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SDGs in IMAGE

Detlef van Vuuren

https://eartharxiv.org/repository/view/2386/

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Defining a Sustainable Development Target Space for 2030 and 2050

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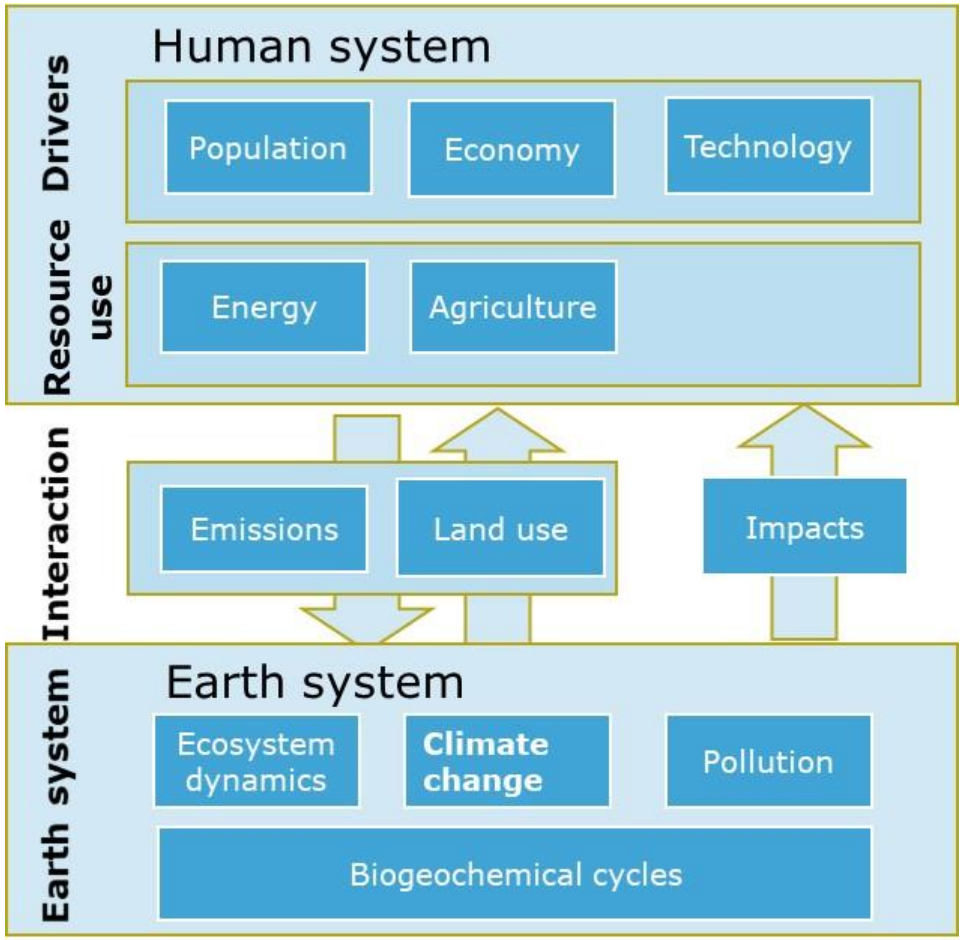

- Roads from Rio+20
- Nexus studies
  - Nat-Sust.
  - SHAPE
  - [Bending the Curve]
  - Doelman et al.
  - …

