Convention on Long-range Transboundary Air Pollution

Joint WGE-TFIAM background report to the revised Gothenburg Protocol

Briefing by the chair

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

Purpose

- Background info to revised protocol
- Description of scenario assumptions
- Maps for Europe
- Tables with data per country

→ useful for review & implementation problems

Contents

1. **Activity trends and future scenario 1990-2020**
   1. GDP 2. Energy 3. Transport 4. Agriculture
2. **Key measures**
3. **Emissions (BL, Protocol, …, MTFR)**
4. **Air quality and deposition**
5. **Impacts**
   1. Yolls 2. Acidification 3. Eutrophication 4. Ozone deaths
   5. Ozone damage to vegetation 6. Damage to materials 7. Climate
6. **Costs and benefits**
7. **Long term prospects**

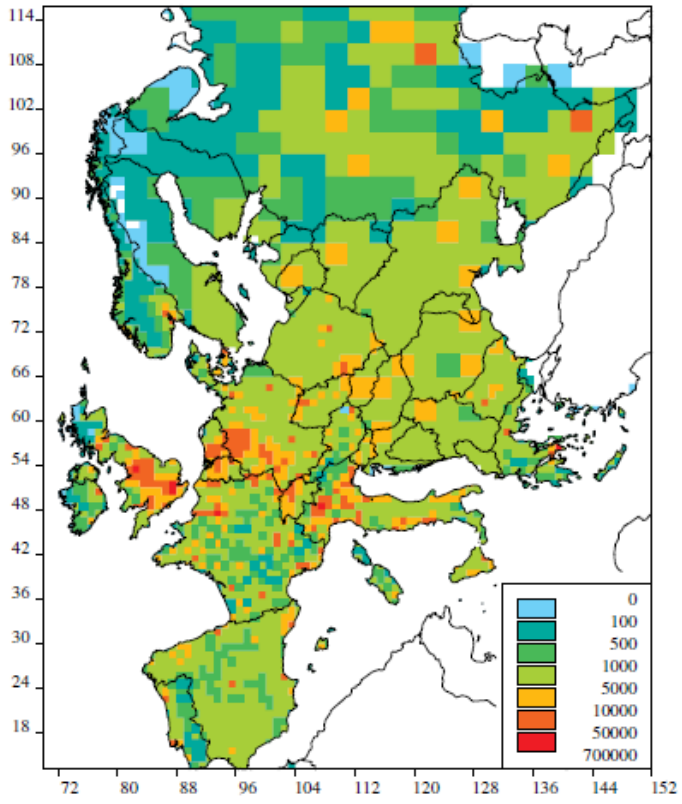
Examples

Table 2.3: Projection of economic, energy and transport statistics for the year 2010

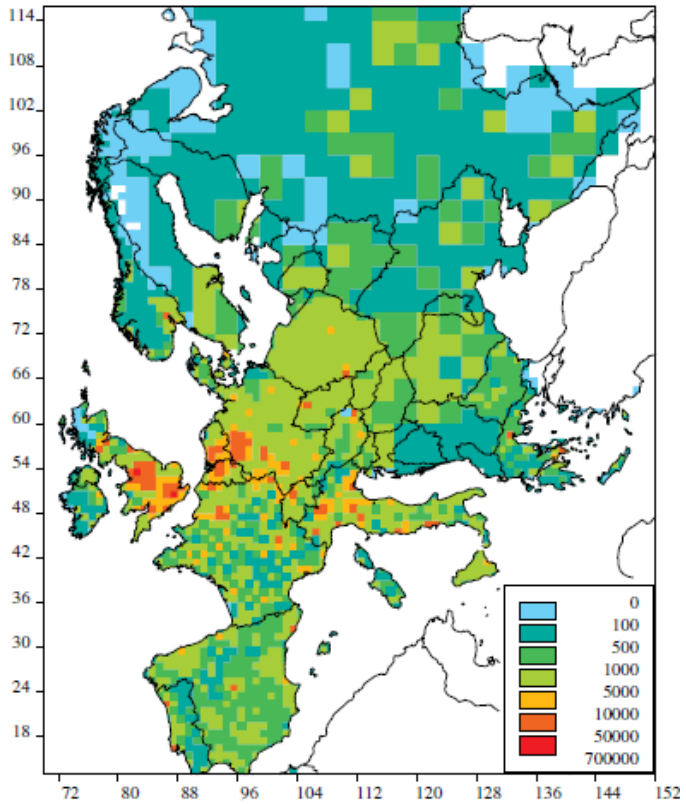
	Population		GDP		Energy		Vehicles	
	Million persons 2010	Change 1990-2010	Billion EURO 2010	Change 1990-2010	PJ 2010	Change 1990-2010	1000 vehicles 2010	Change 1990-2010
Austria	8.23	*6.7%*	158.4	*46%*	1421	*14%*	5813	*53%*
Belgium	9.96	*0.0%*	198.9	*52%*	2436	*28%*	6729	*45%*
Denmark	5.27	*2.6%*	110.0	*55%*	783	*7%*	2391	*15%*
Finland	5.29	*6.1%*	122.2	*81%*	1615	*31%*	3159	*33%*
France	62.20	*10.2%*	1266.4	*49%*	11128	*22%*	43100	*39%*
Germany	83.59	*5.3%*	1663.8	*58%*	14176	*-2%*	56785	*36%*
Greece	10.75	*6.2%*	135.5	*74%*	1813	*97%*	6550	*126%*
Ireland	3.58	*2.2%*	79.1	*146%*	698	*71%*	2348	*139%*
Italy	57.80	*0.2%*	1081.5	*46%*	8444	*26%*	41220	*25%*
Luxembourg	0.38	*0.6%*	10.8	*58%*	129	*6%*	278	*34%*
Netherlands	16.50	*10.4%*	398.2	*91%*	3713	*36%*	10462	*53%*
Portugal	9.49	*1.3%*	129.9	*81%*	1112	*59%*	7251	*48%*
Spain	40.57	*4.1%*	631.2	*67%*	5215	*44%*	27262	*60%*
Sweden	9.12	*6.5%*	180.2	*47%*	2581	*6%*	5709	*41%*
UK	60.22	*4.9%*	1190.3	*58%*	9875	*16%*	36803	*48%*
EU-15	382.96	*5.1%*	7341.2	*57%*	65141	*19%*	255861	*42%*

