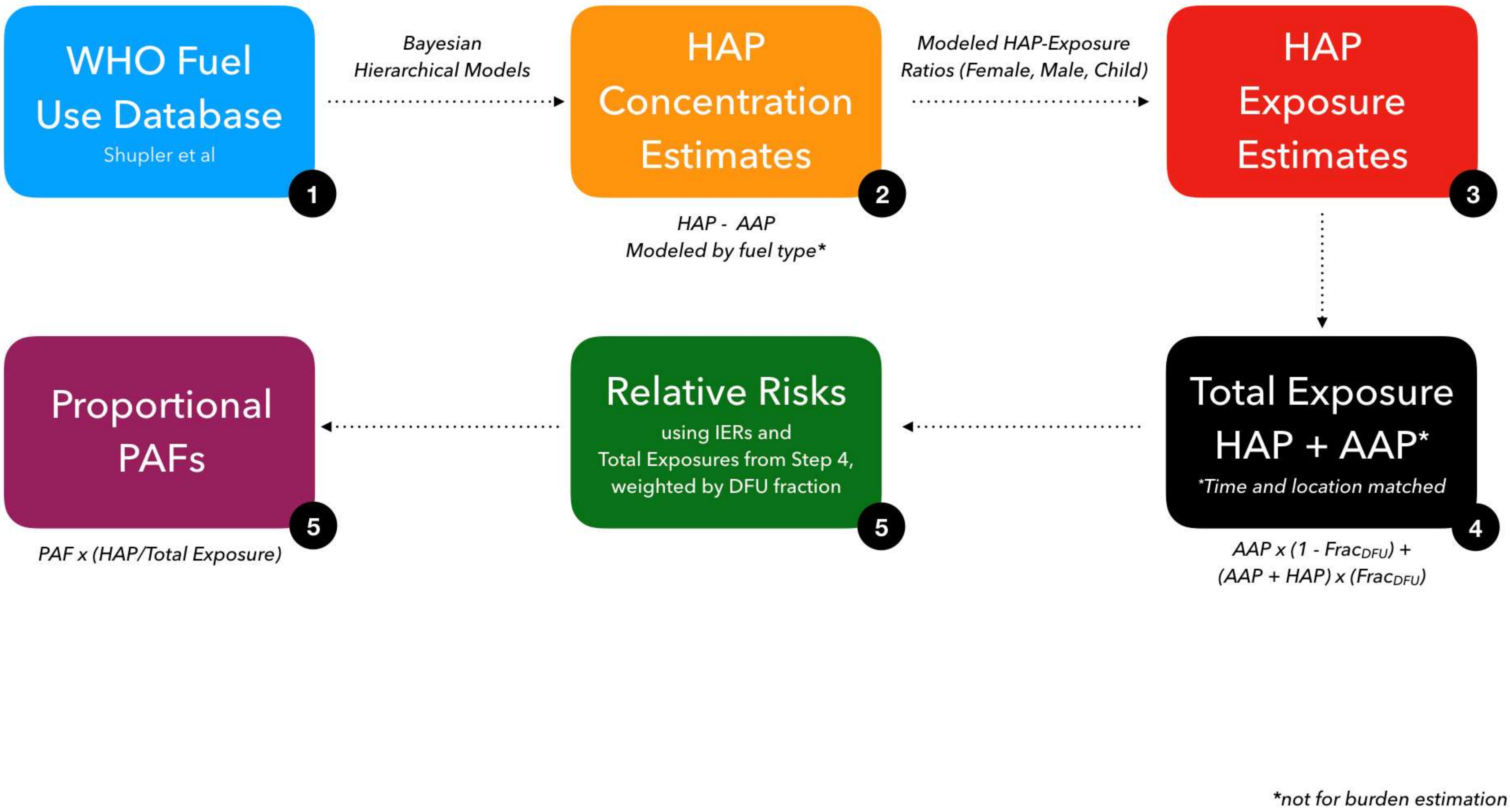
*not for burden estimation



*not for burden estimation


An attempt to prevent double-counting
Relative Risk
3.0
2.5
2.0
1.5
1.0
0
250
500
750
1000
Annual Average PM2.5 Exposure
cause
COPD
IHD
LC
LRI
Stroke
T2DM


WHO Fuel Use Database
Shupler et al
1
Bayesian Hierarchical Models
HAP Concentration Estimates
2
HAP - AAP
Modeled by fuel type*
Modeled HAP-Exposure Ratios (Female, Male, Child)
HAP Exposure Estimates
3
Total Exposure
HAP + AAP*
*Time and location matched
4
AAP x (1 - Frac$_{DFU}$) +
(AAP + HAP) x (Frac$_{DFU}$)
Relative Risks
using IERs and
Total Exposures from Step 4,
weighted by DFU fraction
5
*not for burden estimation


WHO Fuel Use Database
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Bayesian Hierarchical Models
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HAP - AAP
Modeled by fuel type*
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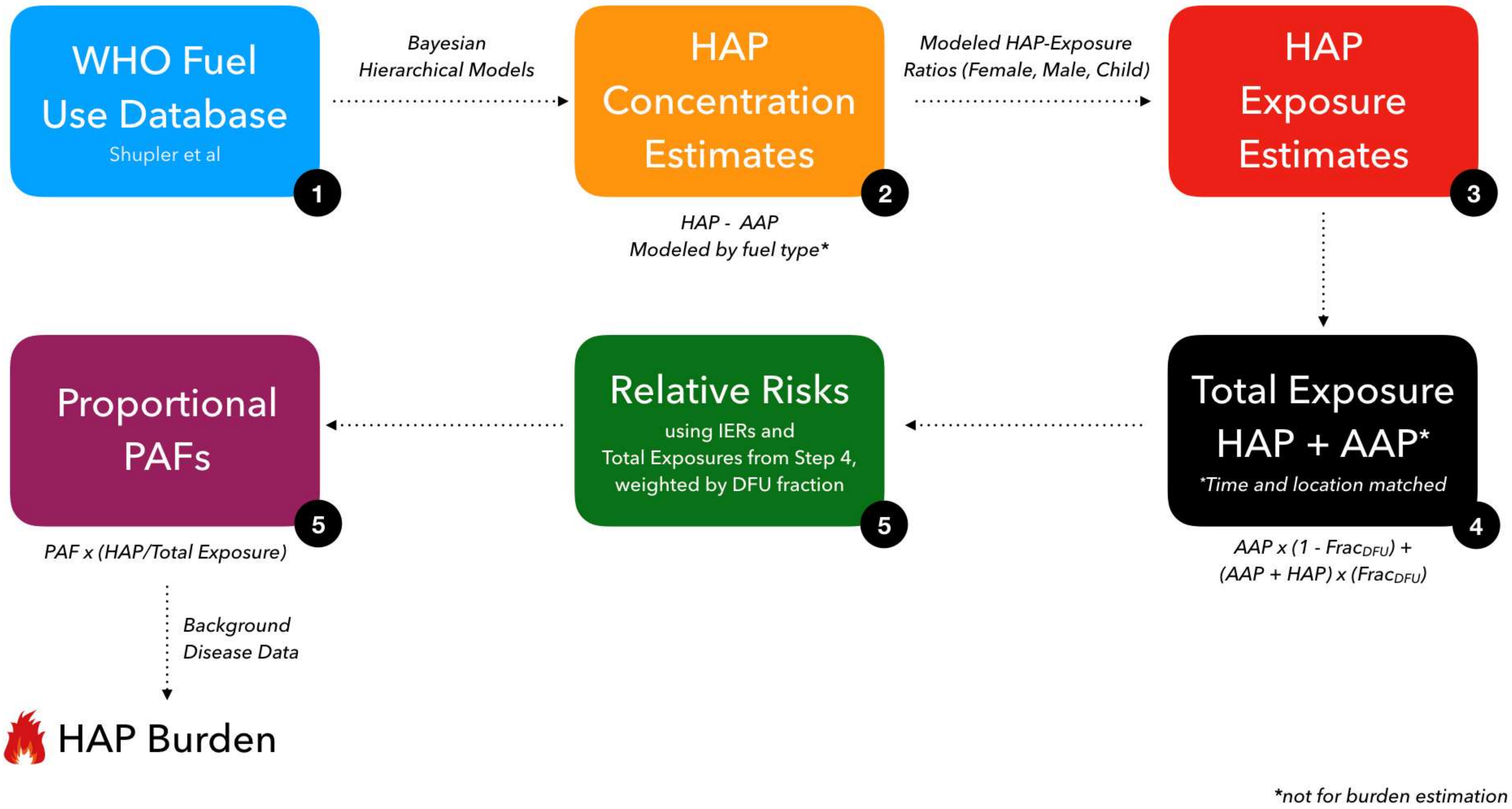
HAP Exposure Estimates
3
Total Exposure HAP + AAP*
*Time and location matched
4
AAP x (1 - FracDFU) +
(AAP + HAP) x (FracDFU)
Relative Risks
using IERs and
Total Exposures from Step 4,
weighted by DFU fraction
5
Proportional PAFs
5
PAF x (HAP/Total Exposure)
*not for burden estimation


WHO Fuel Use Database
Shupler et al
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HAP Exposure Estimates
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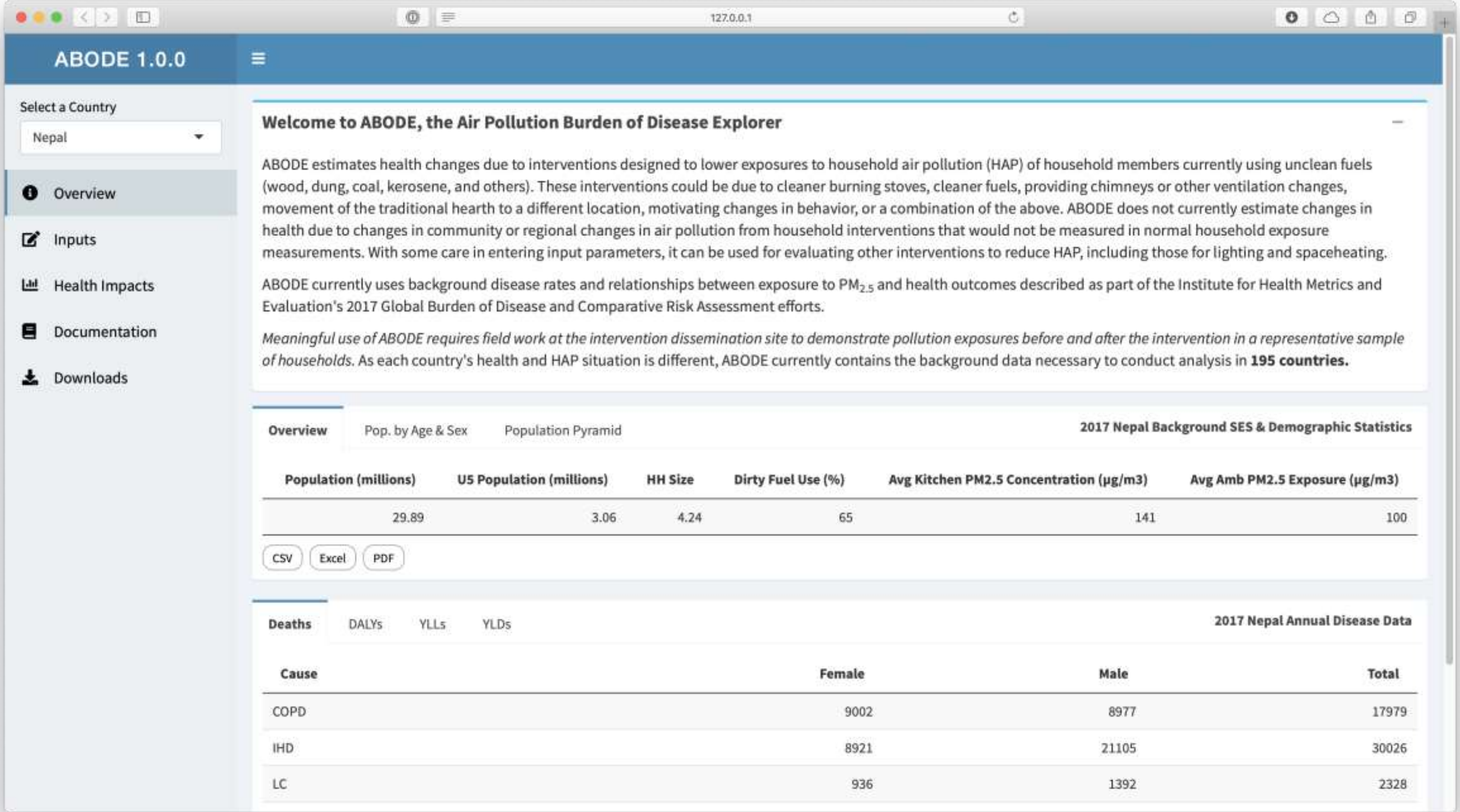
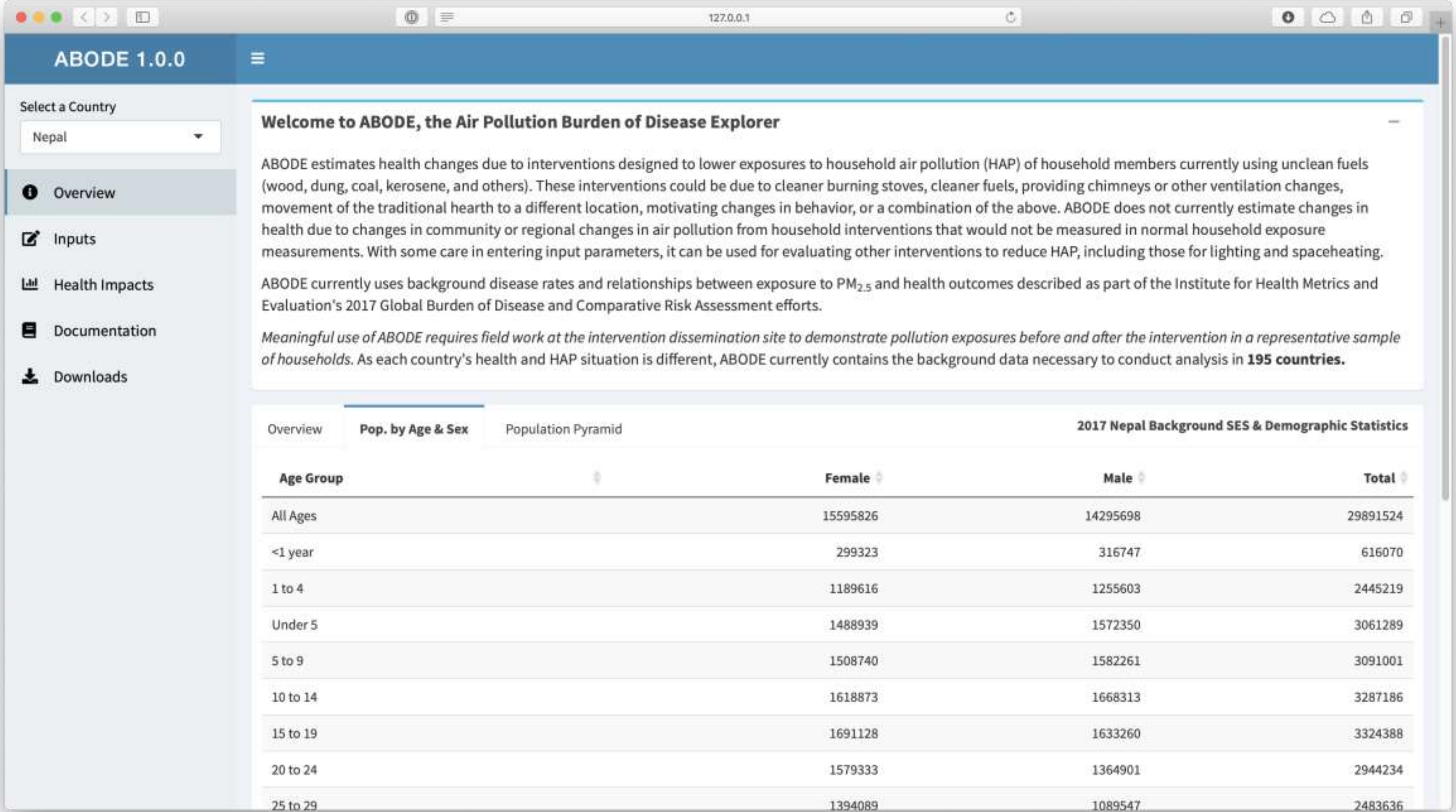
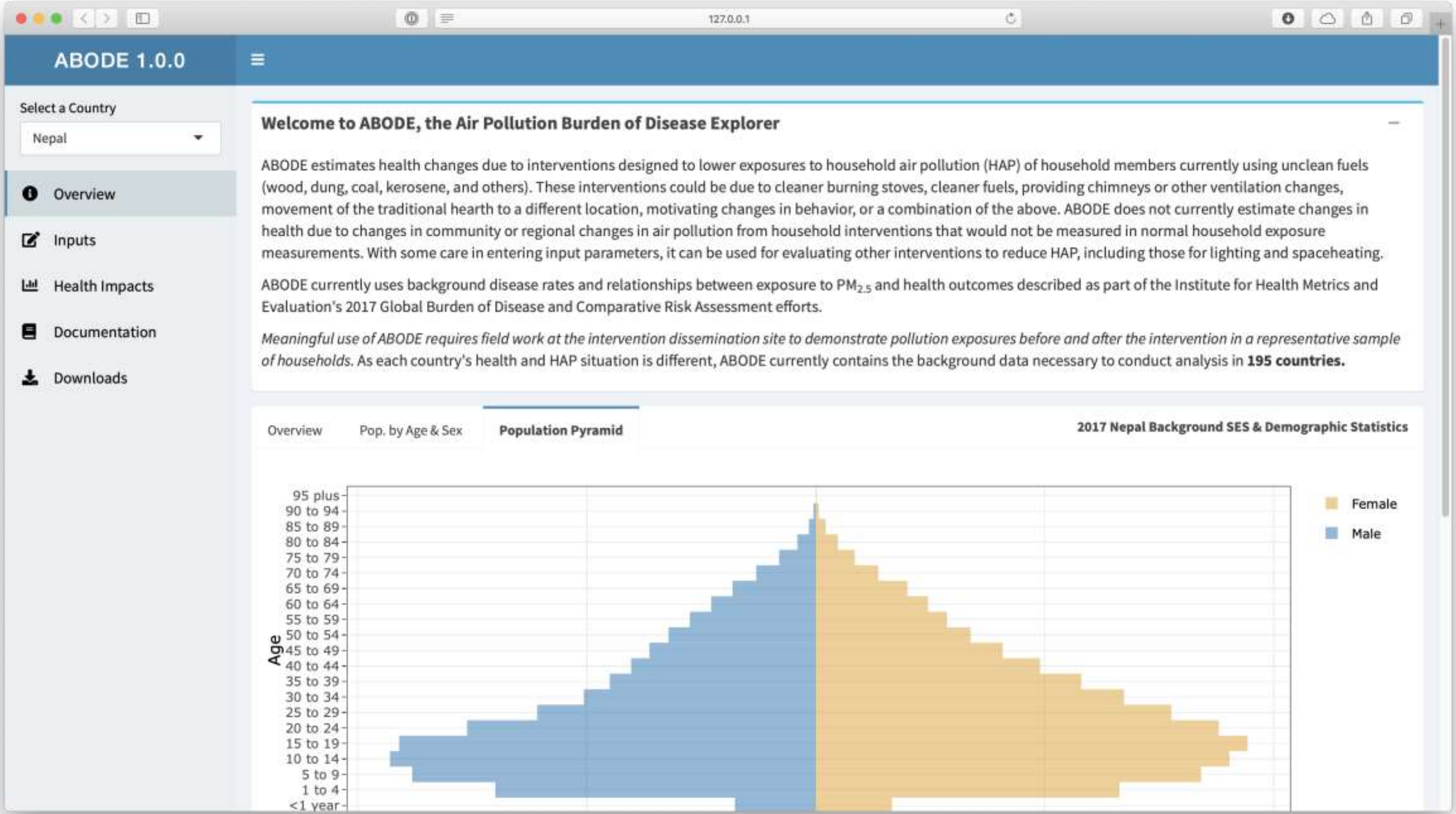
Total Exposure HAP + AAP*
*Time and location matched
4
AAP x (1 - Frac$_{DFU}$) +
(AAP + HAP) x (Frac$_{DFU}$)
Relative Risks
using IERs and
Total Exposures from Step 4,
weighted by DFU fraction
5
Proportional PAFs
5
PAF x (HAP/Total Exposure)
Background Disease Data
HAP Burden
*not for burden estimation

It’s complicated.

It’s complicated. ABODE, in the same vein as HAPIT, tries to simplify things to the extent possible.


127.0.0.1
ABODE 1.0.0
Select a Country
Nepal
Overview
Inputs
Health Impacts
Documentation
Downloads
Welcome to ABODE, the Air Pollution Burden of Disease Explorer
ABODE estimates health changes due to interventions designed to lower exposures to household air pollution (HAP) of household members currently using unclean fuels (wood, dung, coal, kerosene, and others). These interventions could be due to cleaner burning stoves, cleaner fuels, providing chimneys or other ventilation changes, movement of the traditional hearth to a different location, motivating changes in behavior, or a combination of the above. ABODE does not currently estimate changes in health due to changes in community or regional changes in air pollution from household interventions that would not be measured in normal household exposure measurements. With some care in entering input parameters, it can be used for evaluating other interventions to reduce HAP, including those for lighting and spaceheating.
ABODE currently uses background disease rates and relationships between exposure to $PM_{2.5}$ and health outcomes described as part of the Institute for Health Metrics and Evaluation's 2017 Global Burden of Disease and Comparative Risk Assessment efforts.
Meaningful use of ABODE requires field work at the intervention dissemination site to demonstrate pollution exposures before and after the intervention in a representative sample of households. As each country's health and HAP situation is different, ABODE currently contains the background data necessary to conduct analysis in **195 countries.**
Overview
Pop. by Age & Sex
Population Pyramid
2017 Nepal Background SES & Demographic Statistics
Population (millions) | U5 Population (millions) | HH Size | Dirty Fuel Use (%) | Avg Kitchen PM2.5 Concentration (µg/m3) | Avg Amb PM2.5 Exposure (µg/m3)
29.89 | 3.06 | 4.24 | 65 | 141 | 100
CSV
Excel
PDF
Deaths
DALYs
YLLs
YLDs
2017 Nepal Annual Disease Data
Cause | Female | Male | Total
COPD | 9002 | 8977 | 17979
IHD | 8921 | 21105 | 30026
LC | 936 | 1392 | 2328


127.0.0.1
ABODE 1.0.0
Select a Country
Nepal
Overview
Inputs
Health Impacts
Documentation
Downloads
Welcome to ABODE, the Air Pollution Burden of Disease Explorer
ABODE estimates health changes due to interventions designed to lower exposures to household air pollution (HAP) of household members currently using unclean fuels (wood, dung, coal, kerosene, and others). These interventions could be due to cleaner burning stoves, cleaner fuels, providing chimneys or other ventilation changes, movement of the traditional hearth to a different location, motivating changes in behavior, or a combination of the above. ABODE does not currently estimate changes in health due to changes in community or regional changes in air pollution from household interventions that would not be measured in normal household exposure measurements. With some care in entering input parameters, it can be used for evaluating other interventions to reduce HAP, including those for lighting and spaceheating.
ABODE currently uses background disease rates and relationships between exposure to $PM_{2.5}$ and health outcomes described as part of the Institute for Health Metrics and Evaluation's 2017 Global Burden of Disease and Comparative Risk Assessment efforts.
Meaningful use of ABODE requires field work at the intervention dissemination site to demonstrate pollution exposures before and after the intervention in a representative sample of households. As each country's health and HAP situation is different, ABODE currently contains the background data necessary to conduct analysis in **195 countries.**
Overview
Pop. by Age & Sex
Population Pyramid
2017 Nepal Background SES & Demographic Statistics
Age Group Female Male Total
All Ages 15595826 14295698 29891524
<1 year 299323 316747 616070
1 to 4 1189616 1255603 2445219
Under 5 1488939 1572350 3061289
5 to 9 1508740 1582261 3091001
10 to 14 1618873 1668313 3287186
15 to 19 1691128 1633260 3324388
20 to 24 1579333 1364901 2944234
25 to 29 1394089 1089547 2483636