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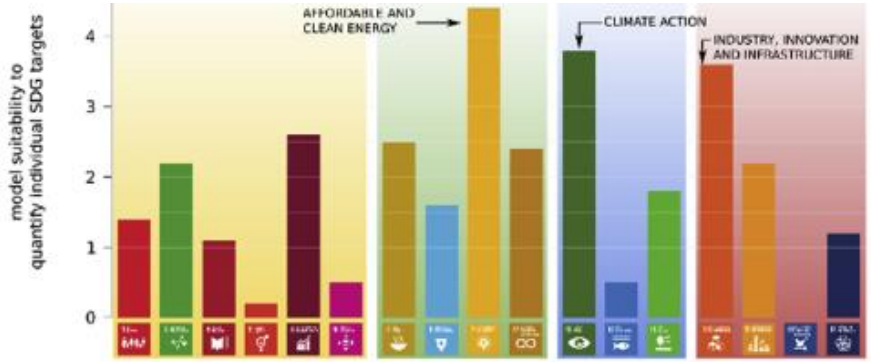
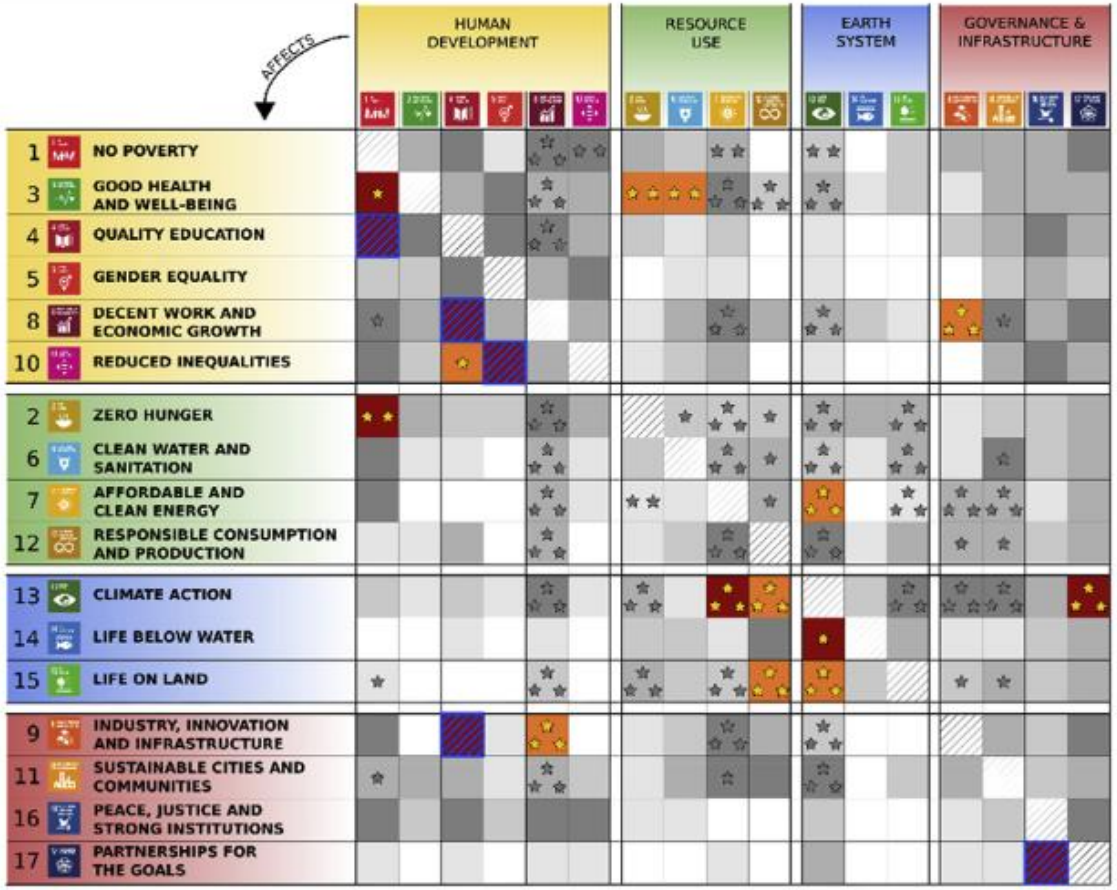
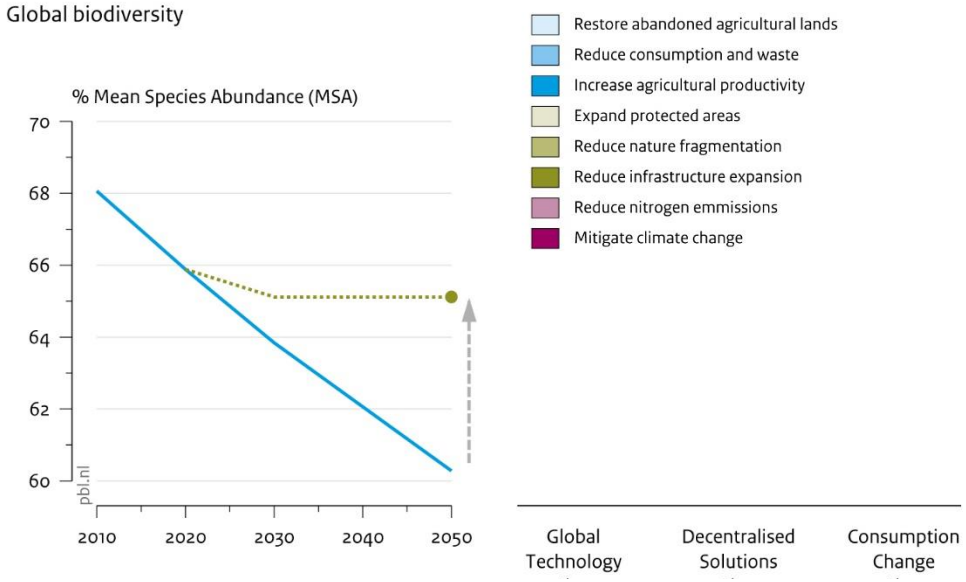
SDG	Representation	Leverages
SDG2	# people undernourished	Production increase, redistribution
SDG3	Under 5 mortality	Reduction of hunger; air pollution
SDG6	Water stress; minimum flow requirements	Water efficiency [climate policy; food policies]
SDG7	# people without access to electricity; modern energy (Africa)	Grid extension; local access; energy subsidies; improved stoves
SDG8	GDP convergence	-
SDG11	Urban air pollution	Emission reduction, energy transition
SDG12	Food loss	Assumptions on food loss
	Material flows	Function of development and energy transition
SDG13	Emissions (compared to PA)	Climate policy (price; standards)
SDG14	Ocean acidification	Climate policy (price; standards)
	Phosphor imbalance	Diet change; reduced fertilizer application
SDG15	Mean species abundance	Diet change; protected areas; yield increase; reduced food loss; climate policy; reduced nitrogen loads
	Nitrogen imbalance	Diet change; reduced fertilizer application
	Forest area	Diet change; protected areas; yield increase; reduced food loss;



