PBL Netherlands Environmental Assessment Agency

UNSD / WCMC SEEA Post-2020 workshop

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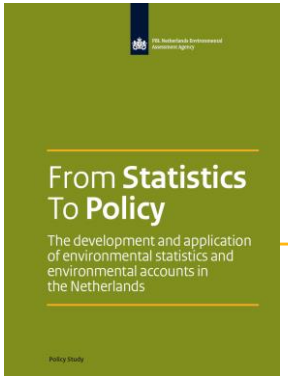
PBL's involvement with SEEA / WAVES

- From statistics to policy
  - Place and function of statistics in policy development

- Global model results to develop accounts
  - Global assessments, scenarios
  - Examples where global modelled data are used to provide basic accounts

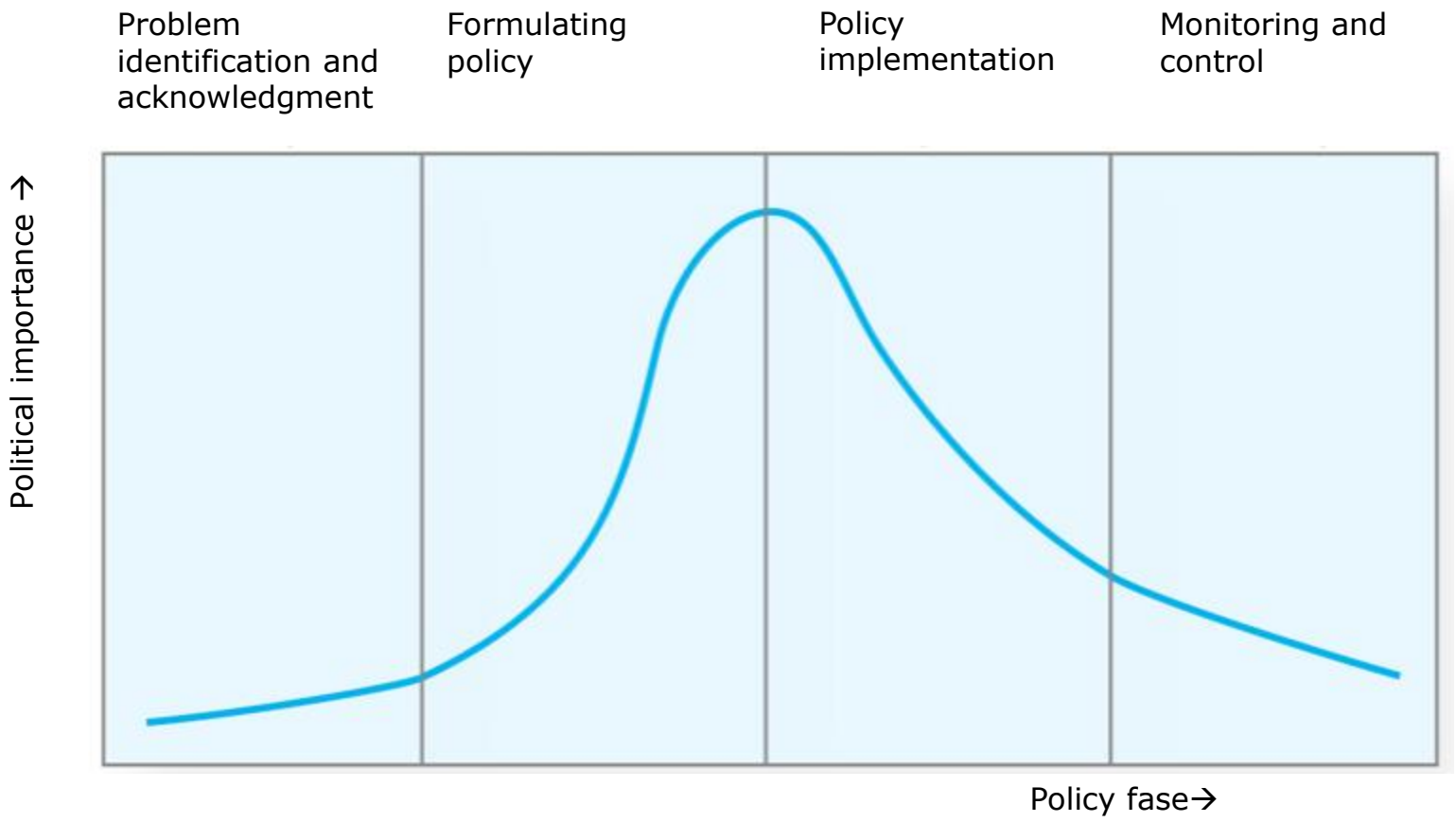


https://www.pbl.nl/en/publications/from-statistics-to-

From statistics to policy – key takeaways

- Information needs differ
  - per policy phase
  - per use
  - per audience
- Policy evaluation is a separate task that requires specific expertise and instruments
- Realise there can be multiple channels for linking statistics and policy
  - Policy evaluation institutes
  - Online accessible data
  - Mandatory (by law) reports and national committees

Phases in the policy cycle



Uses of environmental statistics

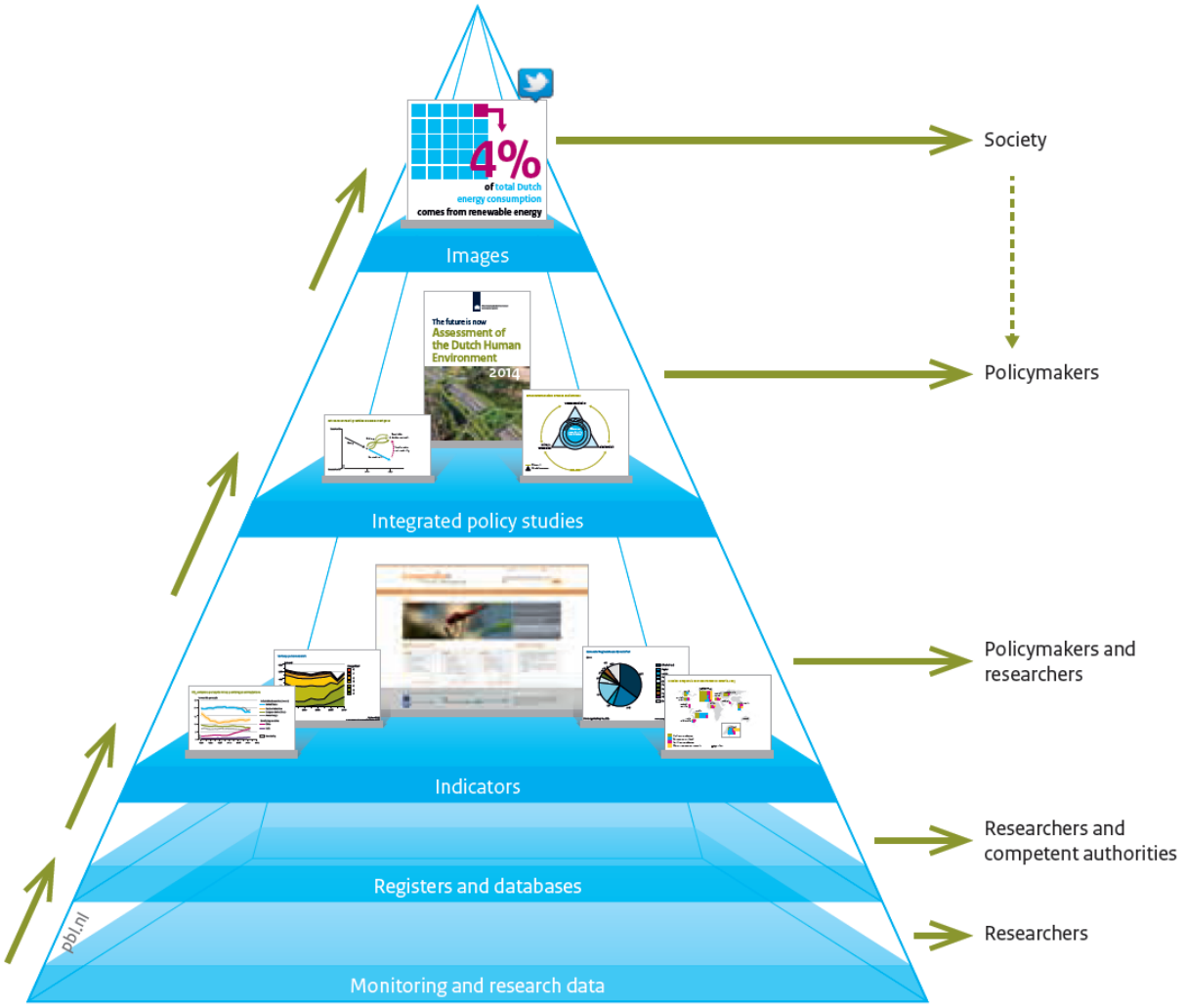
- Policy cycle:
  - awareness-raising, agenda-setting and prioritisation of environmental issues
  - supporting policy development
  - policy monitoring, evaluation and adjustment

- Others:
  - the extent and distribution of environmental costs and benefits;
  - international comparisons and obligations;
  - scientific research (not directly policy-related).

Different audiences

Figure 1.1

The environmental information pyramid



Source: PBL

Policy evaluation as a separate task

- In most cases, raw statistical data not used in policy evaluation (in the Netherlands)
- Need to
  - Integrate analysis based on different data and sources
  - Against policy targets
  - Reasons for past developments - check for cause/effect
  - Assess potential effects of future policies
  - Know about policy instruments, evaluation methods

Communication

- Example from online system:
  - Breakdown into categories
  - Time series
  - Policy target
  - Data provided by non-profit organization

Figure 4.1

Market share of certified timber

Source: Probos

Global model results as basis for accounts

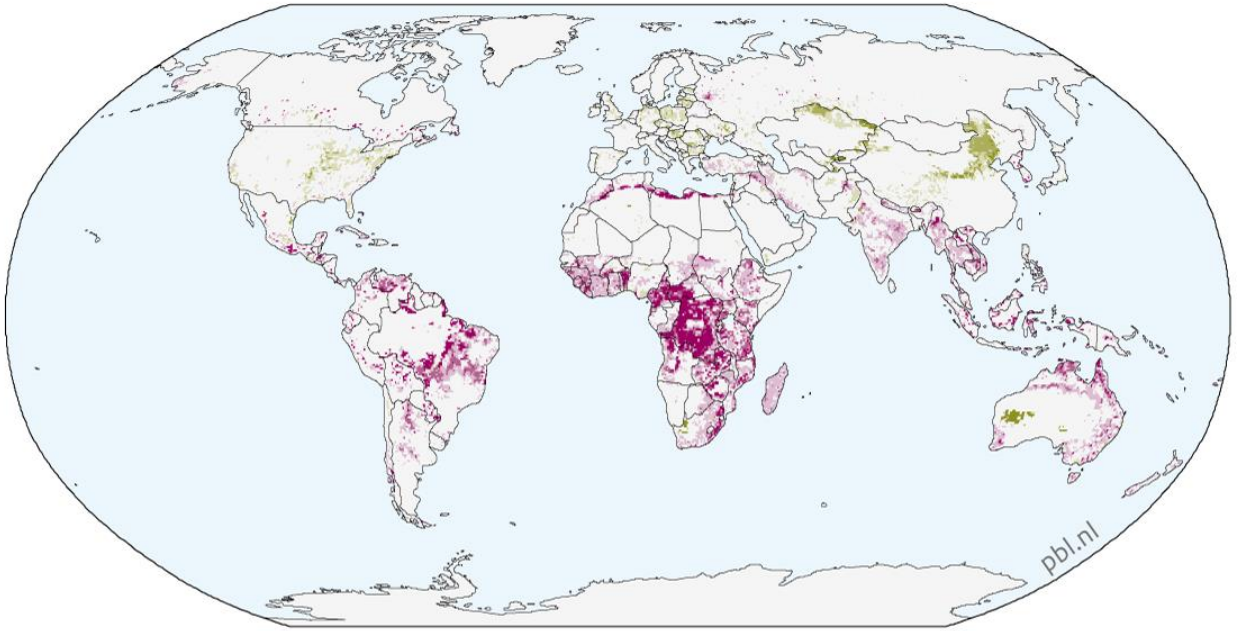
- What to expect from global modelled indicators?
  - Big questions
  - Direction of change, order of magnitude, interactions

- Three examples:

  - Biodiversity – in cooperation with Mexico
  - Soils – ongoing, in cooperation with India and Mexico
  - UNCCD National reports

Land-use change per scenario, 2010 – 2050

SSP2 scenario



Deforestation and conversion of other natural land (% change per gridcell)

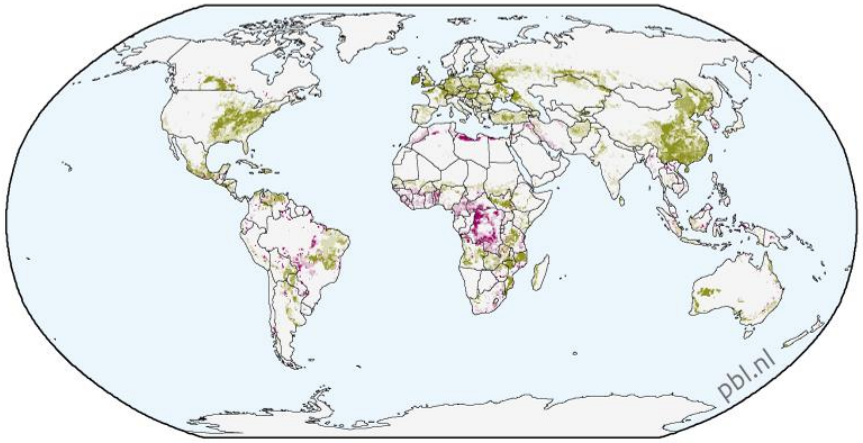
5 30 50 100

Reforestation and abandonment of agriculture to other natural land (% change per gridcell)

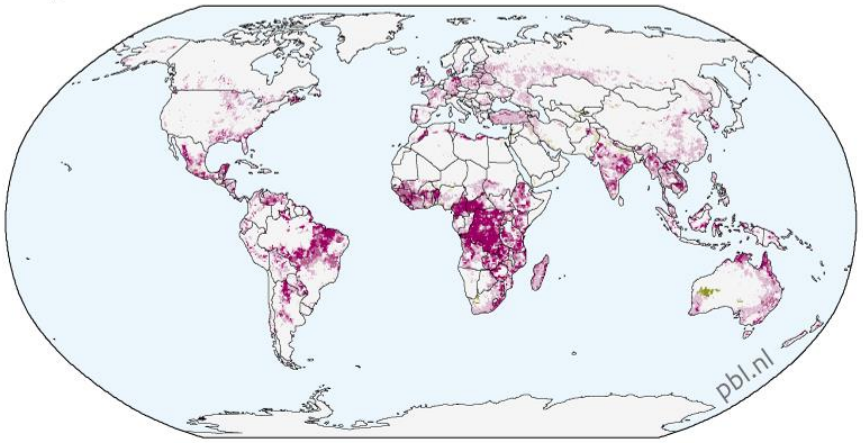
5 30 50 100

No or small change (less than 5%)

