



New contributions to the GP review: impacts of future scenarios

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** Financial support provided by Defra (UK) and UNECE*

Methods



- POD_3 IAM and AOT40 for wheat
- POD_1 IAM for deciduous forest

Met data	Emissions	Scenario
2005	2005	Baseline
2015	2015	Baseline
2015	2030	Baseline
2015	2030	MFR
2015	2050	Baseline
2015	2050	MFR
2015	2050	LOW

- Used spatial wheat production data (SPAM), for the year 2010 (converted to 2015 using FAO data).
- Used global land cover data for 2015 (ESA CCI), to calculate how much deciduous forest per EMEP grid square.

Results

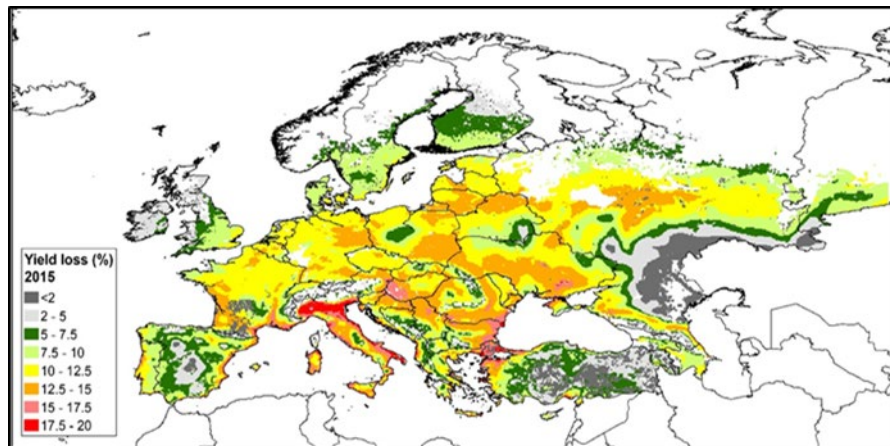


POD₃IAM, wheat

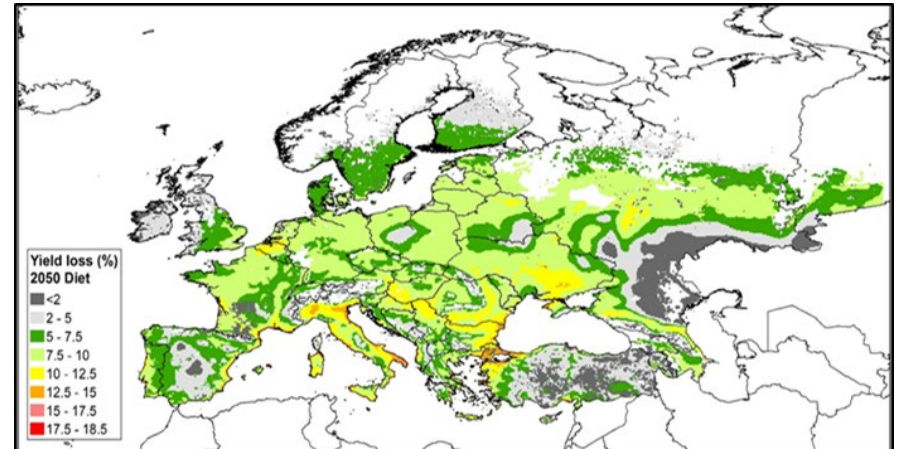
Calculations of production loss used equations from Chpt. 3 of the Mapping Manual, and followed methods used by Mills et al. 2018.

The percentage yield loss varies across Europe, with the highest losses generally in Italy and parts of central-southern Europe (e.g. Hungary), and negligible losses in northern areas of the UK, Ireland, central Spain and central Finland.

Estimated yield losses decrease with time and also with emissions scenario.



