

Looking into the future of agriculture (without a crystal ball)

Climate change and global agricultural production

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“NUEVOS RETOS Y HERRAMIENTAS INNOVADORAS EN LA GESTIÓN DE LOS
RIESGOS AGRARIOS”

UIMP, Santander, 28 July 2011

Aknowledgements

- My colleagues: Sonia Quiroga, Luis Garrote, Agustin Diz
- Suport: MARM, Spain; EU 6th and 7th FP (CIRCE, PICCMAT, WassrMed, ClimateCost)

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Looking into the future of agriculture in a changing climate

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Re-thinking water policy priorities in the Mediterranean region in view of climate change

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Regional Assessment on Climate Change in the Mediterranean

Volume 2

2 Water and people: assessing policy priorities for climate change adaptation in the Mediterranean

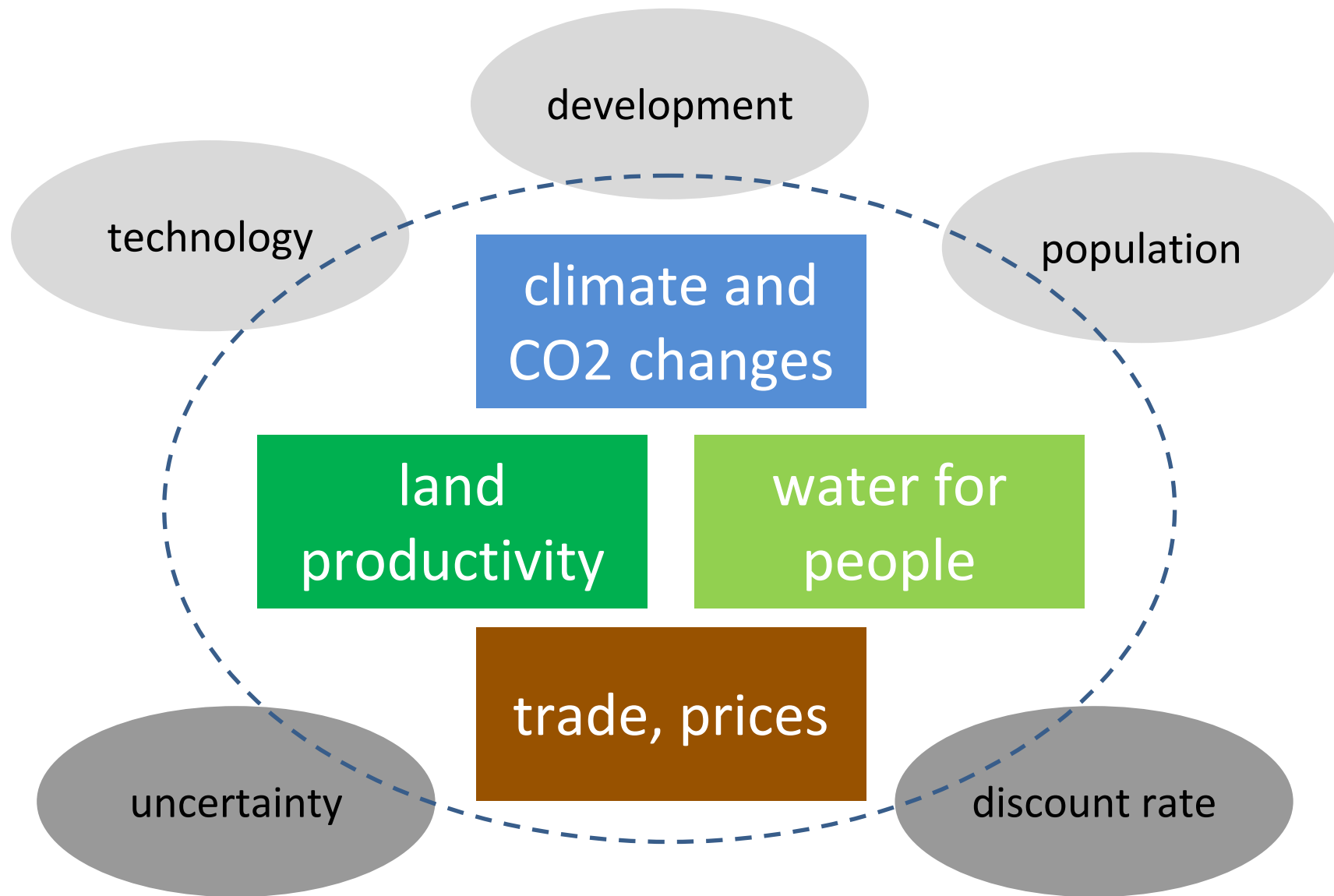
Ana Iglesias¹, Luis Garrote¹, Agustin Diz¹, Jeremy Schlickenrieder¹, Marta Moneo², Sonia Quiroga³

Based on the FP6 EU Funded IP Project

Climate Change and Impact Research: the Mediterranean Environment – CIRCE

Contract no. 036961



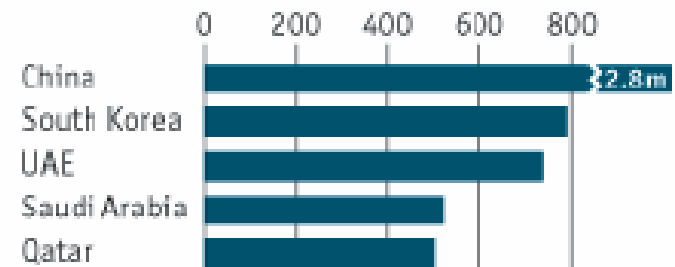


Tuesday June 16th 2009

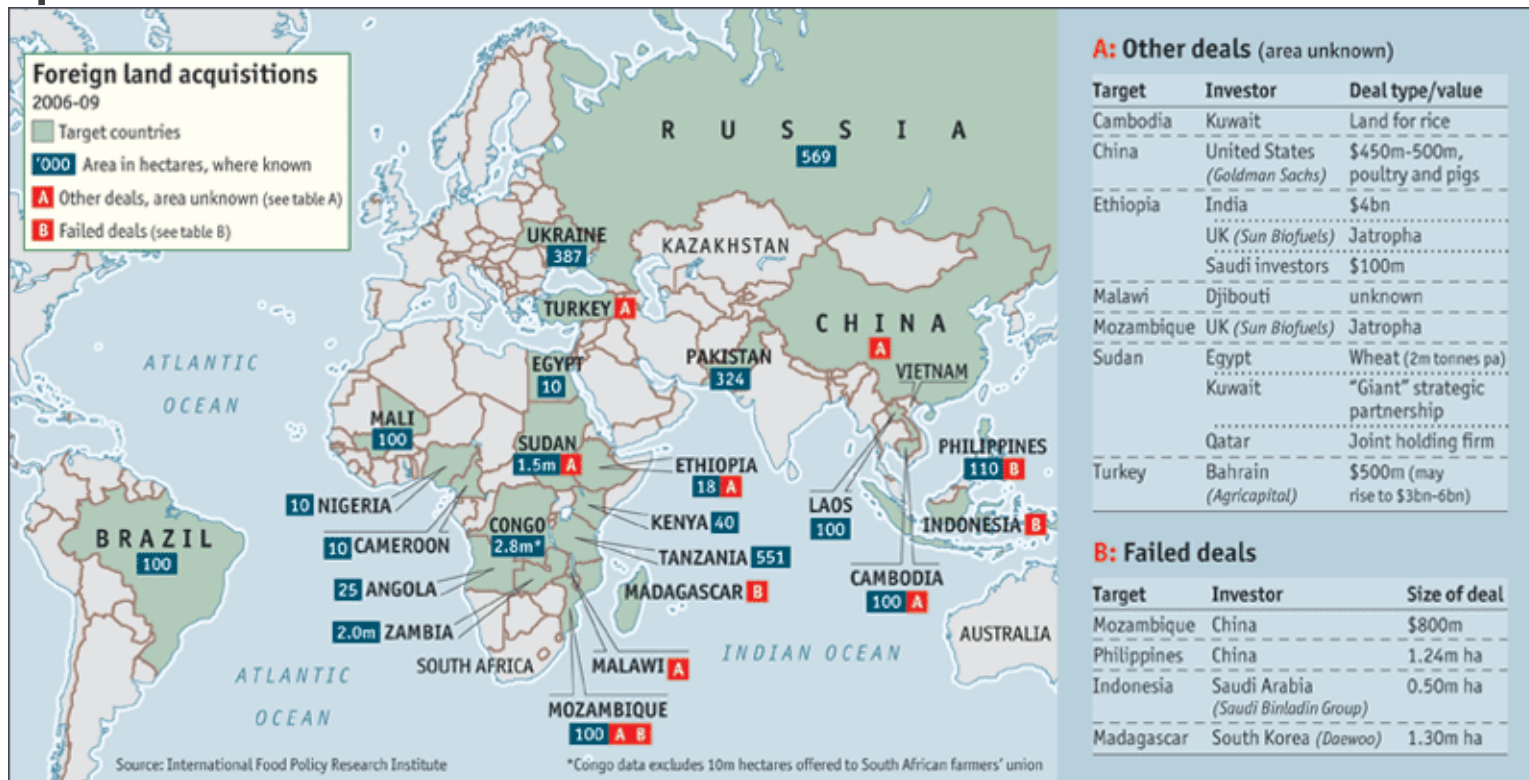
Food importers are buying agricultural land of poor countries

Farms race

Selected investors, hectares obtained, 2006-09, '000



Source: International Food Policy Research Institute



Defining the baseline is difficult

crop models: conceptual framework



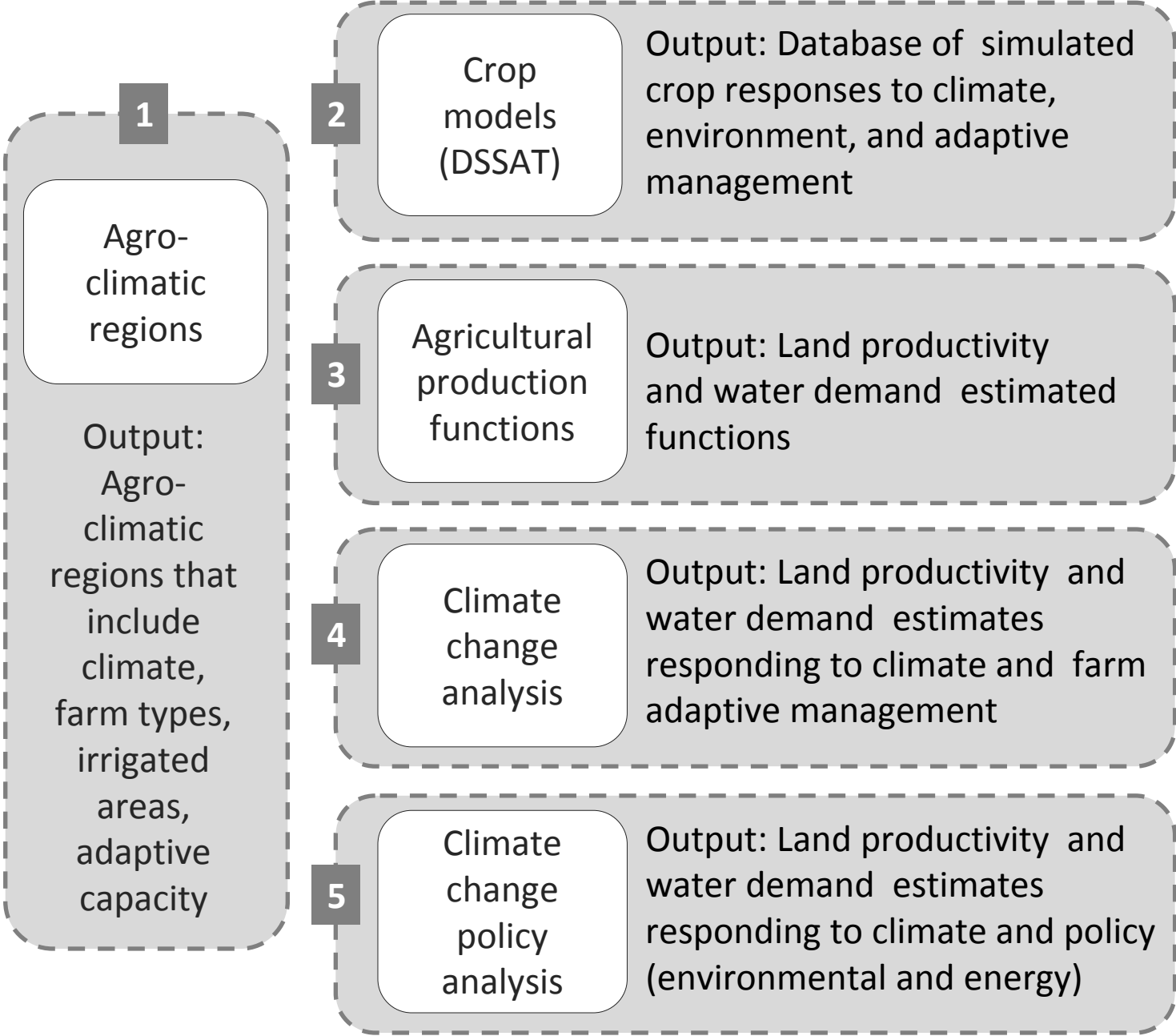
atmosphere

management

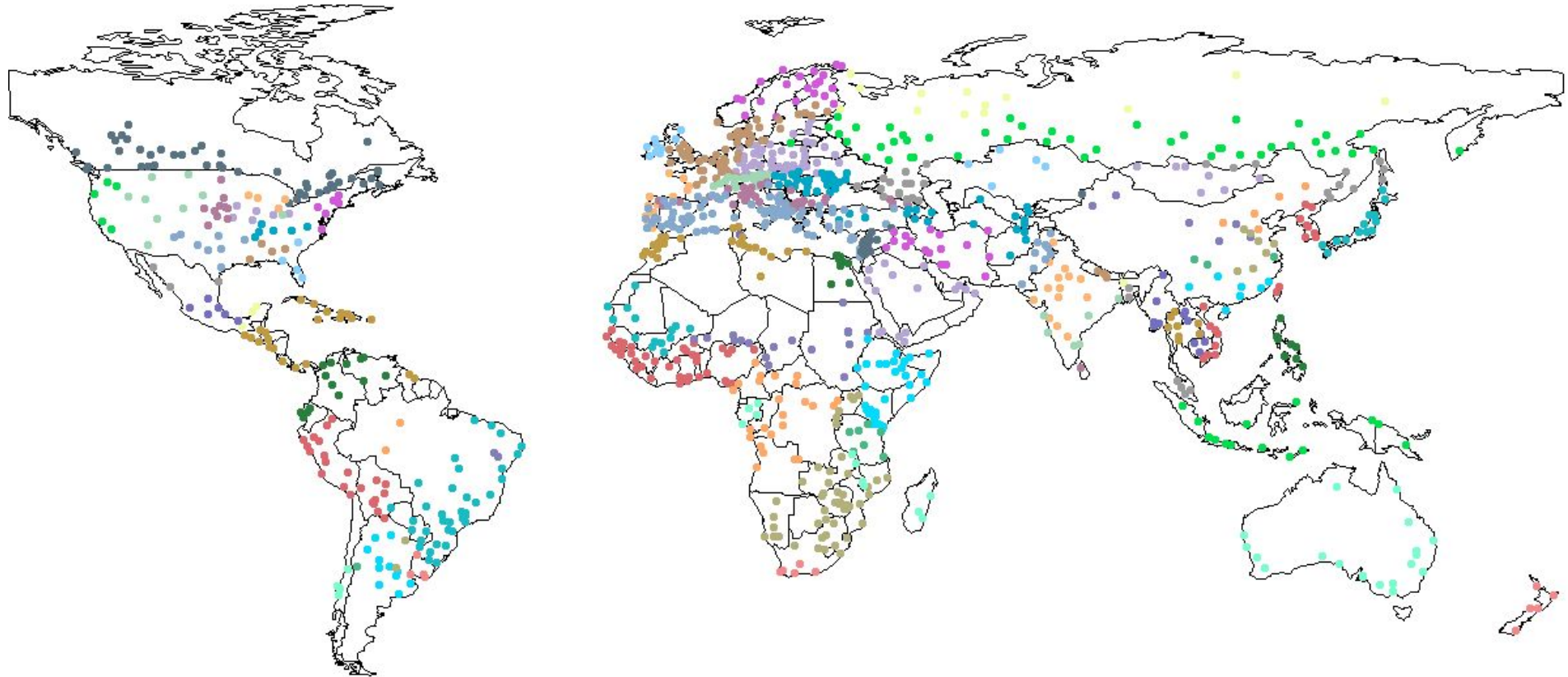
soil

crop

ClimateCrop model



Understanding global uncertainty, land and water

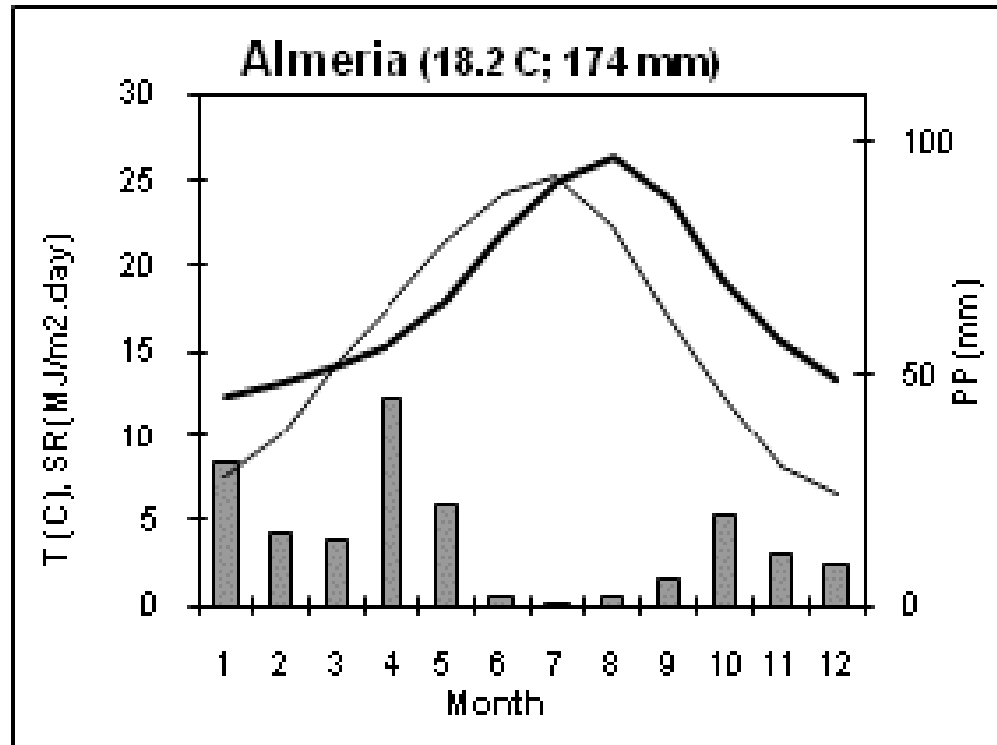


Stations (1141)
and agroclimatic zones (73)

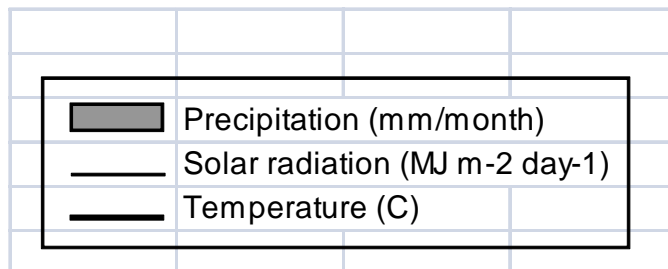
Improvements of the estimates

- 73 agro-climatic regions in the world, 1141 climatic sites for crop simulation, 433 sites in Europe
- Nitrogen and water demand elasticities estimated for the major agro-climatic regions

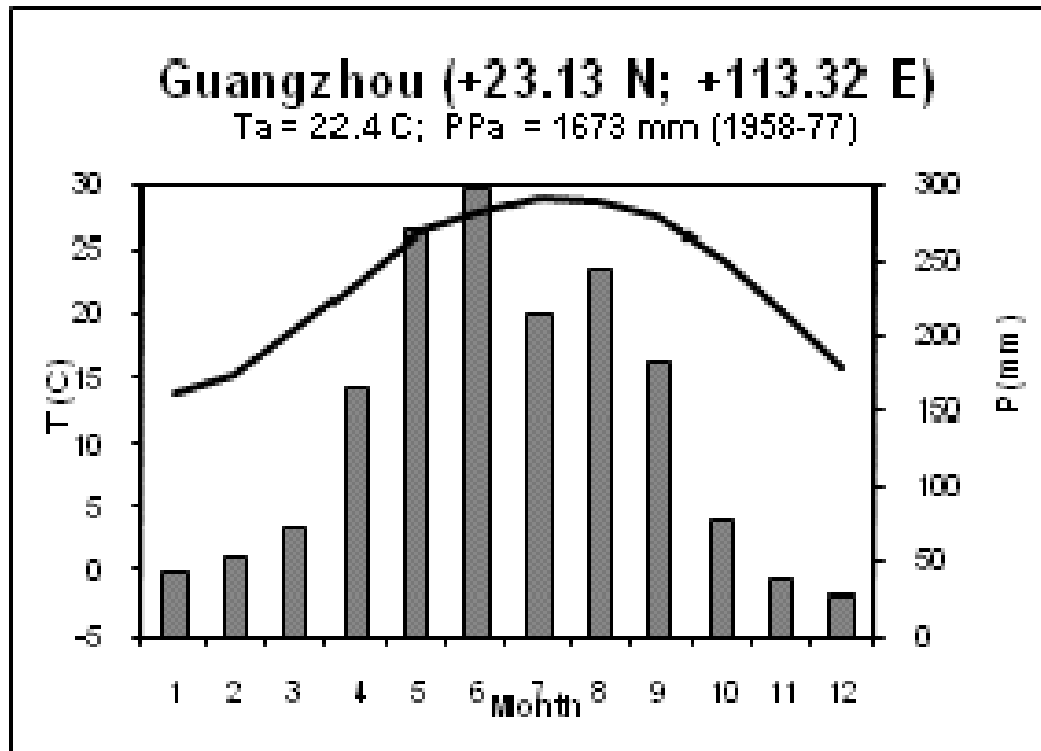
9 agro-climatic regions in Europe



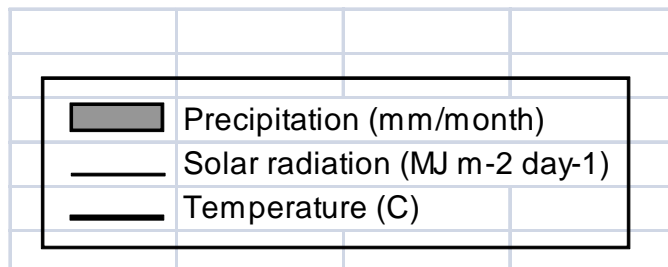
Mediterranean
South



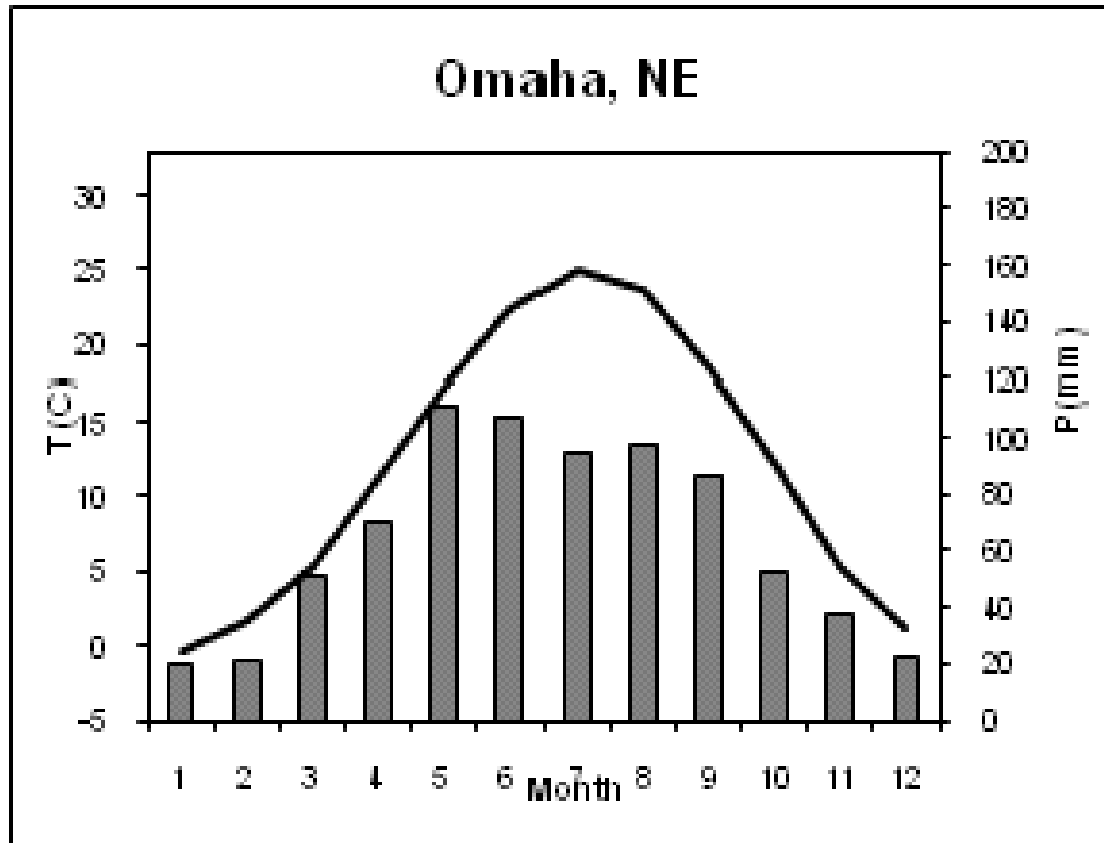
9 climatic regions in China



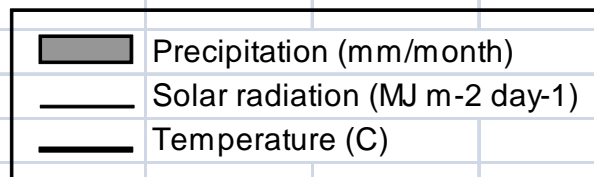
Warm and wet



17 climatic regions in USA



Corn Belt



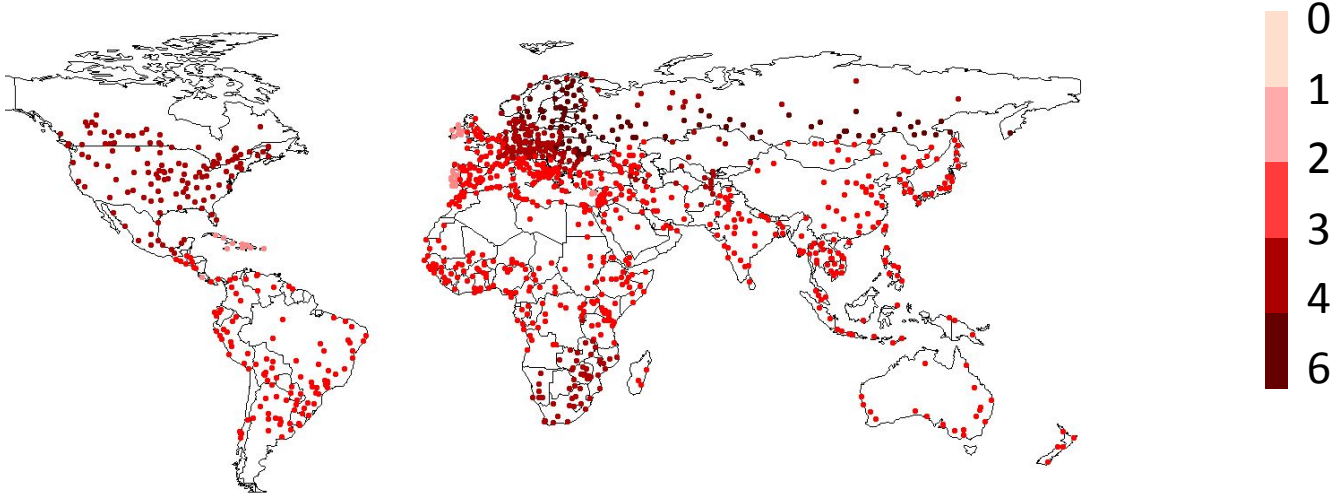
Representative Emmission Pahways (RPC)

- **A1B**
- A balanced emphasis on all energy sources.
- A1B 2080 = 712 ppm CO₂

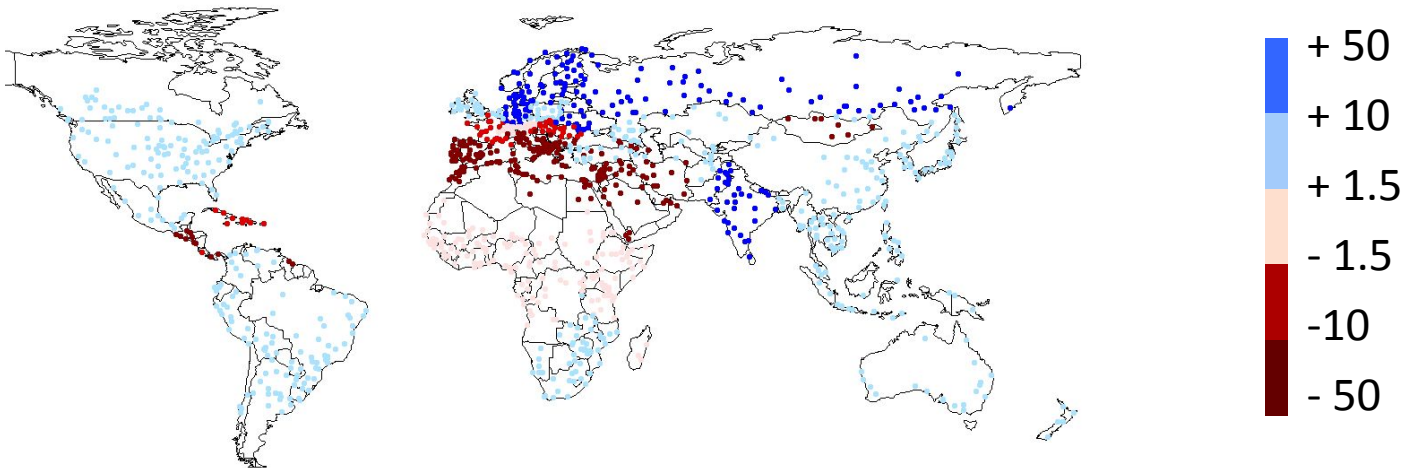
- **E1**
- The so-called global “2 °C-stabilization” scenario is characterized by an atmospheric concentrations of 498 ppmv CO₂ in the 2080s)
- E1 2080 = 498 ppm CO₂

Scenario A1B_1

Temp change (C)

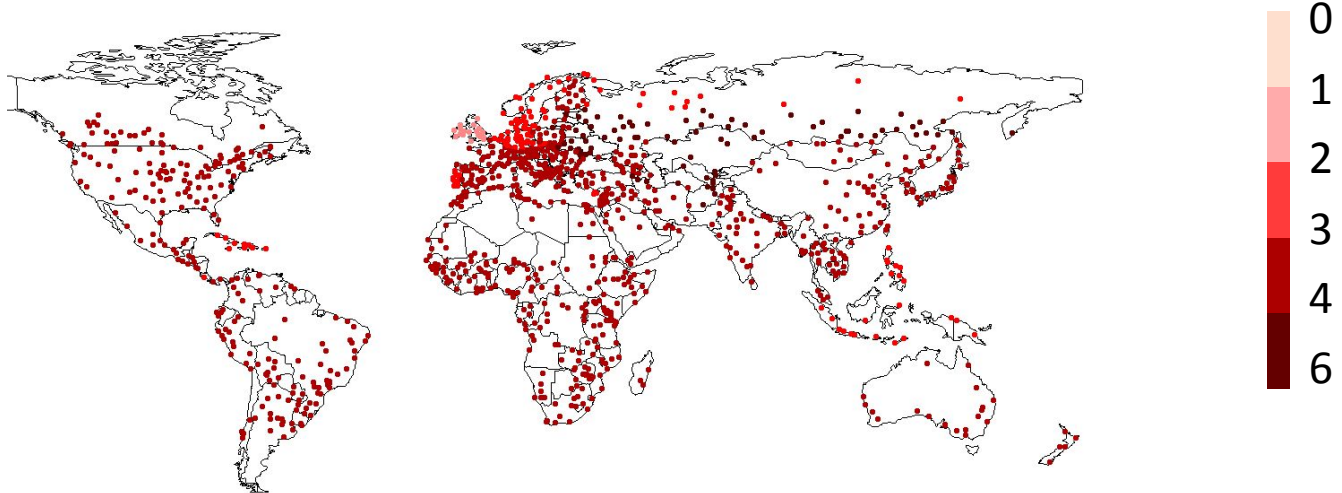


Precip change (%)

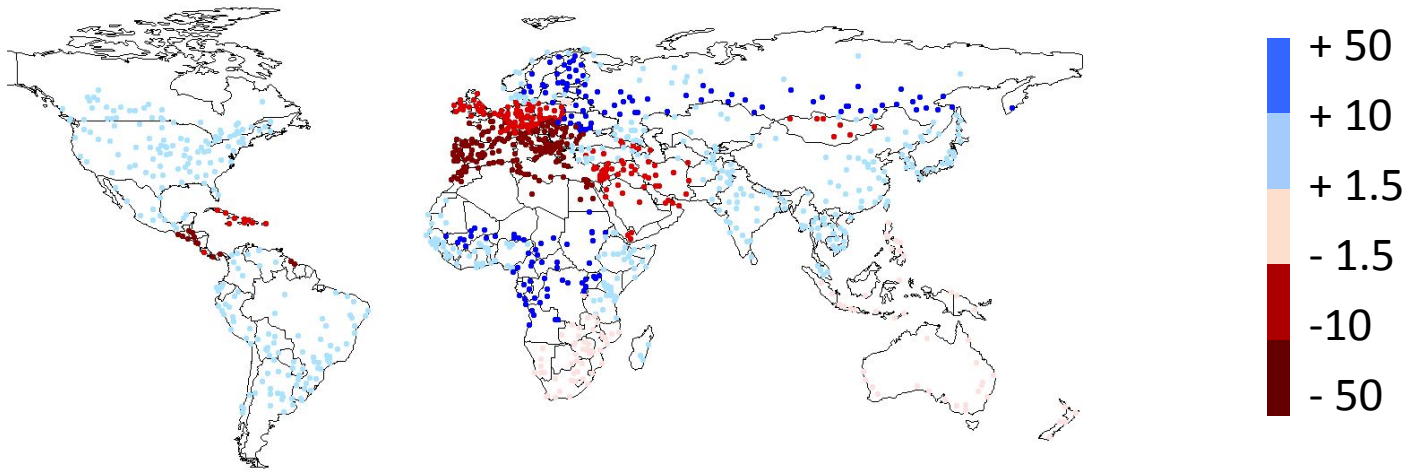


Scenario A1B _2

Temp change (C)

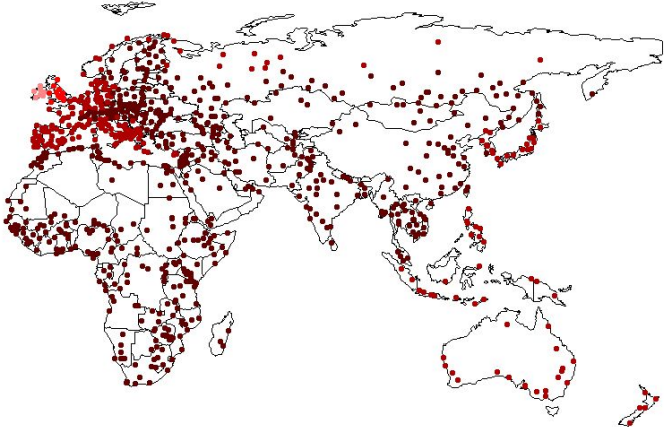


Precip change (%)

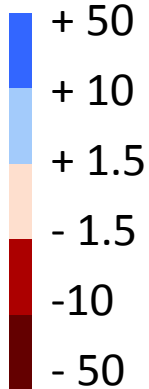
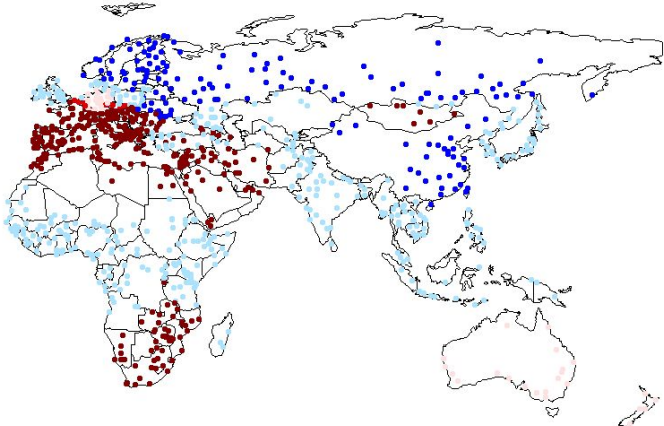
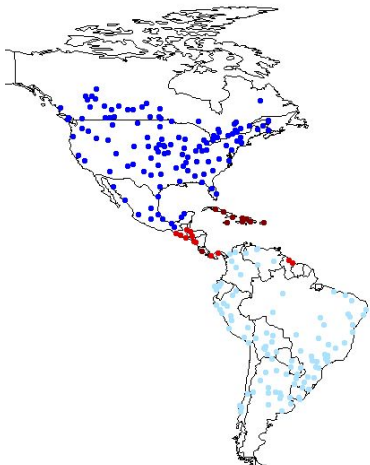


Scenario A1B_3

Temp change (C)

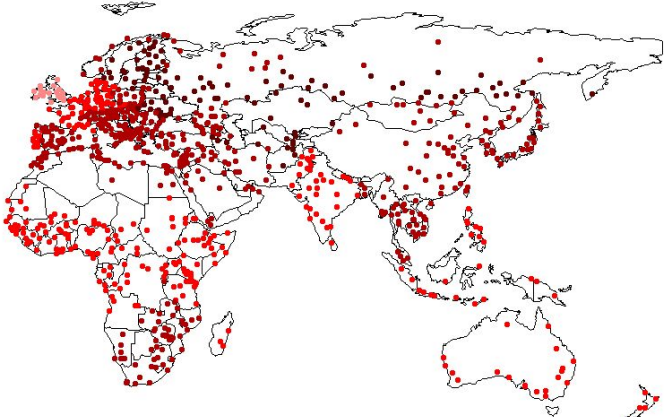


Precip change (%)

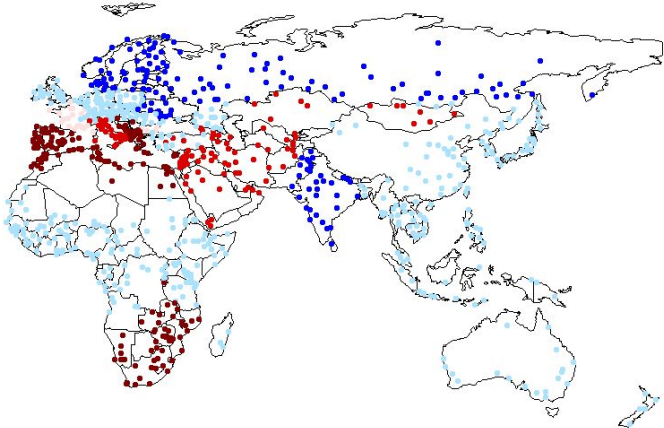
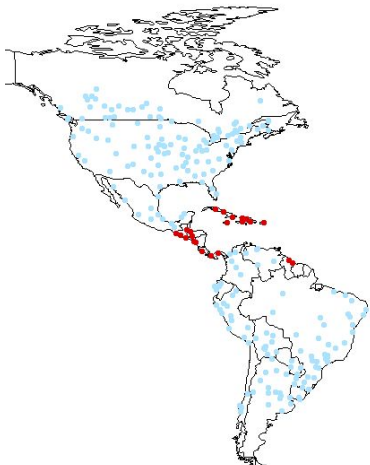


Scenario A1B_4

Temp change (C)

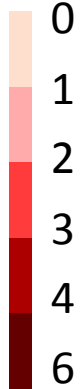
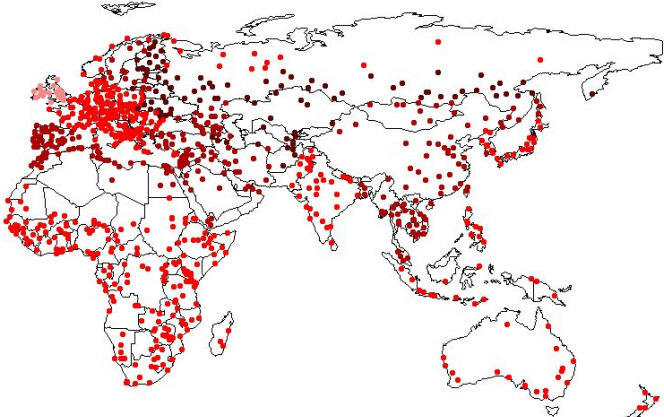
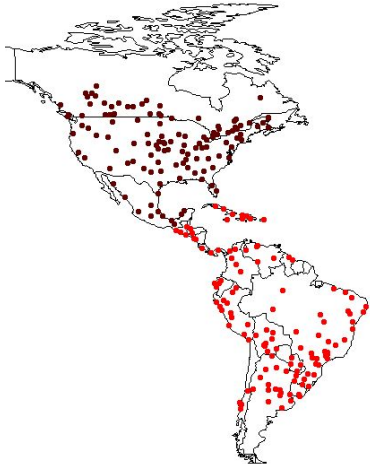


Precip change (%)

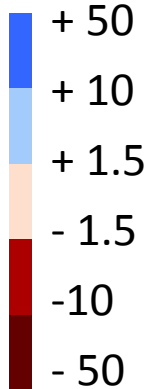
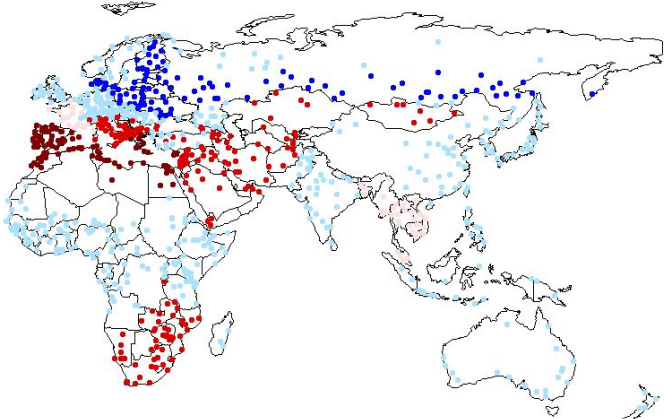
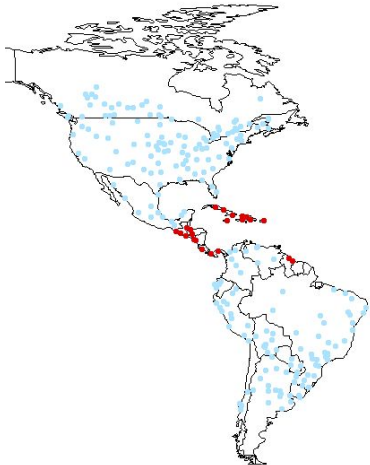


Scenario A1B_5

Temp change (C)

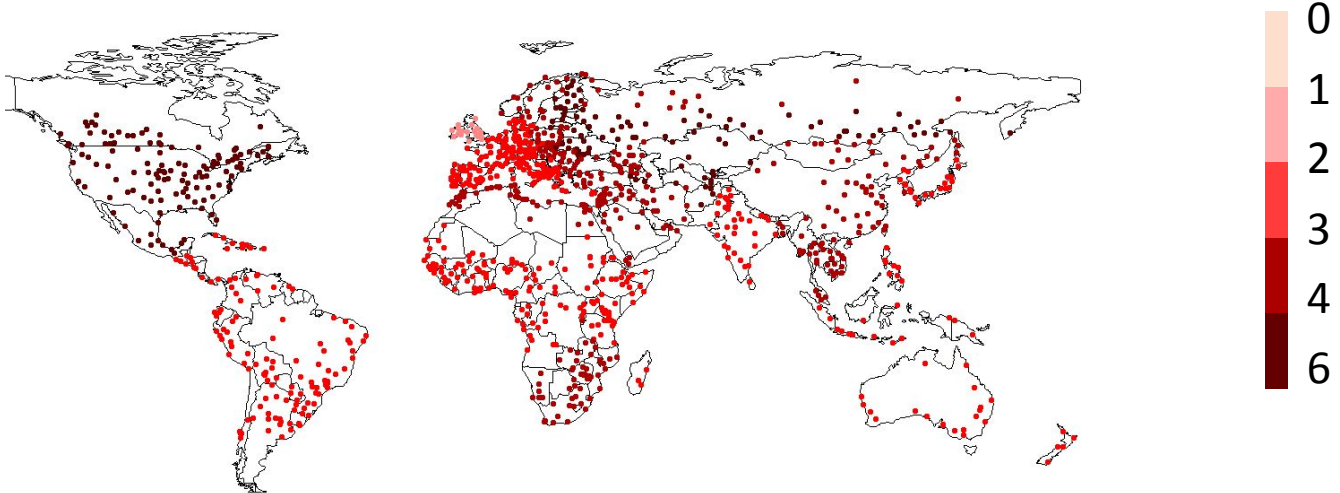


Precip change (%)

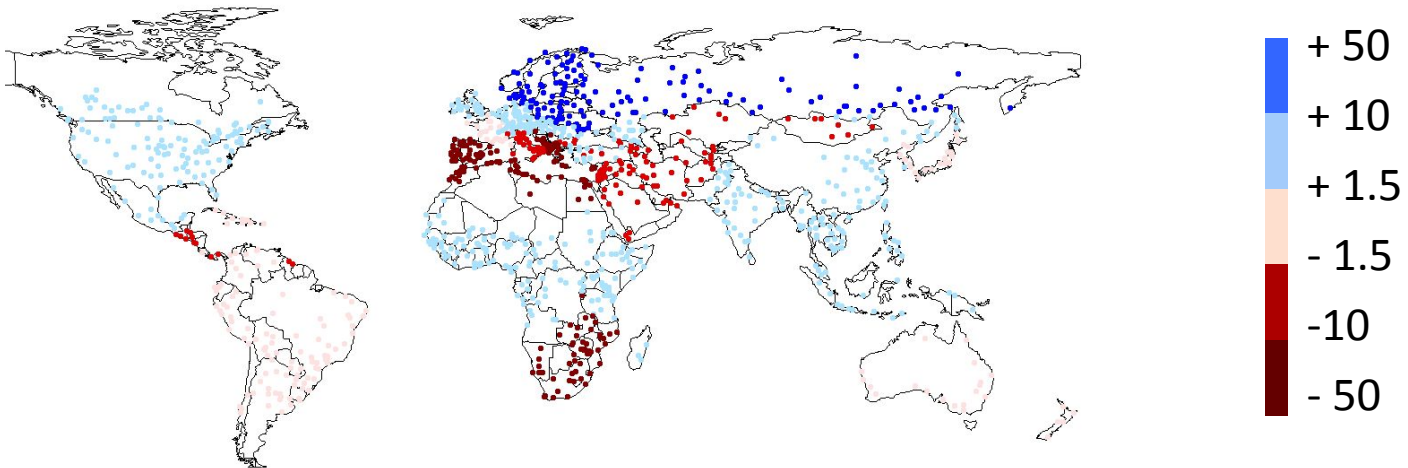


Scenario A1B_6

Temp change (C)

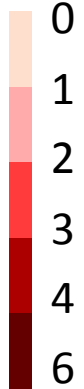
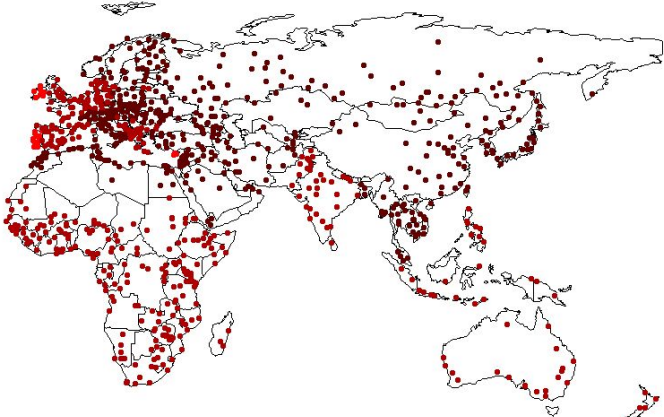
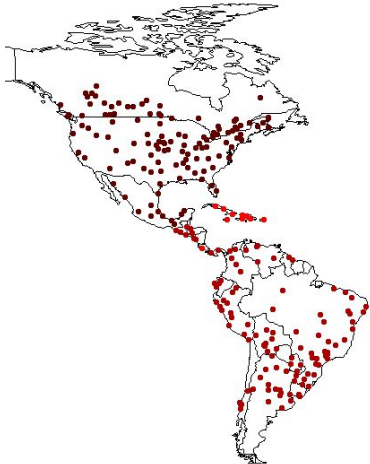


Precip change (%)

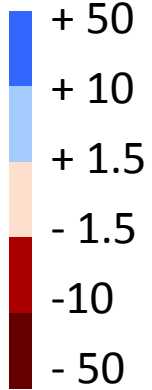
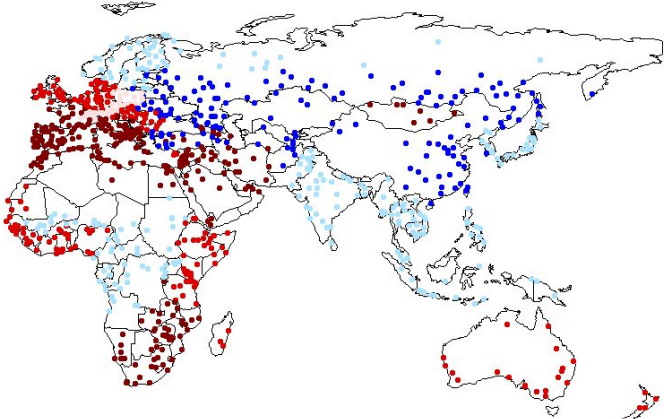
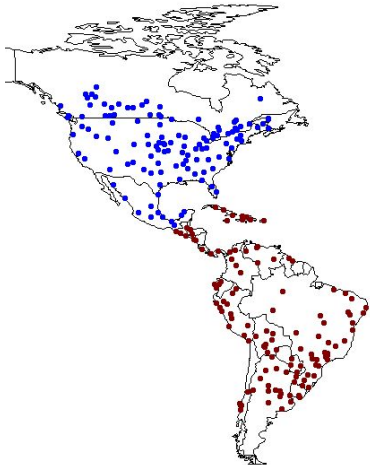