127.0.0.1
ABODE 1.0.0
Select a Country
Nepal
Overview
Inputs
Health Impacts
Documentation
Downloads
Welcome to ABODE, the Air Pollution Burden of Disease Explorer
ABODE estimates health changes due to interventions designed to lower exposures to household air pollution (HAP) of household members currently using unclean fuels (wood, dung, coal, kerosene, and others). These interventions could be due to cleaner burning stoves, cleaner fuels, providing chimneys or other ventilation changes, movement of the traditional hearth to a different location, motivating changes in behavior, or a combination of the above. ABODE does not currently estimate changes in health due to changes in community or regional changes in air pollution from household interventions that would not be measured in normal household exposure measurements. With some care in entering input parameters, it can be used for evaluating other interventions to reduce HAP, including those for lighting and spaceheating.
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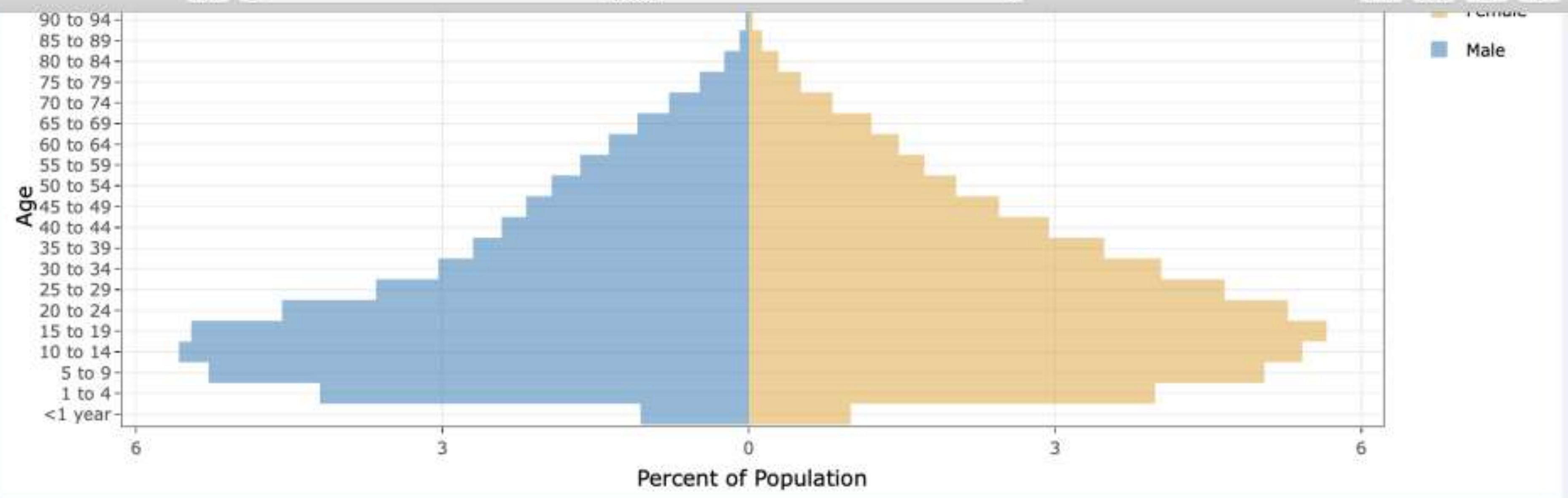
Overview
Pop. by Age & Sex
Population Pyramid
2017 Nepal Background SES & Demographic Statistics
Age
95 plus
90 to 94
85 to 89
80 to 84
75 to 79
70 to 74
65 to 69
60 to 64
55 to 59
50 to 54
45 to 49
40 to 44
35 to 39
30 to 34
25 to 29
20 to 24
15 to 19
10 to 14
5 to 9
1 to 4
<1 year
Female
Male

127.0.0.1

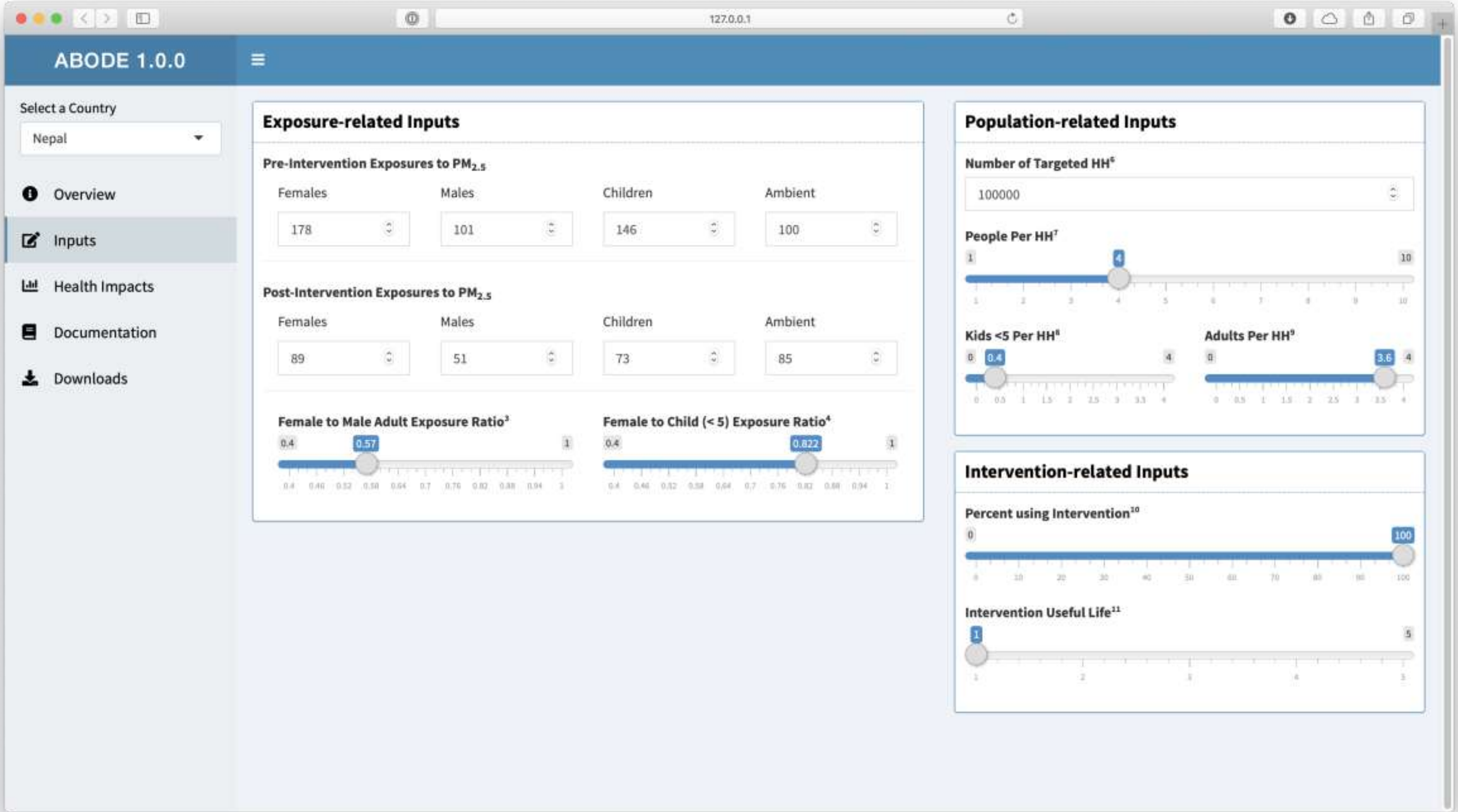


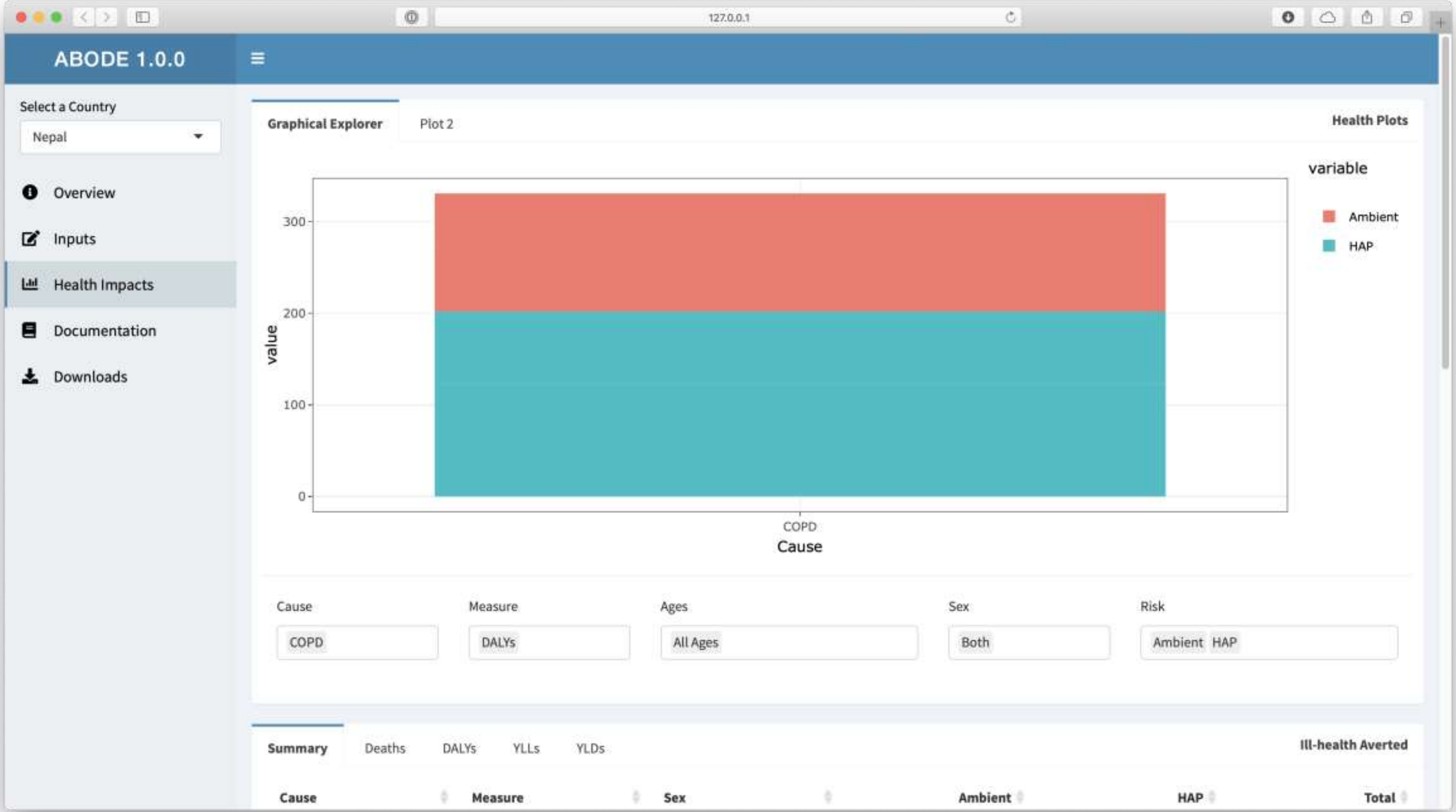
Deaths | DALYs | YLLs | YLDs

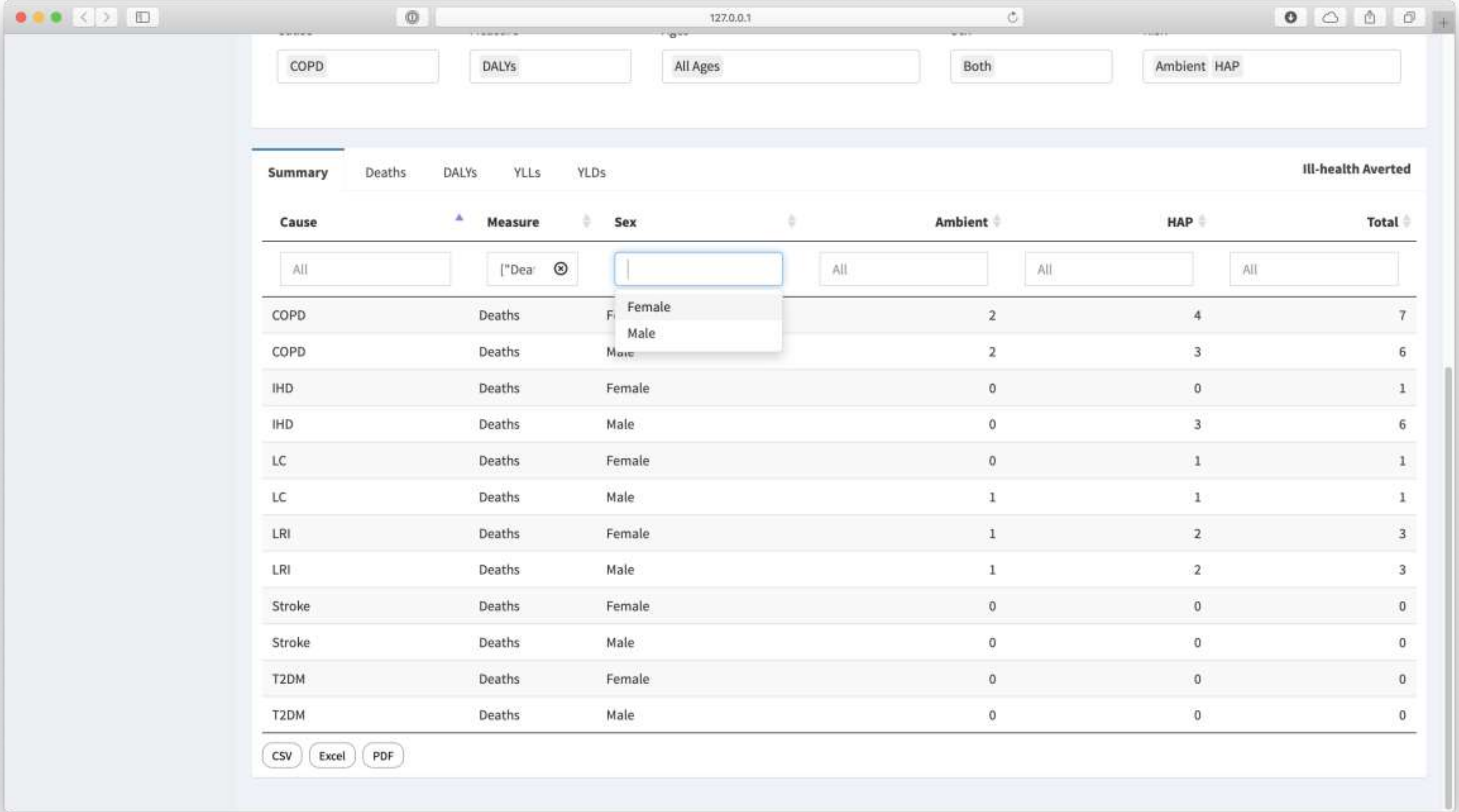
2017 Nepal Annual Disease Data

Cause	Female	Male	Total
COPD	9002	8977	17979
IHD	8921	21105	30026
LC	936	1392	2328
LRI	4689	4608	9297
Stroke	4982	8820	13802
T2DM	1945	1678	3623

CSV | Excel | PDF


127.0.0.1
ABODE 1.0.0
Select a Country
Nepal
Overview
Inputs
Health Impacts
Documentation
Downloads
Exposure-related Inputs
Pre-Intervention Exposures to PM2.5
Females
Males
Children
Ambient
178
101
146
100
Post-Intervention Exposures to PM2.5
Females
Males
Children
Ambient
89
51
73
85
Female to Male Adult Exposure Ratio3
0.4
0.57
1
Female to Child (< 5) Exposure Ratio4
0.4
0.822
1
Population-related Inputs
Number of Targeted HH6
100000
People Per HH7
1
4
10
Kids <5 Per HH8
0
0.4
4
Adults Per HH9
0
3.6
4
Intervention-related Inputs
Percent using Intervention10
0
100
Intervention Useful Life11
1
5


127.0.0.1
ABODE 1.0.0
Select a Country
Nepal
Overview
Inputs
Health Impacts
Documentation
Downloads
Graphical Explorer
Plot 2
Health Plots
variable
Ambient
HAP
300
200
100
0
value
COPD
Cause
Cause
COPD
Measure
DALYs
Ages
All Ages
Sex
Both
Risk
Ambient
HAP
Summary
Deaths
DALYs
YLLs
YLDs
Ill-health Averted
Cause
Measure
Sex
Ambient
HAP
Total



Cause	Measure	Sex	Ambient	HAP	Total
COPD	Deaths	F	2	4	7
COPD	Deaths	Male	2	3	6
IHD	Deaths	Female	0	0	1
IHD	Deaths	Male	0	3	6
LC	Deaths	Female	0	1	1
LC	Deaths	Male	1	1	1
LRI	Deaths	Female	1	2	3
LRI	Deaths	Male	1	2	3
Stroke	Deaths	Female	0	0	0
Stroke	Deaths	Male	0	0	0
T2DM	Deaths	Female	0	0	0
T2DM	Deaths	Male	0	0	0

Limitations

Requires significant M&E efforts to verify benefits

Changes to underlying HAPIT data may invalidate results from previous HAPIT runs

Clearly conveying uncertainty challenging

Convincing health studies still needed for chronic diseases

IHME will revise the IERs, causes, and background disease data again in early 2020.
Low birth weight and short gestational age.

Issues

The science and the burden of disease estimation methods are changing – you may have noticed in recent years a change in the amount of ill-health attributed to HAP. This doesn't necessarily reflect changes on Earth, but does reflect changes in methods.

How does one deal with this? At a policy level or burden estimation level?

WHO will release new GBD estimates to member states; these will be stable estimates for a designated period of time.

The science can continue to move forward, but the estimates will be ~ stabilized

Issues

As has been discussed, the air pollution epidemiology is fairly strong, but the efficacy of HAP interventions is questionable.

One could consider quantifying and attempting to monetize reductions in exposure, with a description of the scale of health benefits associated with that reduction

Or could adopt the WHO burden estimates when they arrive for these methodologies

In the ADALY methodology and in HAPIT and ABODE, we've tried to balance the challenges of monitoring and evaluation with a minimum set of inputs to estimate averted ill-health

Next Steps

Finish ABODE – before new GBD data arrives!

HAPIT 3.1 will remain live and accessible

HAPIT 3.2 will include updated background disease data, but no other changes (no new IERs, no proportional attribution, etc)

Evaluate models to estimate exposure from other parameters and look into recompiling the literature base to provide expected exposure reductions by intervention type at the regional or country level – could one award a fraction of ADALYs for projects that use literature values to estimate exposure reductions?

Thank You… and stay tuned.

hapit.org

Global Alliance for Clean Cookstoves

Kirk R. Smith, Donee Alexander, Katie Pogue, Sumi Mehta

Heather Adair-Rohani, Sophie Bonjour, Drew Hill, Cooper Hanning, and Nicholas L. Lam

ajaypillarisetti@gmail.com

HOUSEHOLD ENERGY & HEALTH RESEARCH GROUP
UNIVERSITY OF CALIFORNIA, BERKELEY

Gold Standard Impact Tools

Vikash Taylan, The Gold Standard

Climate Action and Clean Cooking Co-benefits Workshop

Gold Standard®

Overview of Gold Standard Impact Quantification Tools

Sep 2019

Impact Quantification

Tools

Cookstove Impact Quantification

SDG Impact tools

Shared value calculation

Cookstove IQ

Tremendous sustainable development impact but most complex project type to develop and audit

Decision making - Cost Benefit analysis	Project management	Project development	Monitoring	Audit	SDG impacts
• Methodology selection • Project Scale • Returns on Investment	• Project portfolio management • Data management	• Simplified calculation tool • Data requirements	• Project database • Monitoring plan and data gathering – surveys, KPTs • Sampling requirements • Data sharing	• Data check • Audit report preparation	• Other co-benefits • Indicator selection • Monitoring and reporting

An integrated web-based tool to help decision making, quantification and monitoring of emission reductions and sustainable development impacts for Gold Standard cookstove projects.

Gold Standard® iQ

Cookstove IQ - Funders

World Vision

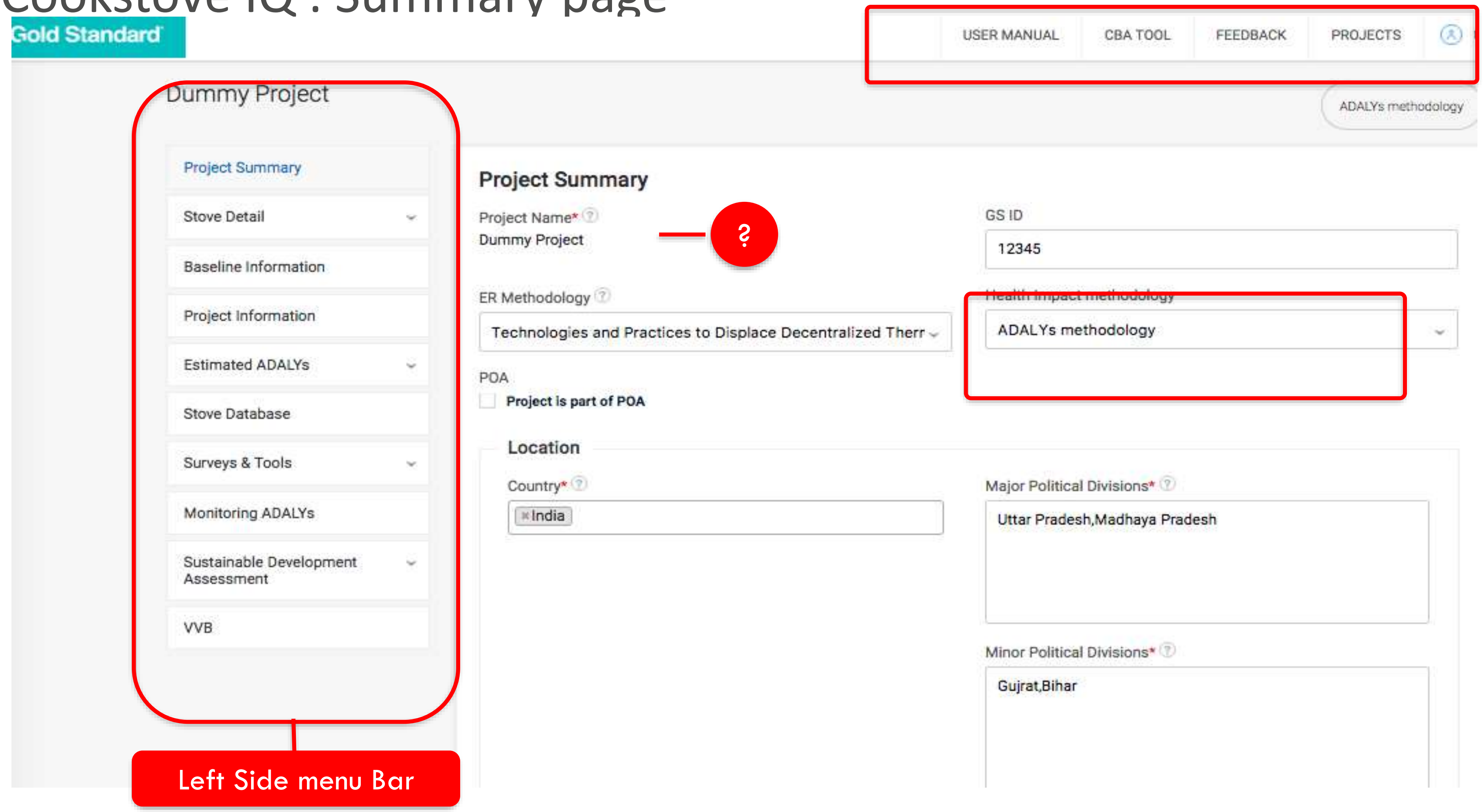
BID

FOMIN
Multilateral Investment Fund
Member of the IDB Group

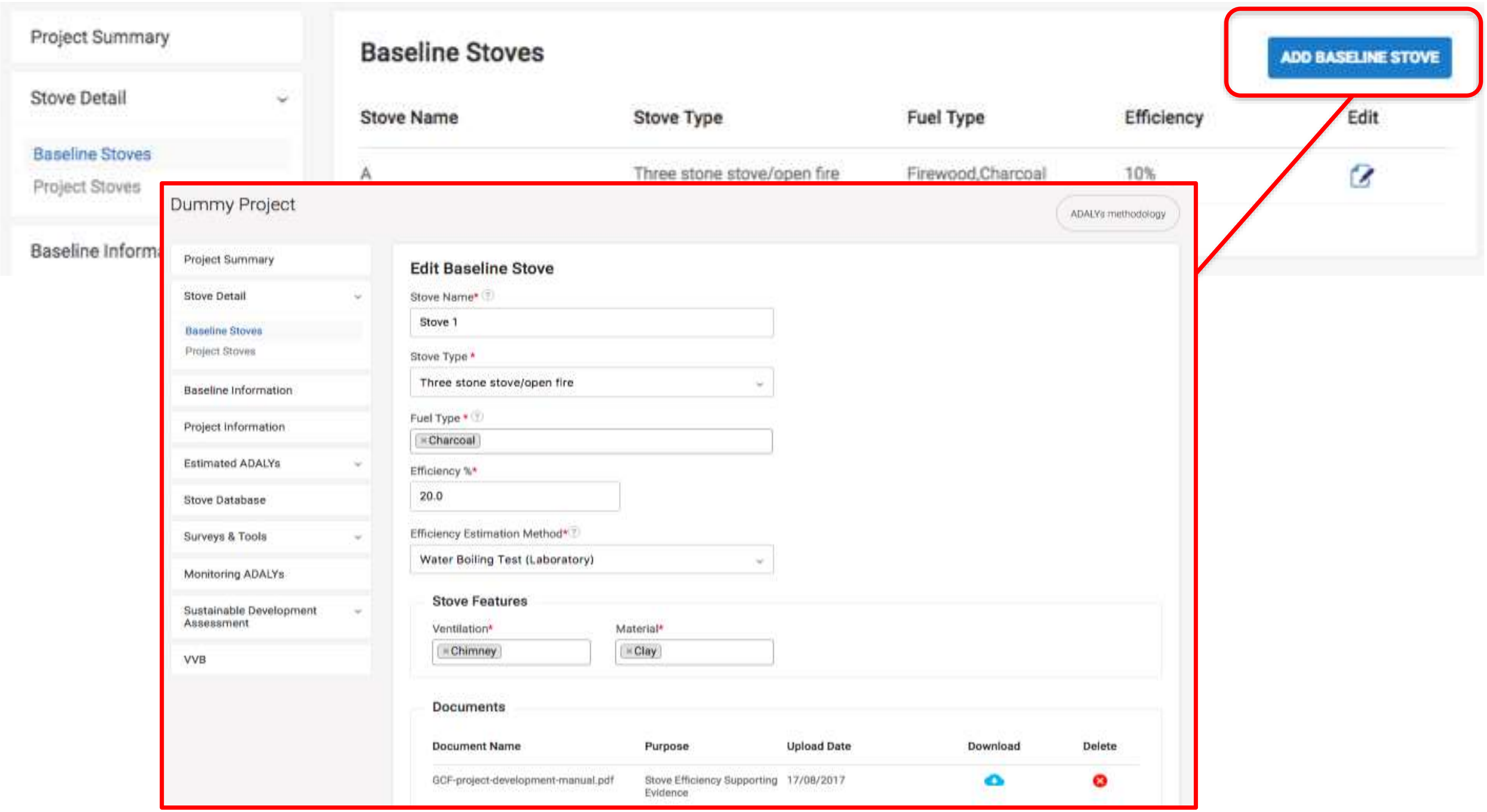
THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

