Overview of BANR Lifecycle Assessment Activities

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Unique Aspects of BANR Project

Non-cultivated feedstock!

- ~42 M acres of mountain pine beetle-damaged forests across western US
- Highly episodic
- Bioenergy use requires ***knowledge*** of:
  - Exact location, quantity
  - Practicality of harvest
  - Site-level enviro. impacts, socio-political constraints
- Is this a good idea from a climate perspective??

Large C stock = Large C debit??

- Harvesting existing biomass can affect both C storage and productivity
  - Con: long persistence of dead wood
  - Pro: system already highly disturbed
  - How does harvest affect regeneration?
  - What about wildfire??
- Time-explicit climate impact accounting necessary

https://www.americanforests.org/magazine/article/weathering-a-perfect-plague/

Biochar -> C-negative energy

Net carbon withdrawal from atmosphere: **20%**

COMMENTARY:

Betting on negative emissions

Sabine Fuss, Josep G. Canadell, Glen P. Peters, Massimo Tavoni, Robbie M. Andrew, Philippe Ciais, Robert B. Jackson, Chris D. Jones, Florian Kraxner, Nebosja Nakicenovic, Corinne Le Quéré, Michael R. Raupach, Ayyoob Sharifi, Pete Smith and Yoshiki Yamagata

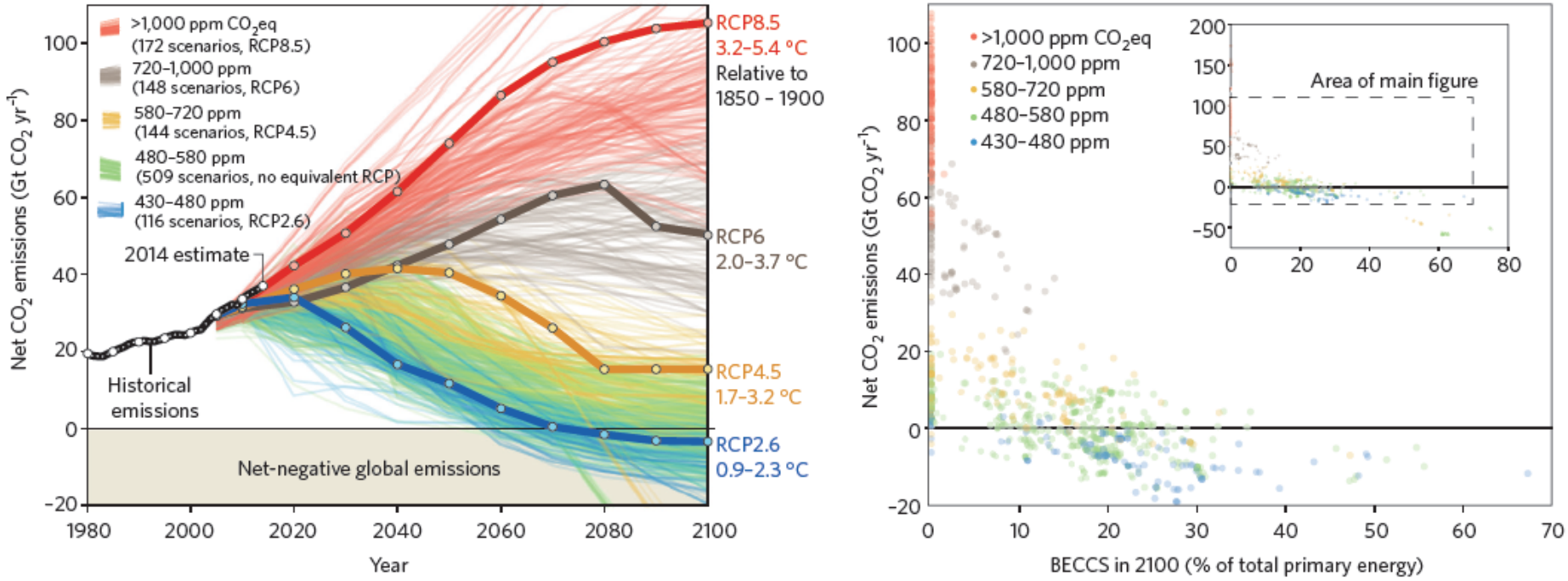
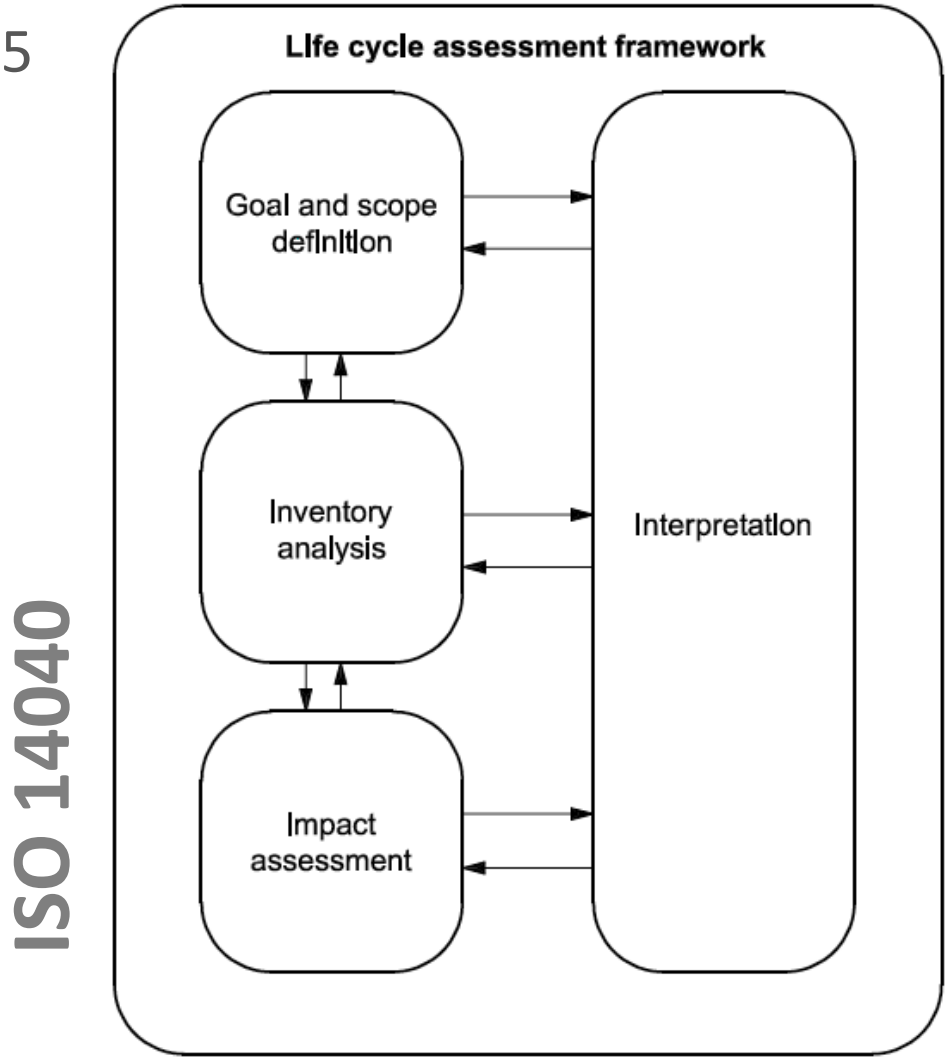