SSP1 scenario

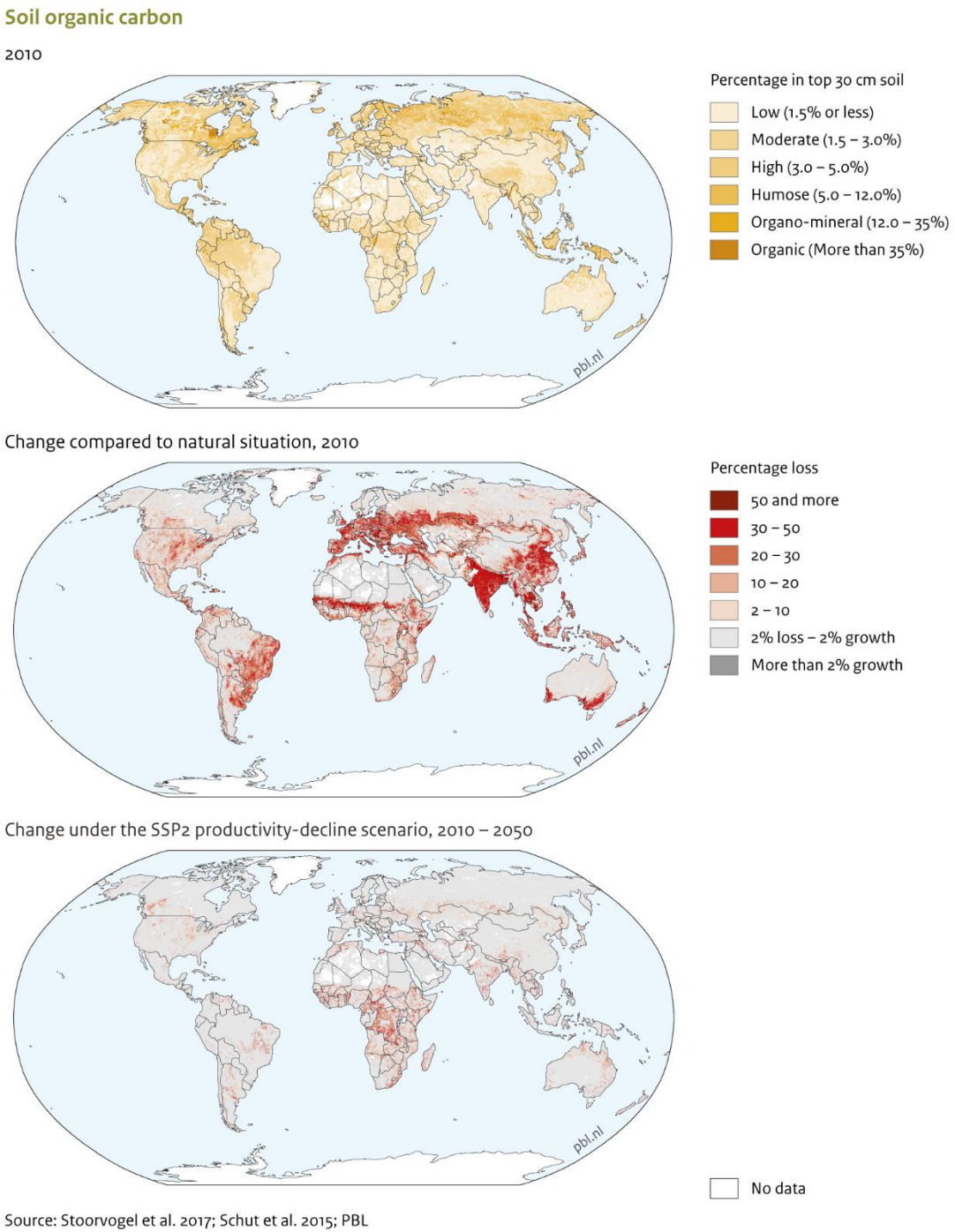


SSP3 scenario



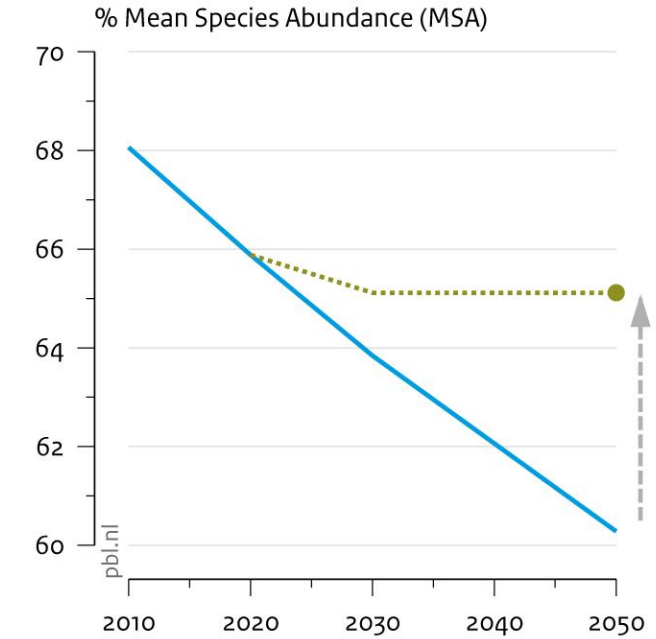
Source: PBL/IMAGE

Past, current, future projection for soil organic carbon



Global biodiversity and options to prevent biodiversity loss

Global biodiversity



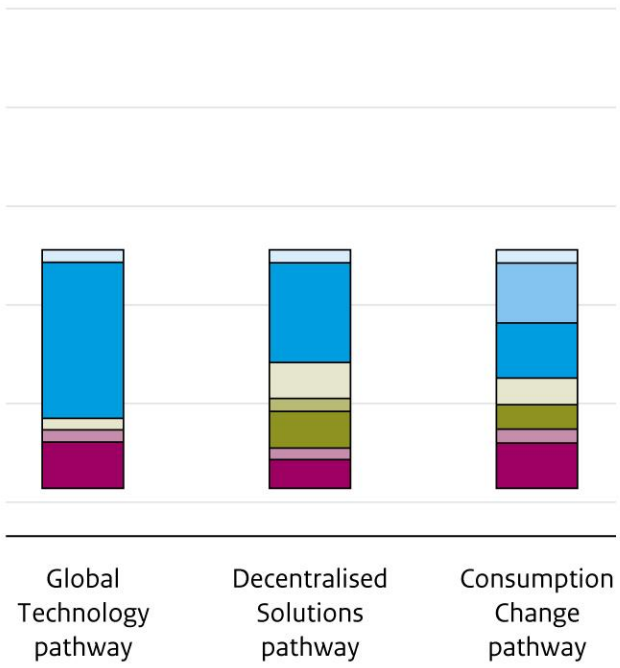
Trend scenario

Goal

Derivation of 2050 goal

Policy gap

Contribution of options to prevent biodiversity loss, 2050



Restore abandoned agricultural lands

Reduce consumption and waste

Increase agricultural productivity

Expand protected areas

Reduce nature fragmentation

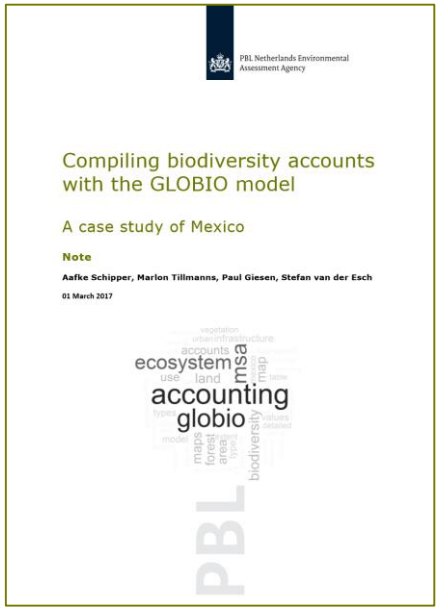
Reduce infrastructure expansion

Reduce nitrogen emmissions

Mitigate climate change

Three examples

- Biodiversity
  - GLOBIO model, in cooperation with Mexico
  - Ecosystem extent, ecosystem condition (MSA)
  - Three levels of detail: global (0.75), aggregated national (0.72), detailed national (0.65)
    - › Difference mainly caused by distinguishing secondary vegetation



- Soil accounts
  - Based on S-World
  - In progress

- UNCCD National reports

- Example of model-based indicator for Mexico

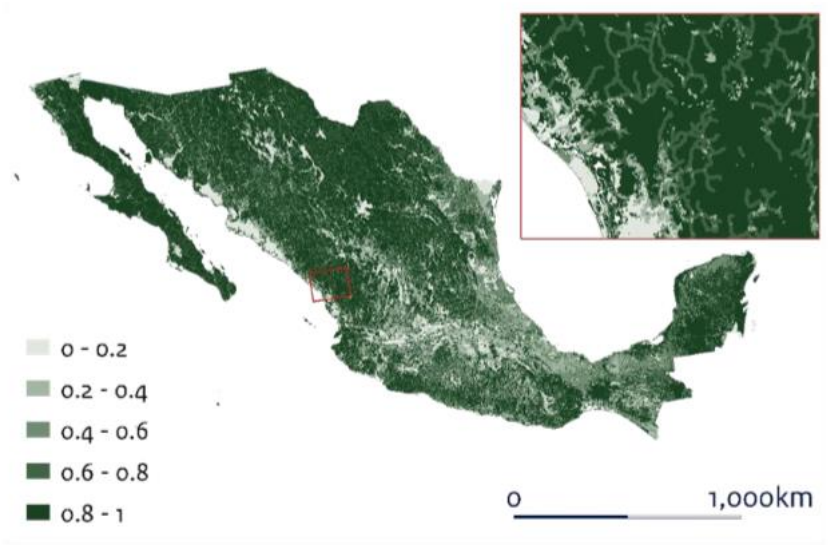


Figure 3.2 MSA in Mexico as function of land use and infrastructure (roads), based on the aggregated vector-based land-use map.

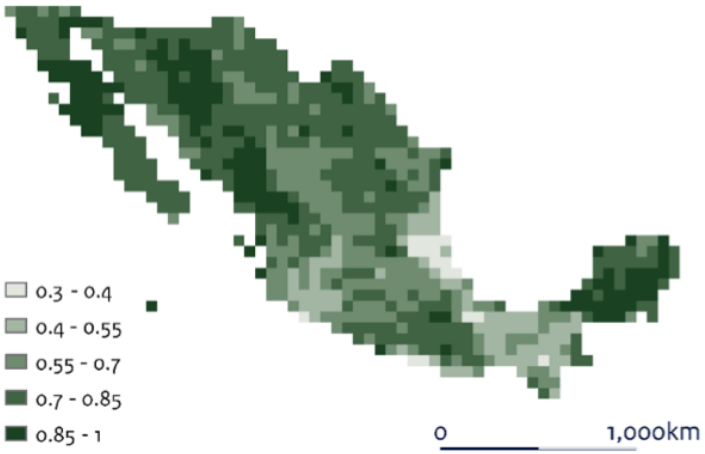


Figure 3.1 MSA in Mexico as function of land use and infrastructure (roads), based on the GLOBIO land-use map.

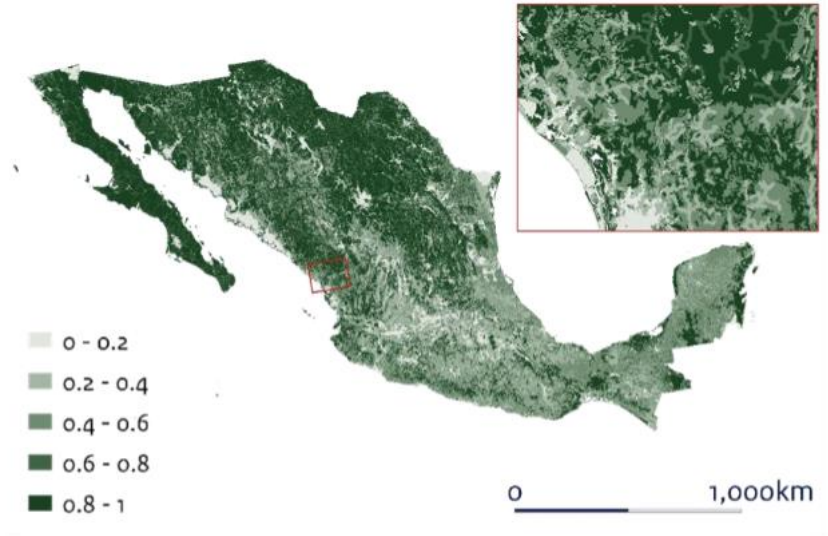


Figure 3.3 MSA in Mexico as function of land use and infrastructure (roads), based on the detailed vector-based land-use map.

Pre-filled national reports based on global databases / modelled results

degradation, promote sustainable land management and contribute to land degradation neutrality

SO1-2 Trends in land productivity or functioning of the land

Land productivity dynamics

Quantitative data National level estimates of land productivity dynamics within each land cover type: area covered by each class of land productivity dynamics (in km^2).

Default data are derived from the Joint Research Centre's Land Productivity Dynamics dataset

and they can be amended as appropiate

Net land productivity dynamics (2000-2013) (km^2)

Land cover class	Declining	Moderate decline	Stressed	Stable	Increasing	No data
Tree-covered areas	5	10	89	1.130	2.261	6
Grassland	63	199	817	3.395	7.356	21
Cropland	19	44	337	4.009	9.389	45
Wetland	5	6	28	187	353	34
Artificial surfaces	20	9	114	1.111	1.257	15
Other land			1	25	3	17

Estimates of land productivity dynamics for areas where a land conversion to a new land cover type has taken place (in km^2)

Land conversion Net area change		Net area change	Net land productivity dynamics (2000-2013) (km2)					
From	To	km^2	Declining	Moderate decline	Stressed	Stable	Increasing	
Cropland	Artificial surf	967	9	5	64	332	553	
Grassland	Artificial surf	270	5	2	20	62	179	
Tree-covered	Artificial surf	116	3	0	4	41	64	
Cropland	Grassland	56	0	0	6	11	39	

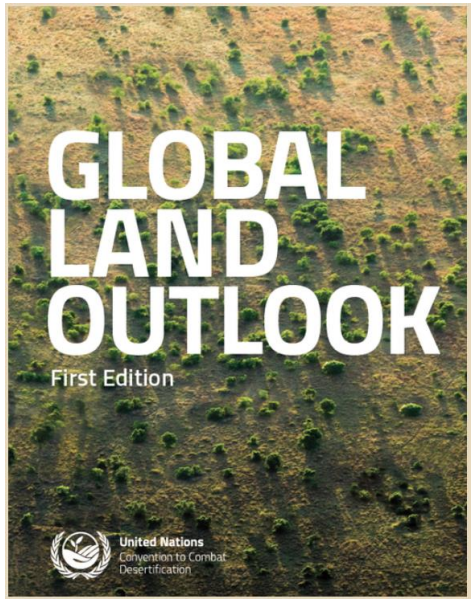
Add row

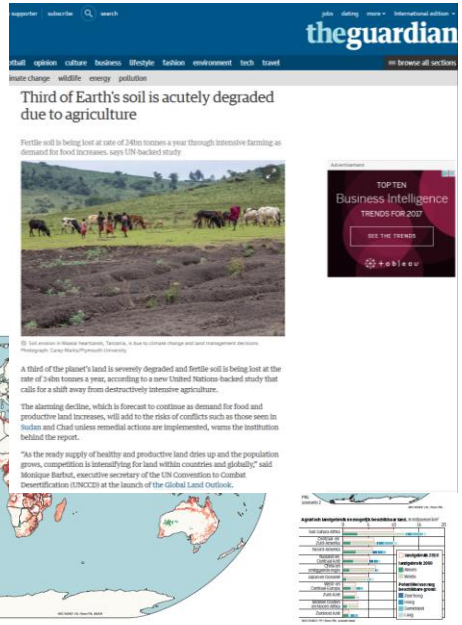
Please answer the following questions if you have edited or replaced the default data using other data sources:

Other metrics If your country uses a different metric to assess land productivity (e.g. Normalized Difference Vegetation

PBL Netherlands Environmental Assessment Agency

United Nations
Convention to Combat Desertification



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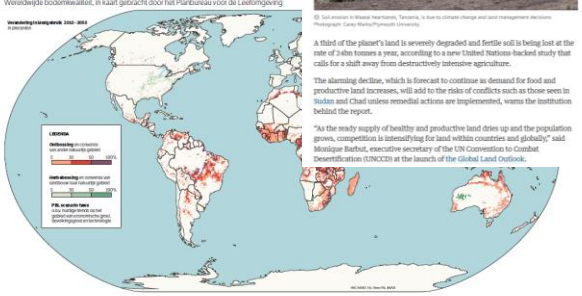
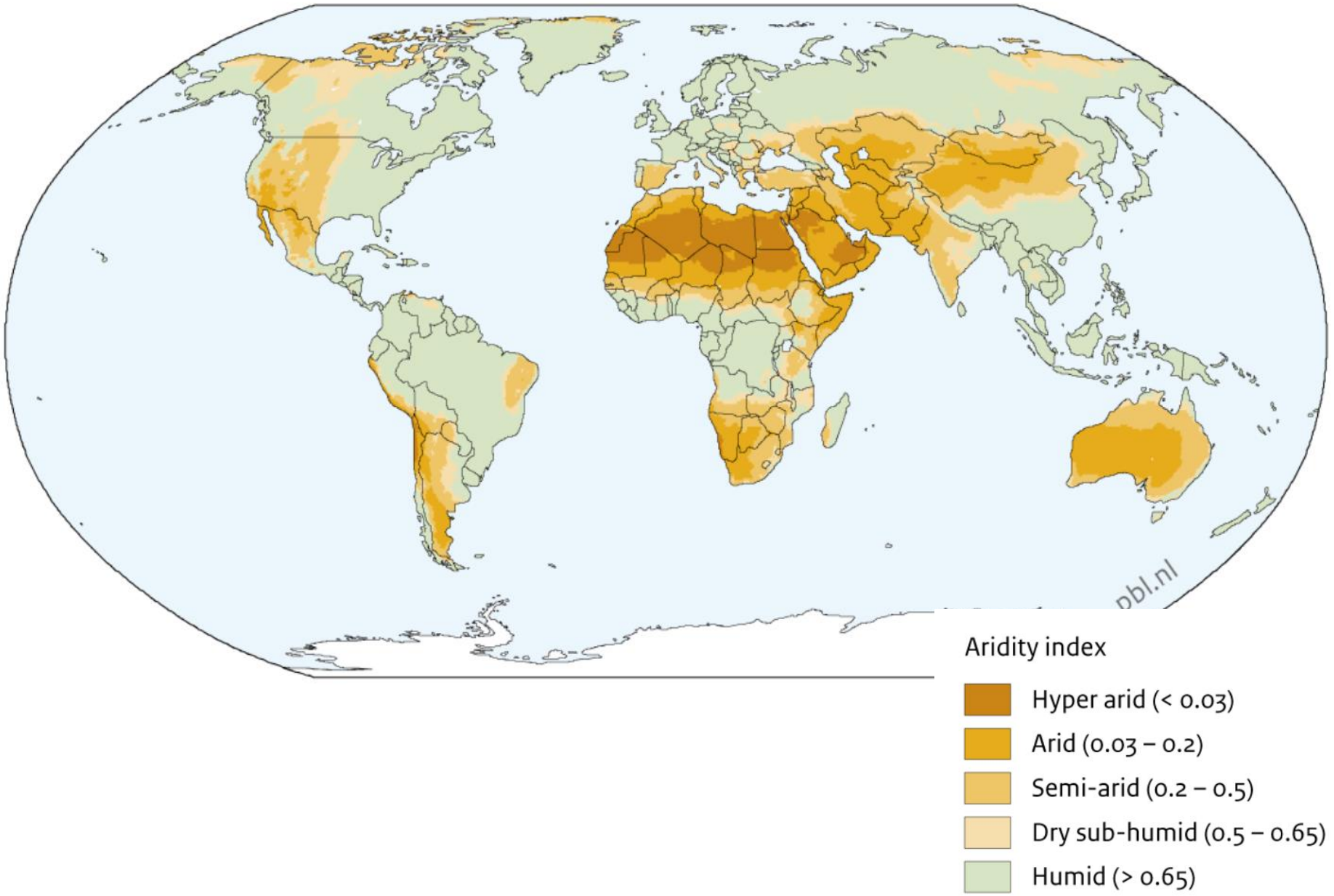


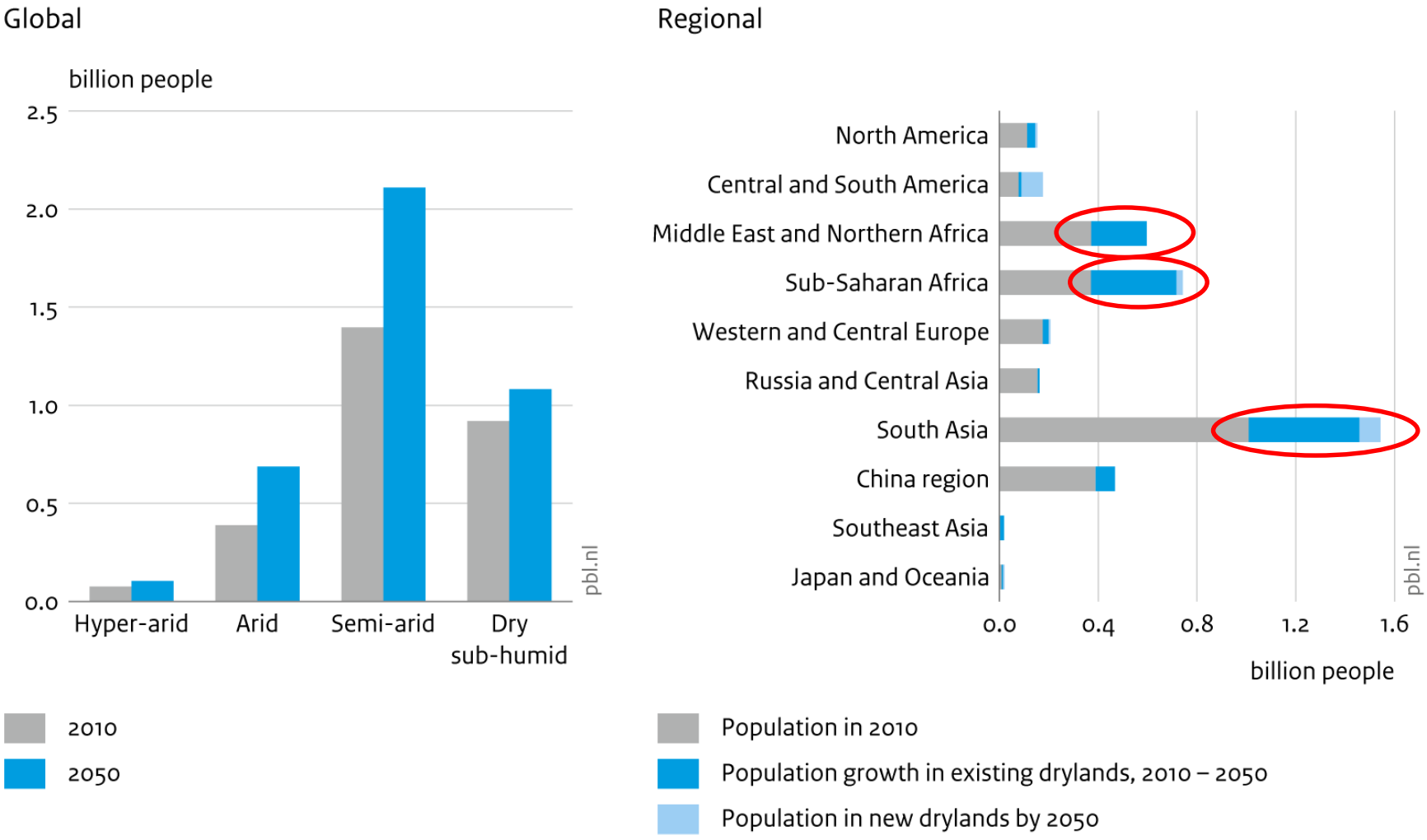

LANDGEBRUIK
Aardbodem valt ten prooi aan droogte en uitputting
Het Planbureau voor de Leefomgeving brengt een prestigieuze opdracht van de Verenigde Naties bring wereldwijd in kaart hoe aardbodem zich ontwikkelt. De resultaten zijn weinig bemoedigend.

