Challenges and Environmental Trade-Offs in Using Harvest Residues for Energy Production

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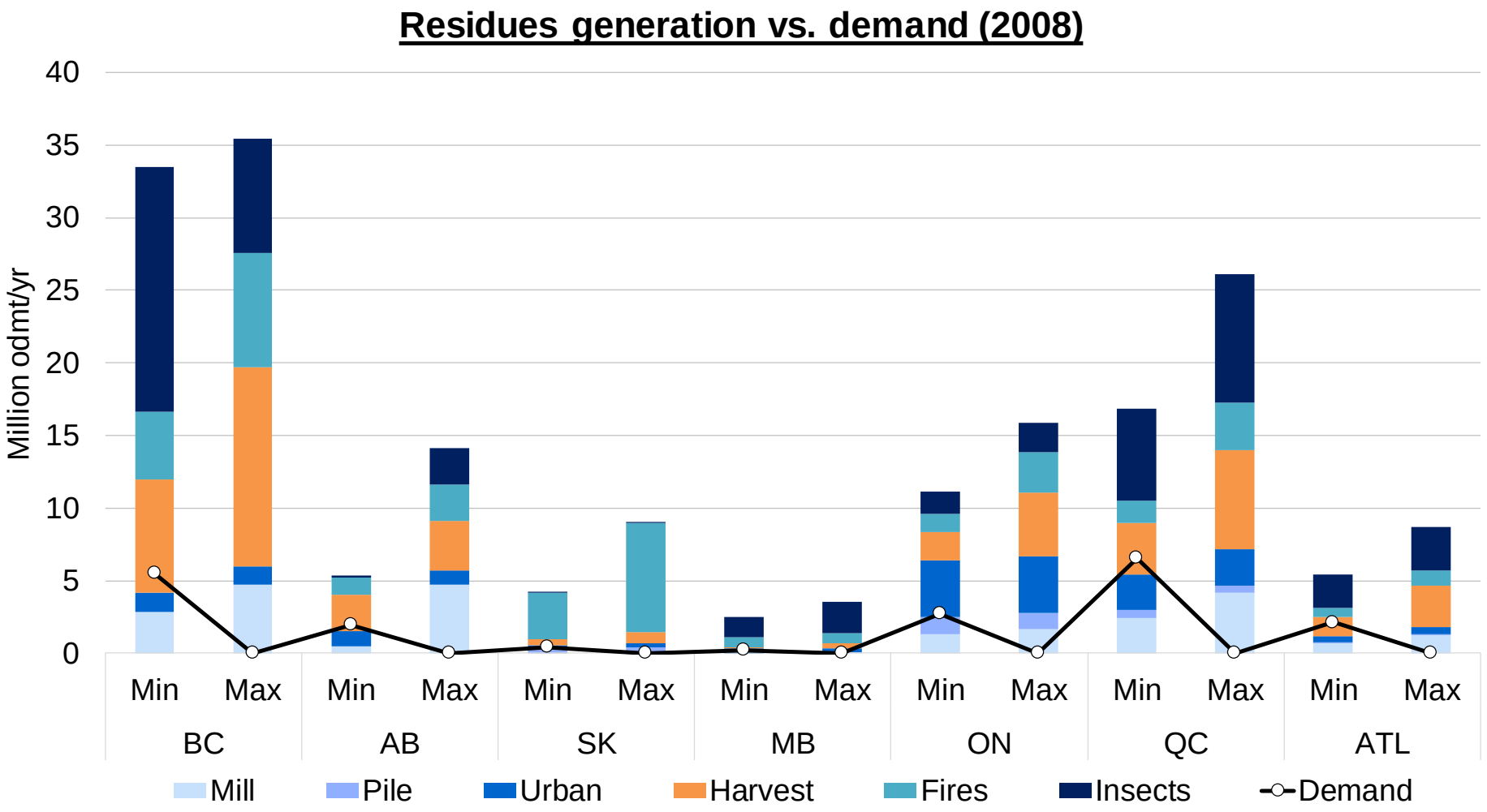
BioCleantech Forum

