# Understanding Europe's future ability to feed itself within an uncertain climate change and socio-economic space

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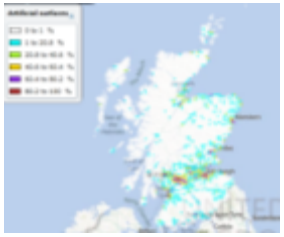
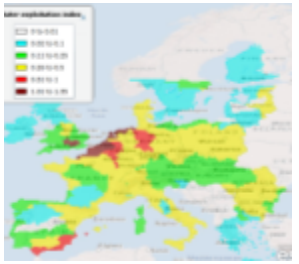
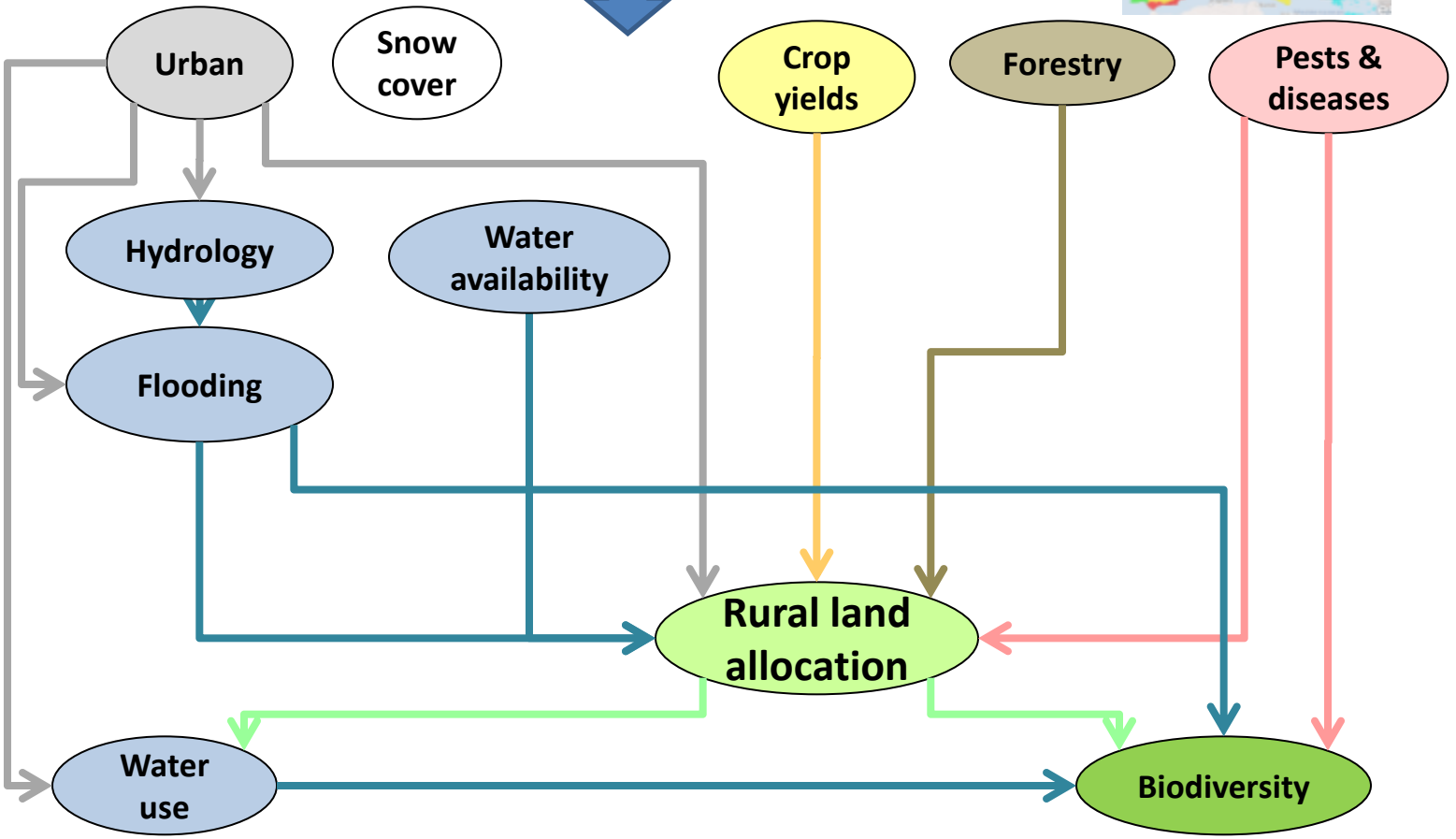
www.cranfield.ac.uk