Aridity

Aridity index, 2010



Population in drylands, under the SSP2 scenario



Source: PBL/IMAGE

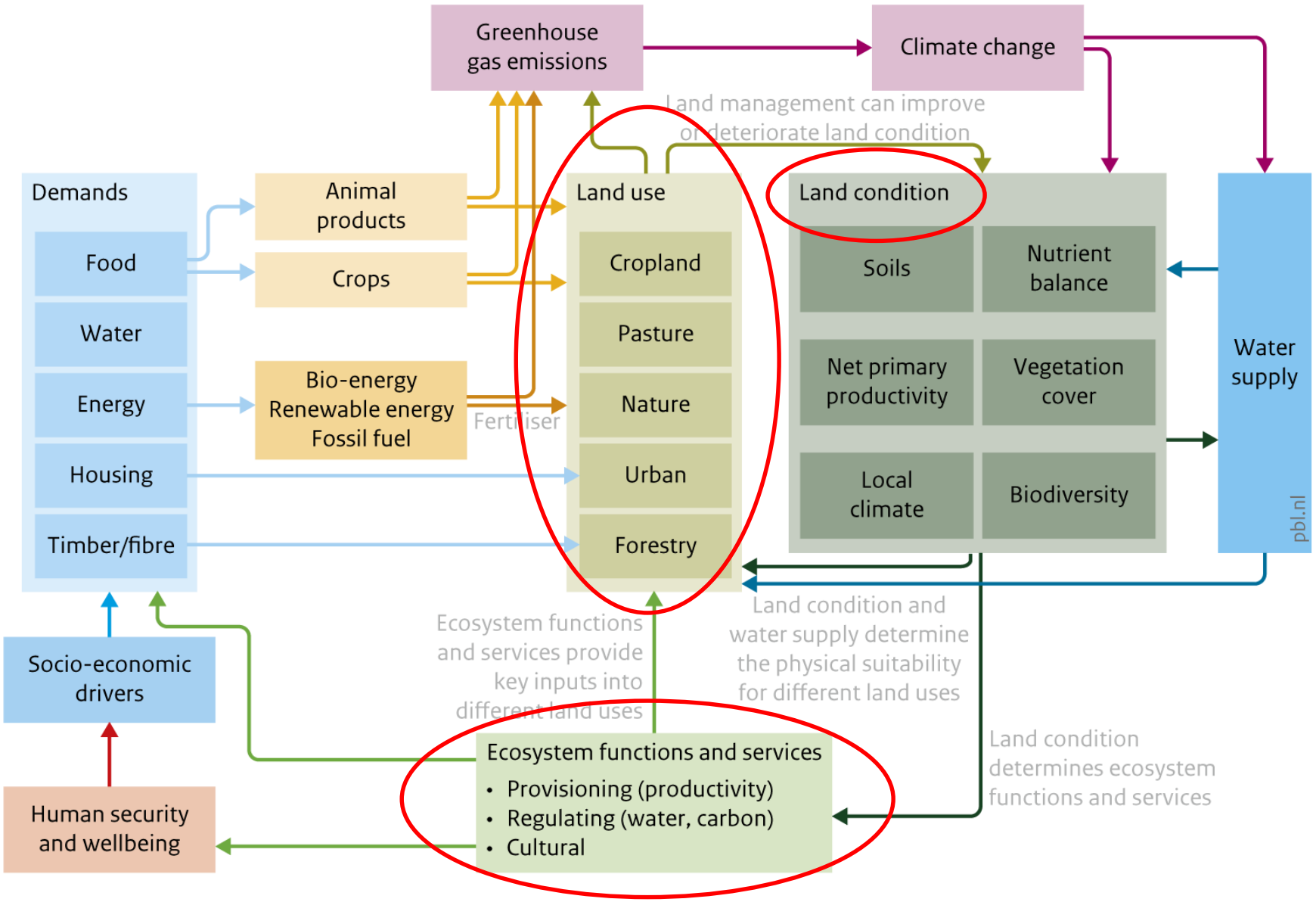
- Biggest growth in SSA, North Africa & Middle East, South Asia
- 80% faster than average population growth (~+45% vs +25%)

Global Land Outlook: Future changes to land use and land condition

- How is land use expected to change over the coming decades?
- How will that influence the challenge to achieve global sustainability ambitions?
- How will continued land degradation exacerbate this challenge?

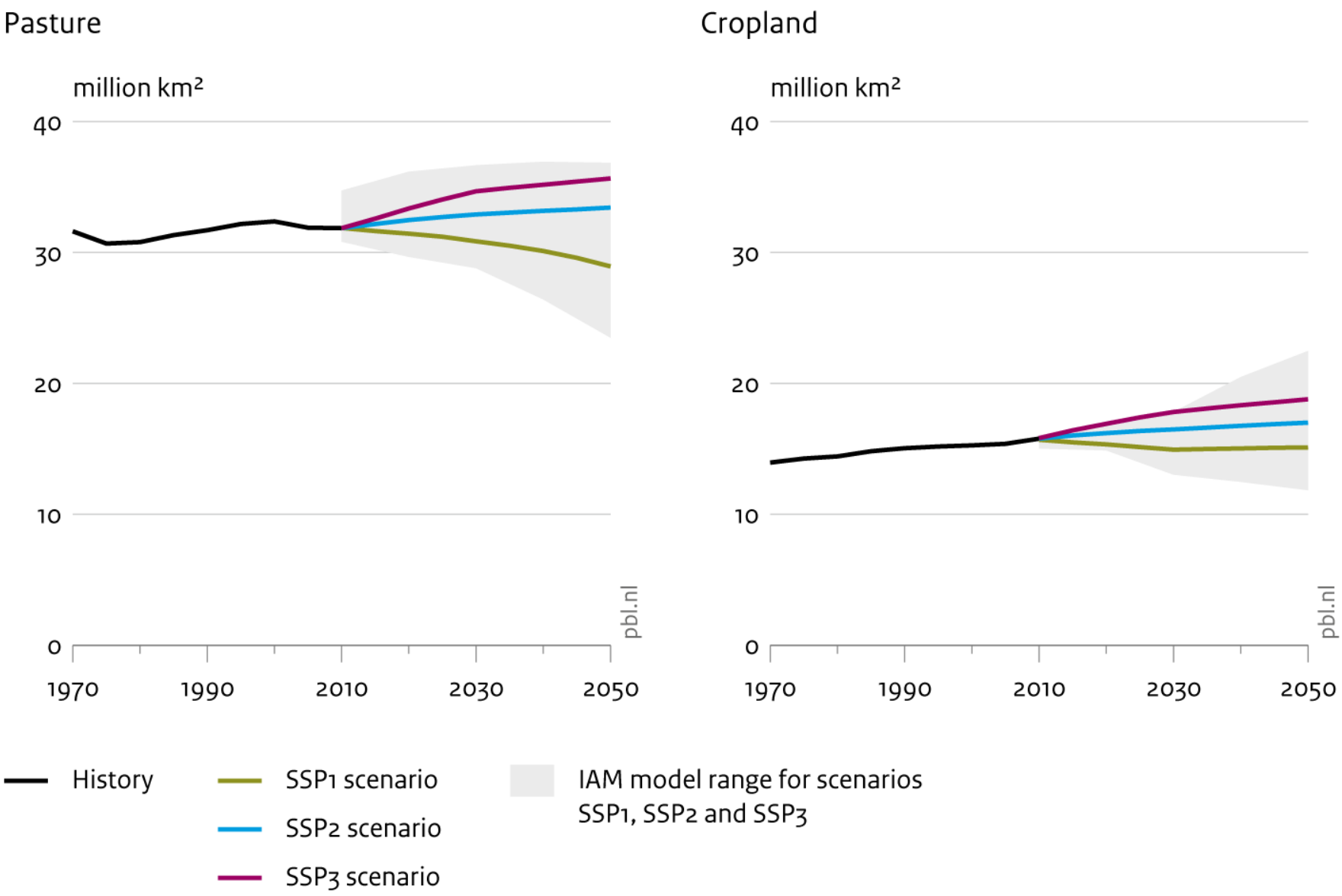
- SDG15.3 not limited to drylands

Interlinkages between key themes in global land systems



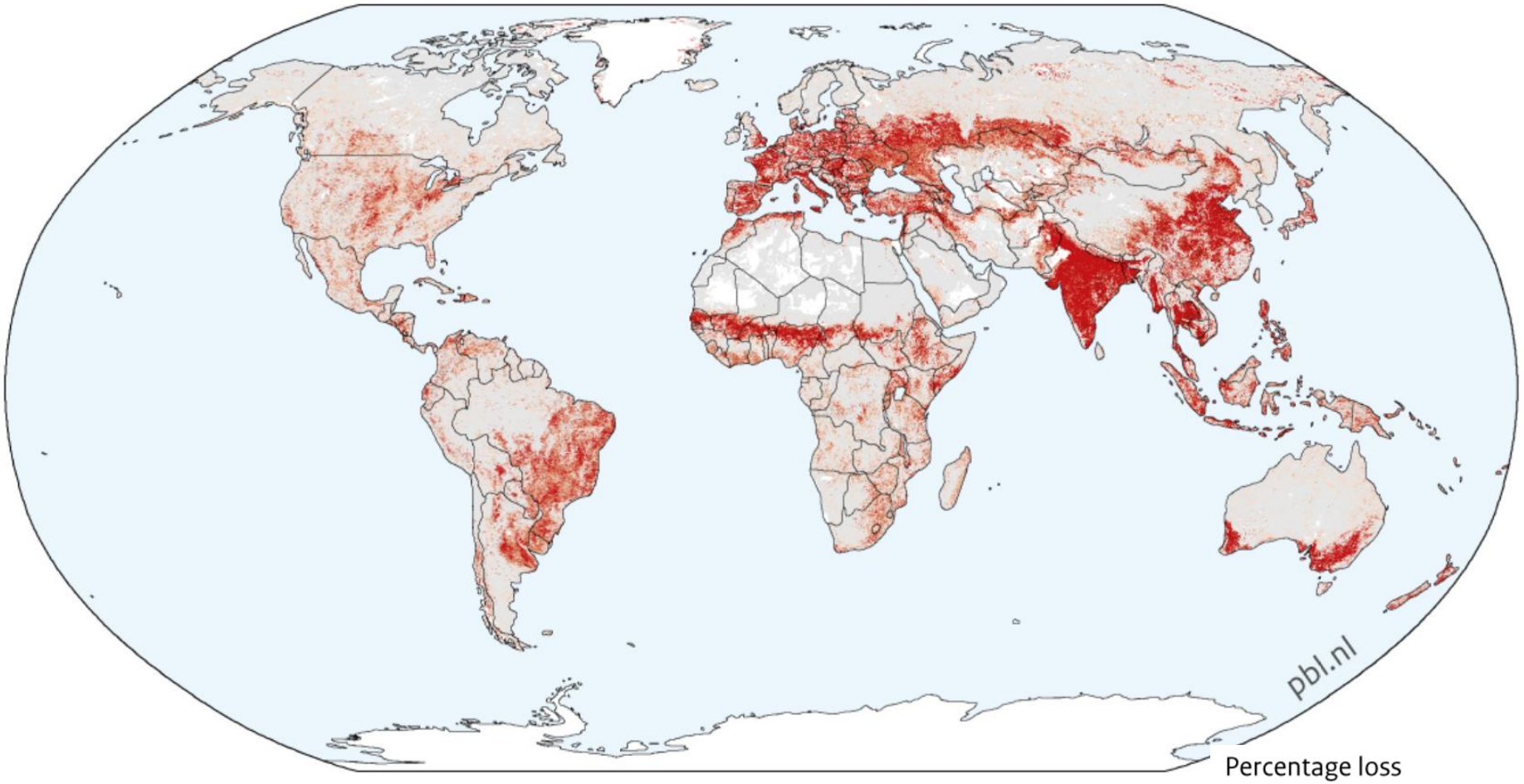
Source: PBL

Global agricultural area per scenario



Source: PBL/IMAGE

Change compared to natural situation, 2010

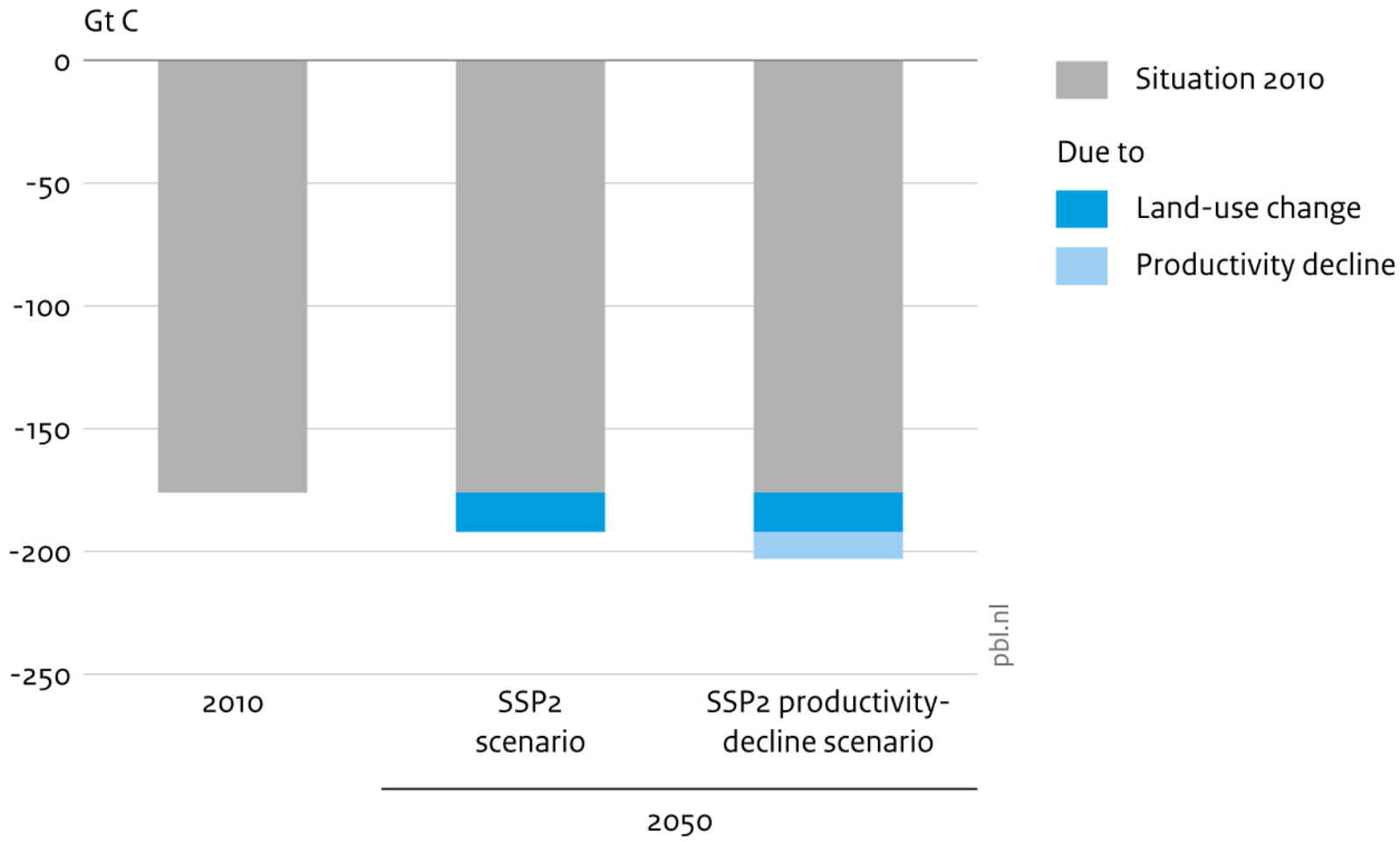


Percentage loss

- 50 and more
- 30 – 50
- 20 – 30
- 10 – 20
- 2 – 10
- 2% loss – 2% growth
- More than 2% growth