ESMAP
Energy Sector Management Assistance Program

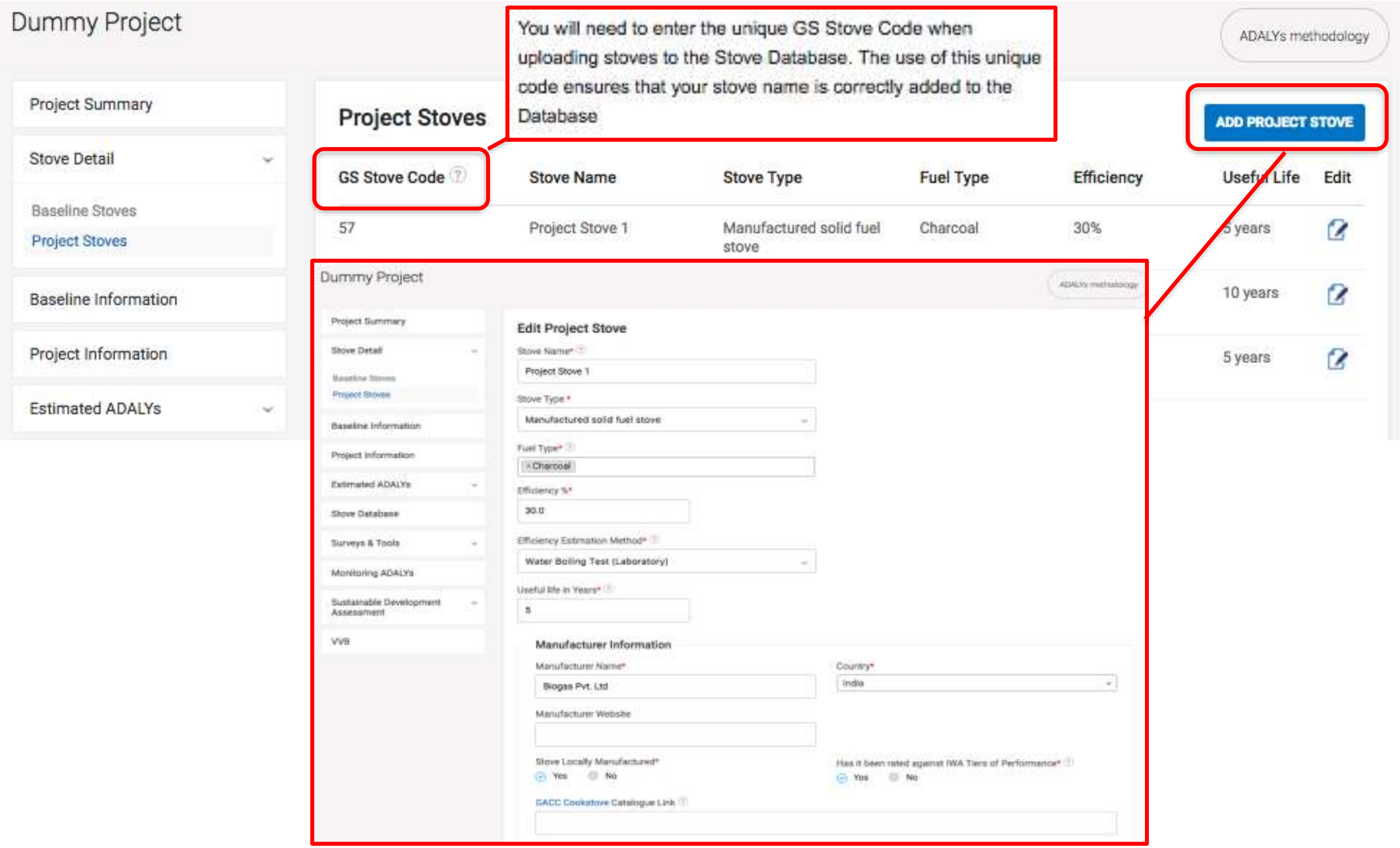
Cookstove IQ : Summary page



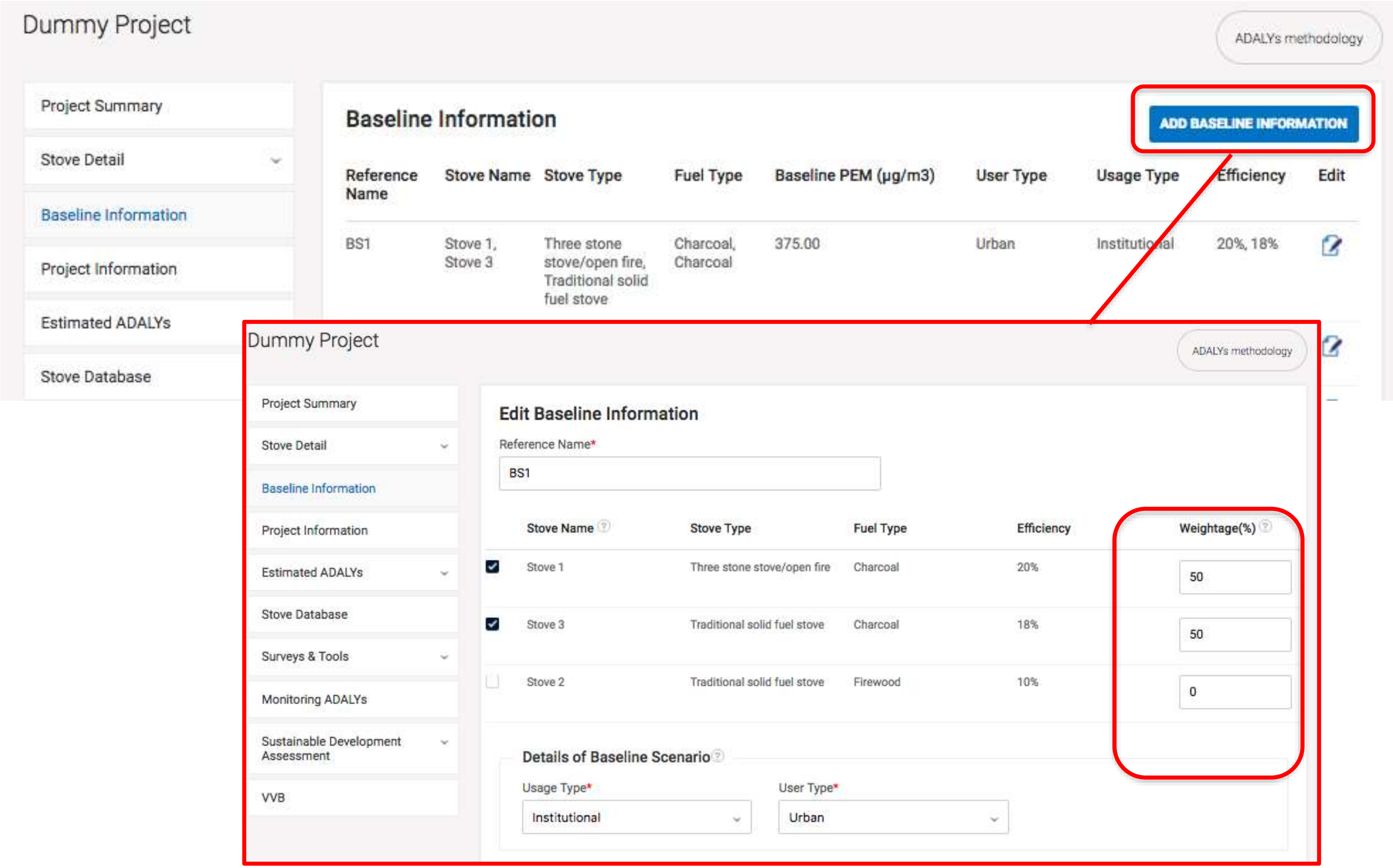
Cookstove IQ: Stove details



Cookstove IQ: Stove details



Cookstove IQ: Baseline Information



Cookstove IQ: Baseline Information

Baseline Survey Information

		Total Daily Frequency	% User
Primary Stove in Summer/dry/hot season	Three stone stove/open f	2.0	90.0
Primary Stove in rainy/winter/cold season	Three stone stove/open f	2.0	100.0
Main fuel in Summer/dry/hot season	Firewood	2.0	100.0
Main fuel in rainy/winter/cold season	Firewood	2.0	100.0
No other use for Stove	-	-	0.0

Methodology for baseline personal exposure monitoring (PEM) of PM2.5 *

Optical

What is the average number of people per household?*

7

Baseline PEM(μg/m3)*

500.0

Family members (age group 0-5)*

2

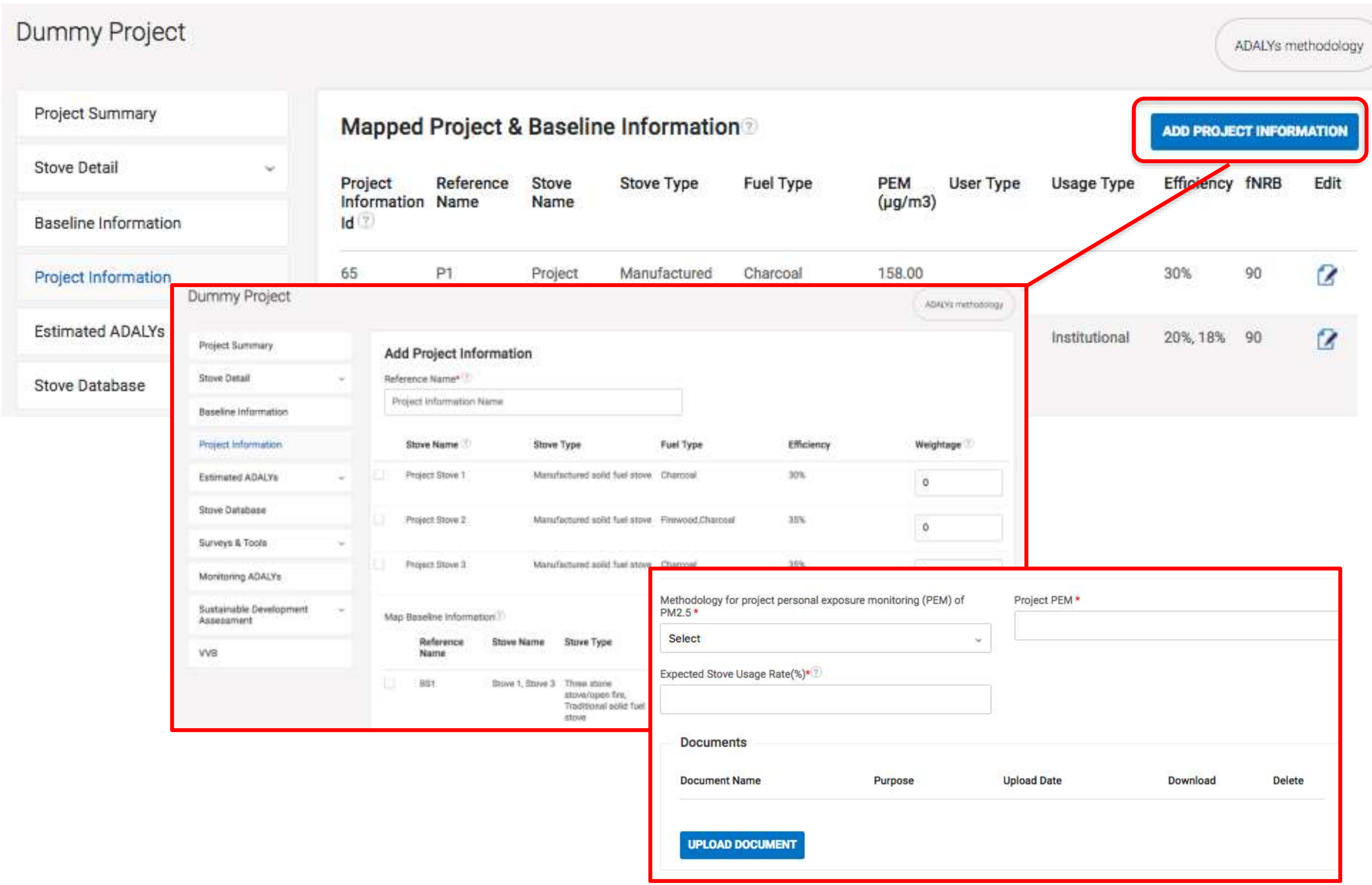
Adjustment factor (AFoptical)*

0.75

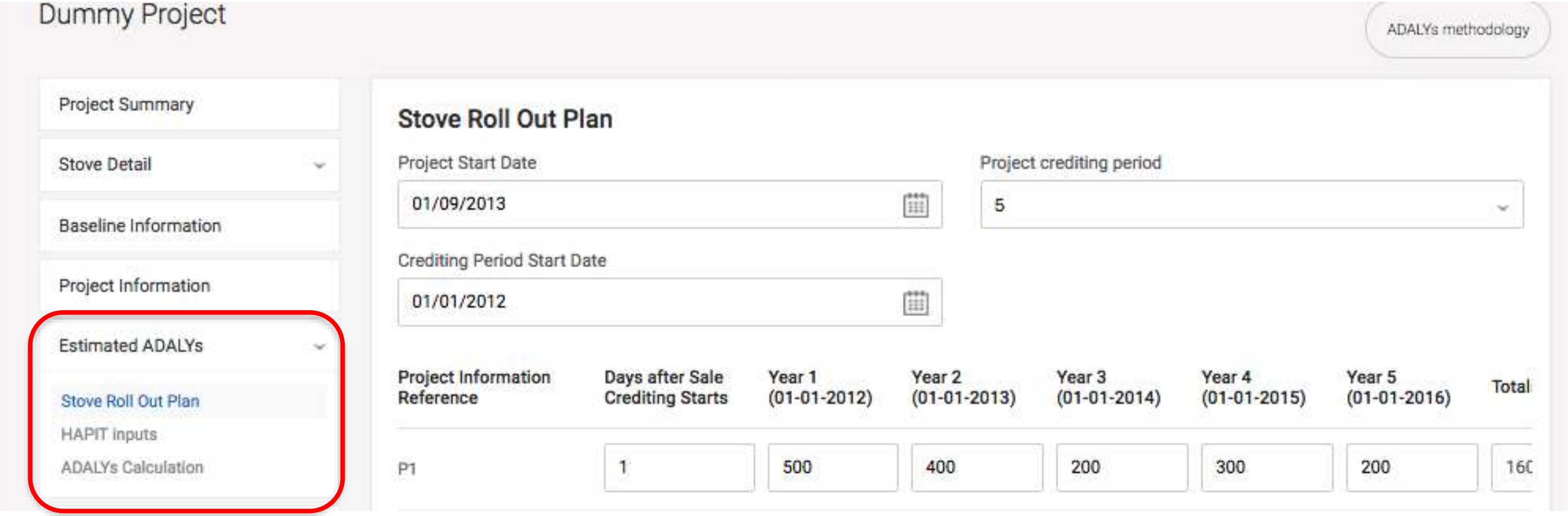
Documents

Document Name	Purpose	Upload Date	Download	Delete

Cookstove IQ: Project Information



Cookstove IQ: Estimated ADALYs



Cookstove IQ: HAPIT INPUT

HAPIT Inputs

Project Information Reference	Stoves Count	Family size	Family members (age group 0-5)	Adult family members	Usage rate (%)	Intervention Useful Life (yrs)	CO concentra (above WHO l (%)
P1	1600	7	2	5	90.0	1.0	5.0
P2	1600	5	2	3	90.0	1.0	
P3	1600	5	2	3	90.0	1.0	15.0

GO TO HAPIT

Project Information Reference	HAPIT Mean ADALYs	ALRI	COPD	IHD	LC	STROKE
P1	244.0	56.0	63.0	89.0	8.0	28.0
P2	177.0	27.0	51.0	71.0	6.0	22.0
P3	124.0	17.0	41.0	50.0	5.0	11.0
Totals	545.00	100.00	155.00	210.00	19.00	61.00

Cookstove IQ: Estimated ADALYs

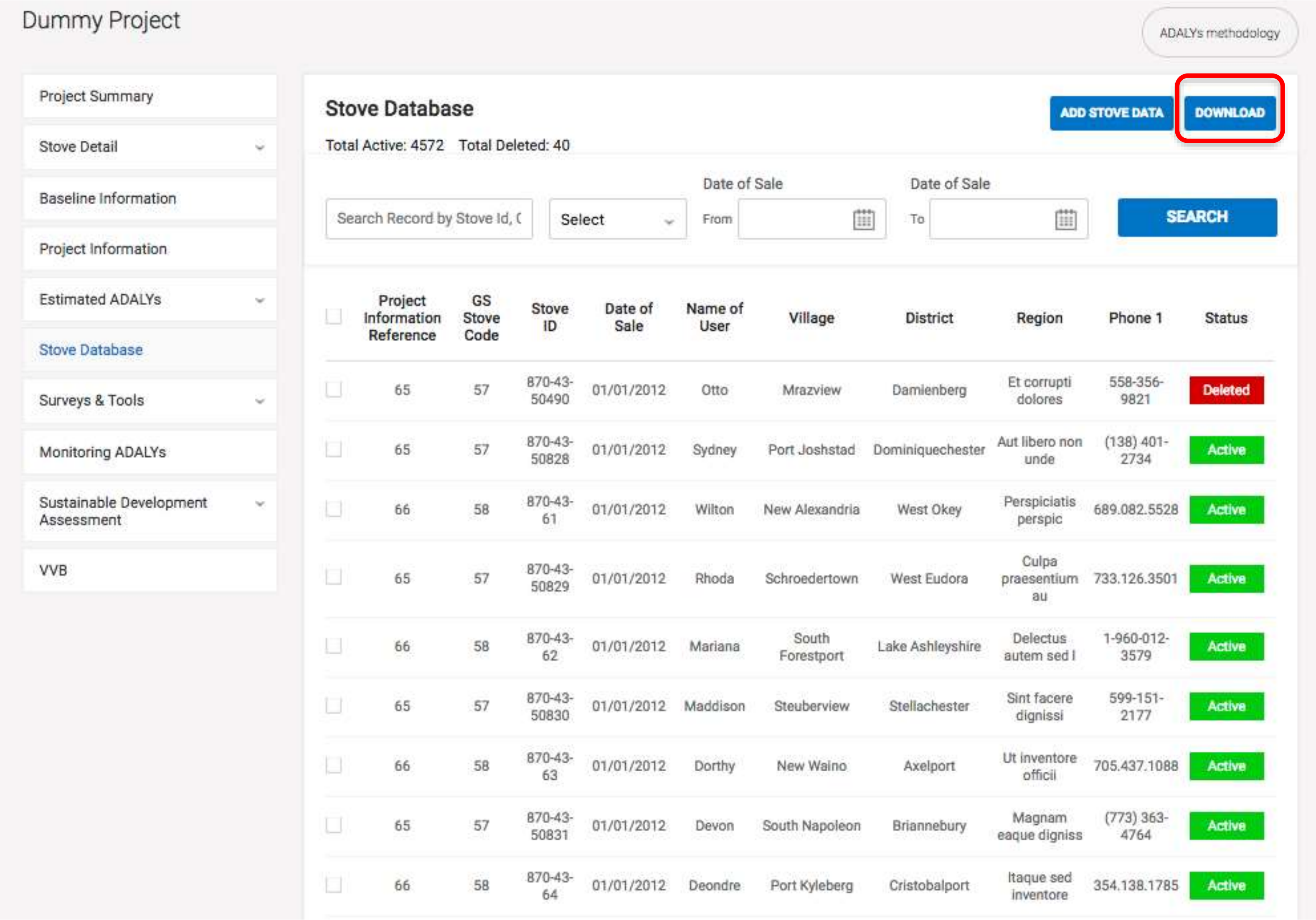
ADALYs Calculation

Project Information Reference	Stoves Count	Stove Operational days	ADALYs/Household/day	Year-1	Year-2	Year
P1	1600	2007500	0.0004	72.44	130.39	159.…
P2	1600	2007500	0.0003	55.31	99.56	121.…
P3	1600	2007500	0.0002	32.94	59.29	72.4…
Totals	**4800.00**	**6022500.00**	**0.0009**	**160.69**	**289.24**	**353.…**

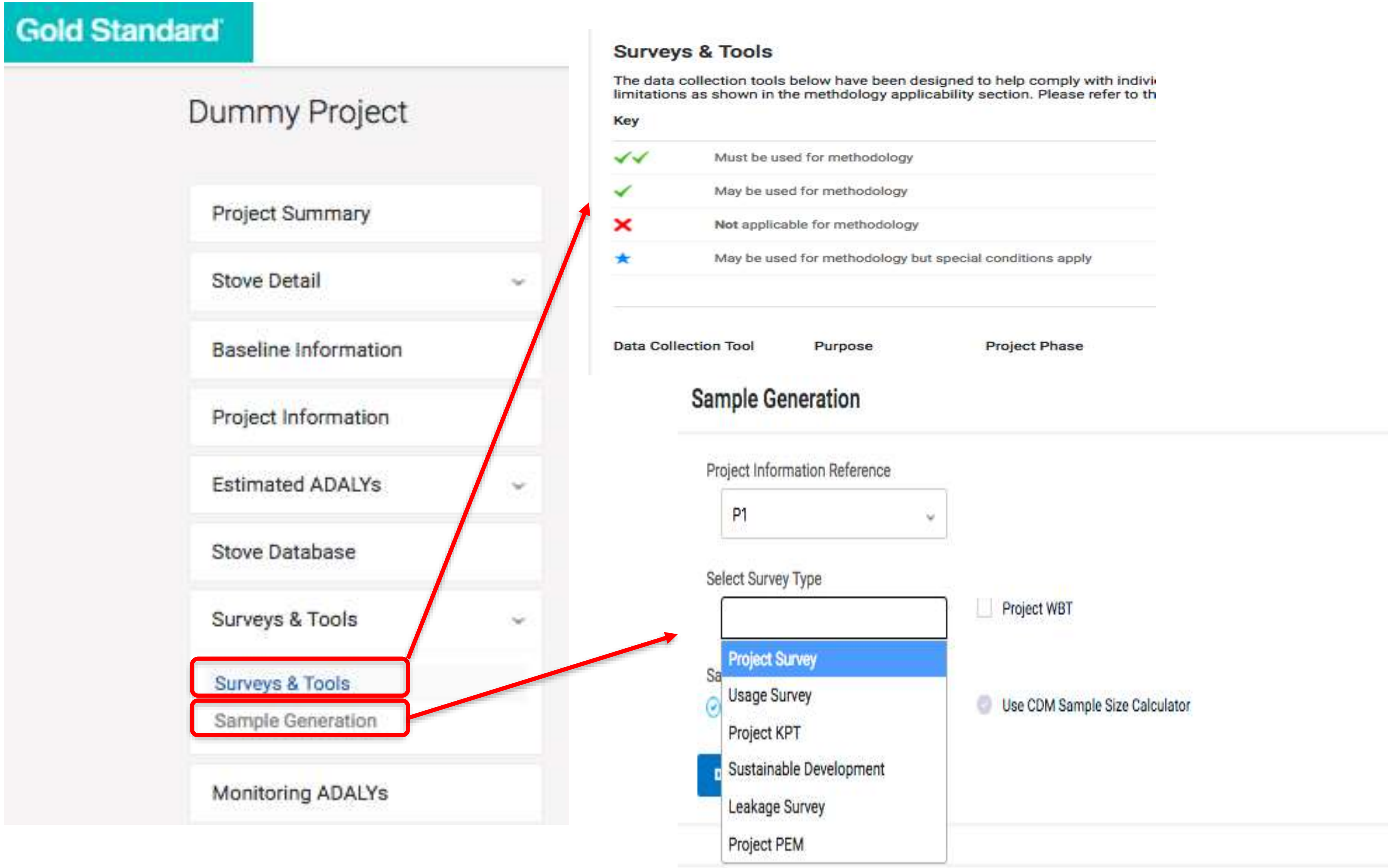
Year-1	Year-2	Year-3	Year-4	Year-5	TOTAL ADALYs	ALRI	COPD	IHD	LC	STROKE
72.44	130.39	159.36	202.82	231.80	796.81	182.88	205.73	290.64	26.12	91.44
55.31	99.56	121.69	154.88	177.00	608.44	92.81	175.31	244.06	20.62	75.62
32.94	59.29	72.46	92.22	105.40	362.31	49.67	119.80	146.09	14.61	32.14
160.69	**289.24**	**353.51**	**449.92**	**514.20**	**1767.56**	**325.36**	**500.84**	**680.79**	**61.35**	**199.20**