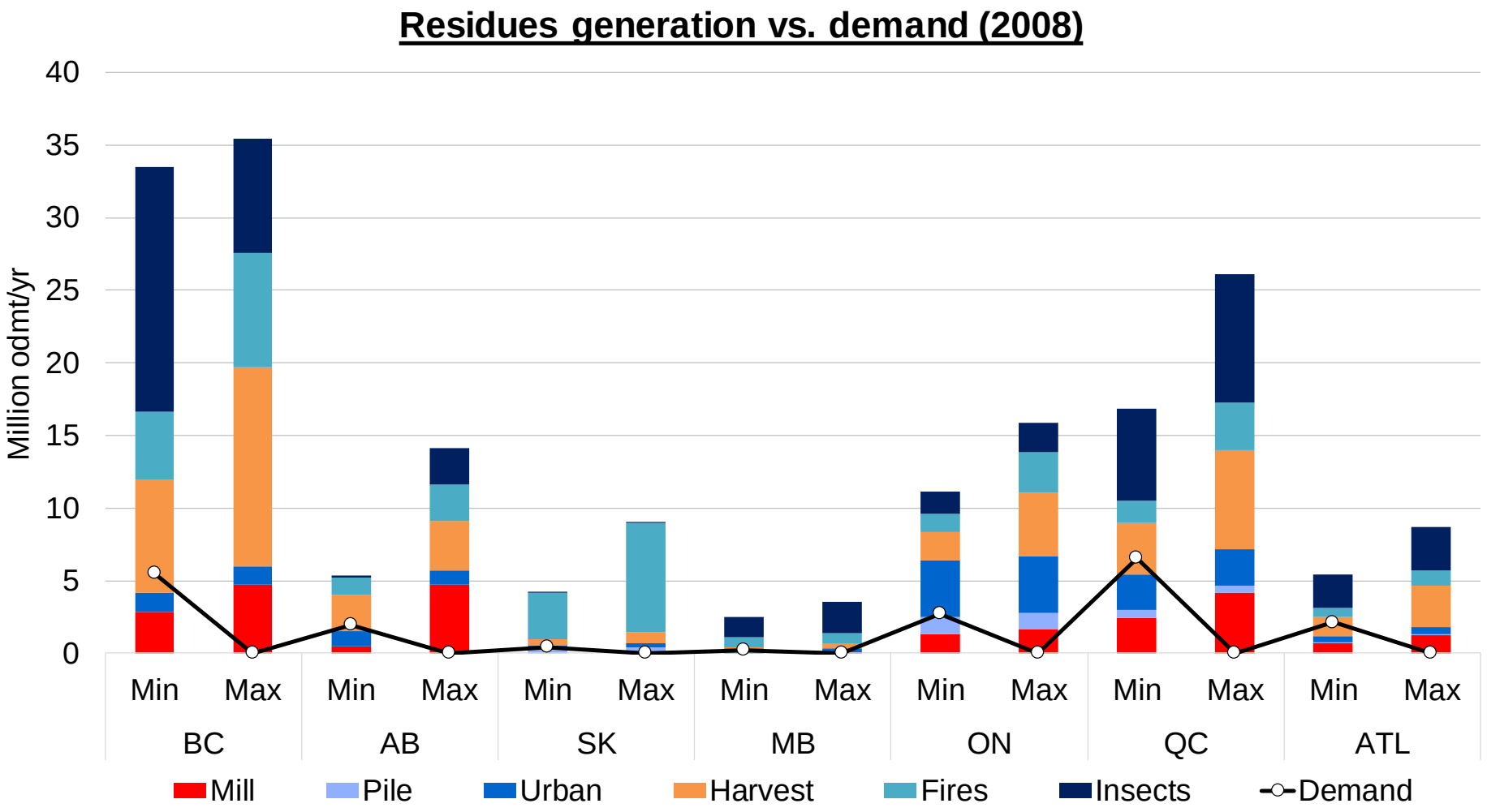
November 3, 2016

Wood residues are generated from many sources in the forest products value chain