Source: Stoorvogel et al. 2017; Schut et al. 2015; PBL

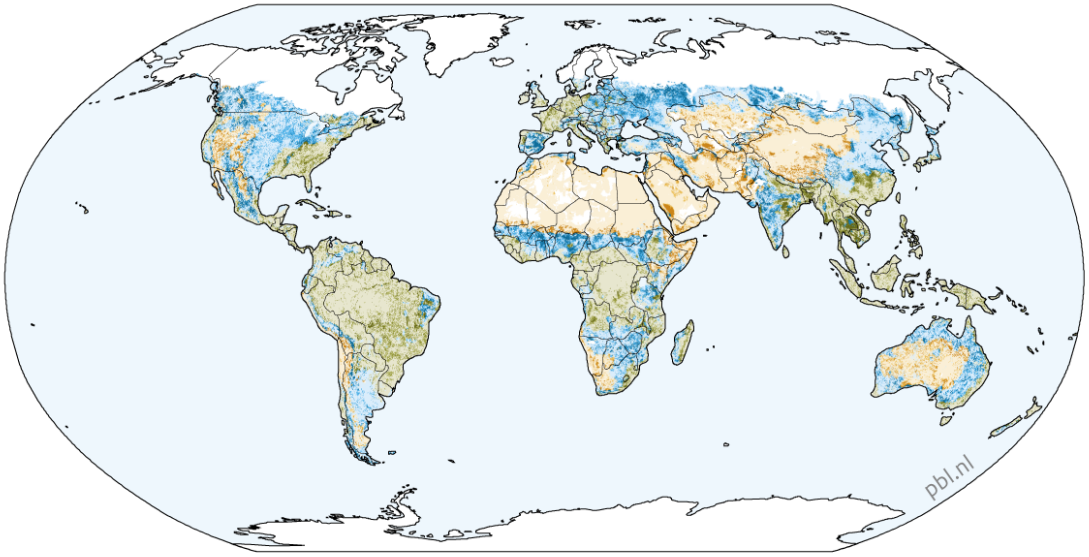
Change in soil organic carbon, per scenario, compared to natural situation



Source: PBL/IMAGE

Net primary production

2010 compared to natural conditions



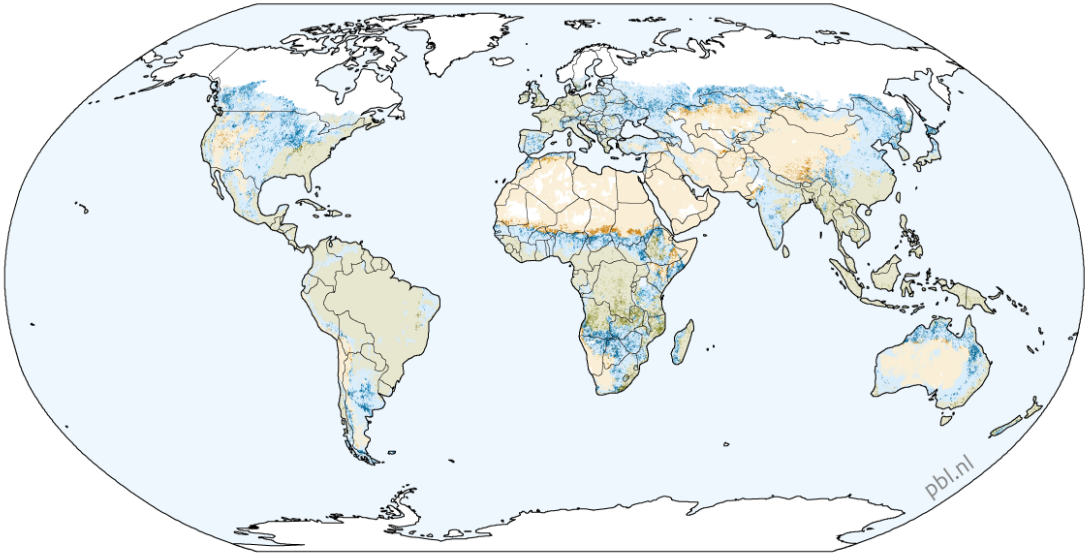
Low-productivity areas
- No significant loss
- 5 – 20 % loss
- More than 20% loss

Medium-productivity areas
- No significant loss
- 5 – 20 % loss
- More than 20% loss

High-productivity areas
- No significant loss
- 5 – 20 % loss
- More than 20% loss

Areas with extremely low productivity

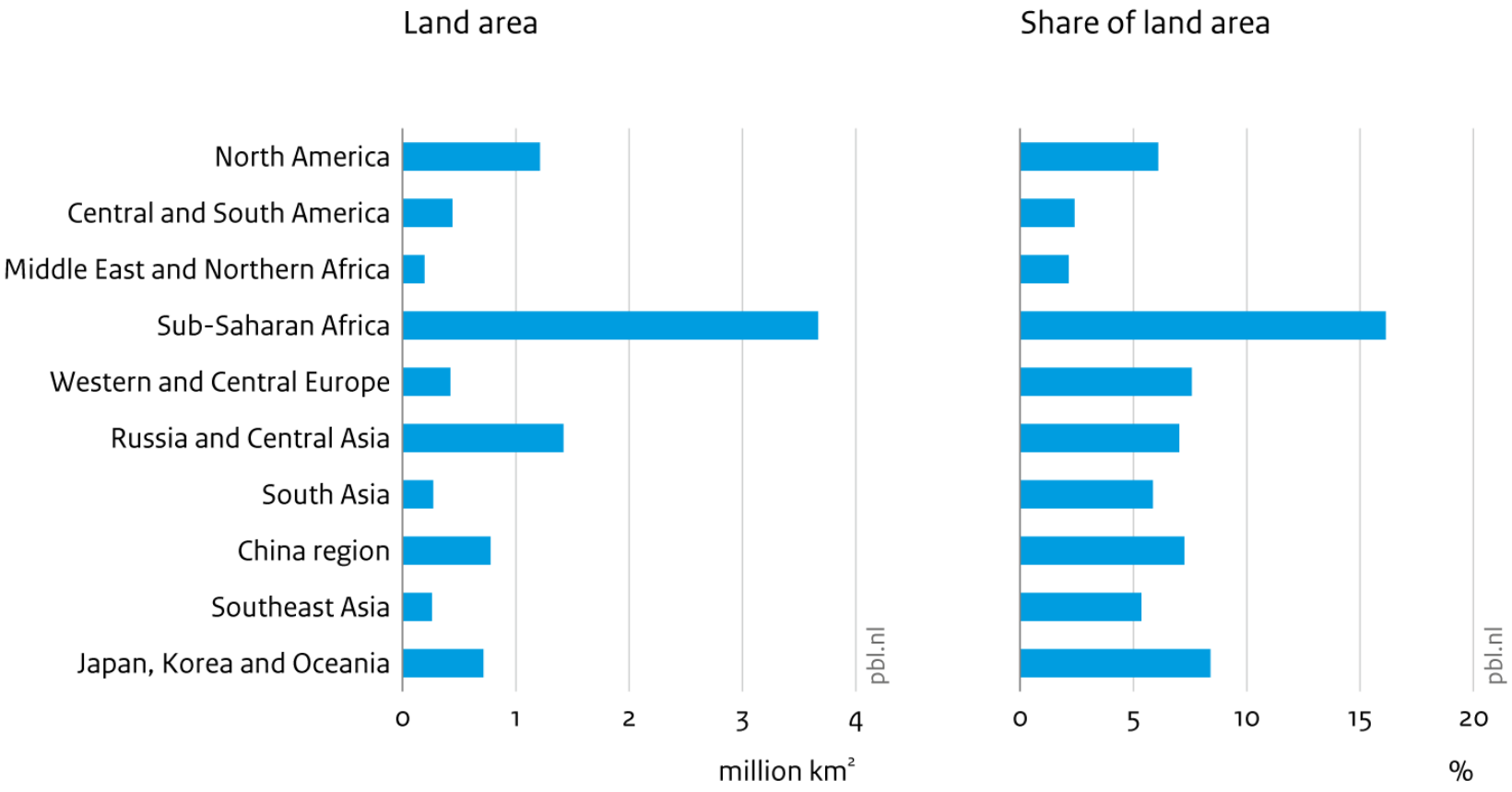
Change under the SSP2 productivity-decline scenario, 2010 – 2050



Insights:
- 28 million km2 productivity < natural
- ~ 5% lower NPP

Source: Stoorvogel et al., 2017; Schut et al., 2015; PBL

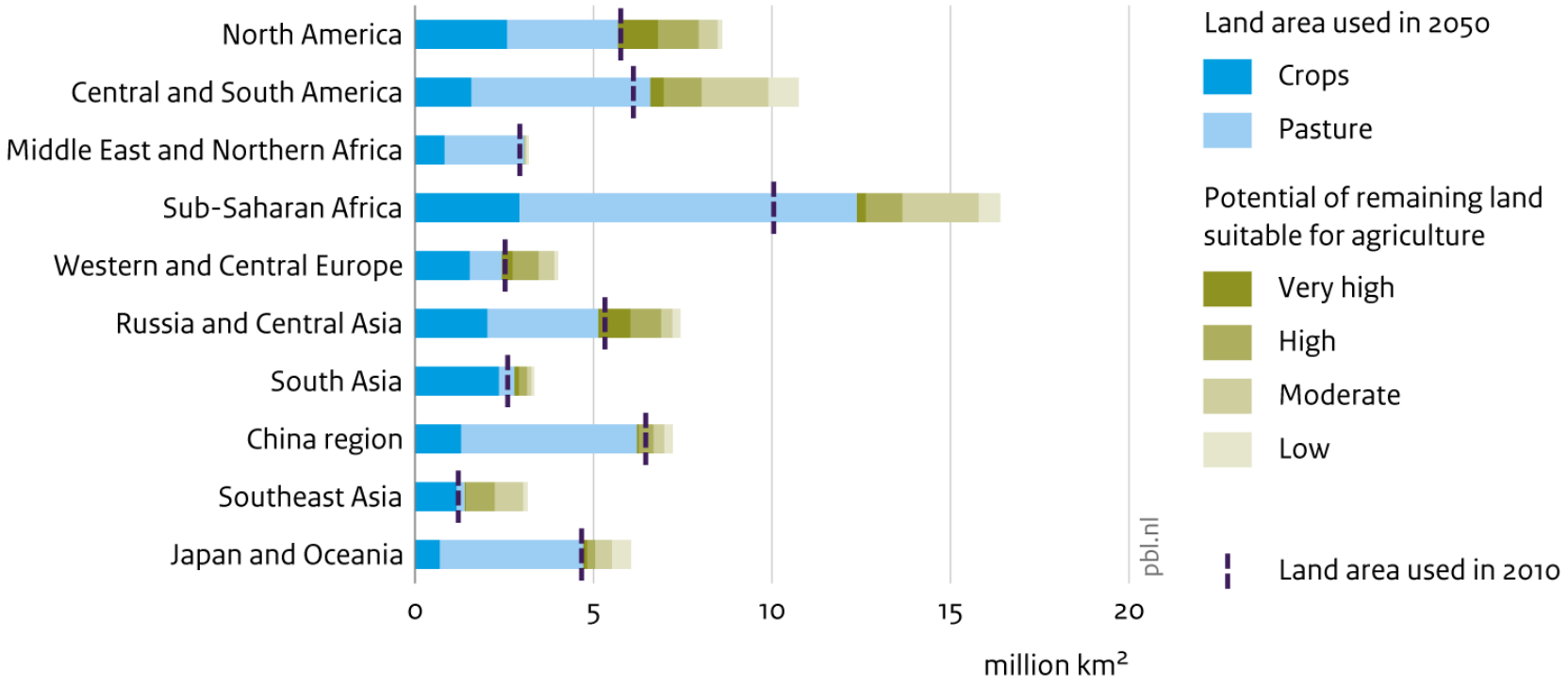
Area with negative productivity trend, corrected for climate change, 1982 – 2010



Source: PBL

- 9 million km^2 shows human-induced productivity decline
- Sub-Saharan Africa most exposed

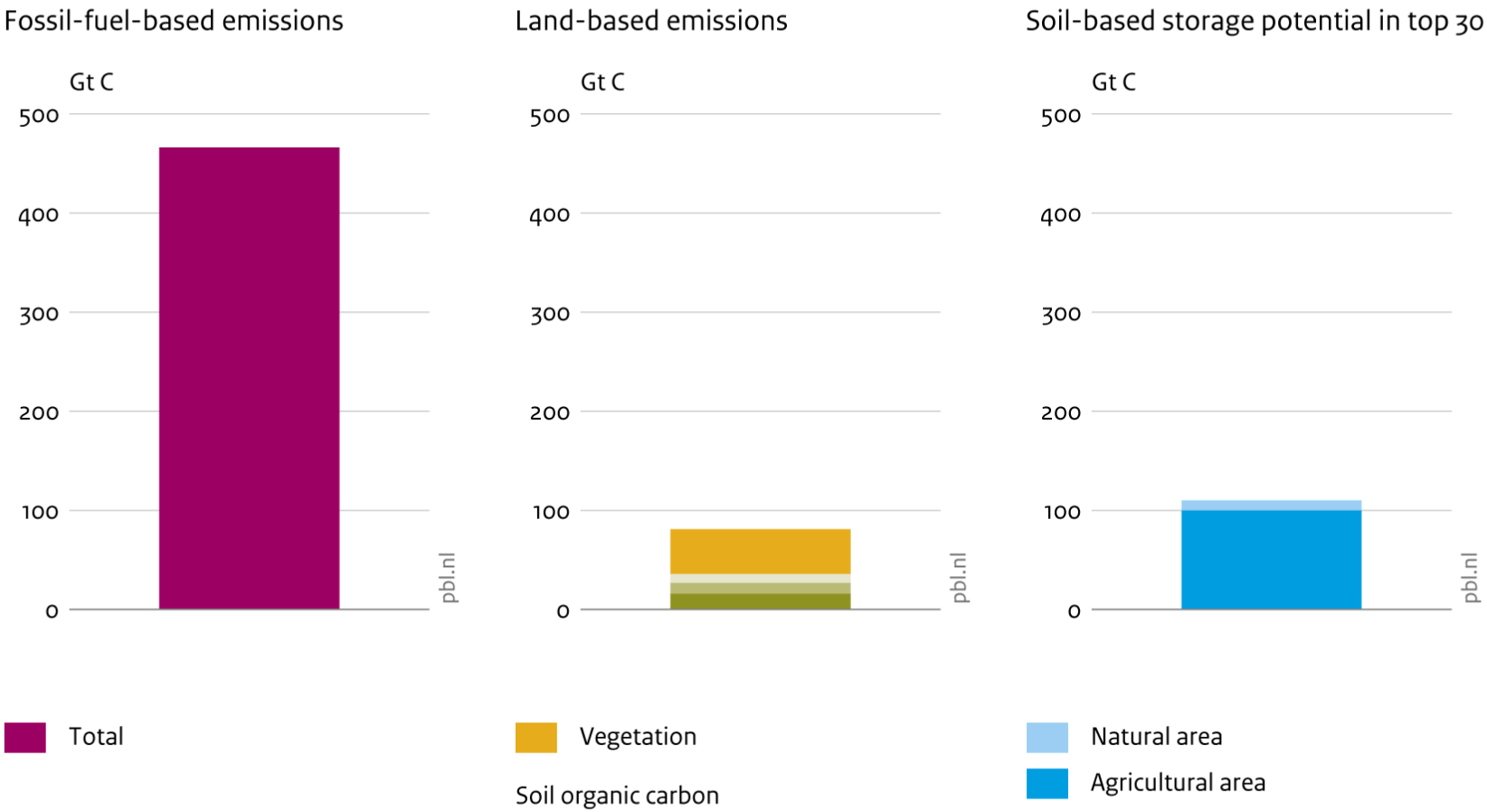
Agricultural land use and remaining suitable land, under the SSP2 scenario



Source: PBL/IMAGE

- Availability of land for agriculture increasingly limited, productivity per ha increases
- Expansion onto less productive areas and on vulnerable tropical soils
- Estimated ~12% of cropland shows signs of degradation
- Declining productivity increases cropland expansion by 5% to 2050

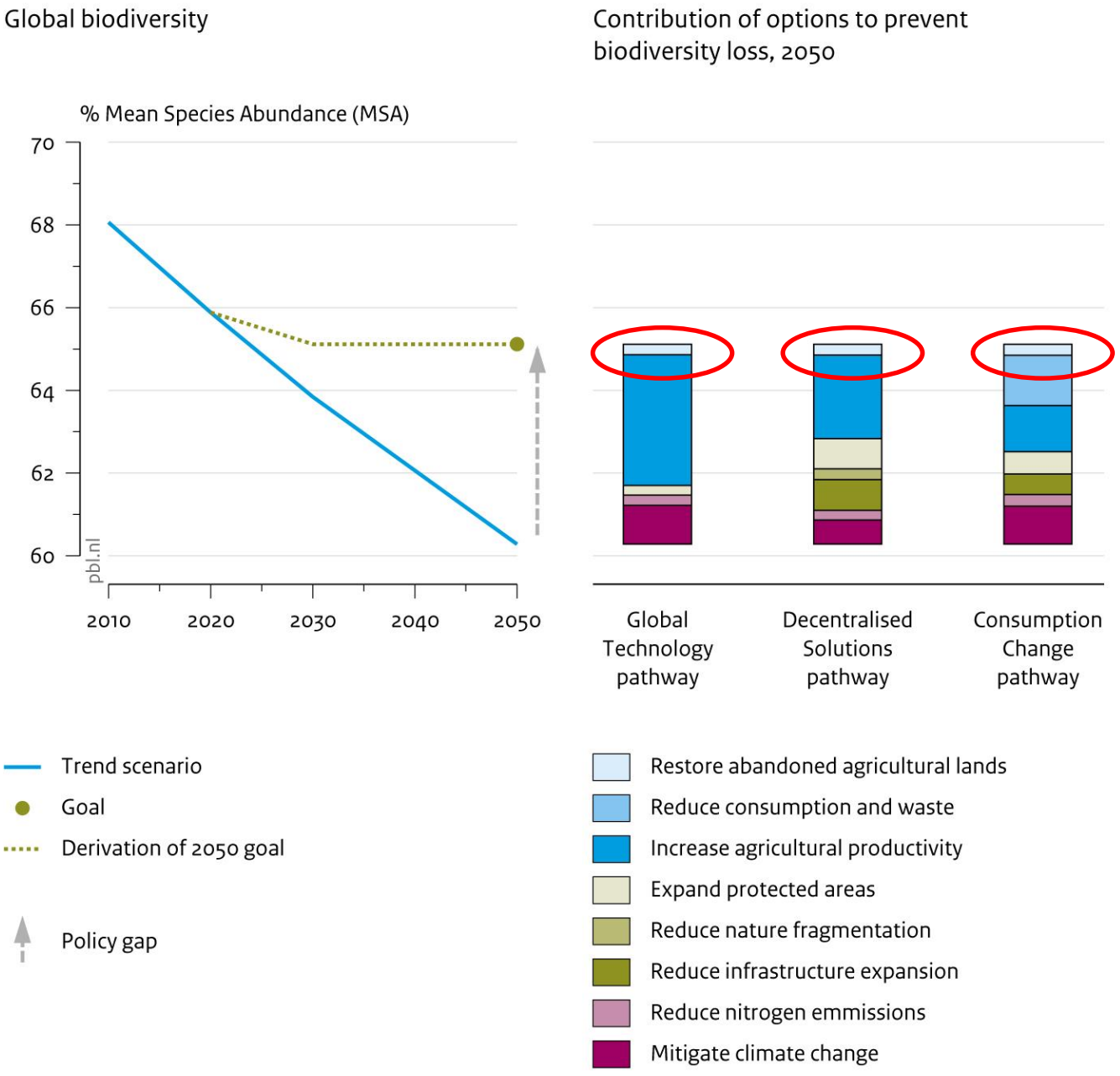
Carbon emissions from fossil fuel and land use, under the SSP2 productivity-decline scenario, 2010 – 2050