UPLOAD DOCUMENT SAVE

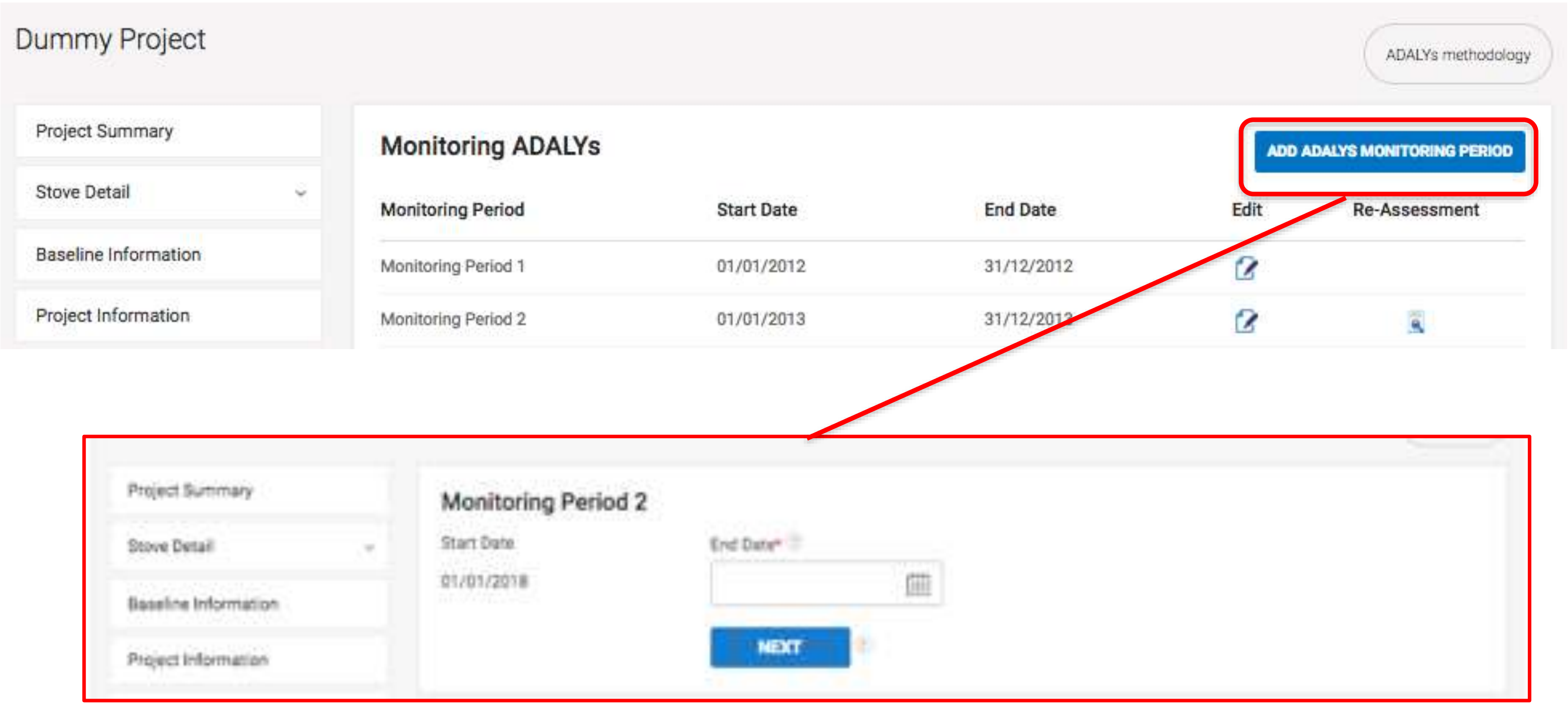
Cookstove IQ: Stove Database



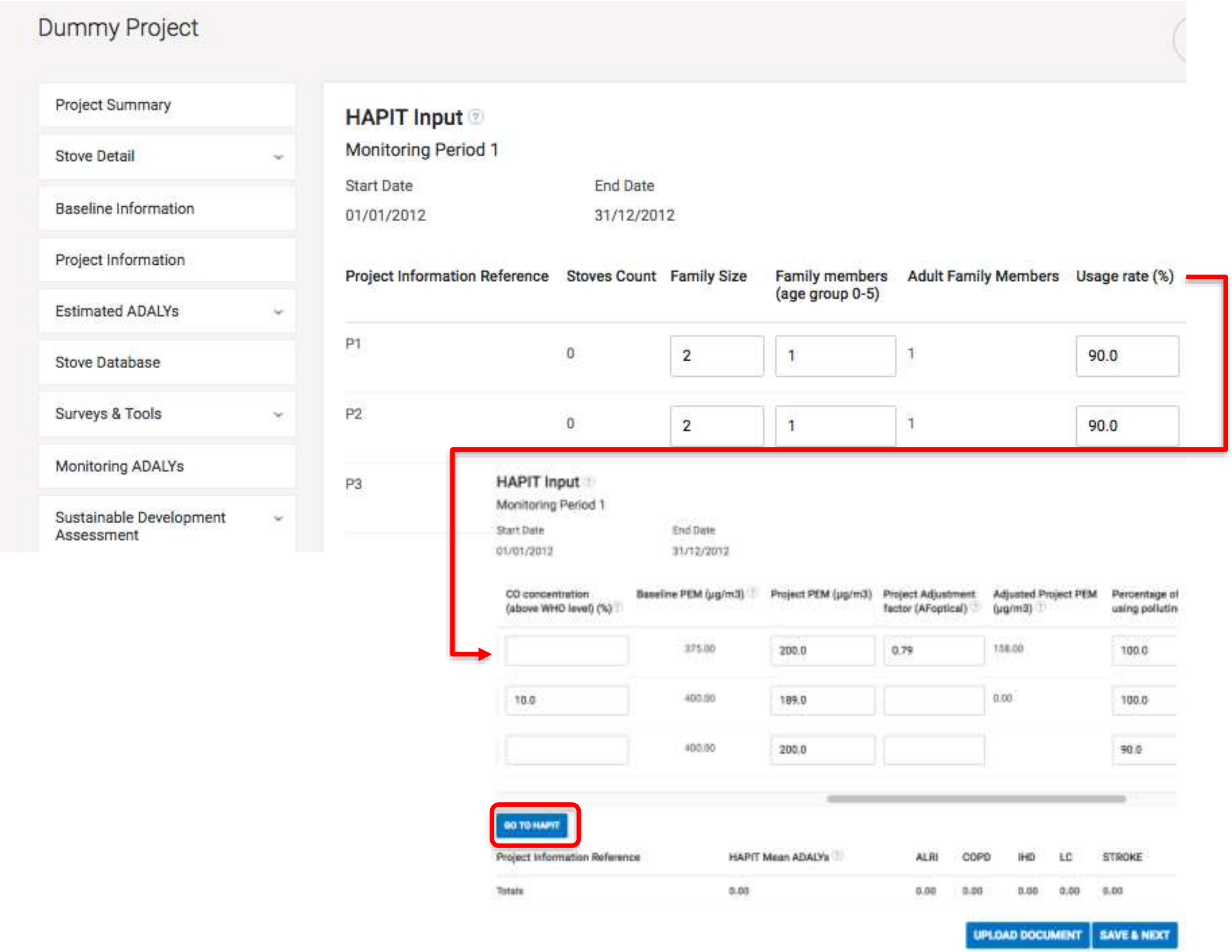
Cookstove IQ: Survey and Tools



Cookstove IQ: Monitoring ADALYs



Cookstove IQ: HAPIT INPUTs



Cookstove IQ: ADALYs Calculation

Dummy Project

ADALYs methodology

- Project Summary
- Stove Detail
- Baseline Information
- Project Information

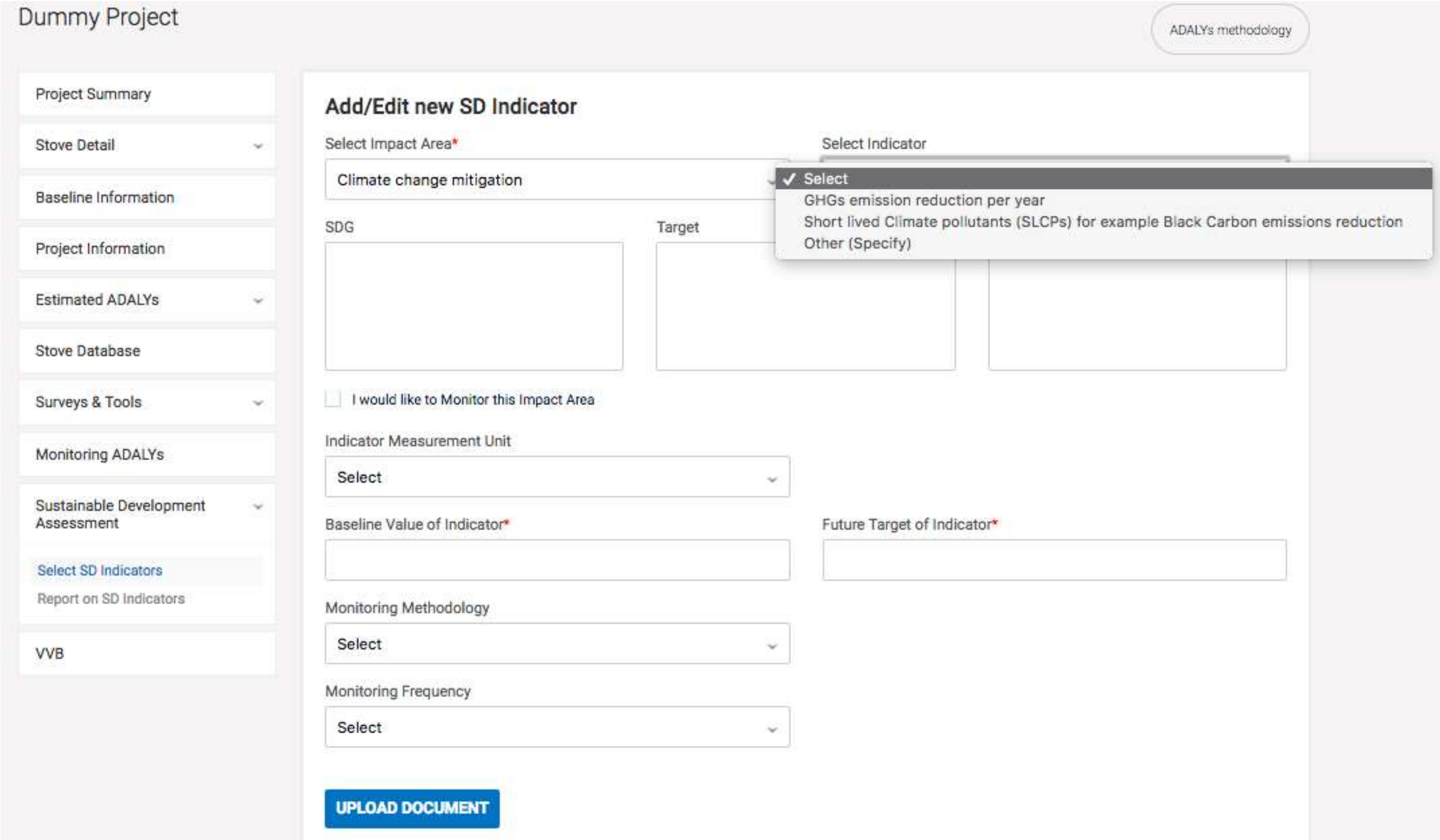
ADALYs Calculation

Start Date	End Date
01/01/2013	31/12/2013

Project Information Reference	Stove Count	Stove Operational days	ADALYs/Household/day	ADALYs	Re-Assessment ADALYs

Moniotring Period	Calculated ADALYs	Issuable ADALYs	Withheld ADALYs	aDALYs reawarded	Final ADALYs Issuance	ALRI	COPD	IHD	LC	STR(

Cookstove IQ: Sustainable Development Assessment



Cookstove IQ: Sustainable Development Assessment

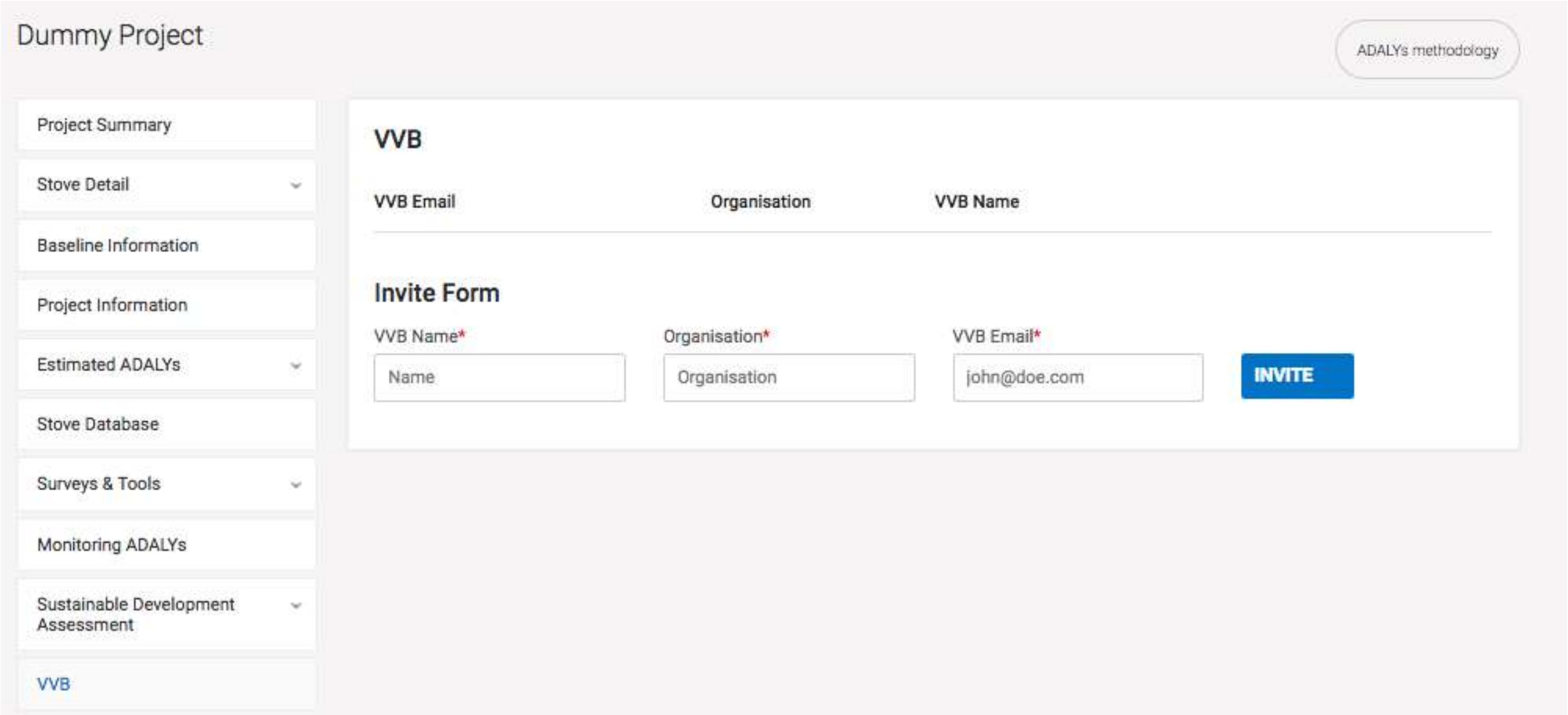
Report on SD Indicators

Impact Area	Indicator	Unit	Baseline Value	Future Target	Methodology	Frequency	Monitoring P
Gender	Average level of participation of women in decision making in household	%	0	90	Survey	Other	01/01/2012-3

HIDE MONITORED DATA

Monitoring Period 1						70	

Cookstove IQ: VVB



SDG IMPACT TOOLS

17 Goals
169 targets
232 Global Indicators

Development of impact assessment and reporting tools that enables project developers and organisations to report their climate and SDG contributions at an intervention (project) level

- Enabling quantifying SDGs from a bottom-up approach
- Simplify and standardize quantification of SDG impact
- Streamlining reporting and certification process
- Enhancing transparency and comparability
- Facilitate comparability and aggregation of SDG impacts for reporting at a portfolio level and performance comparability
- Avoid "SDG washing" and projects overclaiming impacts.

EXPECTED OUTCOMES FROM THE PROGRAMME

Programme Phases	1. SDG tool guidance	2. Sector- specific modules	3. Digitization and roll out
	Phase 1: Guidance	**Phase 2: Implementation.**	**Phase 3: Digitization.**
Description	SDG tool guidance document to serve as blueprint and template to develop sector-specific modules	Development of sector-specific tool modules and testing Functional excel based tools on initial sector-specific modules: 1. Community based projects 2. Renewable Energy and waste 3. Land use	Development of an online version of SDG tools
Outcomes	Agreed framework for SDG tool development, including general structure, functionality, and features of the tools Completed	Standardised quantification and reporting of SDG impacts using relevant indicators for each intervention type + MRV guidance	Digitized SDG tools and integrating Shared Value Calculation Facilitating access and updating of the tools

SDG TOOLS – Prototype example

Select Project type + impact area or SDG + identify monitoring indicators + monitor performance

Automated list of SDGs and targets

Monitoring guidance

Results in a clear, transparent and standardized way

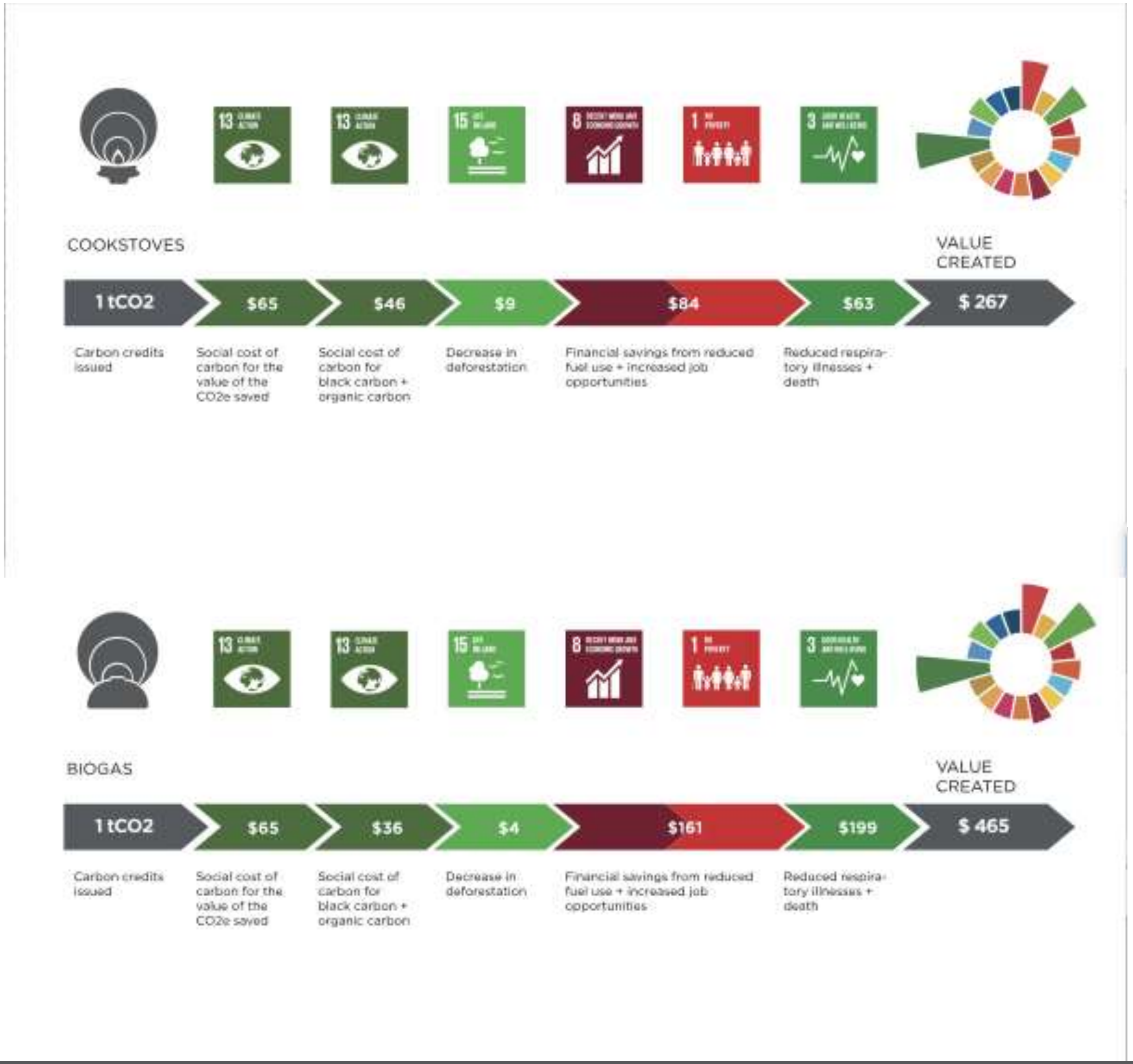
Shared Value calculator

- Economic value of clean cooking

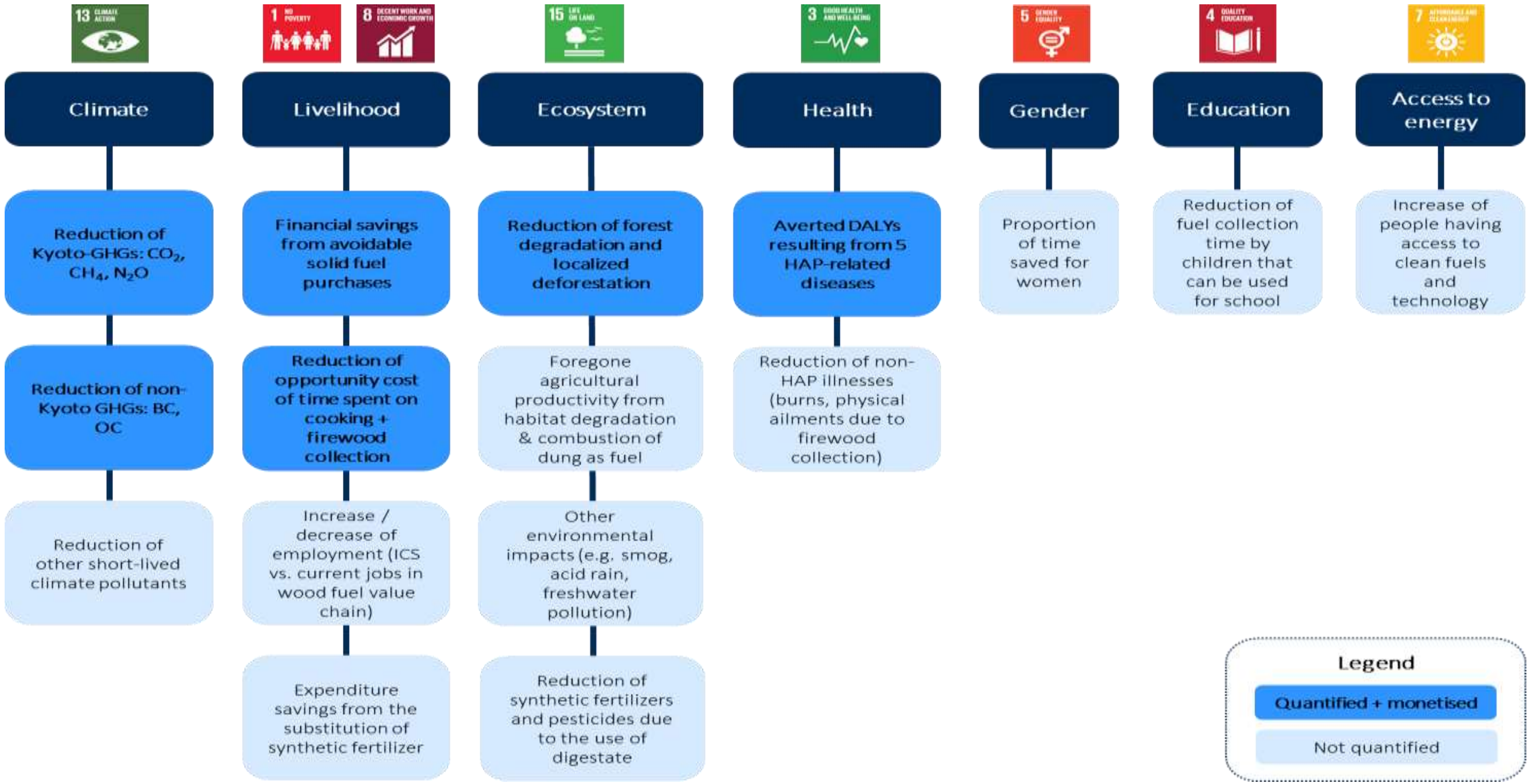
- Average per credit
- Clean cookstove project = $267 Biogas projects = $465 per credit.

- The net benefit of Gold Standard's improved cooking solutions portfolio adds up to $2.6 billion per annum

- https://www.goldstandard.org/blog-item/report-valuating-benefits-improved-cooking-solutions



Impact mapping and quantification



Questions ?

Suggestions

MoFuSS

Adrian Ghilardi, Autonomous University of Mexico

MoFuSS

Modeling Fuelwood Savings Scenarios

Adrián Ghilardi Rob Bailis Ulises Olivares

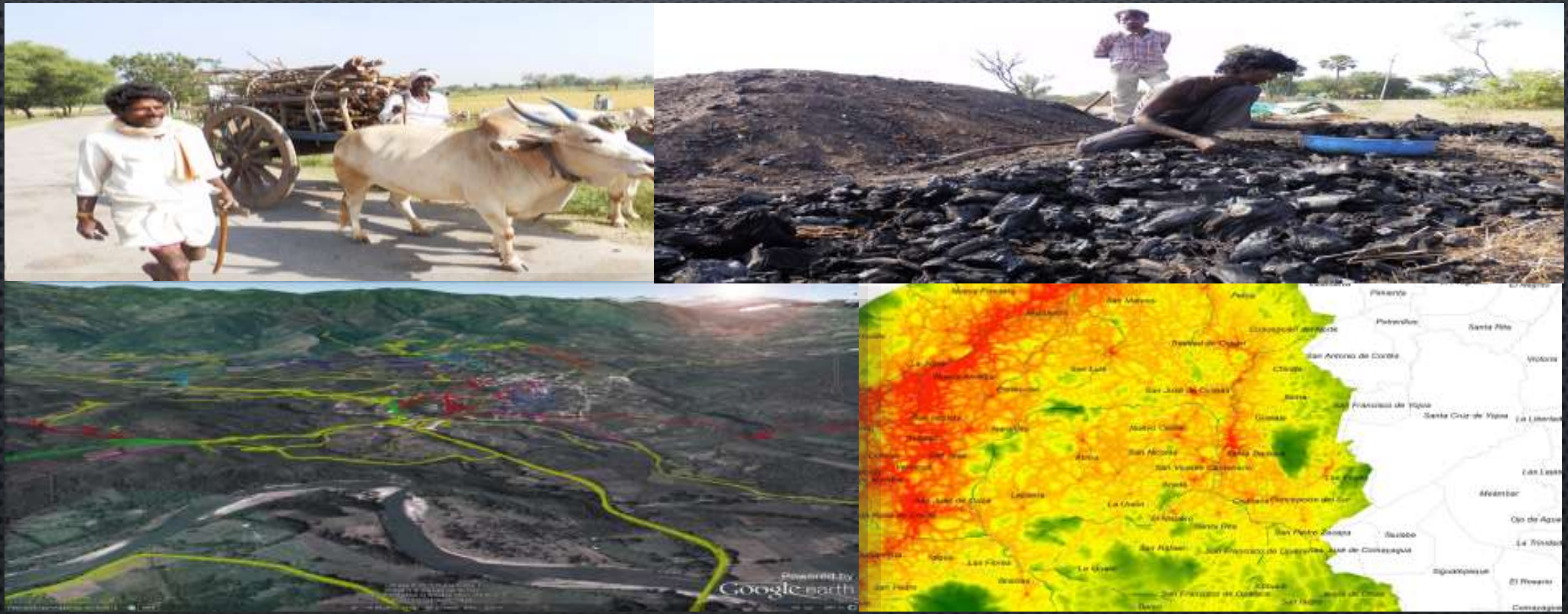
Climate Action and Clean Cooking Co-benefits Workshop

September 9th-11th, 2019 Washigton DC

OVERVIEW

1. WHAT IS MOFUSS?
2. WHAT IS MOFUSS USEFUL FOR?
3. CURRENT DEVELOPMENT AND AVAILABILITY
4. ONGOING DEVELOPMENT

1. What is MoFuSS?



- **MoFuSS** Its a GIS-based model that simulates the spatial and temporal effects of woodfuel harvesting on the landscape vegetation* and that accounts for savings in non-renewable biomass from reduced consumption.