Figure 1 | Carbon dioxide emission pathways until 2100 and the extent of net negative emissions and bioenergy with carbon capture and storage (BECCS)

Scoping & Stakeholder Engagement

LCA Stakeholder Engagement Session

- Webinar held August 2015
- Agenda:
  - Introduction to BANR, proposed LCA scenarios & methods
  - Survey of LCA stakeholder opinions
- Participants:
  - Industry
  - Academia
  - Agency



LCA Scenario Development

- Proposed 'upstream' assessment scenarios are built around a simple classification for beetle-kill stands on the landscape:

Stands you wouldn't want to actively manage due to:

- Slope
- Roadless areas
- Ecologically sensitive

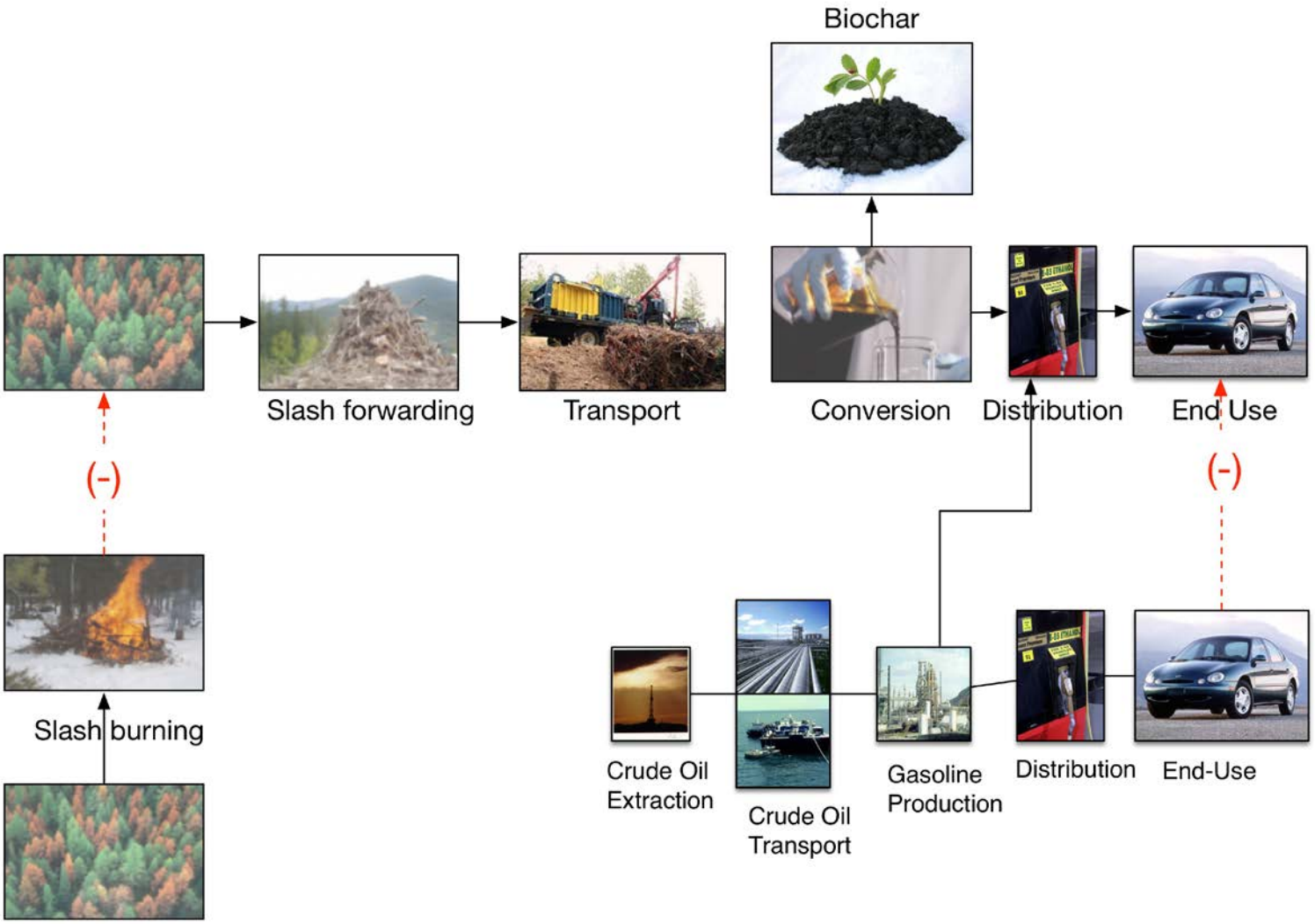
Stands that will be subject to regenerative harvest resulting in:

- Timber
- Slash (typ. burned for disposal)

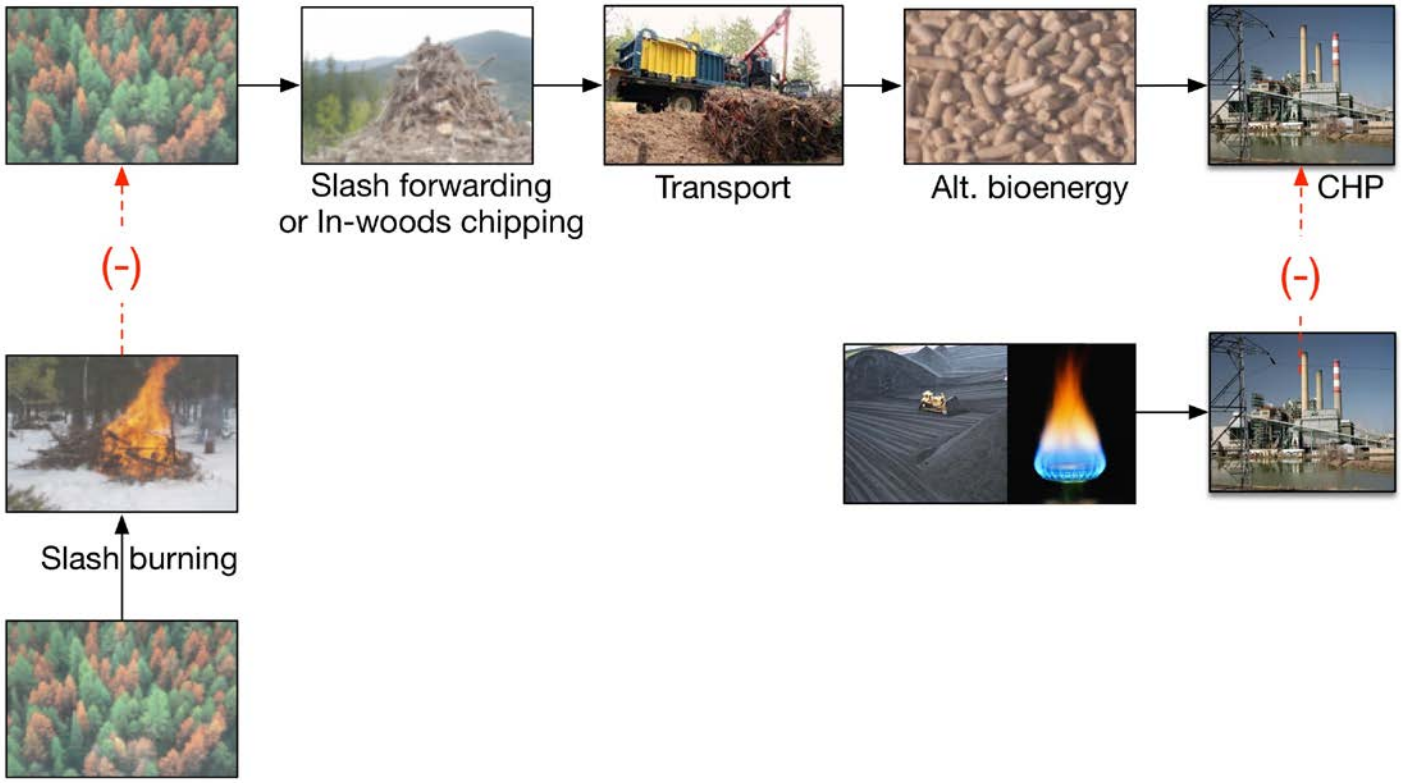
Stands that managers would like to actively manage (regen. harvest), but costs are prohibitive

- 'Downstream' scenarios include either biofuel/biochar or biopower/CHP/pellets options