Source: PBL

- Land emissions modest compared to fossil
- Significant restoration potential in agriculture
- Restoration significant to carbon budget (170-320 Gt C)

Global biodiversity and options to prevent biodiversity loss



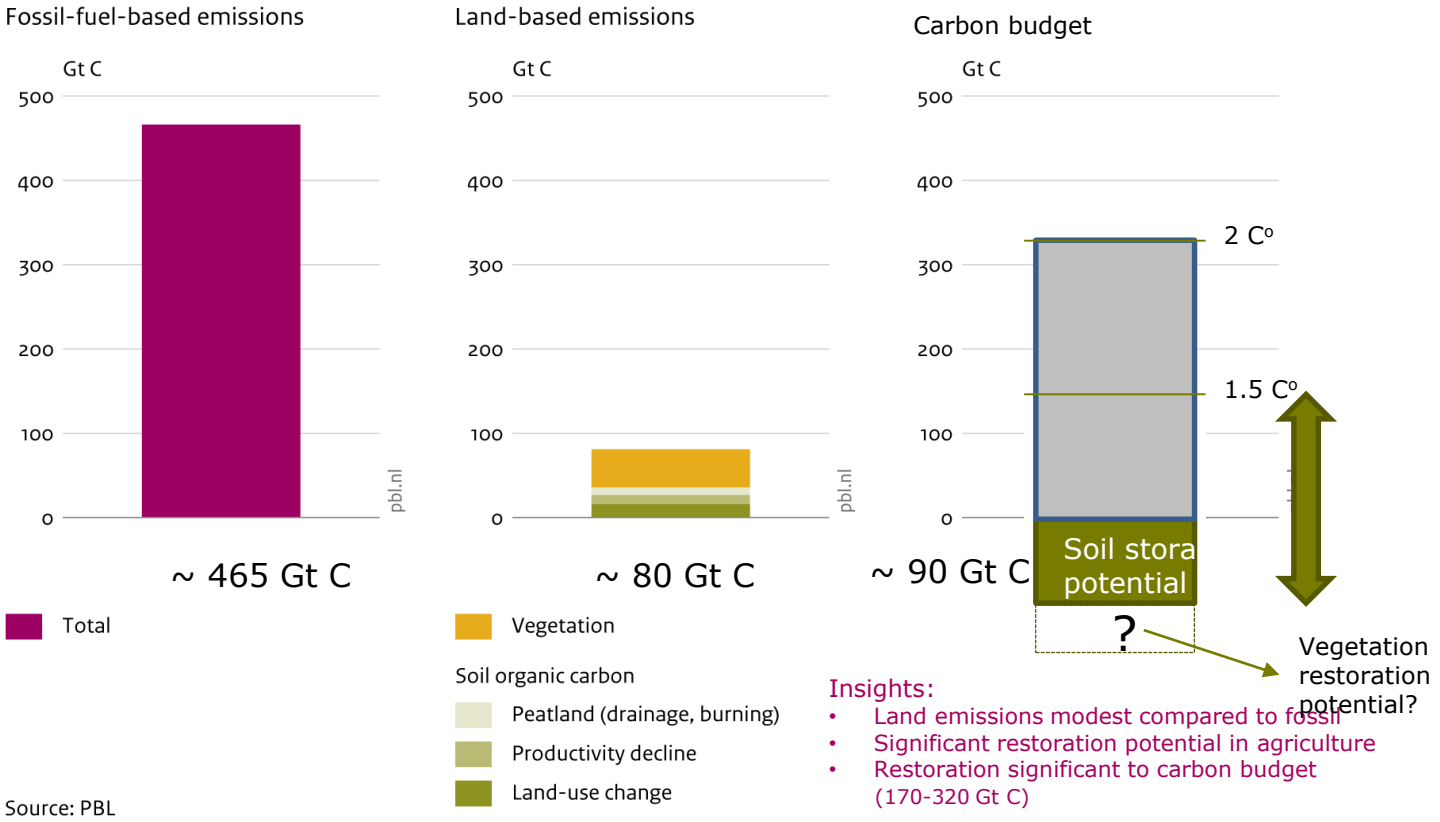
Thank you, and looking forward to your questions.

Additional information:

Stefan.vanderesch@pbl.nl

Carbon emissions & 1.5 C climate target

Carbon emissions from fossil fuel and land use, under the SSP2 productivity-decline scenario, 2010 – 2050



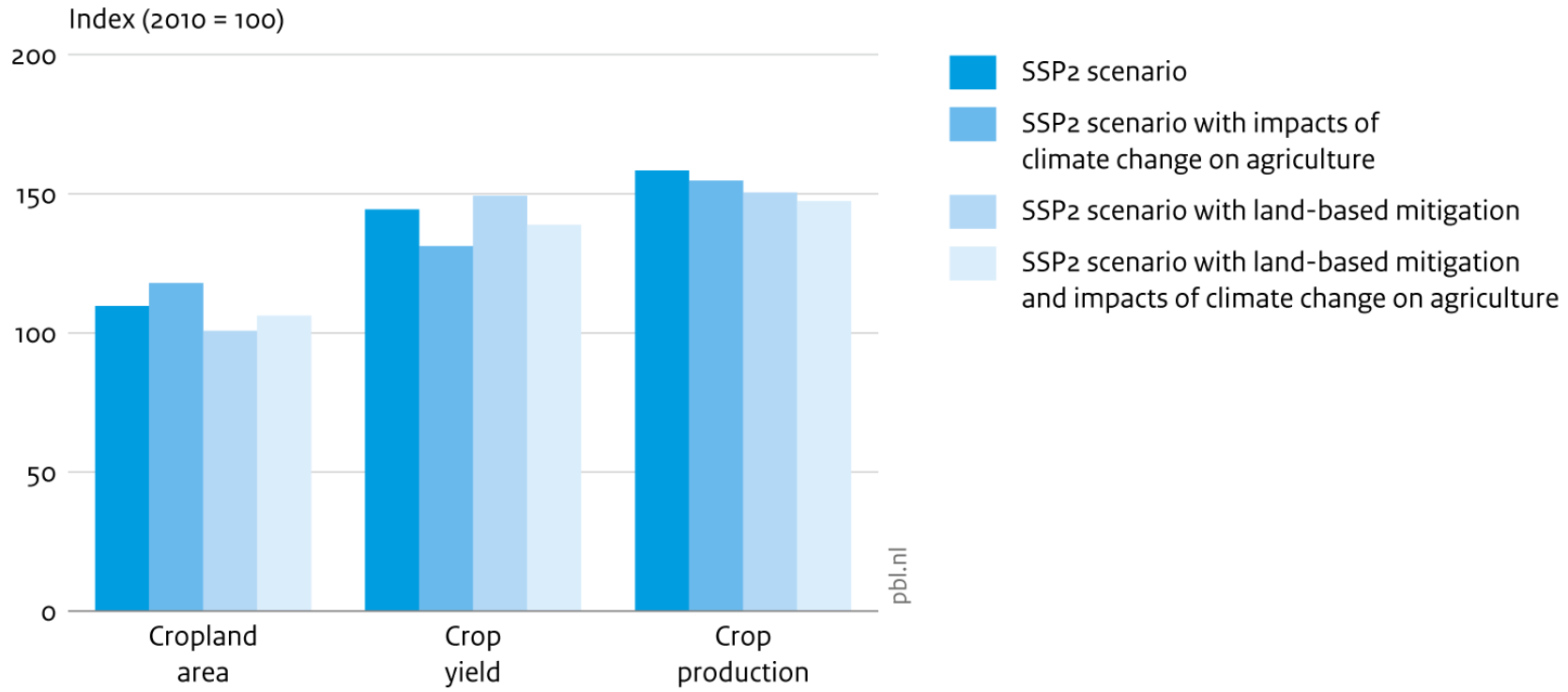
Source: PBL

Insights:

- Land emissions modest compared to fossil
- Significant restoration potential in agriculture
- Restoration significant to carbon budget (170-320 Gt C)

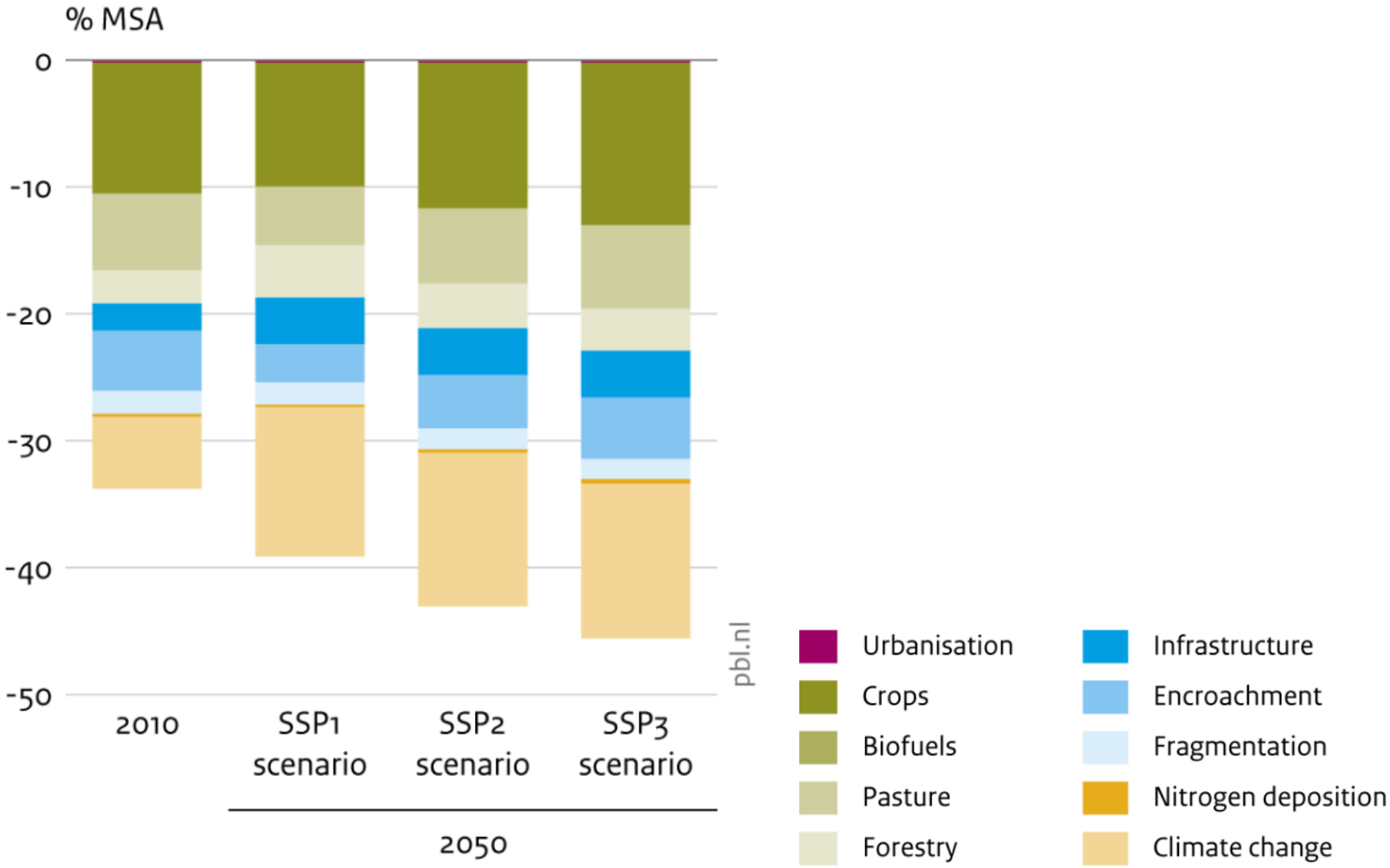
Climate change may result in ~10% lower yields by 2050 than otherwise

Impacts of climate change and land-based mitigation on agriculture, 2050



Source: PBL/IMAGE

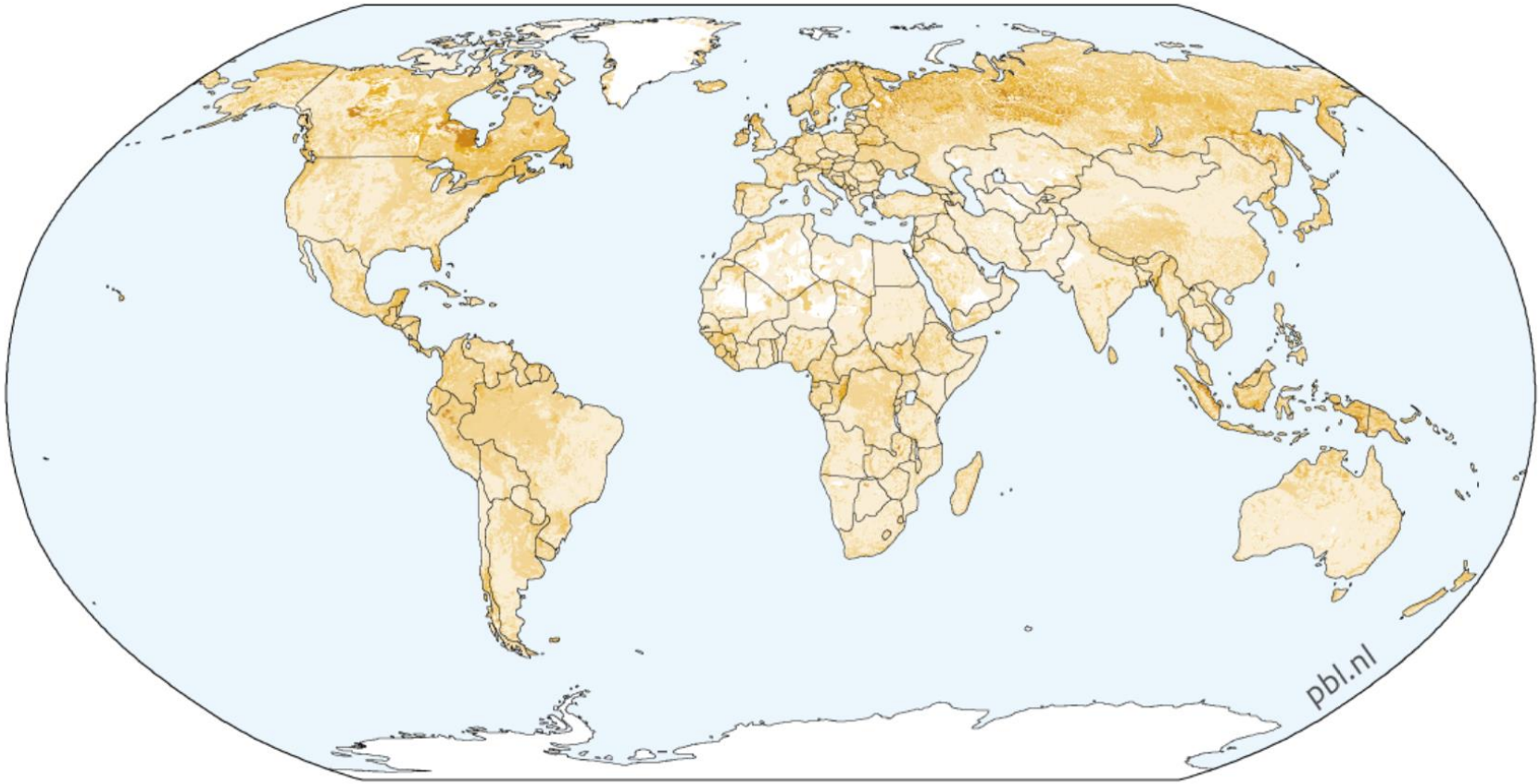
Pressures on global biodiversity, per scenario, compared to natural condition



Source: PBL/IMAGE

Soil organic carbon

2010



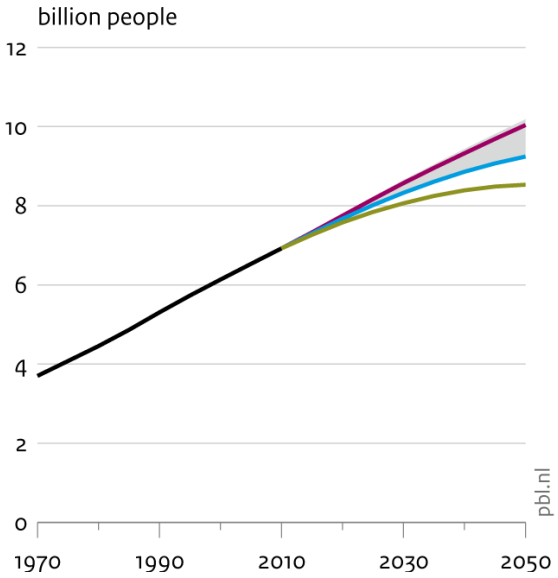
Percentage in top 30 cm soil

- Low (1.5% or less)
- Moderate (1.5 – 3.0%)
- High (3.0 – 5.0%)
- Humose (5.0 – 12.0%)
- Organo-mineral (12.0 – 35%)
- Organic (More than 35%)

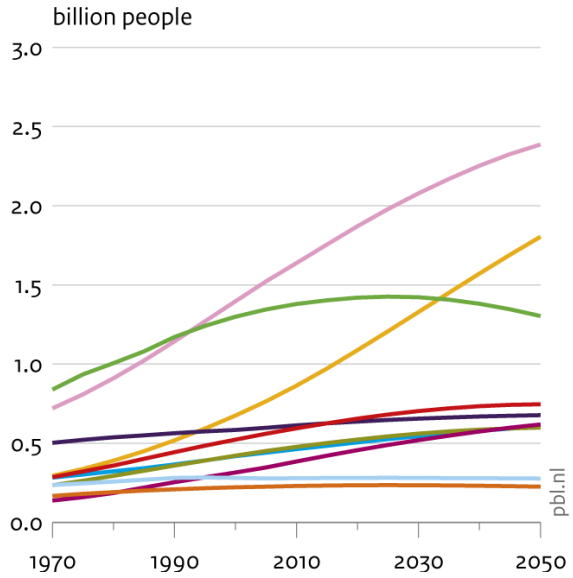
Source: Stoorvogel et al. 2017; Schut et al. 2015; PBL