Table 3.1: Emissions of NO_x for 1990 and the Reference (REF), Protocol, revised G5/2 and hypothetical maximum technically feasible reductions (MFR_{ult}) scenarios (in kilotons). Percentage changes relate to the year 1990.

	1990	REF		Protocol		G5/2rev		MFR_{ult}	
	kt	kt	Change	kt	Change	kt	Change	kt	Change
Austria	192	103	*-46%*	107	*-44%*	91	*-53%*	54	*-72%*
Belgium	351	191	*-46%*	181	*-48%*	127	*-64%*	81	*-77%*
Denmark	274	128	*-53%*	127	*-54%*	113	*-59%*	49	*-82%*
Finland	276	152	*-45%*	170	*-38%*	152	*-45%*	56	*-80%*
France	1867	858	*-54%*	860	*-54%*	704	*-62%*	383	*-79%*
Germany	2662	1184	*-56%*	1081	*-59%*	1081	*-59%*	622	*-77%*
Greece	345	344	*0%*	344	*0%*	344	*0%*	127	*-63%*
Ireland	113	70	*-38%*	65	*-42%*	55	*-51%*	27	*-76%*
Italy	2037	1130	*-45%*	1000	*-51%*	901	*-56%*	396	*-81%*
Luxembourg	22	10	*-55%*	11	*-50%*	8	*-64%*	4	*-80%*
Netherlands	542	280	*-48%*	266	*-51%*	266	*-51%*	127	*-77%*
Portugal	208	177	*-15%*	260	*25%*	144	*-31%*	51	*-76%*
Spain	1162	847	*-27%*	847	*-27%*	726	*-38%*	263	*-77%*
Sweden	338	190	*-44%*	148	*-56%*	159	*-53%*	75	*-78%*
UK	2839	1186	*-58%*	1181	*-58%*	1181	*-58%*	521	*-82%*
EU-15	13226	6849	*-48%*	6648	*-50%*	6054	*-54%*	2836	*-79%*