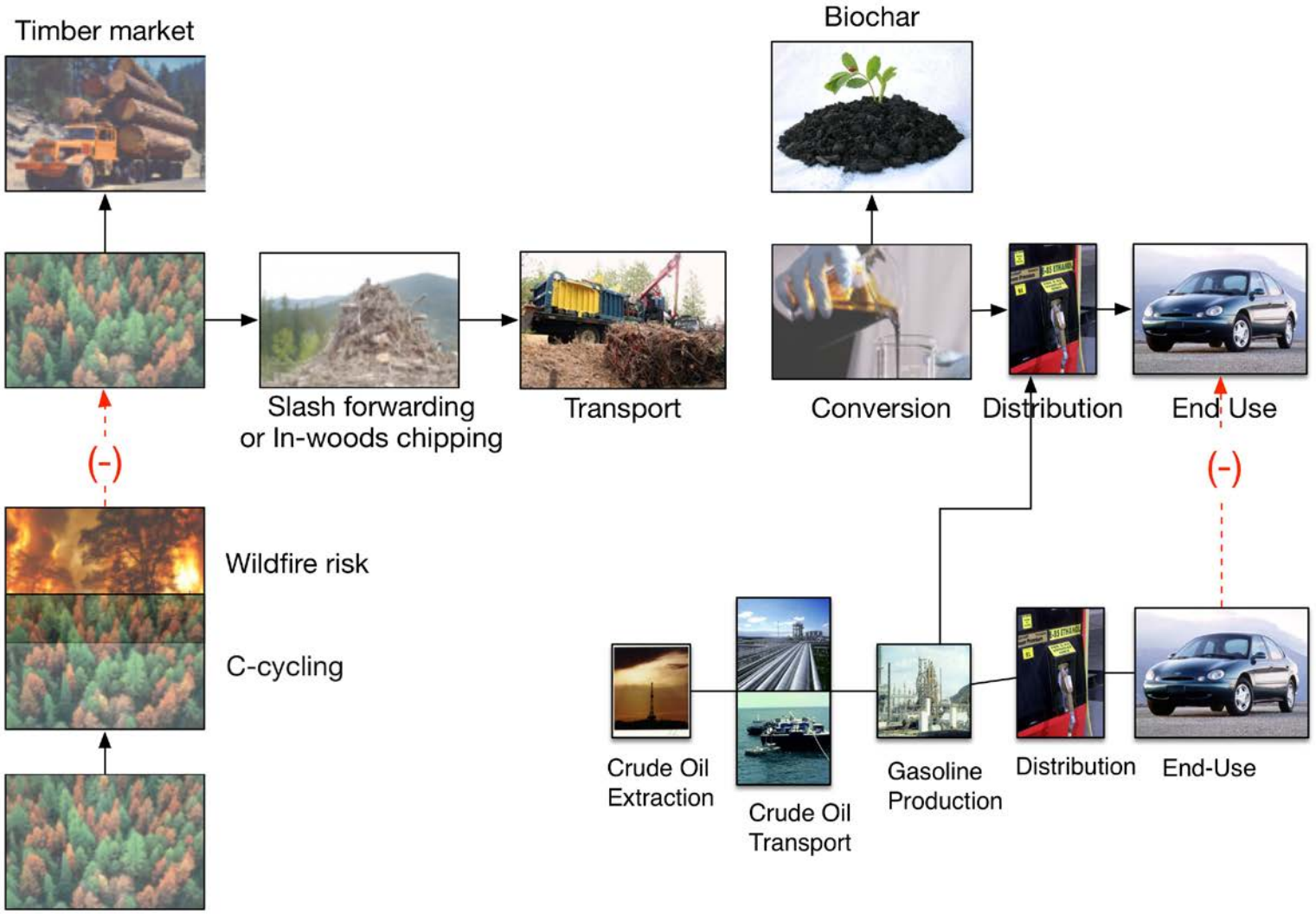
Scenario 1A Utilization of existing slash for biofuels and biochar