Socio-economic drivers

Global population per scenario



Regional population, under the SSP2 scenario



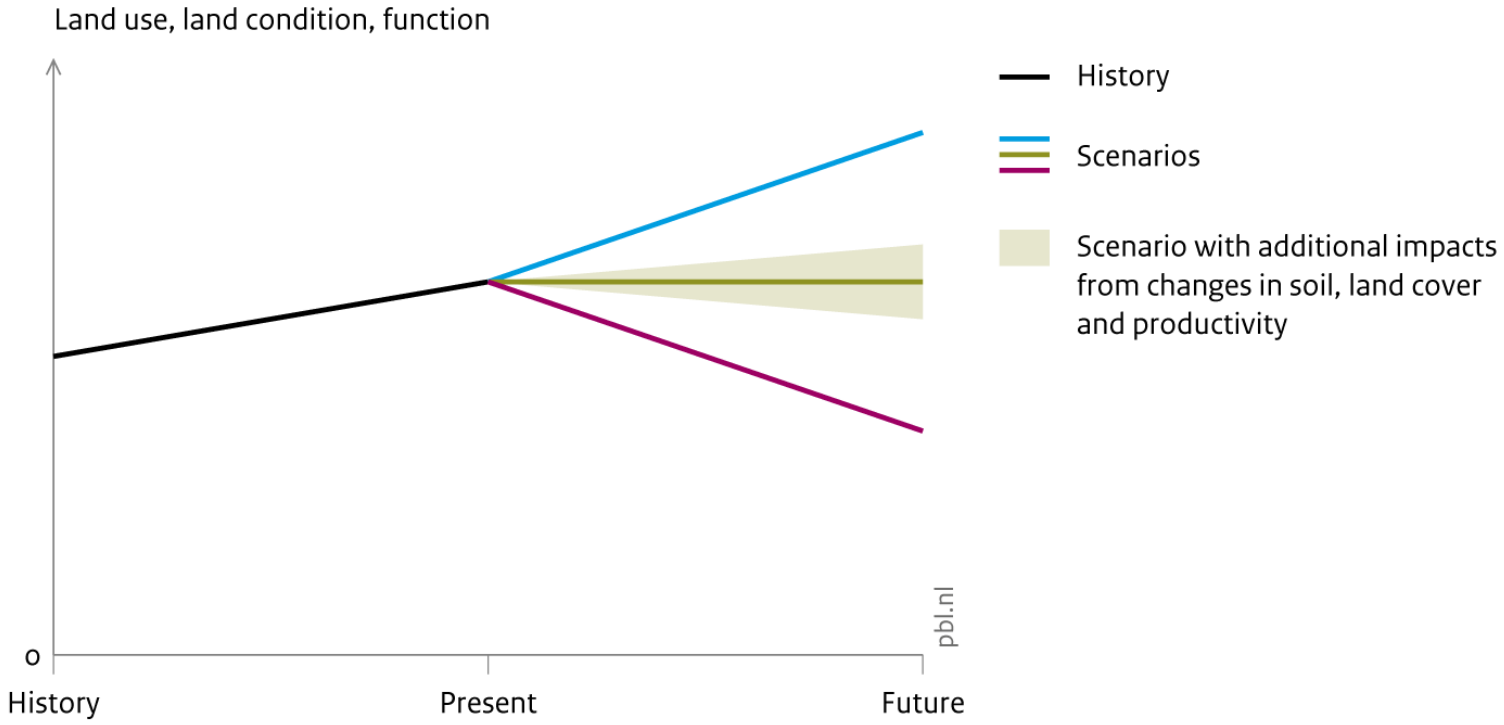
- History
- SSP1 scenario
- SSP2 scenario
- SSP3 scenario
- UN population projections (95% range)

- North America
- Central and South America
- Middle East and Northern Africa
- Sub-Saharan Africa
- Western and Central Europe
- Russia and Central Asia
- South Asia
- China region
- Southeast Asia
- Japan and Oceania

Source: PBL/IMAGE

Uncertain future -> scenarios

Explorative scenarios to analyse future changes in land and ecosystem function



Source: PBL

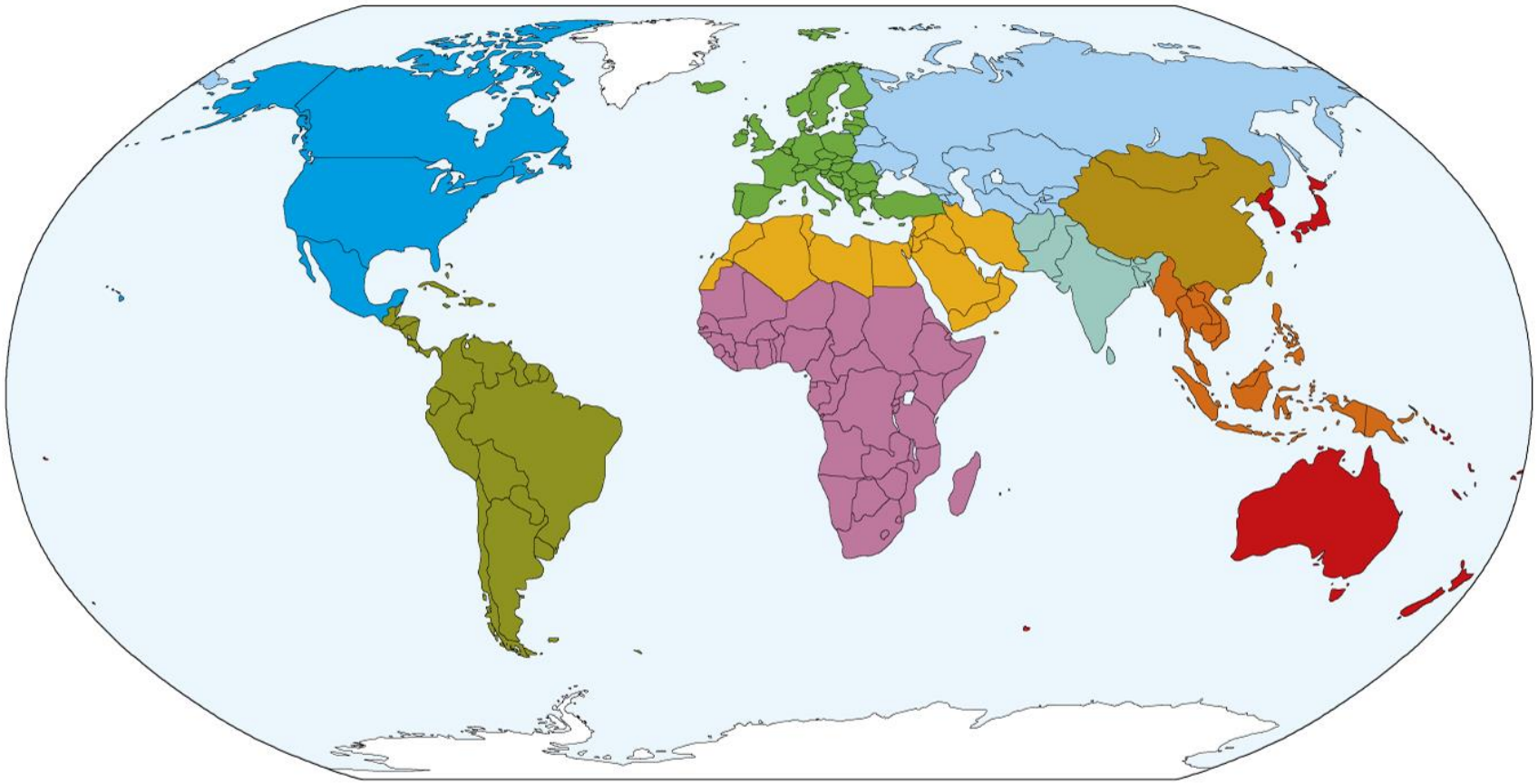
Shared socio-economic pathways (SSPs)

- Developed for climate change assessments under IPCC
- Applied for land for the Global Land Outlook, hence coherent with the climate change community

Characteristics of major land-use components in the SSP storylines. These qualitative assumptions are quantified for the IMAGE SSPs (see Annex 2).

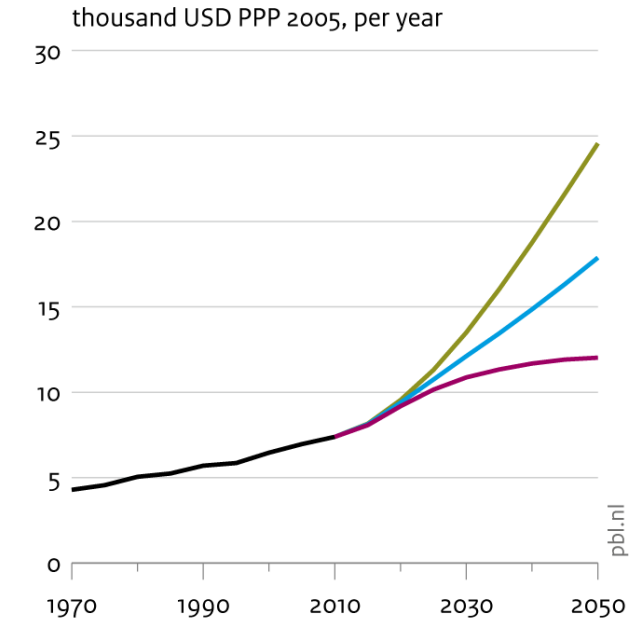
	SSP1 Sustainability	SSP2 Middle of the Road	SSP3 Fragmentation
Globalisation of trade	High	Medium	Low
Meat consumption and waste in the food chain	Low	Medium	High
Land-use regulation (e.g. protected areas)	Strict	Moderate	Low
Crop yield improvement	High	Medium	Low
Livestock system efficiency	High	Medium	Low

The 10 IMAGE regions used in this report

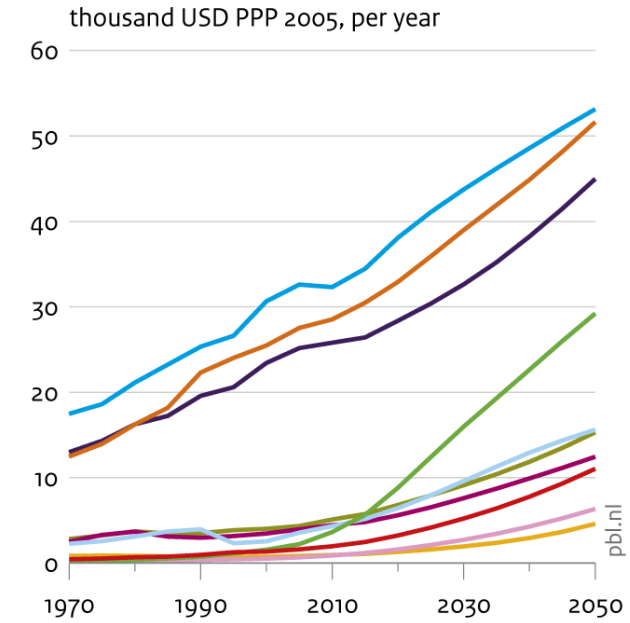


Source: PBL

Global GDP per capita, per scenario



Regional GDP per capita, under the SSP2 scenario



History
SSP1 scenario
SSP2 scenario
SSP3 scenario
UN population projections (95% range)

North America
Central and South America
Middle East and Northern Africa
Sub-Saharan Africa
Western and Central Europe
Russia and Central Asia
South Asia
China region
Southeast Asia
Japan and Oceania

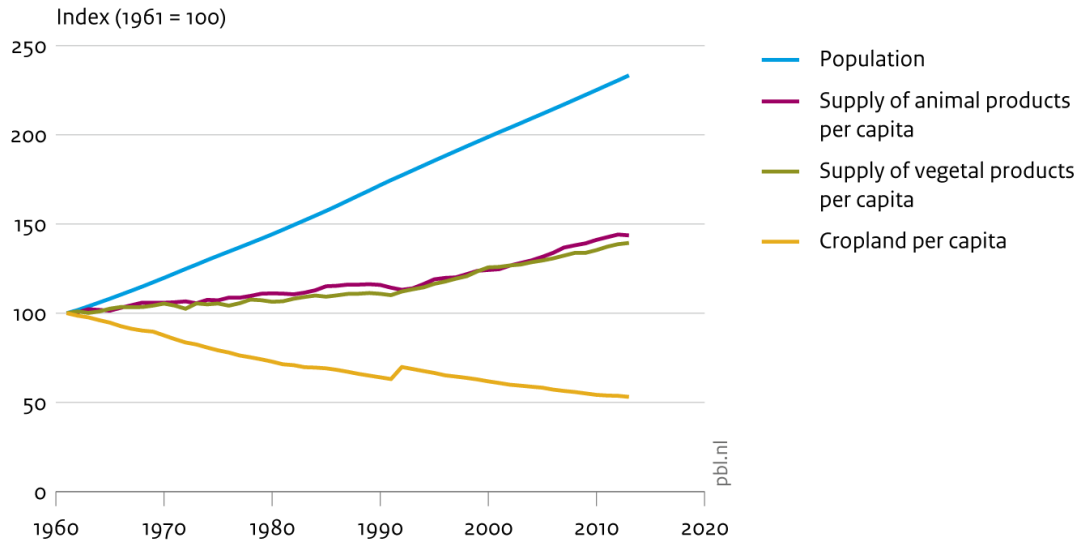
Source: PBL/IMAGE

What affects future use and condition of land?

- Demands
- Availability
- Efficiency
- Water
- Climate change
- Land degradation

Demands for food, timber, bio-energy and urban

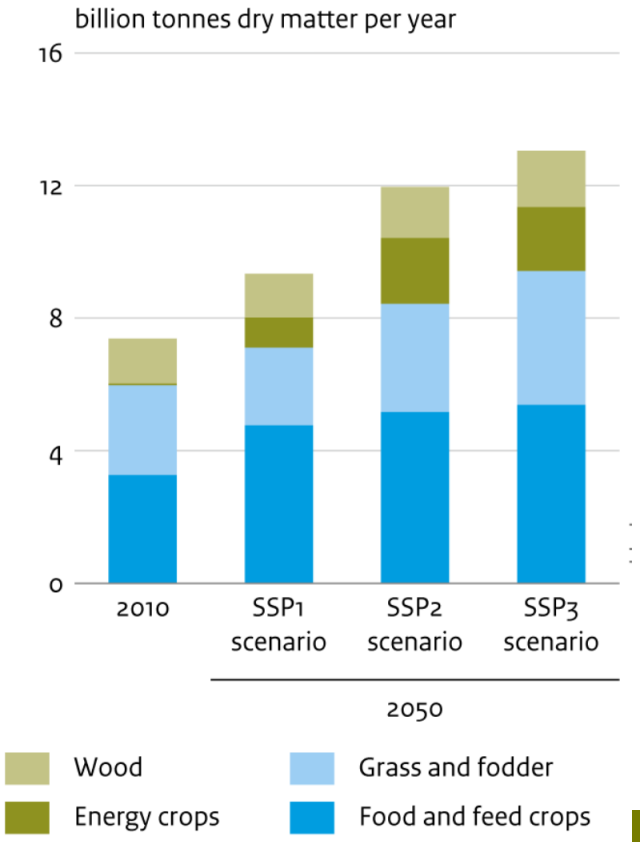
Global population, cropland and food supply



