

Marginal Damage Values *for* Air Pollutants in Ireland



EnvEcon

Decision Support

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Edinburgh

THANK YOU

Miao Fu

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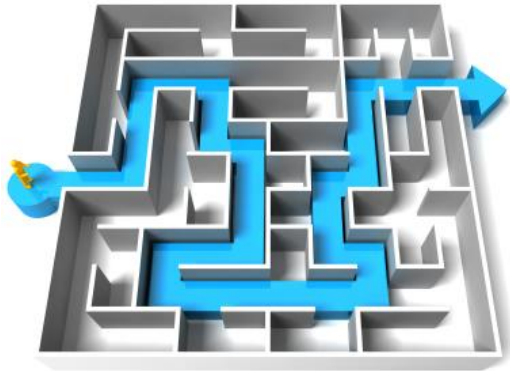
Hilde Fagerli

EPA Colleagues

DECLG Ireland

Others...

Structure of Presentation



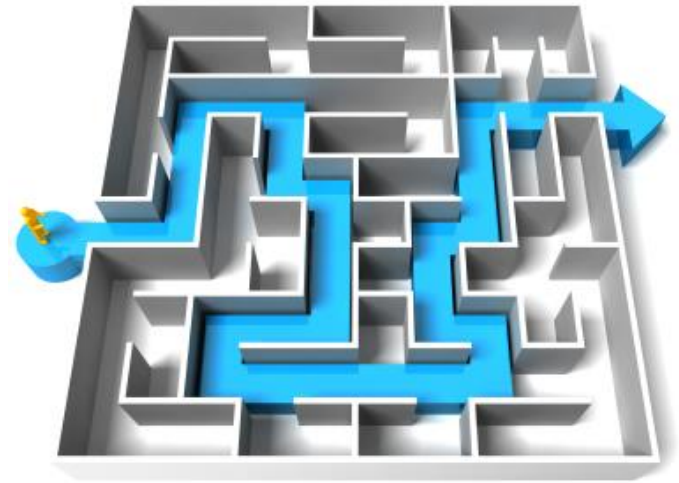
Objective



Method



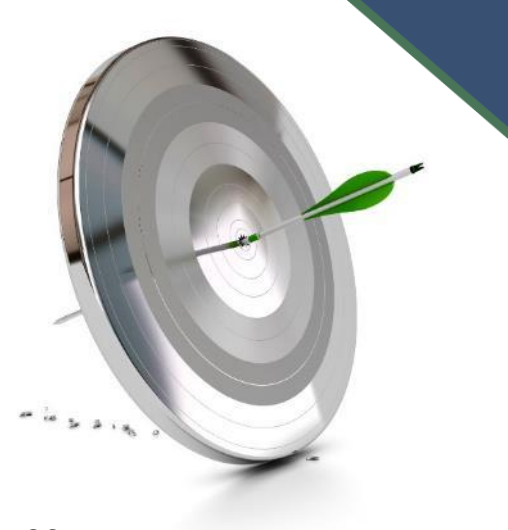
Results



Section 1 Objective

What were we hoping to achieve?