Scenario A1B_7

Temp change (C)

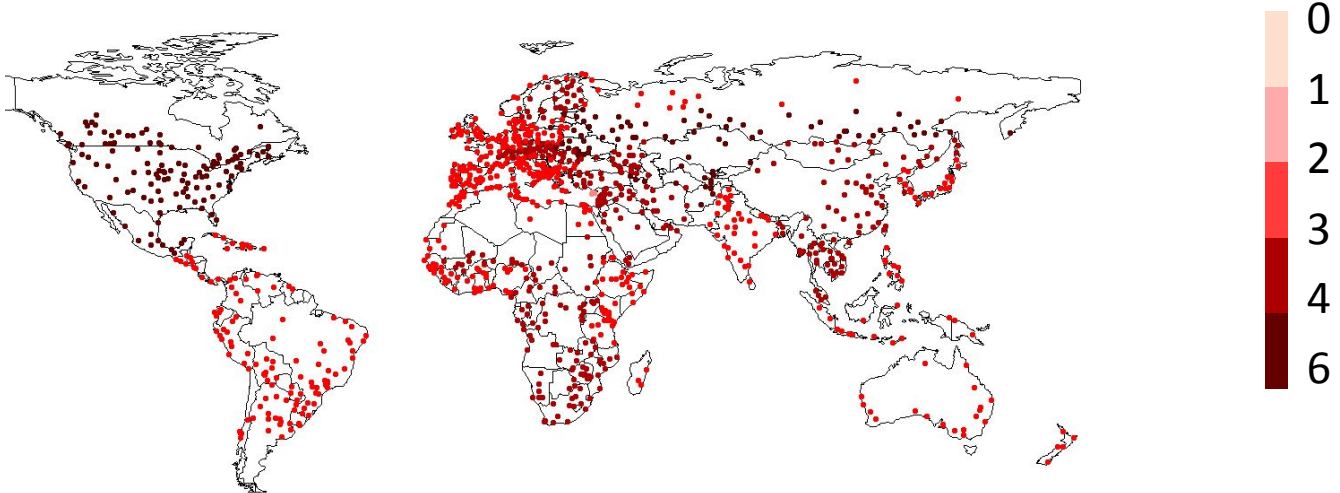


Precip change (%)

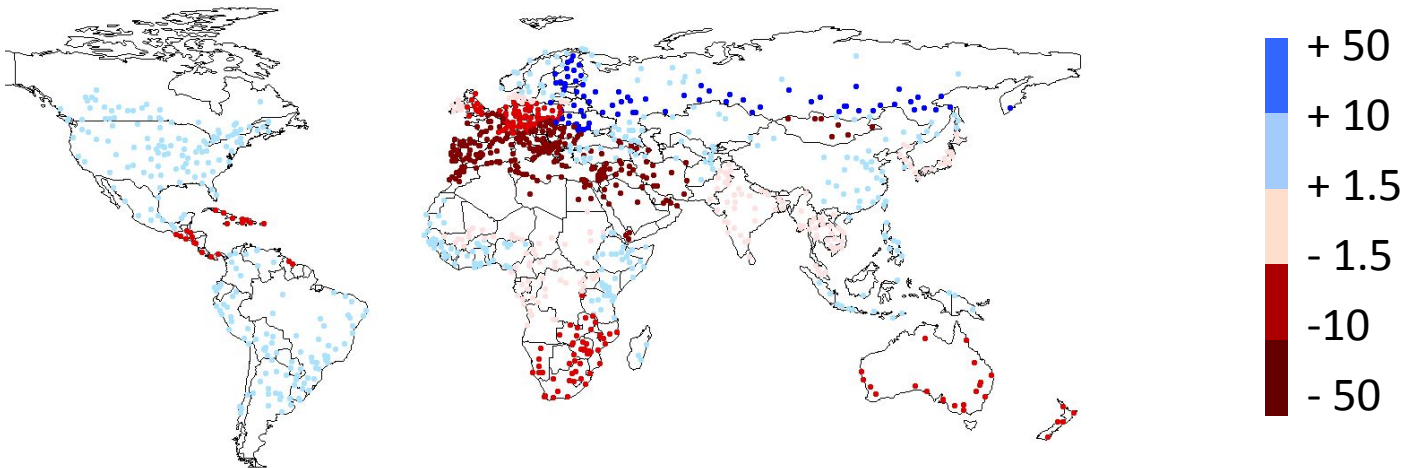


Scenario A1B_8

Temp change (C)

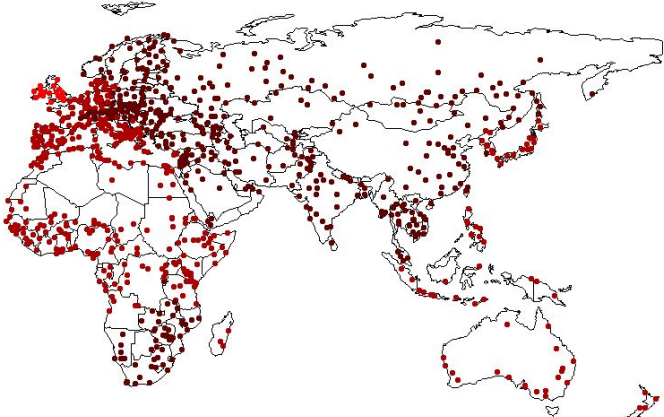


Precip change (%)

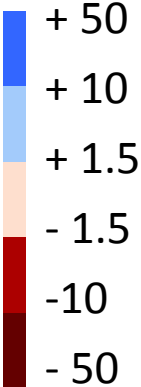
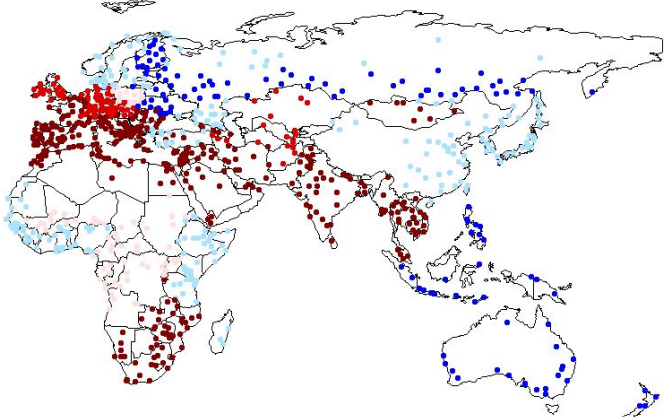
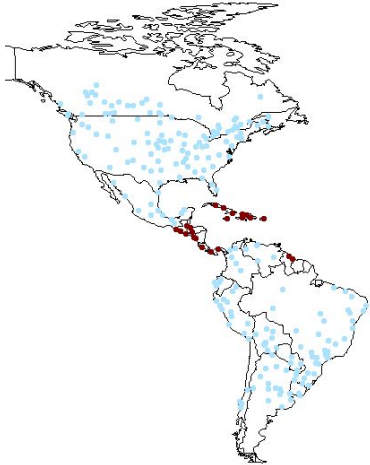


Scenario A1B_9

Temp change (C)

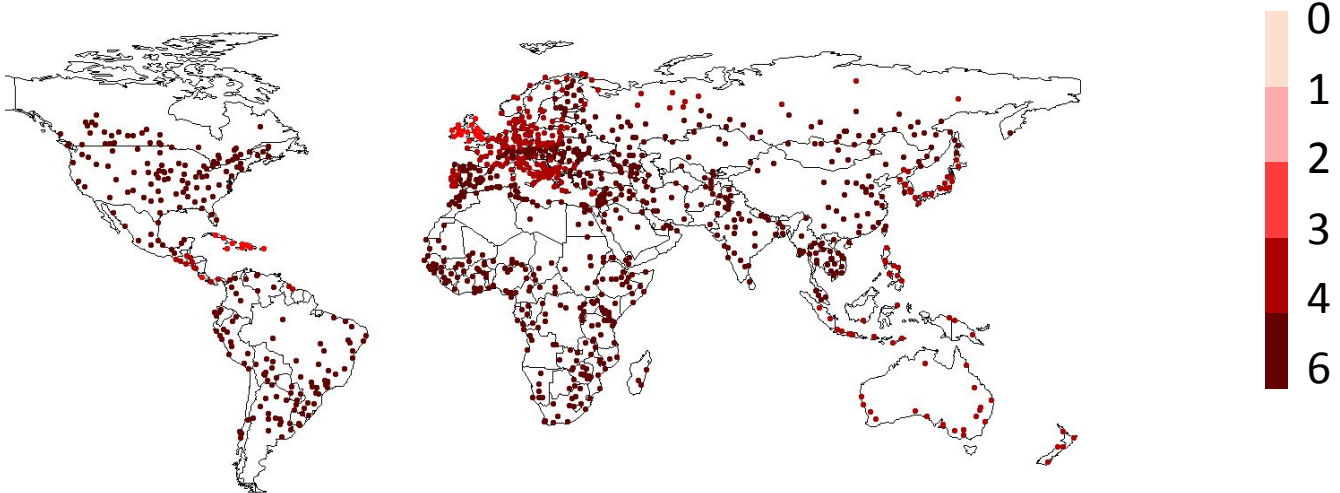


Precip change (%)

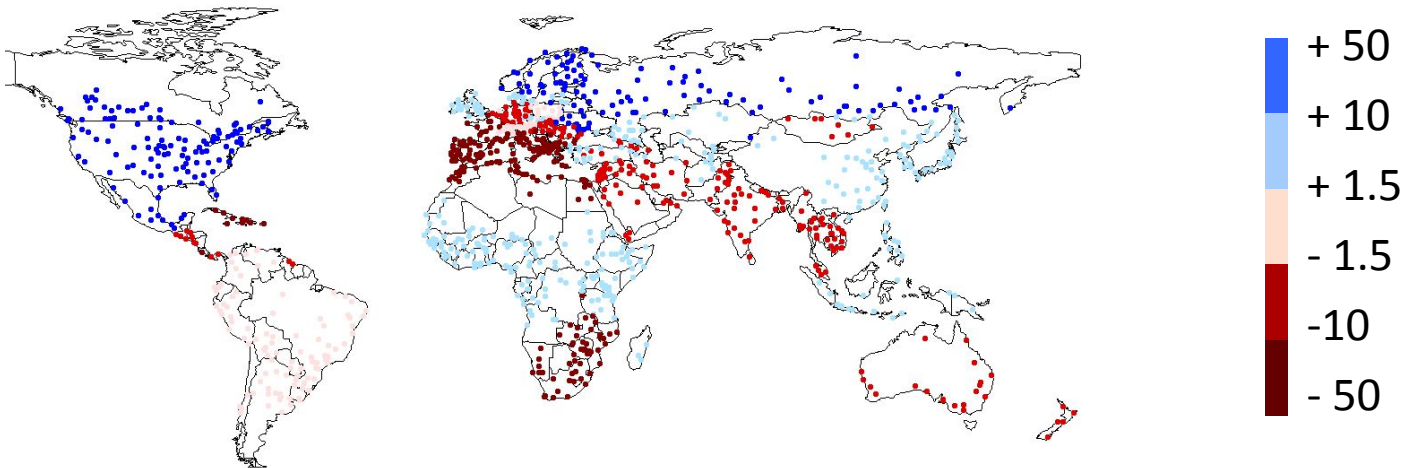


Scenario A1B_10

Temp change (C)

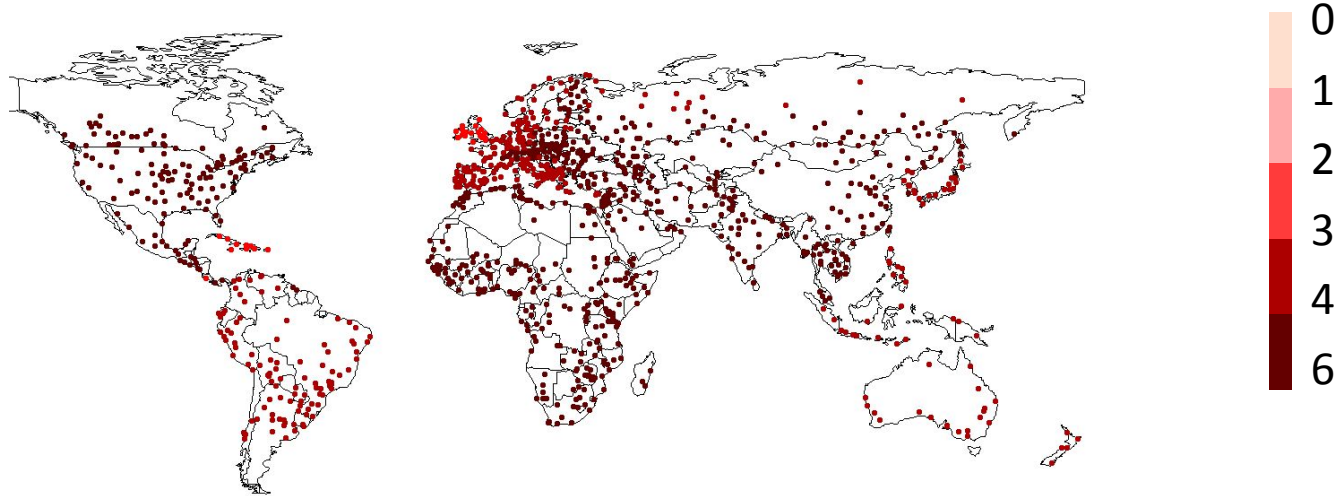


Precip change (%)

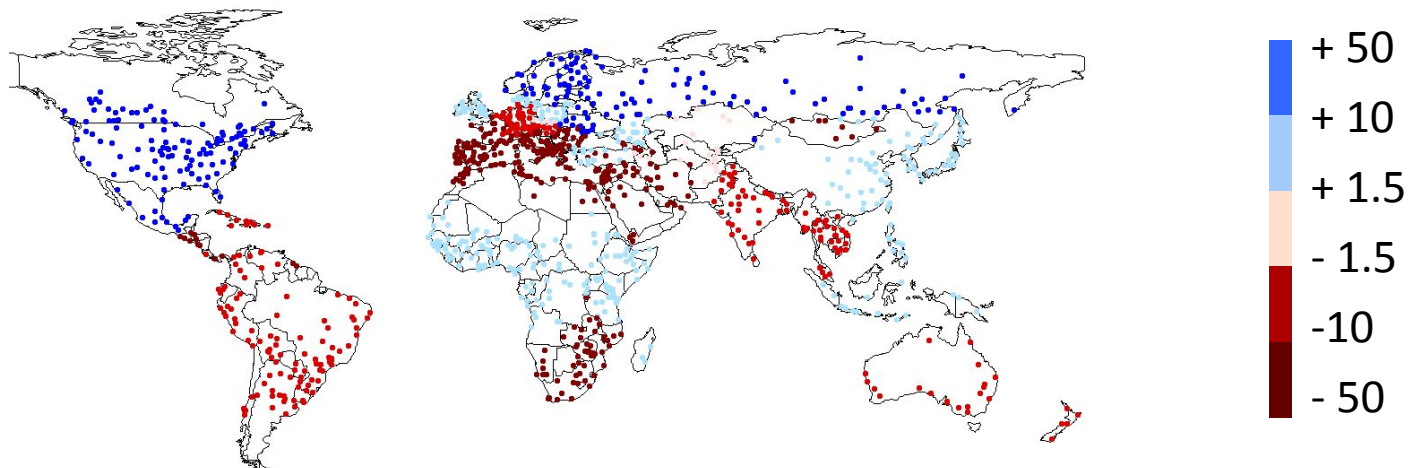


Scenario A1B_11

Temp change (C)

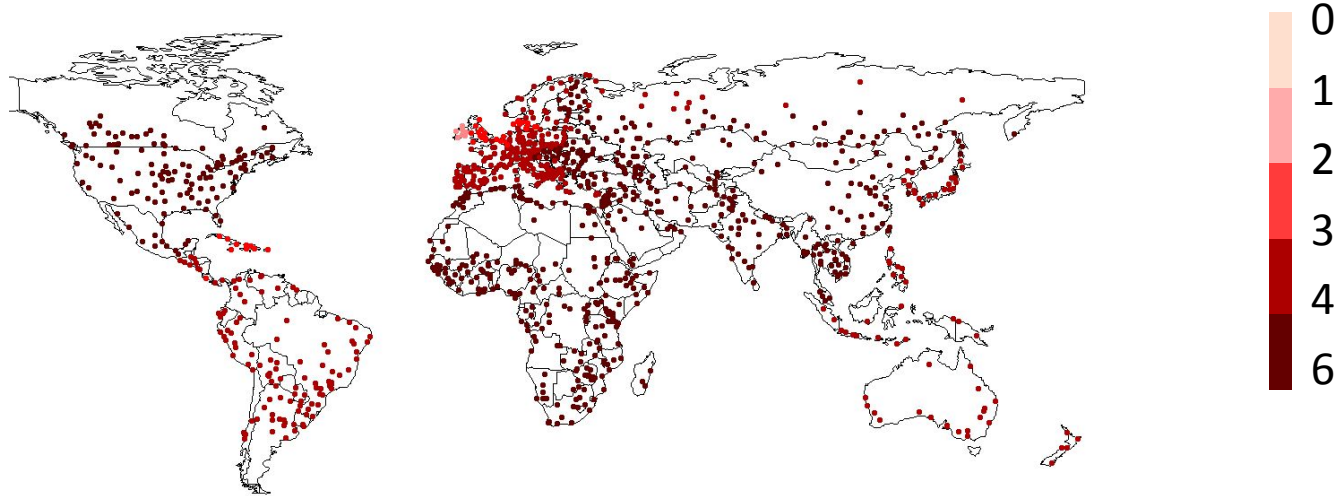


Precip change (%)

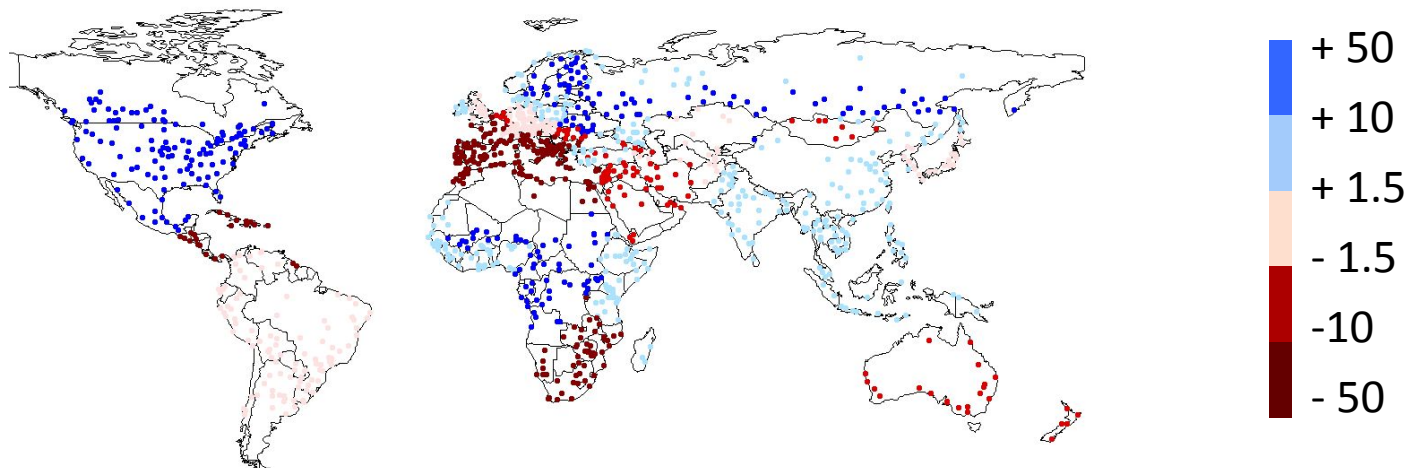


Scenario A1B_12

Temp change (C)

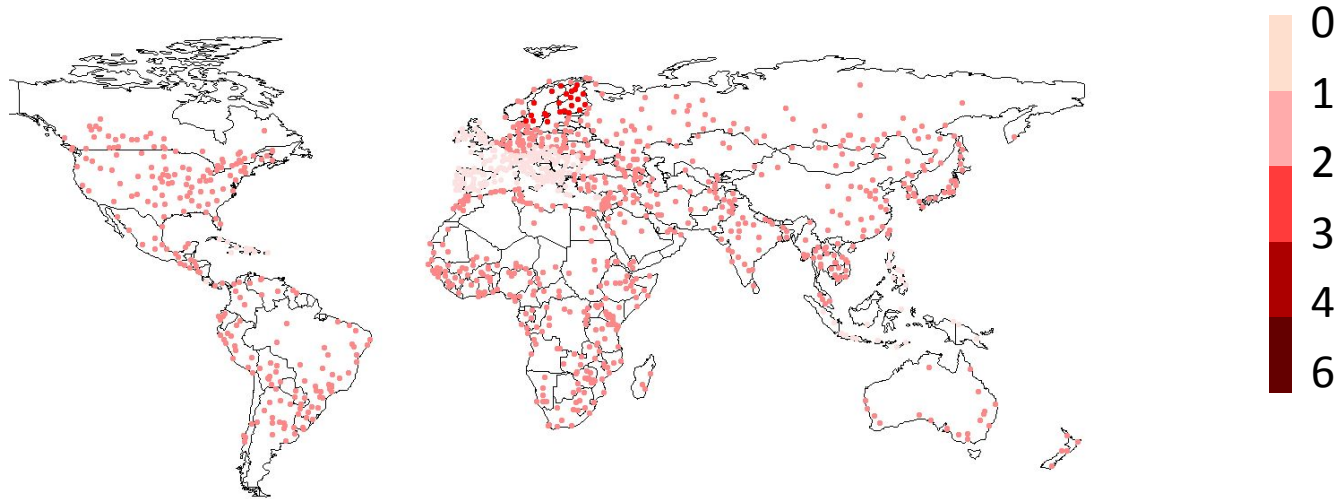


Precip change (%)

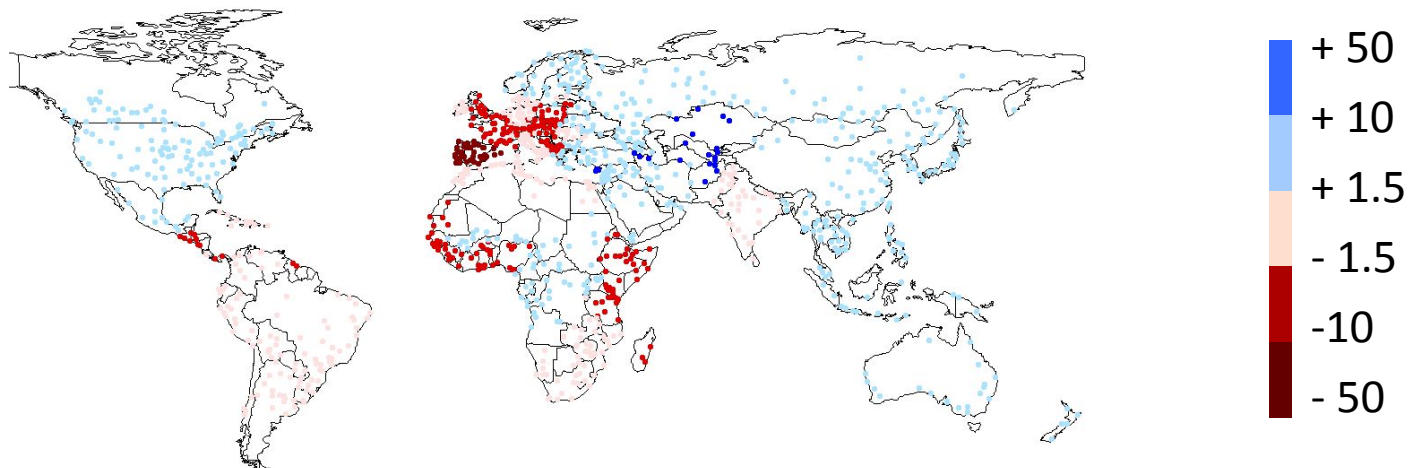


Scenario E1 _1

Temp change (C)

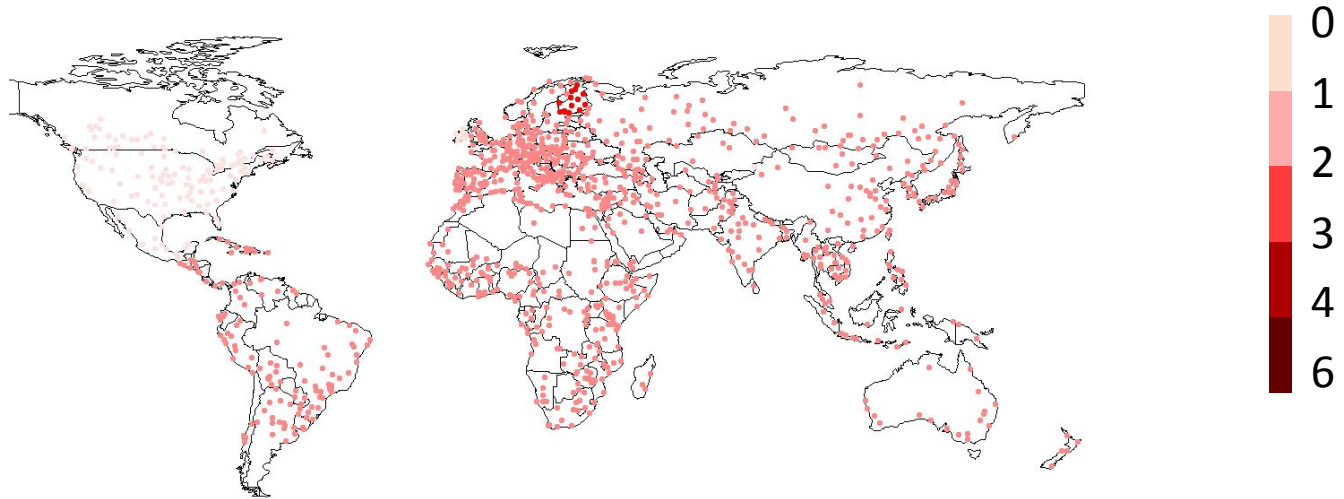


Precip change (%)

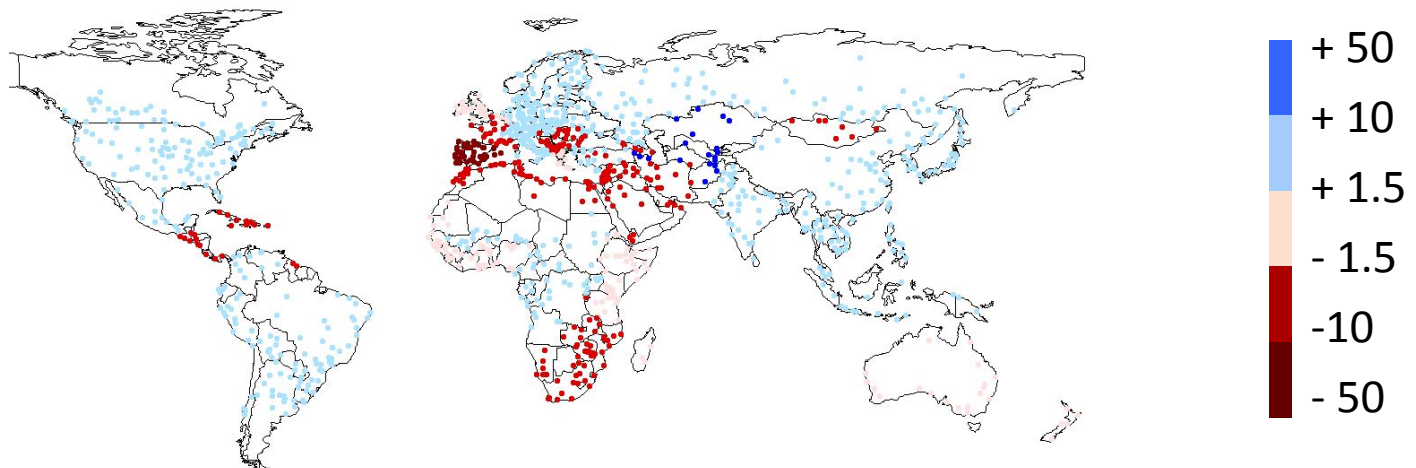


Scenario E1_2

Temp change (C)

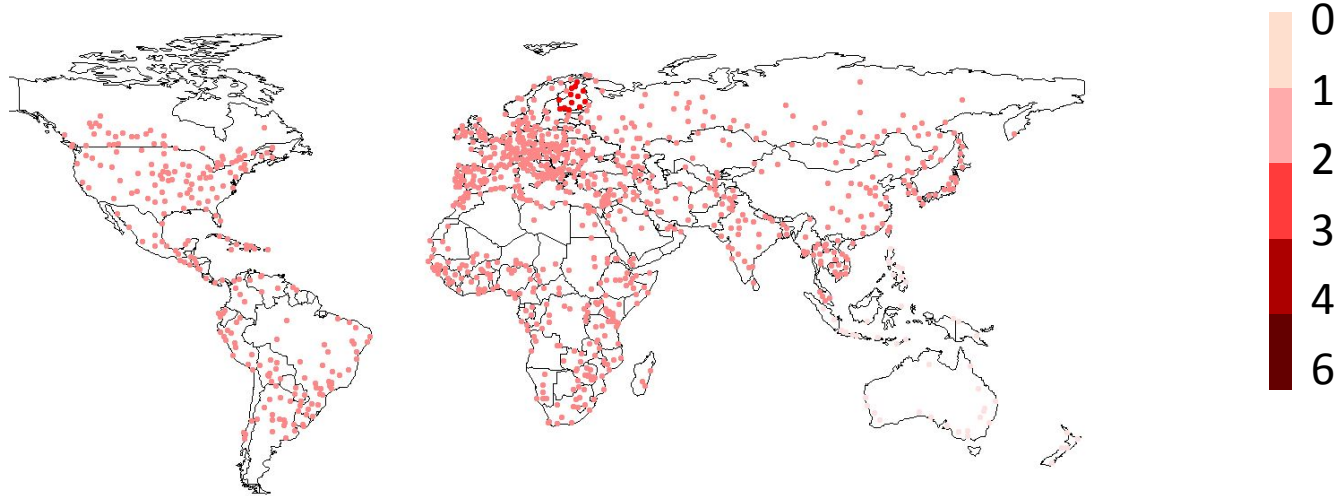


Precip change (%)

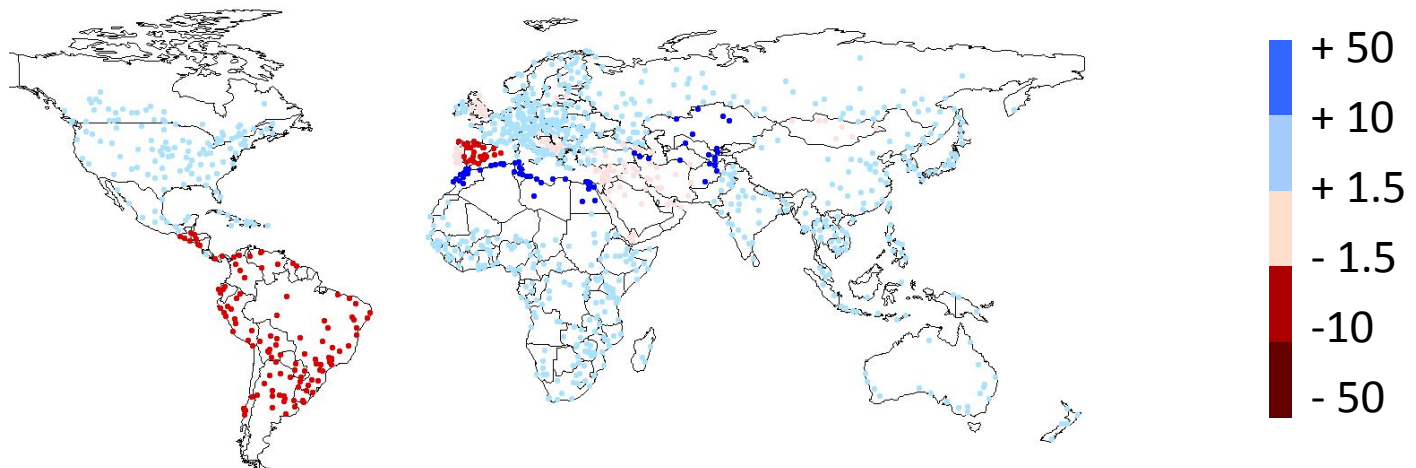


Scenario E1_3

Temp change (C)

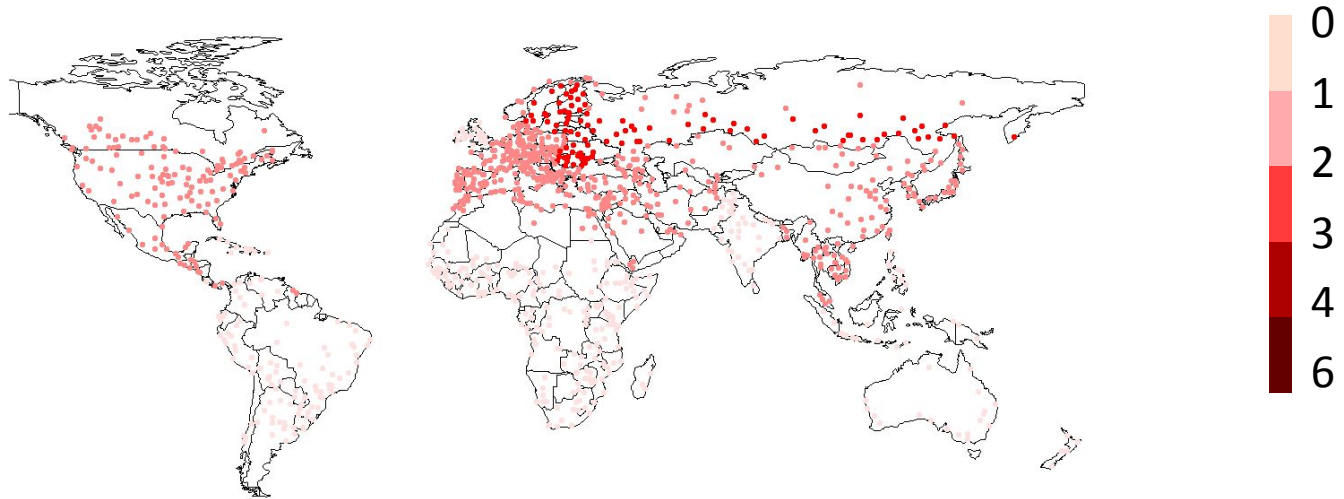


Precip change (%)

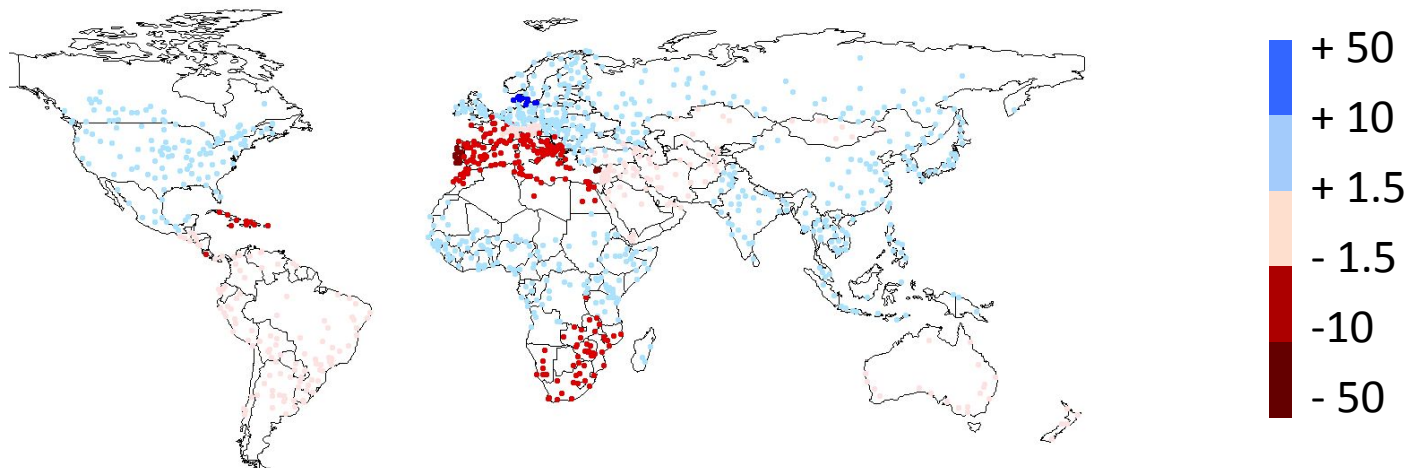


Scenario E1_4

Temp change (C)

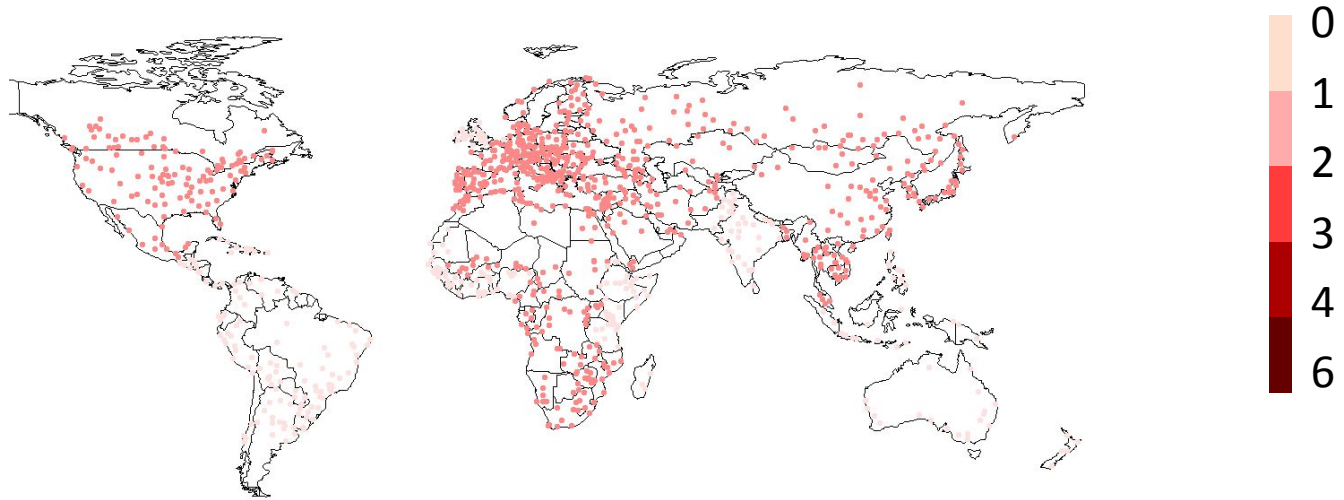


Precip change (%)

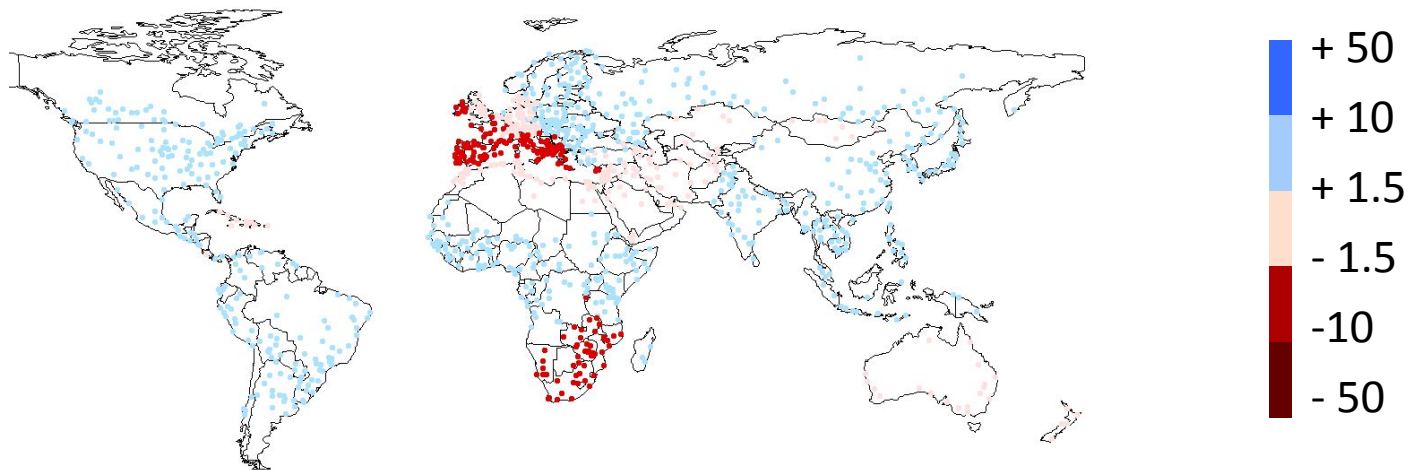


Scenario E1_5

Temp change (C)

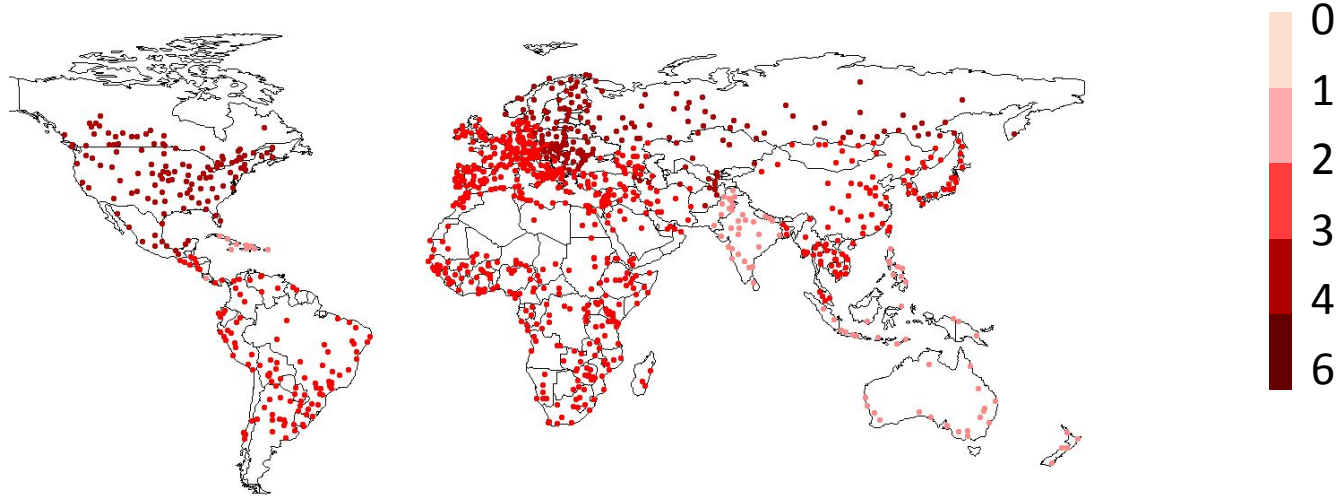


Precip change (%)

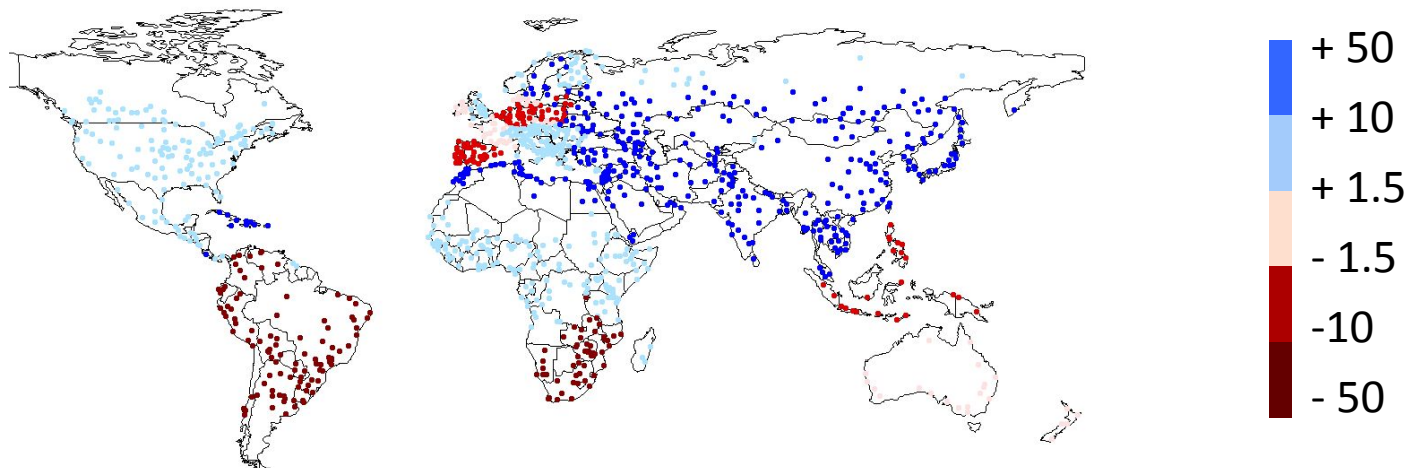


Scenario E1_6

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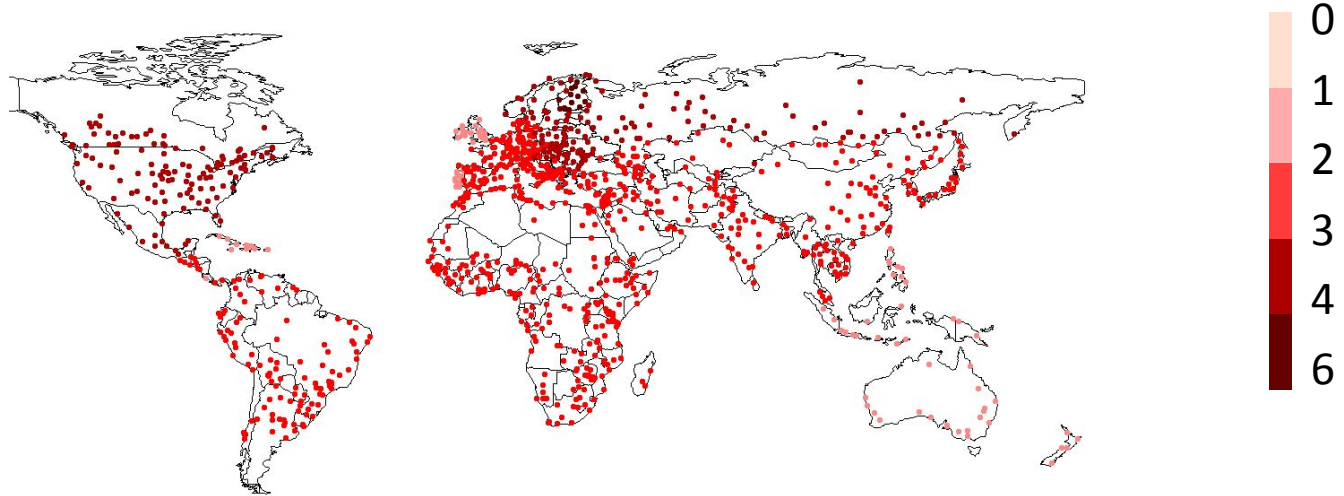


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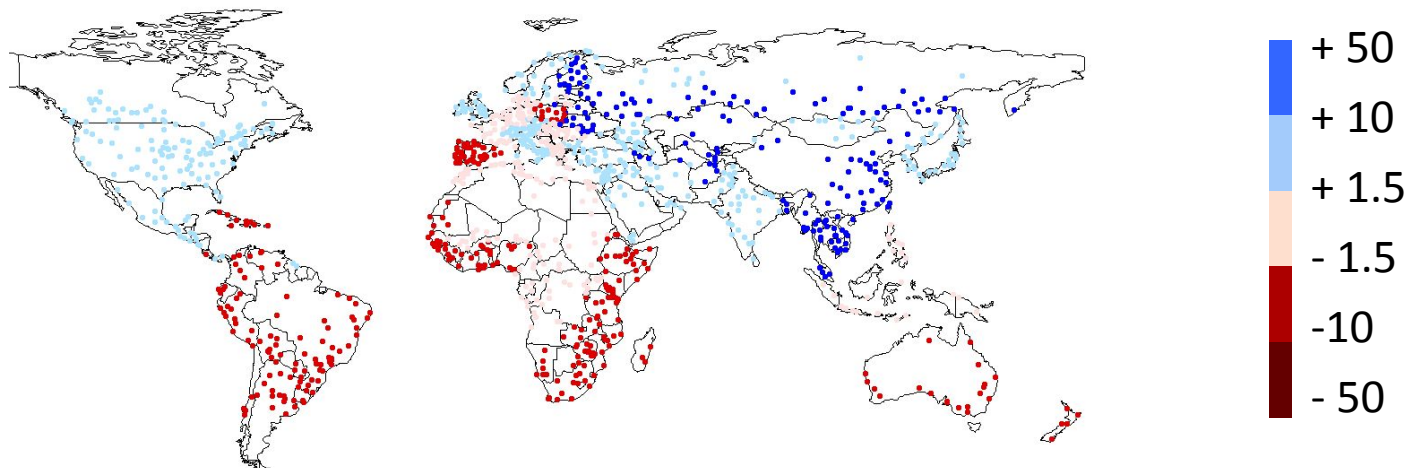


Scenario E1_7

Temp change (C)