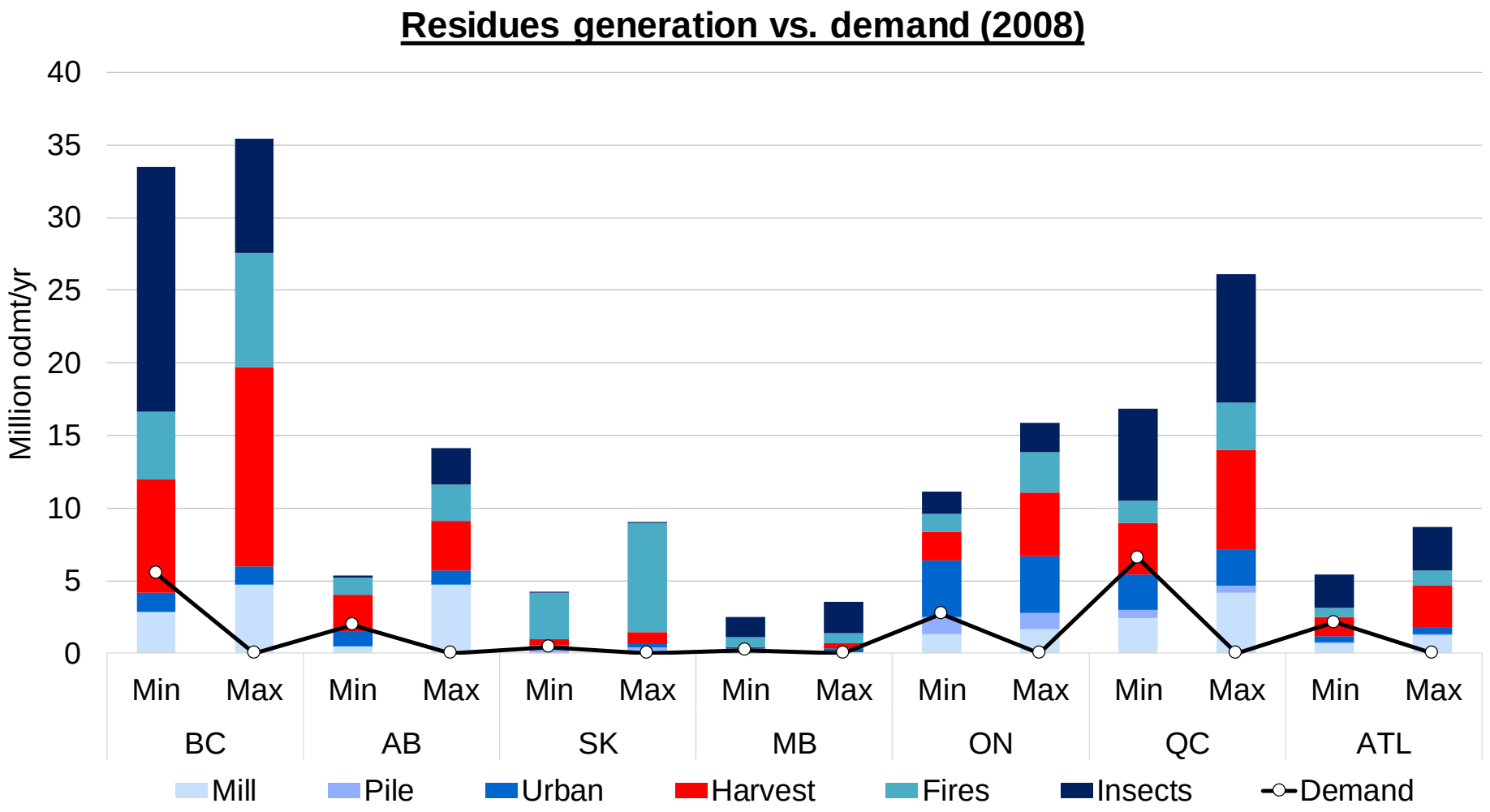


NRC Canada (2008), Bradley (2009), Sidders et al. (2008), Dymond et al. (2010)