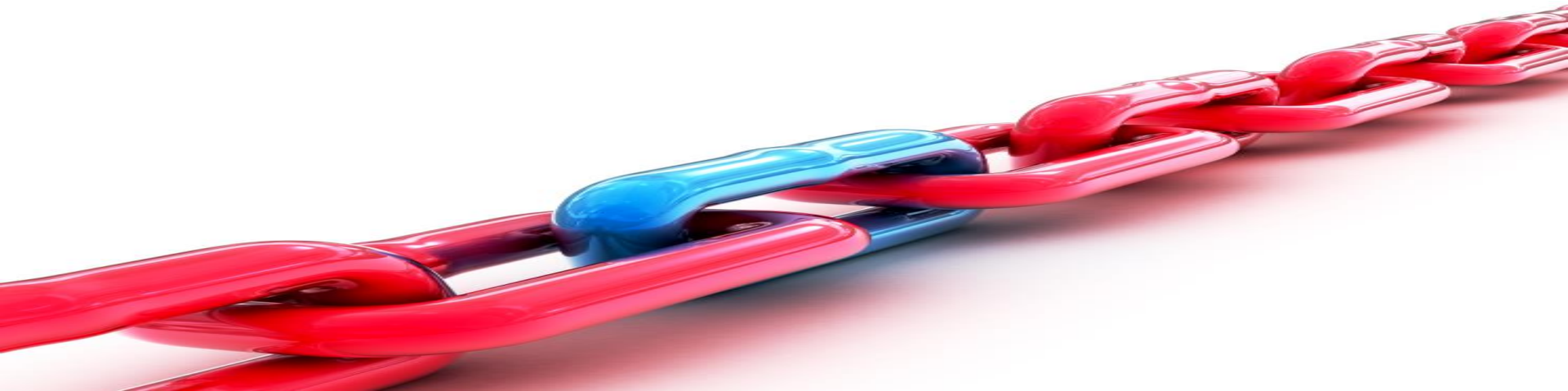
- Air pollution is often in the shadow of climate policy
- Climate policy is often in the shadow of economic policy
- A step toward increased awareness of air pollution is to recognise the values associated with more or less air pollutants in policy decisions
- Climate has this as an *easy* option with a market price for carbon
- Air pollution is not so easy and so is often ignored in decision making
- In Ireland, there were no contemporary, national-specific values available for the marginal damage of a tonne of air pollution for use in CBA/RIA/EIA
- We said there should be, they said please provide them, we said ... OK



What do we want to deliver?

- Resources were very limited for this work so we had to accept certain constraints
- We did not have the capacity or time for detailed chemical/dispersion modelling
- We wanted to deliver something that was a major improvement on the *status quo*...
- And to identify the steps for an increasingly robust systematic approach for the future

- We focused in on marginal damage (health, resources and ecosystem) values for a tonne of each NECD air pollutant, at a county level using 2010 data