# The CLIMSAVE project

Climate Change Integrated Assessment Methodology for Cross-Sectoral Adaptation and Vulnerability in Europe







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The CLIMSAVE Integrated Assessment Platform (IAP) is a web-based tool to enable you to explore climate change from regional to EU scales

- **Impacts** – simulates how climate and socio-economic change may affect urban, flooding, agriculture (arable and grassland), forest, water resources and biodiversity
- **Vulnerability** – identify 'hot spots' in Europe
- **Adaptation** – assess how adaptation can reduce impacts
- **Accessible at [www.climsave.eu](http://www.climsave.eu)**

http://ec.europa.eu/research/fp7/Funded under the European Commission
Seventh Framework Programme
Contract Number: 244031

# Climsave Land Allocation

- Demand = population + changes in (ruminant meat consumption, non ruminant meat consumption) - imports
- Supply = yields + increase (crop breeding, efficiency of irrigation) - land removed for conservation and bioenergy cropping.
- Land is *apriori* allocated to urban then on profit thresholds to arable (350 Eur/ha), dairy grass, extensive grazing, managed forest, unmanaged forest, and finally abandoned. Prices are iterated to supply demand

# Method

- Rapid and systematic Impact Response Surfaces of keys pairs of variables
  - Climate: Temperature Increase, Rainfall decrease, $CO_2$ levels
  - Social: Population increase
  - Adaptation: Yield increase
- Programmatically implemented on the desktop-based CLIMSAVE
- CLIMSAVE has 109 continuous and discrete scenario variables producing 171 output variable for each of the 27k 10’ grids

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IAP Home

Save scenario | Load scenario | Sectoral Indicators | Absolute / Relative to Baseline | Help | Export | Map / Chart / Table

**Scenario selection** Timeslice: Baseline Sector : Agriculture Indicator: Intensively farmed

Annual Temperature changed = 0 °C
0 °C — 6 °C

Winter Precipitation ch.= 0 %
-50 — 50

Summer Precipitation ch.= 0 %
-50 — 50

CO2 concentration = 350 ppm
350 — 700

Sea level change = 0 m
0 — 2

**Socio-economic scenario settings** SESS details ON

Economic (2) | Environmental(1) | Policy governance | Capitals

Guidance | Social | Technological | Economic (1)

Population change = 0% from current
-50 — 50

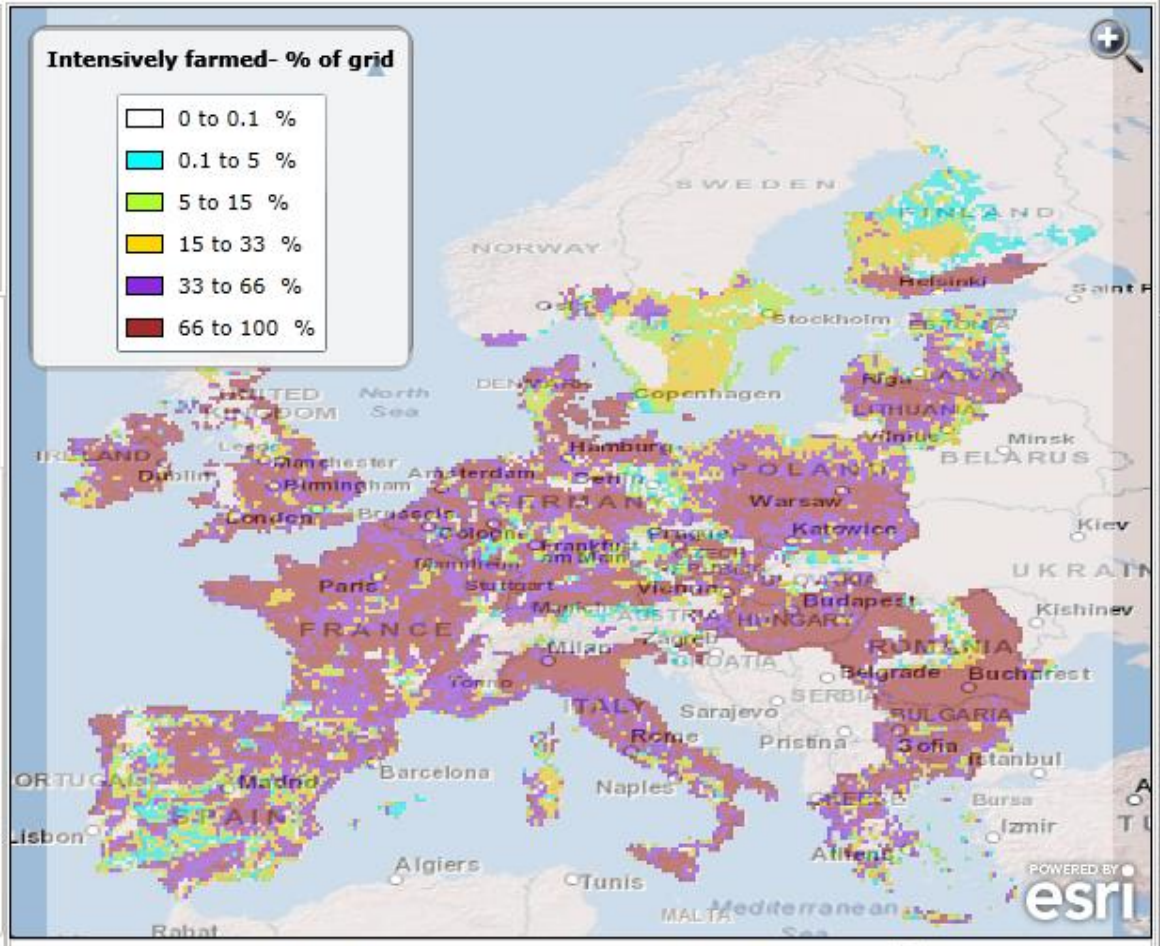
Water savings due to behavioural change = 0% from current
-50 — 50