* Aboveground Woody Biomass (!?)

1. What is MoFuSS?

- MoFuSS first version was developed by one of the Clean Cooking Alliance (CCA) projects between 2013-2015: Geospatial Analysis and Modeling of Non-Renewable Biomass: WISDOM and beyond.
- It was built for CCA partners and other stakeholders to assess fuelwood-driven degradation in a variety of contexts.

THE BASIC PREMISE

Nearly all landscapes produce a measurable increment of woody biomass. If wood is extracted in excess of that amount, stocks decline, and demand is **non-renewable.**

This is "Non-renewable biomass" (NRB)

To assess long-term sustainability and quantify CO_2 emissions from woodfuels, we need to estimate NRB

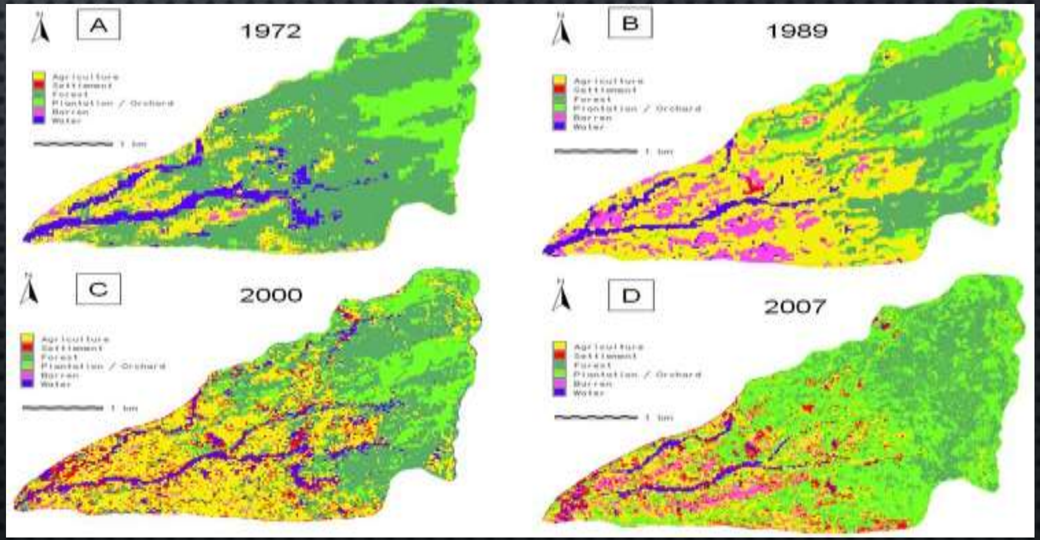
Leleshwa (T. Camphorata) stump sprouts after the tree is cut for charcoal in Narok, Kenya

Charcoal awaiting transport to Nairobi

Landscape are inherently dynamic…

Naturally dynamic

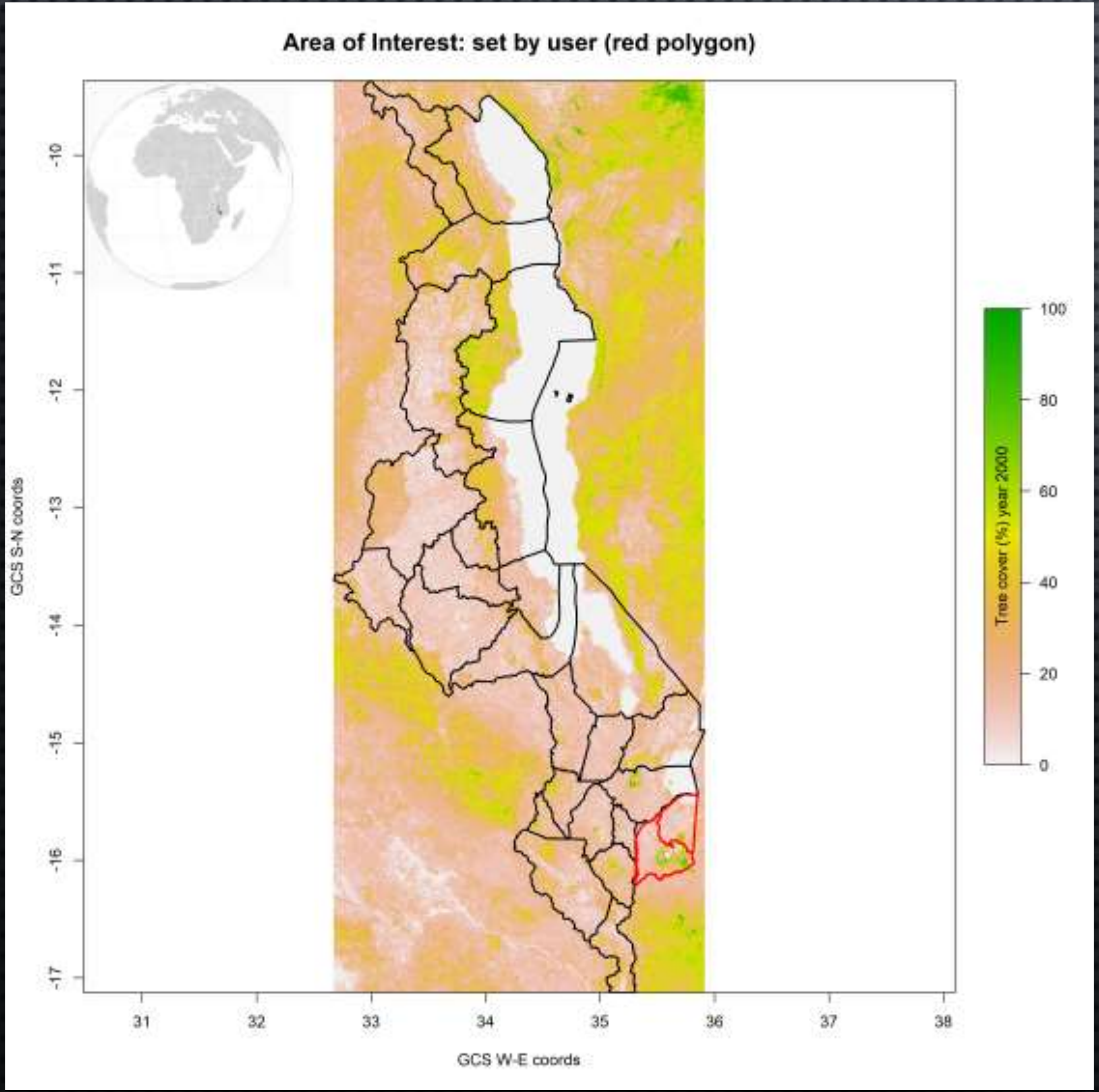
Man-made dynamic

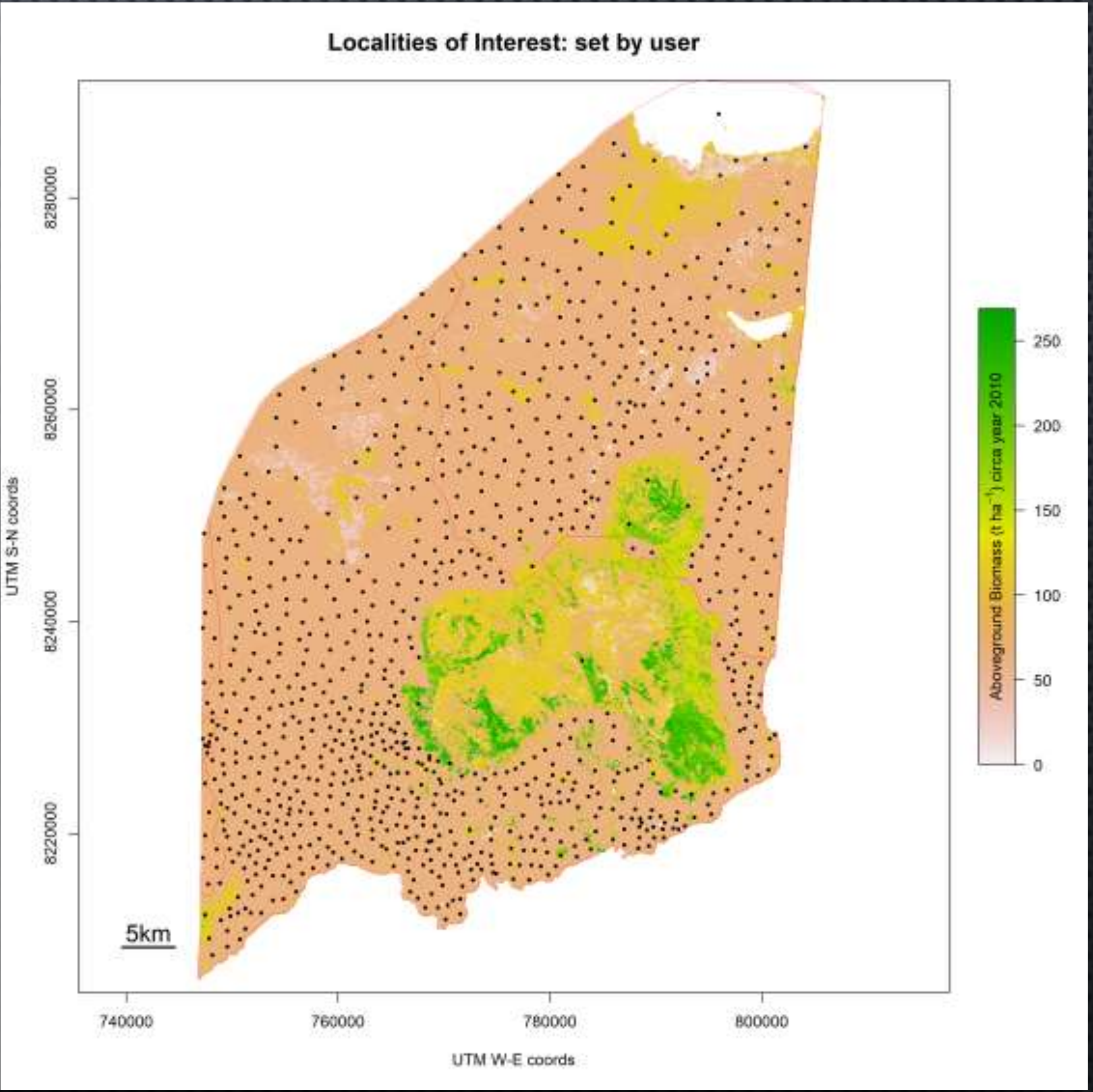


Take home messages about MoFuSS

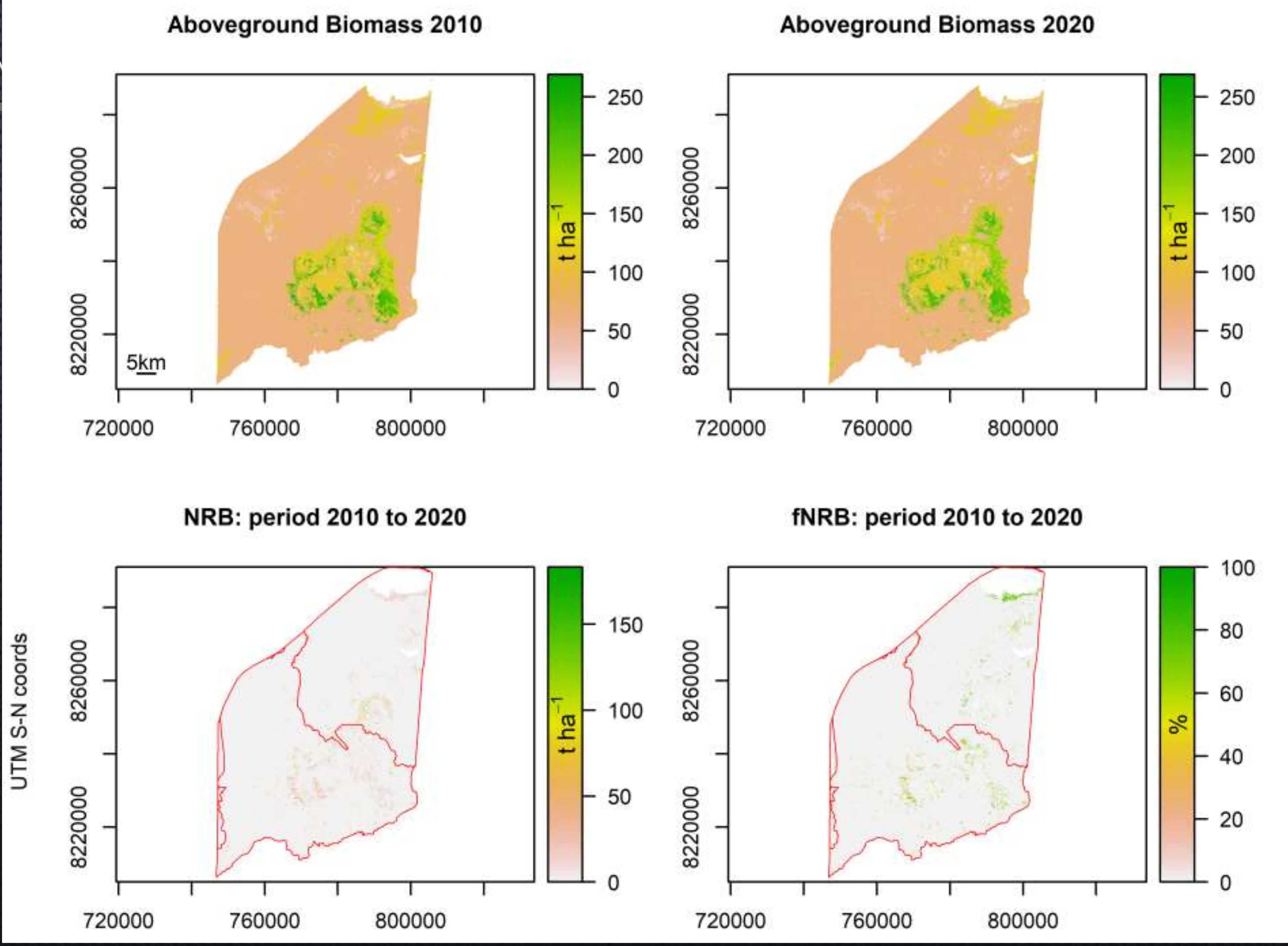
- Woodfuel environmental impacts are site-specific: spatial is important
- Degradation and deforestation only make sense within a defined temporal window
- Stop relying in default aggregated values – its a site-specific problem
- Avoid Project developers' costly consultancies – web-based analysis
- Uncertainty of estimations
- Replicable and tunable to any degree: freeware and open-source