Source: FAOSTAT; World Development Indicators 2017

Agricultural production per scenario

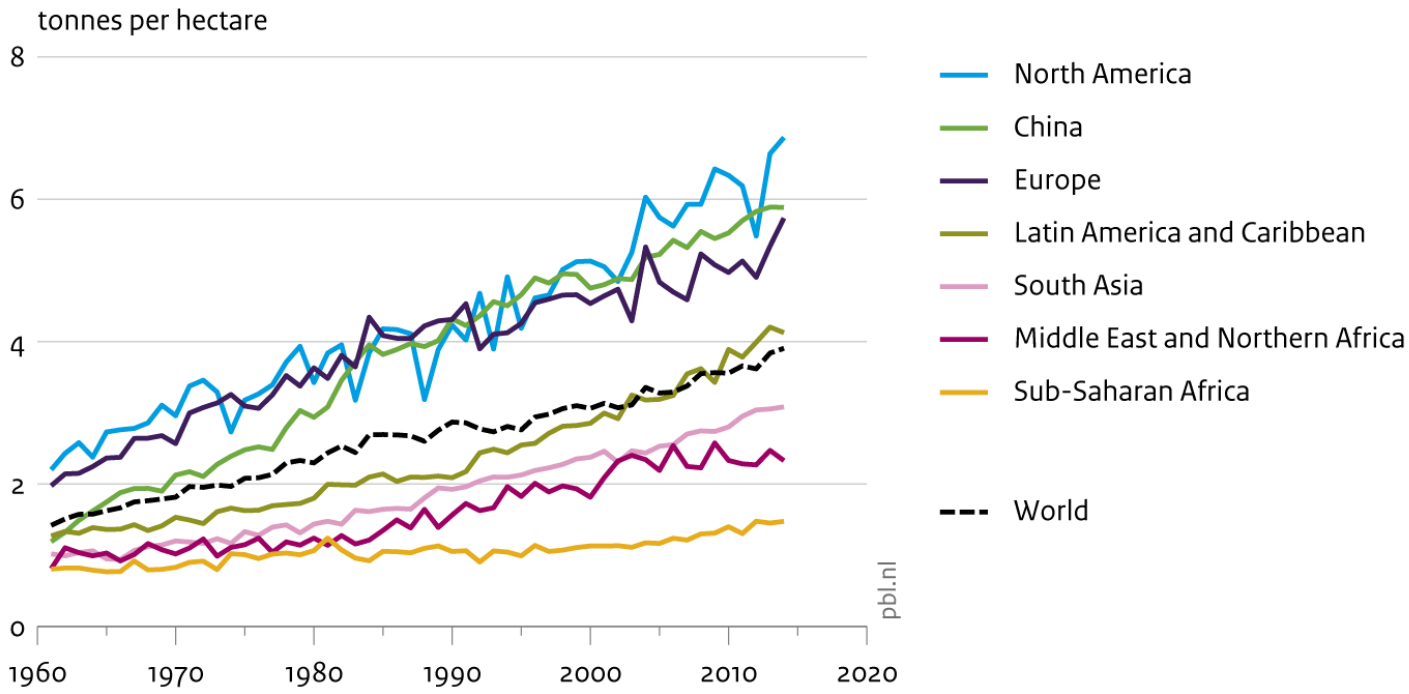
Global



Source: PBL/IMAGE

Efficiency of crop yields and livestock systems

Cereal yield per region

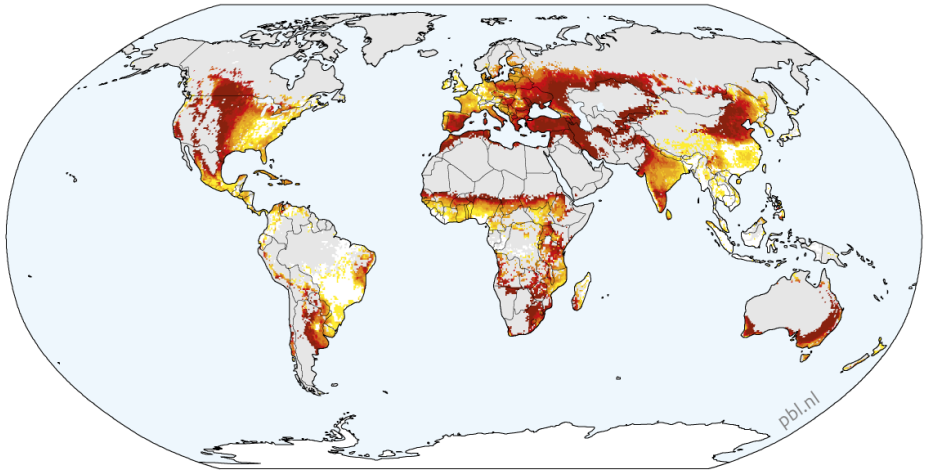


Source: FAOSTAT; World Development Indicators 2017

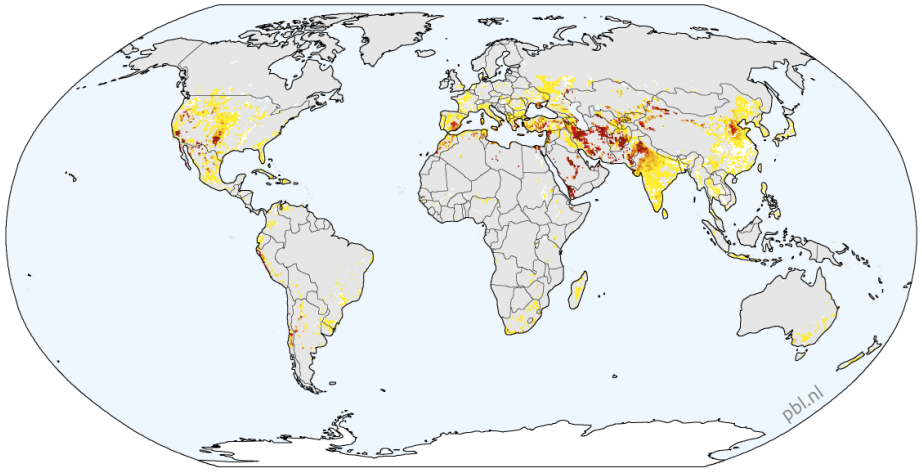
Water availability and use

Reduction in crop production caused by local water shortages, 2010

Rainfed crop production



Irrigated crop production



Percentage

0 5 10 20 30 40 50 60

No rainfed or irrigated crop production

No data

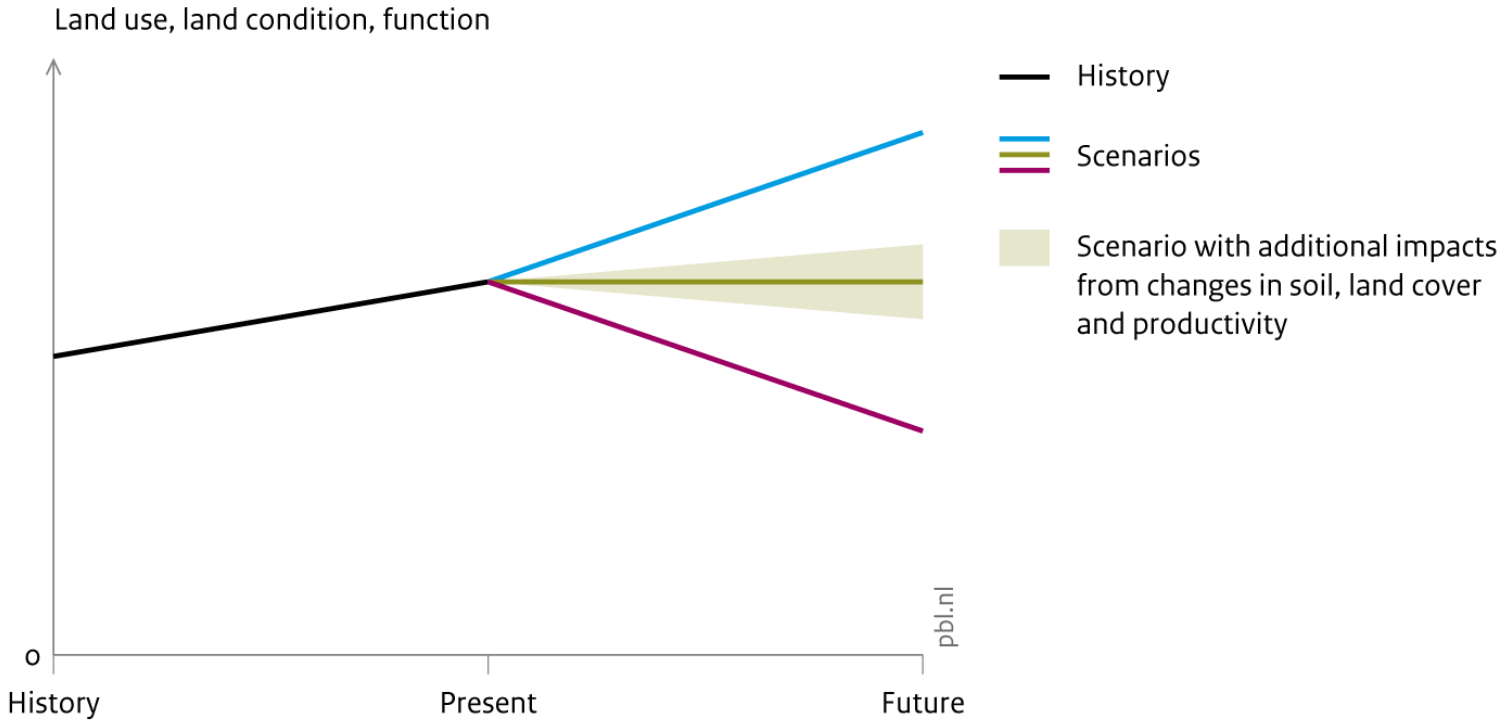
Source: PBL/IMAGE

What affects future use and condition of land?

- Demands
- Availability
- Efficiency
- Water
- Climate change
- Land degradation

Now, what if we add land degradation to the scenario?

Explorative scenarios to analyse future changes in land and ecosystem function

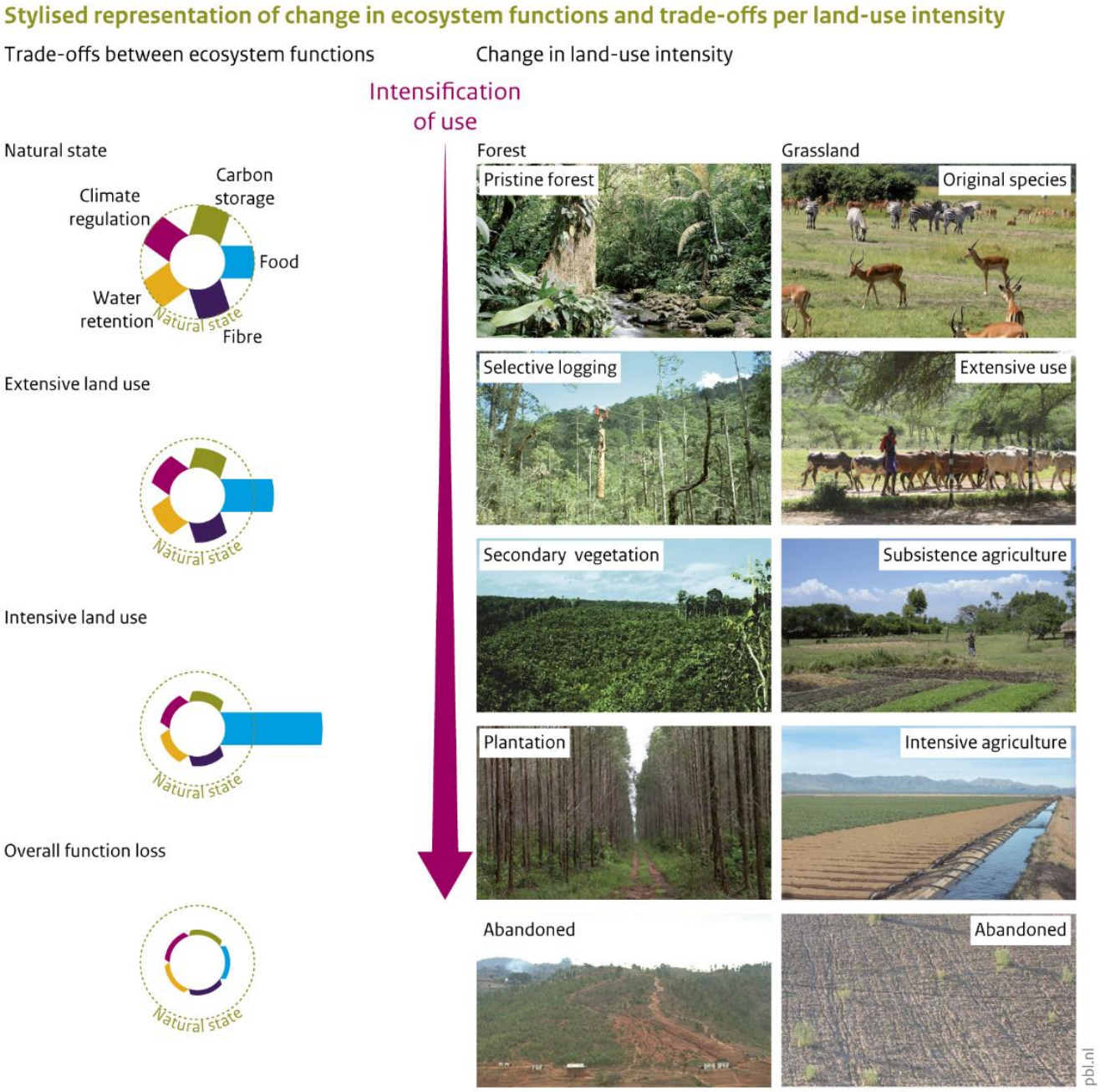


Source: PBL

What is land degradation?

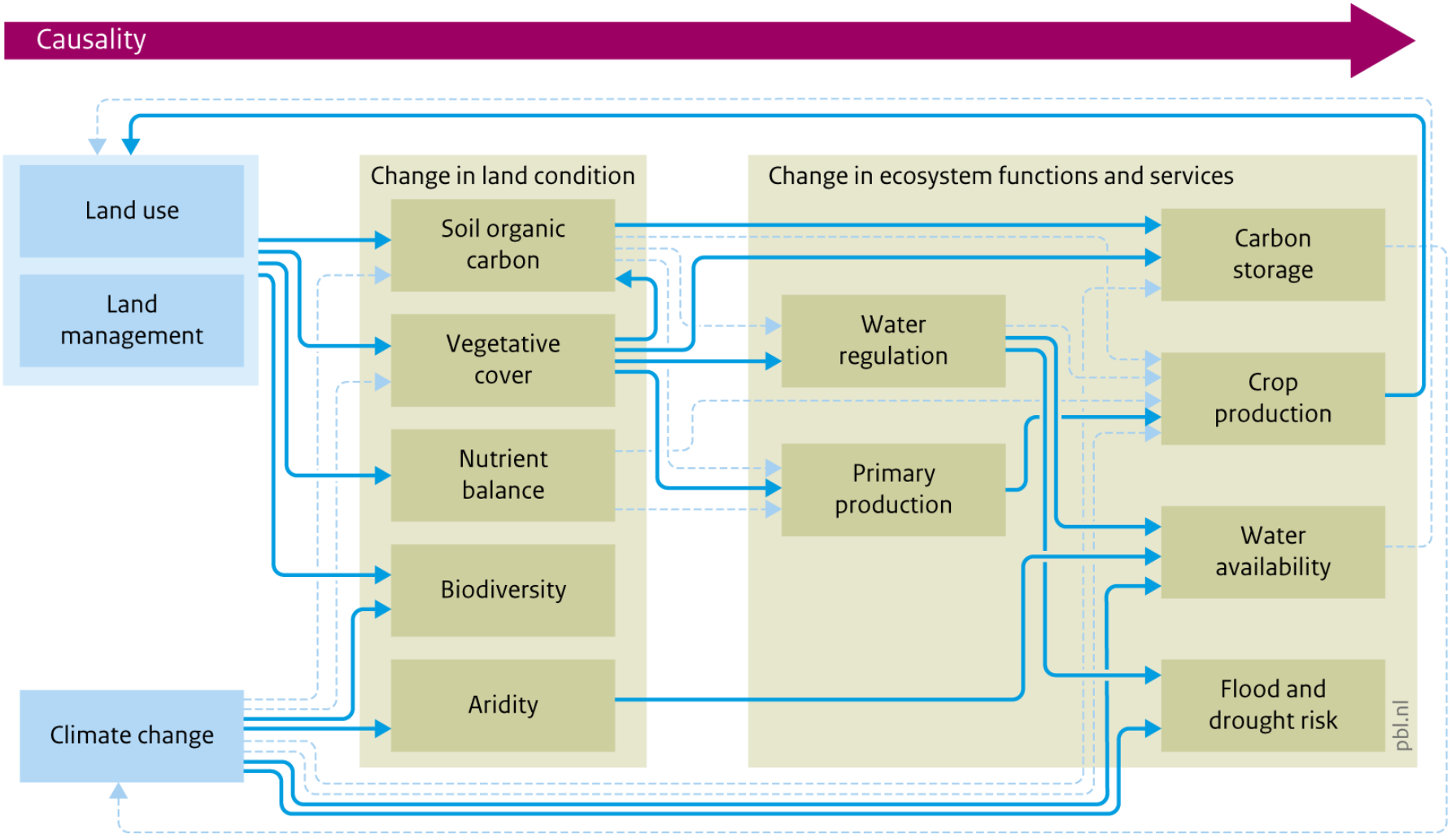
Degradation or progress?

Function-change or trade-offs?



Source: PBL

Effects from change in land use, land management and climate on land condition and ecosystem services