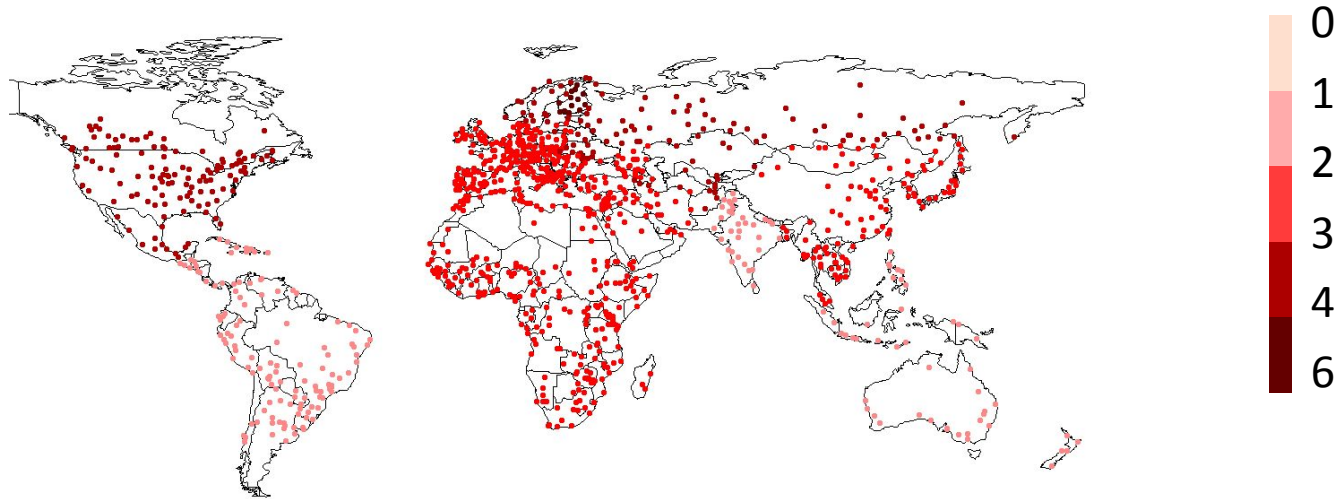


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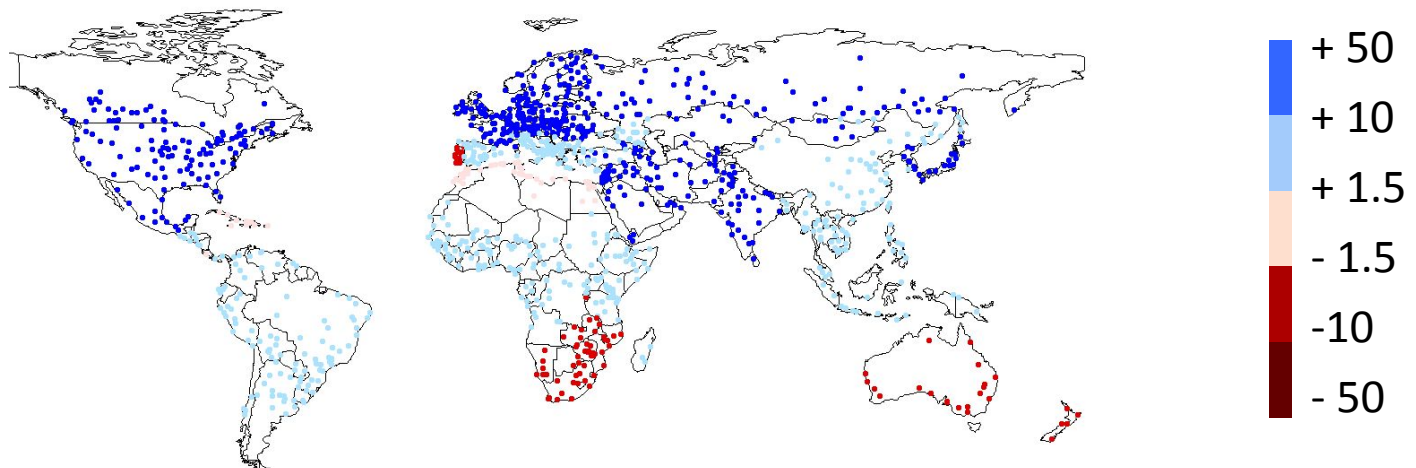


Scenario E1_8

Temp change (C)

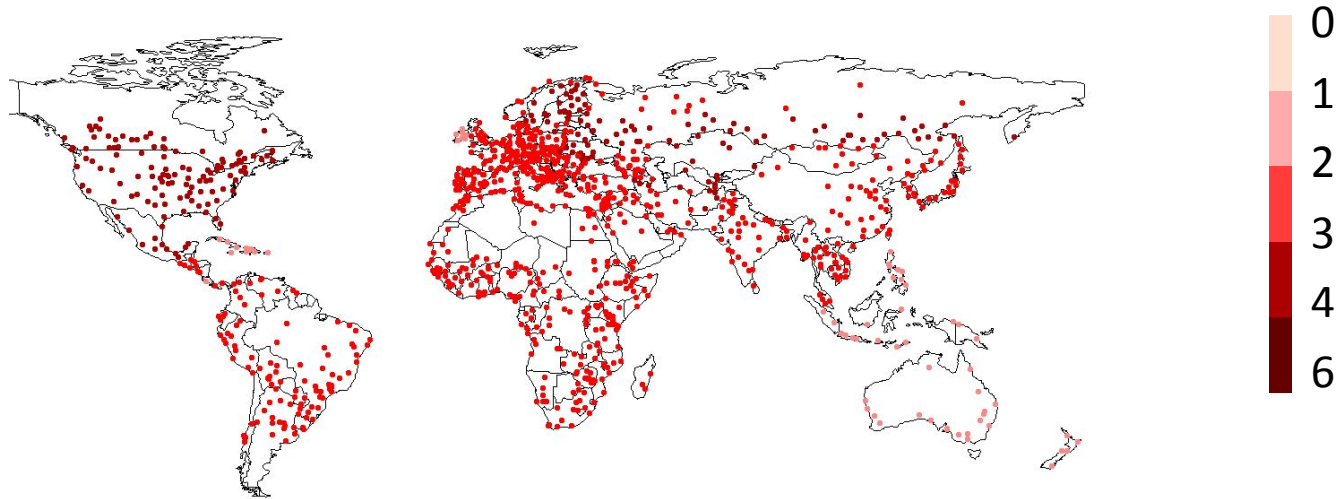


Precip change (%)

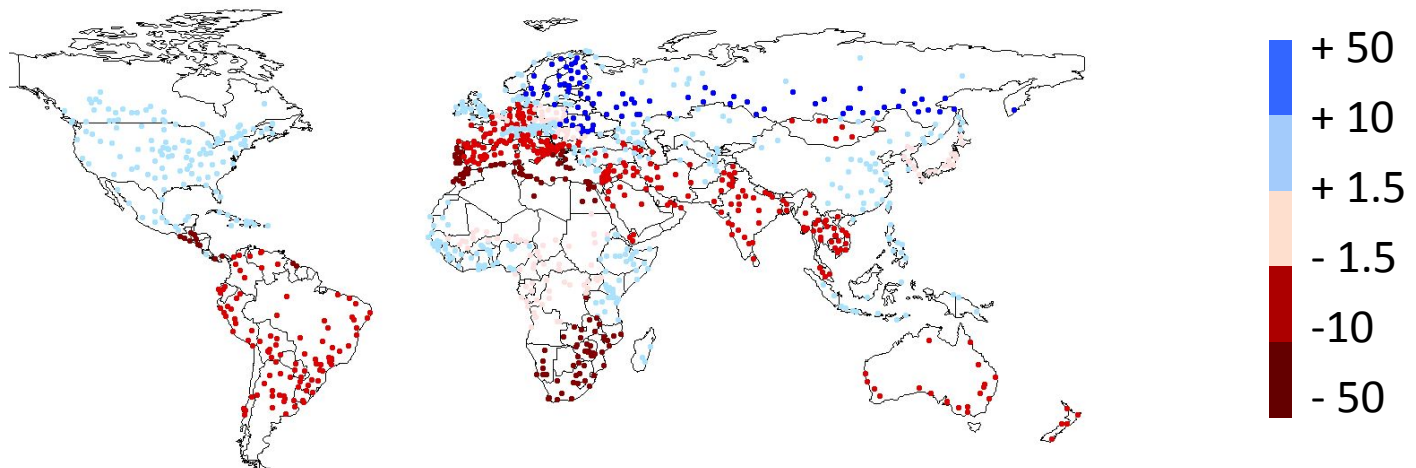


Scenario E1_9

Temp change (C)

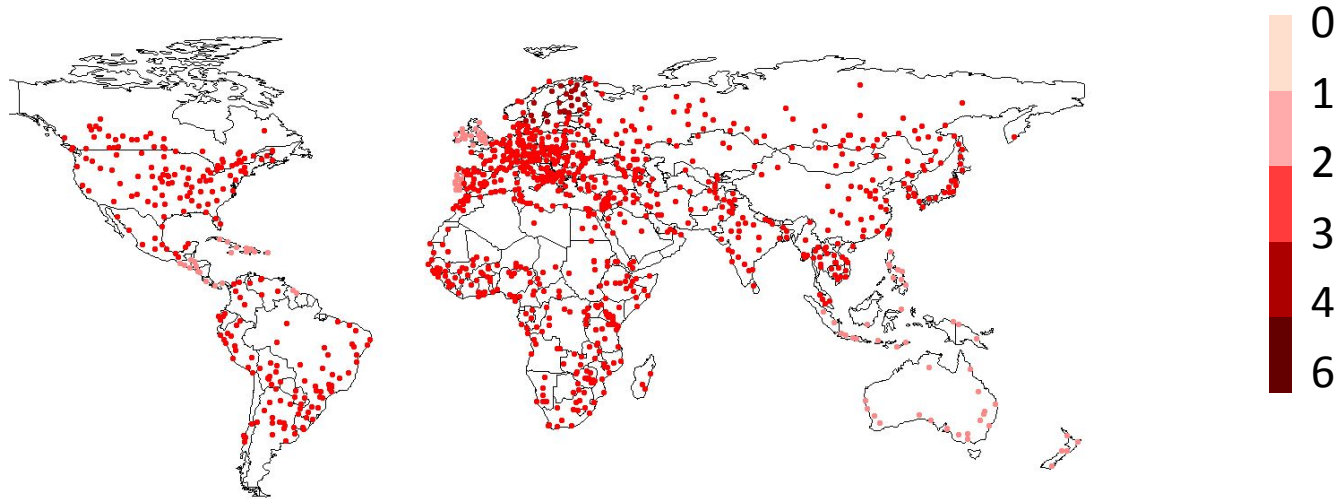


Precip change (%)

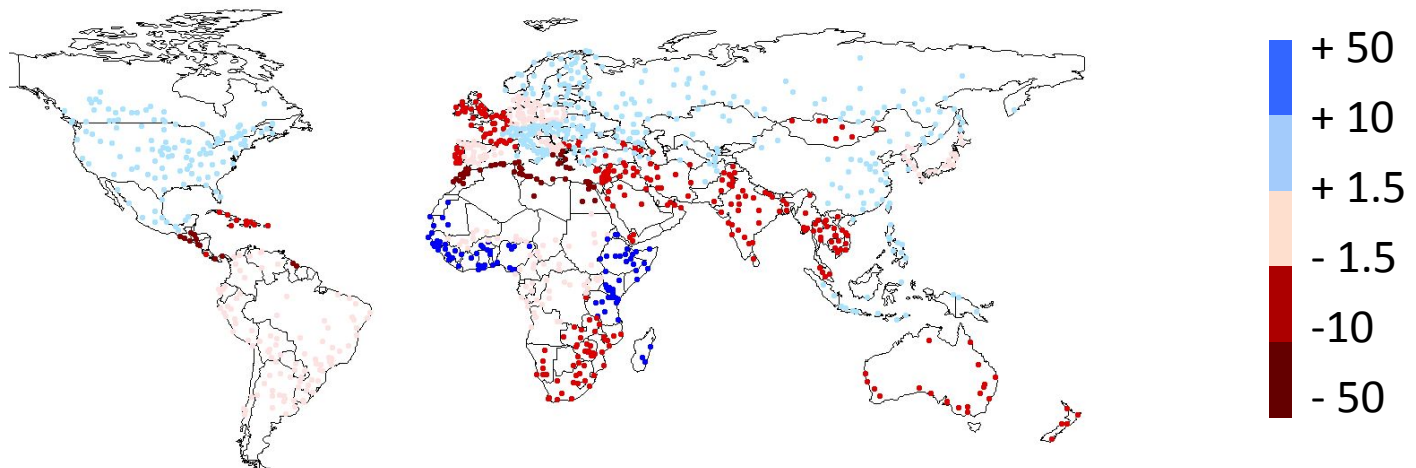


Scenario E1_10

Temp change (C)

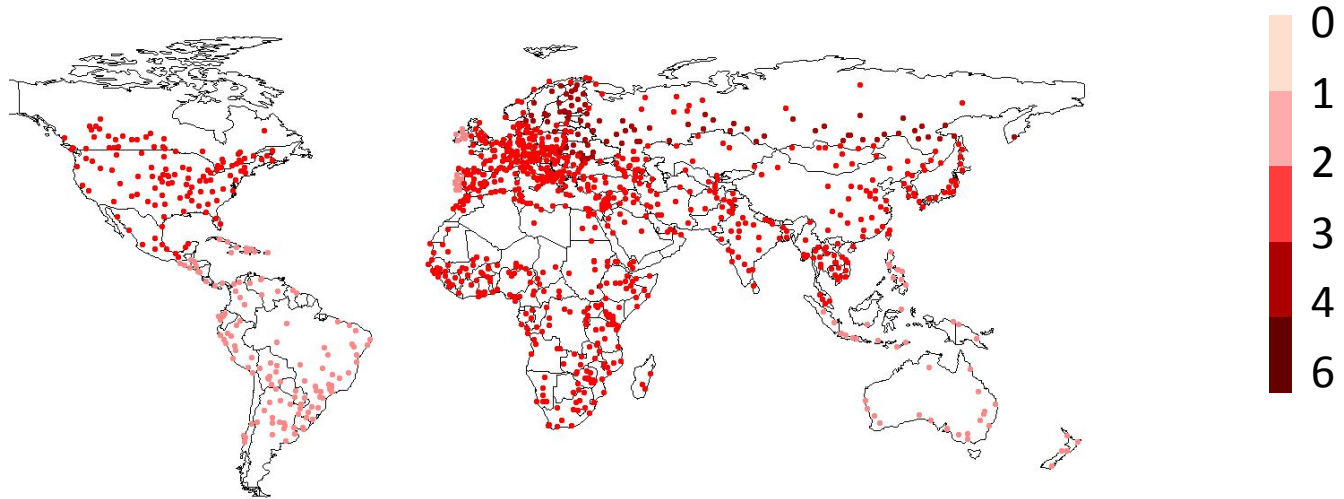


Precip change (%)

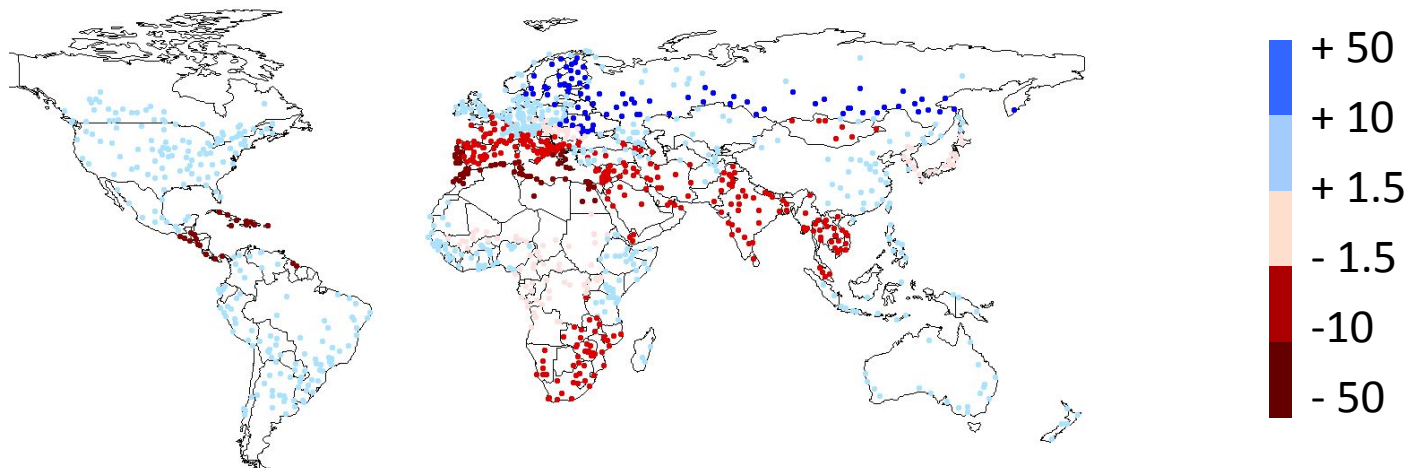


Scenario E1_11

Temp change (C)

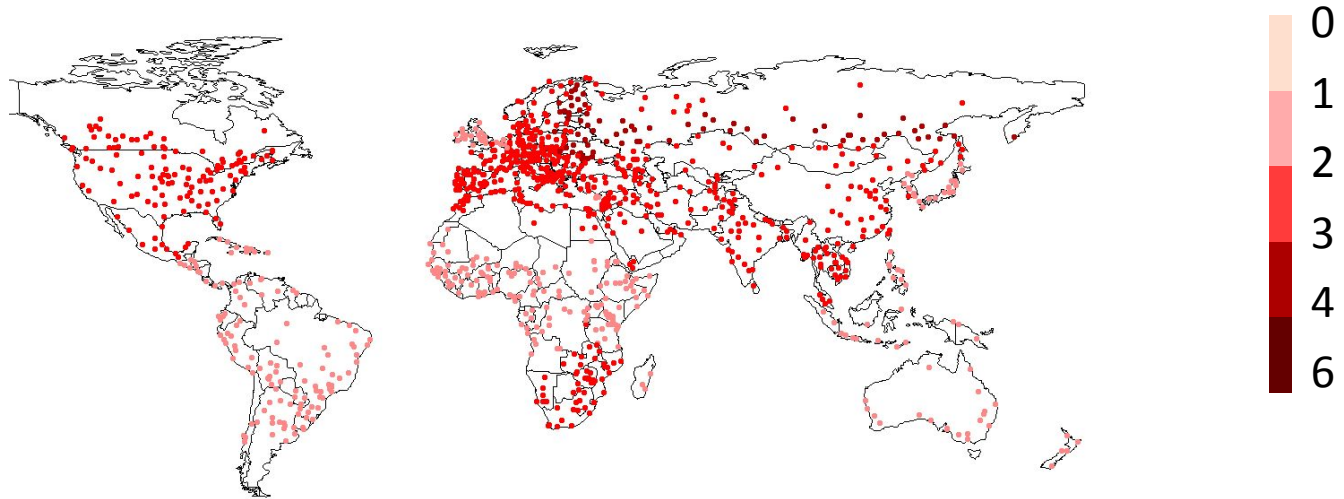


Precip change (%)

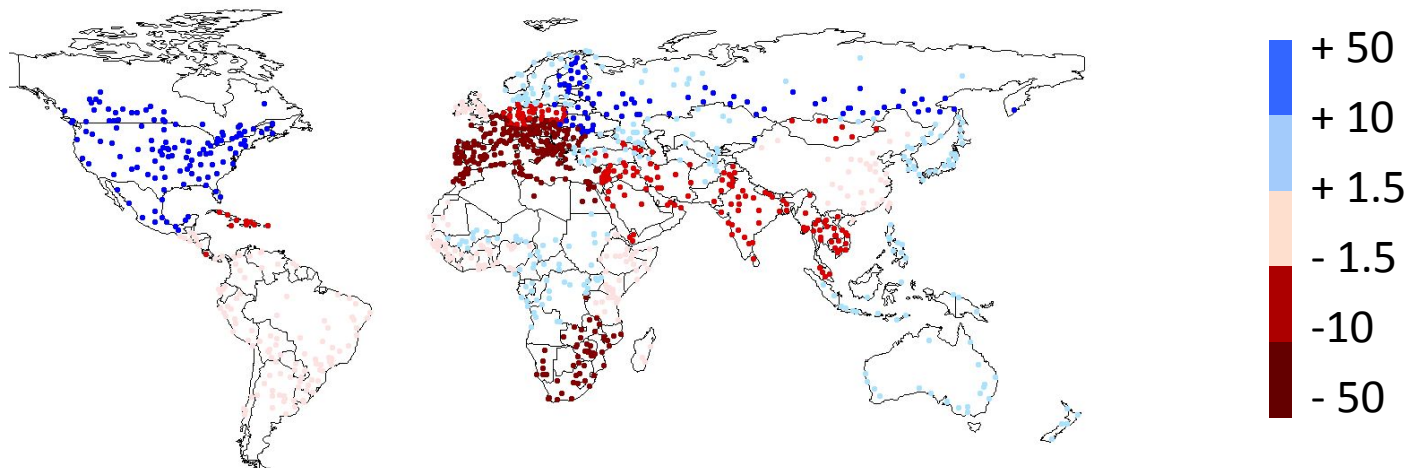


Scenario E1_12

Temp change (C)

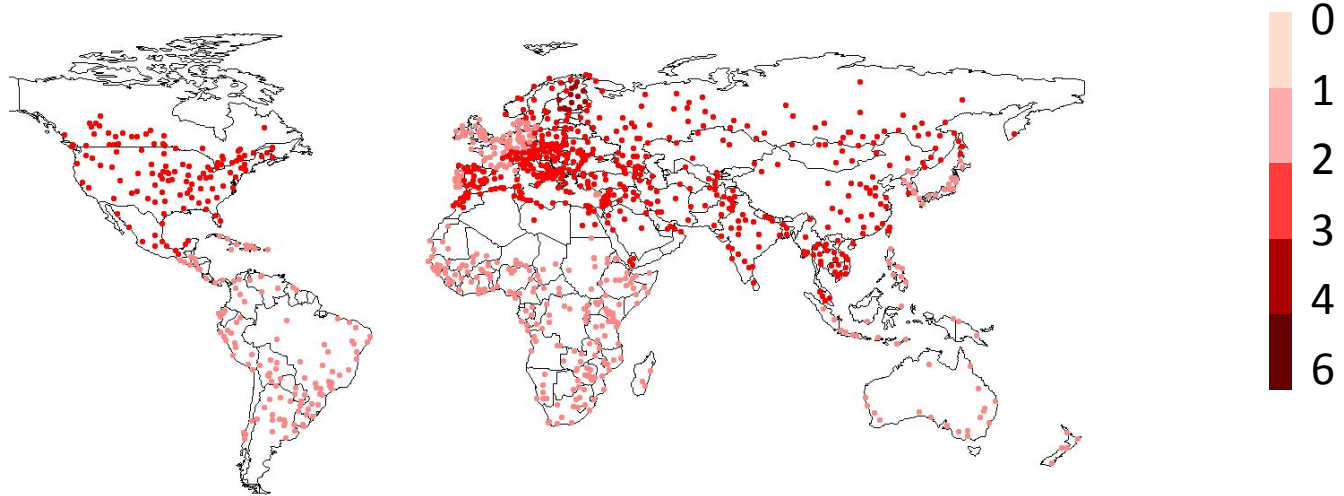


Precip change (%)

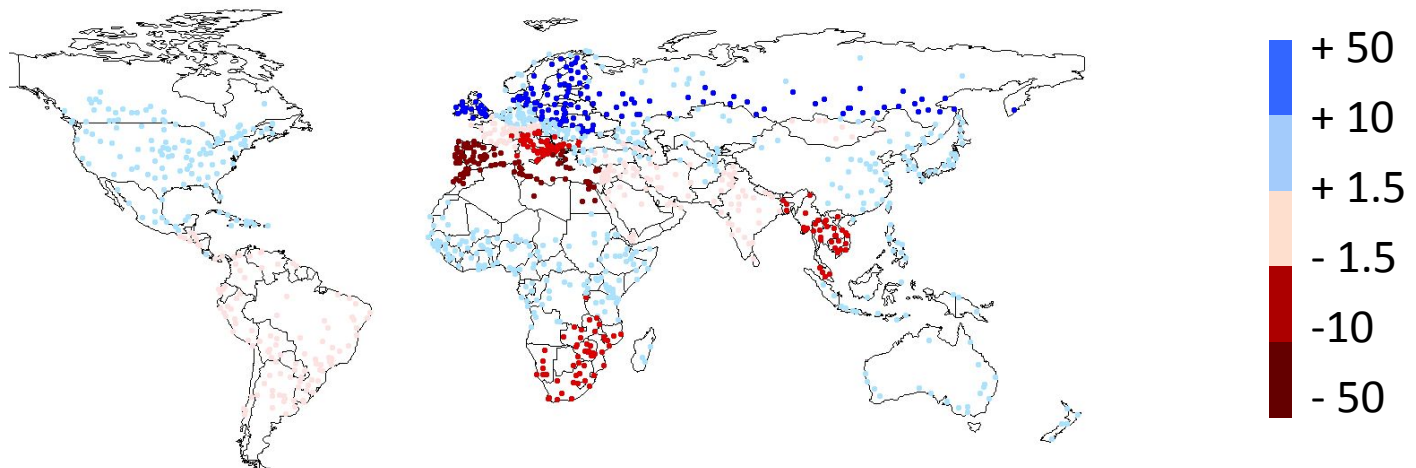


Scenario E1_13

Temp change (C)

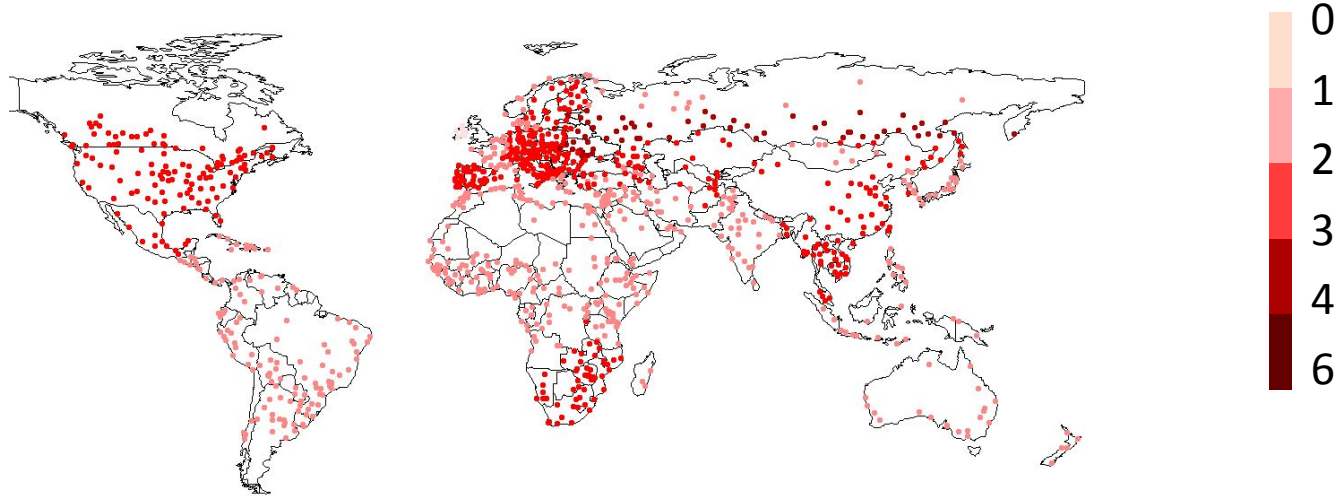


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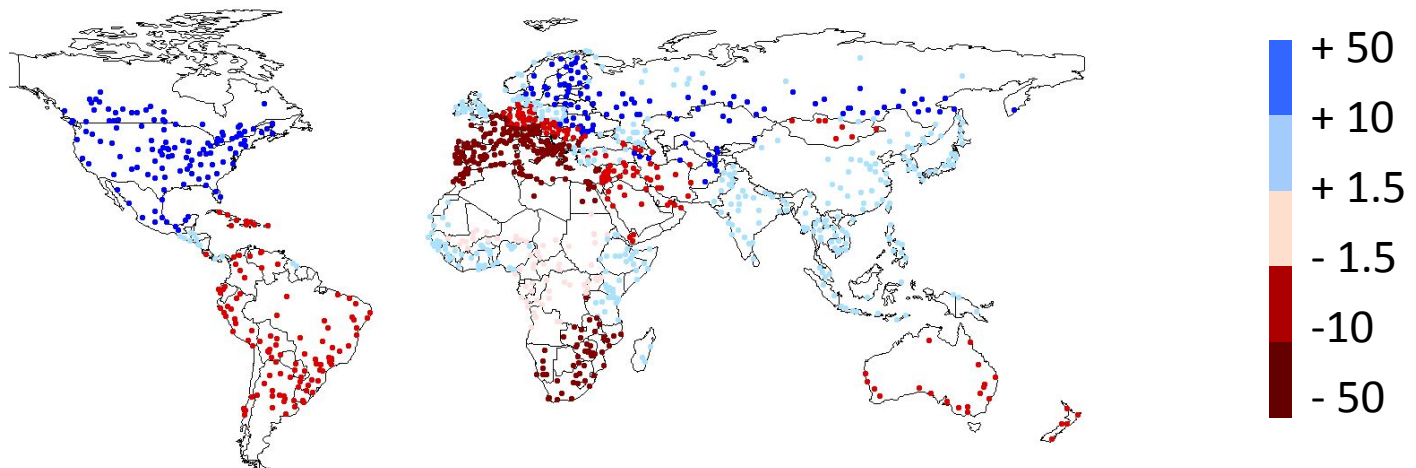


Scenario E1_14

Temp change (C)

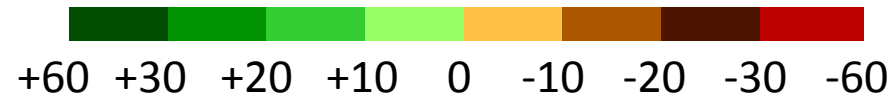
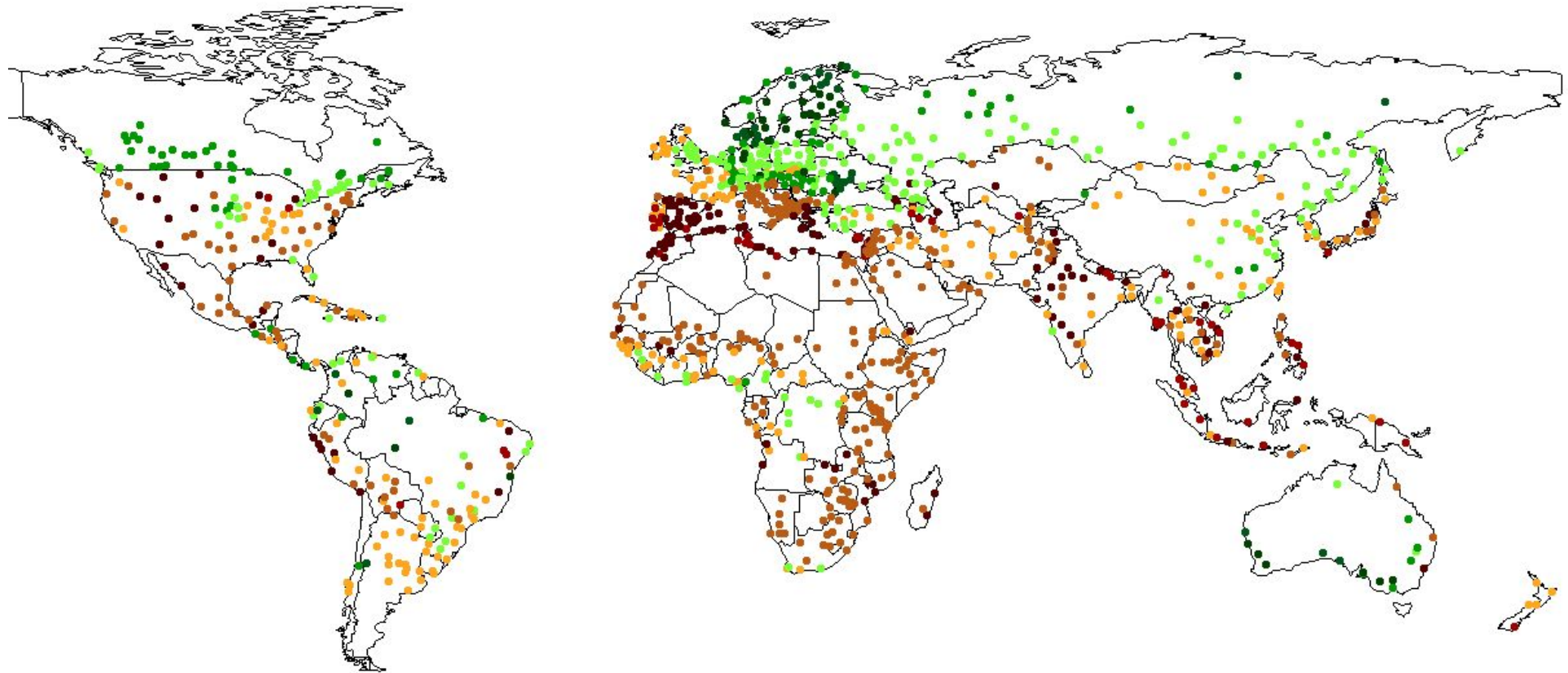


Precip change (%)



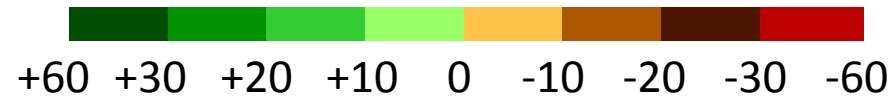
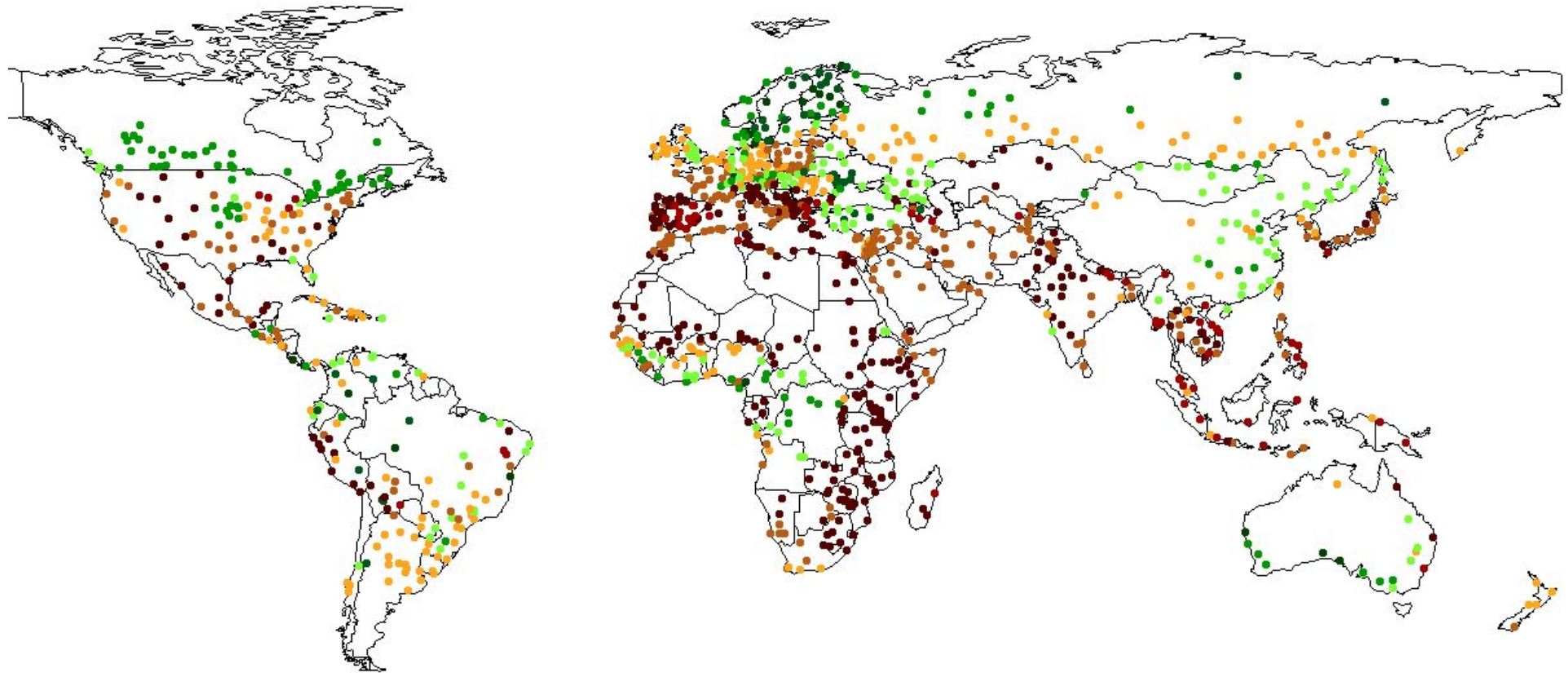
Scenario A1B_1

Agricultural productivity changes (% of baseline)



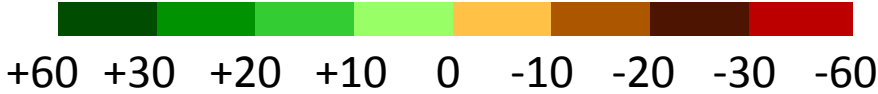
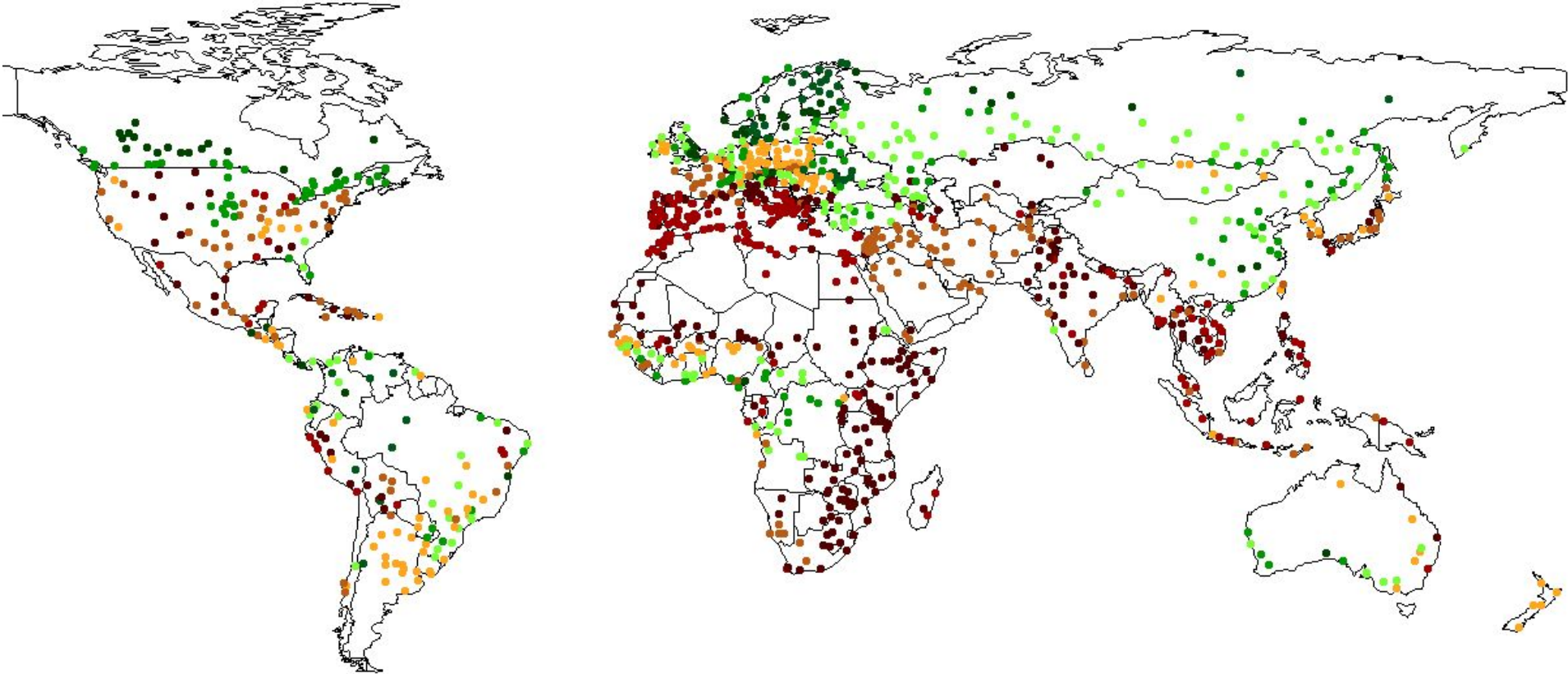
Scenario A1B _2

Agricultural productivity changes (% of baseline)



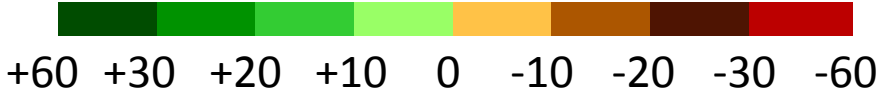
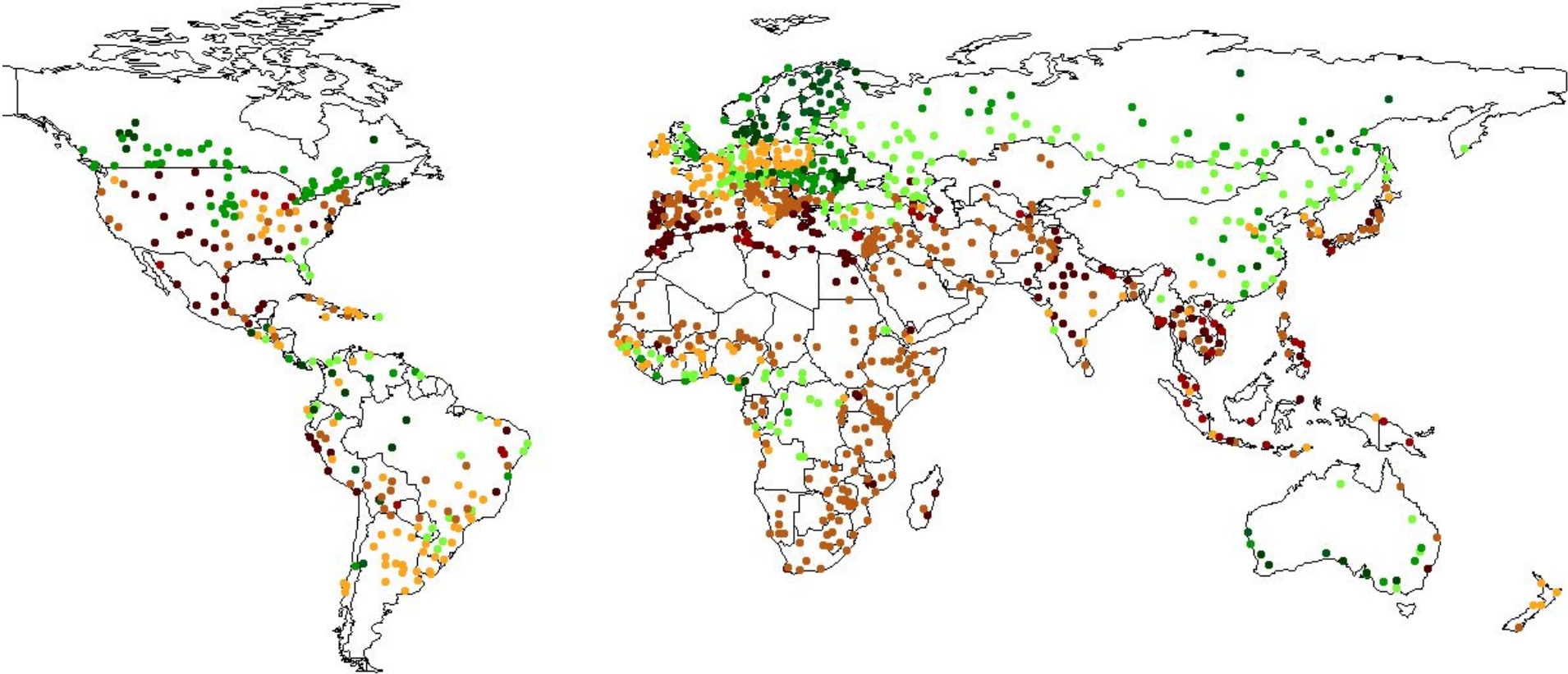
Scenario A1B_3

Agricultural productivity changes (% of baseline)



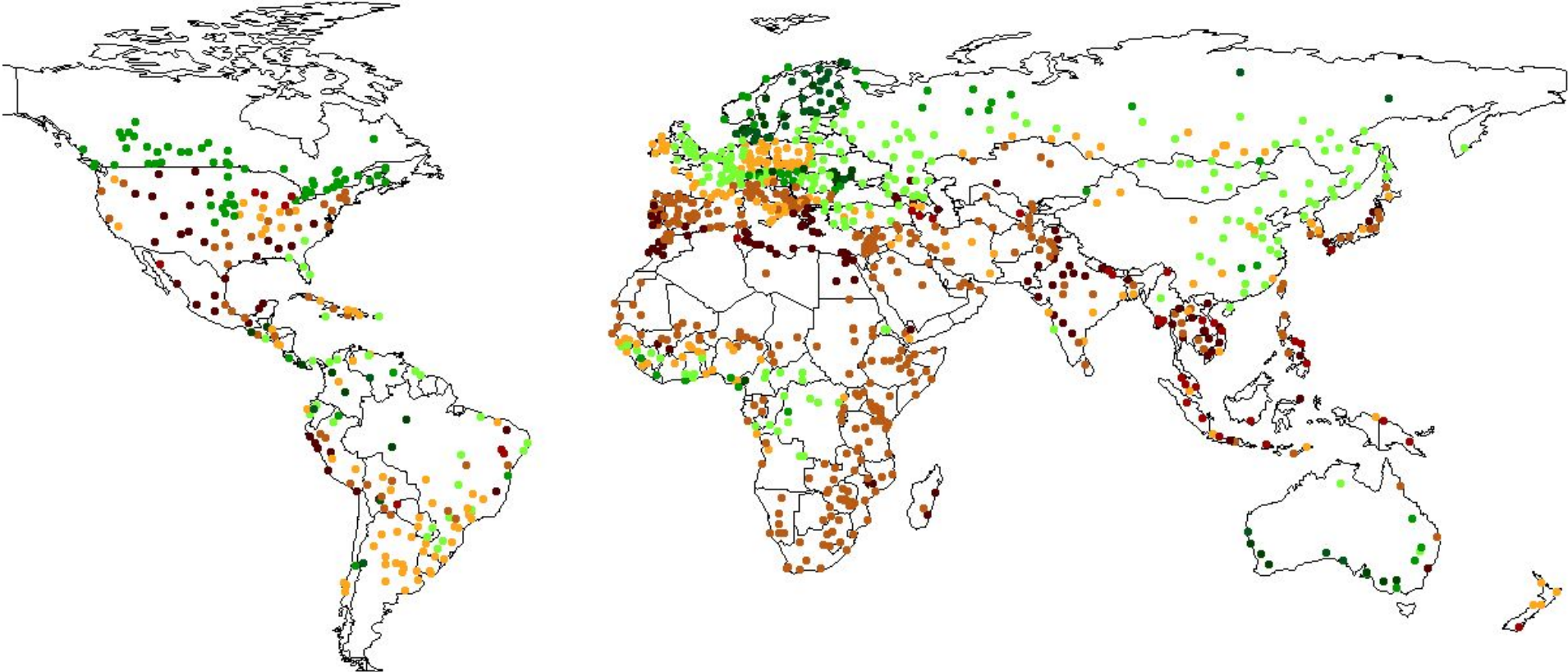
Scenario A1B_4

Agricultural productivity changes (% of baseline)



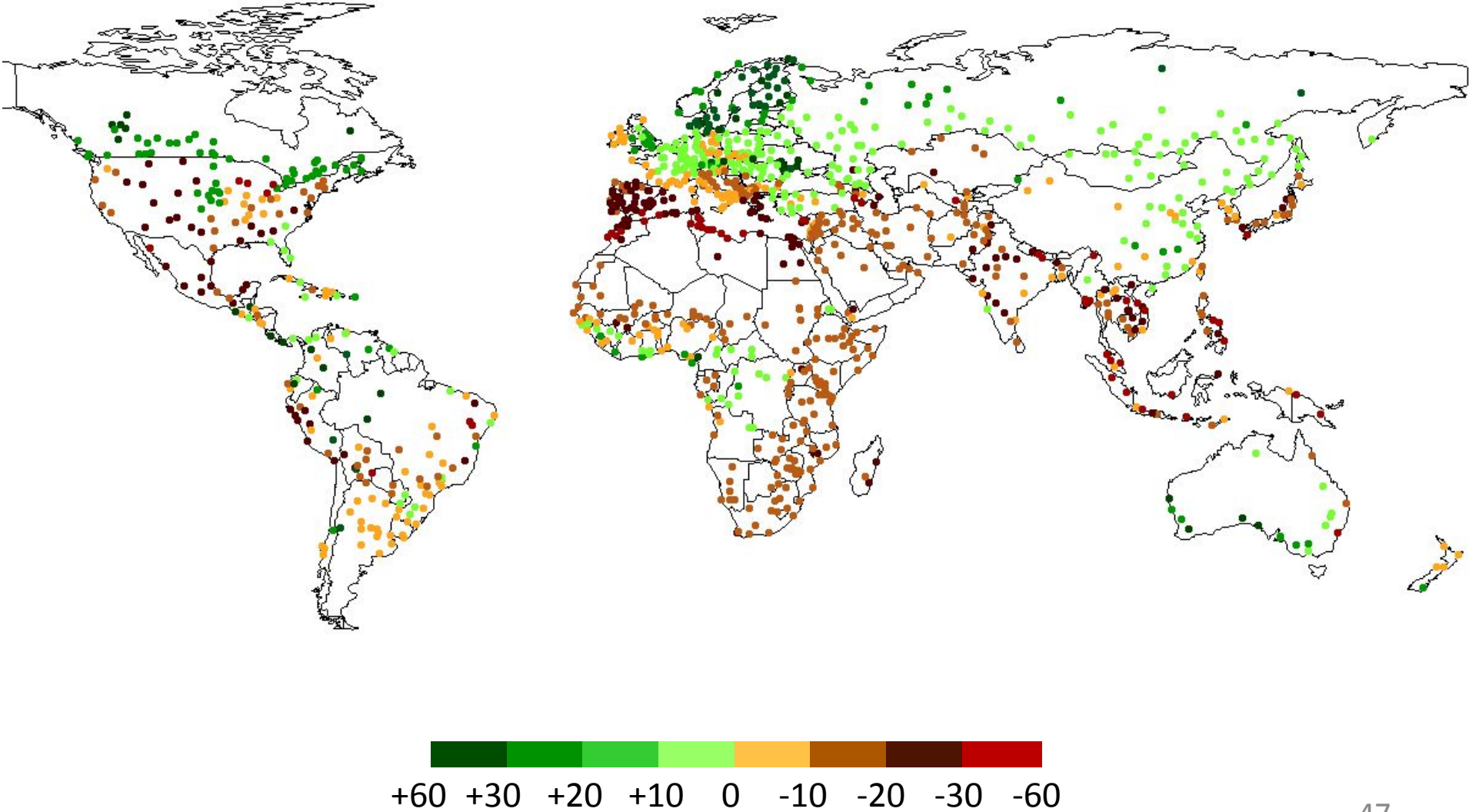
Scenario A1B_5

Agricultural productivity changes (% of baseline)



