The health impacts of PM$_{2.5}$ in the NSW GMR

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Overview

Why the focus on $PM_{2.5}$?

The evidence of health effects

Health impacts in NSW

 Harm related to current levels of anthropogenic $PM_{2.5}$

 Harm related to emissions from specific sources

 The benefit of reducing $PM_{2.5}$

Conclusions

Why the focus on $PM_{2.5}$?

- There are very well established links between PM$_{2.5}$ and health effects
- Based on current knowledge, it is the air pollutant that does most harm
- The new national PM$_{2.5}$ standard means PM$_{2.5}$ is a major focus of governments.

The evidence of health effects

- There's very strong evidence that $PM_{2.5}$:
  - Shortens lives
  - Hastens the development of cardiovascular and respiratory disease

- There are also associations with a range of other outcomes. For example:
  - Neurological conditions
  - Low birth weight
  - Diabetes

- Around 85% of the social cost of $PM_{2.5}$ is attributable to loss of life

Different types of study have been used to investigate the effects of PM$_{2.5}$:

- Toxicological studies that look at effects on animals
- Clinical studies that look at effects in individual humans
- Observational studies that look at effects on populations :
  - Time series studies
 - Cohort studies

Health impacts in NSW

Health Impact Assessment

- HIA is a process for translating evidence into information about the local effects of $PM_{2.5}$
- Why is it necessary?
  - Generally speaking, local studies that directly assess the impacts of $PM_{2.5}$ aren't feasible
  - Without impact assessment, the effects of $PM_{2.5}$ are largely invisible (and hence unlikely to be managed efficiently).
- HIA can answer questions like:
  - How much harm is caused by current levels of $PM_{2.5}$?
  - What would be the benefit of doing something to reduce $PM_{2.5}$ concentrations?

How much harm occurred in 2011 as a result of long-term exposure to PM$_{2.5}$?
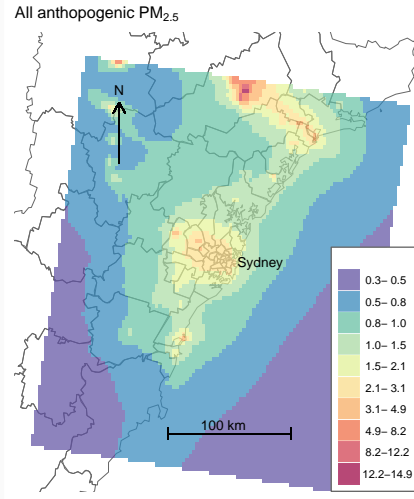
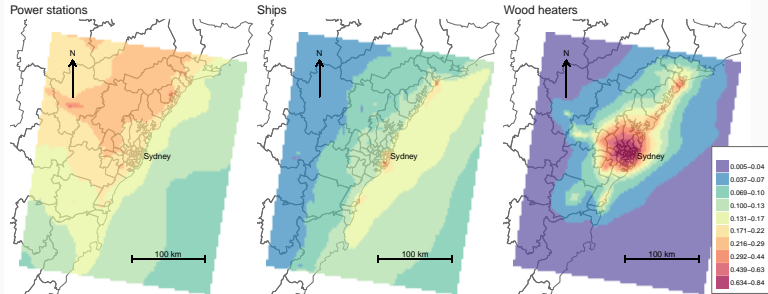# How much harm occurred in 2011 as a result of long-term exposure to PM$_{2.5}$?
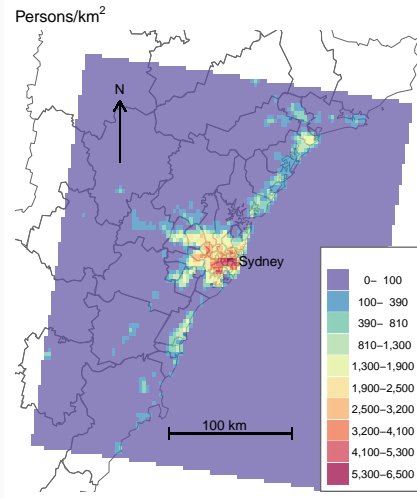
Results

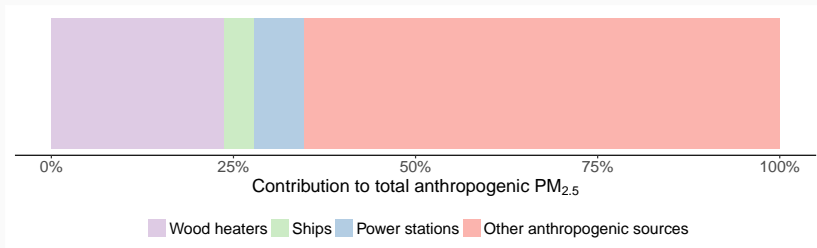|	
Population-weighted concentration	$2\,\mu g/m^3$
Loss of life expectancy	53 days
Years of life lost	5,800
Attributable number of deaths	420

Interpretation

- If everyone is exposed to the same level of $PM_{2.5}$ for a life time we would loose, on average, 2 months of life
    - But $PM_{2.5}$ does not affect everyone equally
    - If only half the population were susceptible, this half would lose 4 months
- Each year, around 5,800 years are lost by those whose lives were shortened by $PM_{2.5}$
- If $PM_{2.5}$ was the 'sole' cause of certain deaths then it would cause 420 deaths at typical ages (ie predominantly among the elderly).
    - But $PM_{2.5}$ is one of many risk factors that affect the timing of people's deaths
    - $PM_{2.5}$ likely affects the timing of death of a much larger number than 420

Exposure related to specific sources

PM$_{2.5}$ concentrations in 2011

Contribution to total anthropogenic PM$_{2.5}$

Wood heaters ■ Ships ■ Power stations ■ Other anthropogenic sources

How much harm was caused by PM$_{2.5}$ in 2011?

Source	Loss of life expectancy (days)	Years of Life Lost	Attributable number of deaths
Anthropogenic	53	5,800	420
Wood heaters	13	1,400	100
Power stations	5	550	40
Ships	–	220*	17*

What would be the benefit of reducing PM$_{2.5}$?

The effect of reducing exposure to PM$_{2.5}$

- People live longer
- The population increases in size
- But ultimately you get the same number of deaths
- We model the life-extending effects to estimate the number of life-years produced

Specifically, we have looked at:

- Ships use low-sulphur fuel at berth
- Implementation of more stringent wood heater standards
- Elimination of precursors to PM$_{2.5}$ from power station emissions

Results

Action	Life-years produced†	Present monetary value (milions AUD)‡
Low-sulphur fuel in ships	6,240*	251*
2.5g/kg emissions standard for wood heaters	58,600	2,600
1.5g/kg emissions standard for wood heaters	88,400	3,900
Elimination of NO_x emissions from power stations	37,600	1,700
Elimination of SO_x emissions from power stations	13,600	630

† These are the life-years produced among people who were alive in 2011. There would also be benefits to people born in the future

‡Assuming VSLY of $187,000 and 3% discount rate

Conclusions

- $PM_{2.5}$ related to human activity is reducing life expectancy by about 2 months and causing 5,800 YLL each year
- Actions that reduce in $PM_{2.5}$ emissions are likely to produce a substantial social benefit.

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