Change in dietary preference for beef and lamb = 0% from cur
-100 — 100

Change in dietary preference for chicken and pork = 0% from c
-100 — 100

Household externalities preference = 3
1 — 5

RUN | Set Legend



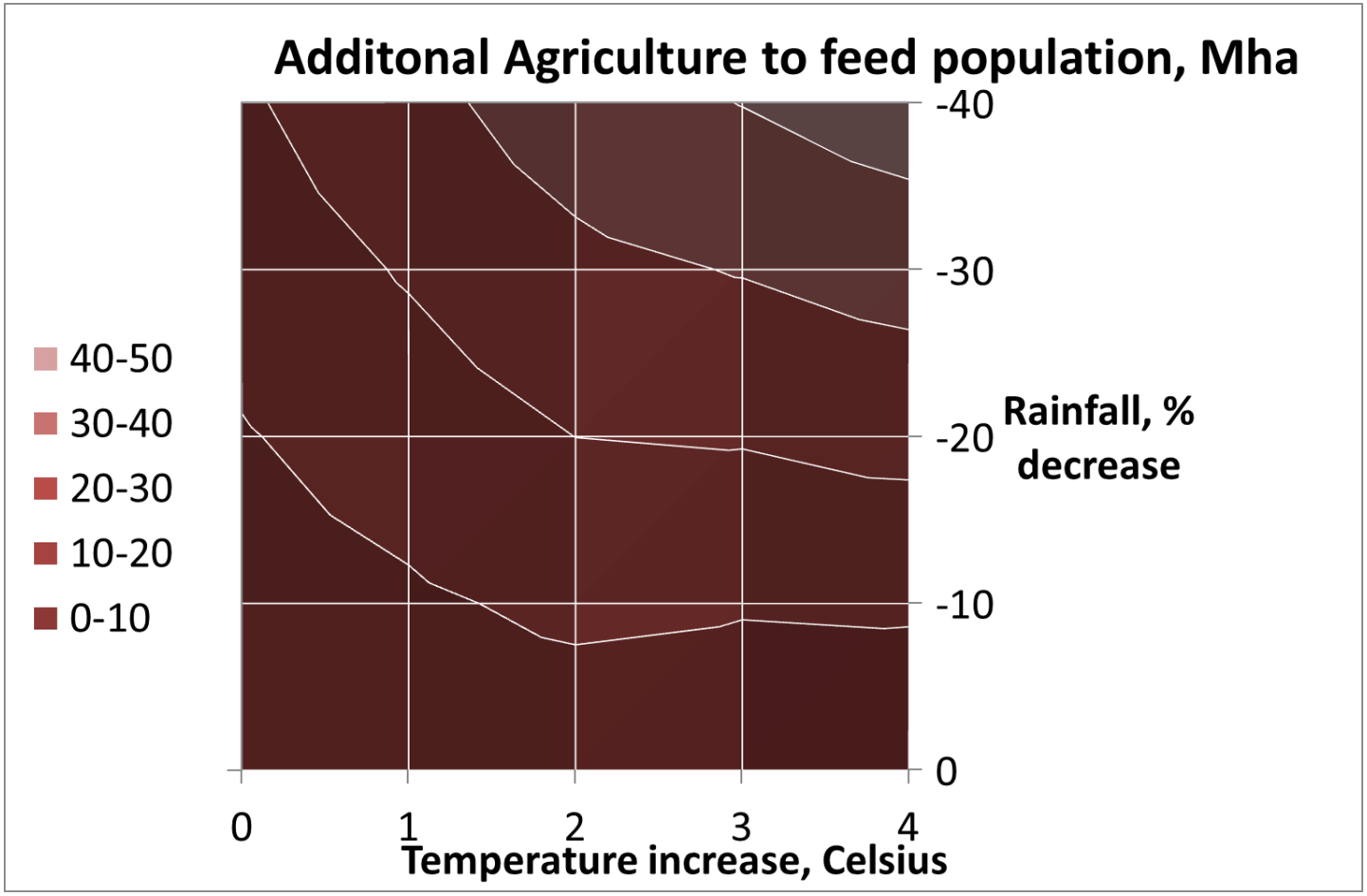

Lat: 63.01, Lon: 10.88 VALUE = 0.0 % Opacity: 0.5

Impacts | Adaptation | Vulnerability

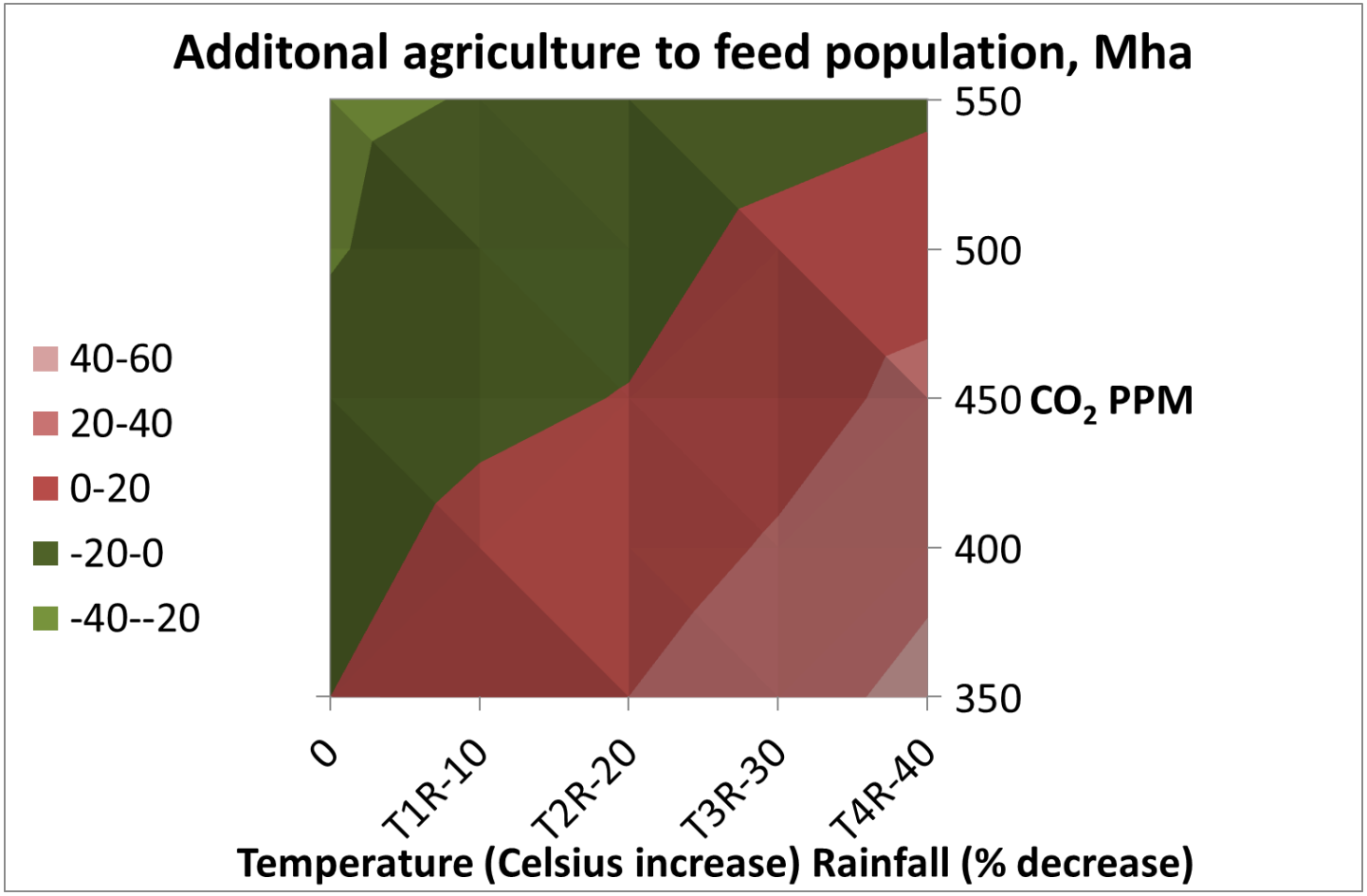
Working ...