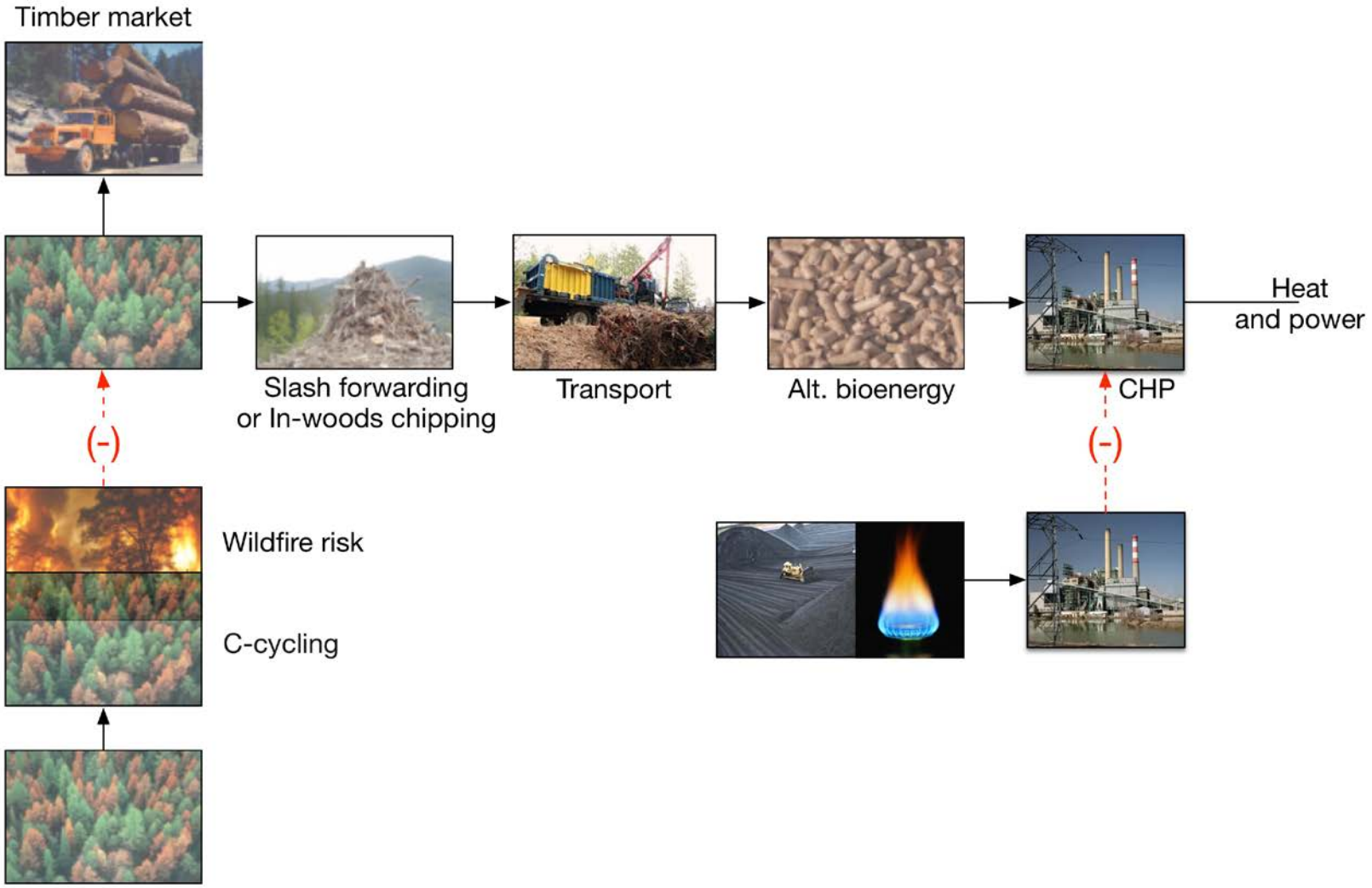
Scenario 1B Utilization of existing slash for alternative bioenergy



Scenario 2A Utilization of previously uneconomic beetle kill land



Scenario 2B Utilization of previously uneconomic beetle kill land



Potential Impact Metrics

Greenhouse gas emissions	Water consumption?
Local air pollution?	Water quality, stream flow?
Wildlife/habitat?	Soil quality, erosion?
Wildfire risk?	Energy security?
Others?	

WHY WE OPPOSE BIOMASS INCINERATION IN GYPSUM, COLORADO

June 28, 2012 · *by* energyjusticenetwork · *in climate, economics, forests, health, Uncategorized* · *Leave a comment*

Biomass and biofuels: Cause significant air pollution that threatens public health; Threaten forests and farmlands by consuming massive amounts of organic matter essential for maintaining soil fertility, forests and crop production; Require massive amounts of water, an increasingly scarce resource; Deplete and destroy soils, by permanently removing nutrients and beneficial microbes; Compete with other energy [...]

Preliminary Modeling Work

Assessment Approach

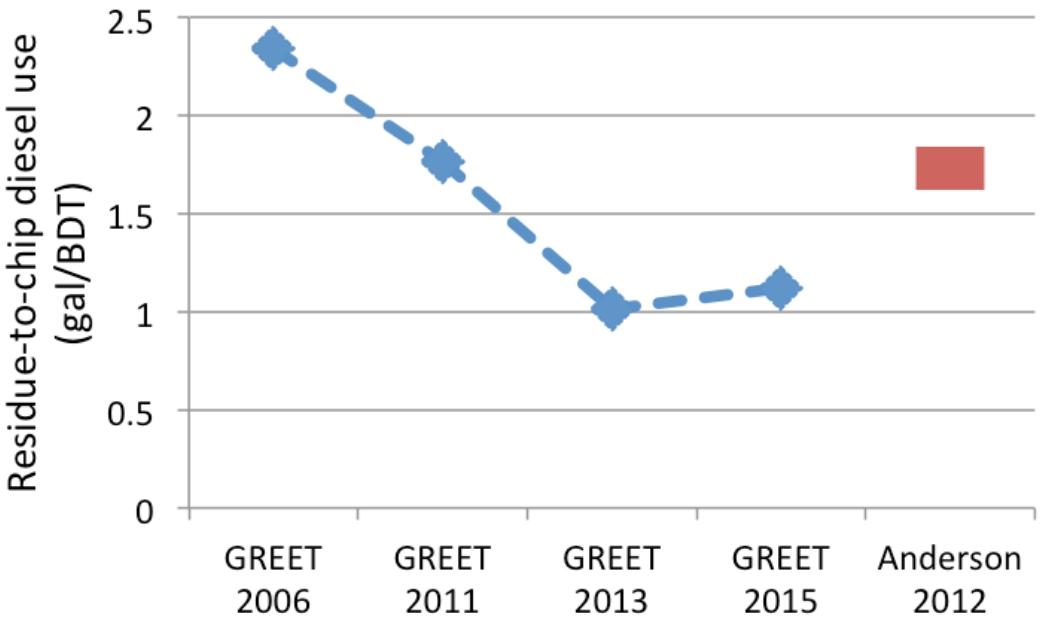
Supply chain model	Ecosystem C model
• Integration of BANR logistics work • Modeling liquid biofuel conversion process	• Stand succession, soil carbon • Biochar • Wildfire?