2015 Baseline



2050 LOW scenario

Results



POD₃IAM wheat, % Yield loss (average per country)

Country	2015	2030	2030 MFR	2050	2050 LOW
Russian Fed.	7.95	7.60	7.09	7.40	5.95
France	10.27	8.81	8.35	8.19	7.19
Ukraine	11.49	10.63	9.93	10.30	8.50
Germany	11.65	10.03	9.56	9.06	8.12
Turkey	4.95	4.67	4.40	4.65	3.83
UK	6.11	5.84	5.58	5.53	4.91
Poland	11.56	9.82	9.26	8.81	7.83
Romania	12.12	10.86	10.14	10.19	8.81
Italy	14.49	12.37	11.80	11.54	9.98
Spain	7.14	6.37	6.10	6.07	5.39
Hungary	13.09	11.18	10.49	10.23	8.94
Czech Rep.	11.33	9.40	8.84	8.38	7.47
Bulgaria	12.20	11.12	10.34	10.41	8.86
Denmark	8.79	7.90	7.57	7.22	6.52
Lithuania	12.43	10.99	10.44	10.03	8.93
Sweden	7.56	6.70	6.44	6.17	5.60
Serbia	11.63	10.33	9.65	9.63	8.27
Belarus	10.32	9.21	8.66	8.64	7.32
Slovakia	11.02	9.25	8.64	8.34	7.24
Azerbaijan	8.86	8.88	8.61	9.09	7.21
Latvia	11.30	10.03	9.58	9.15	8.22
Belgium	11.30	10.76	10.36	10.20	9.21
Austria	10.83	8.78	8.29	7.90	7.00
Greece	10.66	9.59	9.00	9.14	7.67

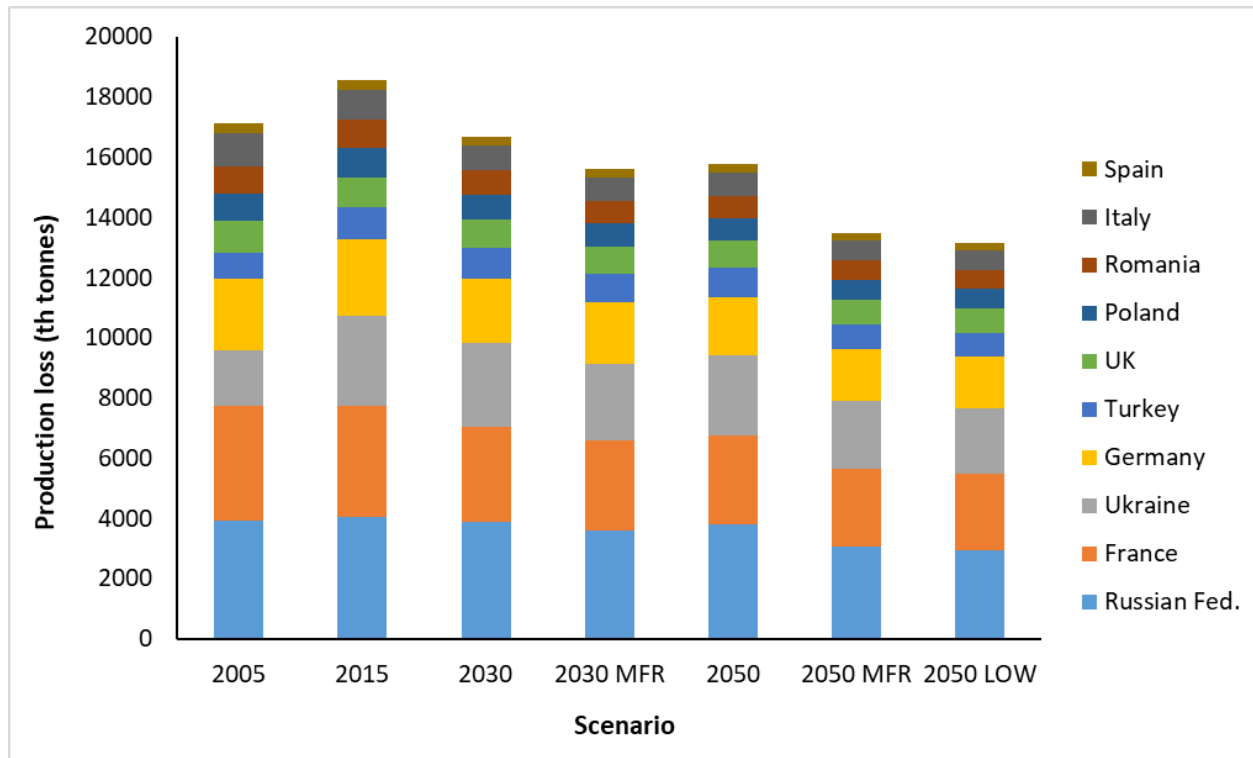
Country	2015	2030	2030 MFR	2050	2050 LOW
Finland	6.26	5.51	5.29	5.08	4.57
Netherlands	10.54	10.35	10.03	9.85	8.97
Moldova	11.41	10.45	9.77	10.03	8.39
Croatia	13.09	11.12	10.48	10.28	8.97
Estonia	10.40	9.21	8.83	8.38	7.54
Ireland	3.09	2.90	2.75	2.82	2.45
Switzerland	8.94	7.52	7.13	6.81	5.86
Armenia	3.64	3.59	3.50	3.73	3.14
Norway	5.52	4.97	4.78	4.66	4.20
Bosnia & Herz.	9.02	7.84	7.34	7.28	6.25
Albania	9.19	8.28	7.75	7.91	6.56
FYR Macedonia	8.50	7.59	7.08	7.12	6.00
Georgia	7.01	6.90	6.70	7.05	5.49
Slovenia	12.41	10.09	9.53	9.02	7.85
Portugal	10.02	9.12	8.75	8.77	7.66
Luxembourg	9.32	8.71	8.25	7.96	6.96
Cyprus	6.26	5.79	5.35	5.76	4.34
Montenegro	5.64	5.02	4.73	4.72	4.06
Malta	0.27	0.24	0.23	0.23	0.20