2. What is MoFuSS useful for?

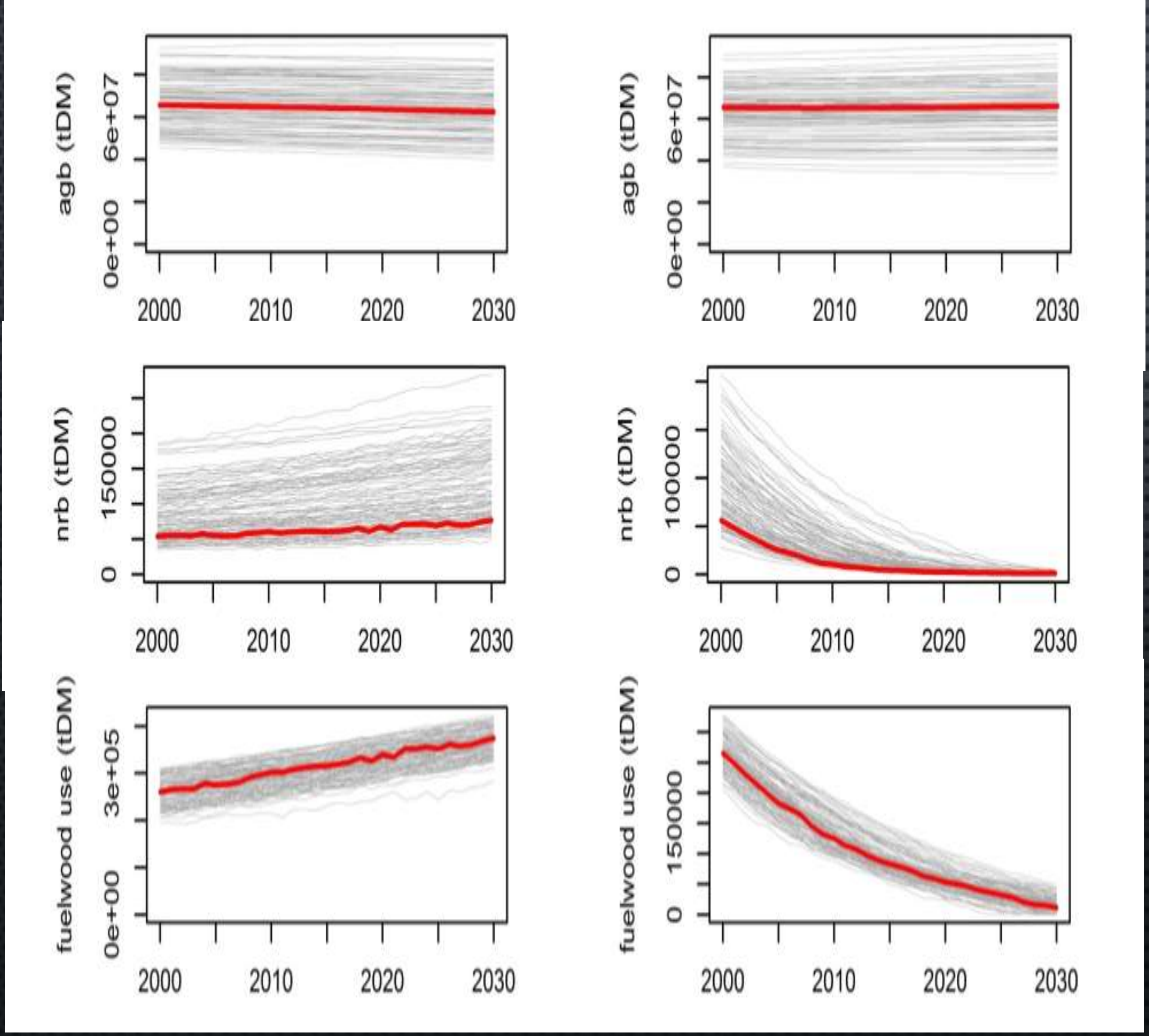


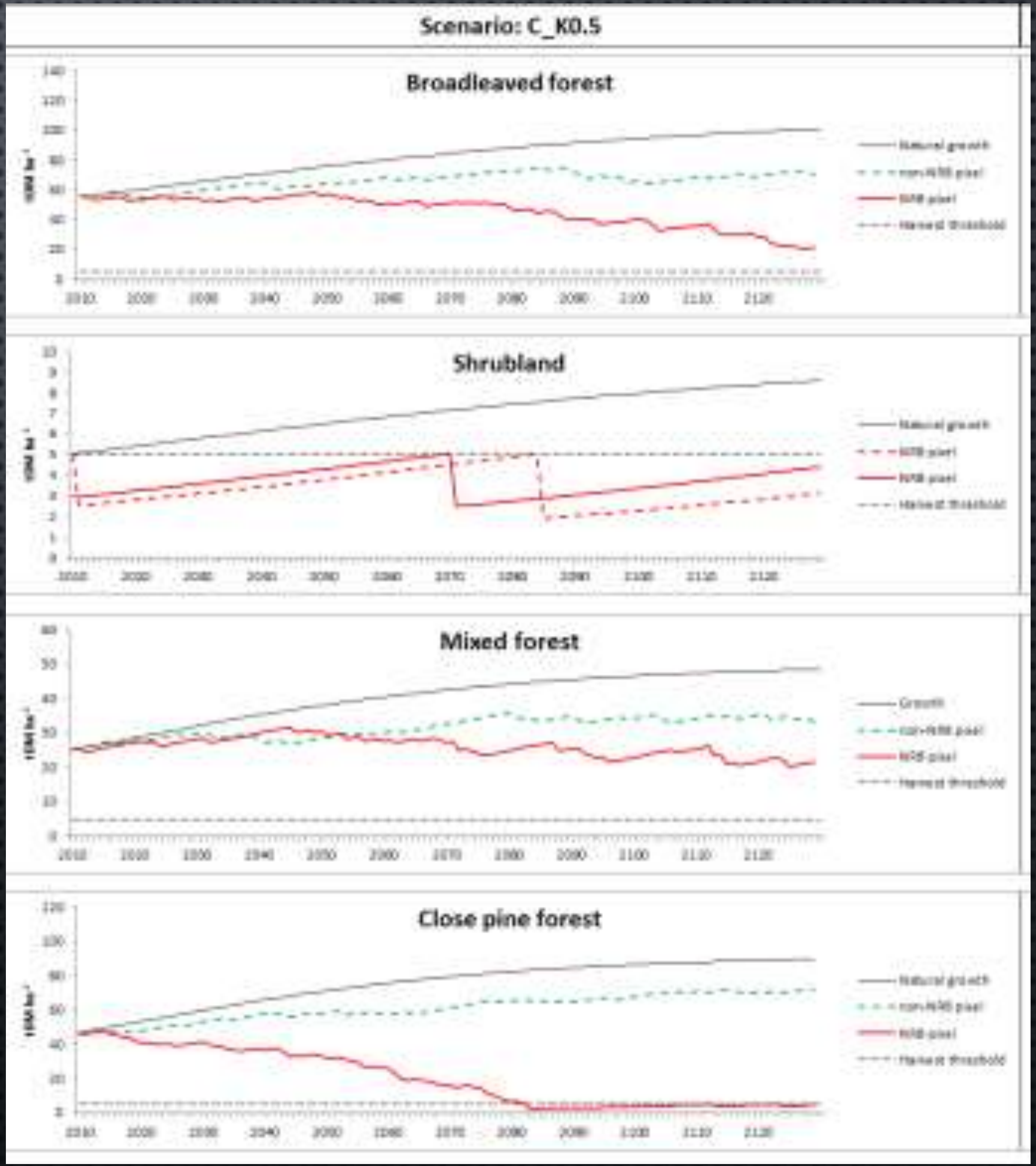


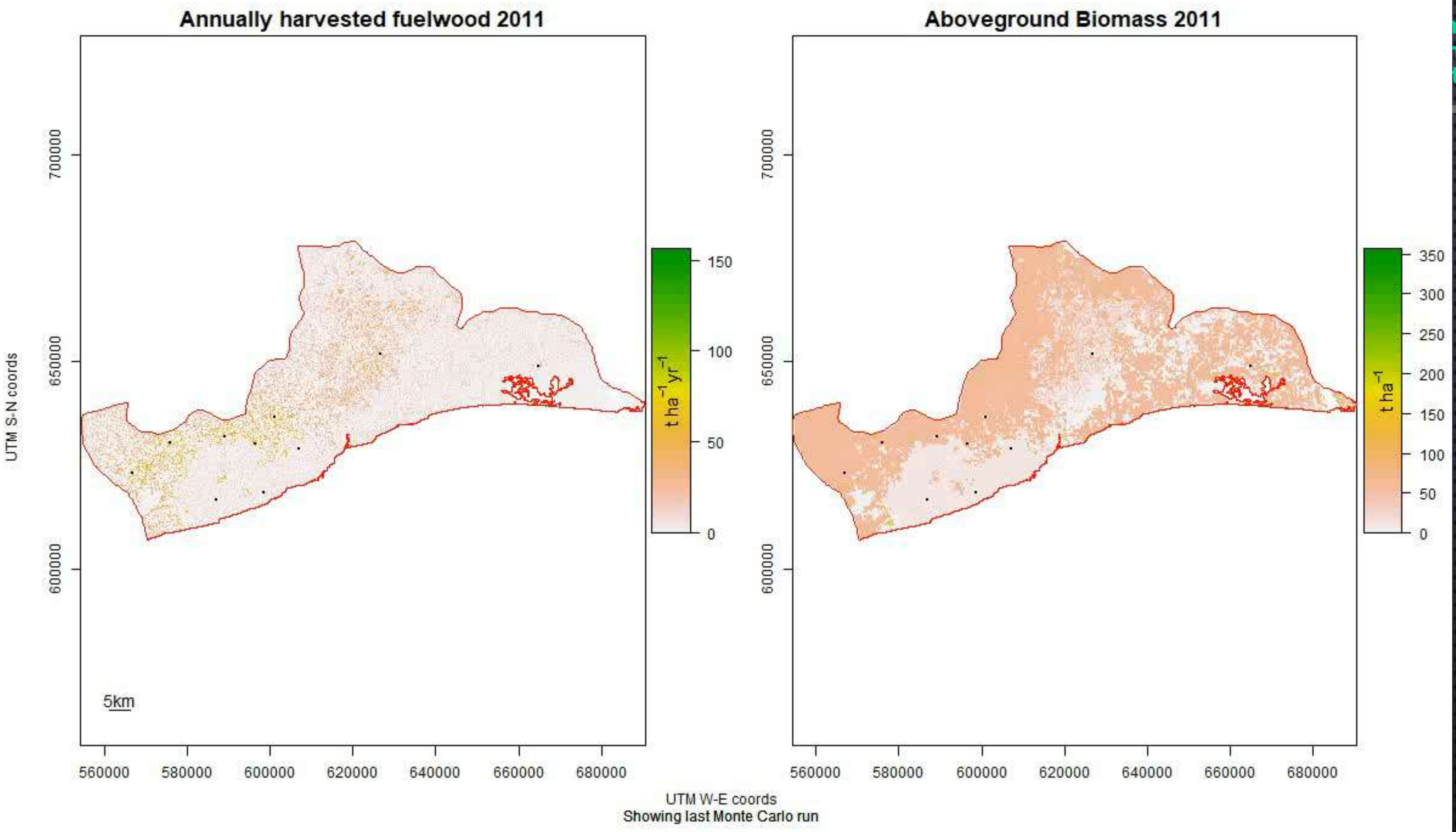
2. What is N

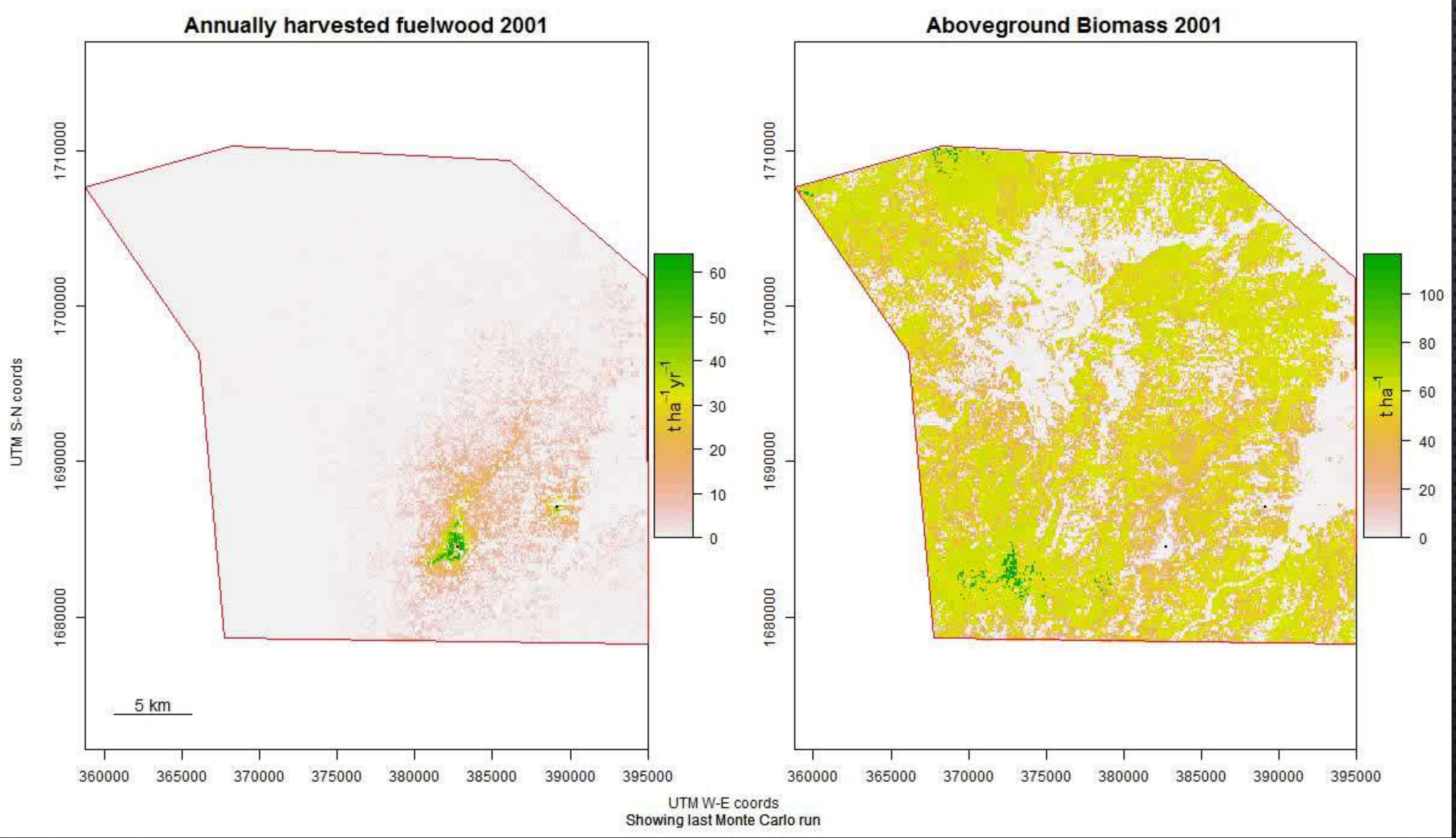

Aboveground Biomass 2010
Aboveground Biomass 2020
NRB: period 2010 to 2020
fNRB: period 2010 to 2020
UTM S-N coords
t ha-1
%
5km
8260000
8220000
720000
760000
800000
250
200
150
100
50
0
80
60
40
20

2. What is MoFuSS useful for?





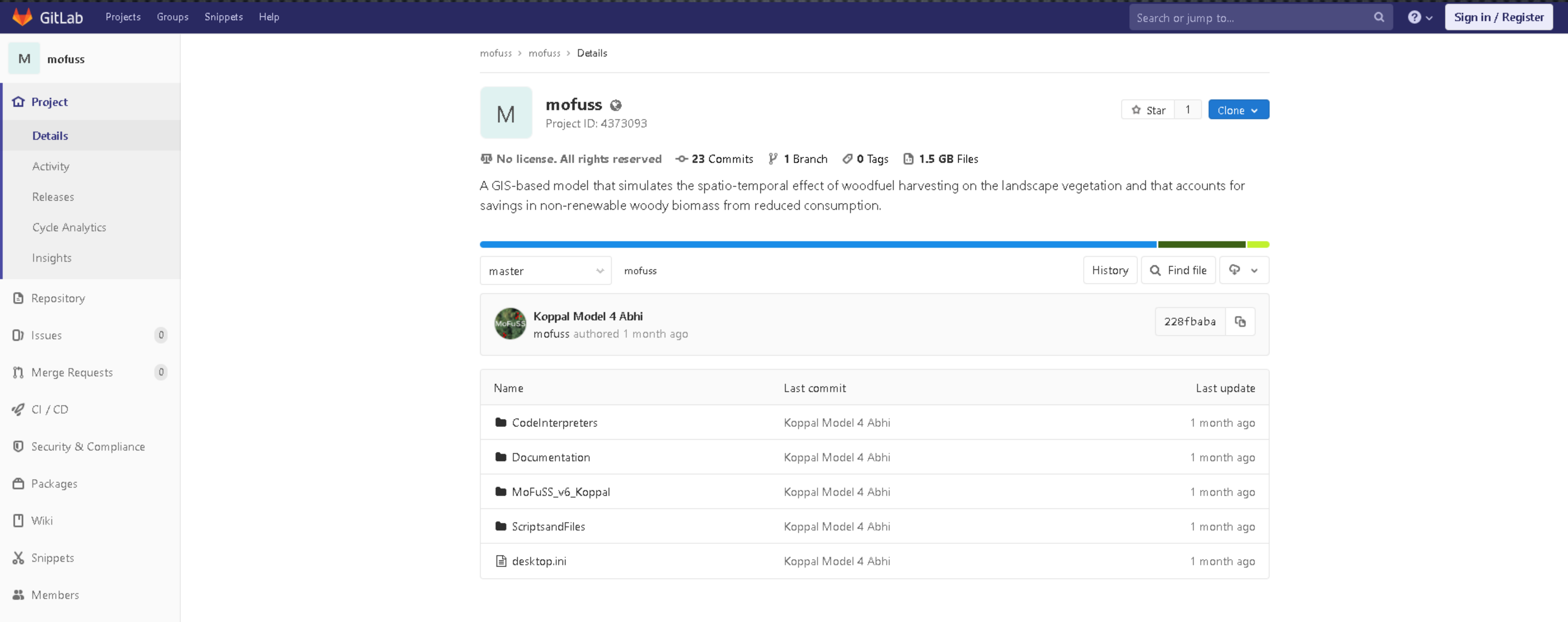

Annually harvested fuelwood 2011
Aboveground Biomass 2011
UTM S-N coords
700000
650000
600000
t ha⁻¹ yr⁻¹
150
100
50
0
t ha⁻¹
350
300
250
200
150
100
50
0
5km
560000
580000
600000
620000
640000
660000
680000
UTM W-E coords
Showing last Monte Carlo run



Annually harvested fuelwood 2001
Aboveground Biomass 2001
UTM S-N coords
1710000
1700000
1690000
1680000
t ha^{-1} yr^{-1}
60
50
40
30
20
10
0
t ha^{-1}
100
80
60
40
20
0
5 km
360000
365000
370000
375000
380000
385000
390000
395000
UTM W-E coords
Showing last Monte Carlo run

3. Current development and availability

GitLab https://gitlab.com/mofuss/mofuss



Informe Final

Proyecto:

Estrategia de Manejo Adecuado de la Leña.

Año:
2016

Implementador:
Túumben K'óoben S.C. de R.L. de C.V.

Ka' Kuxtal
Túumben K'óoben S.C. de R.L. de C.V.

Felipe Carrillo Puerto a 15 de marzo de 2017

Adrian Ghilardi[1], Andrew Tarter[2] and Robert Bailis[3,4]

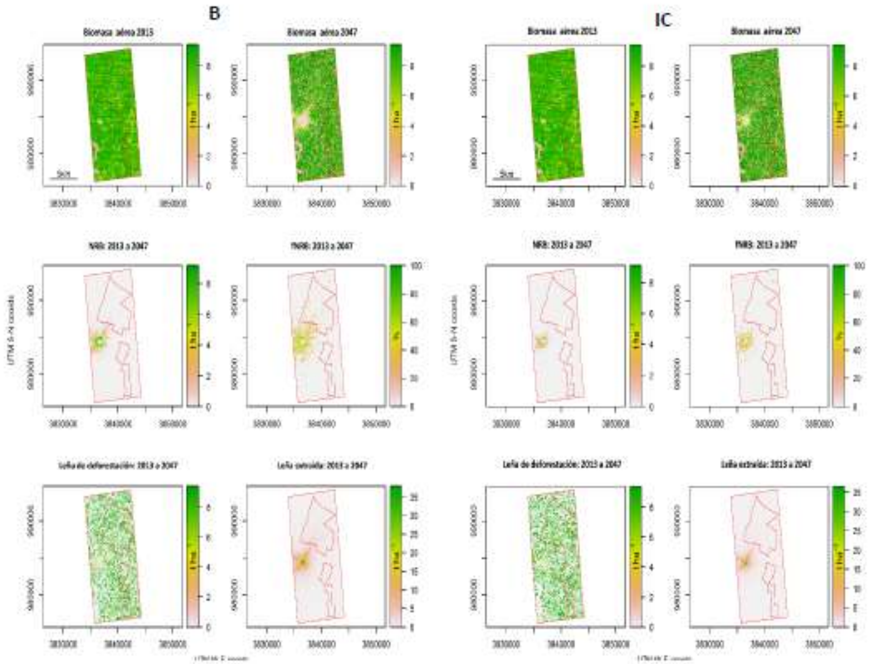
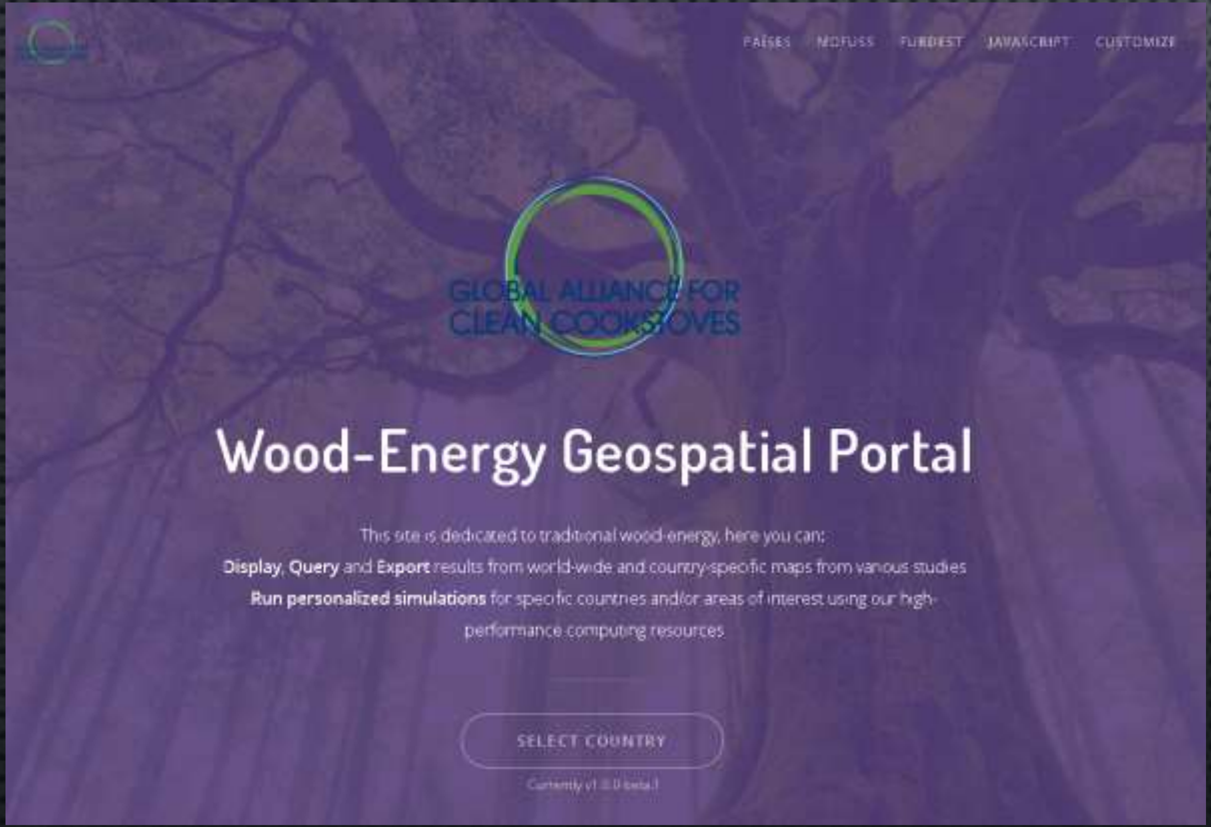
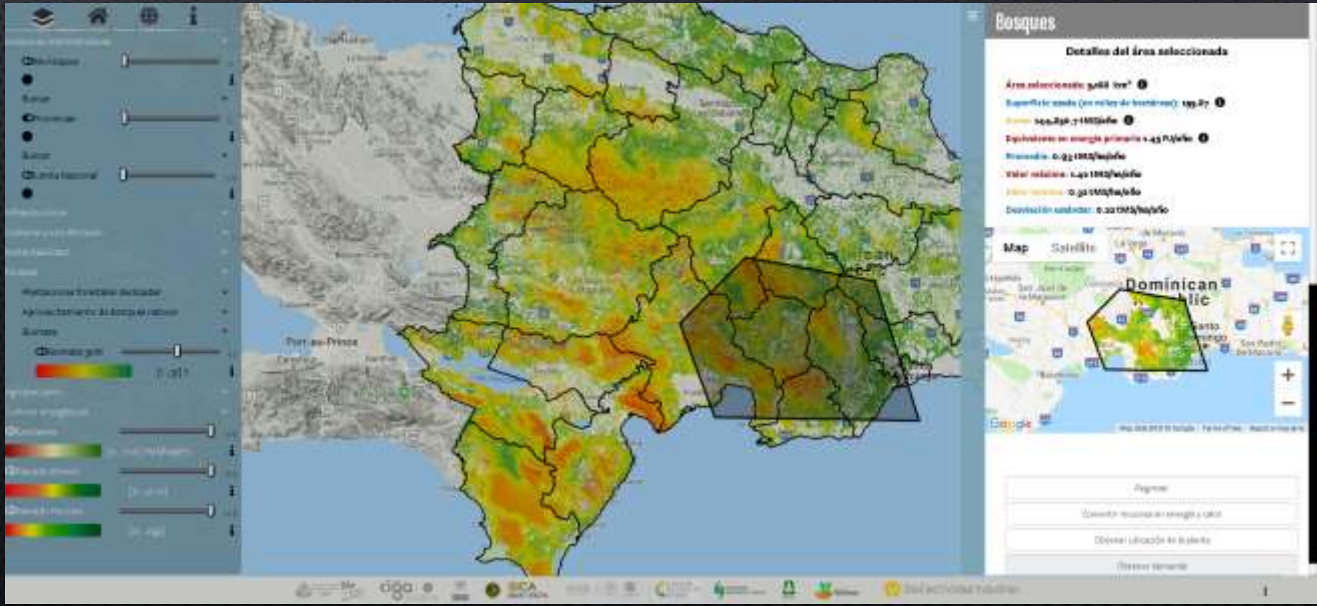


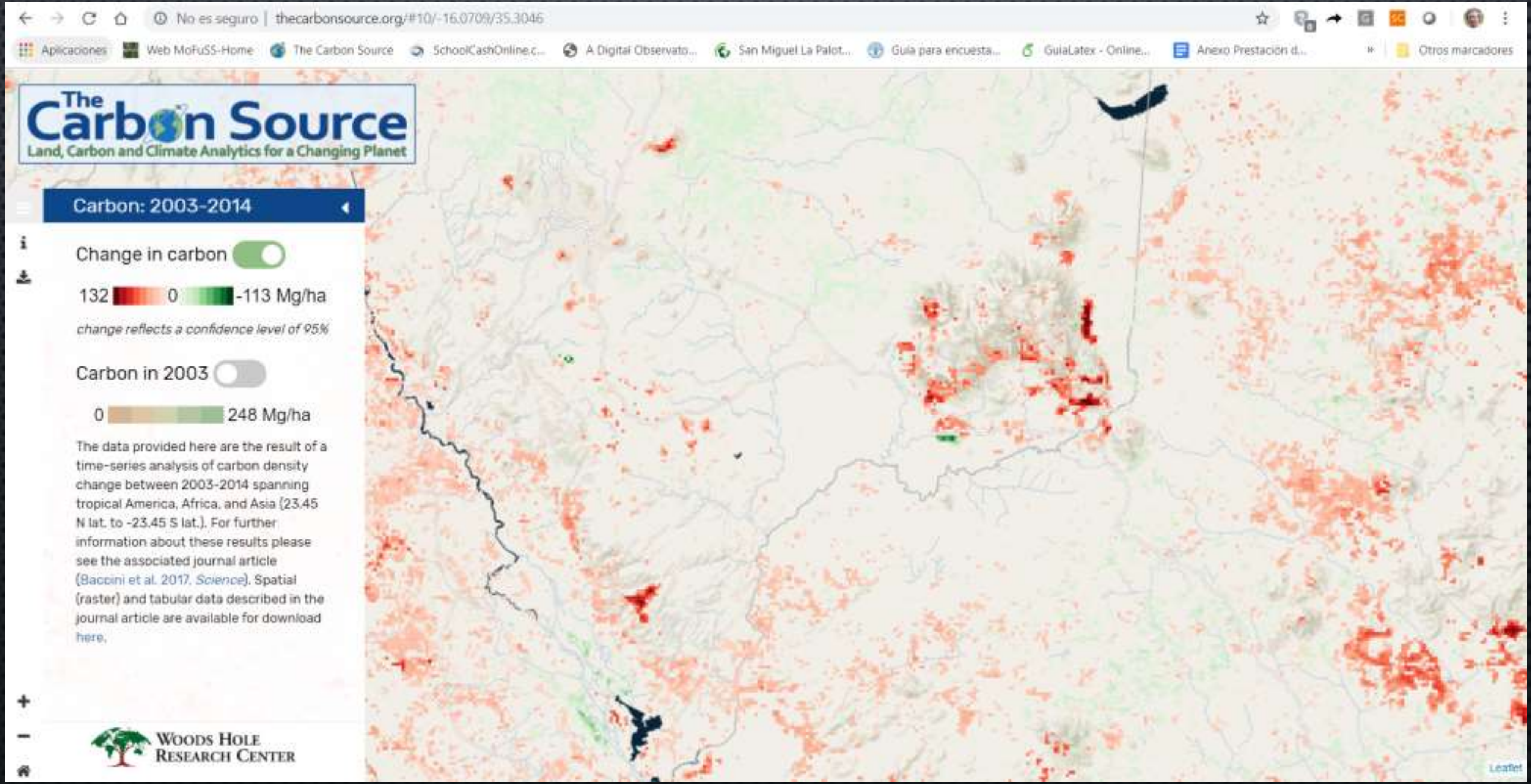
Figura 6. Comportamiento espacial de AGB, NRB, fNRB, leña de deforestación y leña extraída en Kinil para escenarios BaU e ICS a 34 años.

Web-based version under development





Validation with independent data...



4. Ongoing development

UNAM La Universidad de la Nación

SEI Stockholm Environment Institute

MoFuSS

MoFuSS is an open-source freeware developed to evaluate potential impacts of firewood harvest and charcoal production over the landscape. It's a GIS-based model that simulates the spatio-temporal effect of woodfuel harvesting on the landscape vegetation and that accounts for savings in non-renewable woody biomass from reduced consumption. MoFuSS is being developed and supported by the National Autonomous University of Mexico, in close collaboration with the US Center of the Stockholm Environment Institute and the Global Alliance for Clean Cookstoves.

MoFuSS lead developer: Adrián Ghilardi

GET MOFUSS

FuRDEST

FUrDest is a free software tool to estimate the current and projected demand of biomass in the residential sector. Fuelwood demand values are available at both, spatio-temporal level and aggregated level. FUrDest is being developed by National Autonomous University of Mexico and recently also funded by the Solid biofuels Cluster of the Mexican Center of Energy Innovation (CEMIE-BIO for its acronym in spanish).

FUrDest lead developer: Monterrat Serrano

TRY FURDEST (BETA)

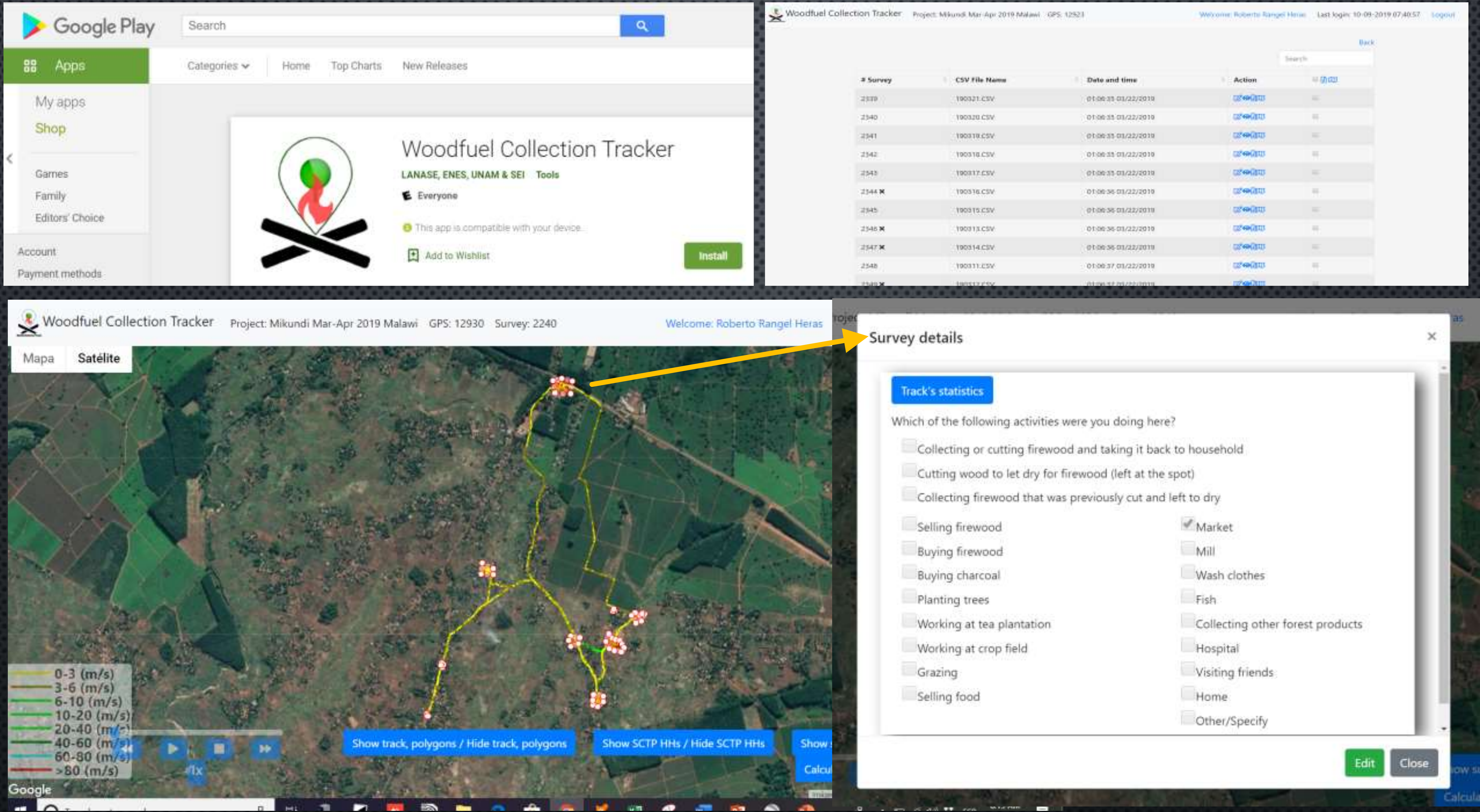
WoodFuel Collection Tracker

Woodfuel Collection Tracker was designed to integrate data from Columbus v990 GPS trackers with semi-structured field surveys to quantify the time effort and places visited by peasants in collecting firewood across the landscape. People need to carry the GPS unit wherever they go during their daily activities, for a period determined by the local conditions and research question. Every 3 to 5 days, tracks recorded by Columbus v990 GPS trackers are loaded into a widescreen tablet and display over a google maps satellite image. A concise multiple-choice interview is conducted to recognize what the person wearing the GPS unit was doing at various times and places along the recorded track. Places where people did some work (e.g. collected firewood, graze, work in the crops) are saved as polygons drawn over the screen by the interviewer. Depending on internet connectivity, data is saved into the tablet or send to the cloud to be analyzed remotely in almost real time. Spatial and temporal descriptive statistics regarding tracks and people's activities are calculated automatically. Please email comments and suggestions to aghilardi@ciga.unam.mx.