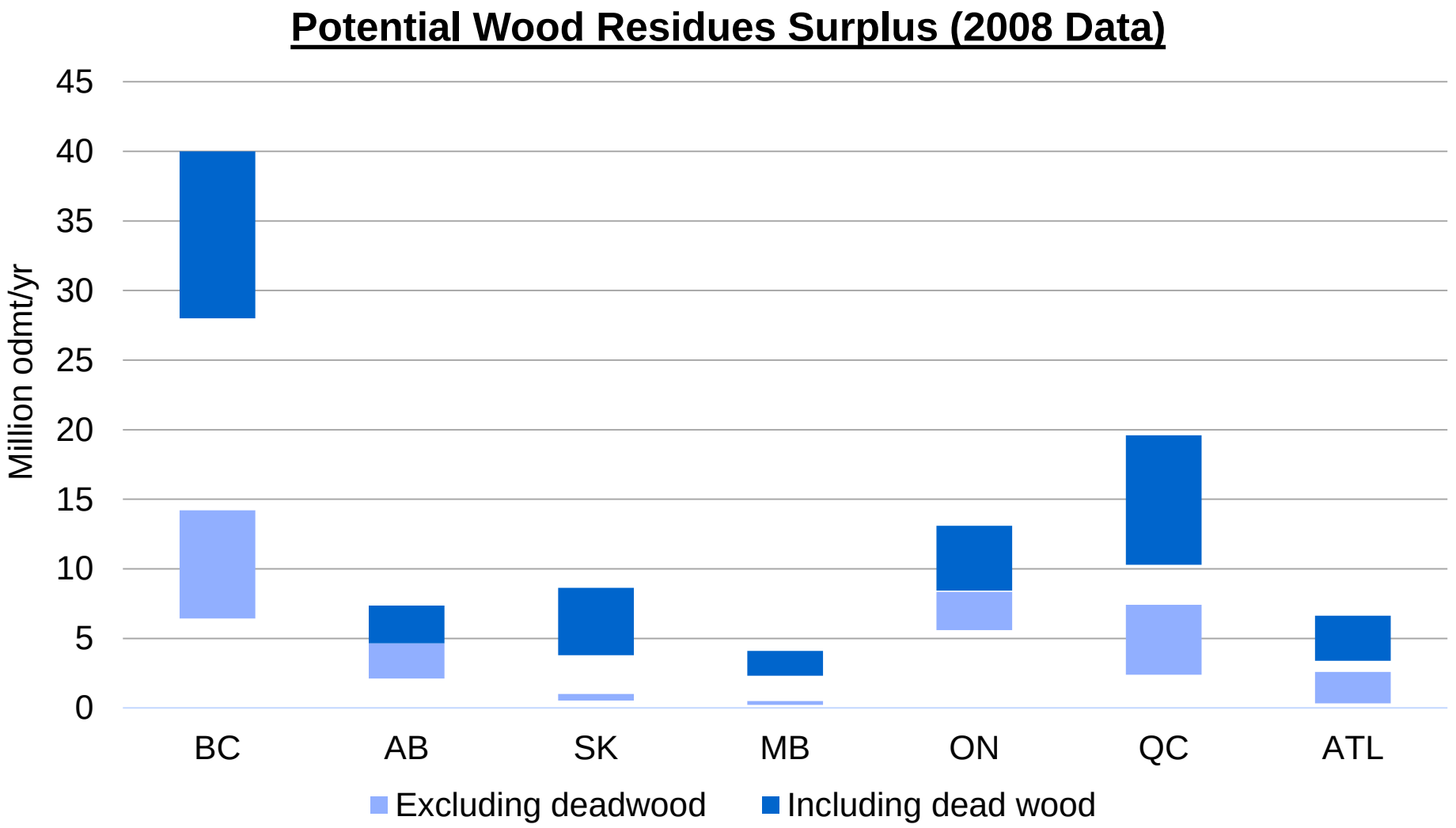
It can be assumed that a significant fraction of the demand is fulfilled using mill residues



Forest product facilities also use some harvest residues



There is a significant potential surplus of wood residues, including harvest residues



NRC Canada (2008), Bradley (2009), Sidders et al. (2008), Dymond et al. (2010)

FACT: There is a significant potential surplus of harvest residues

QUESTIONS:

1. Is it possible to use this surplus?
2. What are the environmental implications of doing so?

Currently, unused forest residues are managed using various approaches

From more to less common*

Piled at roadside

Left in-situ

Piled at roadside and burned

Piled and burned in-situ

- To minimize wildfires

*Based on limited survey by NCASI.

There are several challenges in increasing collection of harvest residues

- High cost of collection and transportation
  - Low-density and high moisture content
- Low market prices
  - Lack of political incentives
- Regulations
- Environmental considerations

Direct releases from burning harvest residues in the forest and in boilers are different

Comparison of Releases from Open-Burning and Energy Production

Generally lower than burning for energy production | It depends | Generally higher than burning for energy production

Air pollutant	Open-Burning in the Forest	Energy Production in Boilers
	g/kg	
PM2.5	ND to 15.5[a,b]	0.001 to 4.25[c,d]
PM10	ND to 12.8[a]	0.003 to 3.95[c,d]
CO	22 to 250[a,b]	0.14 to 17.3[c]
VOCs (excl. CH_4)	ND to 12.1[a,b]	0.13[d]
CO_2	1393 to 1650	1807[e]
CH_4	ND to 9.9[a]	0.617[e]
NO_x	2.38 to 2.62[b]	0.92 to 3.3[c]
SO_2	0.07 to 1.59	0.002 to 0.5[c]

[a]AP-42, logging slash debris. [b]Battye and Battye (2002), pile-and-burn slash or forest fuels. [c]U.S. Boiler MACT (2008-2009). [d]AP-42. [e]U.S. GHG Reporting program.

But direct releases are only part of a bigger story!

Are the environmental benefits of substituting fossil fuels enough to compensate for the environmental impacts of removing harvest residues from the forest floor?