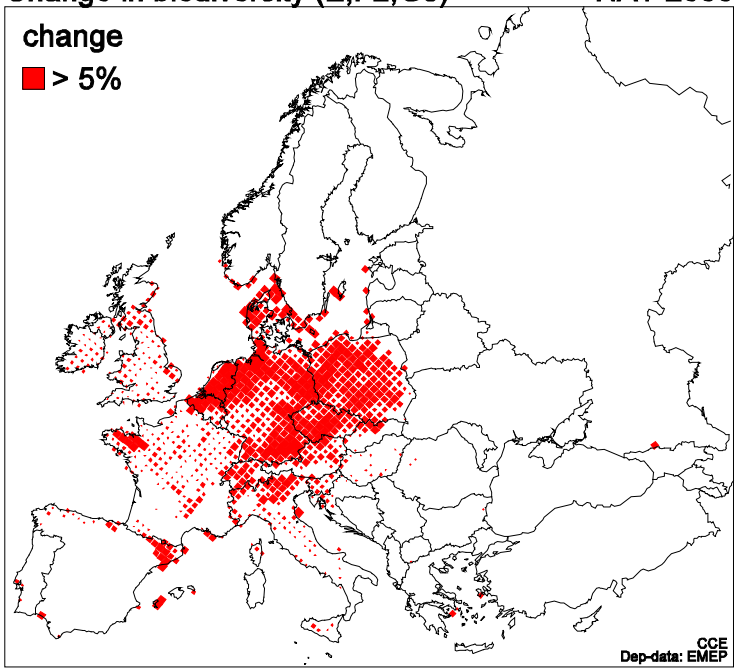
(c) G5/2$_{rev}$ scenario



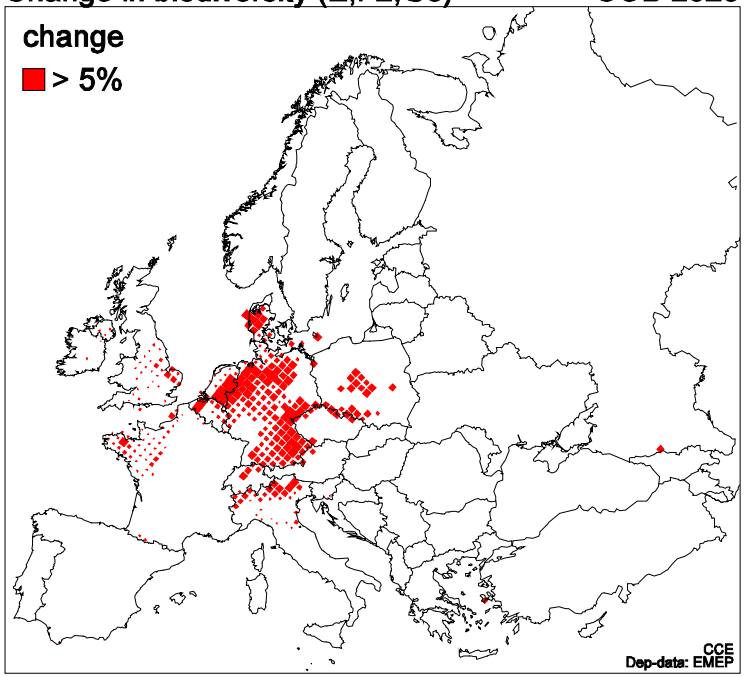
(d) MFR$_{ult}$ scenario

Figure 3.4: VOC emission densities (tons per 50*50 km grid cell)