Integration

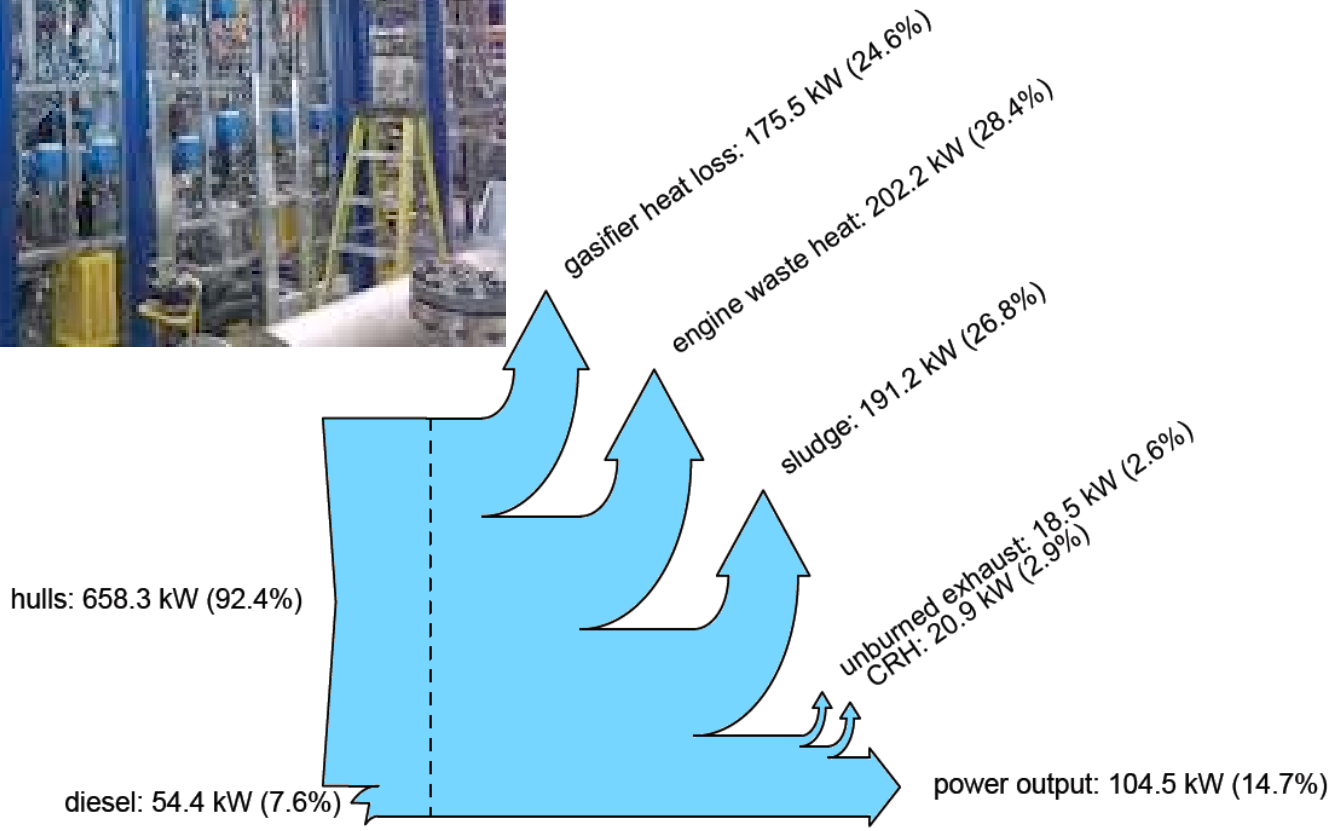
- Adding climate forcings at different points in time

Supply Chain Detail

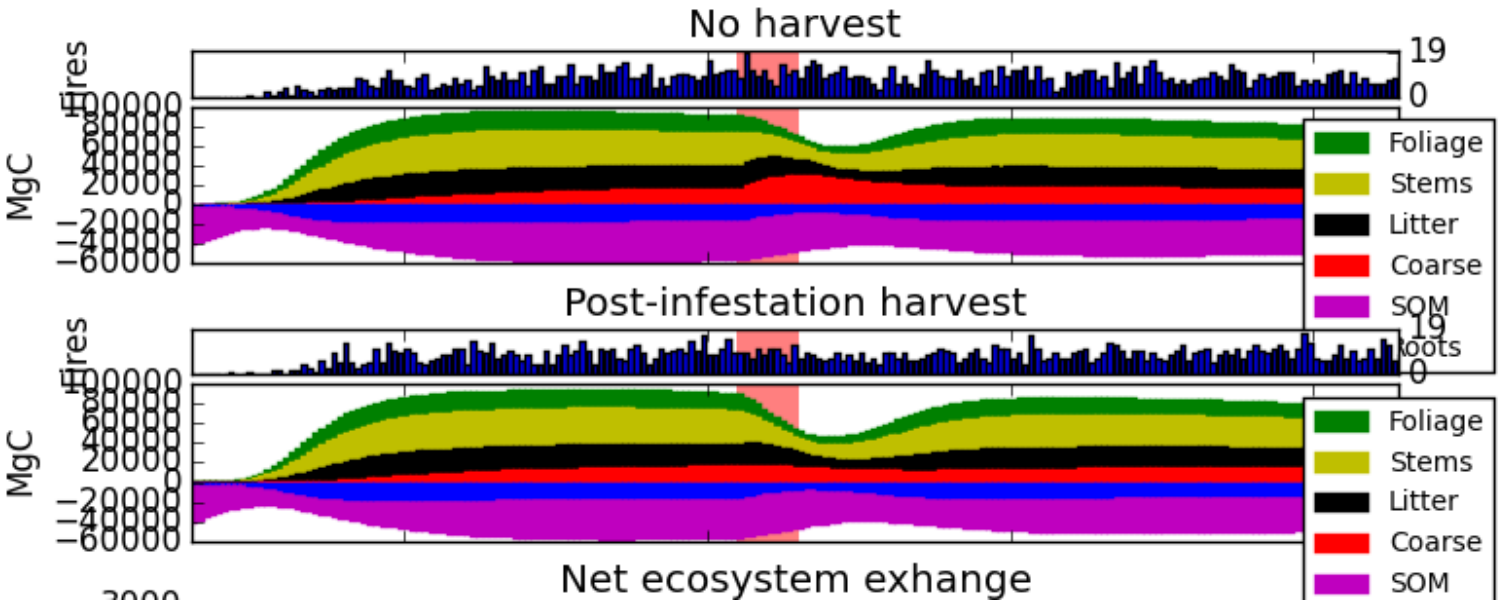
- Integration of BANR logistics work
  - Energy use from optimized in-woods chipping or slash forwarding systems plus transport