RUG ended; SNOW ended; WGMMhu1 ended; PESTS ended; FLOOD ended; SFARMMOD ended; SPECIES started; WGMMu2 ended; LPJ ended;

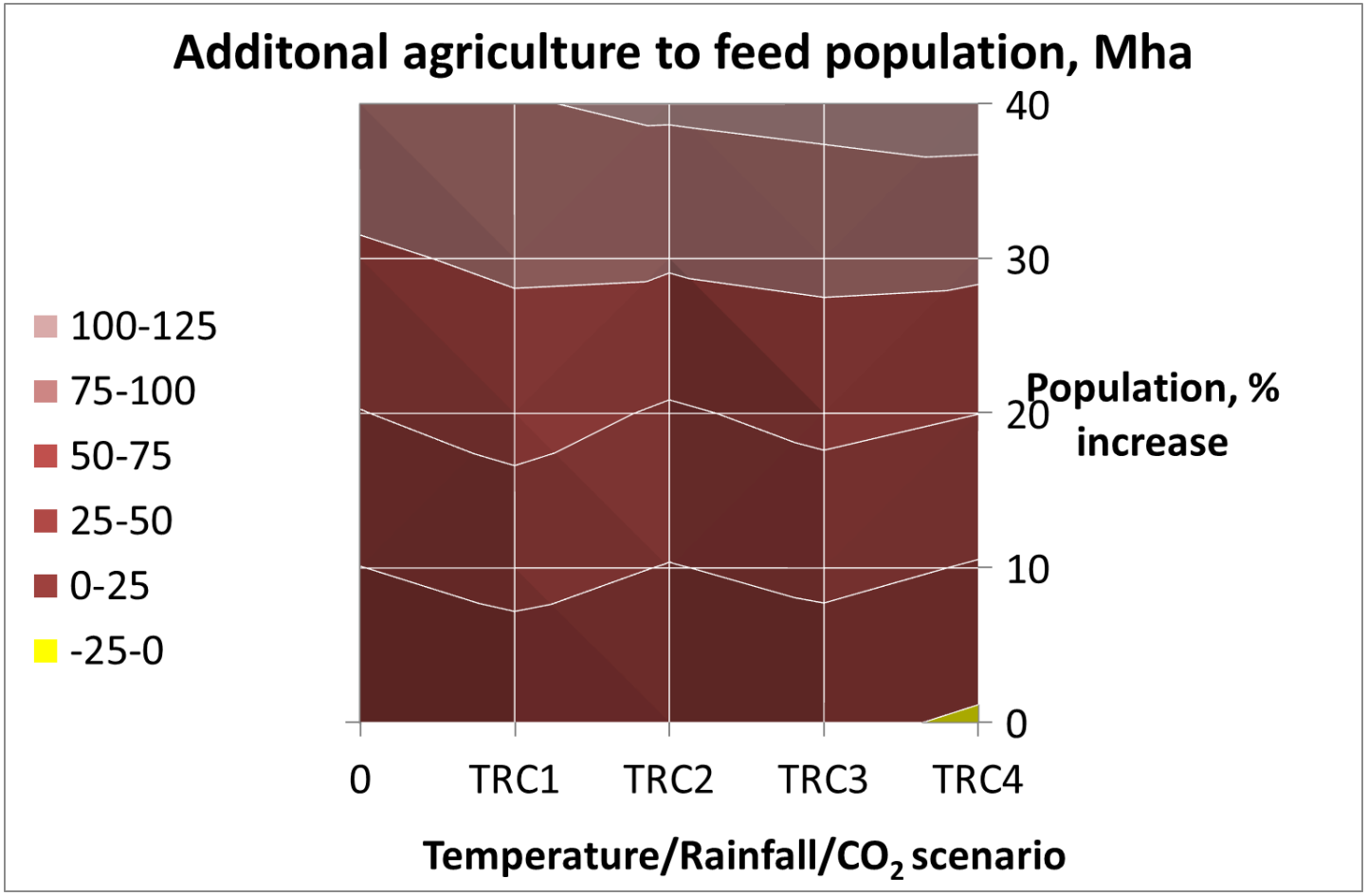
# Results


Additonal Agriculture to feed population, Mha
40-50
30-40
20-30
10-20
0-10
-40
-30
-20
-10
0
Rainfall, % decrease
0
1
2
3
4
Temperature increase, Celsius