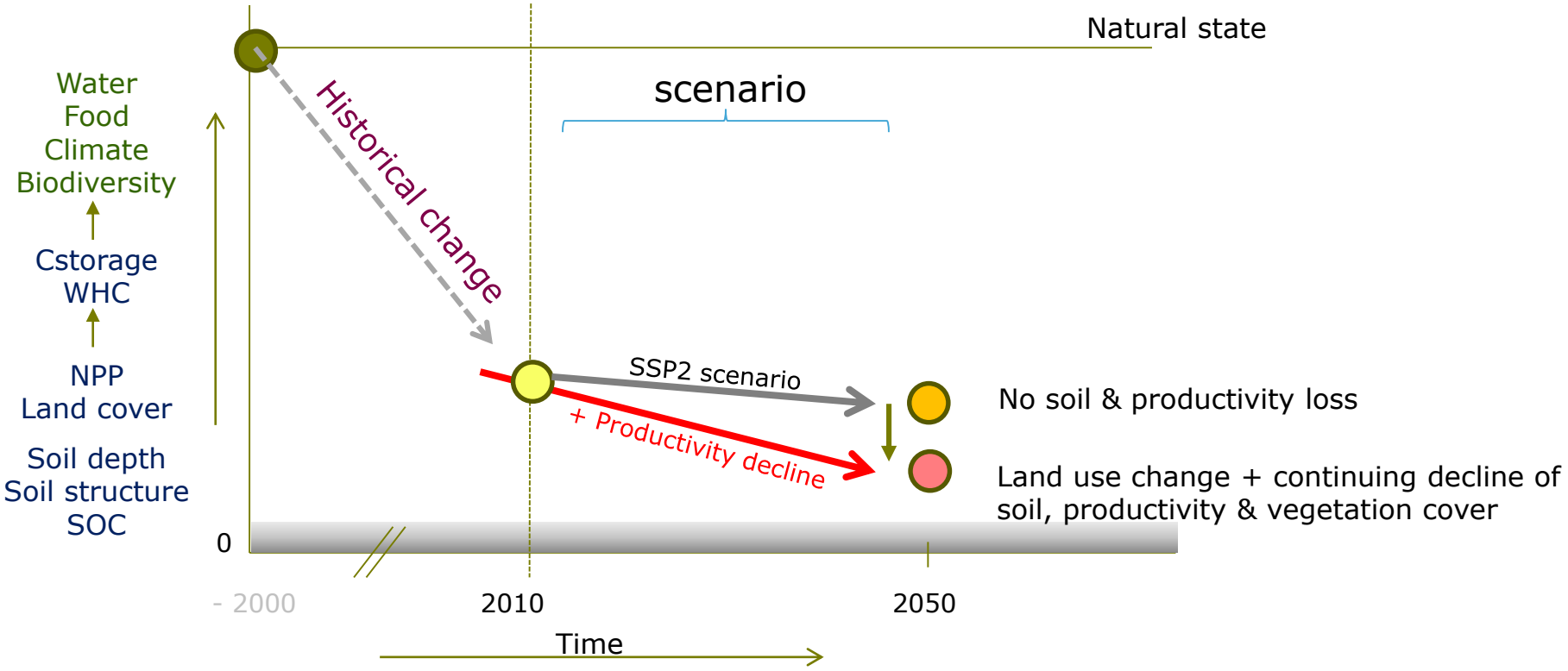


Source: PBL

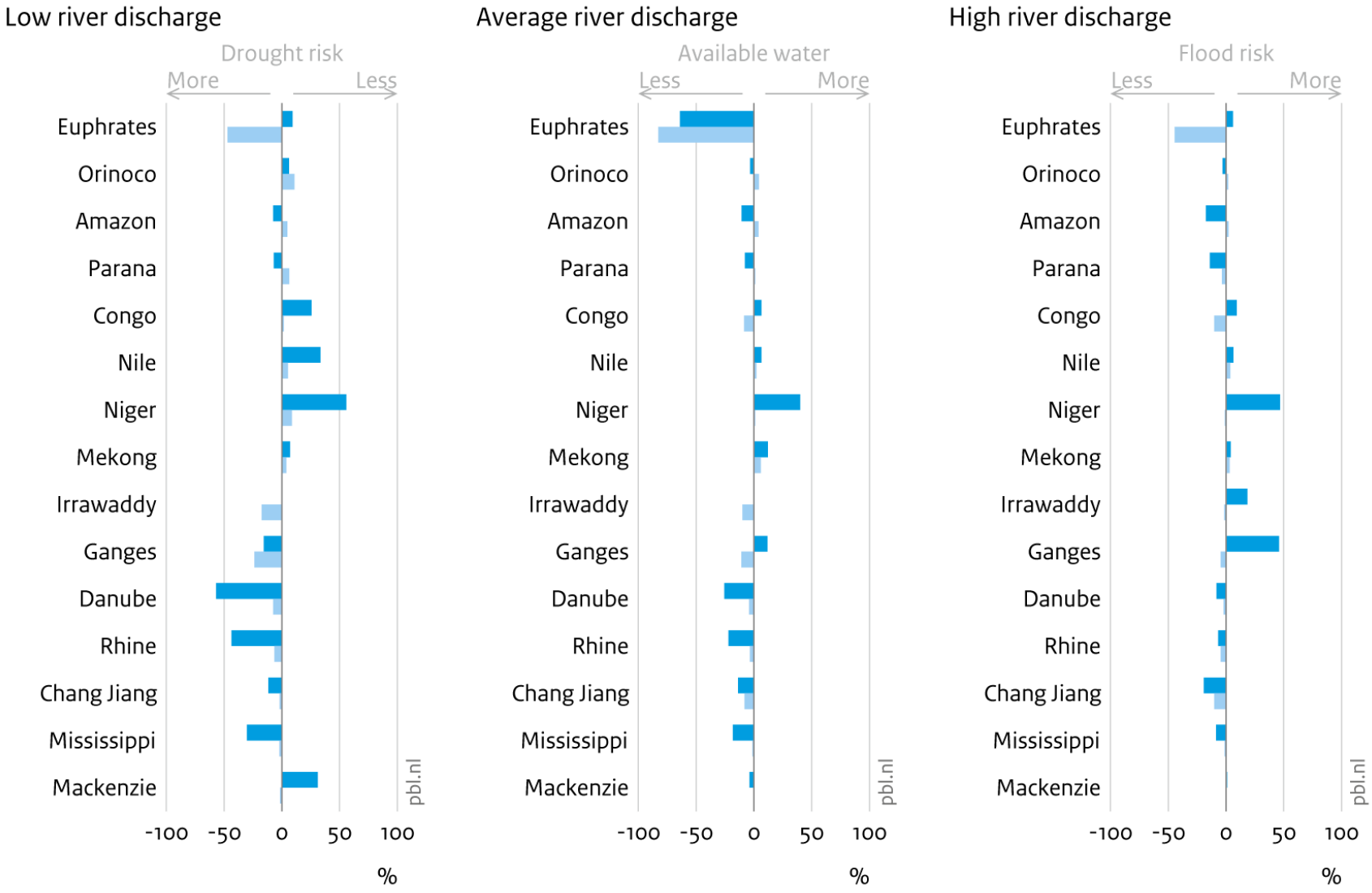
Land condition & scenarios

PBL Netherlands Environmental Assessment Agency

Land properties & ecosystem functions

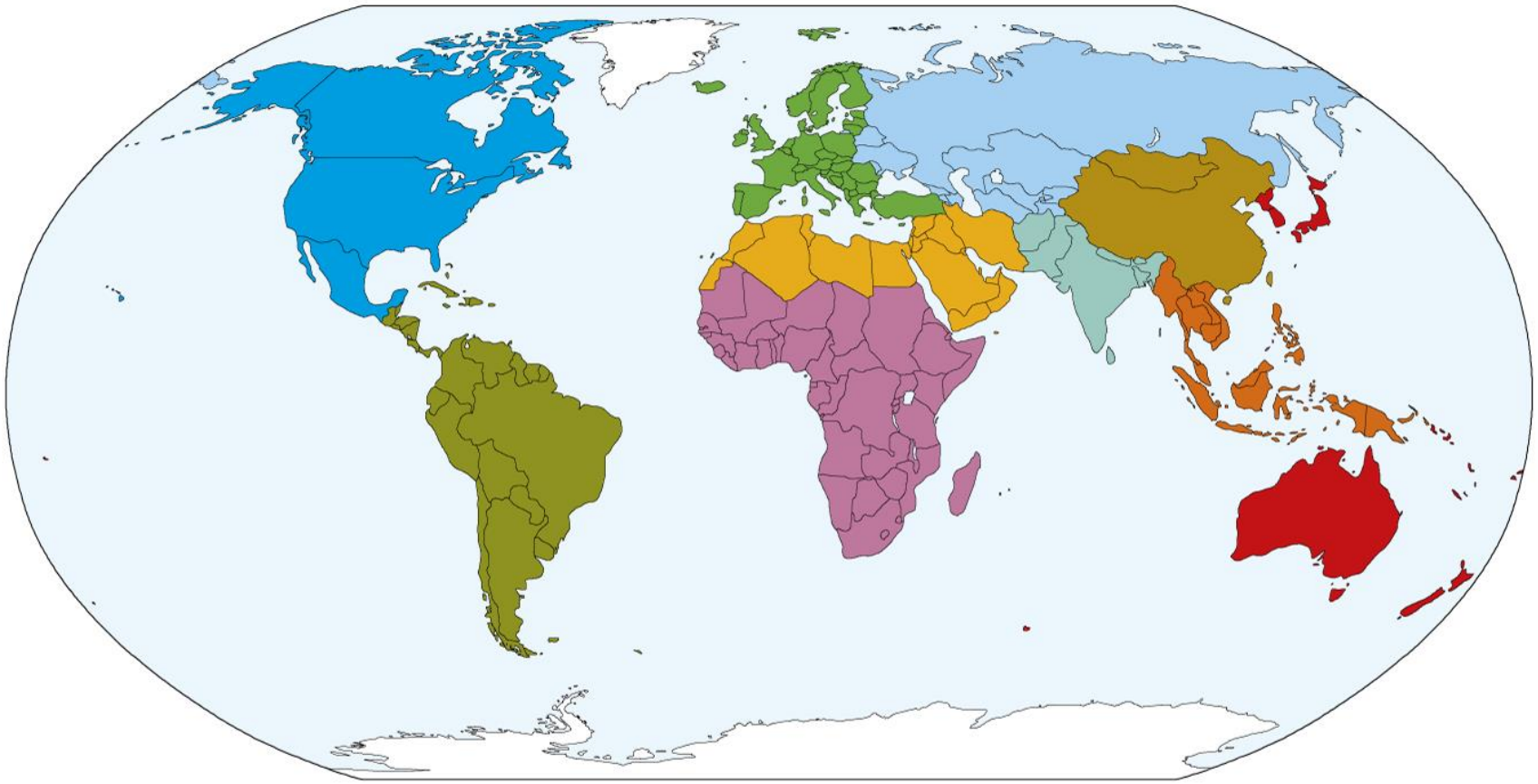


Change in major river-basins discharge, 2010 – 2050



Source: UU; PBL

The 10 IMAGE regions used in this report



Source: PBL

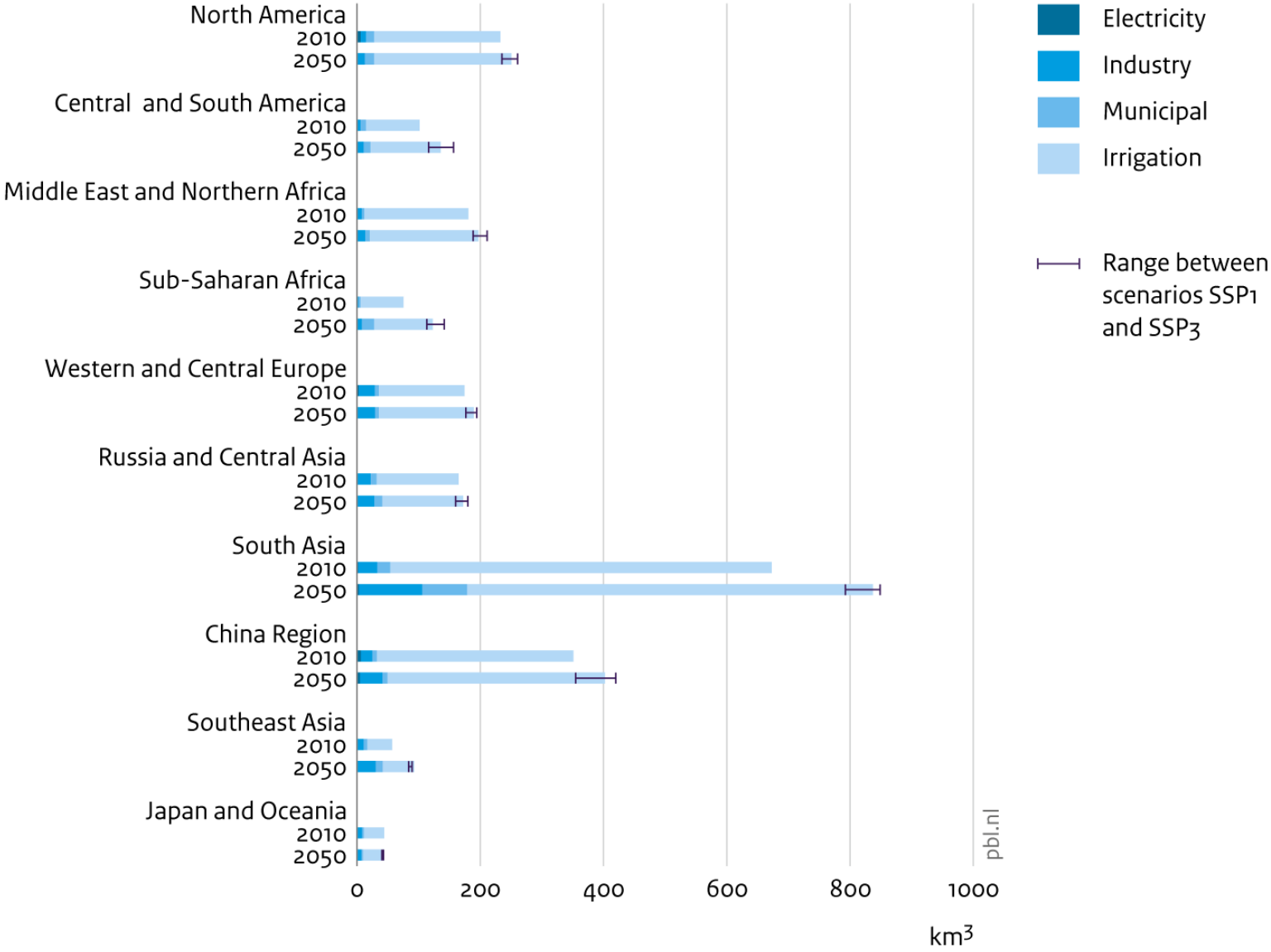
3. Regional overview

PBL Netherlands Environmental Assessment Agency

Overview of selected indicator outcomes, per region

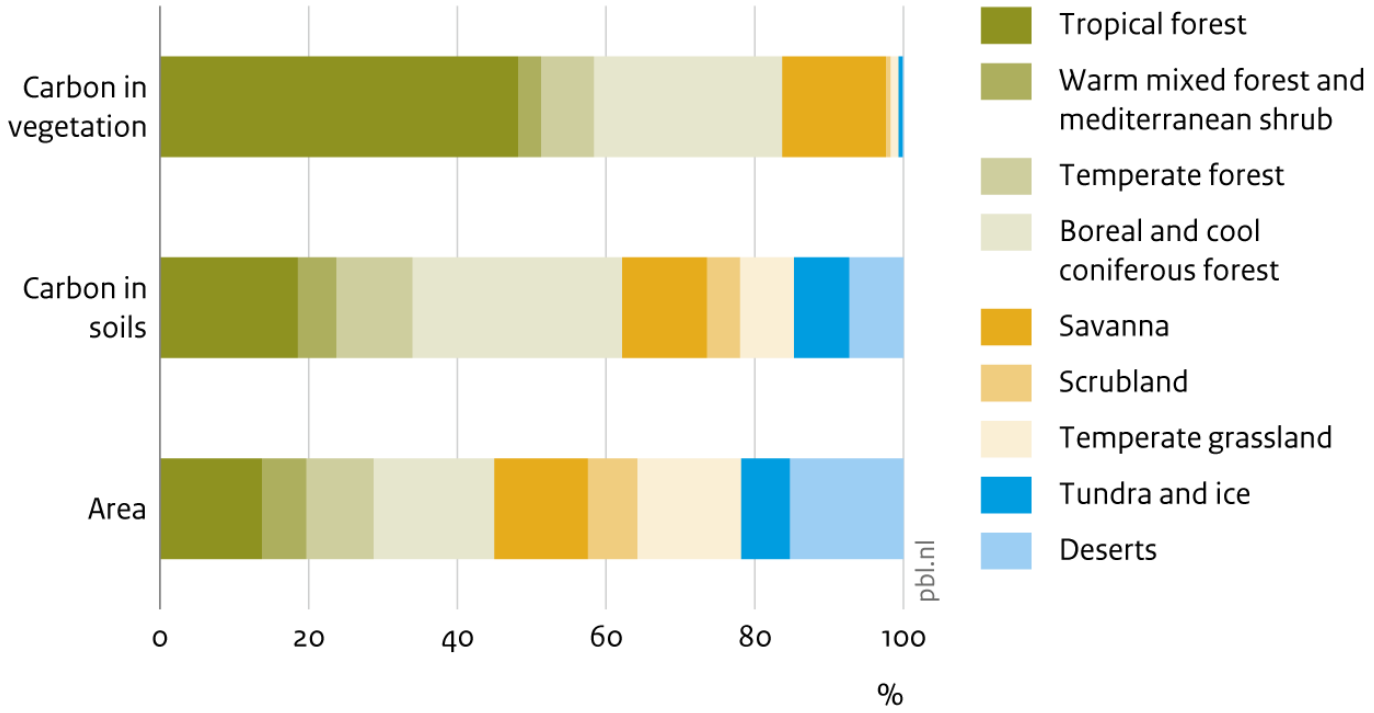
Category	Indicator	Unit	North America		Central and South America		Middle East and Northern Africa		Sub-Saharan Africa		Western and Central Europe		Russian region and Central Asia		South Asia		China region		Southeast Asia		Japan, Korea and Oceania	
			2010	Change 2010–2050	2010	Change 2010–2050	2010	Change 2010–2050	2010	Change 2010–2050	2010	Change 2010–2050	2010	Change 2010–2050	2010	Change 2010–2050	2010	Change 2010–2050	2010	Change 2010–2050	2010	Change 2010–2050
Socio-economic	Population	*billion*	0.46	31%	0.48	25%	0.38	61%	0.86	109%	0.61	11%	0.28	-1%	1.64	46%	1.38	-6%	0.59	26%	0.23	-2%
	Dryland population	*million*	113	36%	79	123%	373	60%	371	100%	176	17%	163	-5%	1010	53%	468	-17%	19	-91%	10	106%
	GDP per capita	*2005 USD PPP*	32,304	64%	5,105	200%	4,455	180%	963	378%	25,802	74%	4,338	260%	898	607%	3,634	704%	1,974	460%	28,537	81%
	Water stress[a]	*number of people exposed (millions)*	183	46%	214	11%	262	67%	234	109%	146	88%	70	73%	1533	46%	1256	-4%	414	29%	177	-2%
Demand	Food crops	*kcal/cap/day*	2,733	-3%	2,300	12%	2,549	0%	2,068	34%	2,624	-4%	2,460	2%	2,260	13%	2,594	-7%	2,403	21%	2,261	-2%
	Livestock products	*kcal/cap/day*	917	-3%	562	12%	289	17%	149	41%	891	1%	639	9%	221	0%	621	2%	244	24%	438	10%
	Water	*km³*	233	8%	102	34%	181	9%	76	63%	174	9%	165	4%	673	24%	351	15%	57	62%	44	0%
	Import dependence (net trade in agricultural products)[b]	*million tonnes of dry matter per year*	88	18% (2010), 15% (2050)	22	6% (2010), -3% (2050)	-59	-36% (2010), -26% (2050)	-18	-6% (2010), 0% (2050)	-25	-5% (2010), 4% (2050)	21	12% (2010), 30% (2050)	-12	-2% (2010), -4% (2050)	-1	0% (2010), -6% (2050)	9	2% (2010), 2% (2050)	-24	-24% (2010), -8% (2050)
Land use	Cropland[c]	*million km²*	2.5	5%	1.5	32%	0.7	24%	2.3	55%	1.6	-1%	2.0	4%	2.2	7%	1.5	-15%	1.0	26%	0.6	56%
	Pasture	*million km²*	3.3	-5%	4.6	8%	2.3	-1%	7.8	21%	1.0	-6%	3.3	-7%	0.4	10%	5.0	-1%	0.2	26%	4.0	0%
	Potential Available Cropland (PAC) per capita	*hectares per capita*	1.8	-24%	2.1	-20%	0.9	-38%	1.8	-52%	0.6	-10%	2.6	1%	0.2	-31%	0.6	6%	0.5	-20%	2.5	2%
	Remaining PAC	*million km²*	2.9	0%	4.5	-8%	0.2	-38%	6.1	-34%	1.5	3%	2.1	7%	0.7	-24%	0.9	14%	1.9	-9%	1.4	-8%
	Remaining High Quality PAC	*million km²*	2.3	0%	1.5	-6%	0.0	-2%	1.7	-26%	1.0	4%	1.7	6%	0.5	-24%	0.4	8%	0.9	-9%	0.4	-11%
	Average crop yield	*tonnes per hectare*	5.1	27%	3.1	58%	2.4	84%	1.2	105%	4.1	21%	1.9	48%	2.5	62%	5.4	39%	3.5	39%	2.1	13%
Land condition	% of natural land with reduced productivity compared to natural situation	%	13%		20%		11%		18%		17%		7%		35%		14%		23%		27%	
	Area with land management-related productivity decline[e]	*million km²*	1.2		0.4		0.2		3.7		0.4		1.4		0.3		0.8		0.3		0.7	
	Additional cropland required to compensate for productivity loss	*% of 2010 cropland area*		2%		1%		22%		7%		3%		4%		4%		3%		2%		5%
	Soil organic carbon loss[e]	GtC	28	2.5	20	2.0	4	0.7	30	12.0	13	1.2	29	2.5	14	1.7	17	0.8	13	2.0	8	1.6
	Biodiversity	*Mean Species Abundance (MSA)*	65%	-13%	65%	-18%	81%	-5%	70%	-20%	37%	-21%	73%	-10%	44%	-21%	56%	-13%	55%	-22%	71%	-19%
	Dryland areas	*million km²*	8.7	-5%	5.1	-1%	10.9	0%	16.3	2%	2.0	5%	7.6	-11%	3.9	5%	6.9	-1%	0.1	-57%	7.2	2%

Regional water demand, under the SSP2 scenario



Source: UU/PBL

Carbon stocks in vegetation and soils, per biome, 2010



Source: PBL