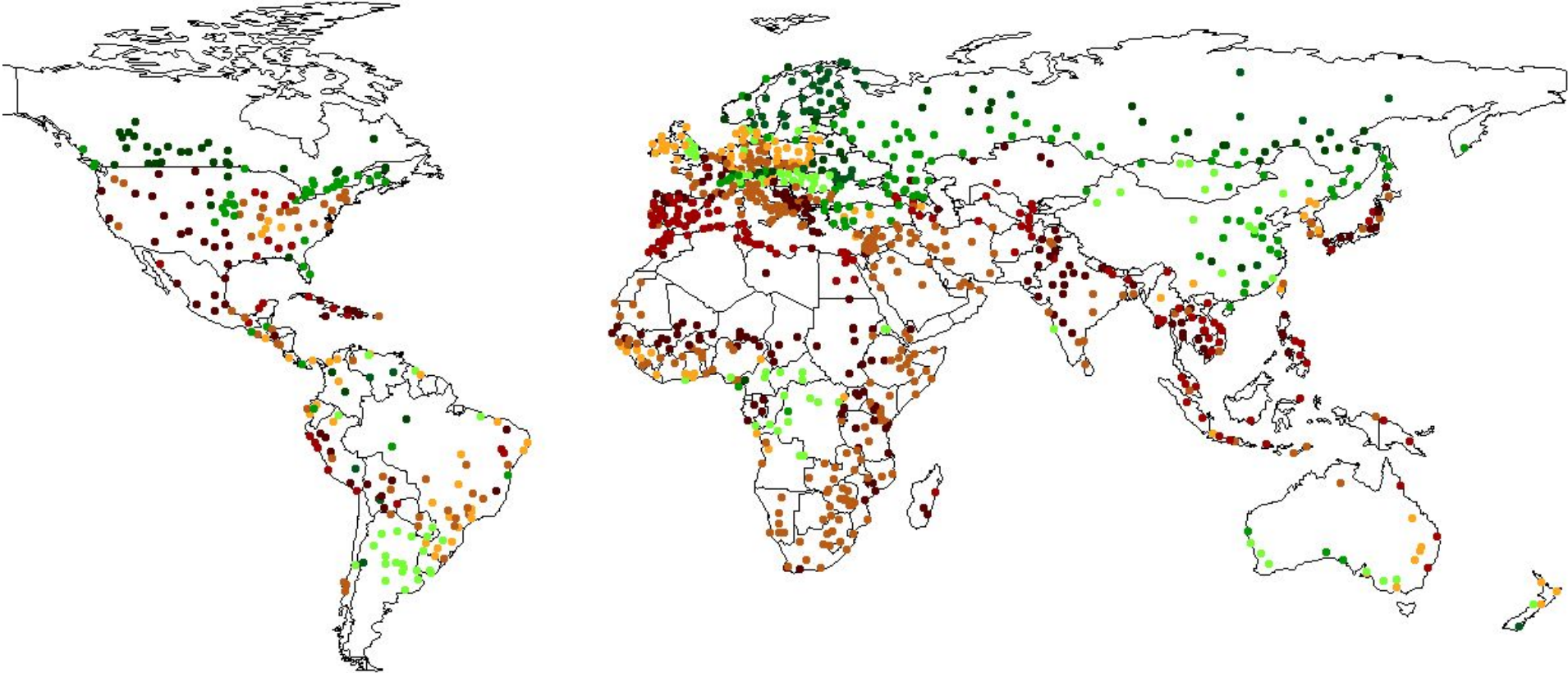
Scenario A1B_6

Agricultural productivity changes (% of baseline)



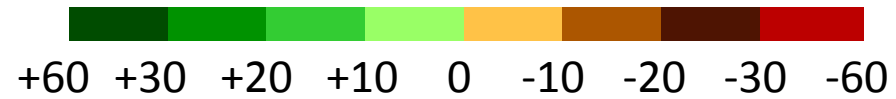
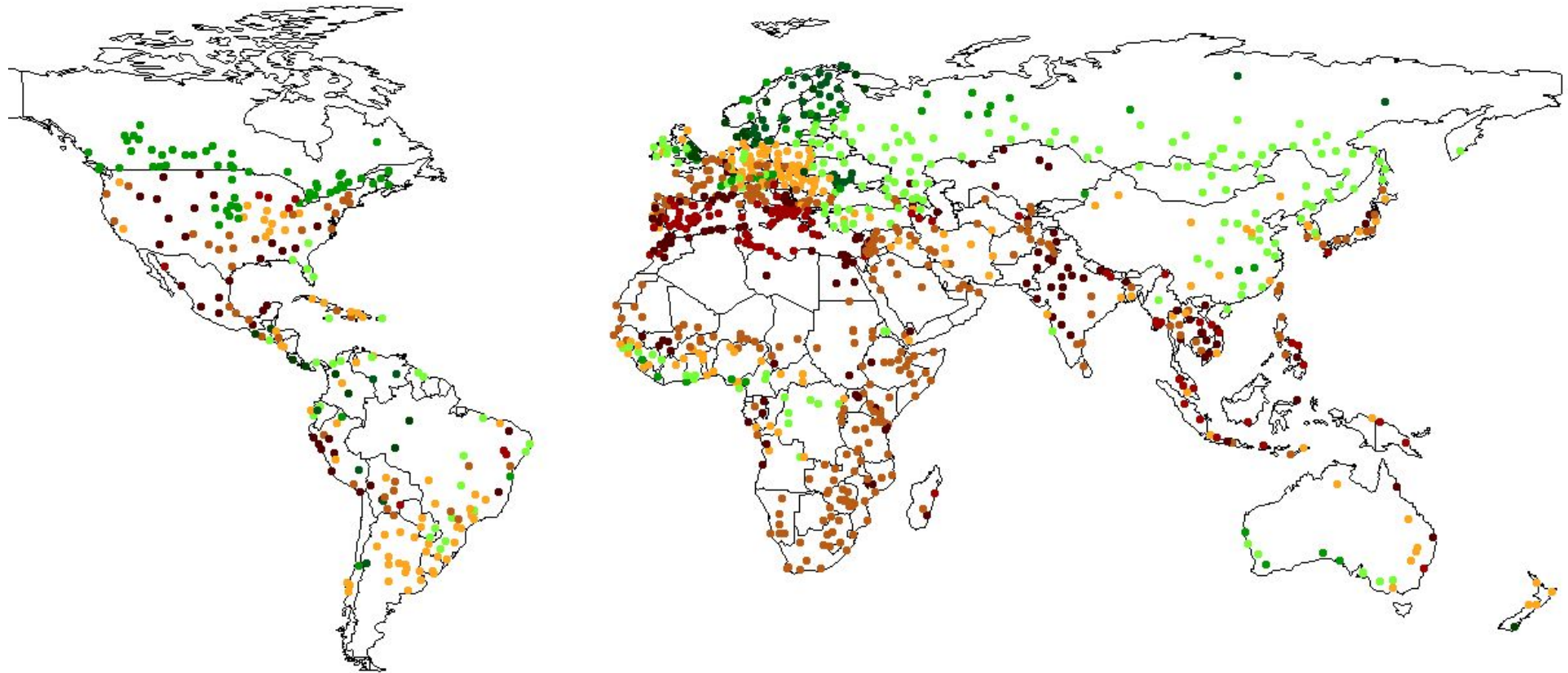
Scenario A1B_7

Agricultural productivity changes (% of baseline)



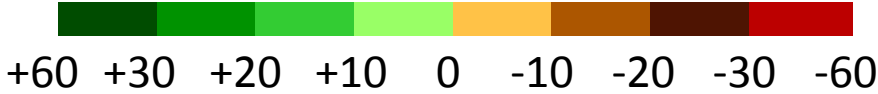
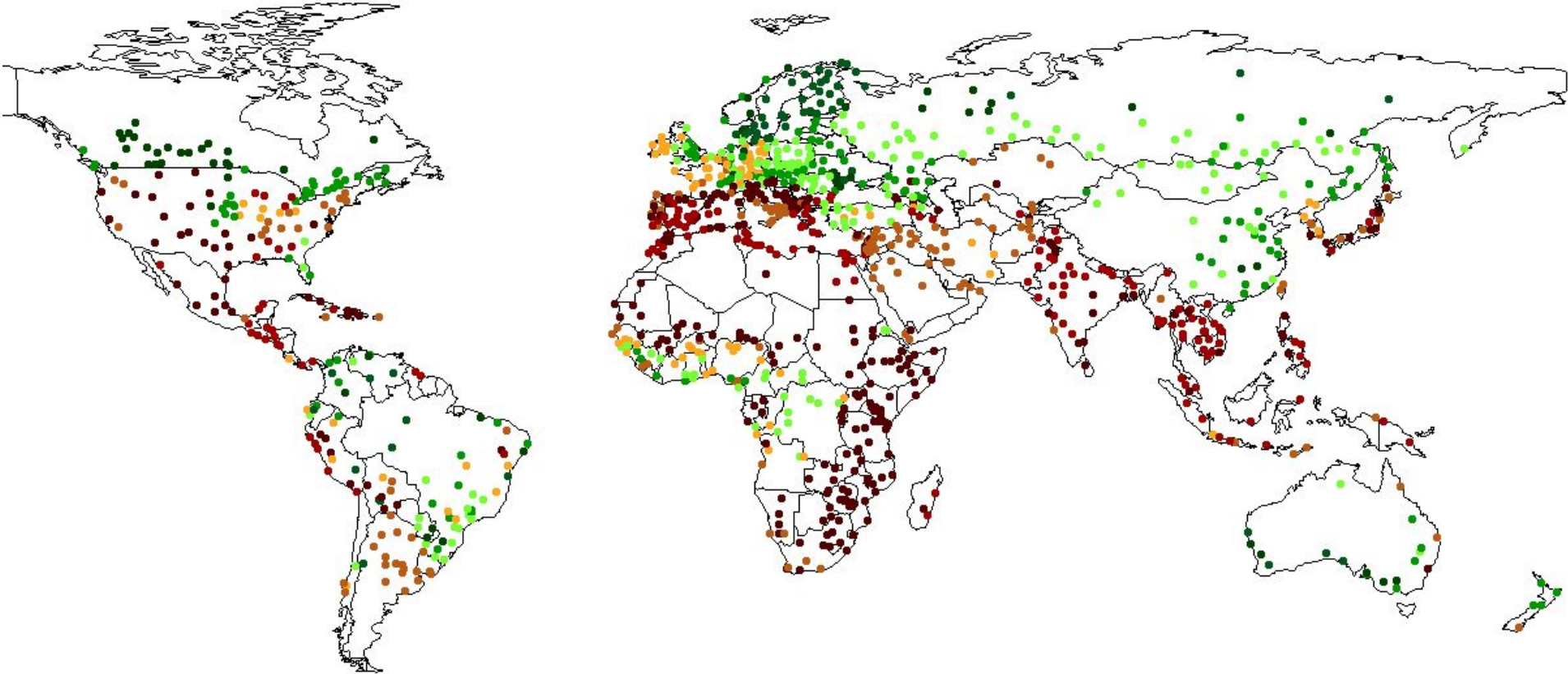
Scenario A1B_8

Agricultural productivity changes (% of baseline)



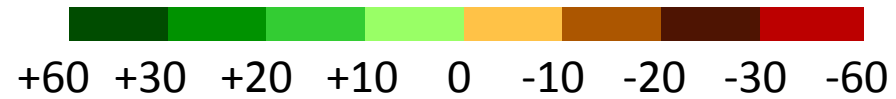
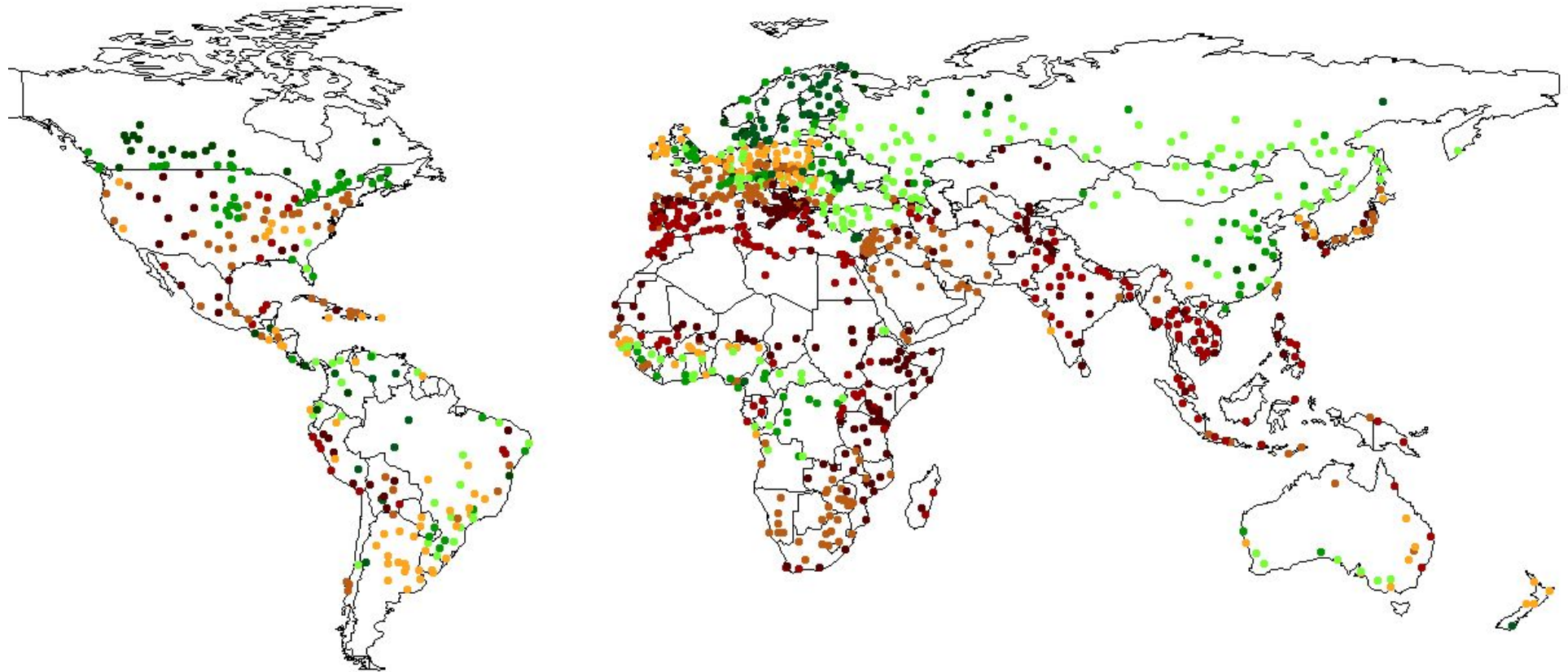
Scenario A1B_9

Agricultural productivity changes (% of baseline)



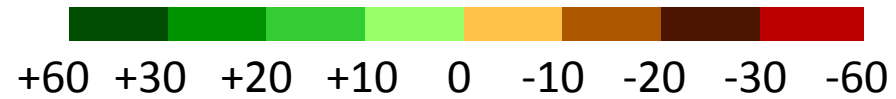
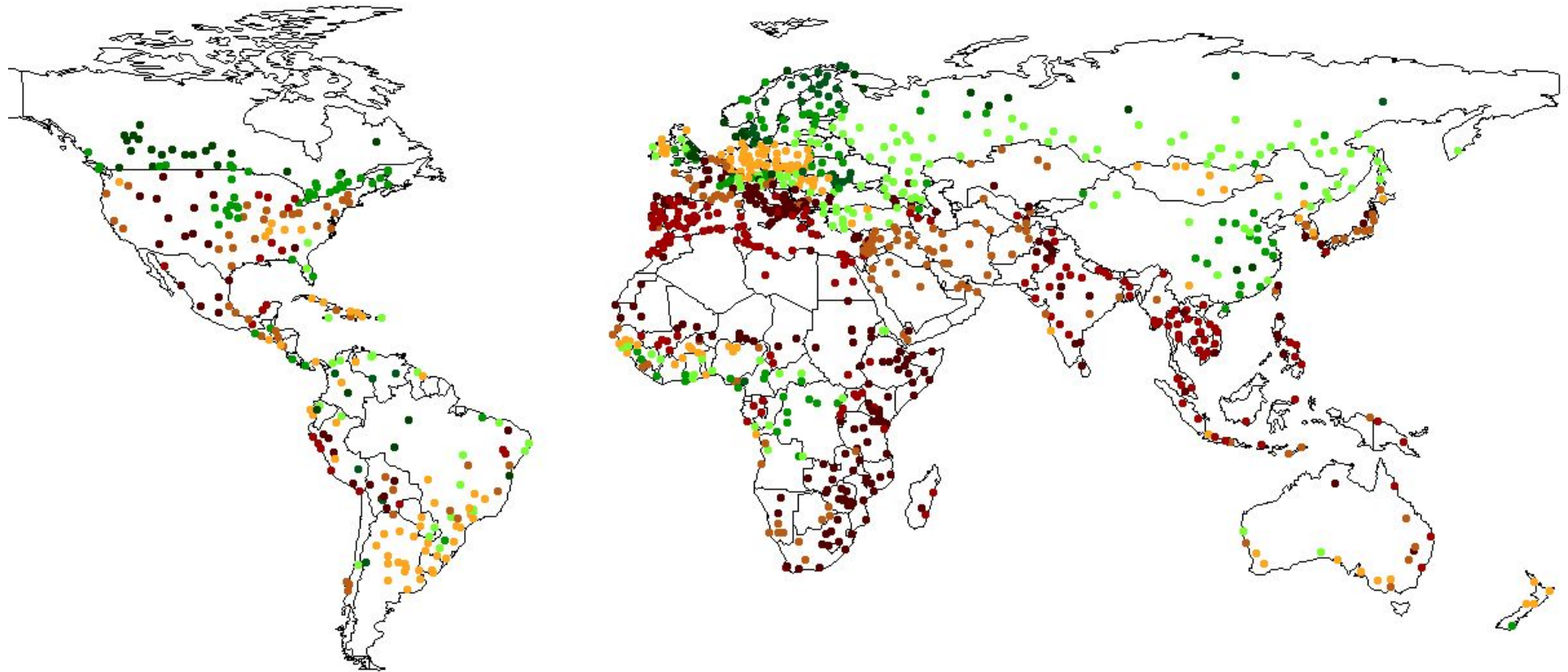
Scenario A1B_10

Agricultural productivity changes (% of baseline)



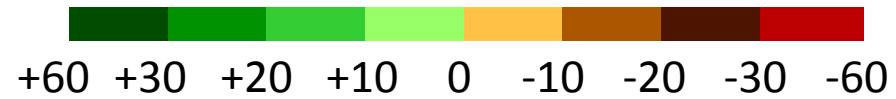
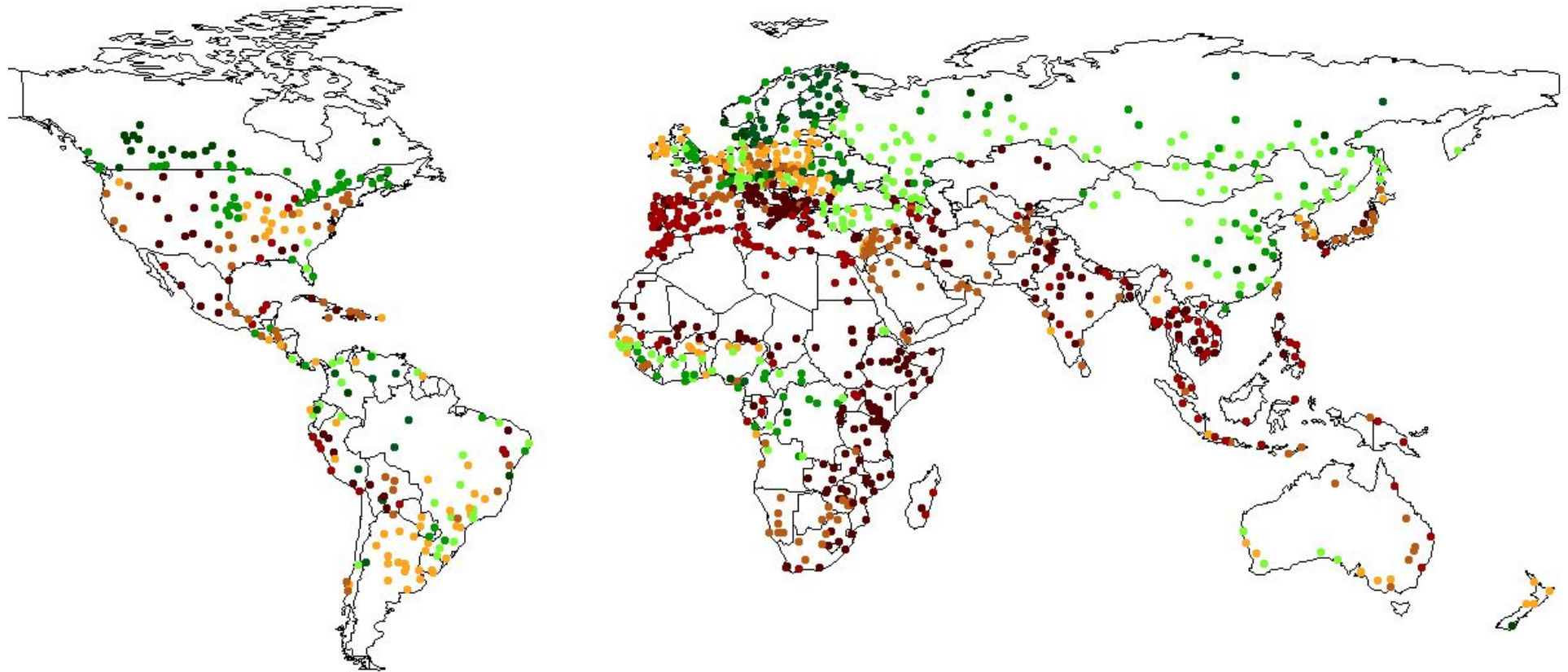
Scenario A1B_11

Agricultural productivity changes (% of baseline)



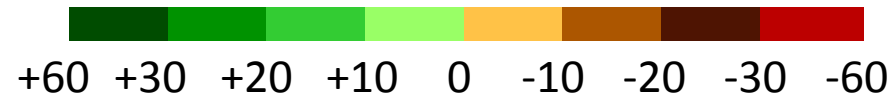
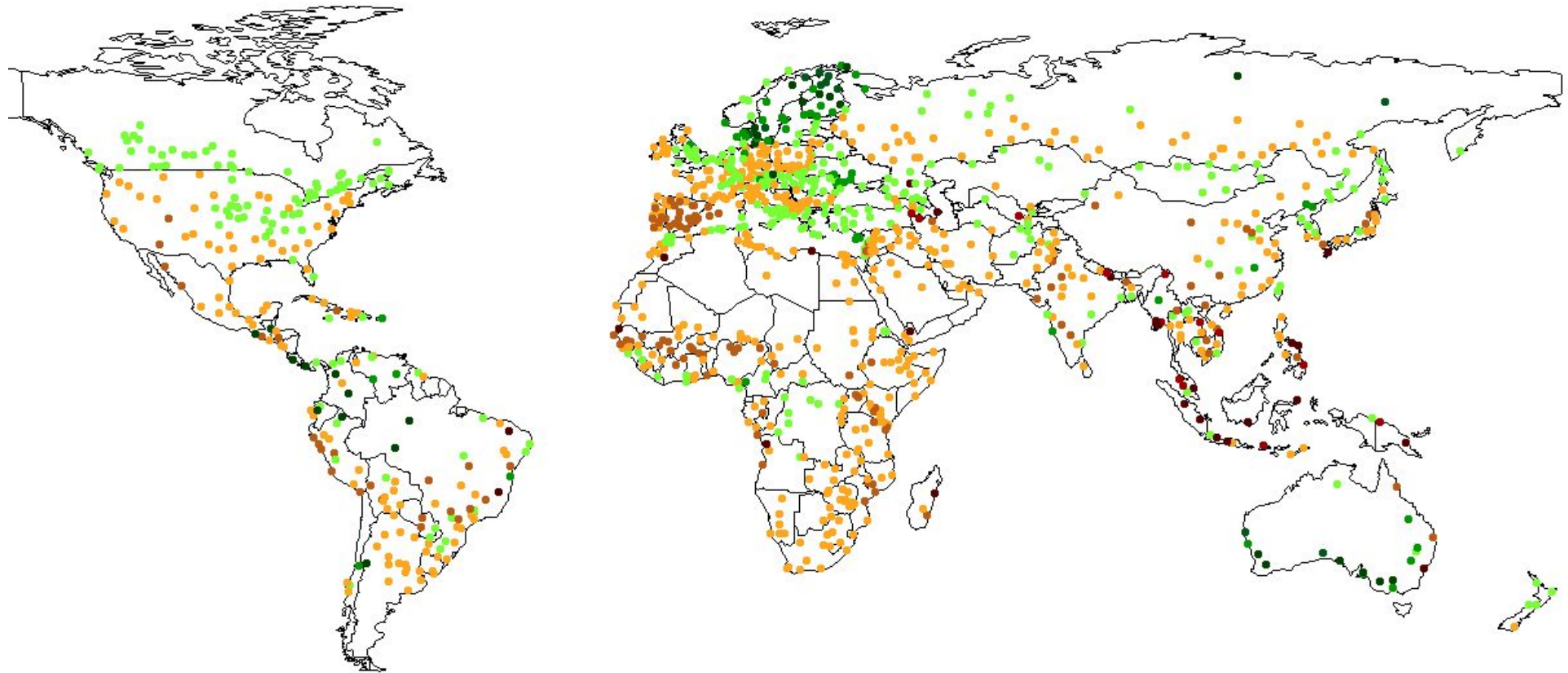
Scenario A1B_12

Agricultural productivity changes (% of baseline)



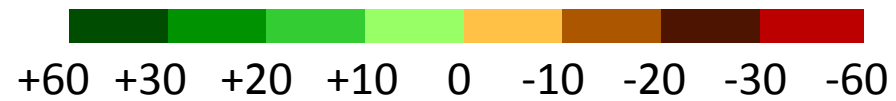
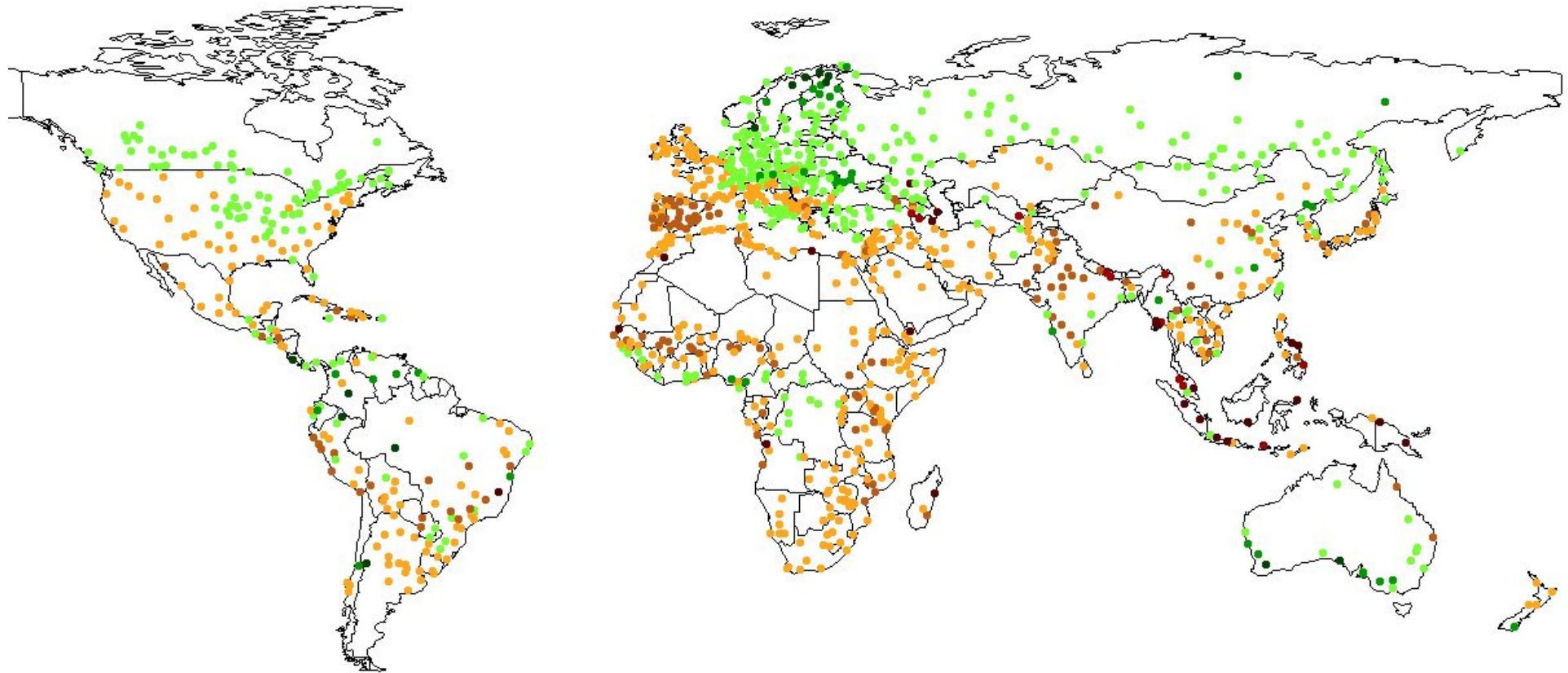
Scenario E1_1

Agricultural productivity changes (% of baseline)



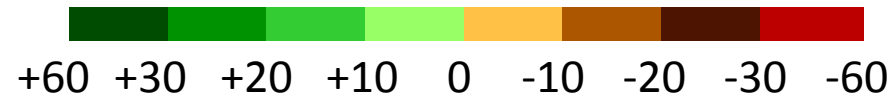
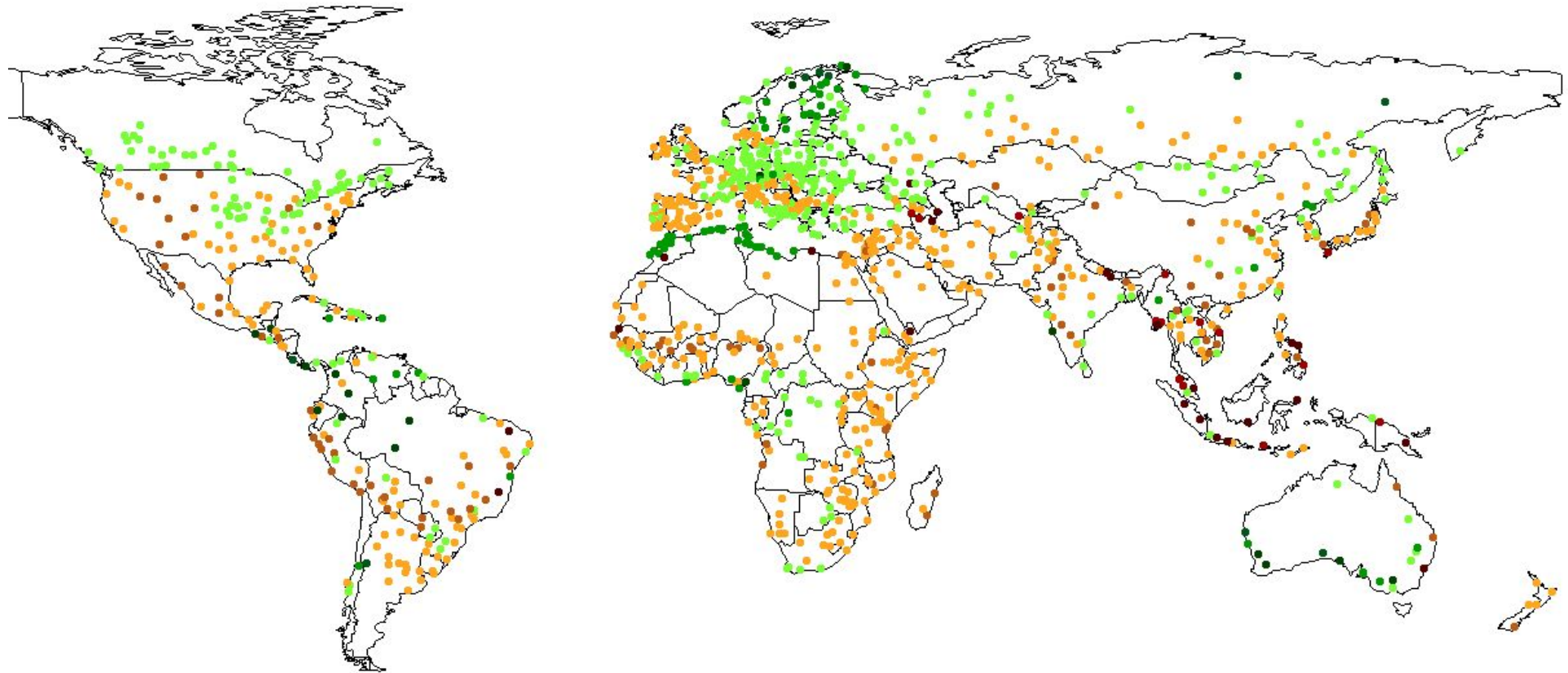
Scenario E1_2

Agricultural productivity changes (% of baseline)



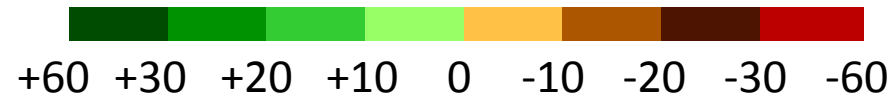
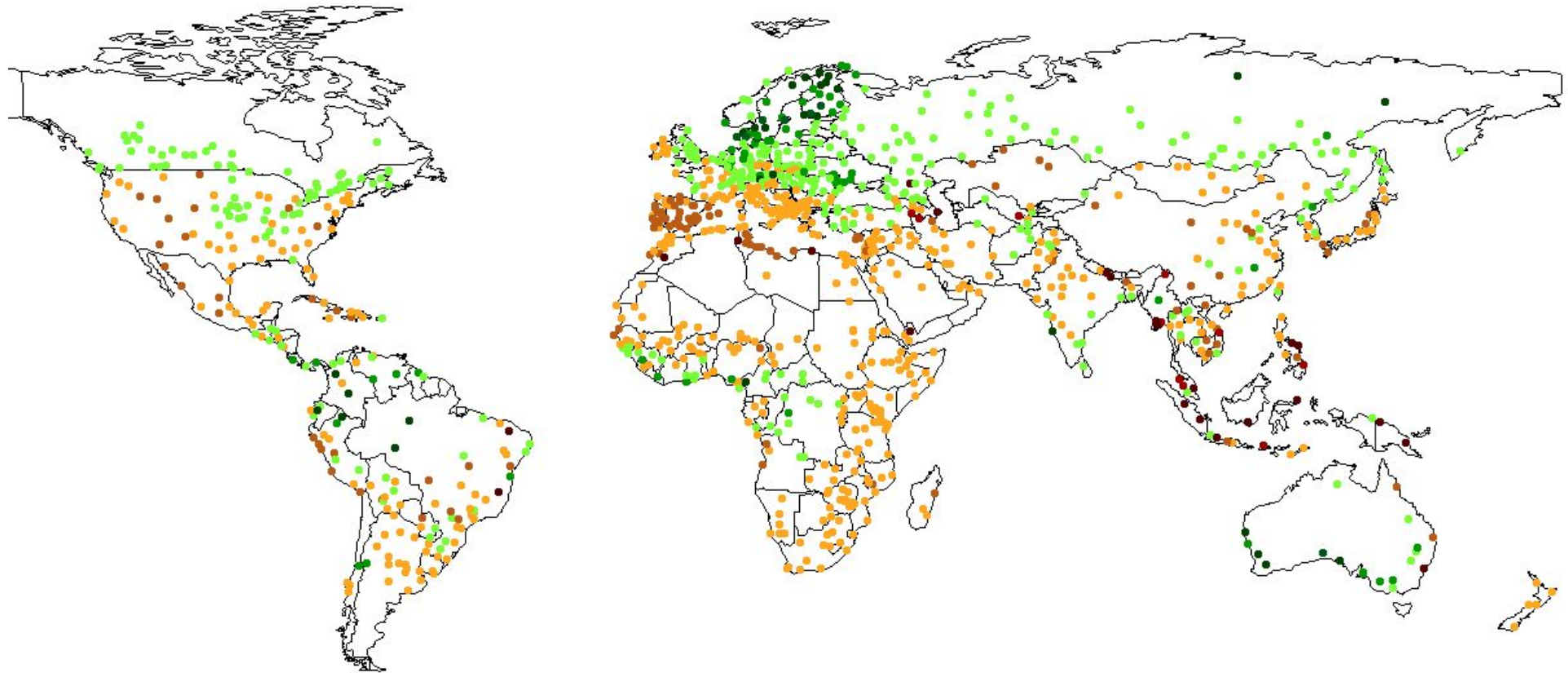
Scenario E1_3

Agricultural productivity changes (% of baseline)



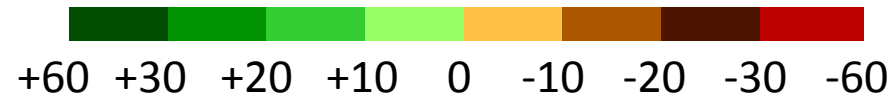
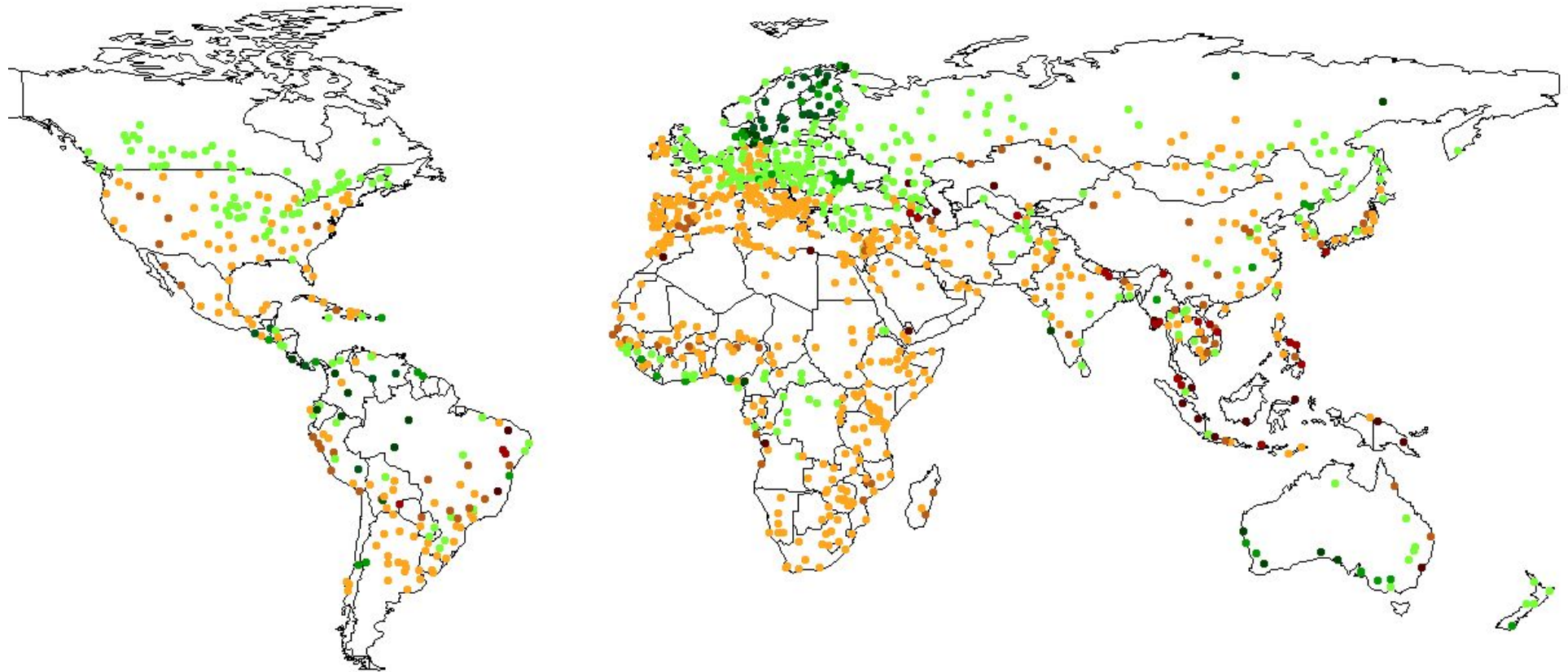
Scenario E1_4

Agricultural productivity changes (% of baseline)



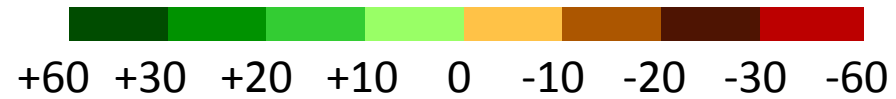
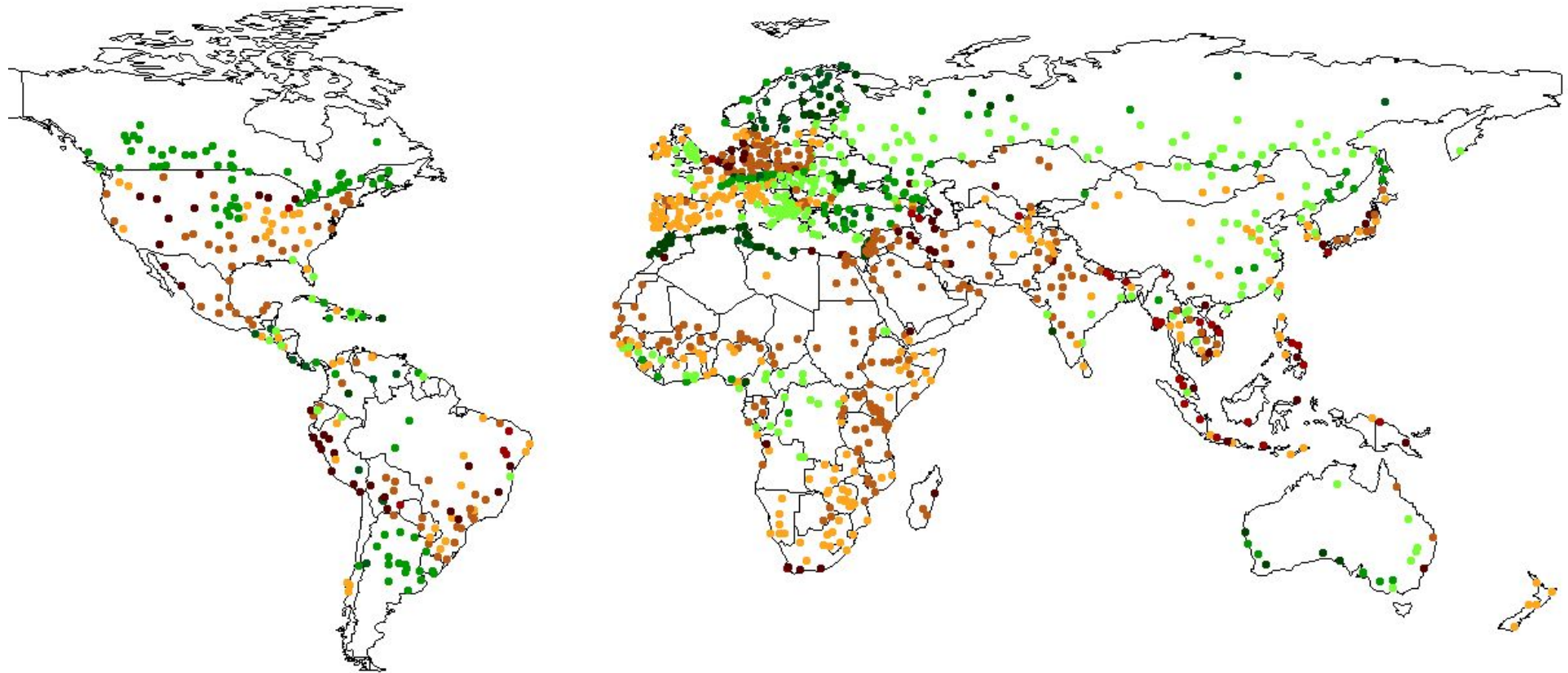
Scenario E1_5

Agricultural productivity changes (% of baseline)



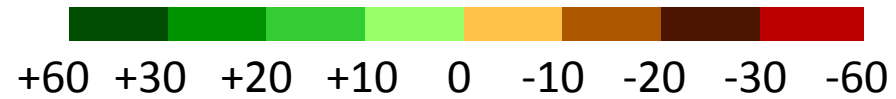
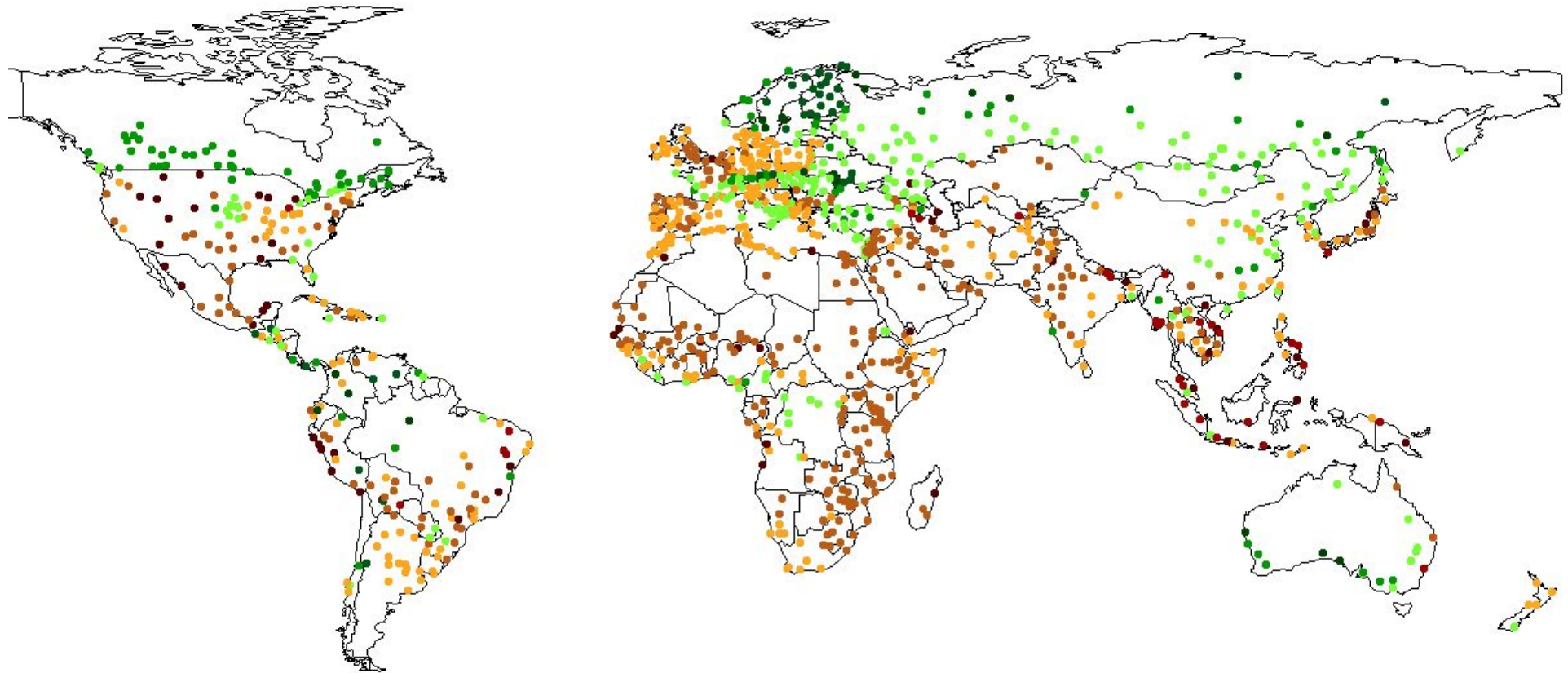
Scenario E1_6

Agricultural productivity changes (% of baseline)



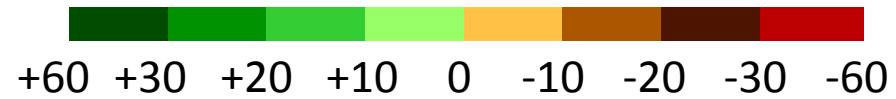
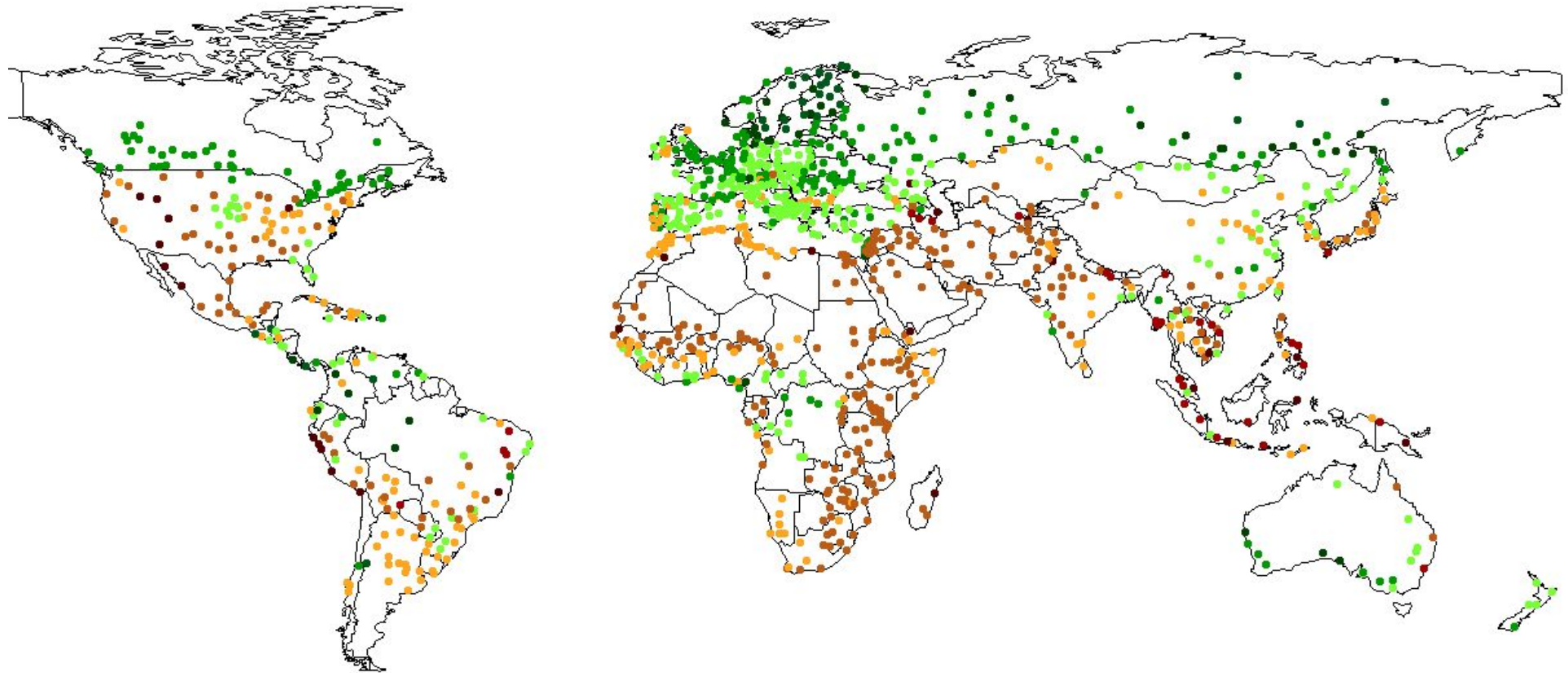
Scenario E1_7