Results



POD₃IAM, wheat - Production losses due to ozone

Countries with greatest production loss are Russian Fed., France and Ukraine. For the most stringent of the scenarios tests, '2050 LOW', there will still be an estimated total loss of 13 million tonnes of wheat (for top 10 producing countries).



Production loss (thousand tonnes) due to ozone for the **top 10** wheat producing countries using the POD₃IAM metric.

Results

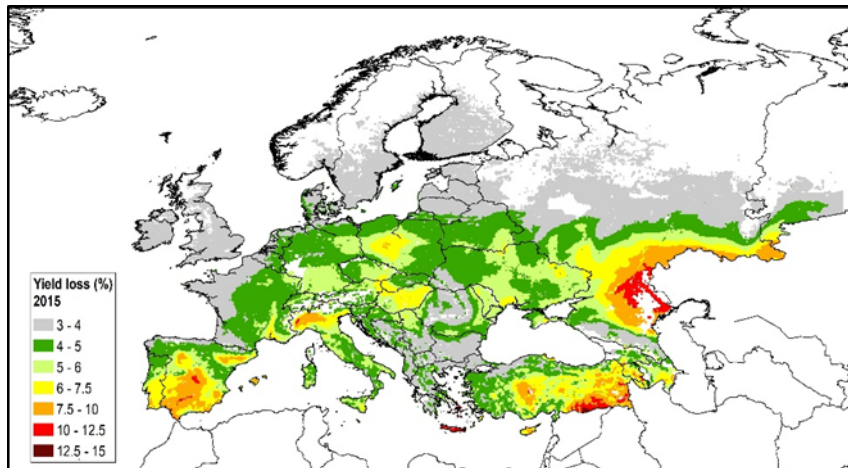


AOT40 - wheat

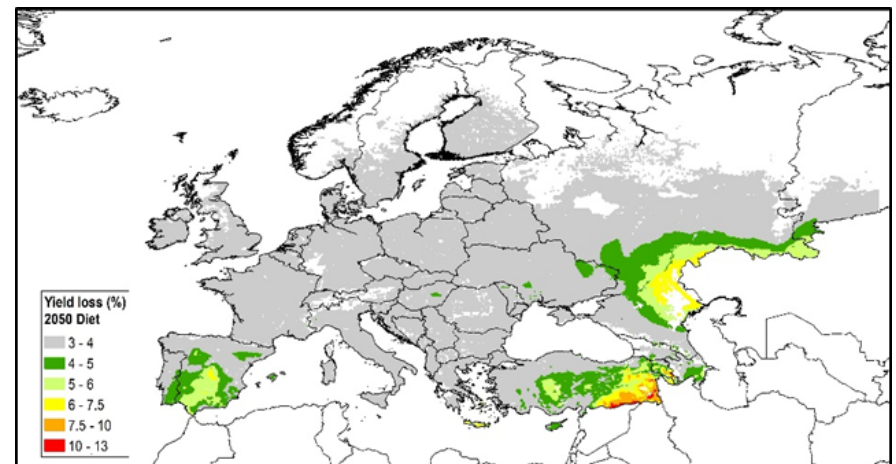
Yield loss equation for AOT40 from Grünhage et al., 2012.