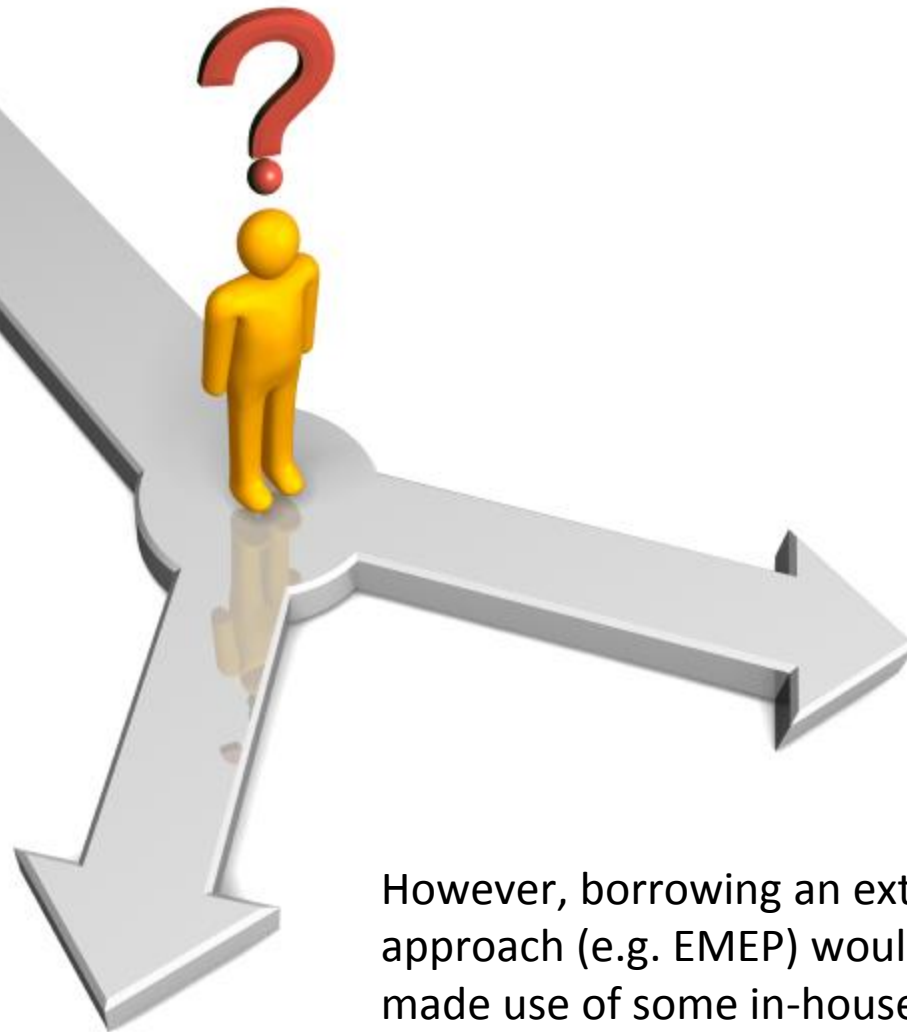


Section 2 Method

Method

We spoke to many very helpful colleagues such as Tim, Stefan, Julian, IIASA...

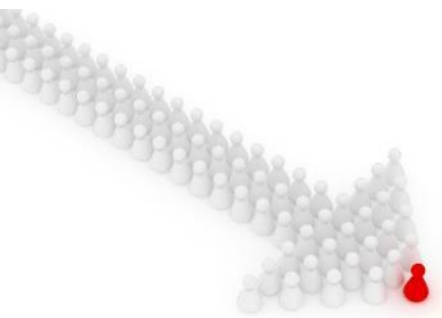
And this helped us frame an approach



However, borrowing an external approach (e.g. EMEP) would not have made use of some in-house work we had been developing on spatial allocation of emissions ... so we tried to develop an innovative in-house approach...

Our Method – Main Components

Emissions and Concentration

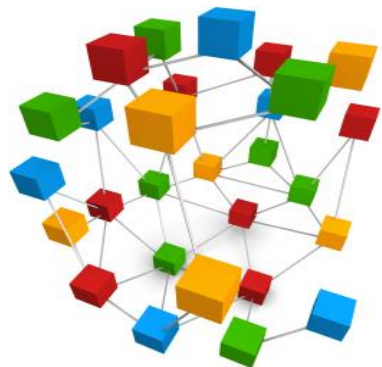


Receptors

- National Inventory for 2010
- Spatially Distributed by EnvEcon
- National AP Monitoring Network Data
- Monitored Data Cleaned by EnvEcon

- National Census Data for 2011
- Spatial Land and Resource Data

Our Method – Main Components



Method & Relationships

- WHO – OECD - CLRTAP
- IOM Life Tables – Updated by EnvEcon
- Research Projects – e.g. NEEDS/ECLAIRE
- International Literature & Research

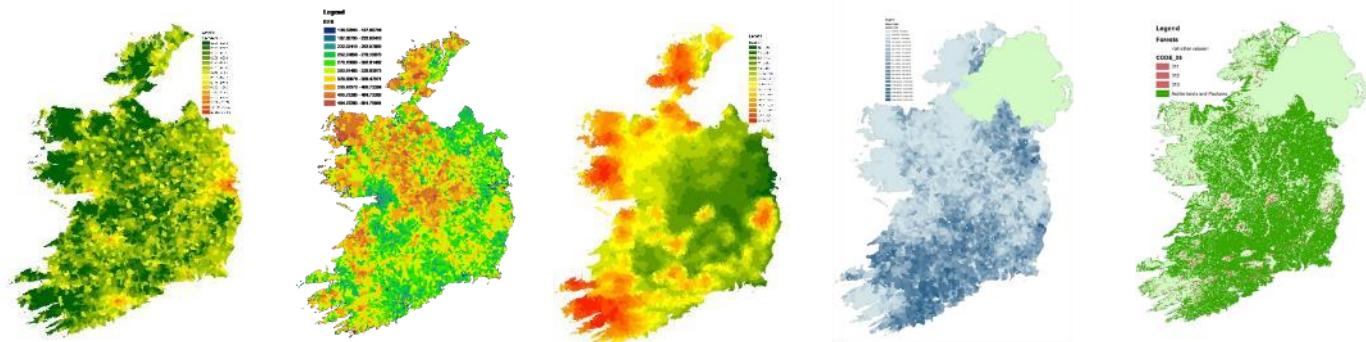


Valuations

- Resource Market Price Data
- External Valuations of Natural Areas
- National Health Expenditure Statistics
- International Literature & Research