Change in biodiversity (E,F2,G3) NAT 2000

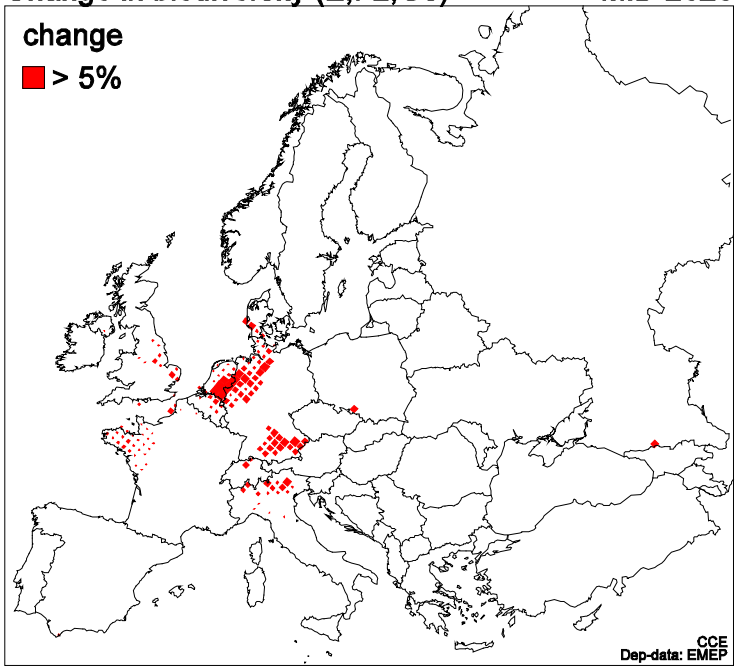


Change in biodiversity (E,F2,G3) COB 2020

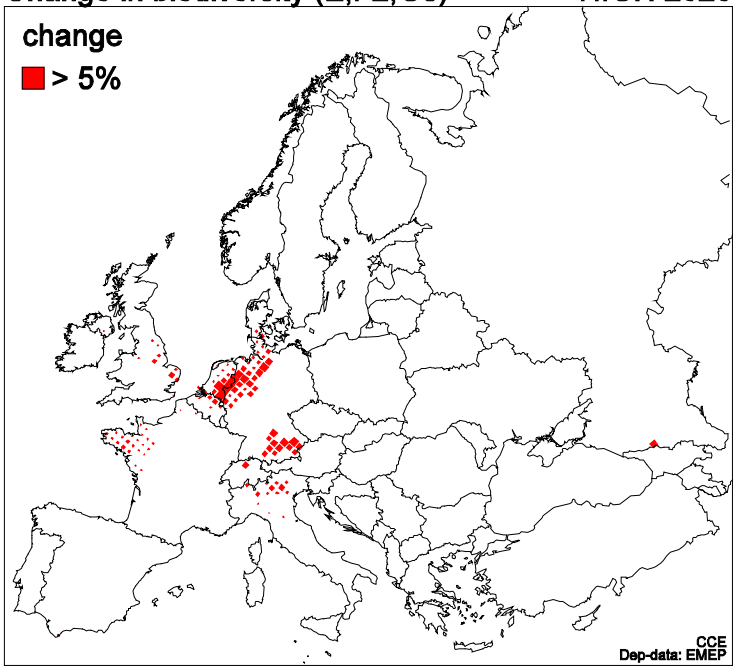


Ex-post Impact Analysis WGE/CCE

Change in biodiversity (E,F2,G3) MID 2020

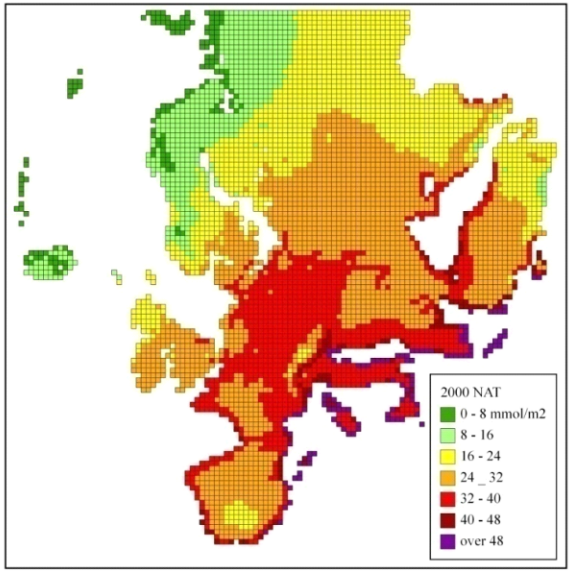


Change in biodiversity (E,F2,G3) HIGH 2020

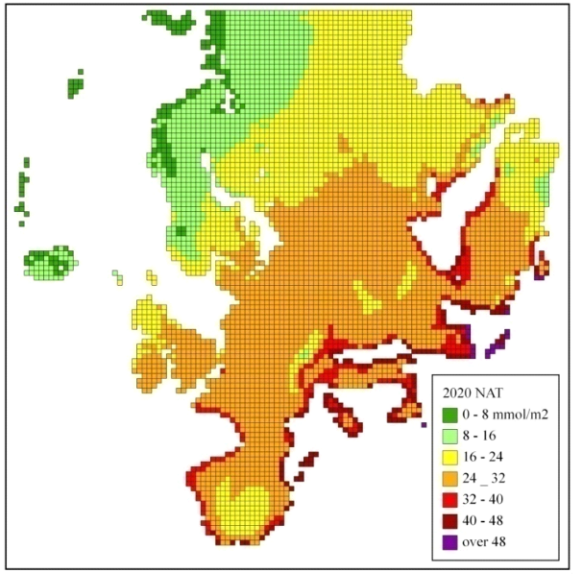


ICP Vegetation:
Ozone impacts (POD_6) decrease in time and with MFR

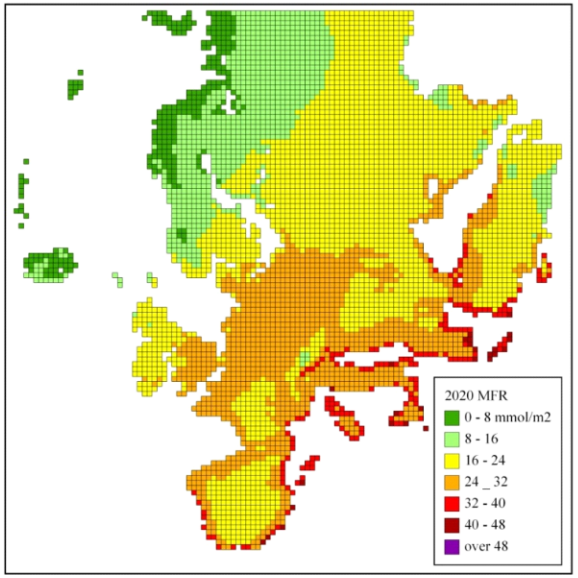
NAT2000



NAT2020



MFR2020



The magnitude of the impact is expected to decrease

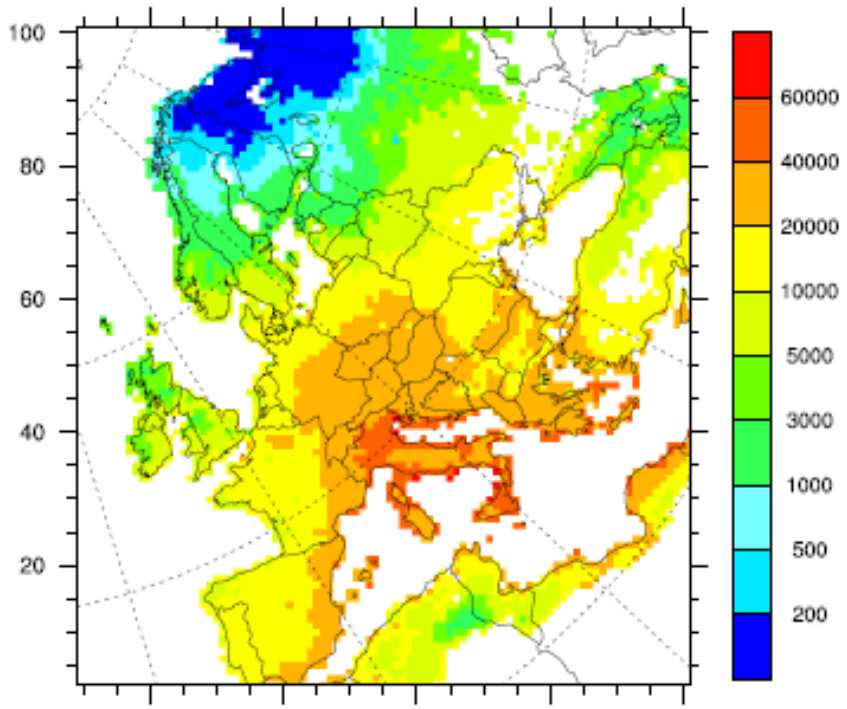
The areas (intensely) impacted are reduced