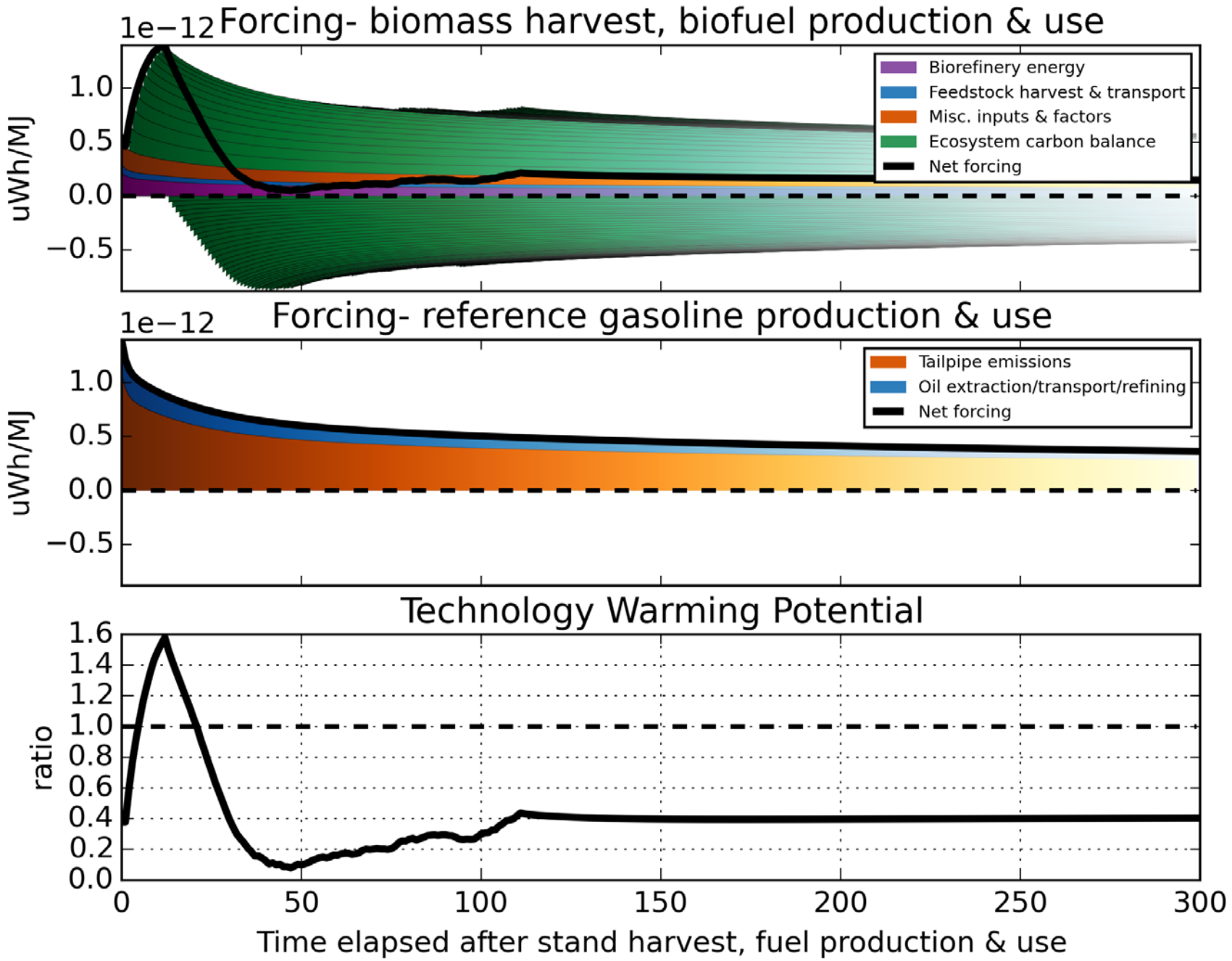
Conversion technology



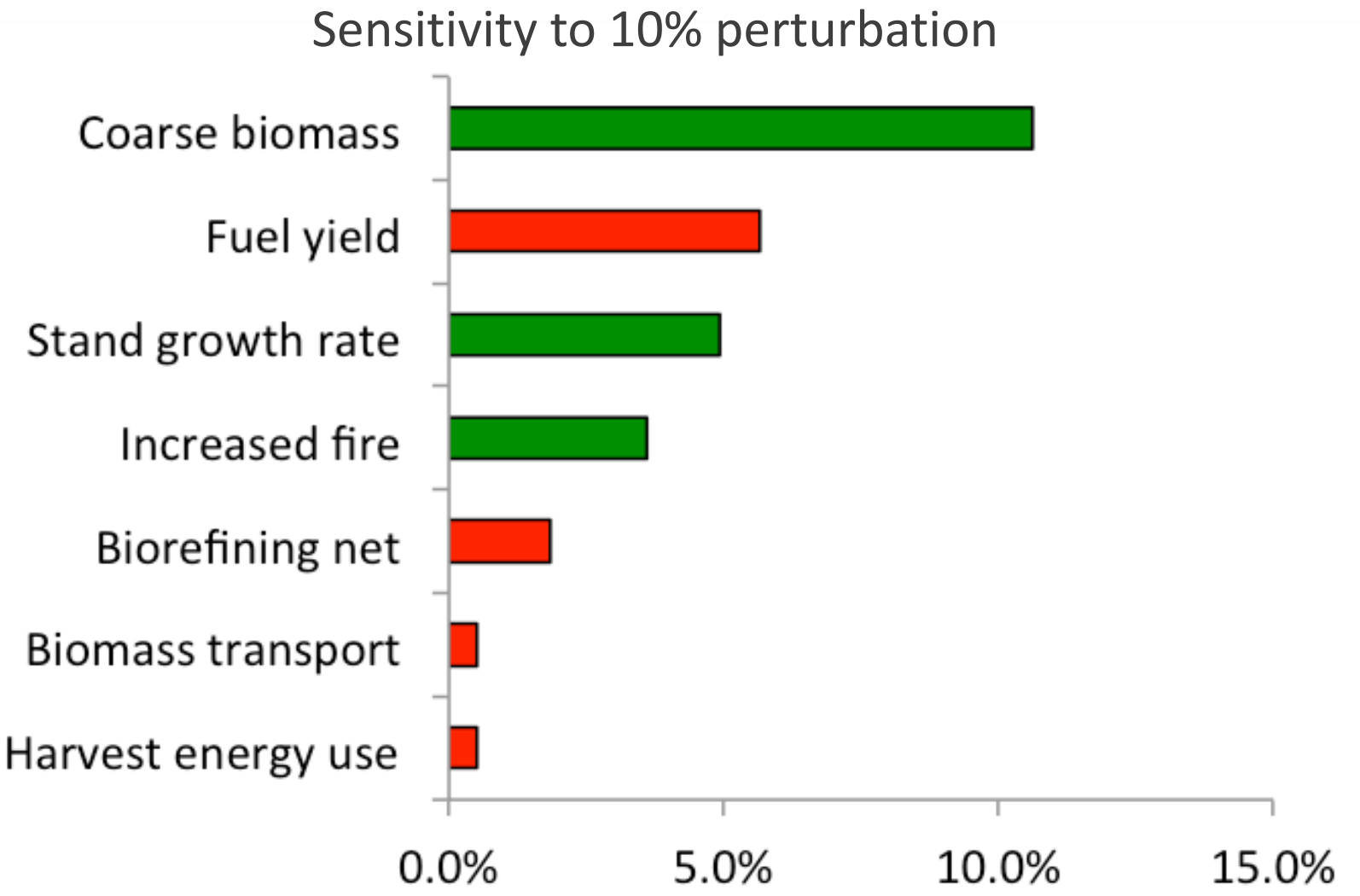
Ecosystem C cycling

- Harvest before-and-after observations, chronosequences
  - Stand-level modeling w/ Forest Veget. Sim., Fuels & Fire Ext. (FVS-FFE)
  - Landscape-level aggregation w/ simplified 3PG model
- 

- Other issues:
  - Biochar- recalcitrance, feedback on productivity
  - Wildfire- still closing the loop


Forcing- biomass harvest, biofuel production & use
1e−12
uWh/MJ
1.0
0.5
0.0
−0.5
Biorefinery energy
Feedstock harvest & transport
Misc. inputs & factors
Ecosystem carbon balance
Net forcing
Forcing- reference gasoline production & use
1e−12
uWh/MJ
1.0
0.5
0.0
−0.5
Tailpipe emissions
Oil extraction/transport/refining
Net forcing
Technology Warming Potential
ratio
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
50
100
150
200
250
300
Time elapsed after stand harvest, fuel production & use

Initial Sensitivity Results



BANR Team

Project members

Colorado State University
University of Idaho
Montana State University
University of Montana
Oregon State University
University of Wyoming
USFS – Rocky Mtn Res. Station
Cool Planet Energy Systems

Affiliates

Michigan State University
USFS – Forest Products Lab
Confluence Energy

Project advisory board

Greg Aplet – Wilderness Society
Pat Connell – Montana State Senate
Rob Davis – Forest Energy Corp.
Angela Farr – USFS, Region 1
Steve Hamburg – Environmental Defense
David Hiller – Colorado Clean Energy
Jim Neiman – Neiman Enterprises

Putting the pieces together

- Supply chain emissions
- Proper accounting of stack/tailpipe CO_2 from biomass carbon
  - Must reconcile ***current*** fossil fuel avoidance against ***future/transient*** changes in ecosystem C storage