b SDG interactions and their representation in IAMs



Global biodiversity and options to prevent biodiversity loss



Global greenhouse gas emissions and options to reduce emissions

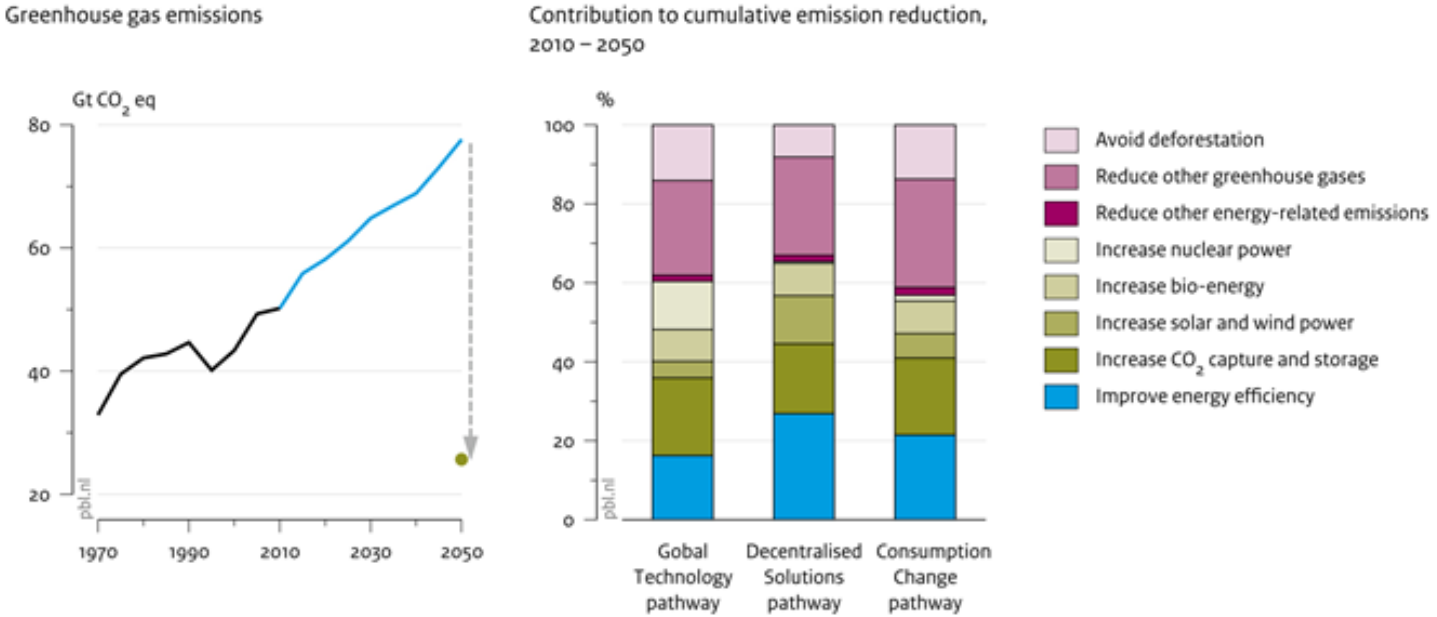
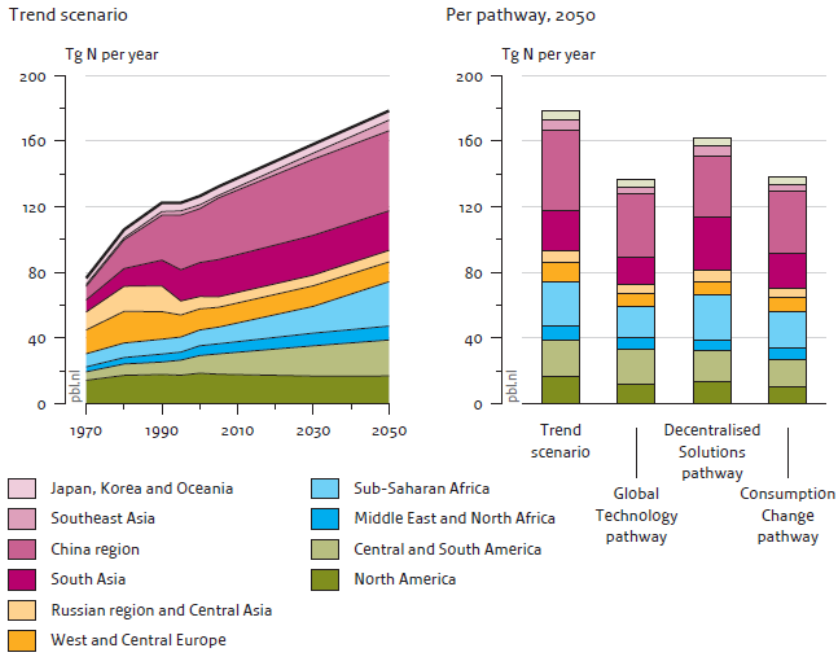
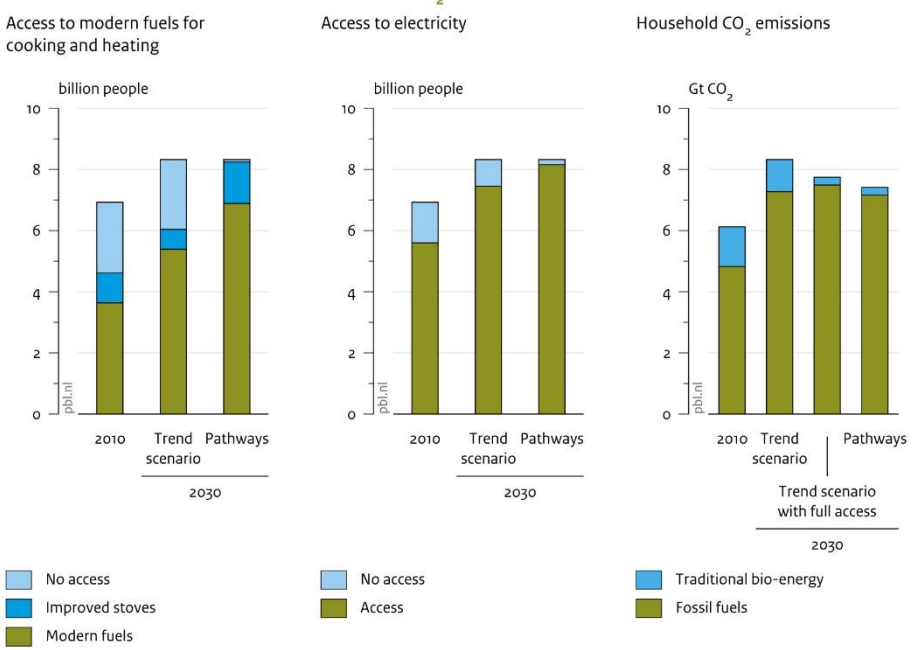