# Results


Additonal agriculture to feed population, Mha
40-60
20-40
0-20
-20-0
-40--20
550
500
450
400
350
$CO_2$ PPM
0
T1R-10
T2R-20
T3R-30
T4R-40
Temperature (Celsius increase) Rainfall (% decrease)

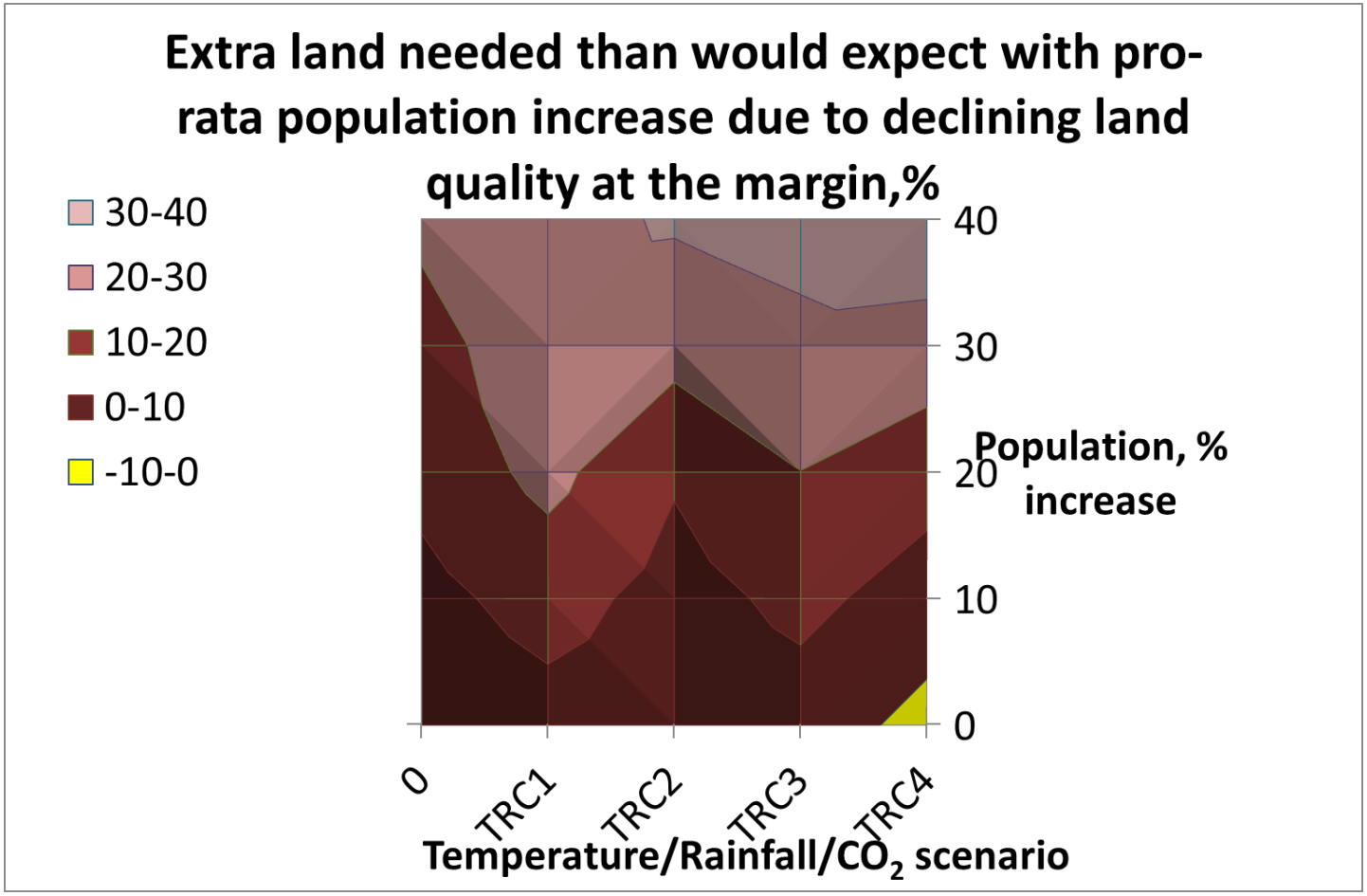
# Results


Additonal agriculture to feed population, Mha
100-125
75-100
50-75
25-50
0-25
-25-0
40
30
20
10
0
Population, % increase
0
TRC1
TRC2
TRC3
TRC4
Temperature/Rainfall/CO2 scenario

# Method

| Label | T Increase, C | Rainfall decrease | $CO_2$,PPM |
|---|---|---|---|
| 0 | 0 | 0 | 350 |
| TRC1 | 1 | -10% | 400 |
| TRC2 | 2 | -20% | 450 |
| TRC3 | 3 | -30% | 500 |
| TRC4 | 4 | -40% | 550 |