Agricultural productivity changes (% of baseline)



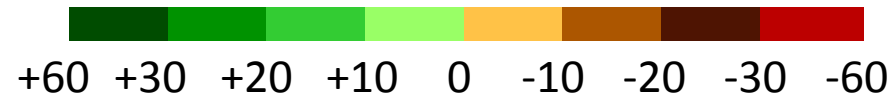
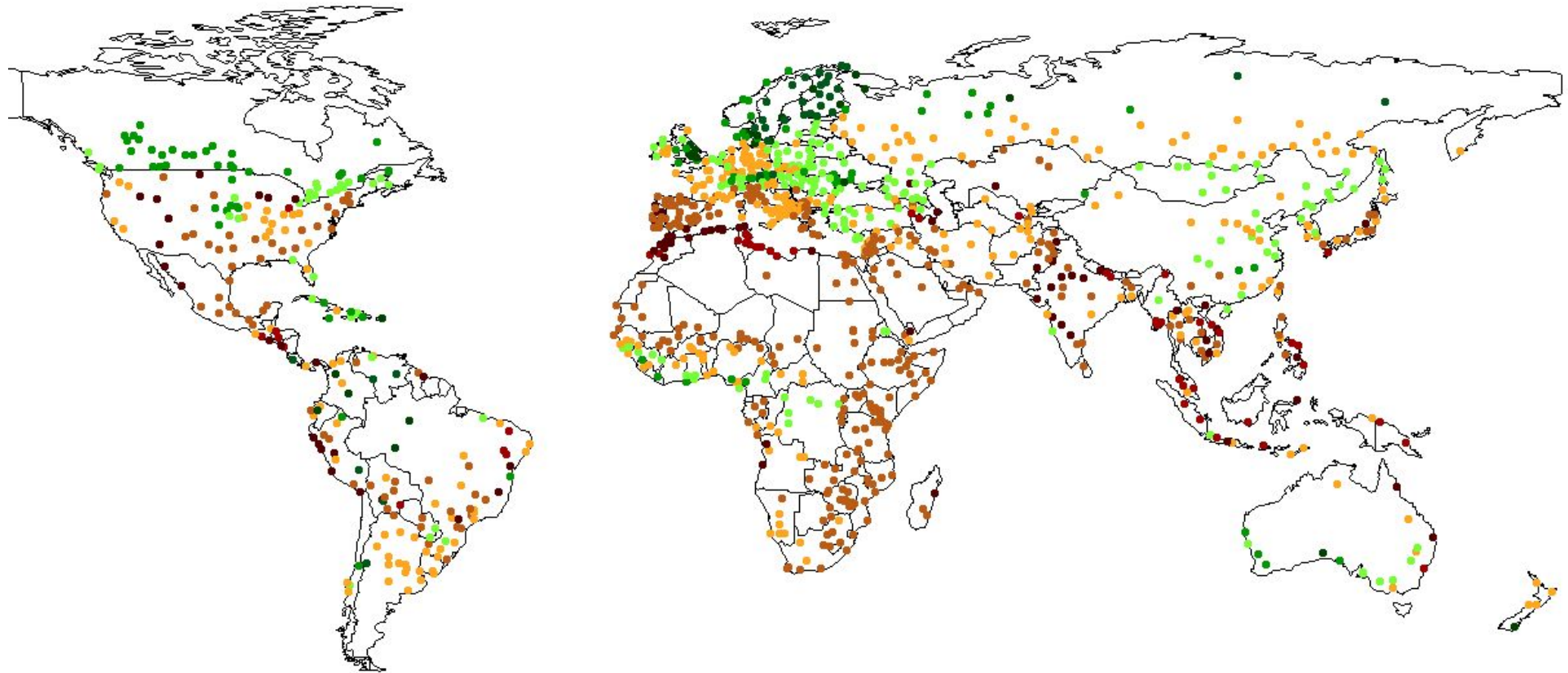
Scenario E1_8

Agricultural productivity changes (% of baseline)



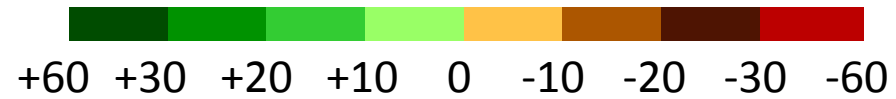
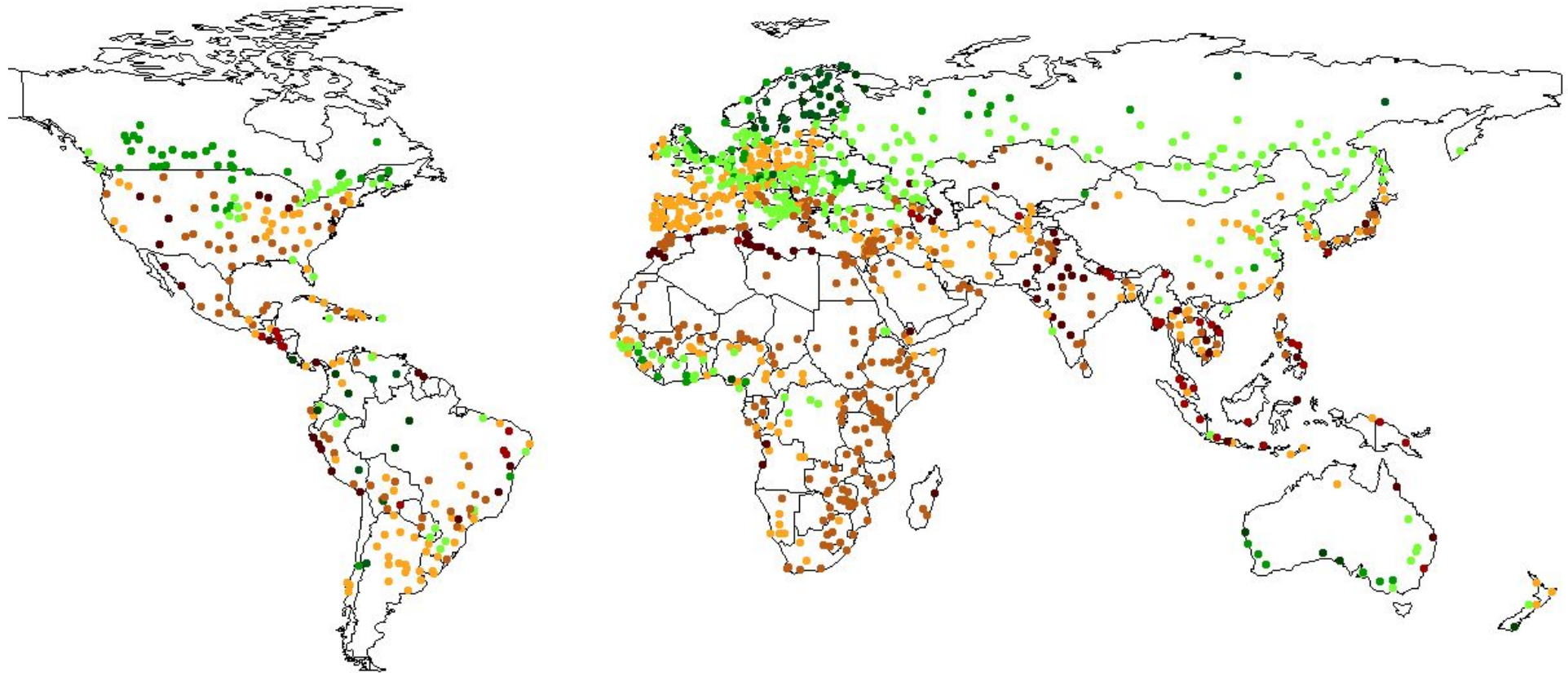
Scenario E1_9

Agricultural productivity changes (% of baseline)



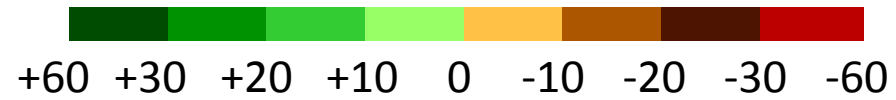
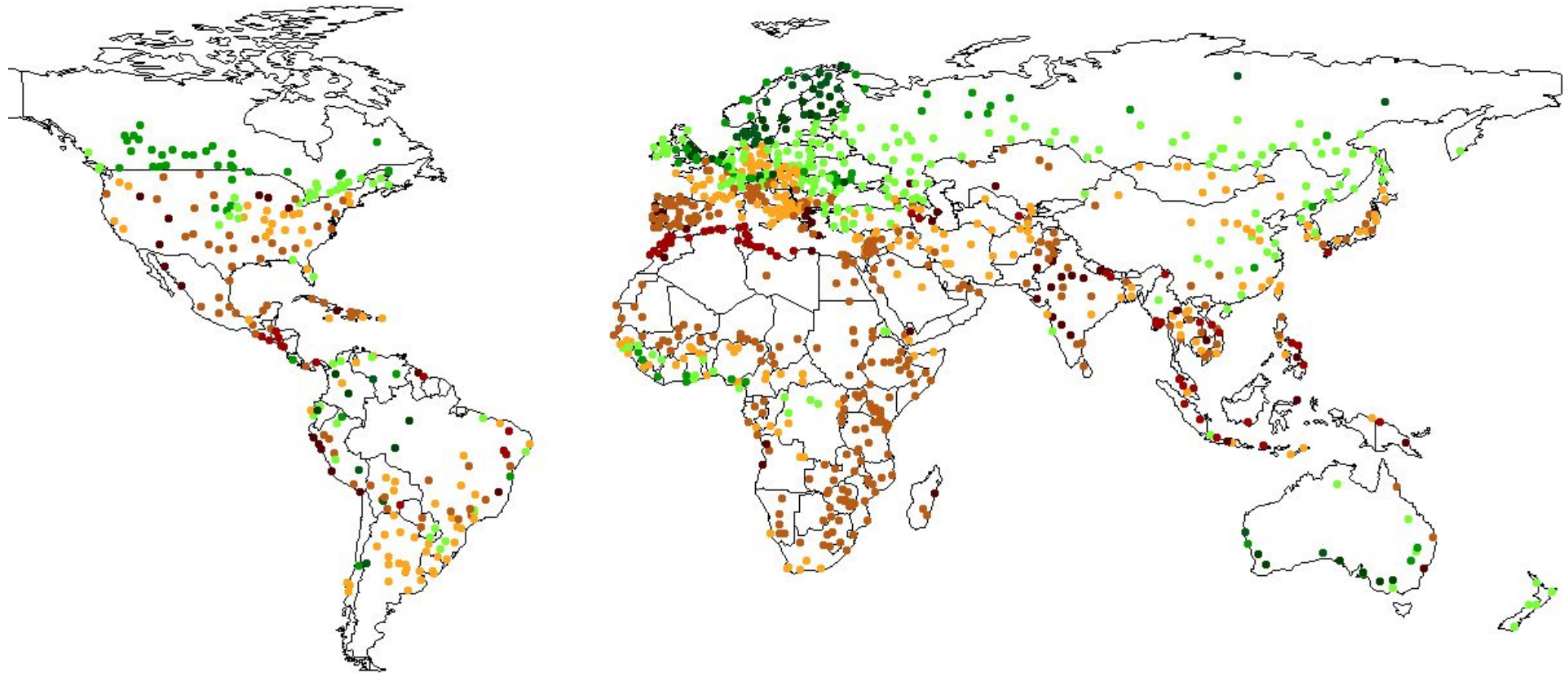
Scenario E1_10

Agricultural productivity changes (% of baseline)



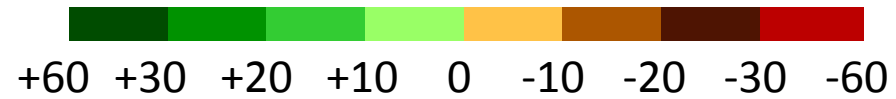
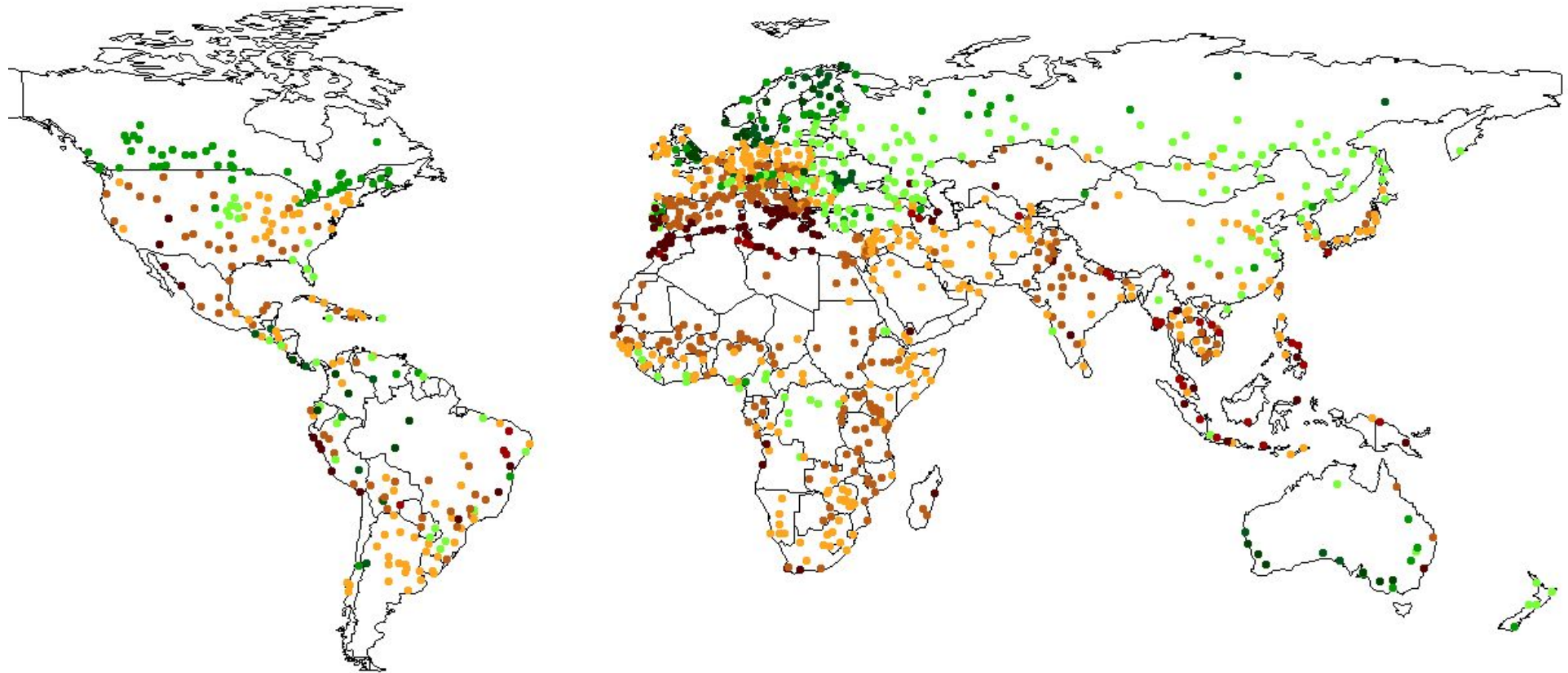
Scenario E1_11

Agricultural productivity changes (% of baseline)



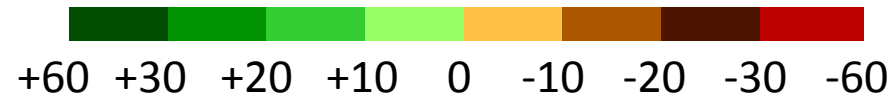
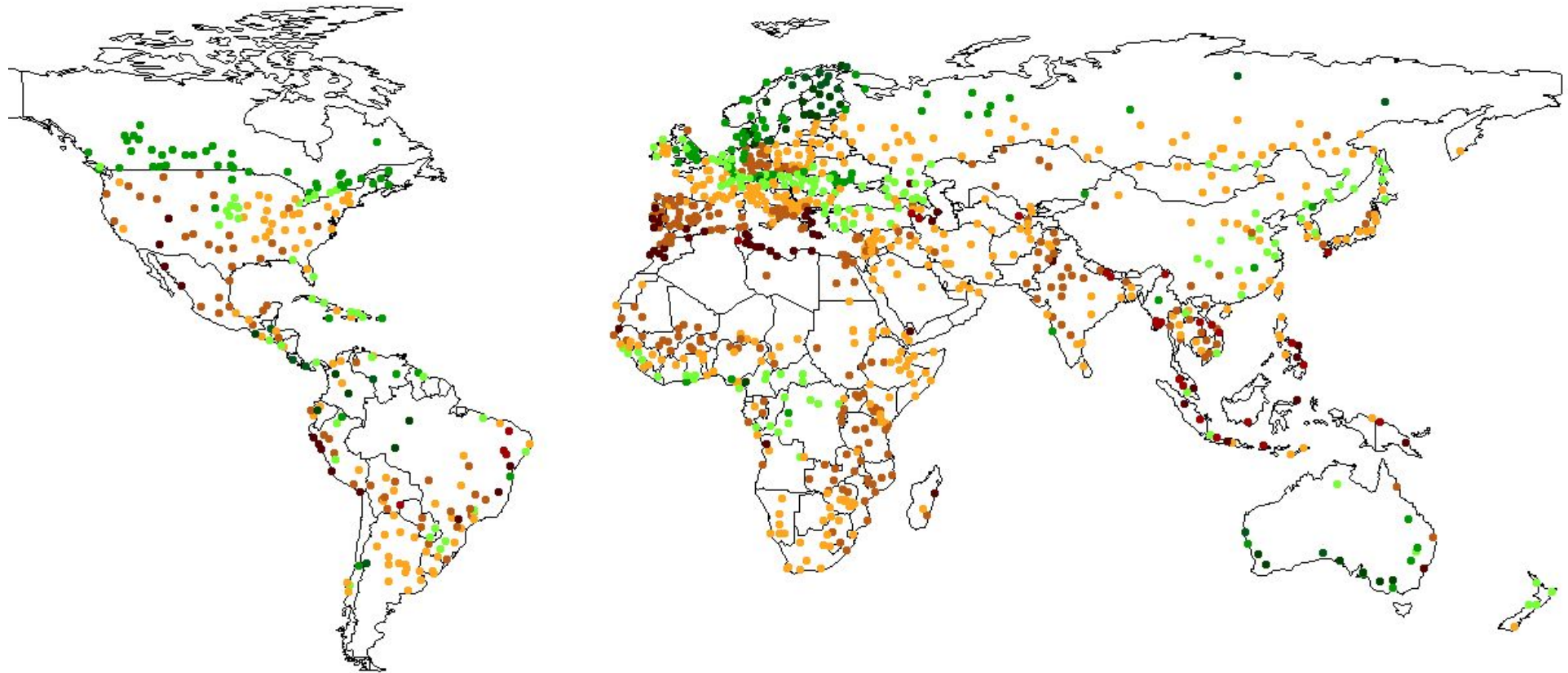
Scenario E1_12

Agricultural productivity changes (% of baseline)



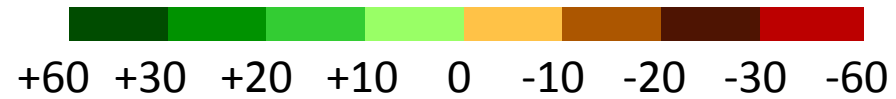
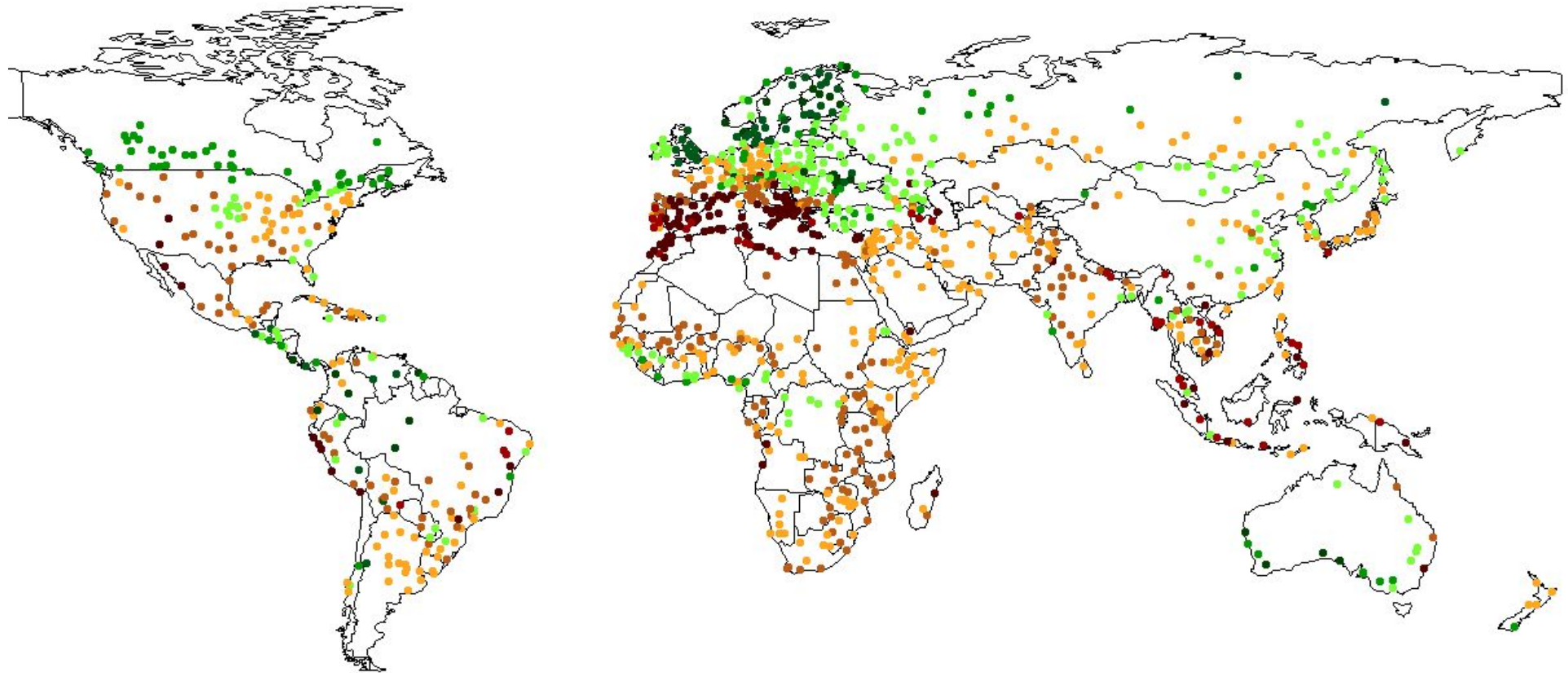
Scenario E1_13

Agricultural productivity changes (% of baseline)



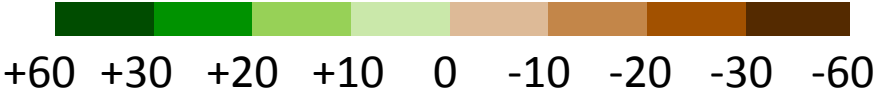
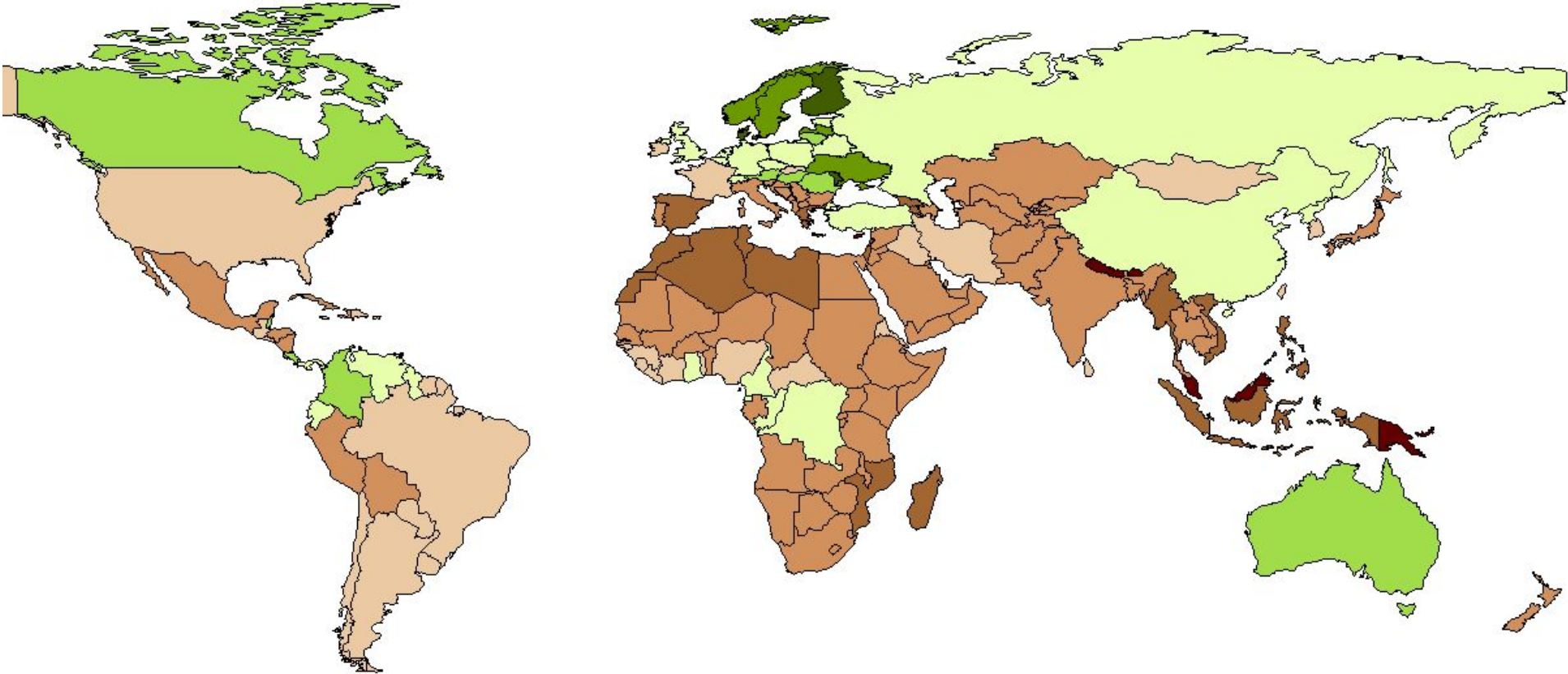
Scenario E1_14

Agricultural productivity changes (% of baseline)



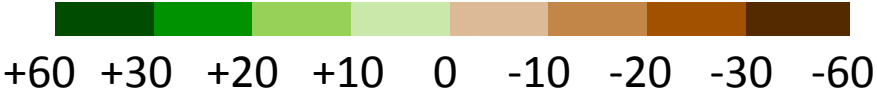
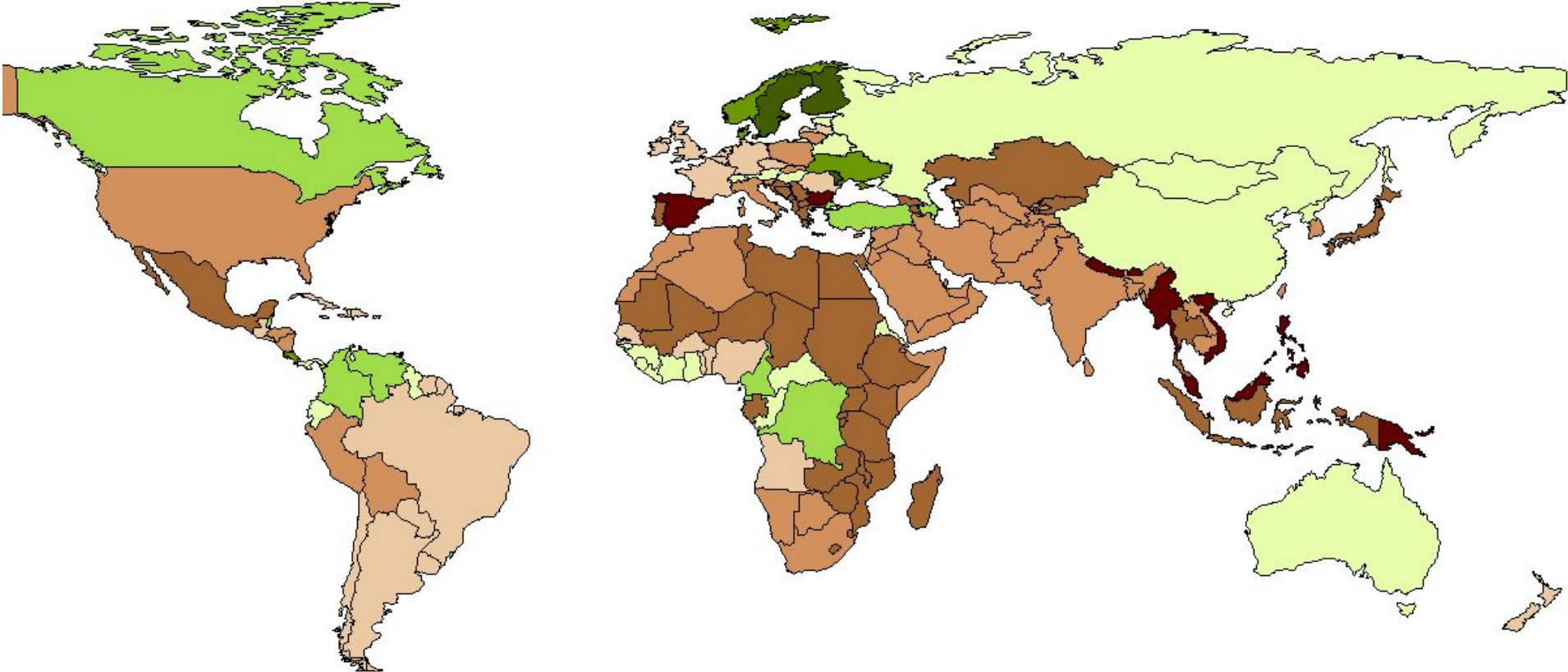
Scenario A1B _1

Agricultural productivity changes (% of baseline)



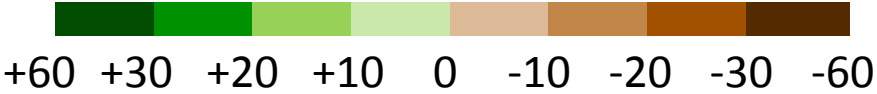
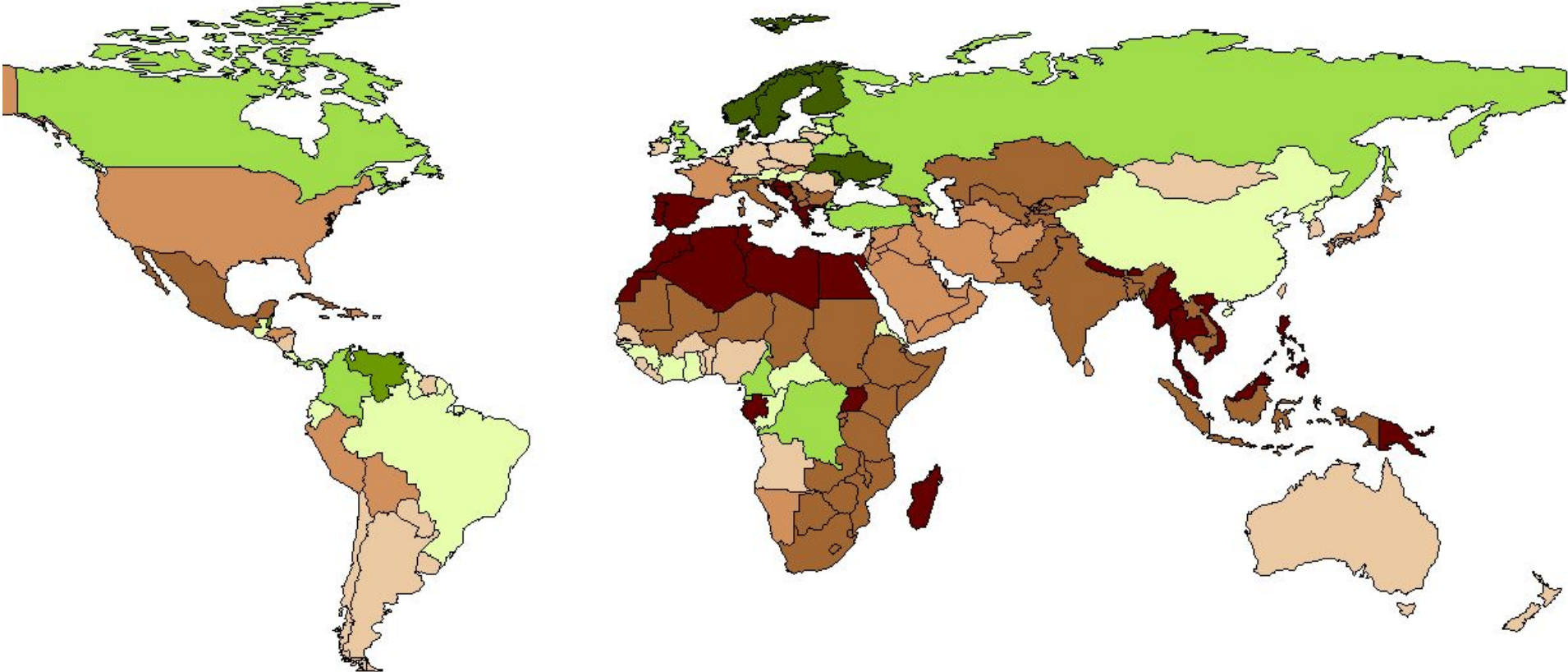
Scenario A1B _2

Agricultural productivity changes (% of baseline)



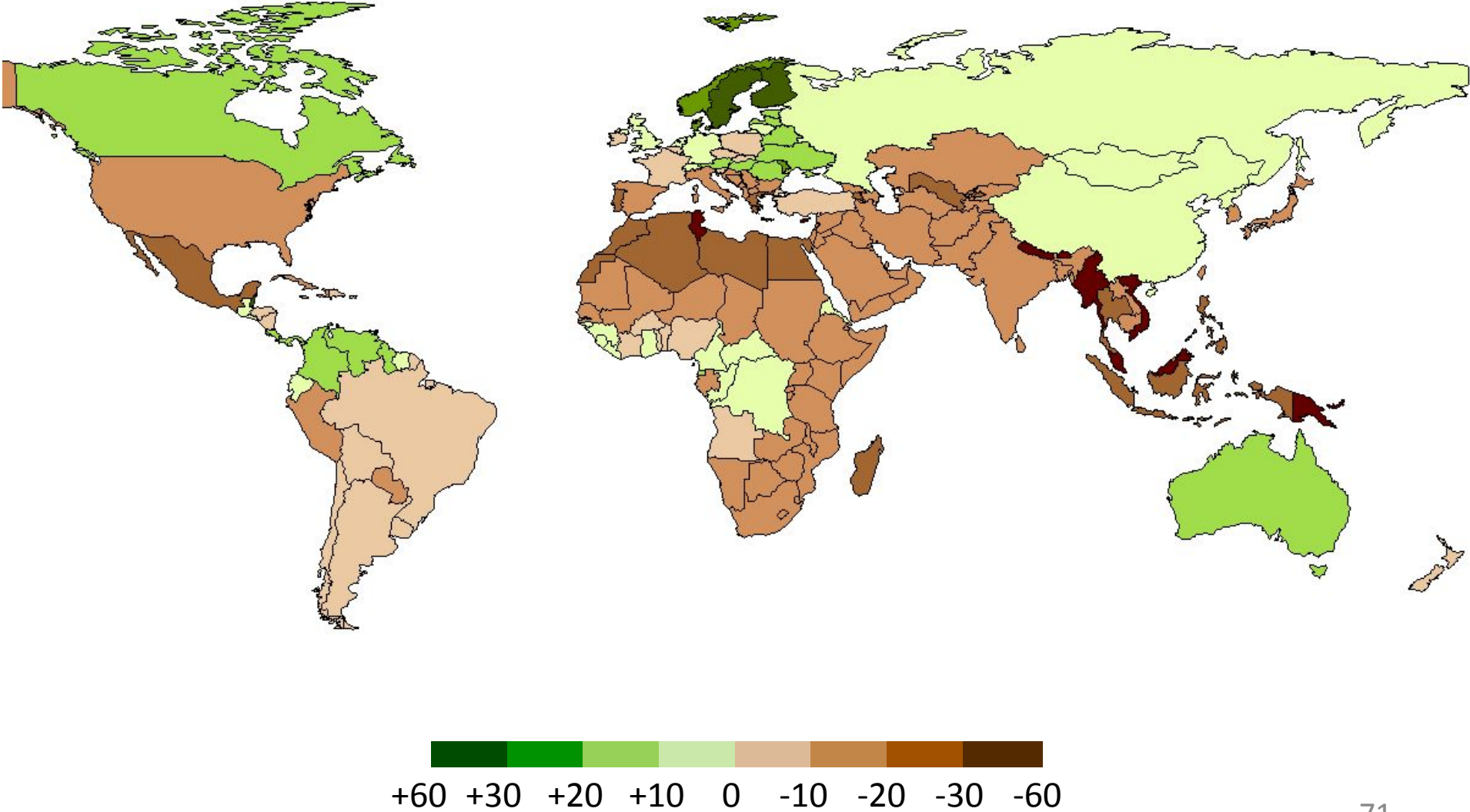
Scenario A1B_3

Agricultural productivity changes (% of baseline)



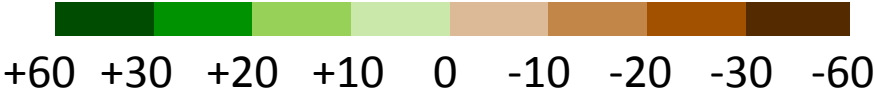
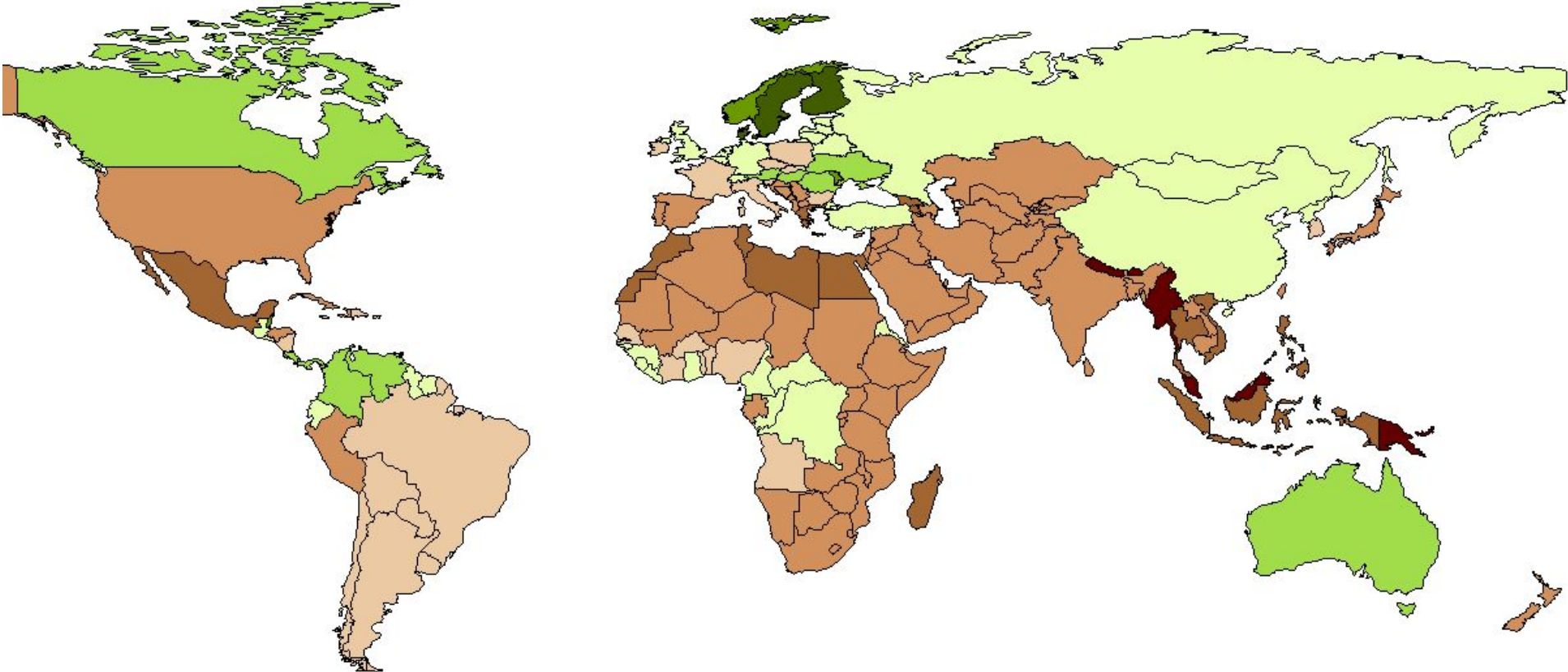
Scenario A1B_4

Agricultural productivity changes (% of baseline)



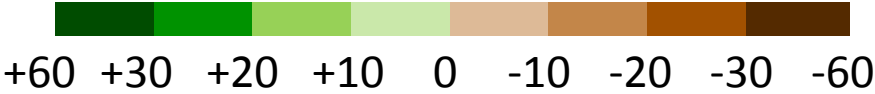
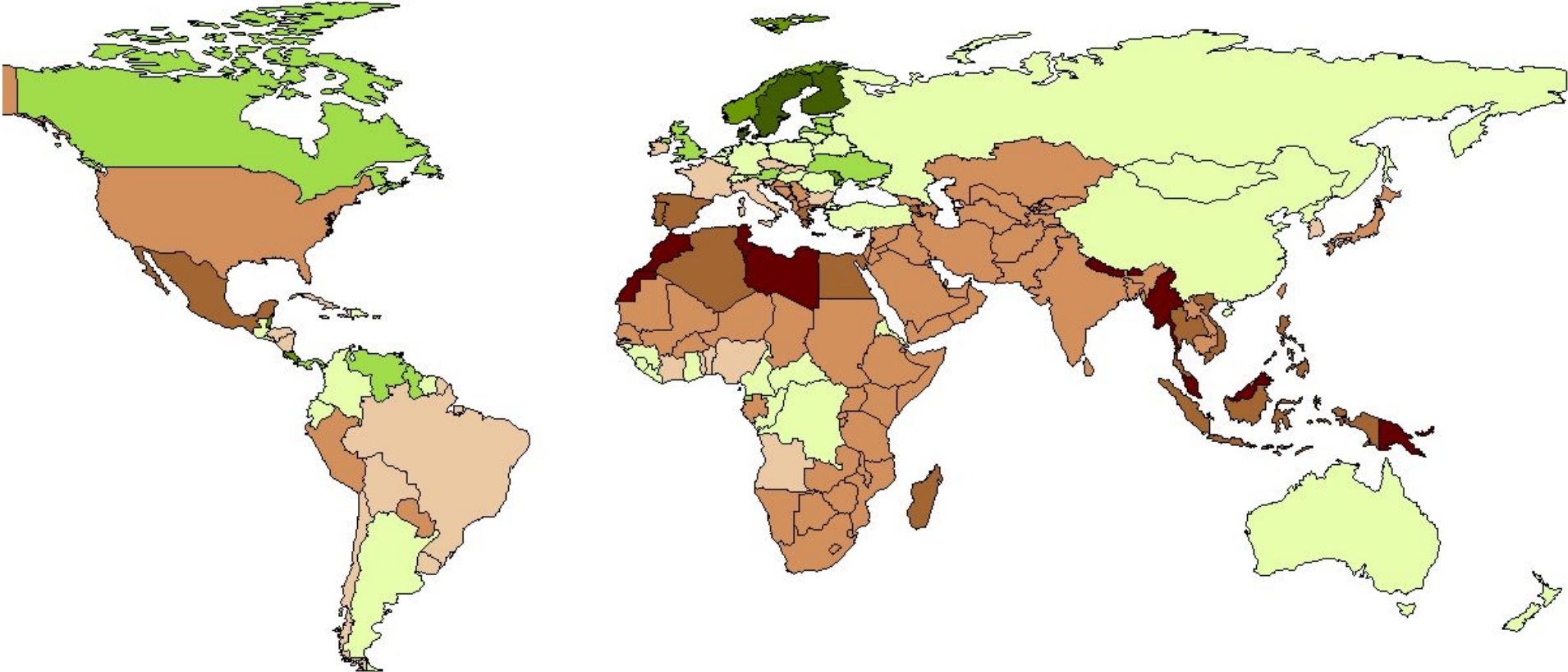
Scenario A1B_5

Agricultural productivity changes (% of baseline)



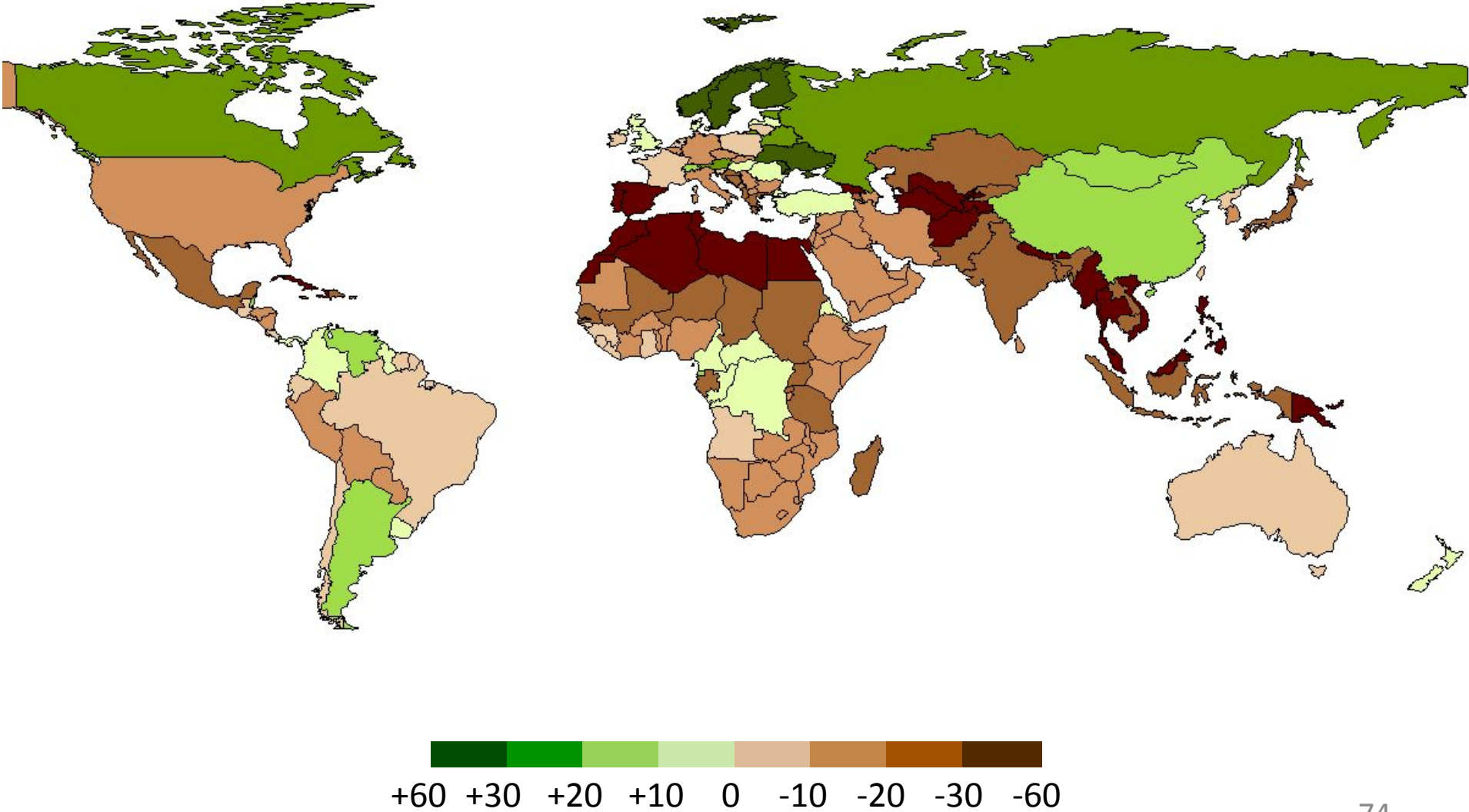
Scenario A1B_6

Agricultural productivity changes (% of baseline)