Note: two methods for calculating AOT40 for crops, EU (uses O₃ concentrations at 3m above crop) and MM (uses O₃ at 1m above crop).

The percentage yield losses based on AOT40 tended to be highest in 2005, particularly in Spain, Italy, Turkey and Russian Fed. Estimated yield losses decrease with time and scenario, and for the 2050 'LOW' scenario, large parts of Europe have a % yield loss of 3-4%.



2015 Baseline



2050 LOW scenario

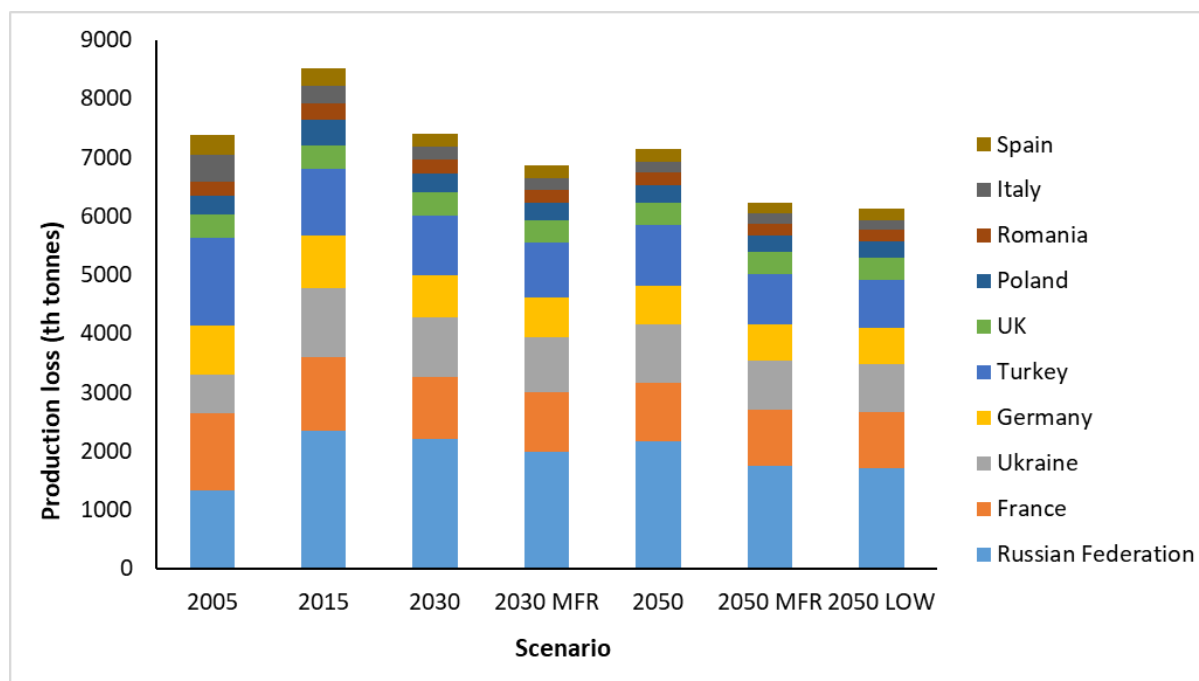
Results



AOT40 - wheat

For '2050 LOW', there is an estimated total loss of 6 million tonnes of wheat (for the top 10 producing countries).