WCT lead developer: Roberto Rangel and Adrián Ghilardi

TRY WCT

www.mofuss.unam.mx



Google Play
Search
Apps
Categories
Home
Top Charts
New Releases
My apps
Shop
Games
Family
Editors' Choice
Account
Payment methods
Woodfuel Collection Tracker
LANASE, ENES, UNAM & SEI
Tools
Everyone
This app is compatible with your device.
Add to Wishlist
Install
Woodfuel Collection Tracker
Back
Survey
CSV File Name
Date and time
Action
Woodfuel Collection Tracker
Project: Mikundi Mar-Apr 2019 Malawi
GPS: 12930
Survey: 2240
Welcome: Roberto Rangel Heras
Mapa
Satélite
0-3 (m/s)
3-6 (m/s)
6-10 (m/s)
10-20 (m/s)
20-40 (m/s)
40-60 (m/s)
60-80 (m/s)
>80 (m/s)
Show track, polygons / Hide track, polygons
Show SCTP HHs / Hide SCTP HHs
Google
Survey details
Track's statistics
Which of the following activities were you doing here?
Collecting or cutting firewood and taking it back to household
Cutting wood to let dry for firewood (left at the spot)
Collecting firewood that was previously cut and left to dry
Selling firewood
Buying firewood
Buying charcoal
Planting trees
Working at tea plantation
Working at crop field
Grazing
Selling food
Market
Mill
Wash clothes
Fish
Collecting other forest products
Hospital
Visiting friends
Home
Other/Specify
Edit
Close

THANKS!

Join MoFuSS email list at:

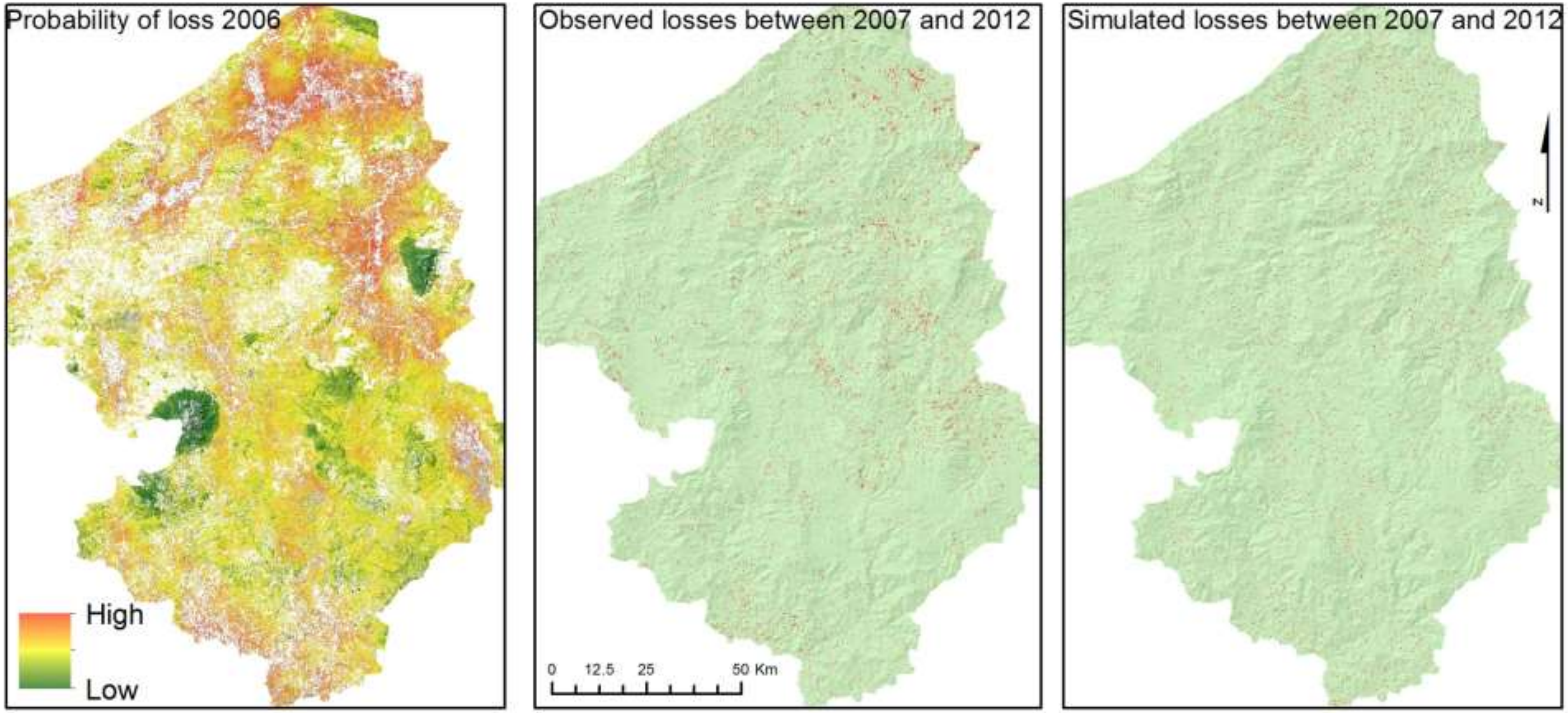
https://groups.google.com/forum/#!forum/MoFuSS

mofuss@googlegroups.com

EXTRAS SLIDES

Built using interpreter-based language

Deforestation 2000 -> 2012



VALIDATION OF PARAMETERS AND/OR RESULTS? – OBSERVED VS MODELED CHANGES IN THE LANDSCAPE

- VALIDATING PARAMETERS: GPS, LOSS/GAIN
- VALIDATING RESULTS: THE ULTIMATE CHALLENGE…

ELSEVIER
Global Ecology and Conservation
Volume 11, July 2017, Pages 213-223
open access

Original Research Article

Impact of biogas interventions on forest biomass and regeneration in southern India

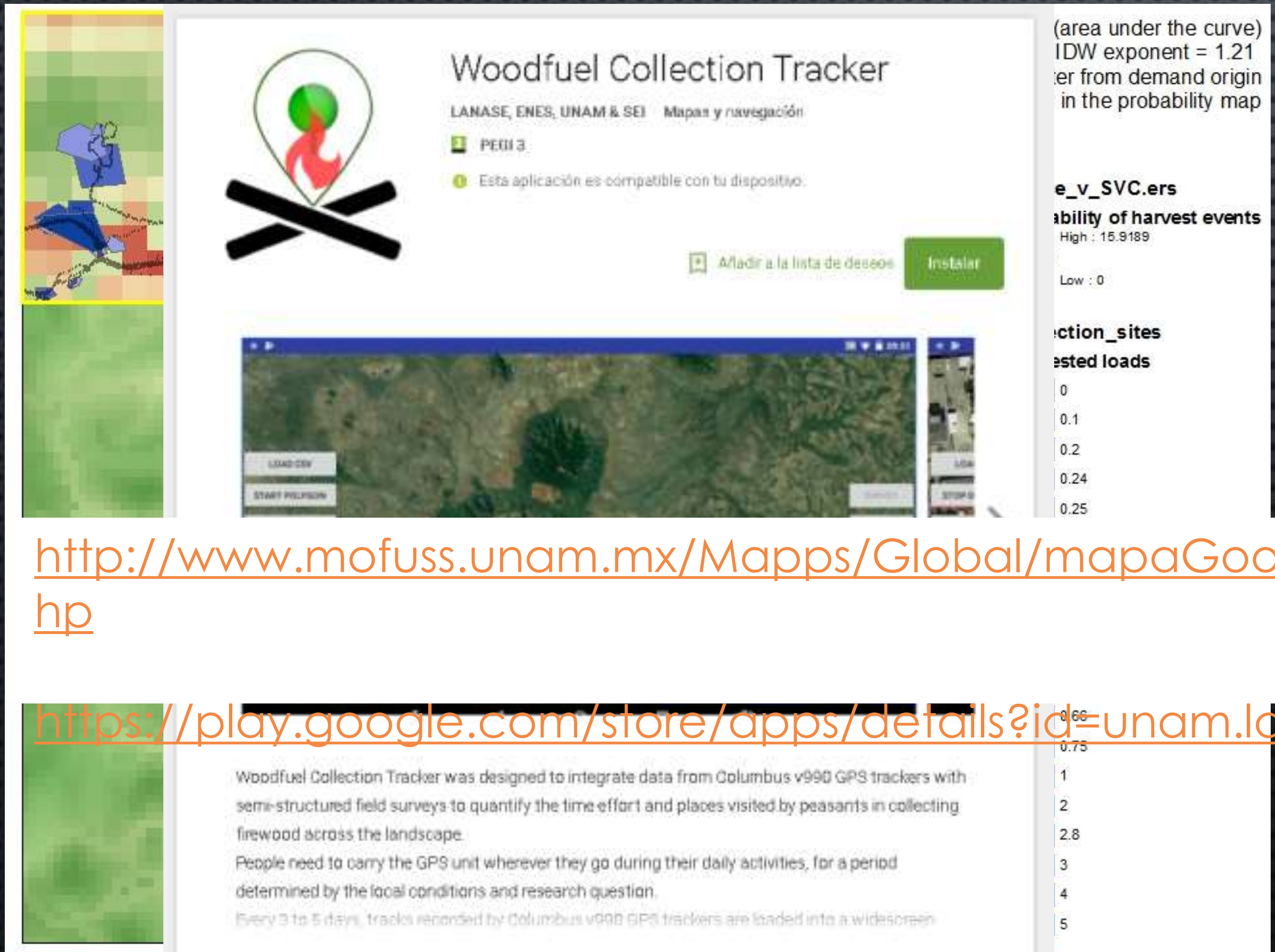
M. Agarwala [a], S. Ghoshal [b], L. Verchot [b, 1], C. Martius [b], R. Ahuja [c], R. DeFries [d]

⊞ Show more

https://doi.org/10.1016/j.gecco.2017.06.005 Get rights and con

ONGOING VALIDATION EFFORTS

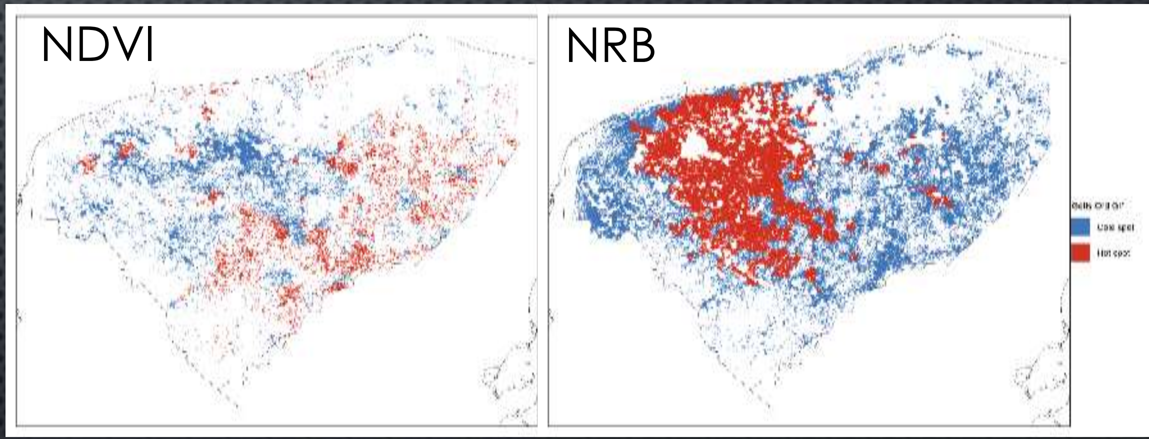
Validating parameters

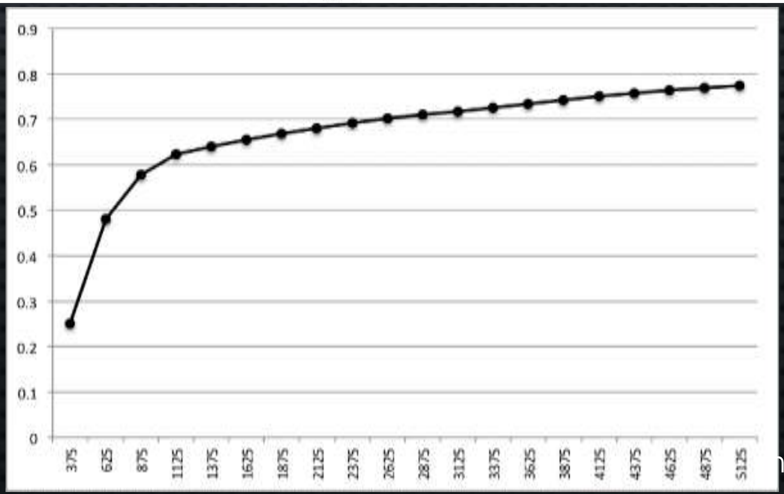


http://www.mofuss.unam.mx/Mapps/Global/mapaGoogle.php

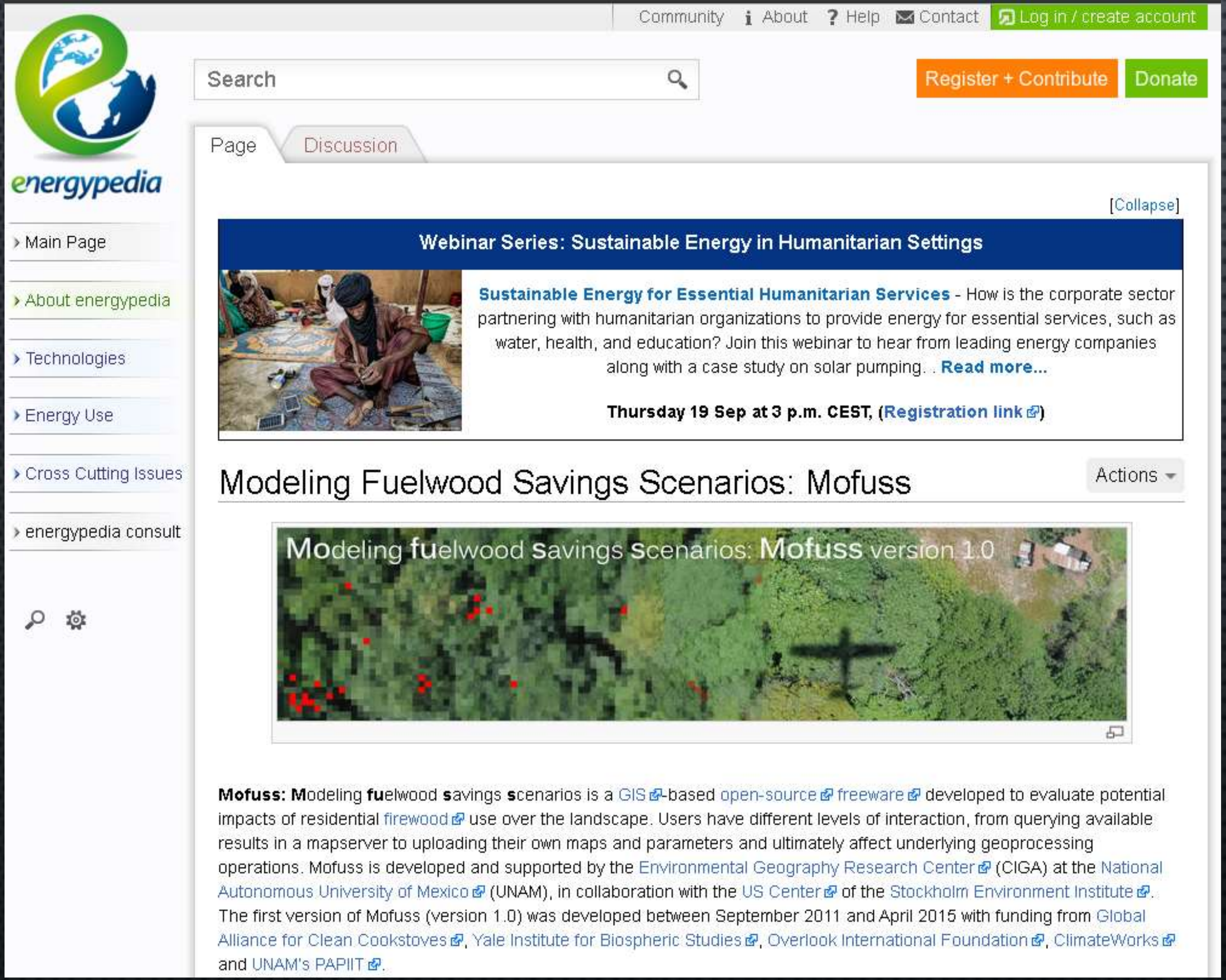
https://play.google.com/store/apps/details?id=unam.lanase

Validating results





3. Current development and availability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energypedia

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- About energypedia
- Technologies
- Energy Use
- Cross Cutting Issues
- energypedia consult

Page | Discussion

[Collapse]

Webinar Series: Sustainable Energy in Humanitarian Settings

Sustainable Energy for Essential Humanitarian Services - How is the corporate sector partnering with humanitarian organizations to provide energy for essential services, such as water, health, and education? Join this webinar to hear from leading energy companies along with a case study on solar pumping. . **Read more...**

Thursday 19 Sep at 3 p.m. CEST, (Registration link)

Modeling Fuelwood Savings Scenarios: Mofuss

Actions

Mofuss: Modeling **fu**elwood **s**avings **s**cenarios is a GIS-based open-source freeware developed to evaluate potential impacts of residential firewood use over the landscape. Users have different levels of interaction, from querying available results in a mapserver to uploading their own maps and parameters and ultimately affect underlying geoprocessing operations. Mofuss is developed and supported by the Environmental Geography Research Center (CIGA) at the National Autonomous University of Mexico (UNAM), in collaboration with the US Center of the Stockholm Environment Institute. The first version of Mofuss (version 1.0) was developed between September 2011 and April 2015 with funding from Global Alliance for Clean Cookstoves, Yale Institute for Biospheric Studies, Overlook International Foundation, ClimateWorks and UNAM's PAPIIT.

https://energypedia.info/wiki/Modeling_Fuelwood_Savings_Scenarios:_Mofuss

Monitoring technologies and best practices

Michael Johnson, Berkeley Air Monitoring Group; and Ajay Pillarisetti, University of California, Berkeley

Monitoring tools and devices for household energy projects

Michael Johnson
Berkeley Air Monitoring Group
mjohnson@berkeleyair.com

Climate Action and Clean Cooking Co-benefits

Washington DC, September, 2019

BERKELEY AIR
MONITORING GROUP

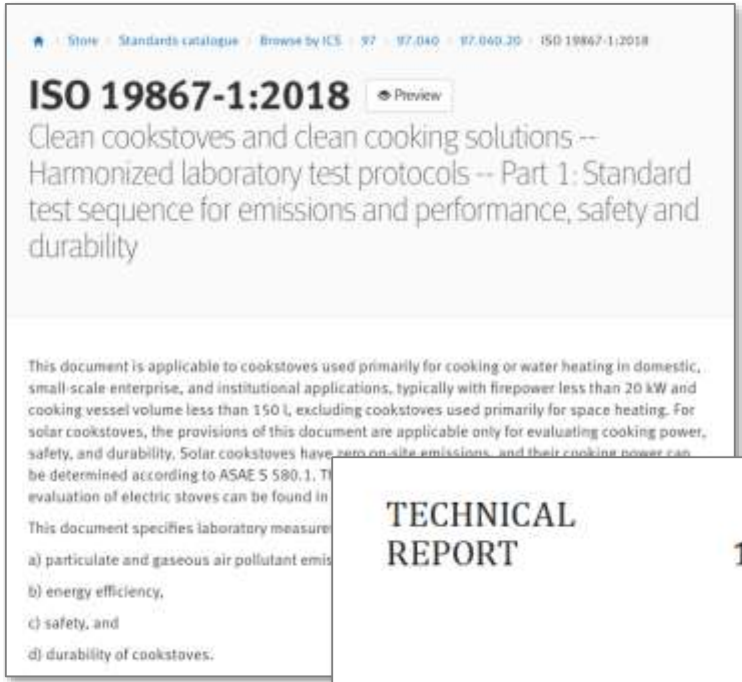
Monitoring tools/models

ISO testing standards

Conceptual framework and definitions

Field testing standard

Laboratory standard and voluntary performance targets



Store / Standards catalogue / Browse by ICS / 97 / 97.040 / 97.040.20 / ISO 19867-1:2018

ISO 19867-1:2018

Preview

Clean cookstoves and clean cooking solutions -- Harmonized laboratory test protocols -- Part 1: Standard test sequence for emissions and performance, safety and durability

This document is applicable to cookstoves used primarily for cooking or water heating in domestic, small-scale enterprise, and institutional applications, typically with firepower less than 20 kW and cooking vessel volume less than 150 l, excluding cookstoves used primarily for space heating. For solar cookstoves, the provisions of this document are applicable only for evaluating cooking power, safety, and durability. Solar cookstoves have zero on-site emissions, and their cooking power can be determined according to ASAE S 580.1. T

evaluation of electric stoves can be found in

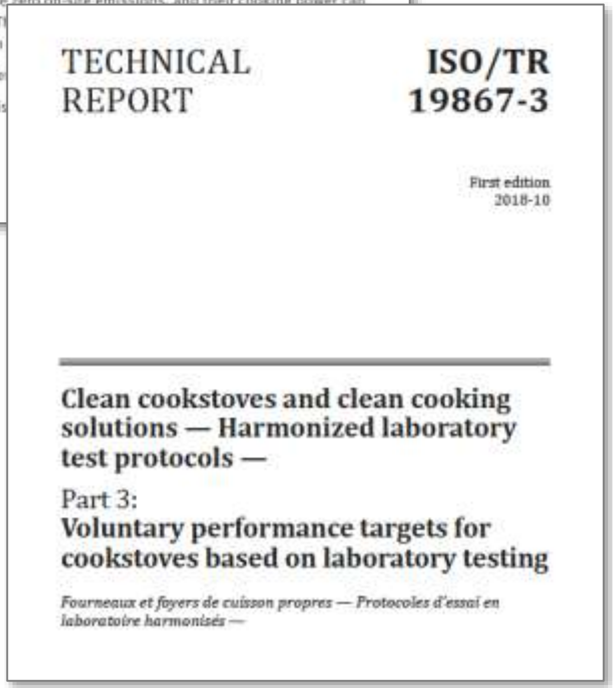
This document specifies laboratory measure

a) particulate and gaseous air pollutant emis

b) energy efficiency,

c) safety, and

d) durability of cookstoves.