The risk to food production continues to be of concern in the future, including northern Europe

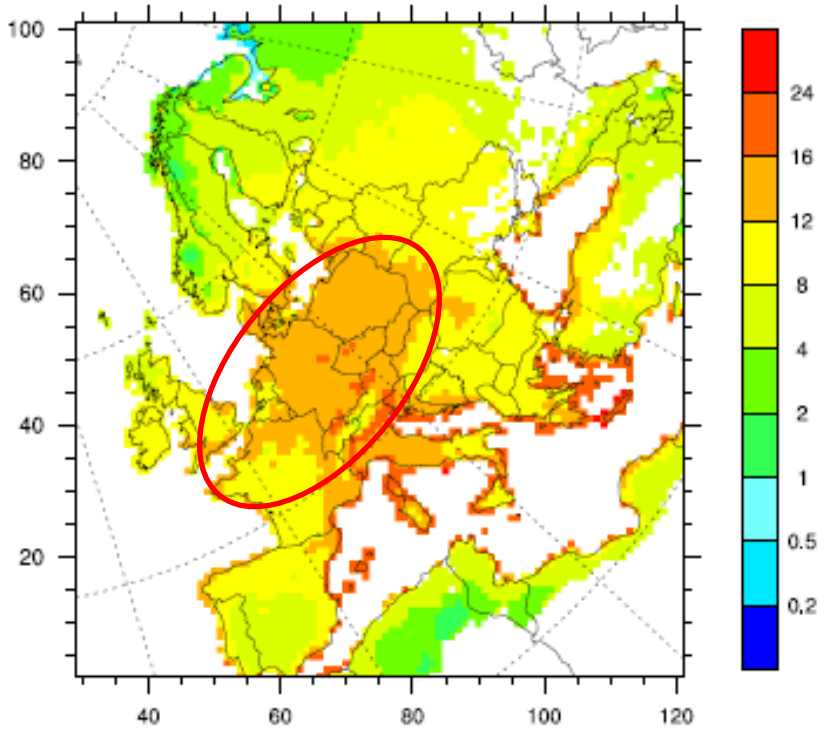
Global wheat production: -15% (2000) .. -25% (2030)
~10% reduction of carbon sequestration

Ozone damage indicators

AOT40



POD_6

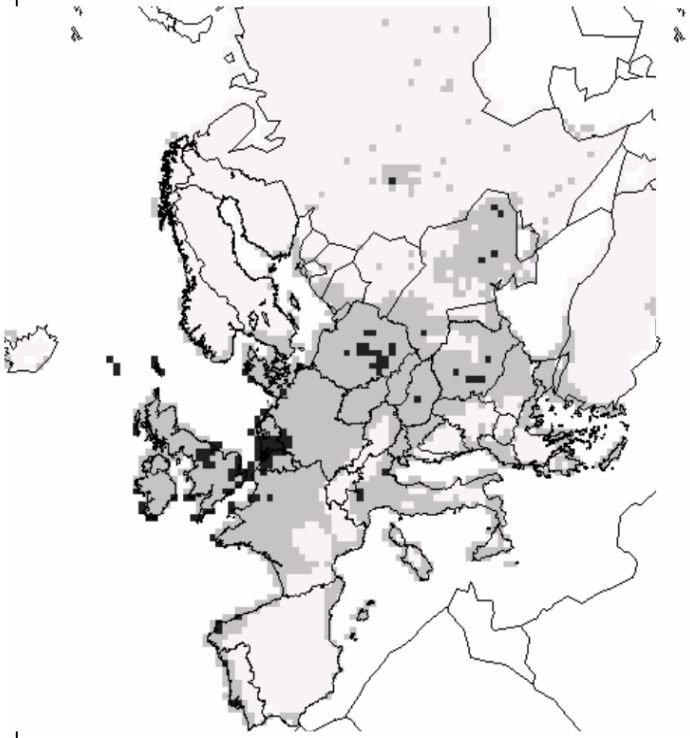


Source: Simpson et al., Env. Poll. (2007)