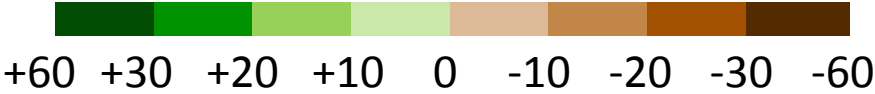
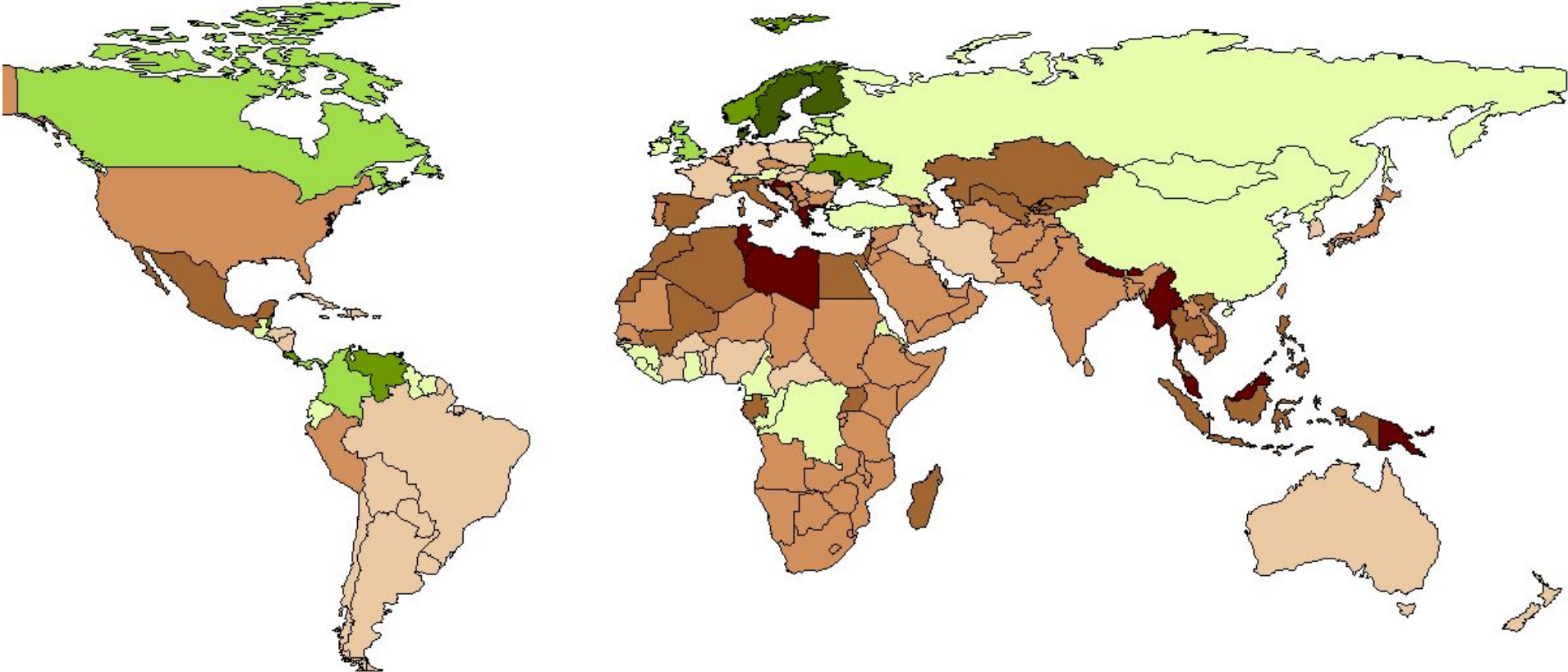
Scenario A1B_7

Agricultural productivity changes (% of baseline)



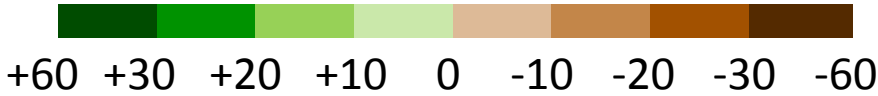
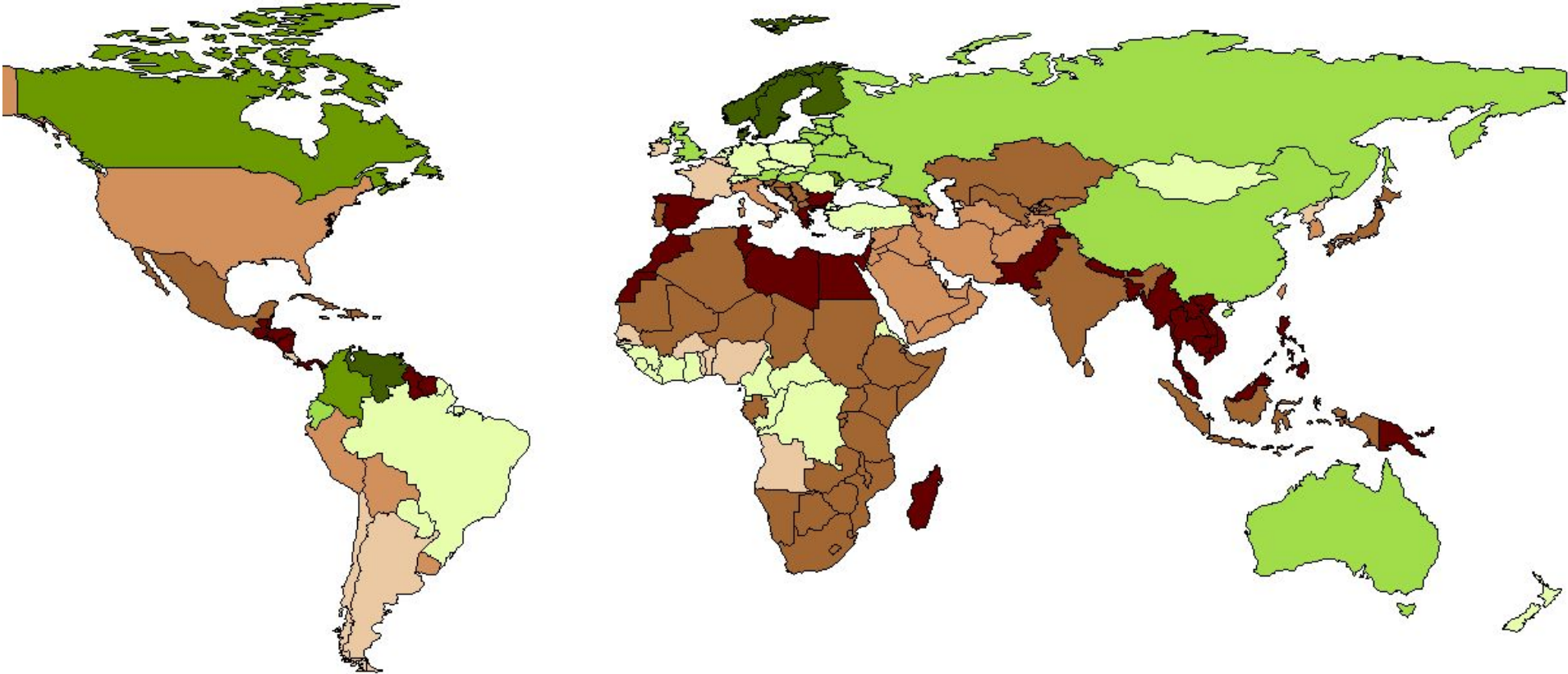
Scenario A1B_8

Agricultural productivity changes (% of baseline)



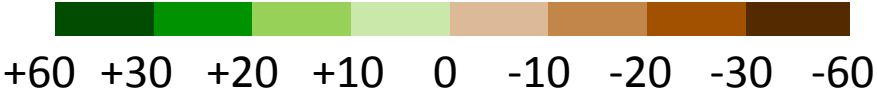
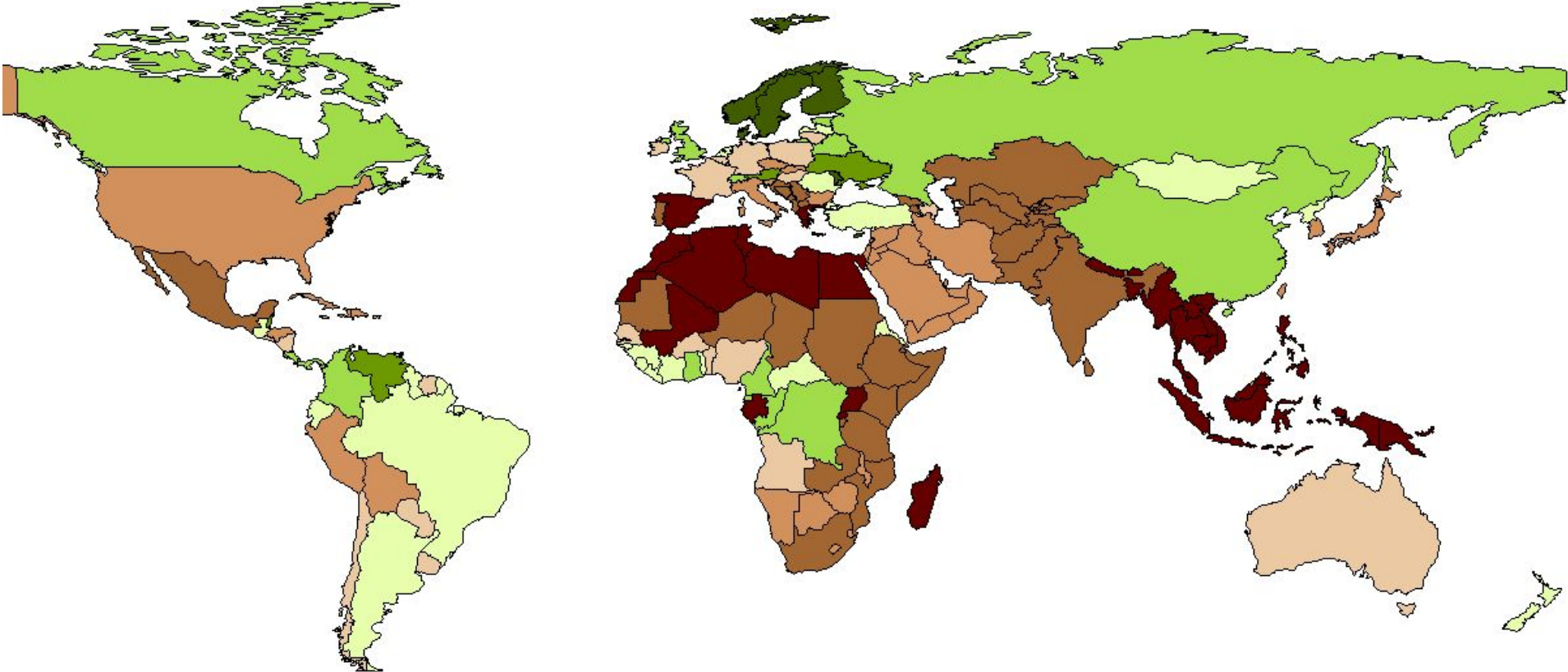
Scenario A1B_9

Agricultural productivity changes (% of baseline)



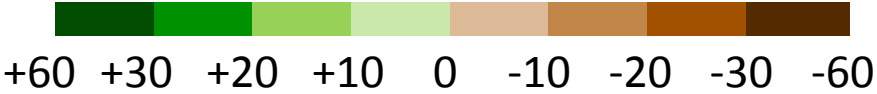
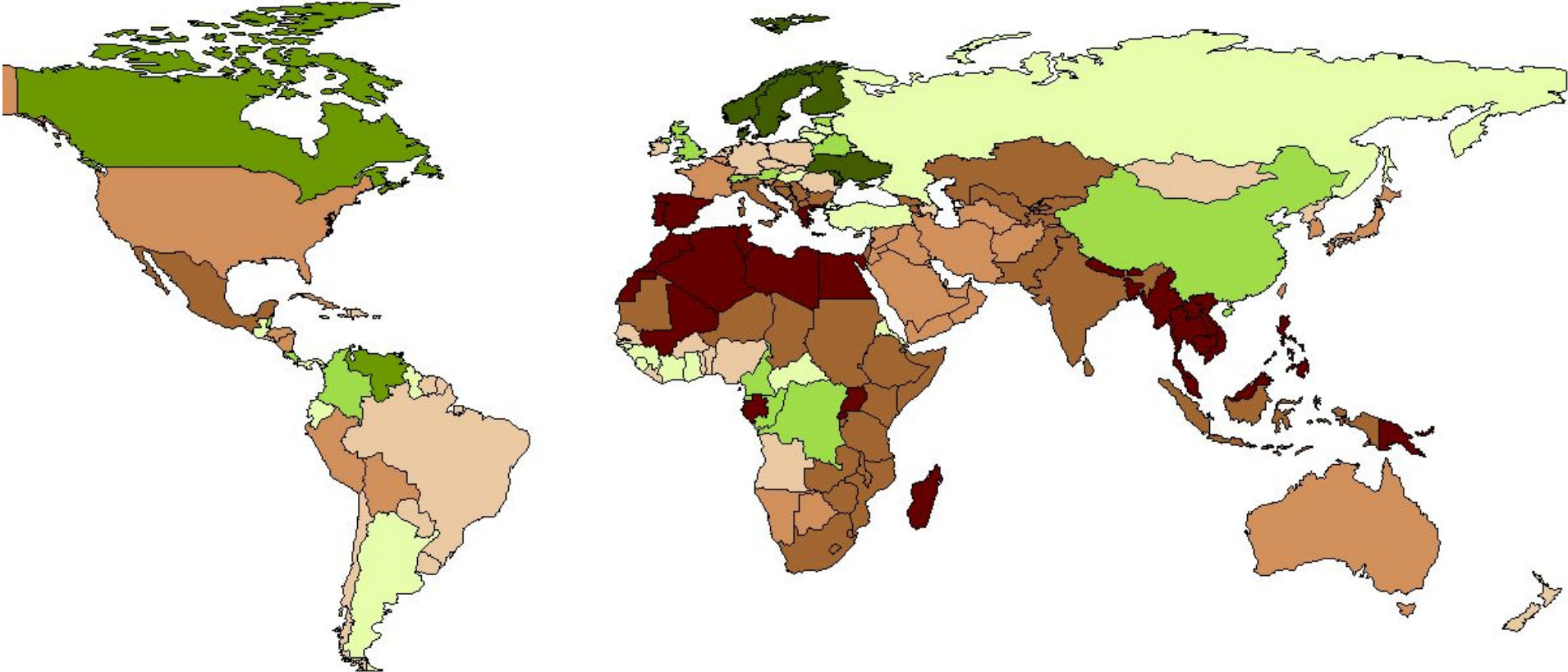
Scenario A1B_10

Agricultural productivity changes (% of baseline)



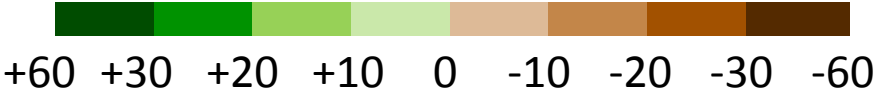
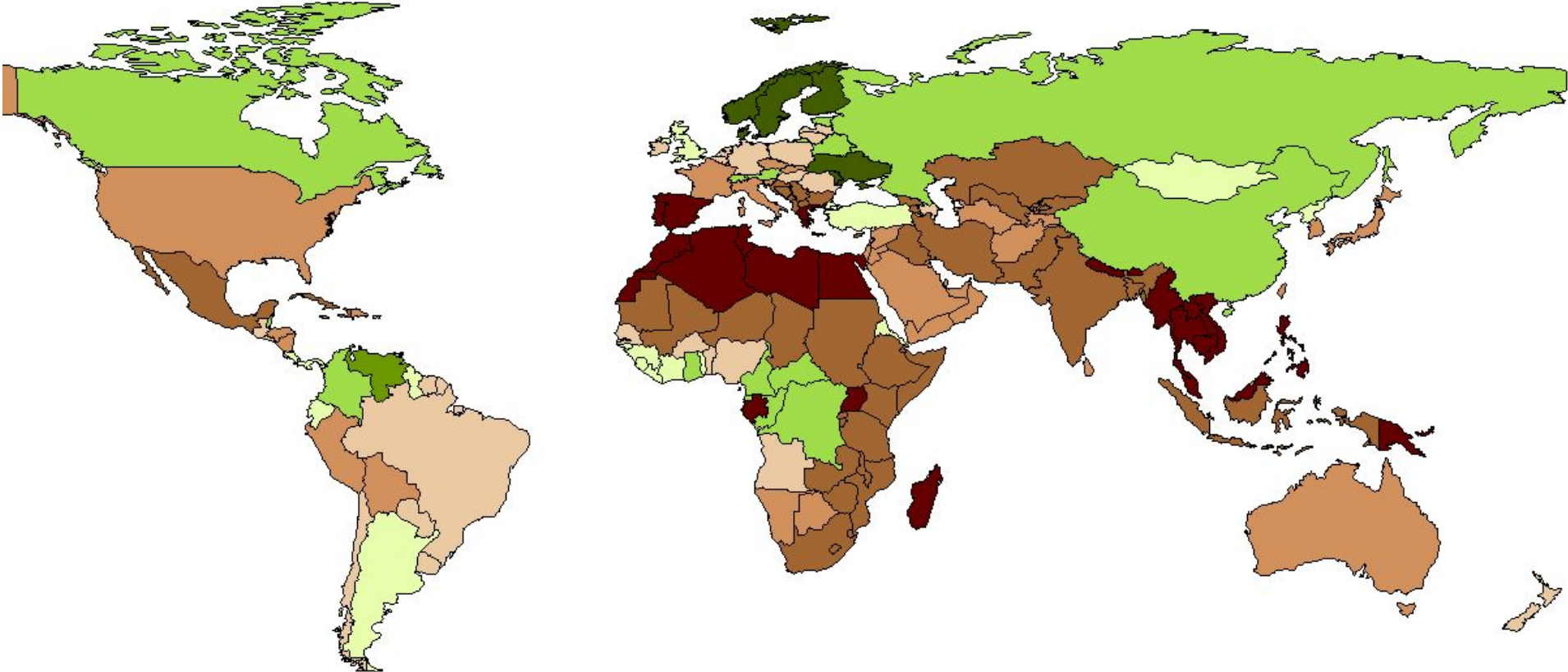
Scenario A1B_11

Agricultural productivity changes (% of baseline)



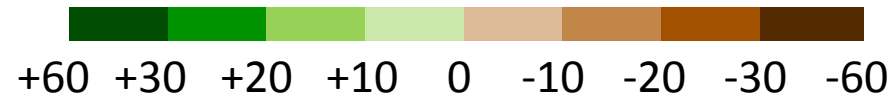
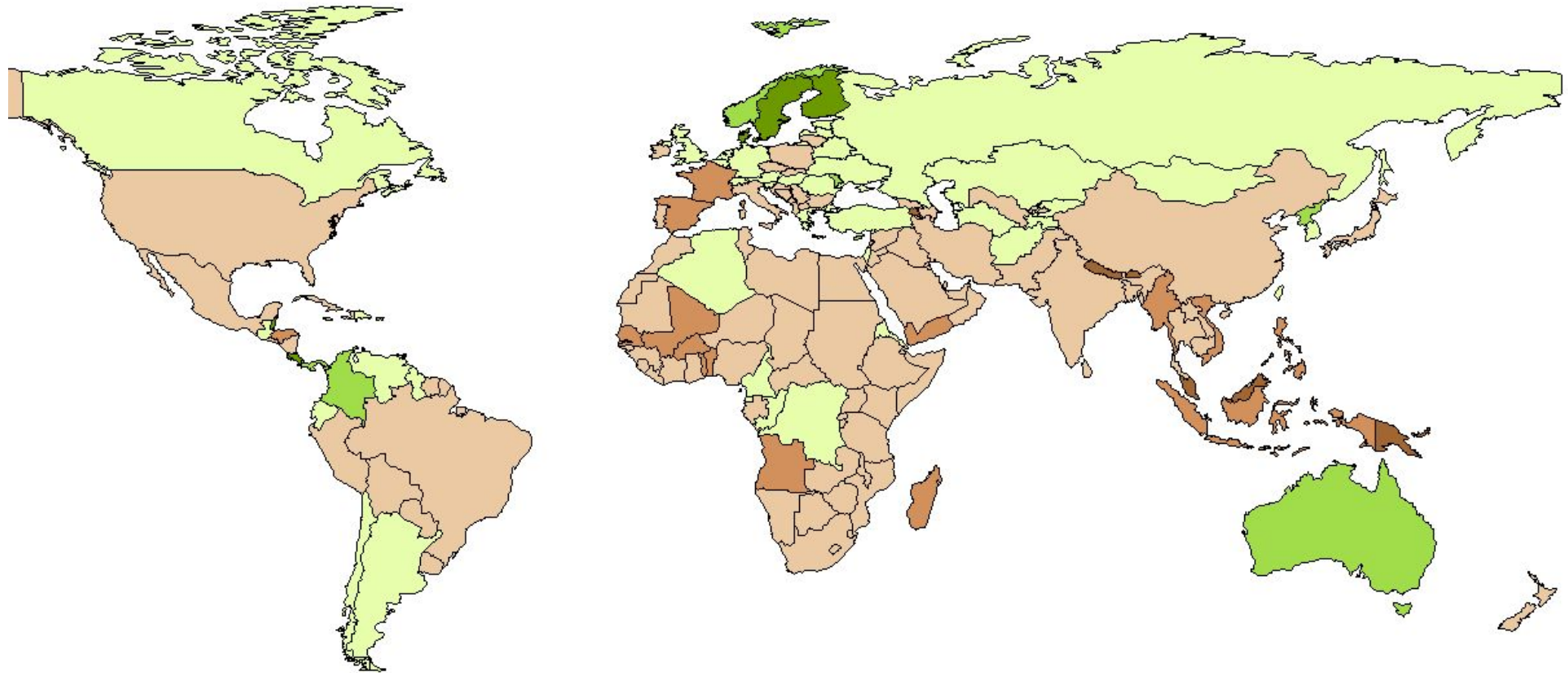
Scenario A1B_12

Agricultural productivity changes (% of baseline)



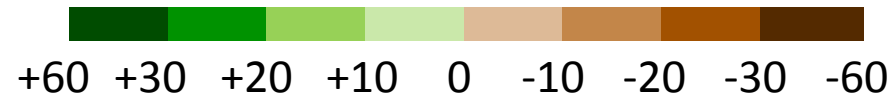
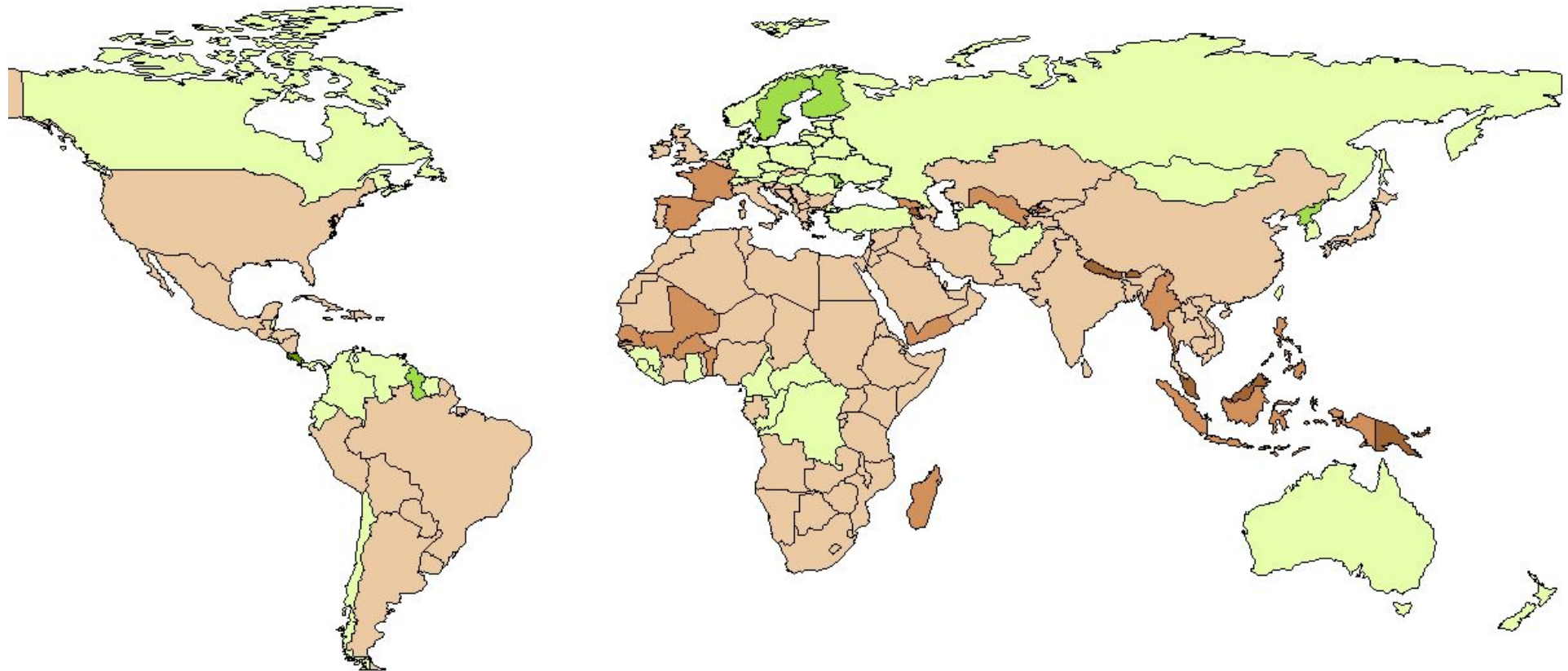
Scenario E1_1

Agricultural productivity changes (% of baseline)



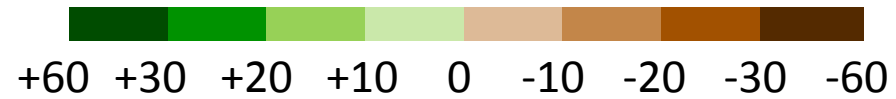
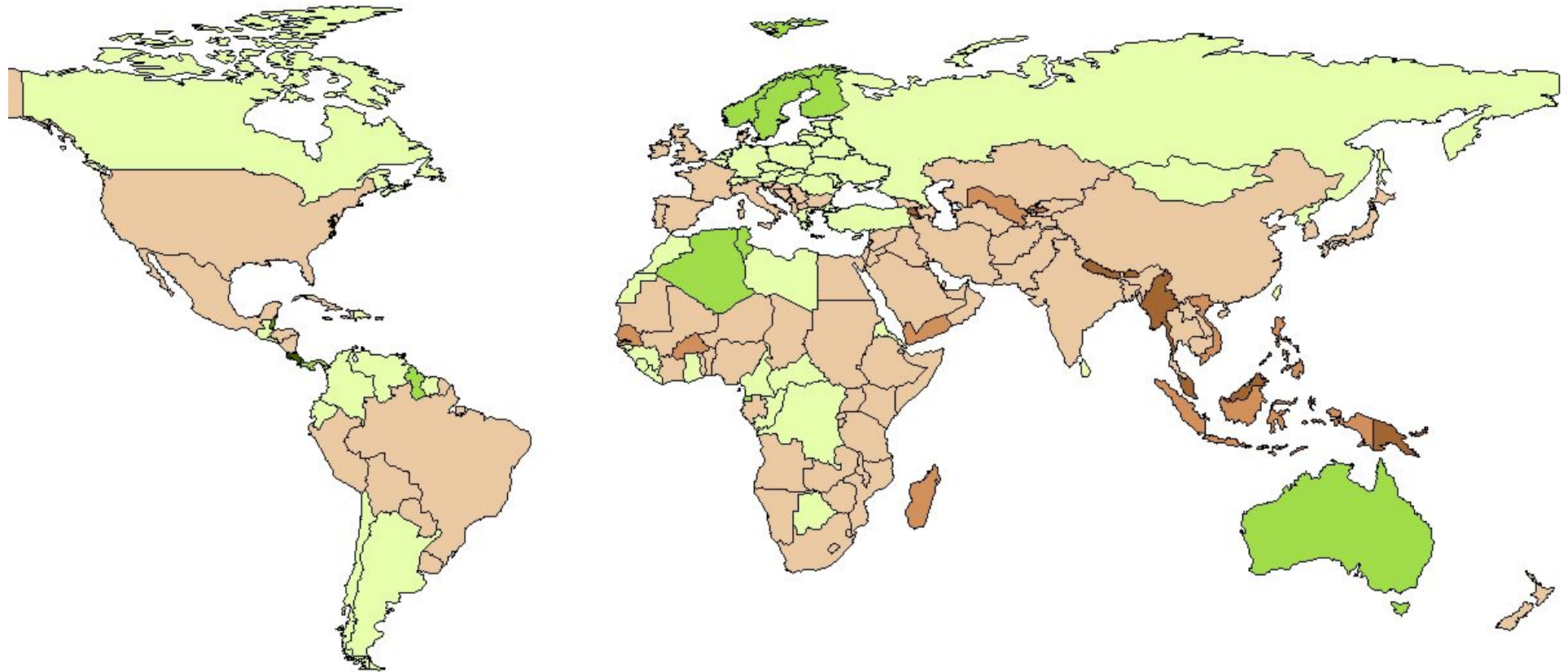
Scenario E1_2

Agricultural productivity changes (% of baseline)



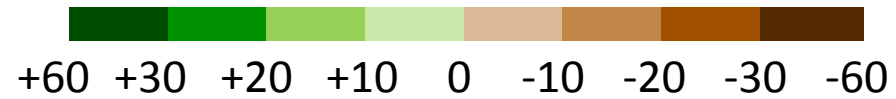
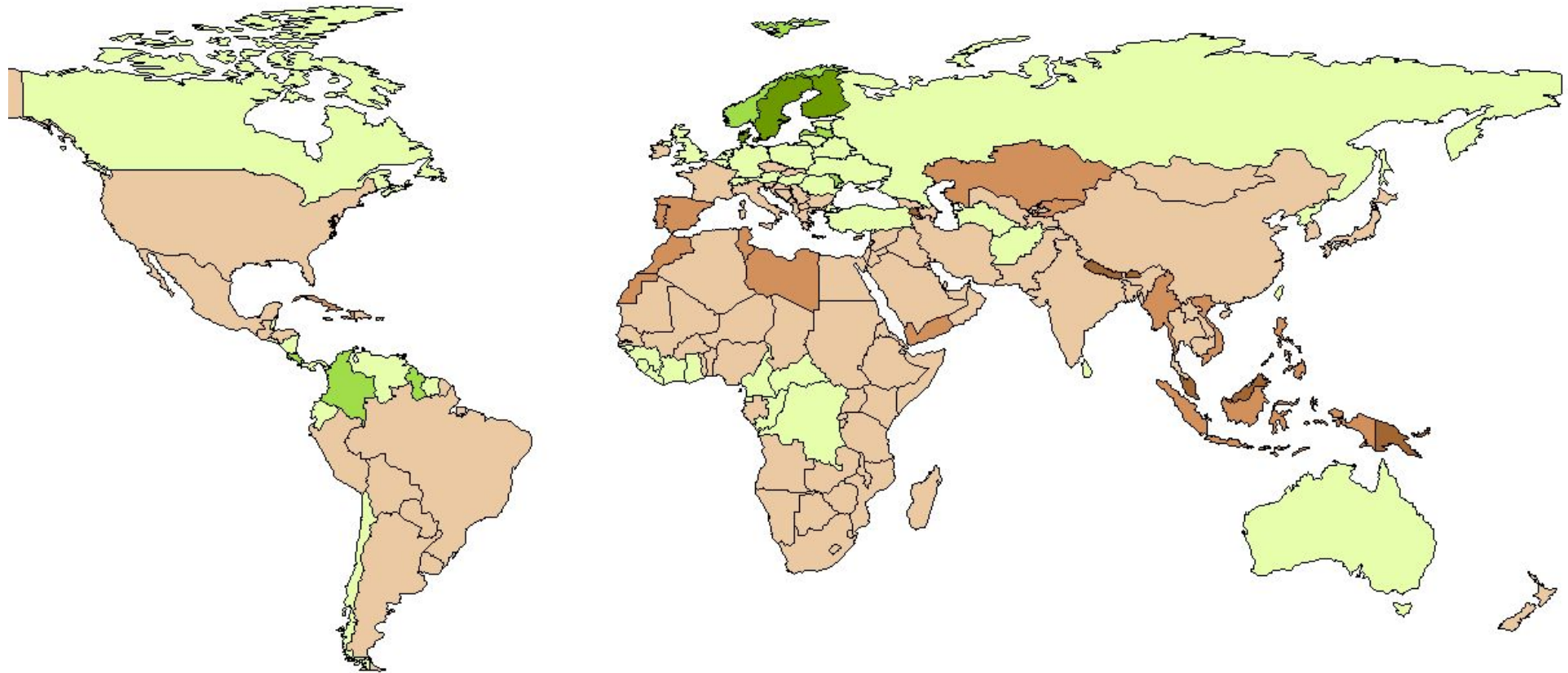
Scenario E1_3

Agricultural productivity changes (% of baseline)



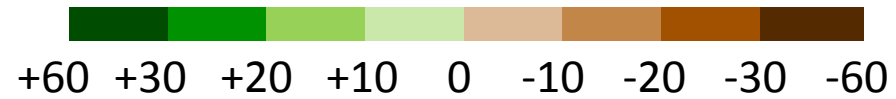
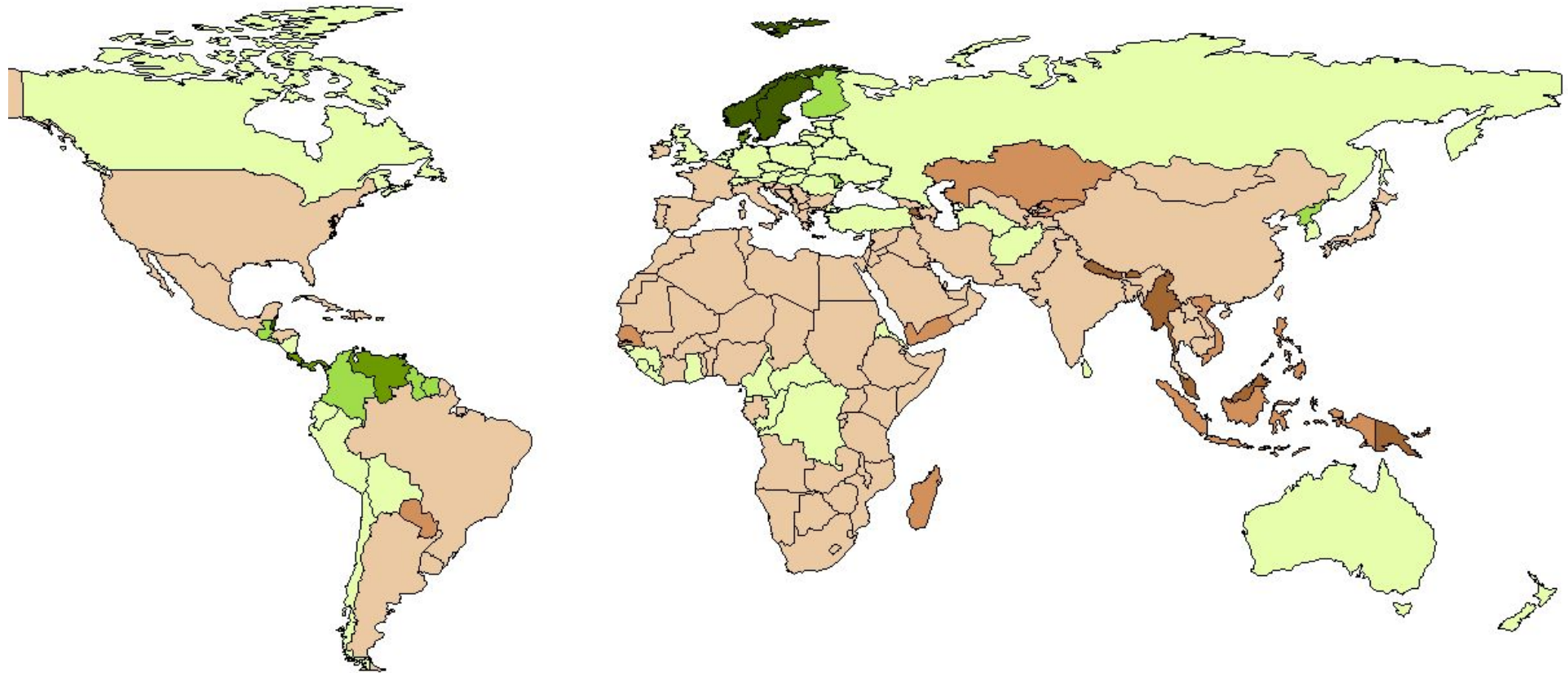
Scenario E1_4

Agricultural productivity changes (% of baseline)



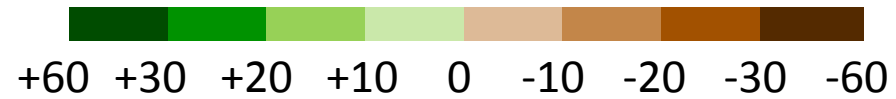
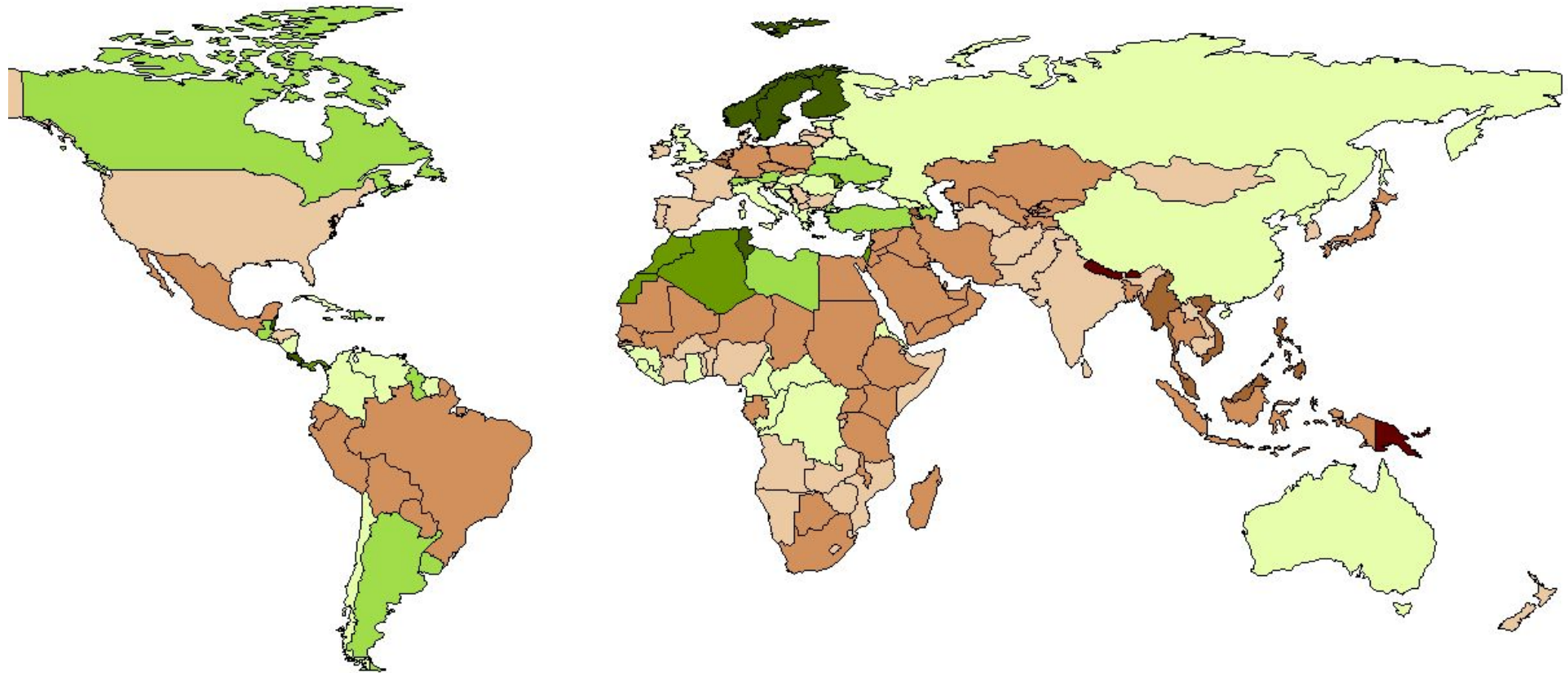
Scenario E1_5

Agricultural productivity changes (% of baseline)



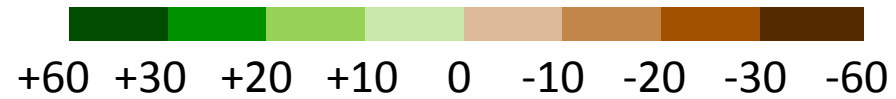
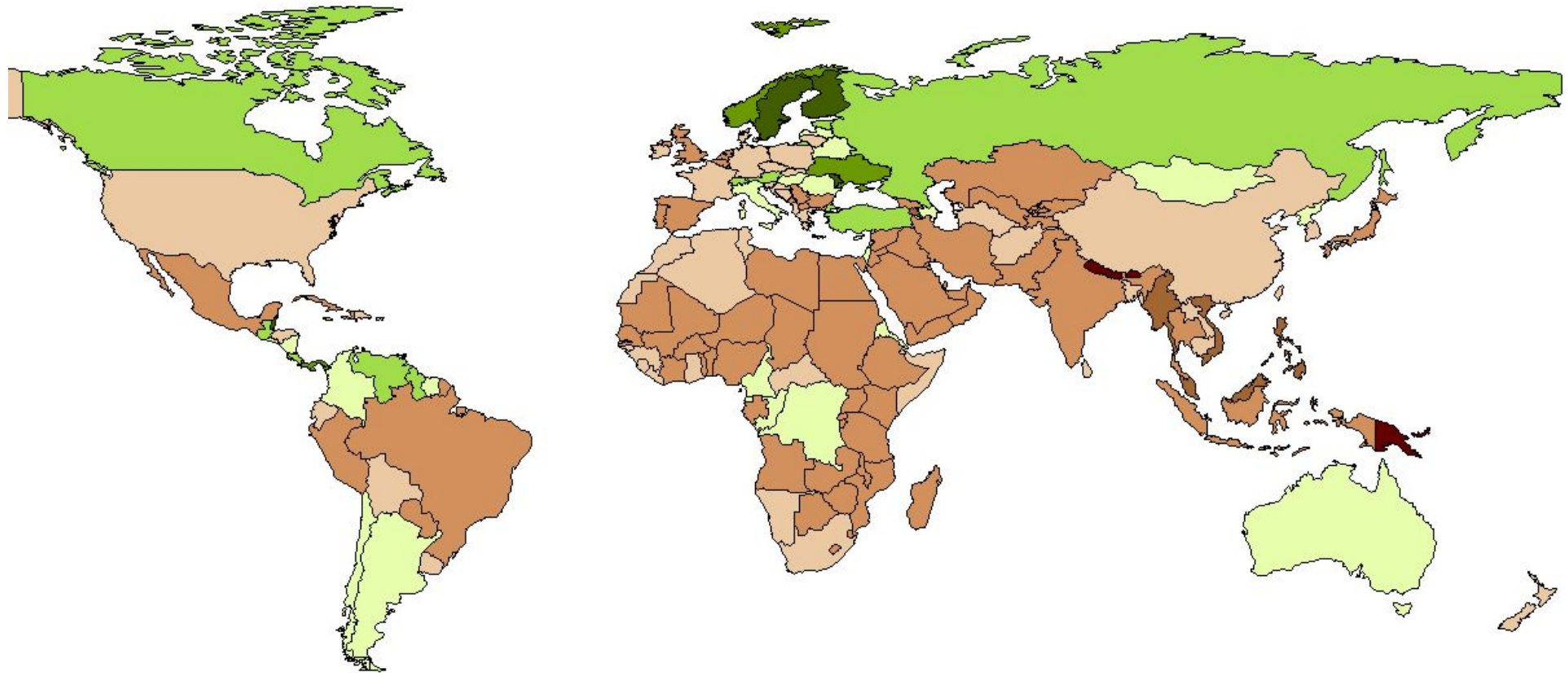
Scenario E1_6

Agricultural productivity changes (% of baseline)



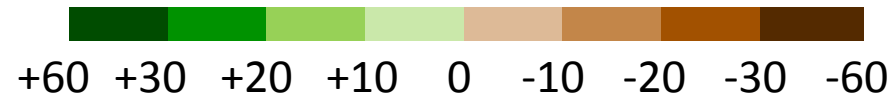
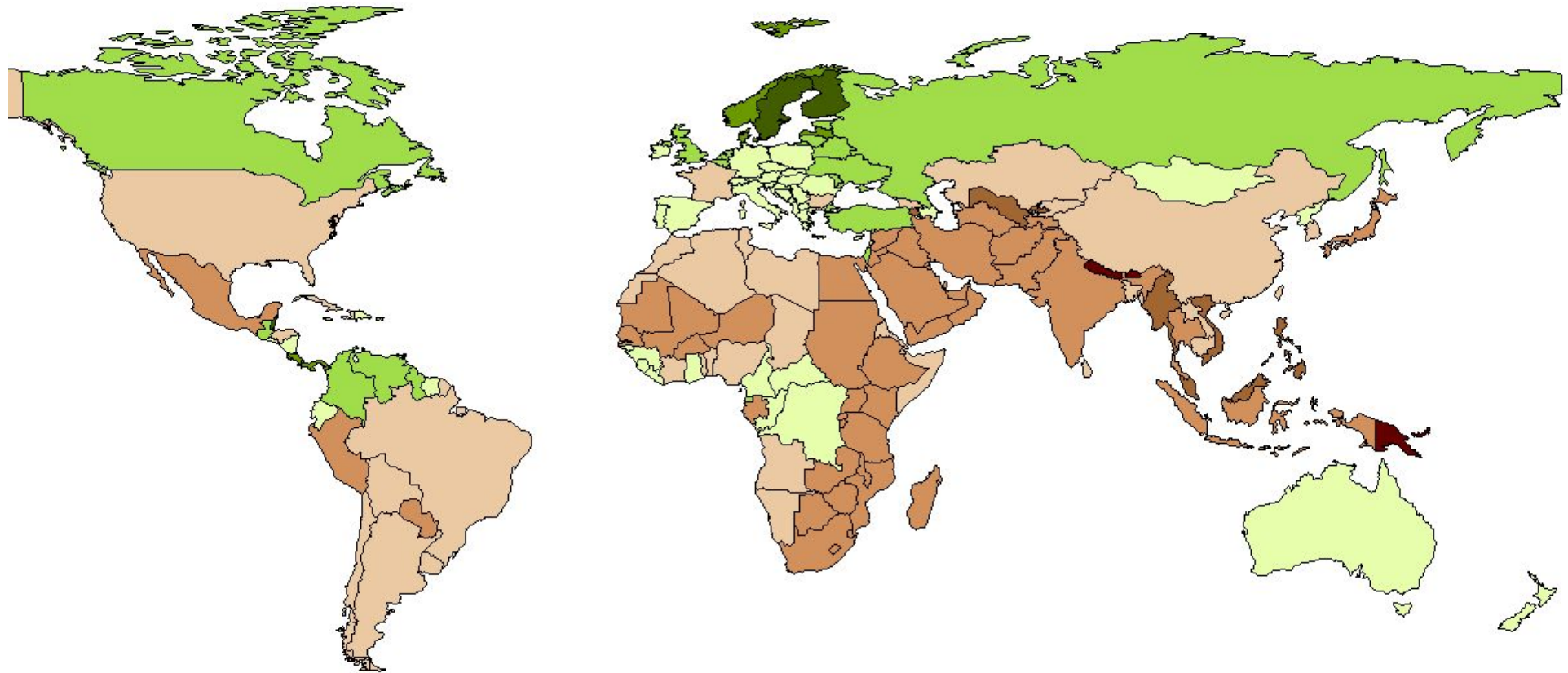
Scenario E1_7

Agricultural productivity changes (% of baseline)



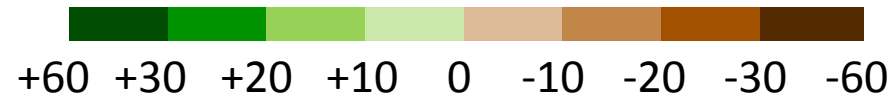
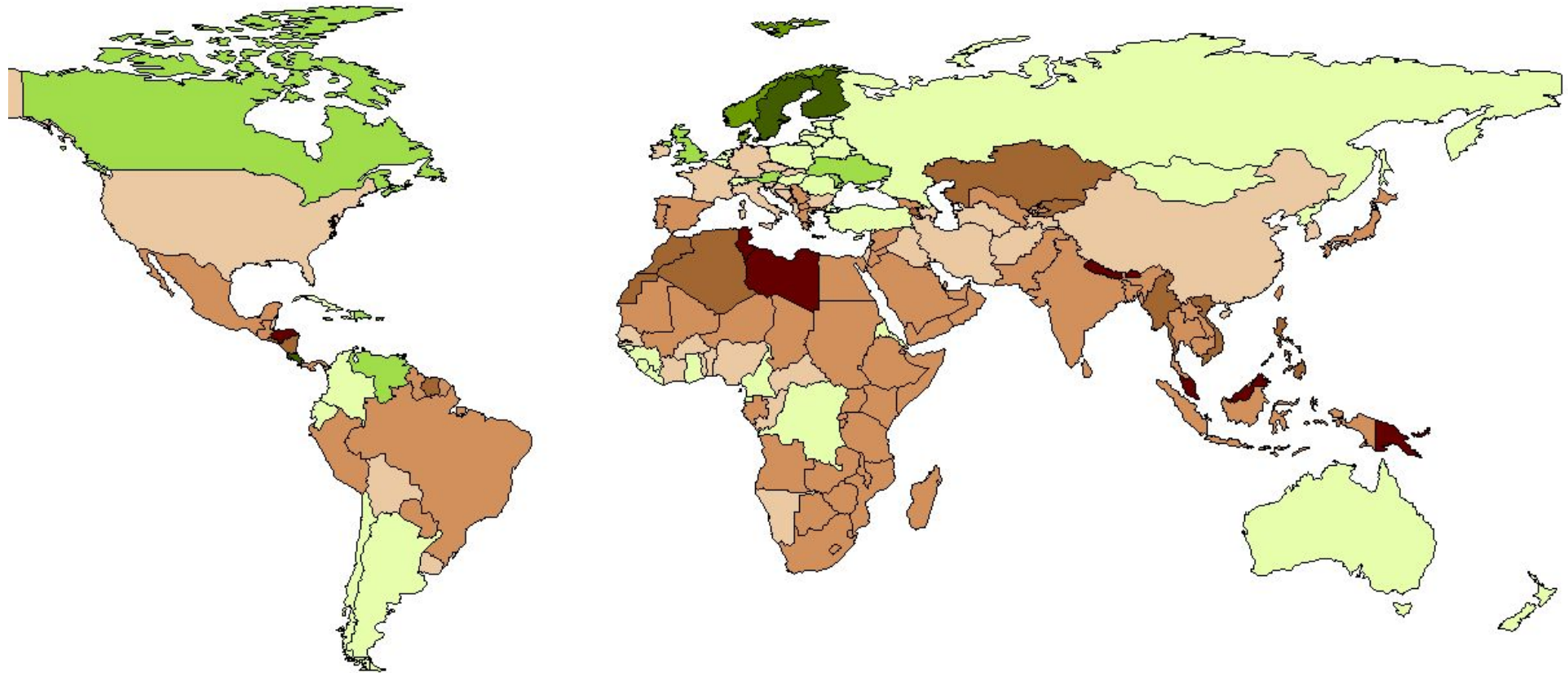
Scenario E1_8