# Results


Extra land needed than would expect with pro-rata population increase due to declining land quality at the margin,%
30-40
20-30
10-20
0-10
-10-0
40
30
20
10
0
Population, % increase
0
TRC1
TRC2
TRC3
TRC4
Temperature/Rainfall/CO2 scenario

# Method

There are 60 climate scenarios

- Five Climate Models (CSMK3 (default), HadGem, CPM4, GFCM21, MPEH5)
- Four Emission Scenarios
- Three Climate Sensitivities

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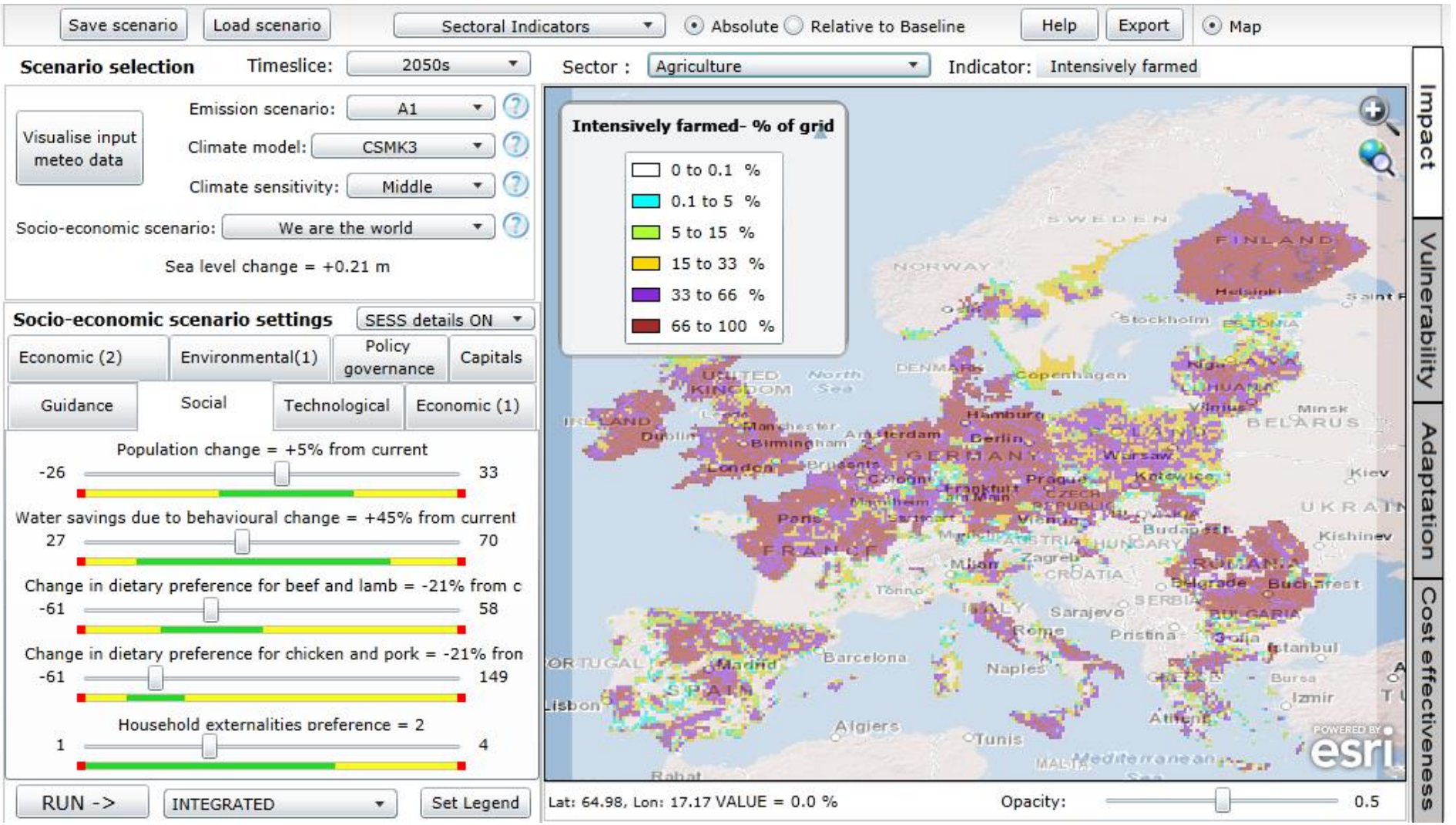
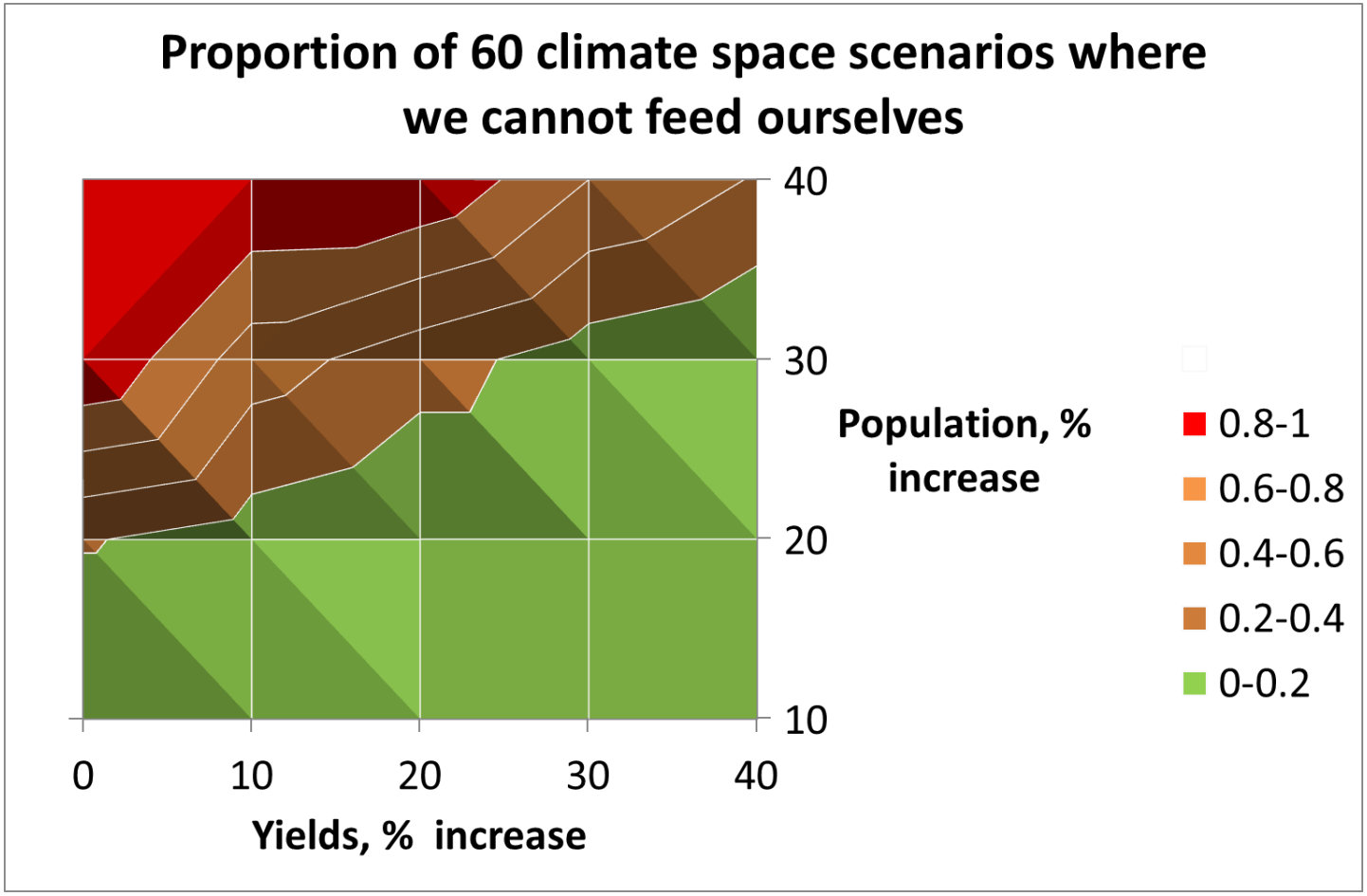


# Results


Proportion of 60 climate space scenarios where we cannot feed ourselves
40
30
20
10
0
10
20
30
40
Yields, % increase
Population, % increase
0.8-1
0.6-0.8
0.4-0.6
0.2-0.4
0-0.2

# Discussion

- Land comes from some other use
  - Timber production is likely to be reduced
- Imports are held constant
  - Global population growth might reduced feed available to import
- Yield increase –is that a good adaptation to population growth ?
  - Would the research investment succeed?

# Conclusions

- Rapid runs enable systematic model evaluation over its input space
- $CO_2$ rising to 550 ppm mitigates the impact of rising temperature and falling rainfall
- Population rising by 40% remains a problem
- It can help identify discontinuities and non intuitive behaviour