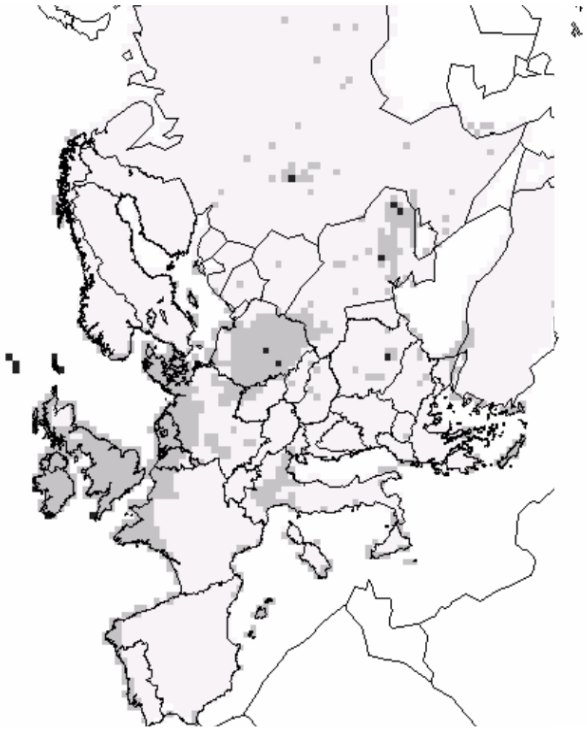
ICP Materials:

Effects on materials will decrease but not disappear by 2020

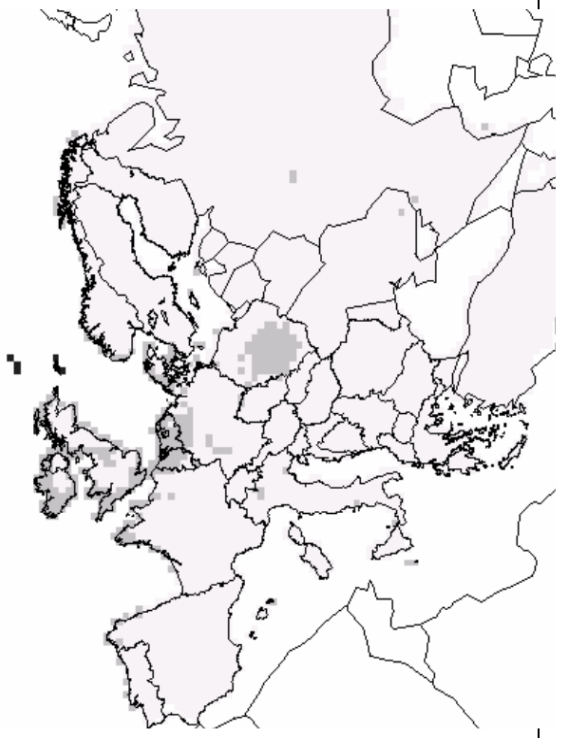
NAT2000



NAT2020



MFR2020



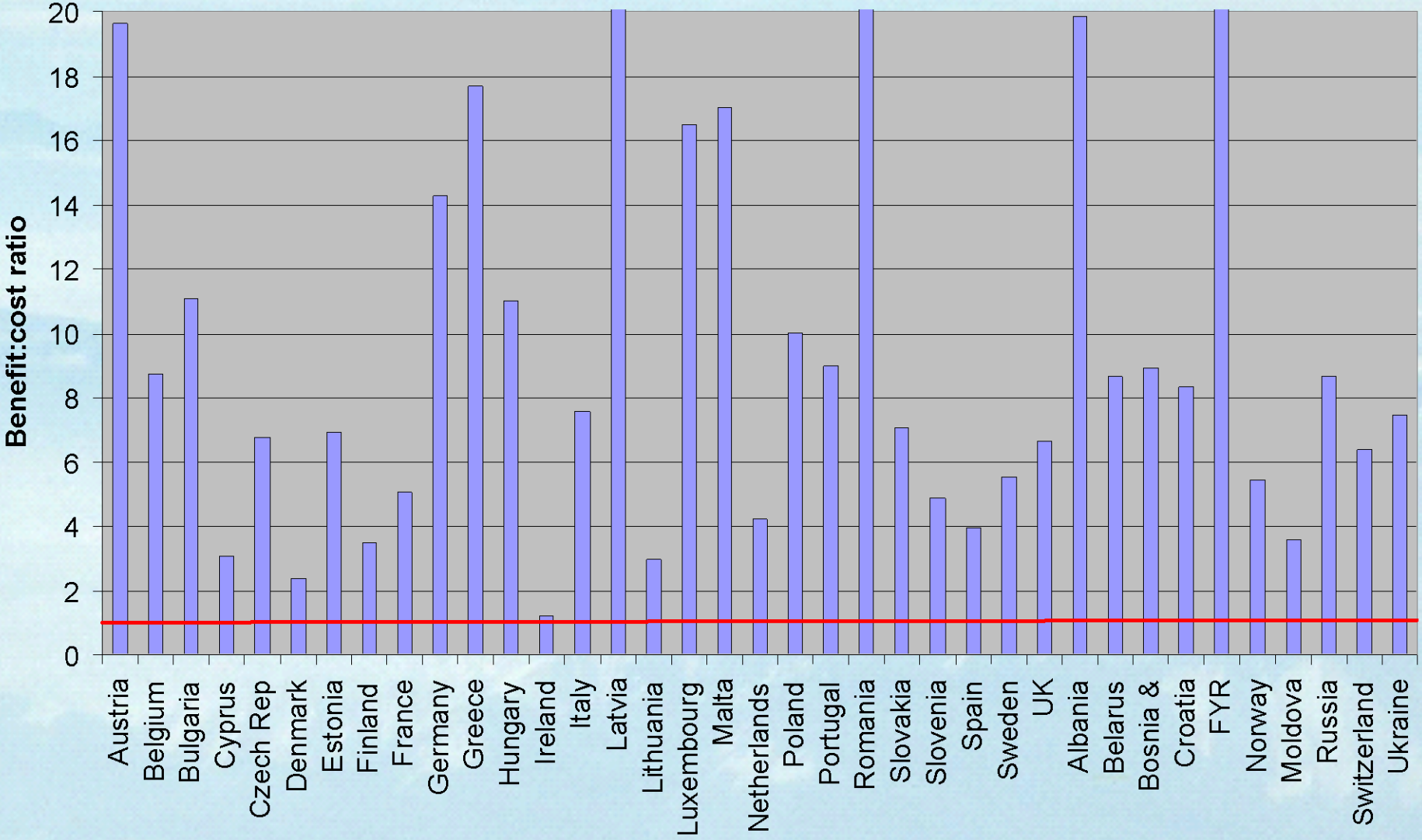
More severe effects are expected in urban areas