There are trade-offs in collecting harvest residues for energy production

On-site management
Additional processing
Energy production

LEAVE ON SITE AND USE FOSSIL FUELS

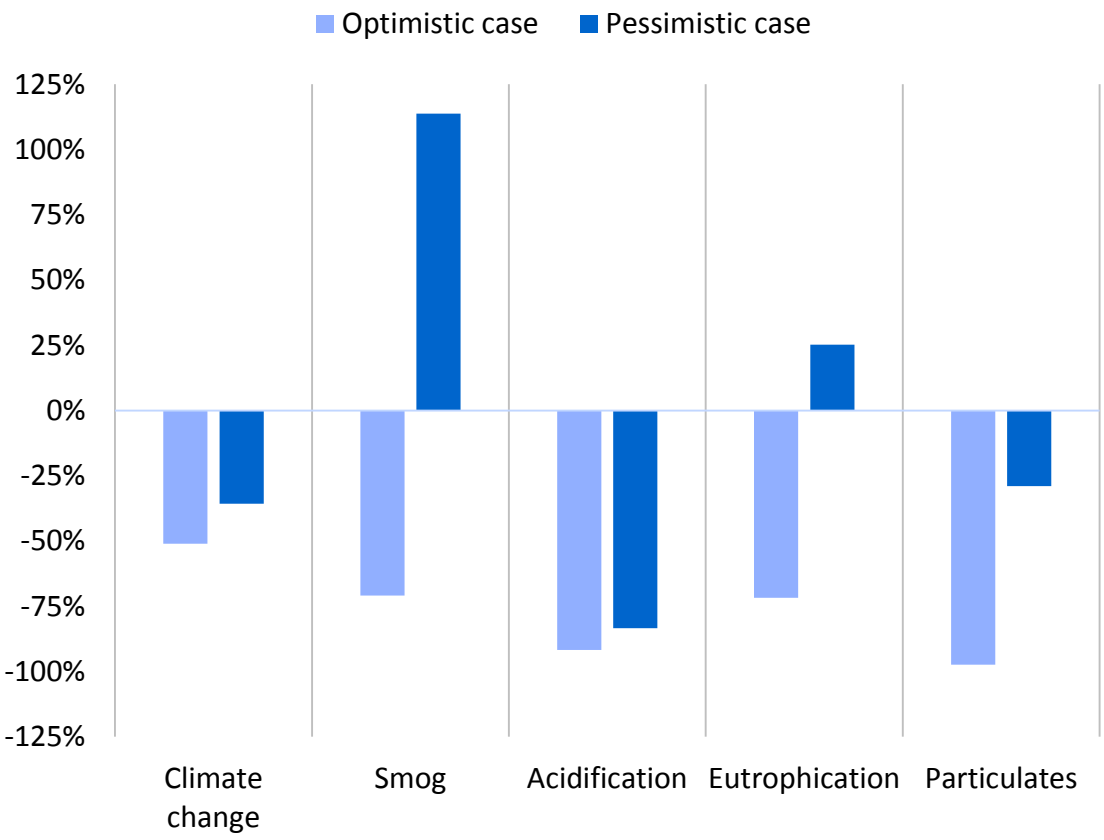
Pile at roadside	Slow decay		Burn fossil fuels (ff)	• GHG releases from pile and ff • Carbon storage from pile • Air and other releases from ff
Leave in situ	Slow decay		Burn fossil fuels	• GHG releases (from pile and ff) • Carbon storage from pile • Air and other releases from ff • Nutrient addition
Pile at roadside and burn			Burn fossil fuels	• GHG and air releases (from pile and ff) • Carbon storage from pile • Air releases from ff

COLLECT AND BURN

Pile at roadside (or other)	Collect	Chip	Transport	Burn residues	• Environmental impacts depend on the collection systems • Loss of carbon storage • Loss of nutrients

Environmental effects of using forest residues for energy depend on assumptions

Percent change in environmental indicator from using forest residues for energy compared to the counterfactual scenario



- Bioenergy scenario:
  - 1 GJ of energy from forest residues
- Counterfactual scenario
  - **Optimistic case:** residues are piled and burned with upper range air releases, coal is burned to produce the energy
  - **Pessimistic case:** residues are left onsite to decay, natural gas is burned to produce the energy

Based on literature data and U.S. EPA TRACI impact assessment method

FACT: There is a significant potential surplus of harvest residues

QUESTIONS:

1. Is it possible to use this surplus?
2. What are the environmental implications of doing so?

FACT: There is a significant potential surplus of harvest residues

QUESTIONS:

1. Is it possible to use this surplus?

   To some extent

2. What are the environmental implications of doing so?

   It depends!

Questions?

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