Greater losses in wheat production are seen when using the ozone flux metric (POD₃IAM) compared to the AOT40 metric.



Production loss (thousand tonnes) due to ozone for the **top 10** wheat producing countries using the AOT40 metric.

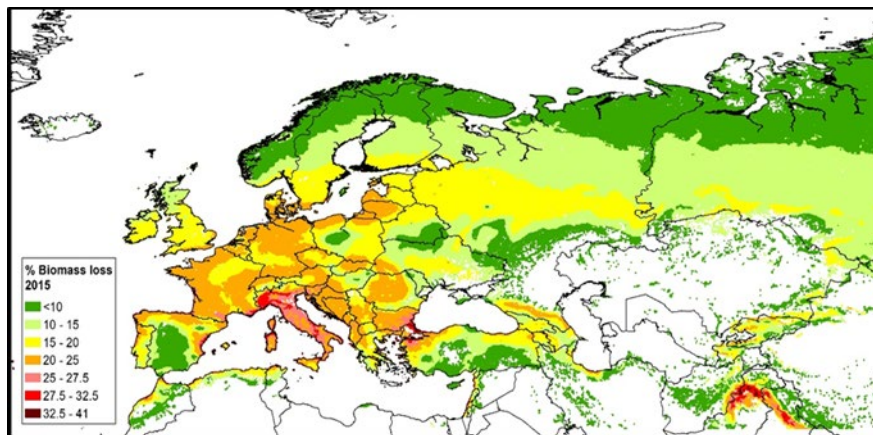
Results



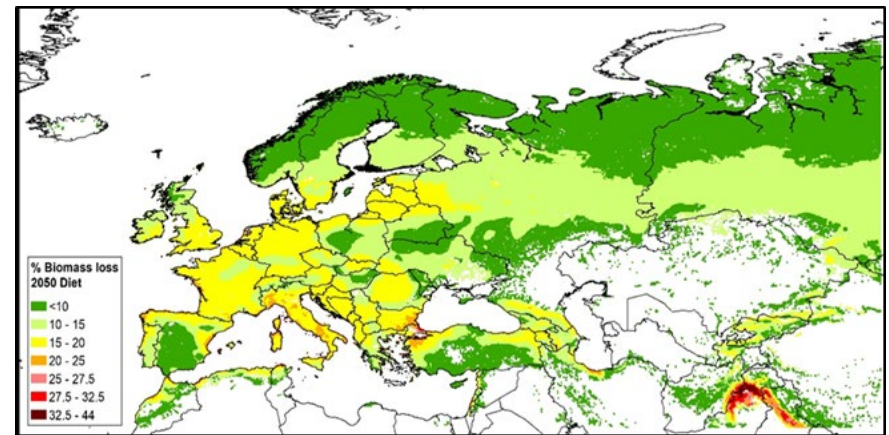
POD₁IAM Deciduous forest

Calculations of **the risk of reduction in annual growth of living biomass** of deciduous trees were made using the equation for deciduous forest POD₁IAM in Chpt. 3 of the Mapping Manual.

The percentage biomass loss due to ozone for deciduous trees varies across Europe. Losses are shown to be highest in Italy and parts of central-southern Europe. Biomass losses are predicted to decrease with time, for example, in 2005 estimated losses of 20-25% are widespread across central mainland Europe, and in 2050 LOW scenario, many areas reduce to 15-20%.



2015 Baseline



2050 LOW scenario

A man with glasses, wearing a light blue long-sleeved shirt, is leaning over a piece of scientific equipment in a greenhouse. The greenhouse has a complex metal frame and is filled with green plants. The background shows another similar greenhouse structure. The overall scene is dimly lit with a blue tint.

Thank you