Costs

Table 3.6: Costs of SO_2 reductions for the Reference (REF), Protocol, revised G5/2 and hypothetical maximum technically feasible reductions (MFR_{ult}) scenarios (in million EURO/year).

	REF	Protocol		G5/2rev		MFR_{ult}
		Above REF	Total	Above REF	Total	Total
Austria	191	1	192	5	196	213
Belgium	426	47	472	122	548	631
Denmark	138	17	156	13	151	276
Finland	247	0	247	0	247	399
France	1276	17	1293	132	1408	1653
Germany	3264	16	3280	240	3504	3761
Greece	434	0	434	0	434	826
Ireland	132	9	142	12	144	192
Italy	1776	17	1793	87	1863	2122
Luxembourg	13	0	13	0	13	16
Netherlands	340	19	359	19	359	360
Portugal	181	0†	181	0	181	290
Spain	809	0	809	9	818	1275
Sweden	316	0	316	0	316	434
UK	1269	142	1411	295	1564	2674
EU-15	10813	285	11098	935	11748	15122

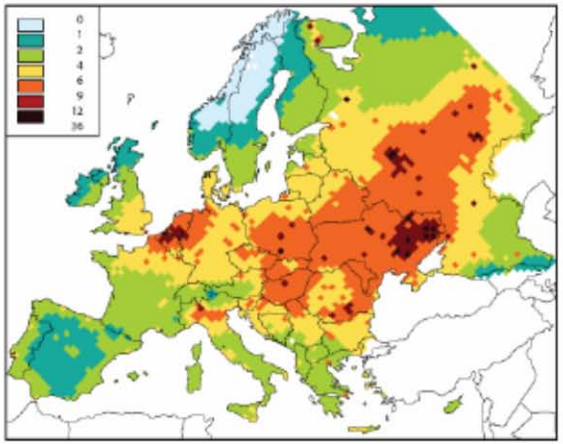
Benefit cost ratios for HIGH*



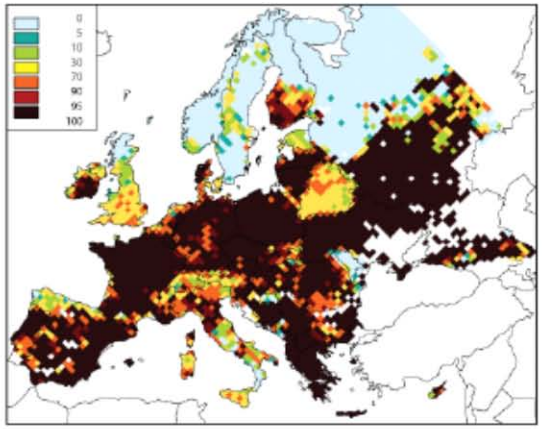
Conservative assumptions: VOLY median valuation, UNECE adjusted valuation, quasi-marginal calculation of costs and benefits, only health impacts included. Red line shows BCR=1, above which net benefit recorded.

Remaining air quality problems in 2020

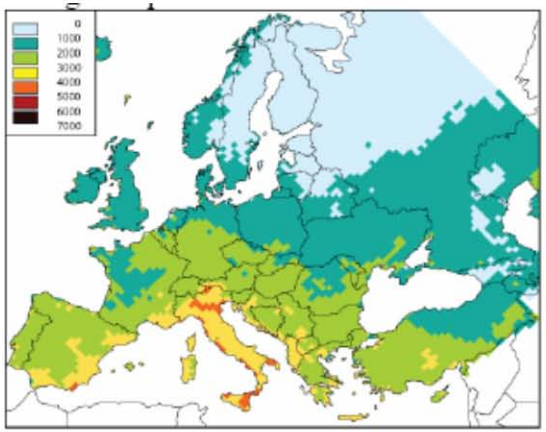
National projections + no CLE enforcement in EECCA countries