TECHNICAL REPORT

ISO/TR 19867-3

First edition 2018-10

Clean cookstoves and clean cooking solutions — Harmonized laboratory test protocols —

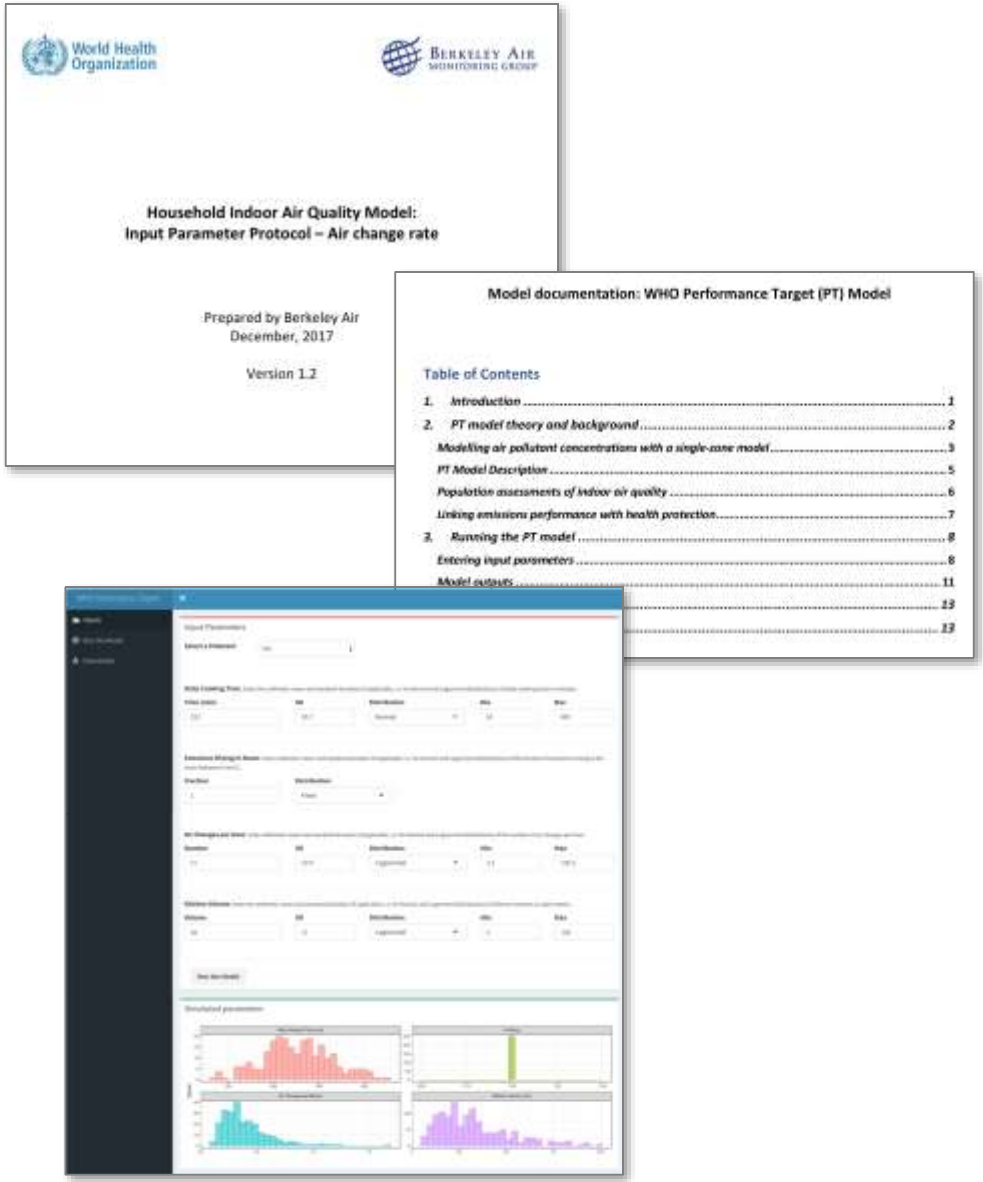
Part 3:

Voluntary performance targets for cookstoves based on laboratory testing

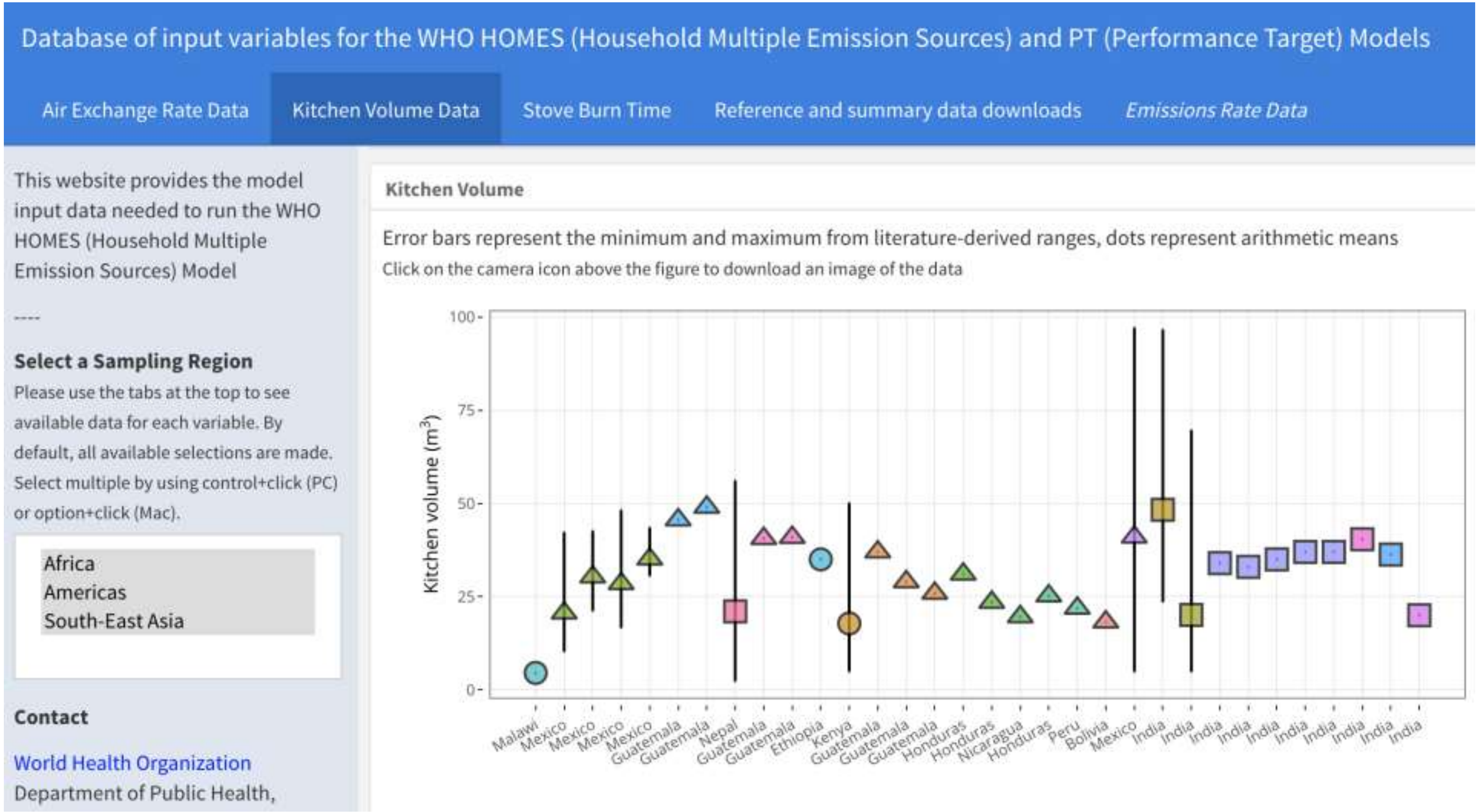
Fourneaux et foyers de cuisson propres — Protocoles d'essai en laboratoire harmonisés —

WHO Performance Target tools

- Set of protocols and guidance documents for how to collect input parameters
  - Kitchen volumes
  - Air change rates
  - Stove use times
  - Other parameters
- Online database of available input parameters
- Online model for determining region specific emission performance targets (PT Model)
- Additional model for exploring more realistic scenarios with stove stacking (HOMES Model)



Database for model inputs



Particulate monitoring devices

UPAS ~ $1300
Access Sensors

MicroPEMs/ECM : available through partnerships with RTI

Gravimetric monitors

PM monitors from Amazon/Alibaba

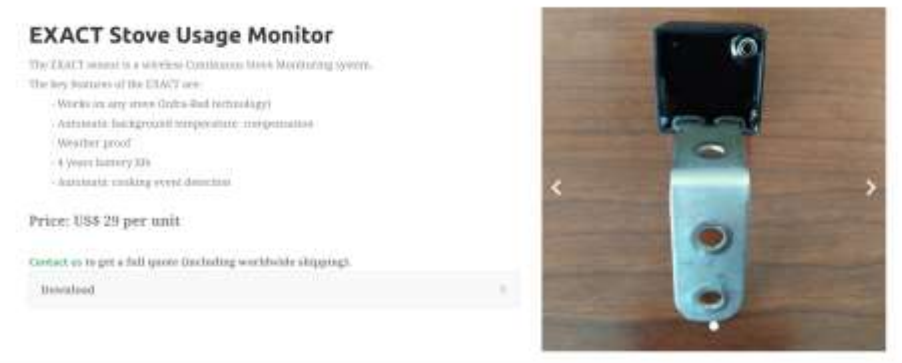
???? Upper limit, log data, battery life, research validation???

PATS+ ~ $500
Berkeley Air

HAPEX~ $130
Climate Solutions

Light scattering (require calibration with gravimetric measurements)

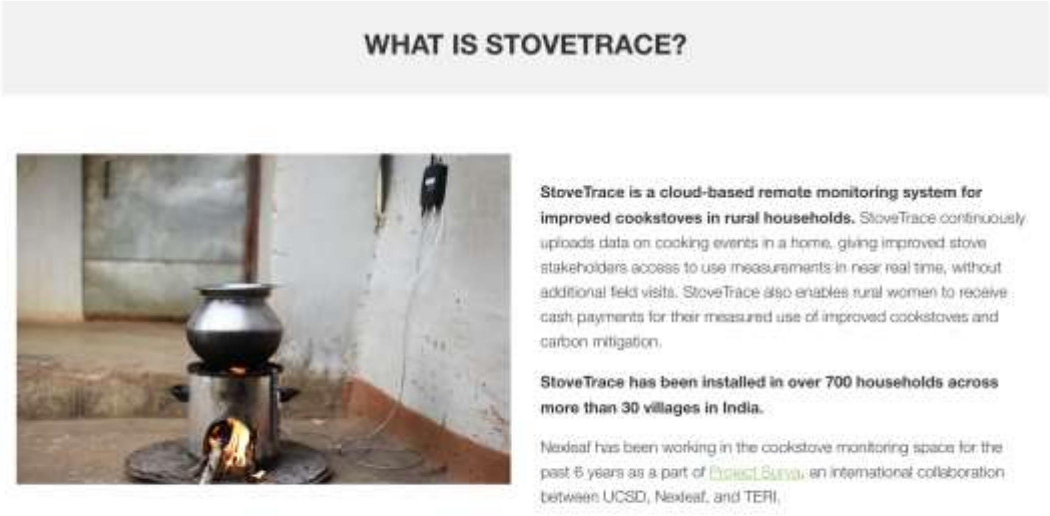
Fit-for-purpose stove use monitors (with analytics)



HAPEX~ $30; Climate Solutions

Geocene Temp Logger ~$100

Sweetsense stove sensor ~ $500



Nexleaf Stovetrace ~ $200

DASHBOARD

Adoption Overview

Last Refreshed **3 minutes ago**

NEW CHART

FILTERS (1) DateRange 90 Days

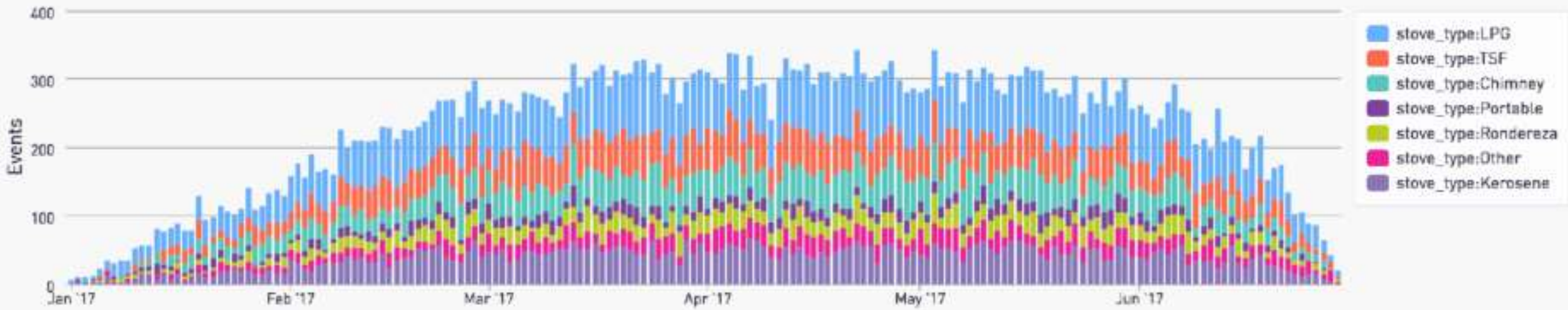
Cooking Activity in Filtered DateRange

	HOUSEHOLD	STOVE	COOKING HOURS	COOKING EVENTS
1	household_number:0001	stove_type:Chimney	0.35	0.42
2	household_number:0001	stove_type:Chimney	0.74	0.90
3	household_number:0001	stove_type:Kerosene	0.48	0.60
4	household_number:0001	stove_type:LPG	1.06	1.19
5	household_number:0001	stove_type:Portable	0.26	0.41
6	household_number:0001	stove_type:Rondereza	0.24	0.33
7	household_number:0001	stove_type:Rondereza	0.42	0.52
8	household_number:0001	stove_type:Rondereza	0.48	0.54
9	household_number:0001	stove_type:TSF	0.83	1.08

Locations of Connections to Dots

Dummy-Guatemala Dummy-India Dummy-Peru Dummy-Rwanda

Events vs. Time



Off-the-shelf temperature loggers

Maxim iButtons ~ $30-$100

Labjack temp logger ~ $40

Wellzion thermocouple logger ~ $40

SUMSARIZER 2.0

an overview • September 2019

SUMSarizer 2.0

more flexible, more usable, and better outputs

SUMSARIZER

web-based application
for a non-technical audience

SUMSARIZR

R package
for technical audiences

TRAINSET

time series labeling tool
for everyone

SUMSarizer 2.0

more flexible, more usable, and better outputs

SUMSARIZER

web-based application
for a non-technical audience

R package
for technical audiences

time series labeling tool
for everyone

SUMSARIZER

web-based application

User "Nocode Nick"

- Household energy practitioner from an NGO, government, or academic institution
- SUMs data in hand, but not sure what to do with it
- Neither I nor my organization have the time or expertise to create custom scripts to analyze data

→ **Upload to web** → **Analyze**

- Upload my data (from any variety of sensors), select the files I want to summarize, and click analyze. Choose a variety of "processors" to analyze your data. Each set of data can be analyzed with different processors.

SUMSARIZER

web-based application

→ **Upload to web** → **Analyze**

- Processors have tweak-able parameters – thresholds, time between events, length of an event, etc.
- Output includes a table of events, a table of events by file, various plots, and cleaned and labeled output
- Takes away nearly all of the complexity and provides fairly fast analysis of data

SUMSarizer 2.0

more flexible, more usable, and better outputs

SUMSARIZER

an R package

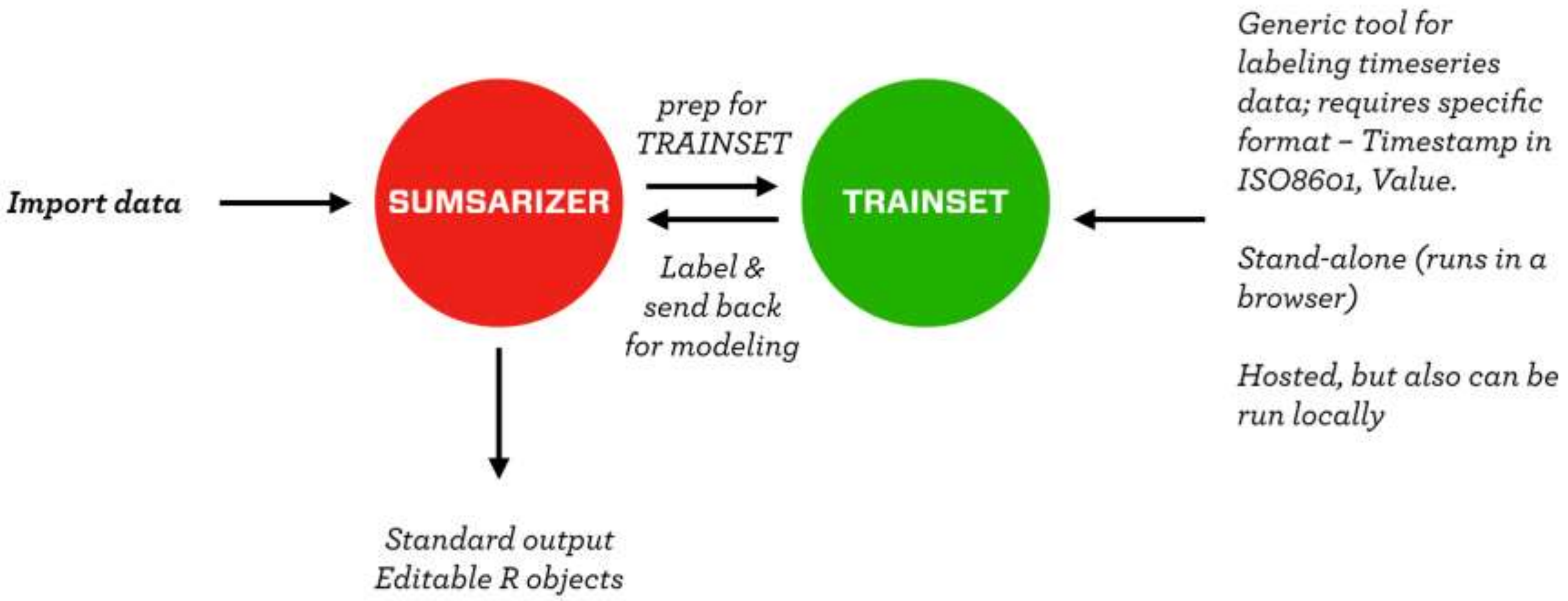
Imports SUMs
Outputs a standard format for TRAINSET
Imports files labeled by TRAINSET
Applies either ML-based algorithms to the data, or uses pre-coded ones

TRAINSET

time series labeling tool

SUMSarizer 2.0

more flexible, more usable, and better outputs

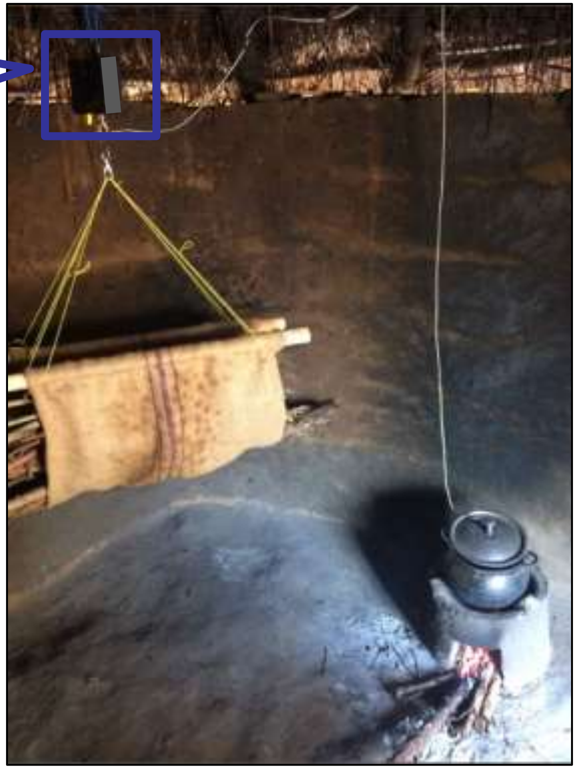


Other devices/tools

The Fuel Use Electronic Logger (FUEL)

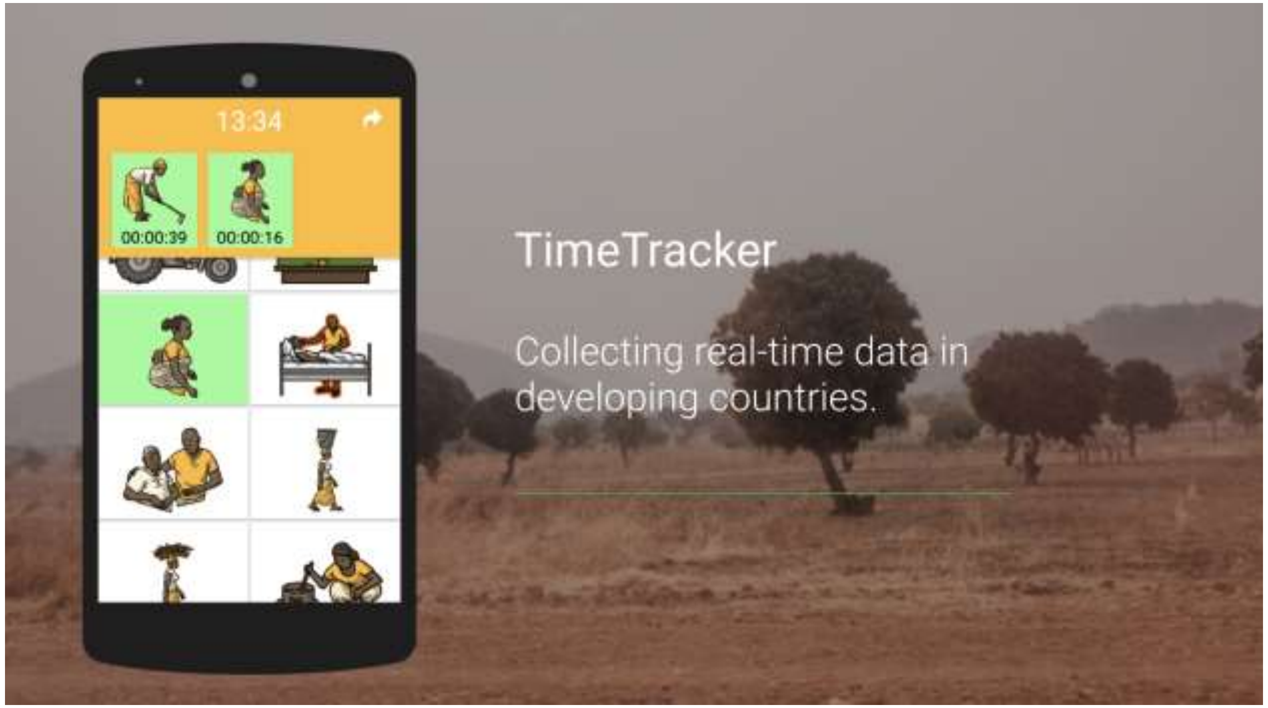
A logging load cell to monitor in-home fuel consumption

- Provides direct measure of fuel consumption per meal, per day, and for up to a three month period
- Includes verification of usage and quantification average firepower when paired with stove use (temperature) monitoring
- Models are available for solid fuel (tensile scale) and LPG (compressive scale) monitoring
- Interfaces seamlessly with a system for integrated sensing of stove usage and PM concentration/exposure for multiple stoves in a single home (available from Climate Solutions Consulting)



Oregon State University

Time tracking apps



http://timetracker.cc/

Daum, T., Buchwald, H., Gerlicher, A., Birner, R., 2018. Smartphone apps as a new method to collect data on smallholder farming systems in the digital age: A case study from Zambia. Computers and Electronics in Agriculture 153, 144–150. https://doi.org/10.1016/j.compag.2018.08.017

Coffee break (15 mins)

3:15-3:30

5 Part IV—Where we go from here

Summary of Key Challenges And Opportunities

Elisa Derby, consultant, Clean Cooking Alliance

Small group discussion

CLEAN COOKING ALLIANCE

CLIMATE & CLEAN AIR COALITION

- *How could market mechanisms, such as outlined under article 6 of the Paris Agreement, support clean cooking projects and countries meeting their commitments outlined in their national climate plans and commitments (e.g. NDCs)?*

- *What MRV gaps need to be filled in order to support clean cooking commitments in countries NDCs?*

- *What are ways to reduce the complexity and cost of monitoring and verification (such as with the use of digital technologies, blockchain, dataloggers, etc.)?*

Report Out

3:50-4:00

Small Group Discussion

- *Project developers, what two things do want from certification bodies, what things do you want from academic researchers?*
- *Researchers, what two things do you want from project developers, what do you want from certification bodies?*
- *Certification bodies what do you want from project developers, and what do you want from researchers?*

Report Out

4:20-4:30

Homework

Think about what we can all do together to achieve our common goal. Where are the opportunities for collaboration and partnerships?

Day-3 Agenda 9:00-11:30

- Setting the stage and goals for the day
- Part IV: Where we go from here
- Close

2

Part IV: Where we go from here: discussion and defining next steps continued…

CLEAN COOKING ALLIANCE

CLIMATE & CLEAN AIR COALITION

Requests from Day 2

9:10-10:30

Researchers!

Project developers want…

- More opportunities to work with researchers and access research/data
    - Such as for calculating fNRB, fuel use, baseline data, survey design, and statistical analysis
- Case studies at the country level putting together the critical data necessary for project development
- Support PDs to make decisions about which stove should be in a project, how to make the decision, what is the evidence for performance, and how appropriate a stove is for a given context
- Research on behavior change and adoption/stove use at the country and sub-national level
- Database on who the researchers are in the sector by subject-expertise updated with ongoing studies and what data researchers have access to

Certification bodies want…

- More information on reference data, esp baseline technologies/fuels, helpful for PDs and cert, to reduce cost of monitoring and project design
    - Involving other agencies who are collecting data with incorporation into surveys
- Around new tech for MRV – if you can use a smaller sample size, we need evidence to support these arguments, so we know how to work with new technologies

Project Developers!

Researchers want…

- Information on costs to identify pain points and recommend cost-effective monitoring. The more granular information the better.
- More transparent data, whatever is shareable. Having an MOU with research partners on data, but in general communication around data and being able to publish. The more sharing the better.
- To know your technical capacities, needs, specs so we can recommend the best monitoring options for you.
- Opportunity to review MRV plans and provide input.
- You to monitor stacking and disuse of traditional stoves.

Certification bodies want…

- You to champion new technologies and test them out – helps researchers and helps us making informed decisions around new requirements

Certification bodies!

Project developers want…

- Simplified processes
- Certainty
- A mechanism for Gold Standard/UNFCCC to flag what changes are happening and what it means for PDs
- Reduce need for so many DOEs
- Simplified DOE reviewer process
- Regional collaboration centers from the GS, similar to the CDM RCCs.
- Verification bodies should be updated
- Templates and tools for emissions reductions calculations and for monitoring
- Understanding that monitoring SDG impacts is not always quantitative and needs to account for qualitative indicators.
- Lightweight verification methodology
- Access to ISO standards
- A centralized place for PDs to access all the relevant tools and trainings for developing projects

Researchers want…

- More information on Cookstove IQ tool
- Guidance on how we can better facilitate black carbon market –do you need more measurements, or what?
- LPG and solar methodologies
- Cheat sheet on how the entire carbon market works – very simple, high-level overview to understand the bigger picture

CLEAN COOKING ALLIANCE

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Coffee Break

10:30-10:45

Workshop Outcome Recommendations

10:45-11:30

Recommendations Overview

- Continued exchange
- Black carbon—support integration into carbon market
- Shared resources
- NDC support

Continued Exchange

- Continued conversations between researchers, project developers and certification bodies
- CACCCB regional workshops (E. Africa, W. Africa, Asia)
- Ongoing discussion: how do we use the carbon market to promote higher quality stoves?

Black carbon – support integration into carbon market

- BC methodology review/suggestions for strengthening (already underway!)
- Additional field studies?
- Dissemination of results to date?
- Publication/dissemination of revised BC methodology via CCAC
- Advocacy and technical assistance for inclusion of BC in NDCs at country level

Shared resources

- Baseline fuel consumption database (started but needs to be expanded)
- Standardized emissions reduction calculation template
- More contextualized fNRB default values (also database?)
- Project Developer-specific knowledge management docs:
  - Summaries of relevant recent research findings
  - Case studies highlighting cost effectiveness and reliability of monitoring devices
  - Guidance on sample sizes under different high/low-tech monitoring scenarios
  - Guidance for using the new ISO lab standard and comparison of ISO lab vs. WBT
- Expert assistance network (how to adapt an existing network?)

NDC support

- Regional workshops to build capacity for incorporating household energy goals into NDC
- Harmonized approach for household energy credits
- Support to convert high-level NDC goals into an investment plan
- Engagement with policy-makers
- Regional collaboration centers

Commitments

Close

11:30 (followed by optional lunch)

CLEAN COOKING ALLIANCE

CLIMATE & CLEAN AIR COALITION