Agricultural productivity changes (% of baseline)



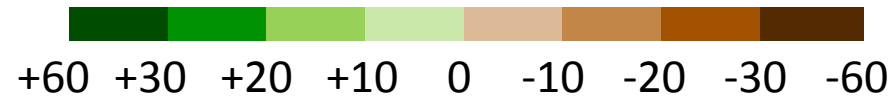
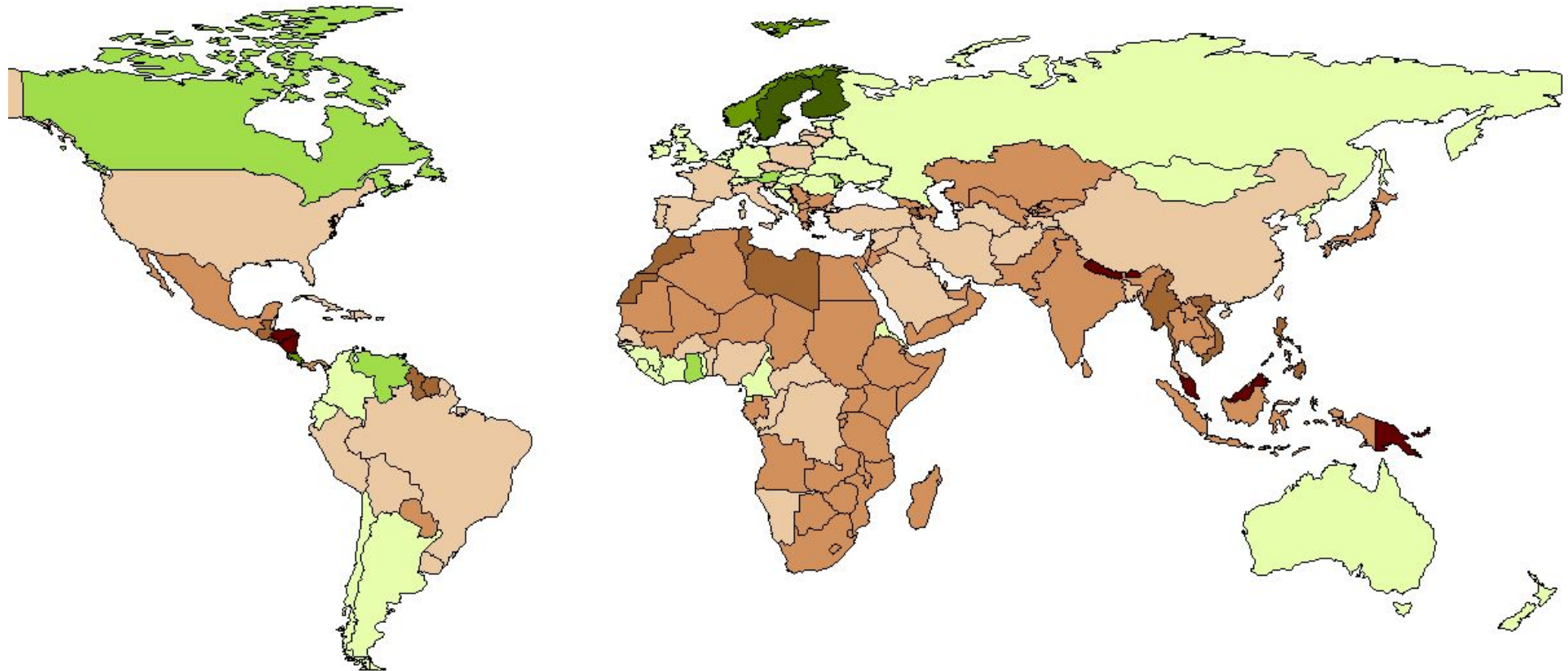
Scenario E1_9

Agricultural productivity changes (% of baseline)



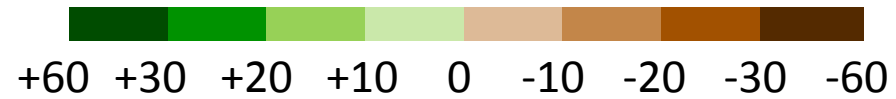
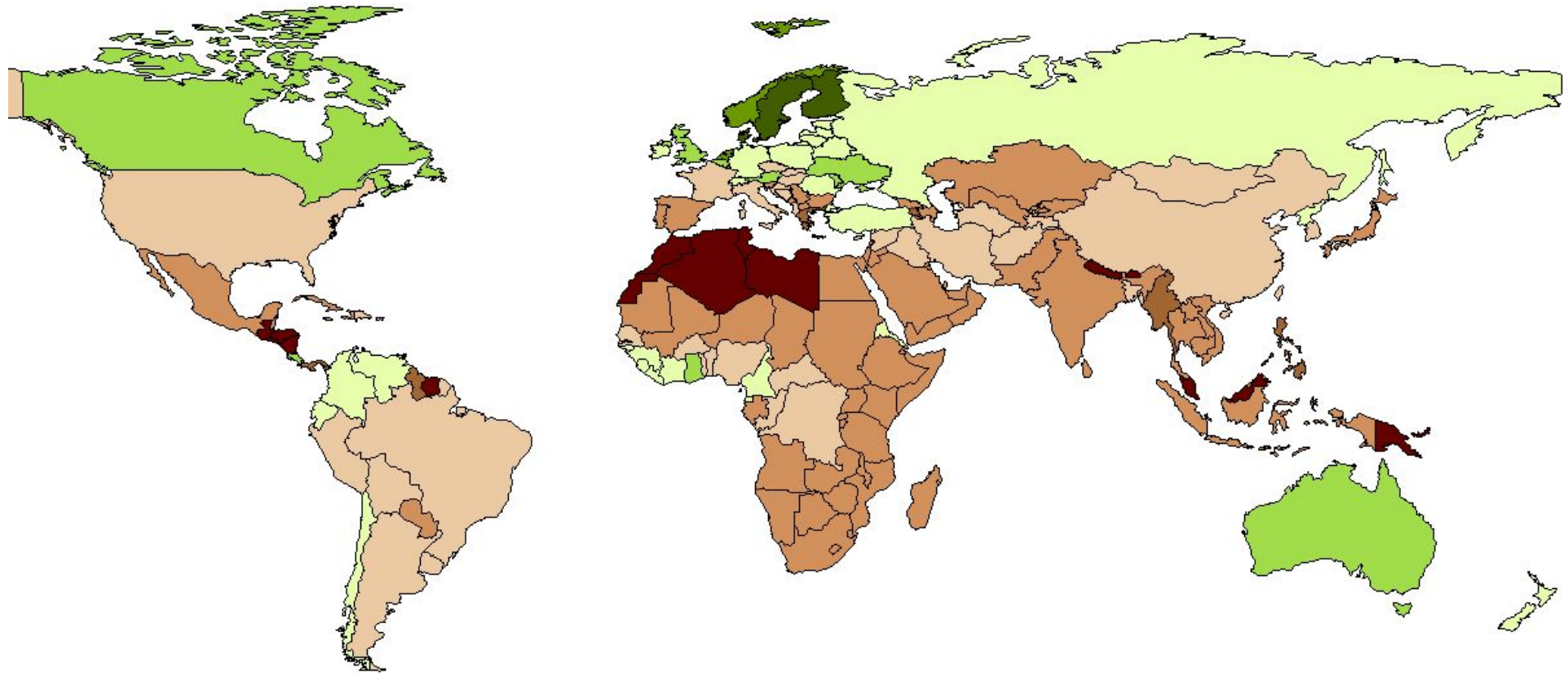
Scenario E1_10

Agricultural productivity changes (% of baseline)



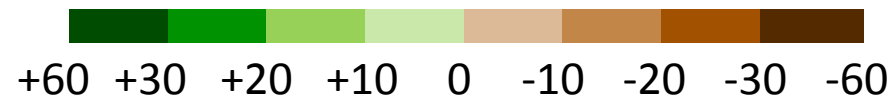
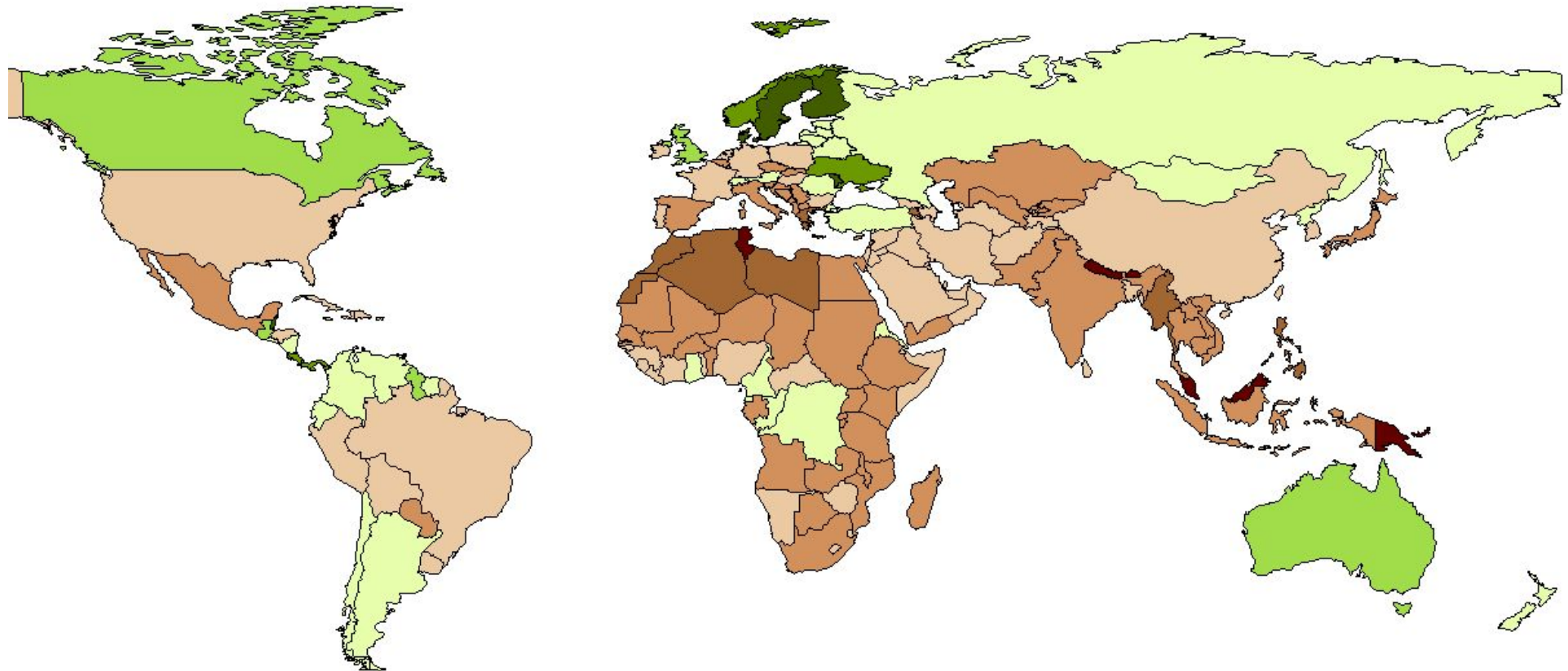
Scenario E1_11

Agricultural productivity changes (% of baseline)



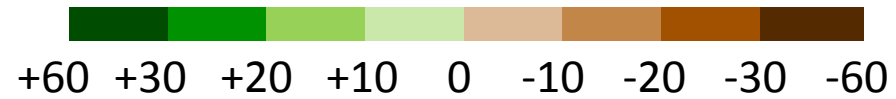
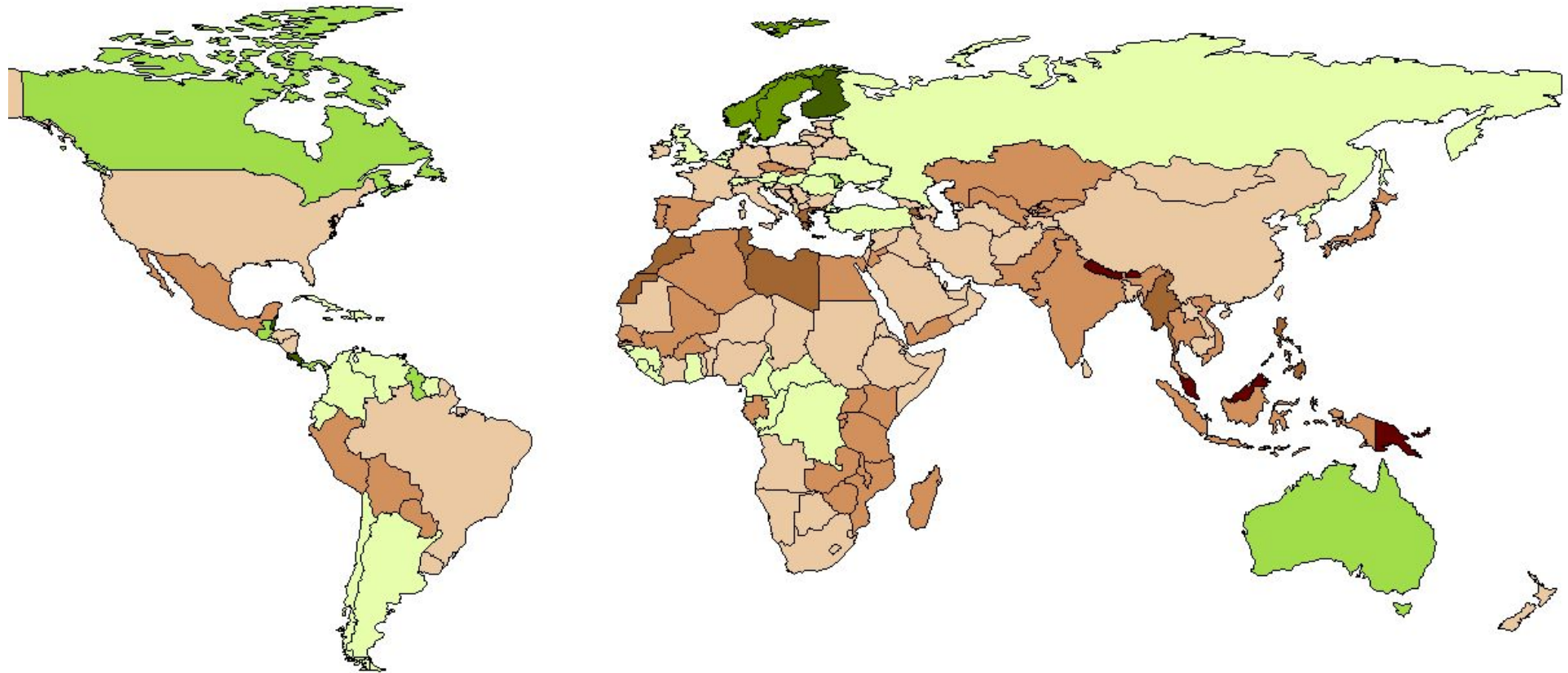
Scenario E1_12

Agricultural productivity changes (% of baseline)



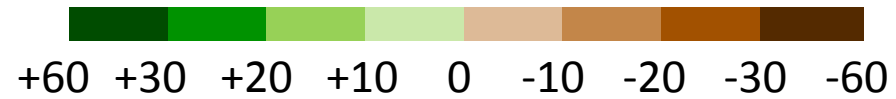
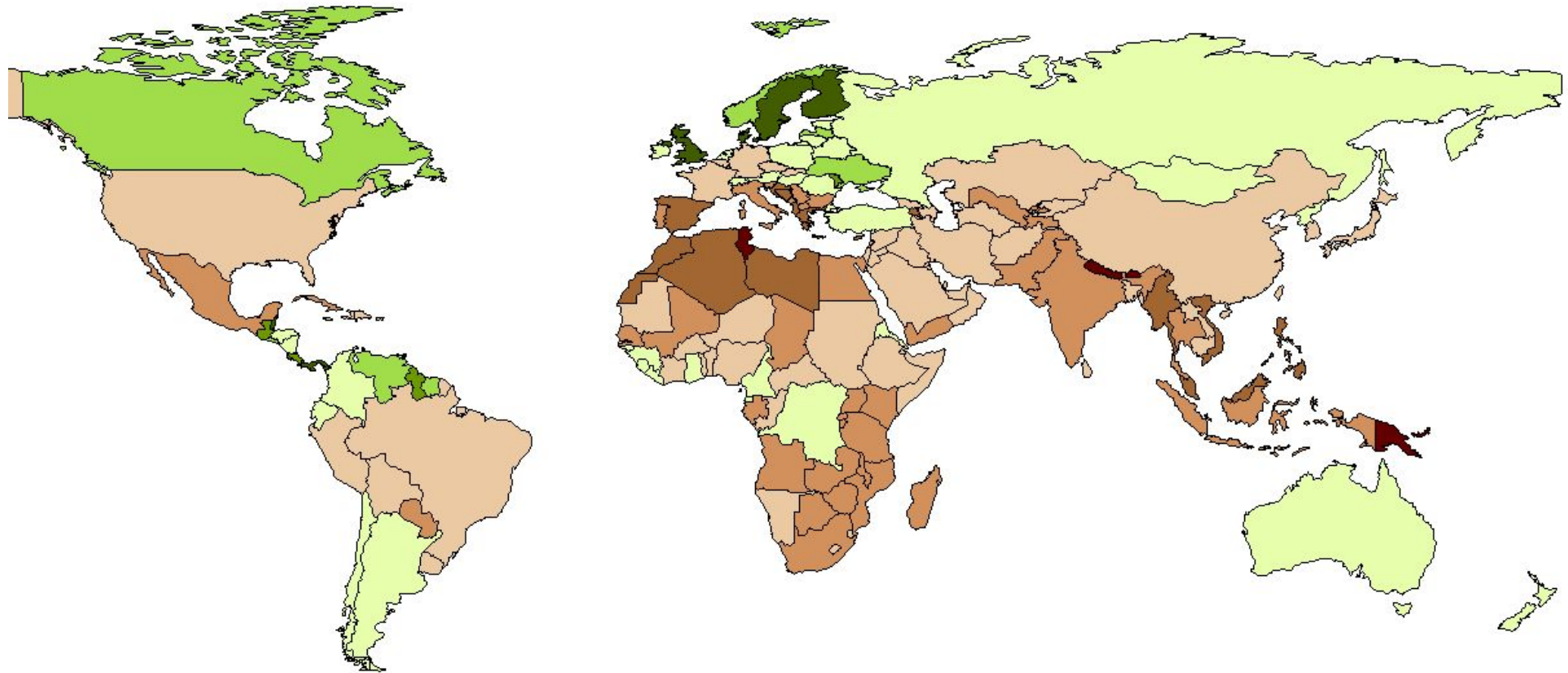
Scenario E1_13

Agricultural productivity changes (% of baseline)



Scenario E1_14

Agricultural productivity changes (% of baseline)





Complexity: need to understand local vulnerabilities



**The
Economist**

A special report on water

For want of a drink
May 20th 2010

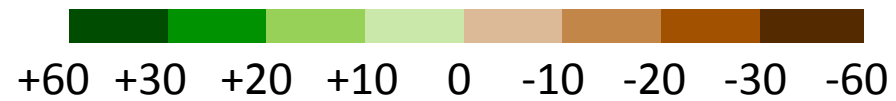
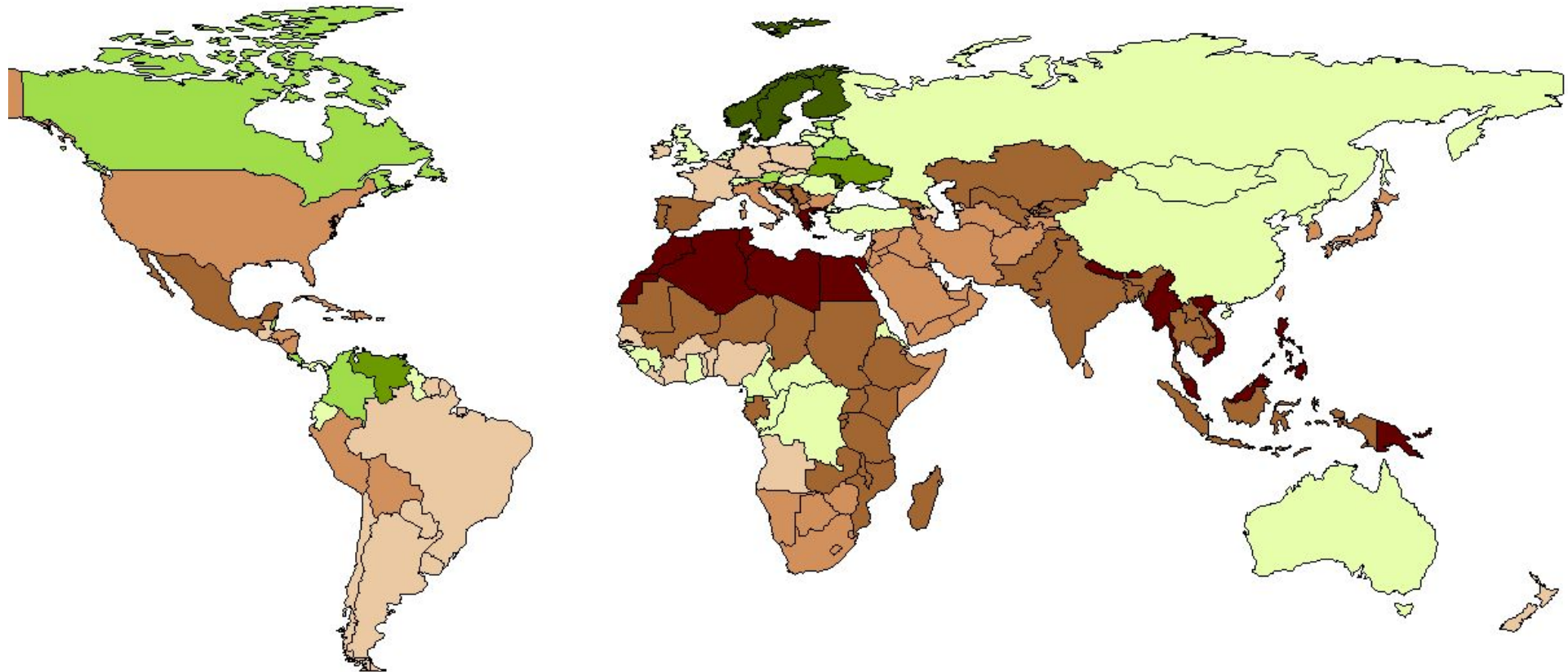


<http://www.economist.com/node/16136302>

Scenario A1B_av

No adaptation

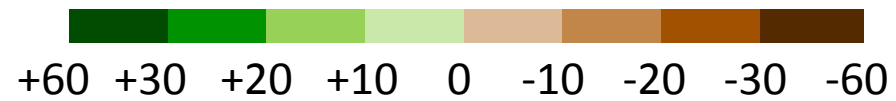
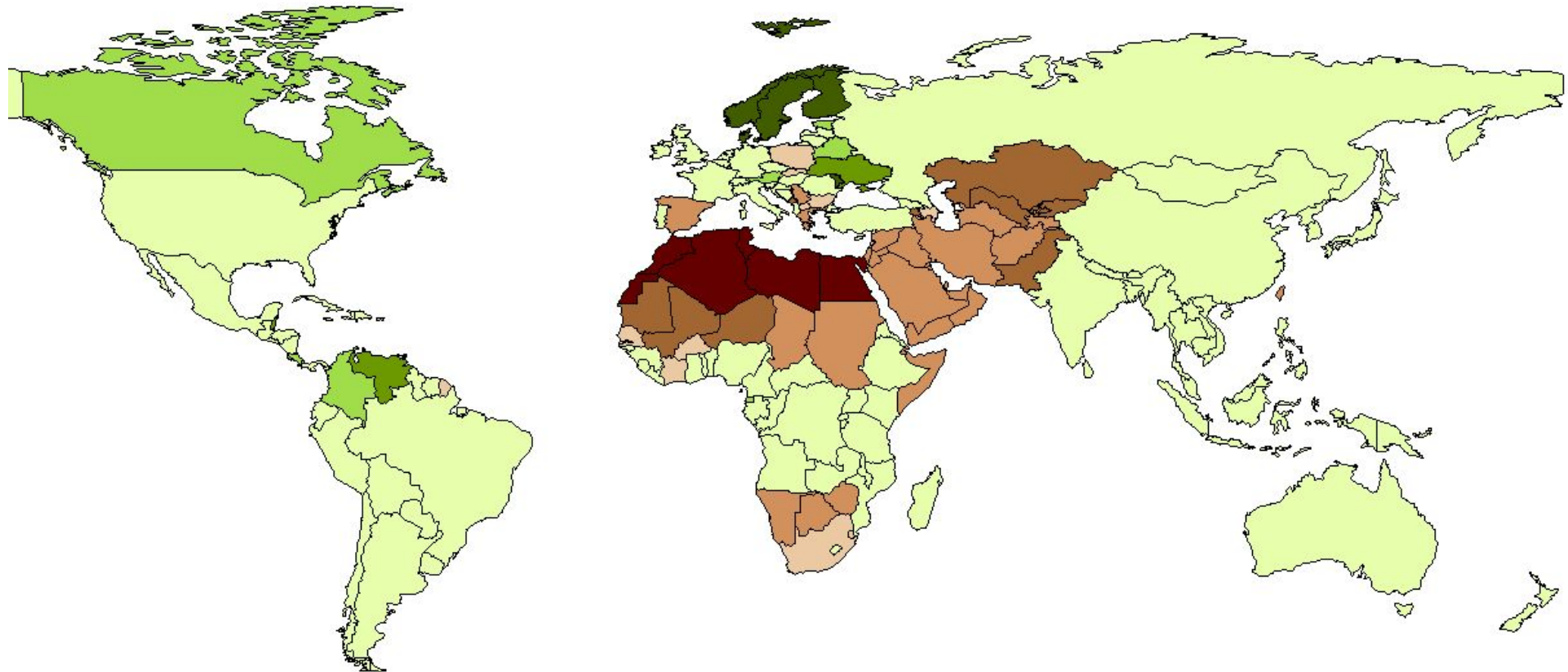
Agricultural productivity changes (% of baseline)



Scenario A1B_av

Adaptation 1

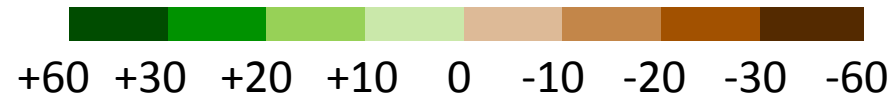
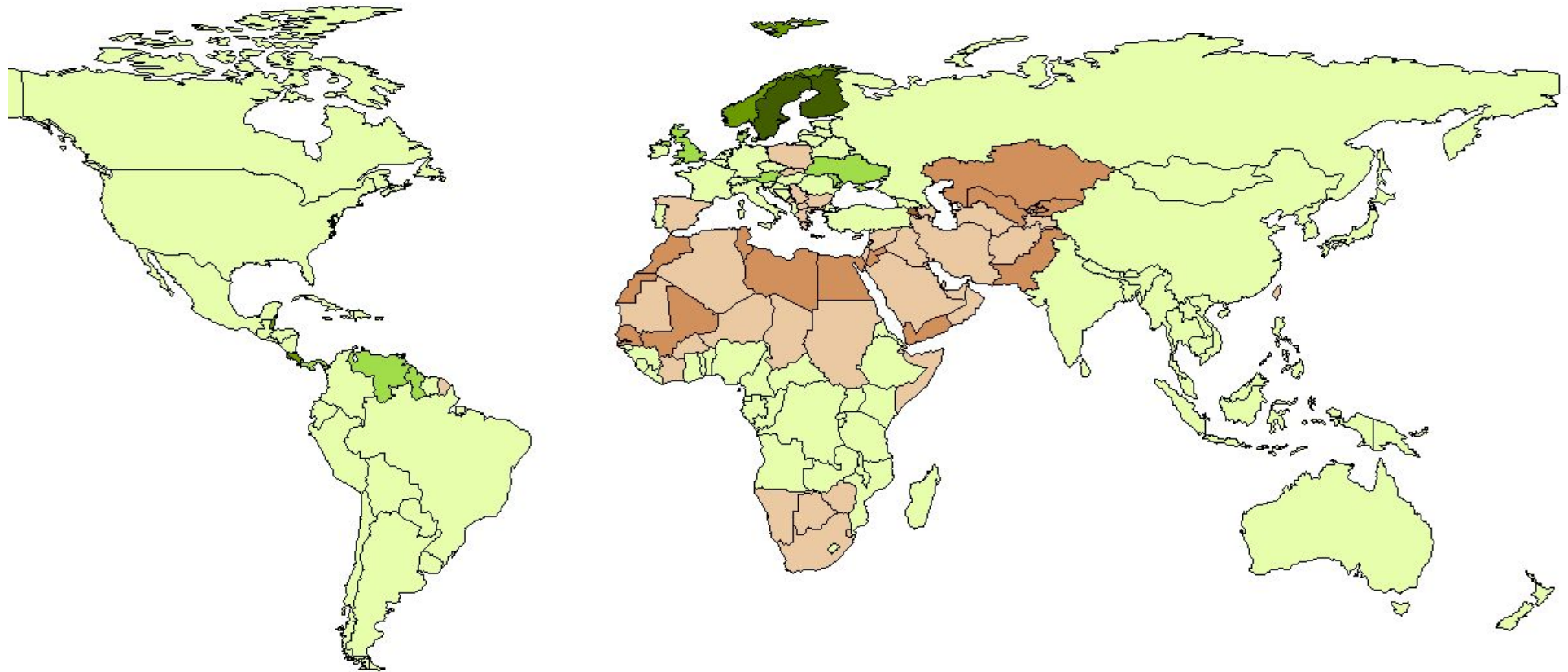
Agricultural productivity changes (% of baseline)



Scenario E1_av

Adaptation 1

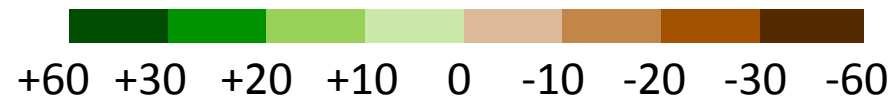
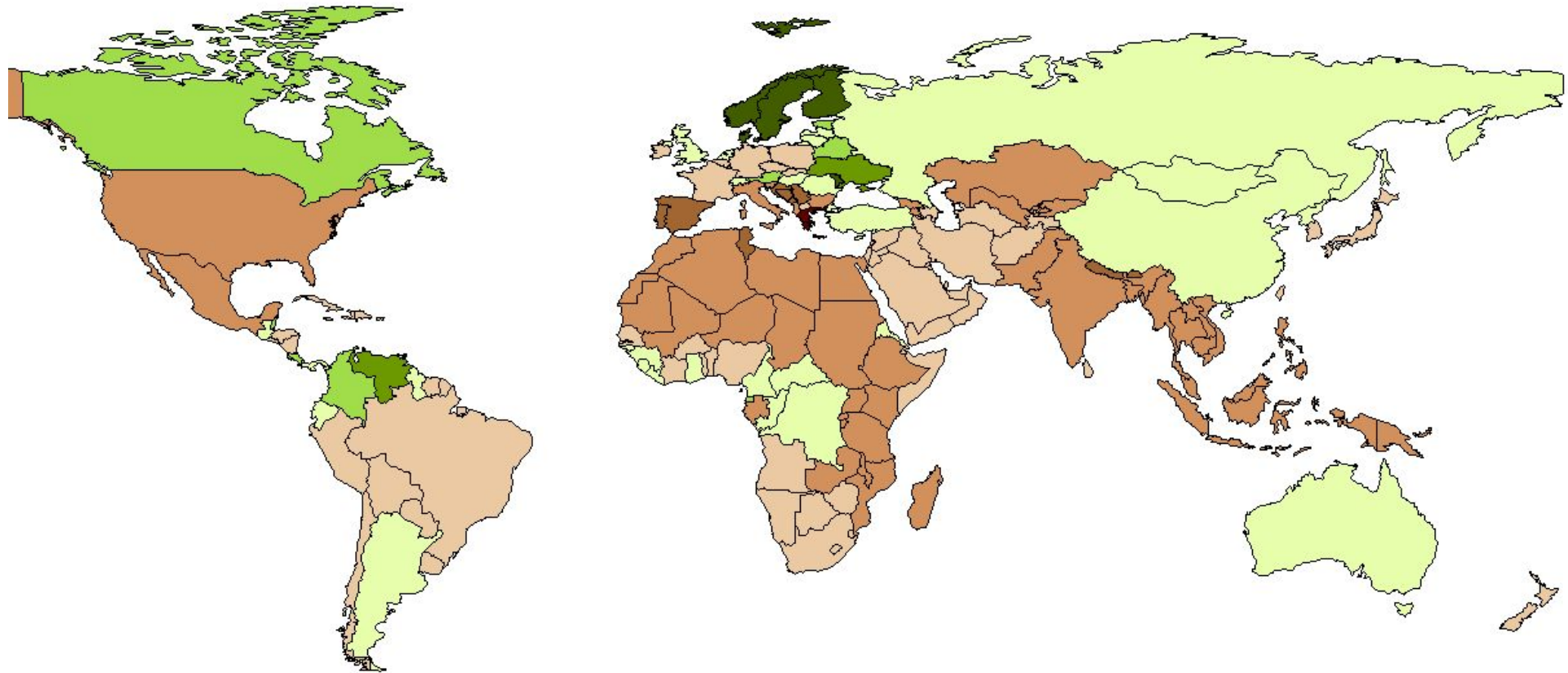
Agricultural productivity changes (% of baseline)



Scenario A1B_av

Adaptation 2

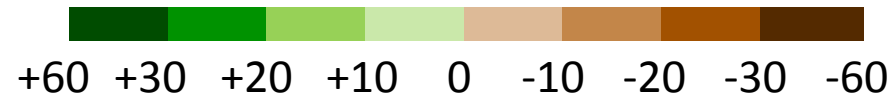
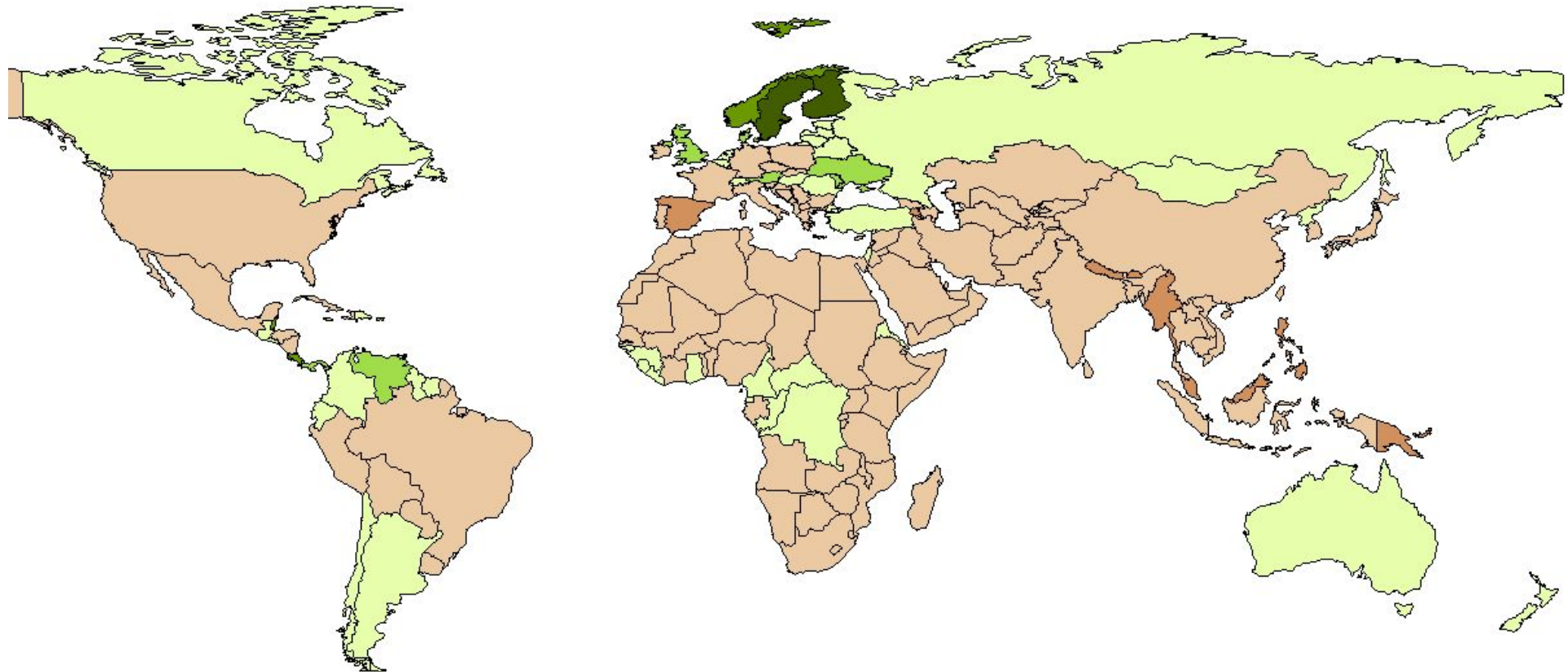
Agricultural productivity changes (% of baseline)



Scenario E1_av

Adaptation 2

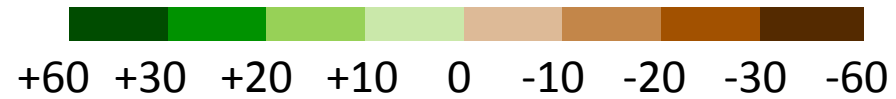
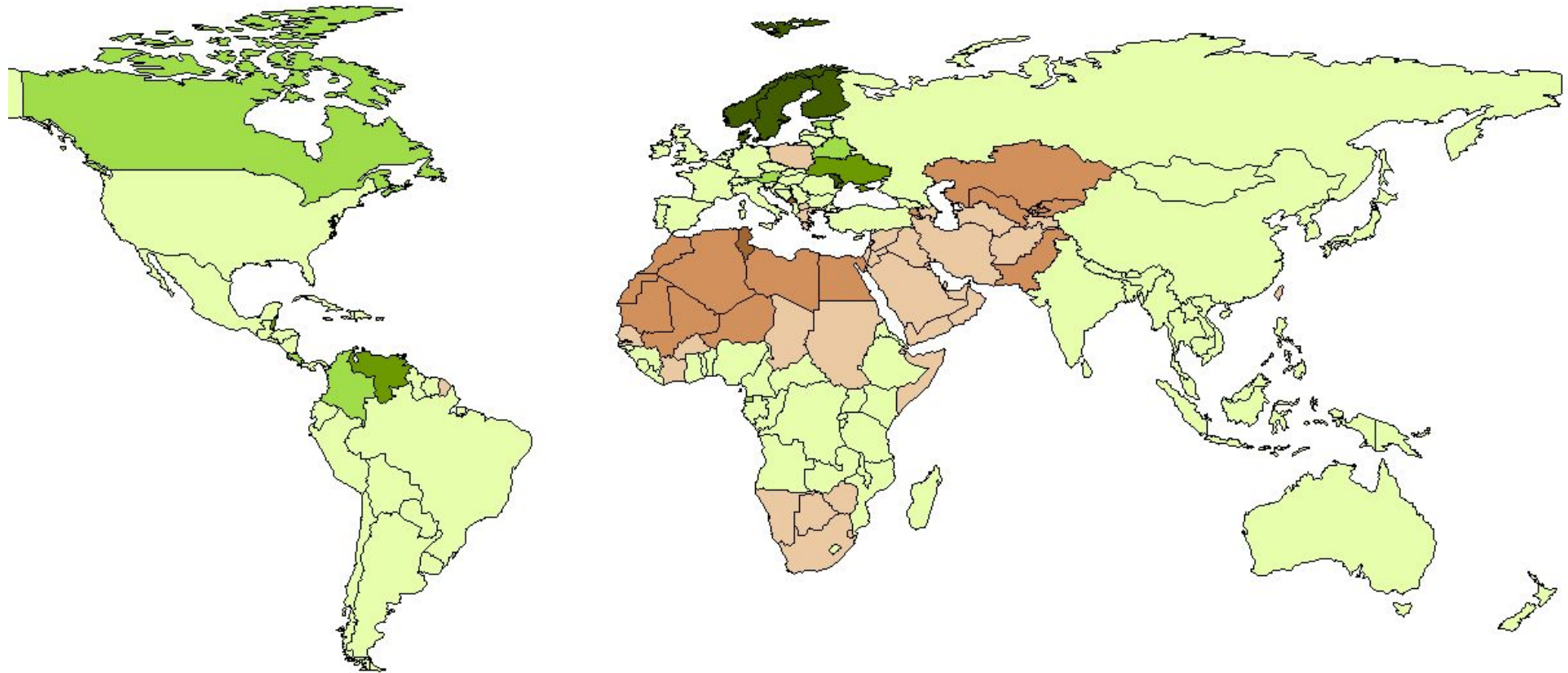
Agricultural productivity changes (% of baseline)



Scenario A1B_av

Adaptation 3

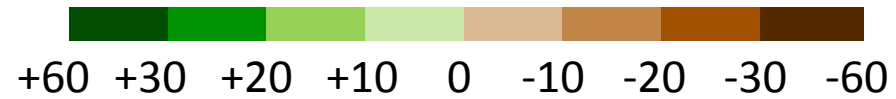
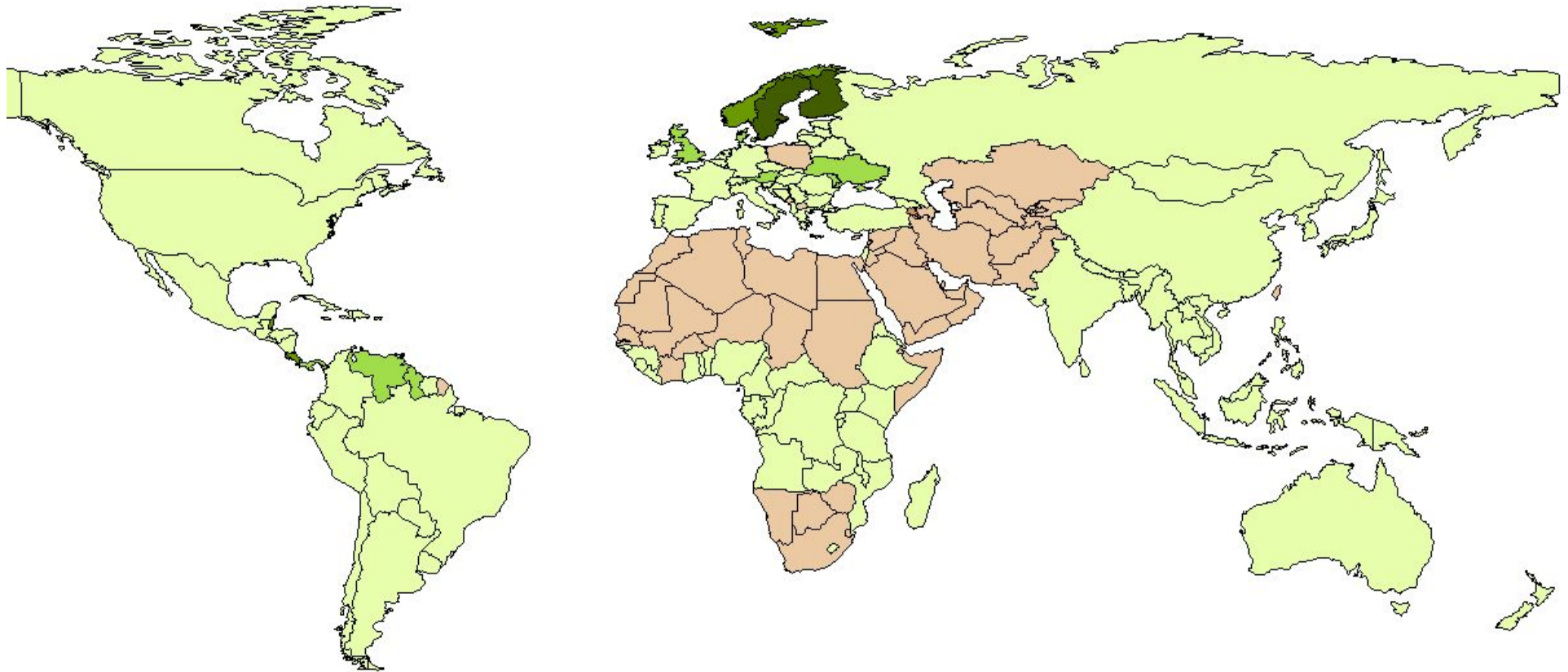
Agricultural productivity changes (% of baseline)

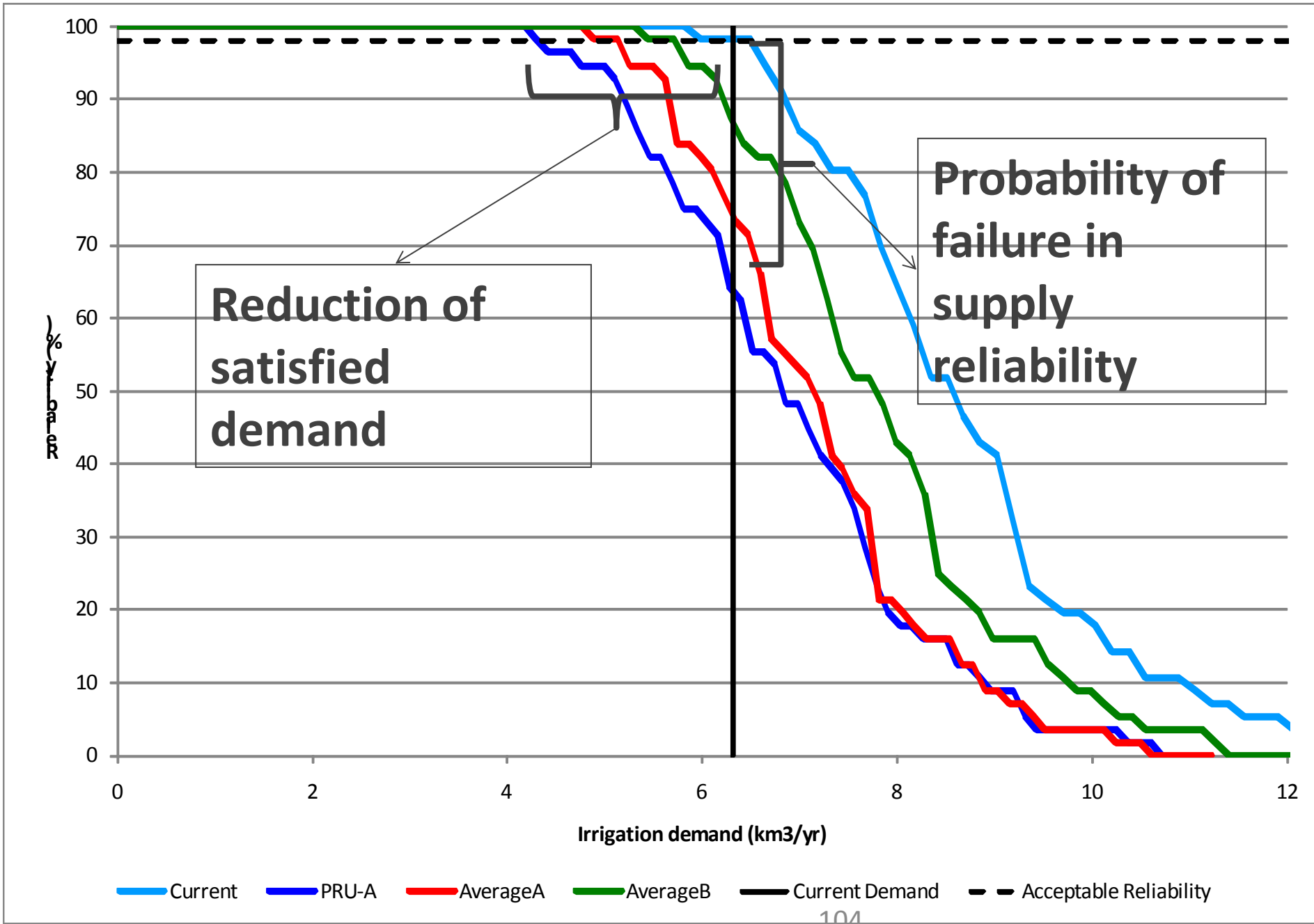


Scenario E1_av

Adaptation 3

Agricultural productivity changes (% of baseline)

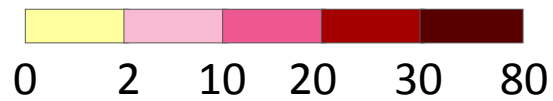
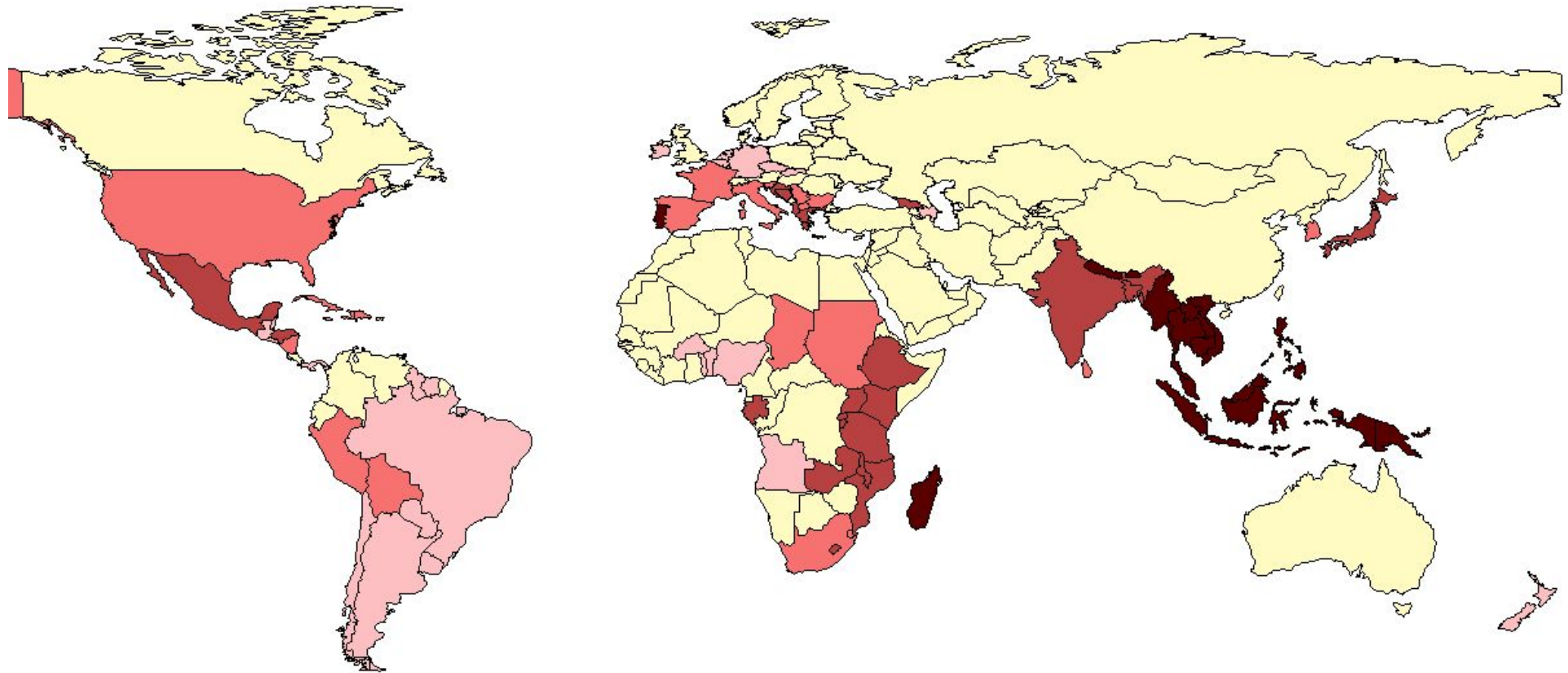