Innovations and Limitations - *Chemistry*

- Our strengths would be in economics, policy, programming, GIS ... not chemistry
- We have not used any chemical dispersion modelling
- Instead we have conducted extensive 'spatial' regression work to reconcile refined estimates of spatially distributed emission inventory with empirical estimates from the national monitoring network
- This approach offered a means of capturing weather impact, dispersion, background concentrations and natural sources in our estimations
- Enhanced low-cost monitoring solutions may greatly enhance this method



Innovations and Limitations – *Data & Scope*

- We have good detailed data on infrastructure, emission sources, population, economic parameters, resources and so forth
- We have updated incomes and life values etc. And have invested more time in the health side than the ecosystem and resource side
- We have not considered building/materials damage or direct health damage from SO₂/NO_x/NH₃
- We are ok with the relationship between emissions and concentrations ... but we struggled to find a means of relating concentrations to health damage for SO₂/NO_x/NH₃



Summary Approach

- Using VOLYs calculated from VSLs (WHO EU, 2014) and IOM life table method for PM and O₃ damage.
- Included health impacts by using health functions (mainly health core functions) indicated in WHO EU (2013) and Holland (2014) documents.
- Included impacts on crops, CLRTAP(2014) and AEAT(2005).
- Included impacts on ecosystems (acidification, eutrophication & O₃ damage), using NEEDS (2006) for acidification and eutrophication, CLRTAP(2014) for O₃ damage.
- O₃ health metric uses SOMO35, WHO EU (2013) and Holland (2014).
- O₃ environmental metric uses AOT40 (CLRTAP, 2014).
- Value of life year is assumed to be constant in 2010 prices over years, i.e., increases with inflation rates in future prices, because there is no evidence that value of future life year will be discounted/lower.
- Lag structure is used for impact factor for all cause long-term mortality loss.





Section 3 Results

Sampled Provisional Results

Aggregate National Estimate of Marginal Damage Value per Tonne of Pollutant (€₂₀₁₀ per tonne per annum)

	NO _x	NH ₃	SO ₂	NO _x Eco	NH ₃ Eco	SO ₂ Eco	NMVOC(O ₃)	PM _{2.5}
Ireland	?			€62	€136	€17	€858	€7,496
Ireland Urban				€10	€31	€3	€2,422	€52,659
Ireland Rural				€78	€137	€20	€828	€6,604

Notes: Rural areas in Ireland have 67139.66 km² and 2,496,358 people, and urban areas in Ireland have 1326.40 km² and 2,091,894 people.

Aggregate County Level Estimates of Marginal Damage Values (Health and Environment) per Tonne of Pollutant (€₂₀₁₀ per tonne per annum)

	NO _x	NH ₃	SO ₂	NO _x Eco	NH ₃ Eco	SO ₂ Eco	NMVOC(O ₃)	PM _{2.5}
Carlow	?			€26	€82	€6	€1,133	€10,888
Dublin				€6	€37	€1	€2,590	€60,600
Kildare				€39	€91	€14	€1,253	€15,257
Kilkenny				€27	€62	€7	€1,074	€9,505
Laois				€54	€118	€14	€993	€8,388



Single Pollutant – Not Additive



Multiple Pollutants with Particulates – Additive Impacts

Future Work



- Bring spatial allocation of emissions by source down to ED or finer scale
- Revisit ozone impacts in 'hot spots' when on a finer scale
- Update material with census 2016, inventory revisions, ECLAIRE, WHO etc.
- Develop a web-based system that incorporates a more complex back-end methodology which addresses the risk of double counting of impacts that can persist where static tables are produced
- Incorporate chemical dispersion modelling
- Refine estimates by source sector and toxicity of particulates (e.g. transport)
- Consider examining marginal benefits e.g. welfare contribution of consumption

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