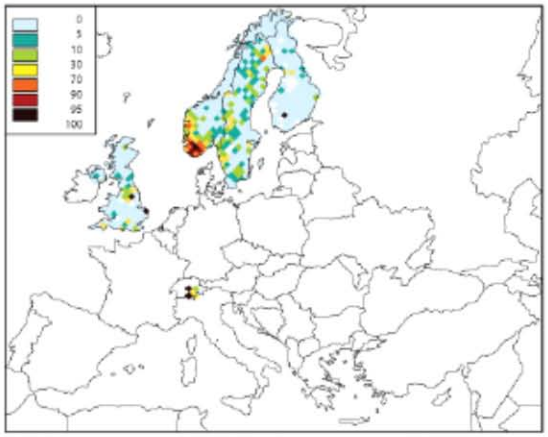
Health - Particulate Matter



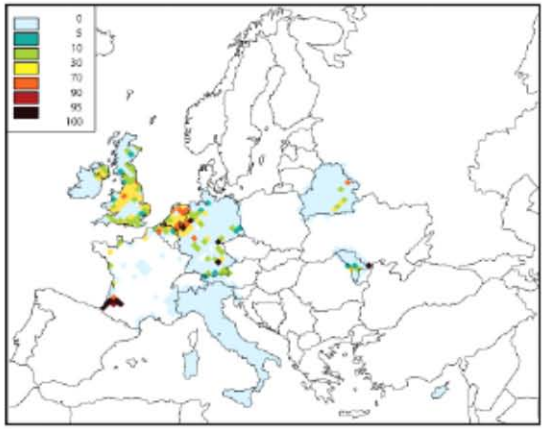
Vegetation - N deposition



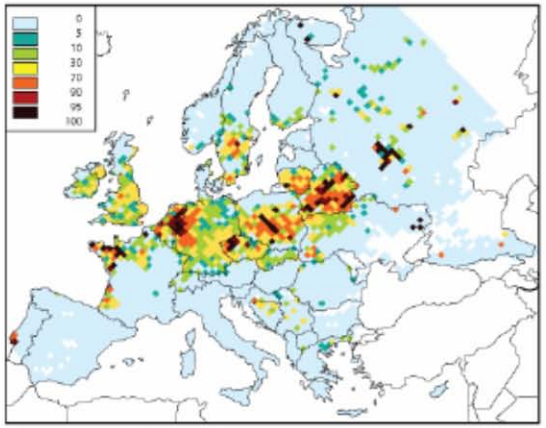
Health and vegetation - ozone



Freshwater ecosystems - Acid deposition



Semi-natural ecosystems - Acid deposition



Forests - Acid deposition

The Nitrogen Challenge

	MFR 2050 with 80% reduction of CO_2 emissions	No damage to health & ecosystems
SO_2	80 %	50 %
PM / Black carbon	80 %	50 %
NO_x	*50 %*	80 %
NH_3	*30 %*	80 %

Indicative emission reduction percentages (+/- 10%) based on TFIAM/ACCENT-workshop 5-6 March 2009

Aspiration: meeting CL's 2050 via equal emission densities

	S	reduction 0.4		NOx-N	reduction 0.5		NH3-N	reduction 1
BG	4.41	91%	LU	3.259	85%	NL	3.23	69%
BA	4.012	90%	NL	2.607	81%	BE	2.146	53%
MD	1.727	77%	BE	2.32	78%	LU	1.901	47%
PL	1.682	76%	GB	1.35	63%	DK	1.617	38%
BE	1.617	75%	DK	1.078	54%	IE	1.531	35%
MK	1.615	75%	IT	1.016	51%	DE	1.446	31%
HU	1.43	72%	DE	1.013	51%	CH	1.245	20%
RO	1.408	72%	PT	0.732	32%	IT	1.15	13%
CS	1.359	71%	CZ	0.725	31%	FR	1.104	9%
TR	1.095	63%	CY	0.682	27%	MD	1.089	8%
UA	0.961	58%	GR	0.618	19%	GB	1.086	8%
CY	0.915	56%	FR	0.606	17%	RO	0.987	0%
BY	0.845	53%	UA	0.605	17%	BG	0.917	0%
NL	0.816	51%	PL	0.602	17%	PL	0.868	0%
CZ	0.767	48%	ES	0.593	16%	UA	0.855	0%
GB	0.748	47%	SI	0.59	15%	SI	0.807	0%
GR	0.641	38%	AT	0.582	14%	AL	0.739	0%
DE	0.633	37%	MD	0.581	14%	HU	0.732	0%
IT	0.623	36%	CH	0.524	5%	CZ	0.716	0%
HR	0.615	35%	HR	0.509	2%	LT	0.7	0%
PT	0.578	31%						
SK	0.55	27%						
SI	0.547	27%						
LU	0.535	25%						
AL	0.517	23%	IE	0.435	0%	CY	0.554	0%
EE	0.457	12%	BG	0.402	0%	AT	0.553	0%
ES	0.418	4%	BY	0.399	0%	SK	0.54	0%

Equal emission densities will reduce emissions more in areas where pollution is high:
e.g. areas with high densities of cattle and traffic