Scenario A1B_av

Adaptation 1&3

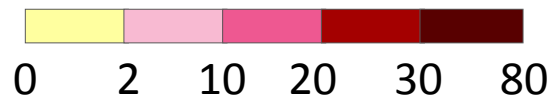
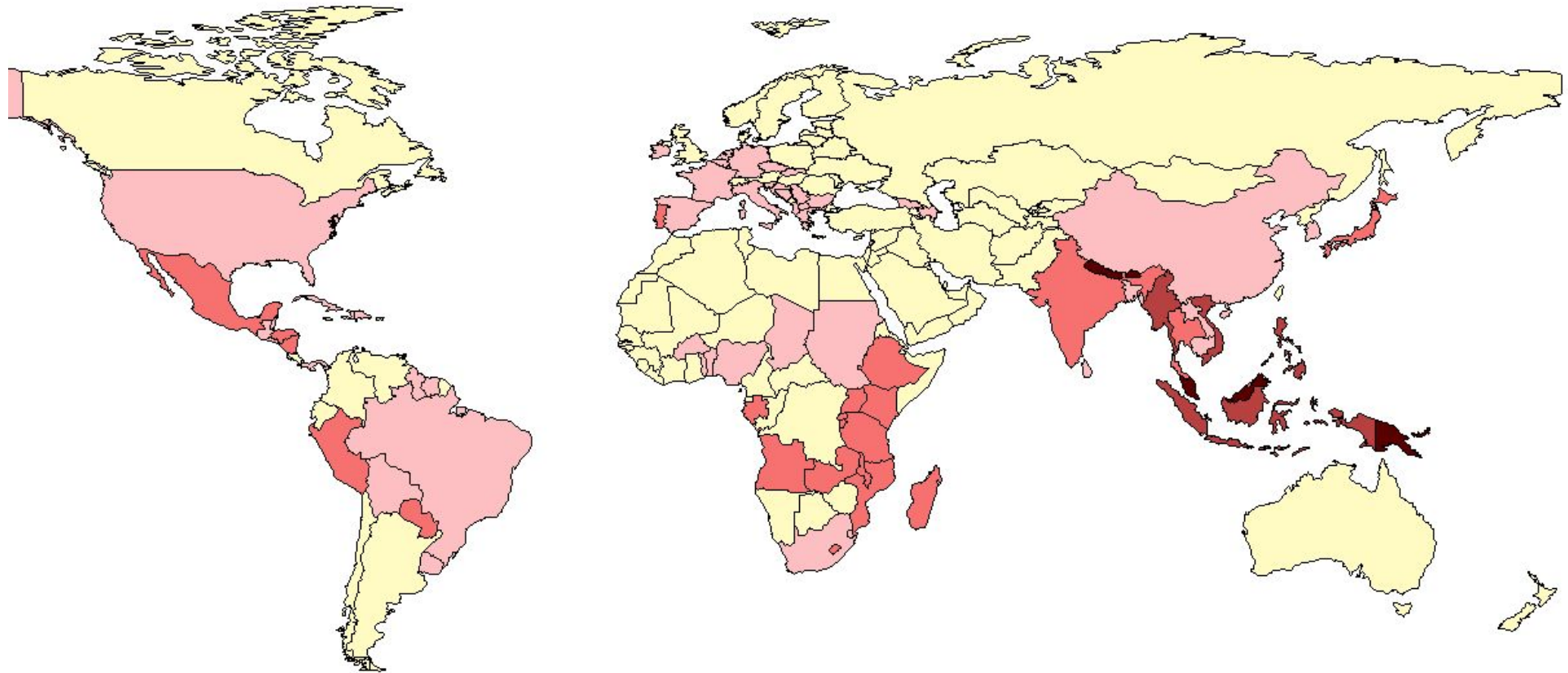
Irrigation water demand change (% of baseline)



Scenario E1_av

Adaptation 1&3

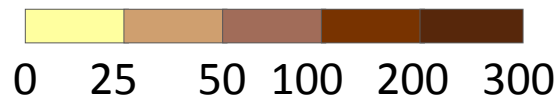
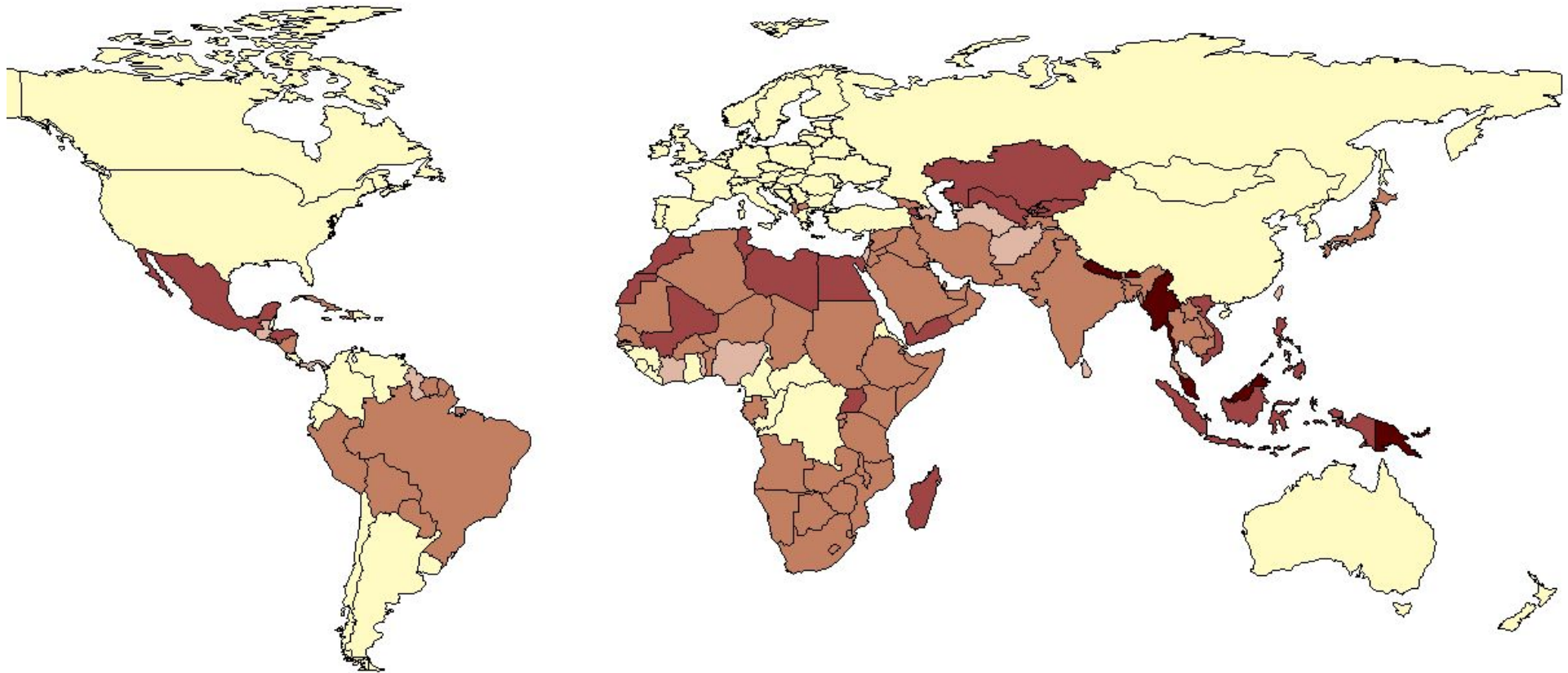
Irrigation water demand change (% of baseline)



Scenario E1_av

Adaptation 2

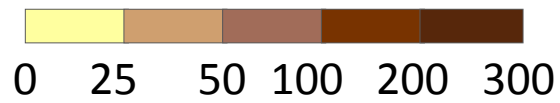
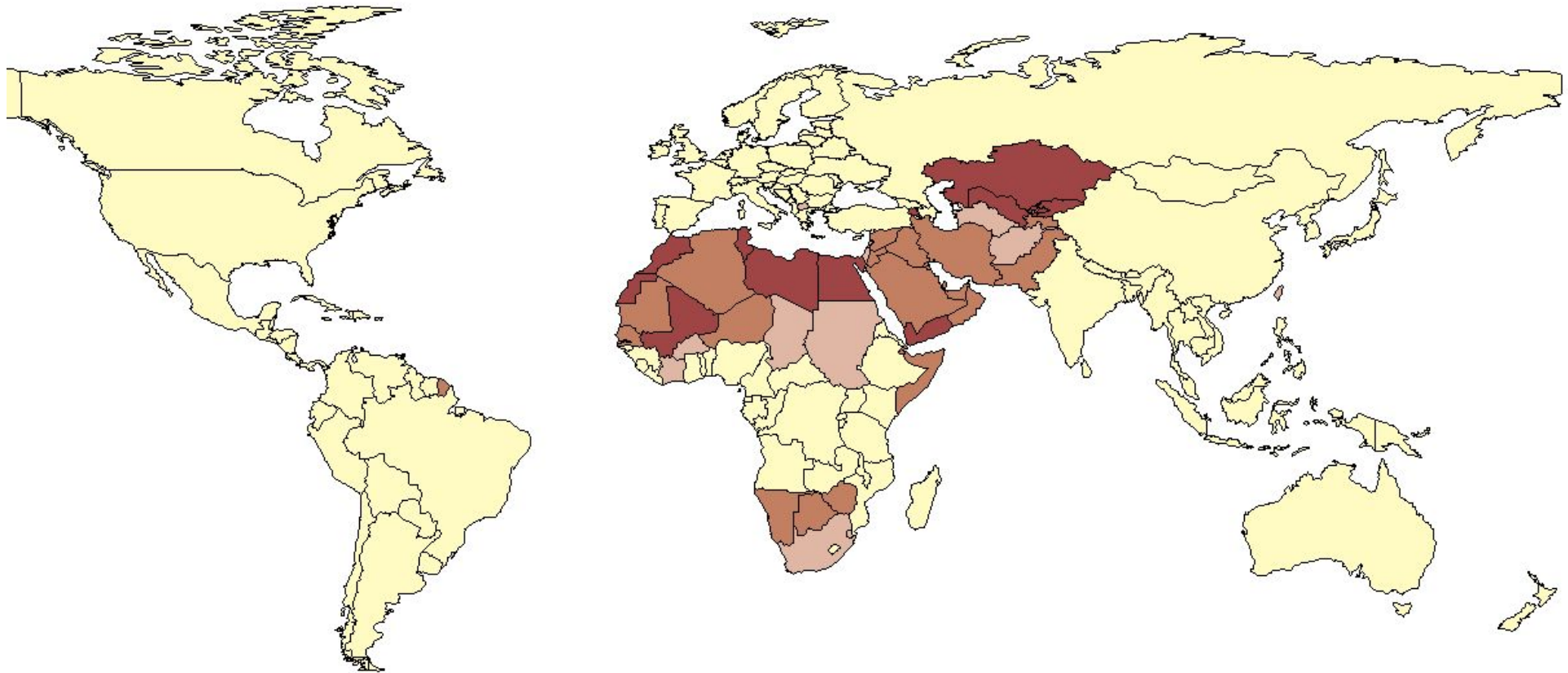
Nitrogen fertiliser change (% of baseline)

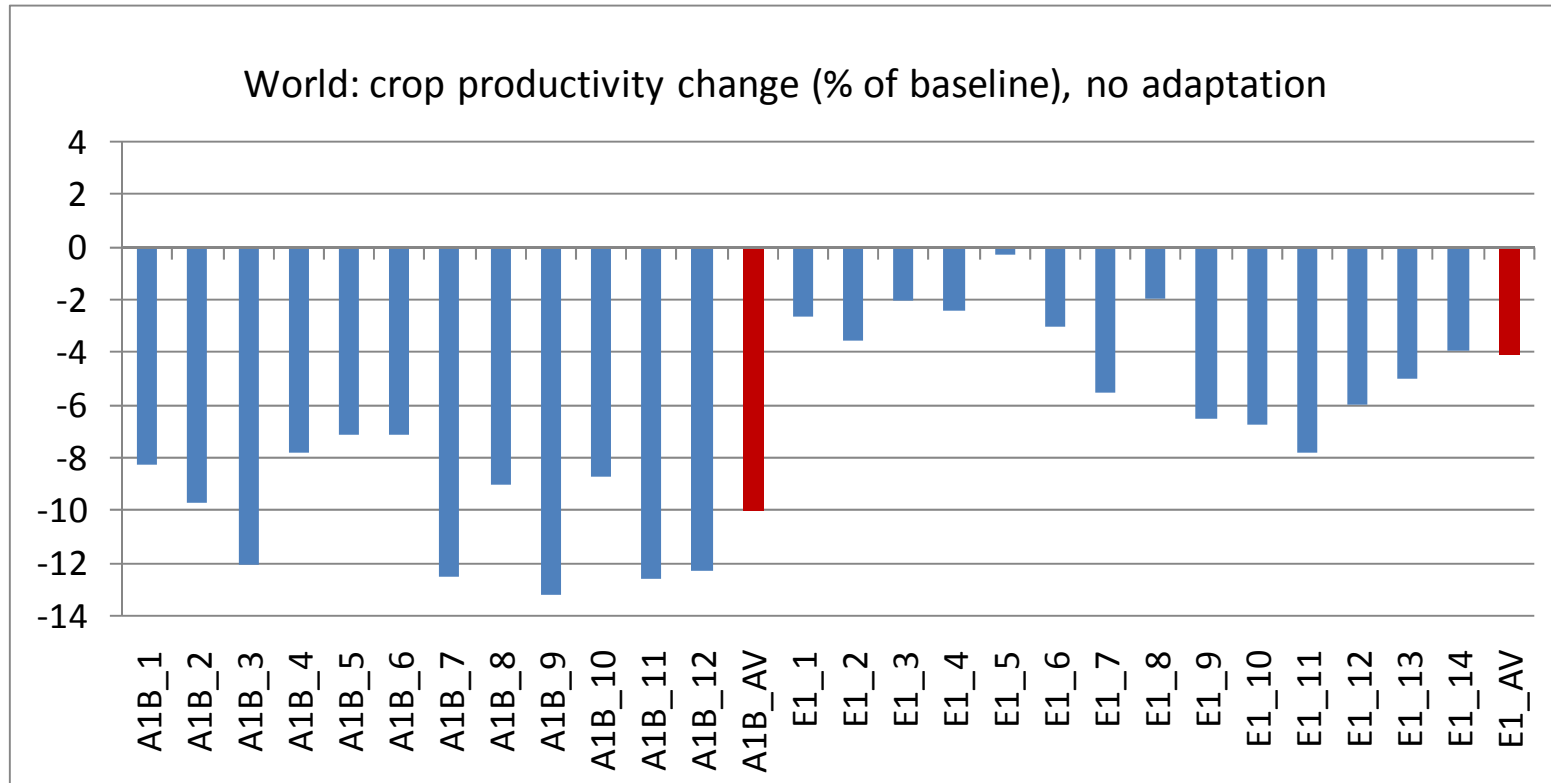


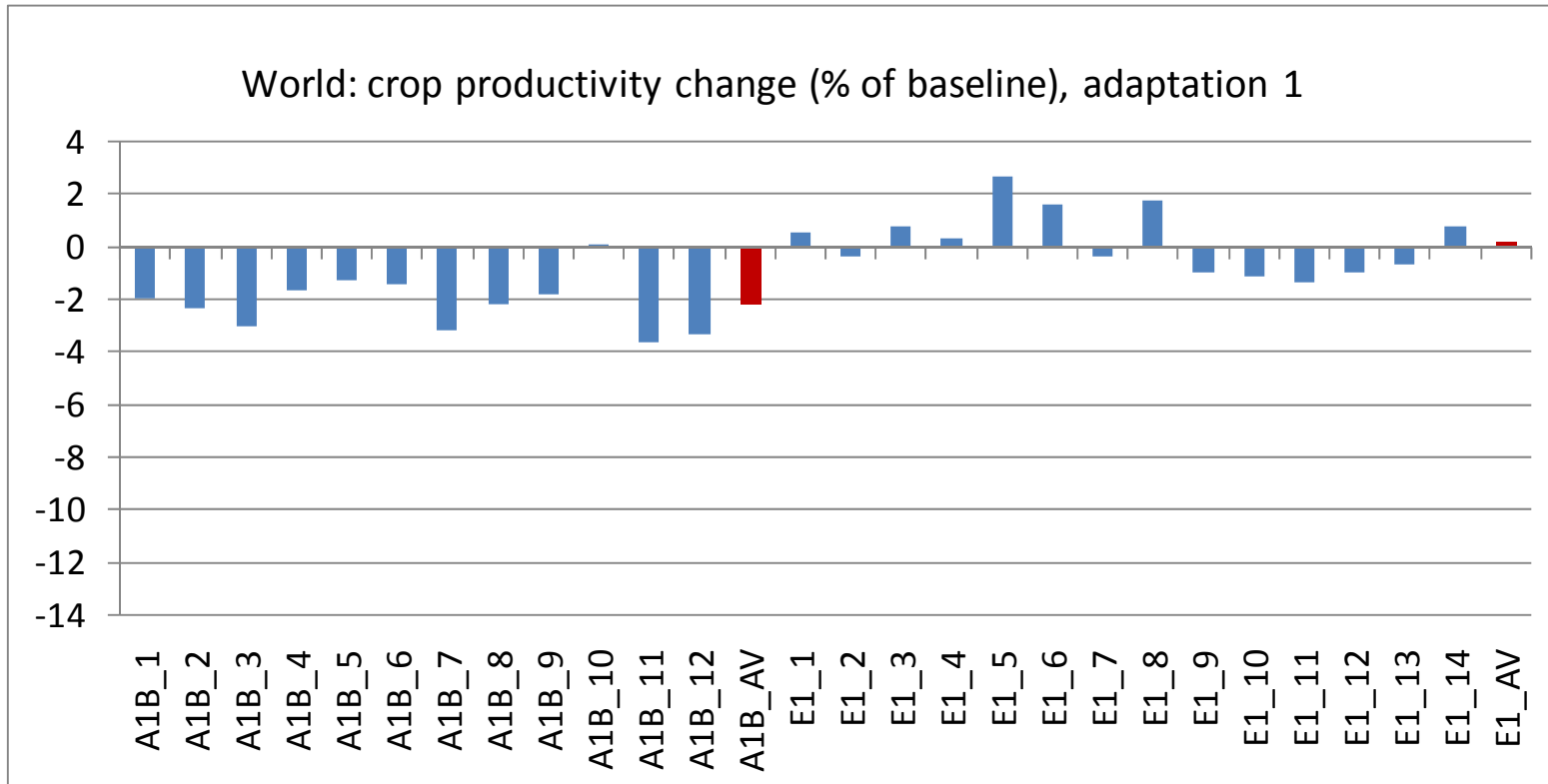
Scenario E1_av

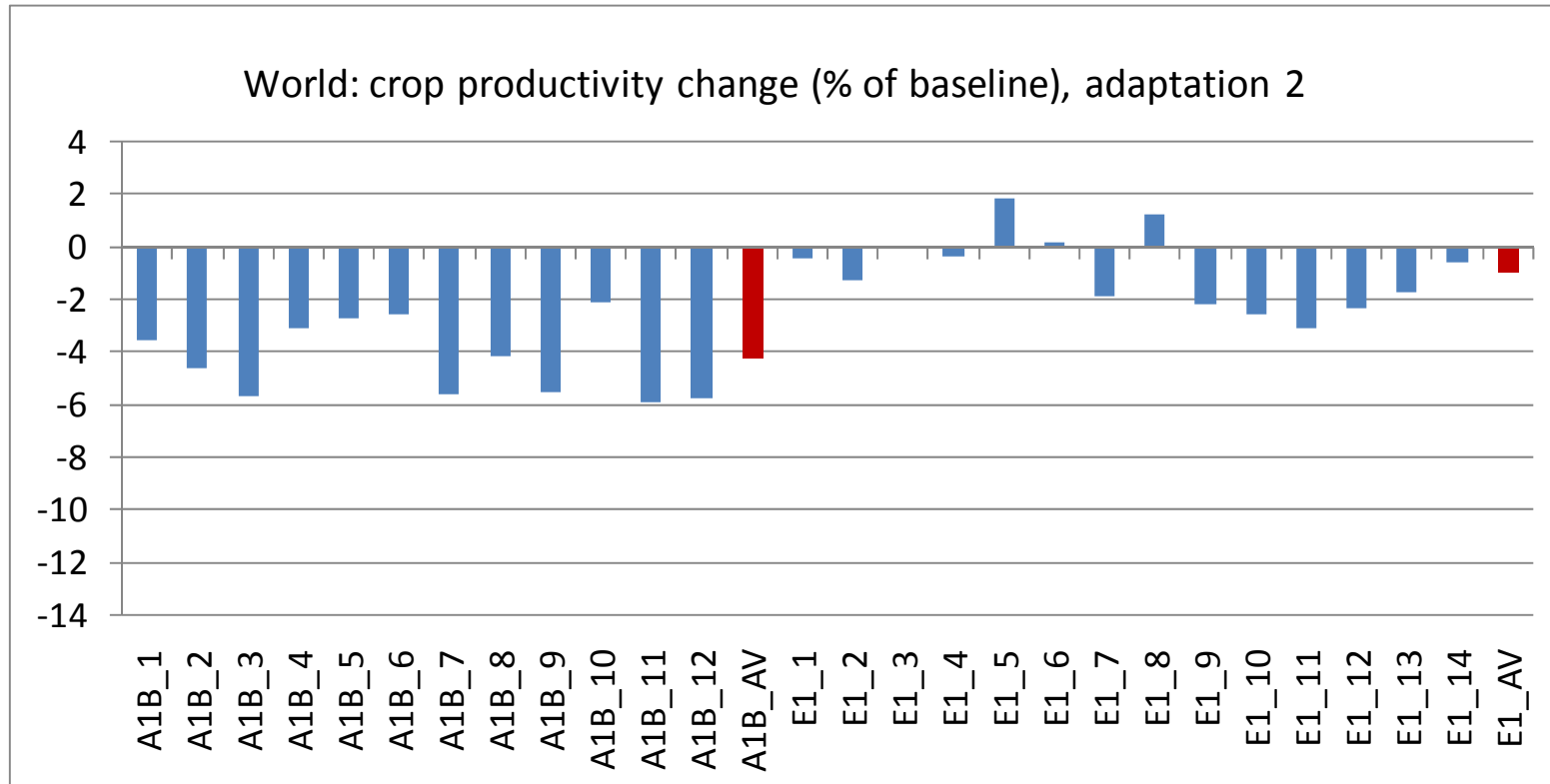
Adaptation 3

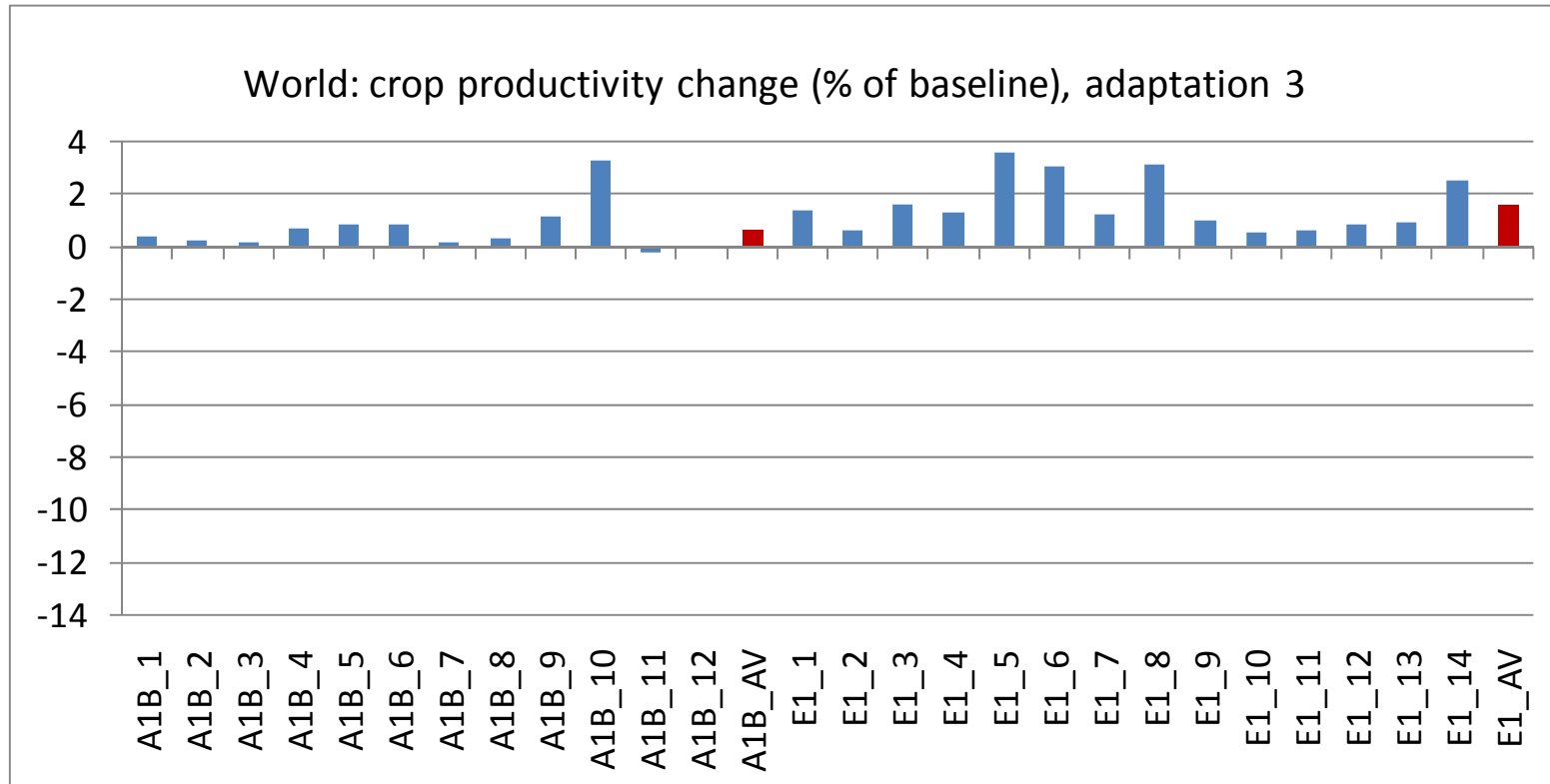
Nitrogen fertiliser change (% of baseline)



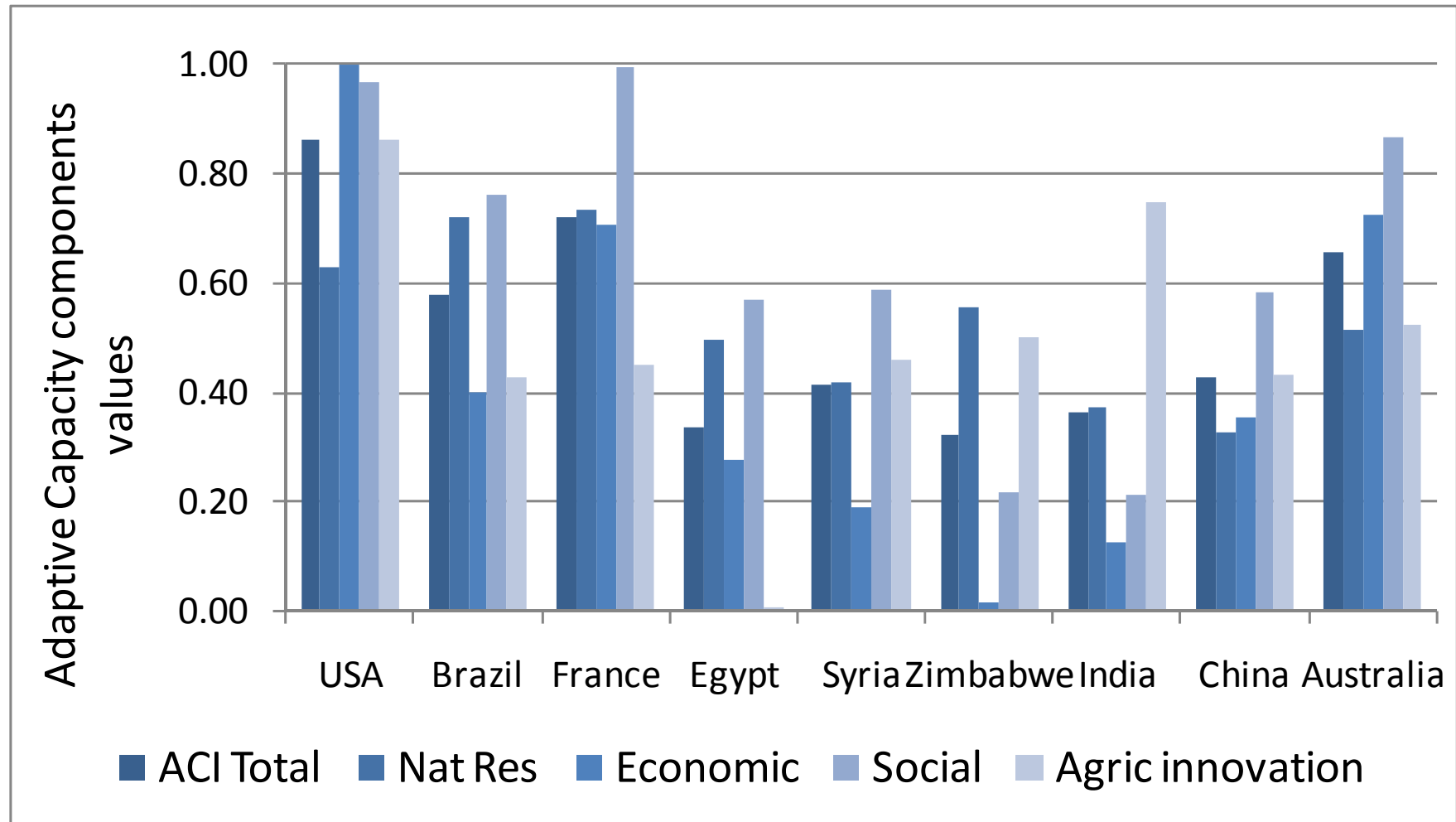


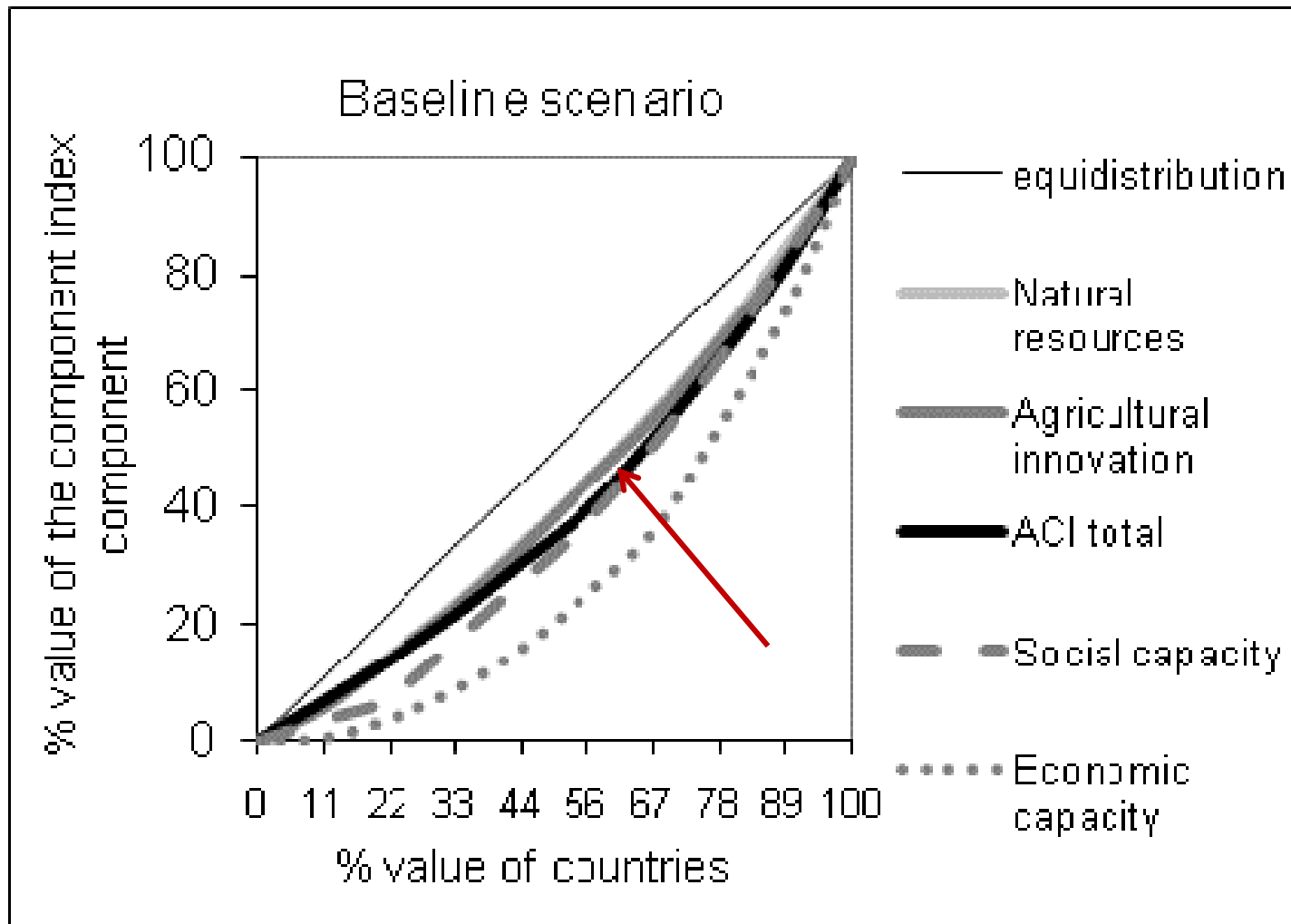




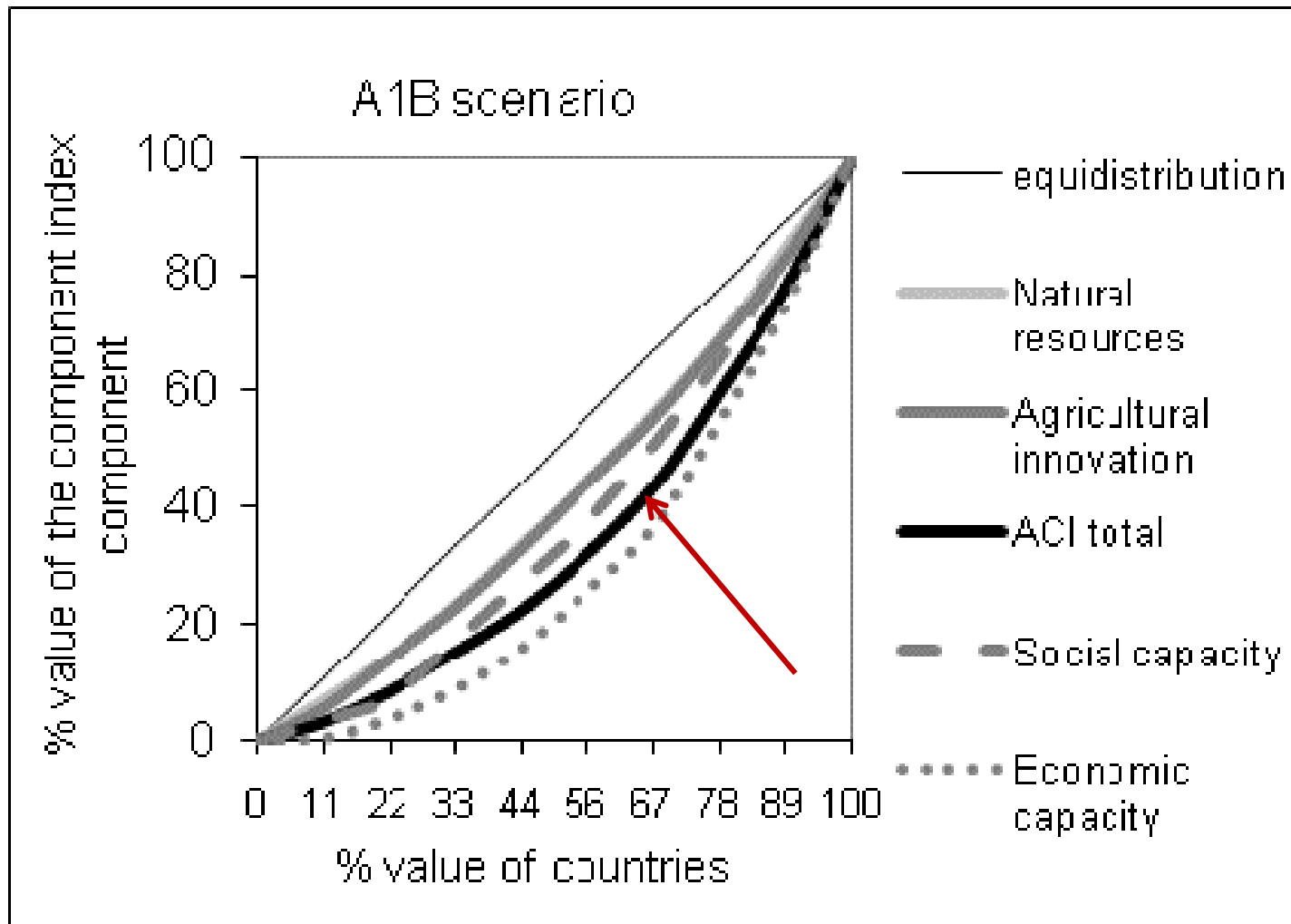


Adaptive capacity: components

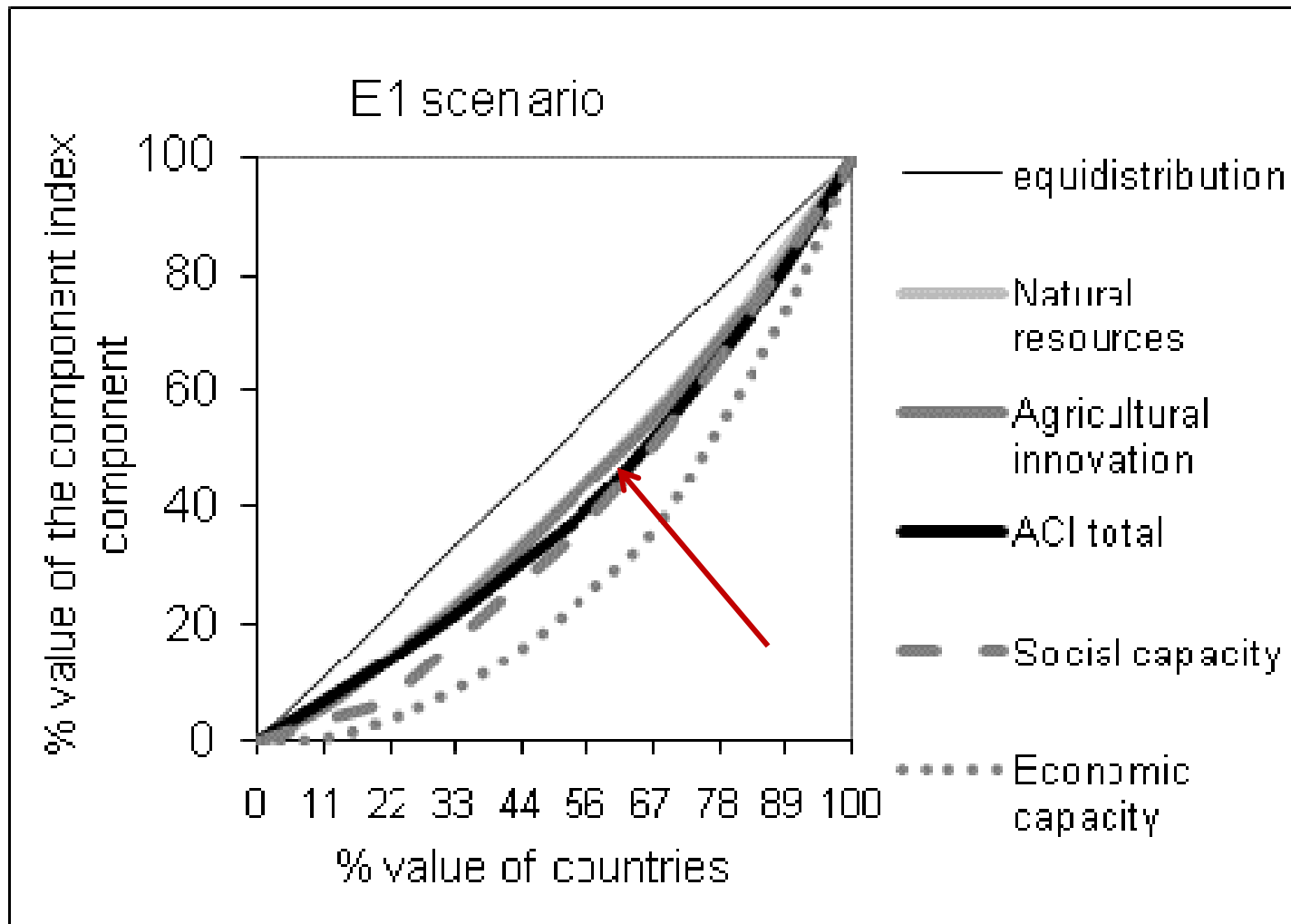




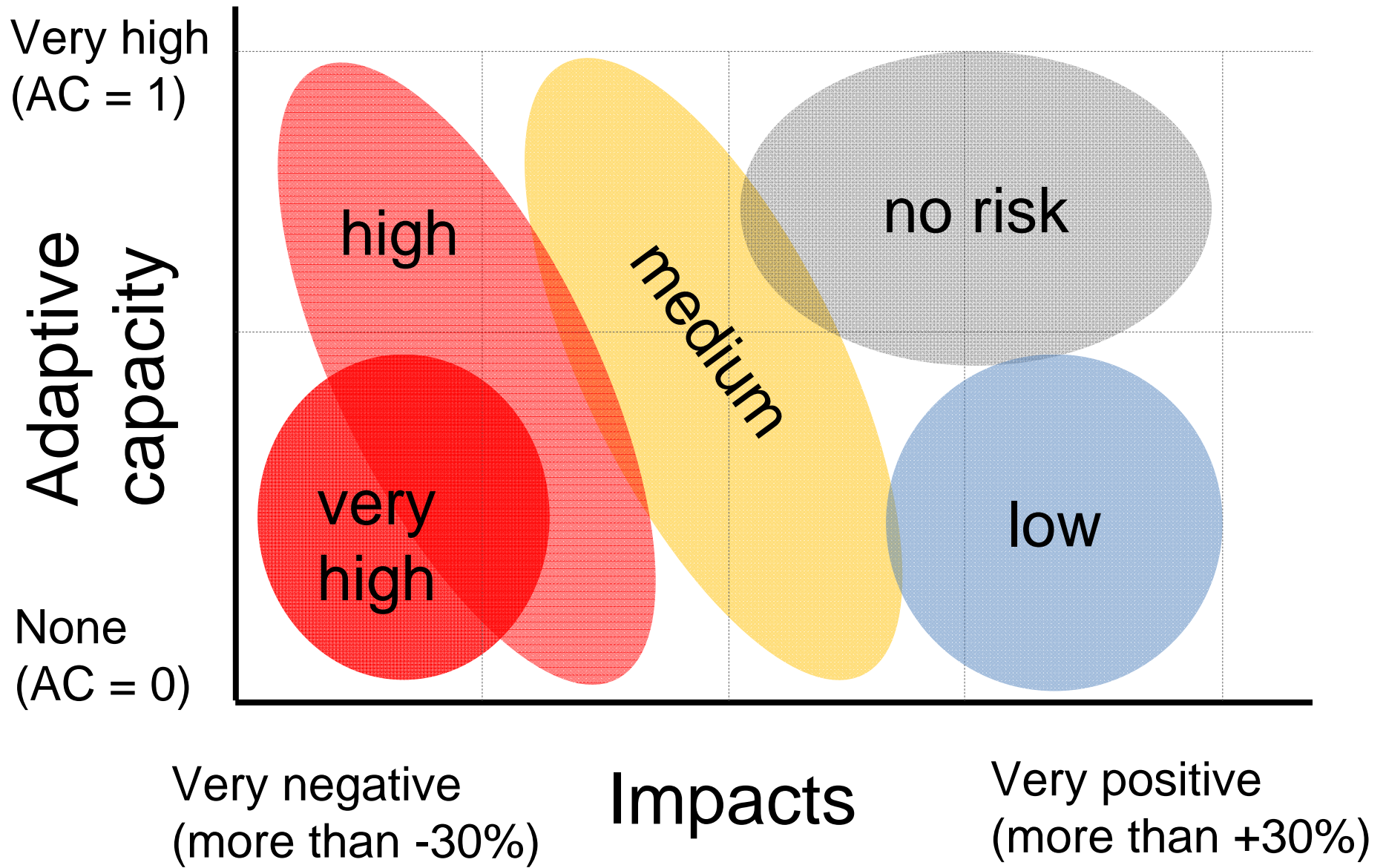
Gini coefficient – Lorenz curves



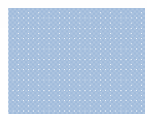
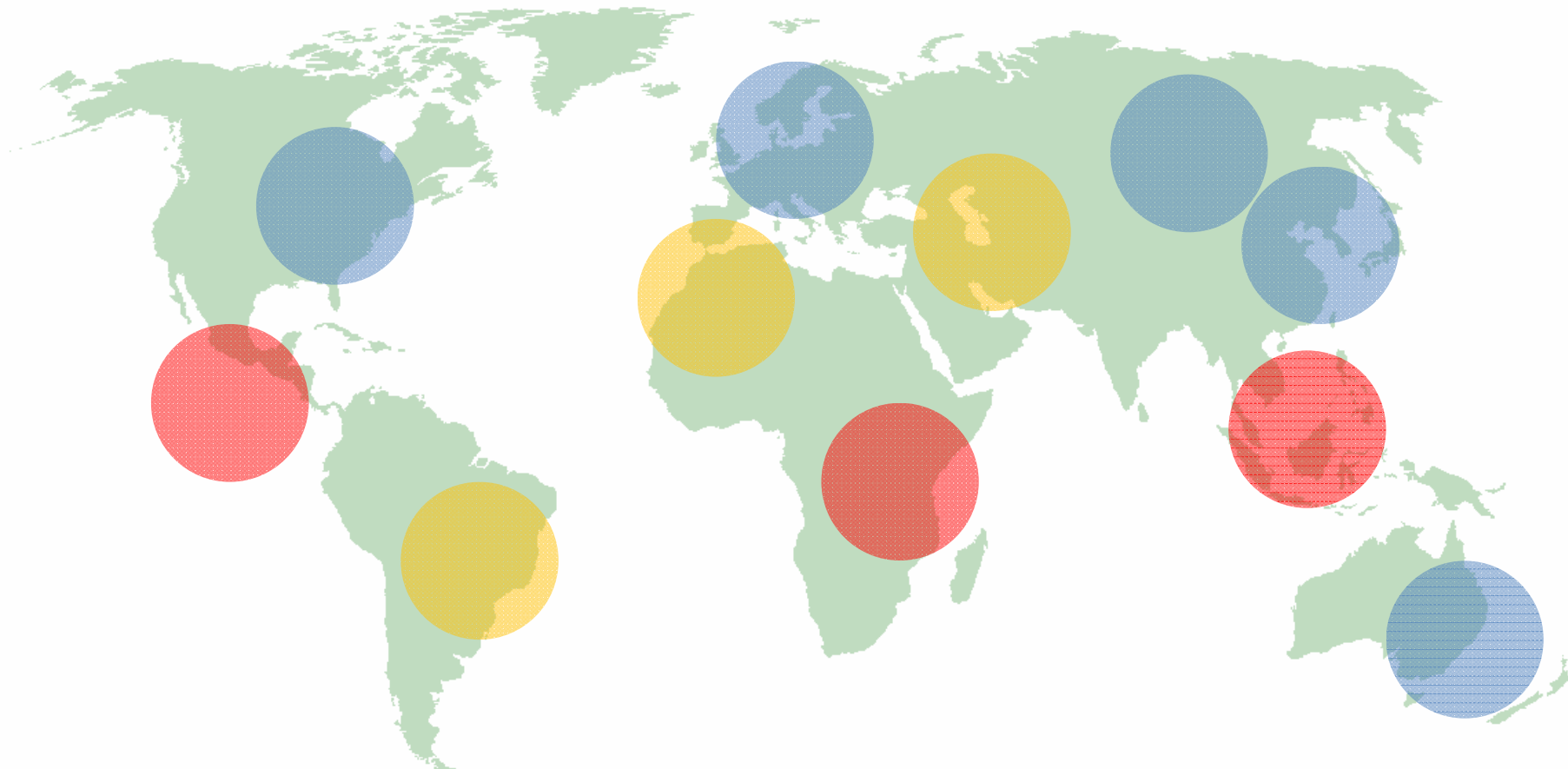
Gini coefficient – Lorenz curves



Gini coefficient – Lorenz curves



potential risk (a synthesis)



low



medium



high or very high

thank you
ana.iglesias@upm.es

Presentation made at the:

“NUEVOS RETOS Y HERRAMIENTAS
INNOVADORAS EN LA GESTIÓN DE LOS
RIESGOS AGRARIOS”
UIMP, Santander, 28 July 2011