Figure 7.5
Global nitrogen surplus



Global household access to modern fuels and CO_2 emissions



	Scenarios			
Measures	WATER	LAND	FOOD	CLIMATE
Environmental flow requirements	Limit water extraction,			
Biodiversity protection		Increase in protection		
Fertilizer efficiency	++	++		+
Diet change			Willett diet	
Food waste			reduction in food waste	
GHG price				Carbon price

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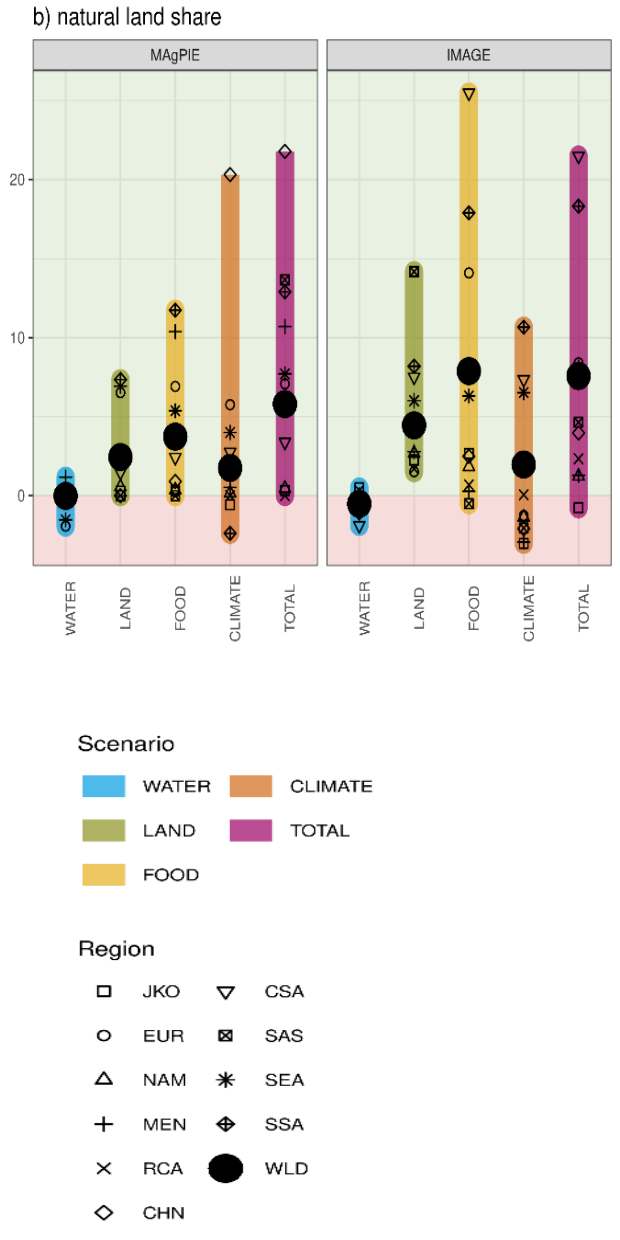

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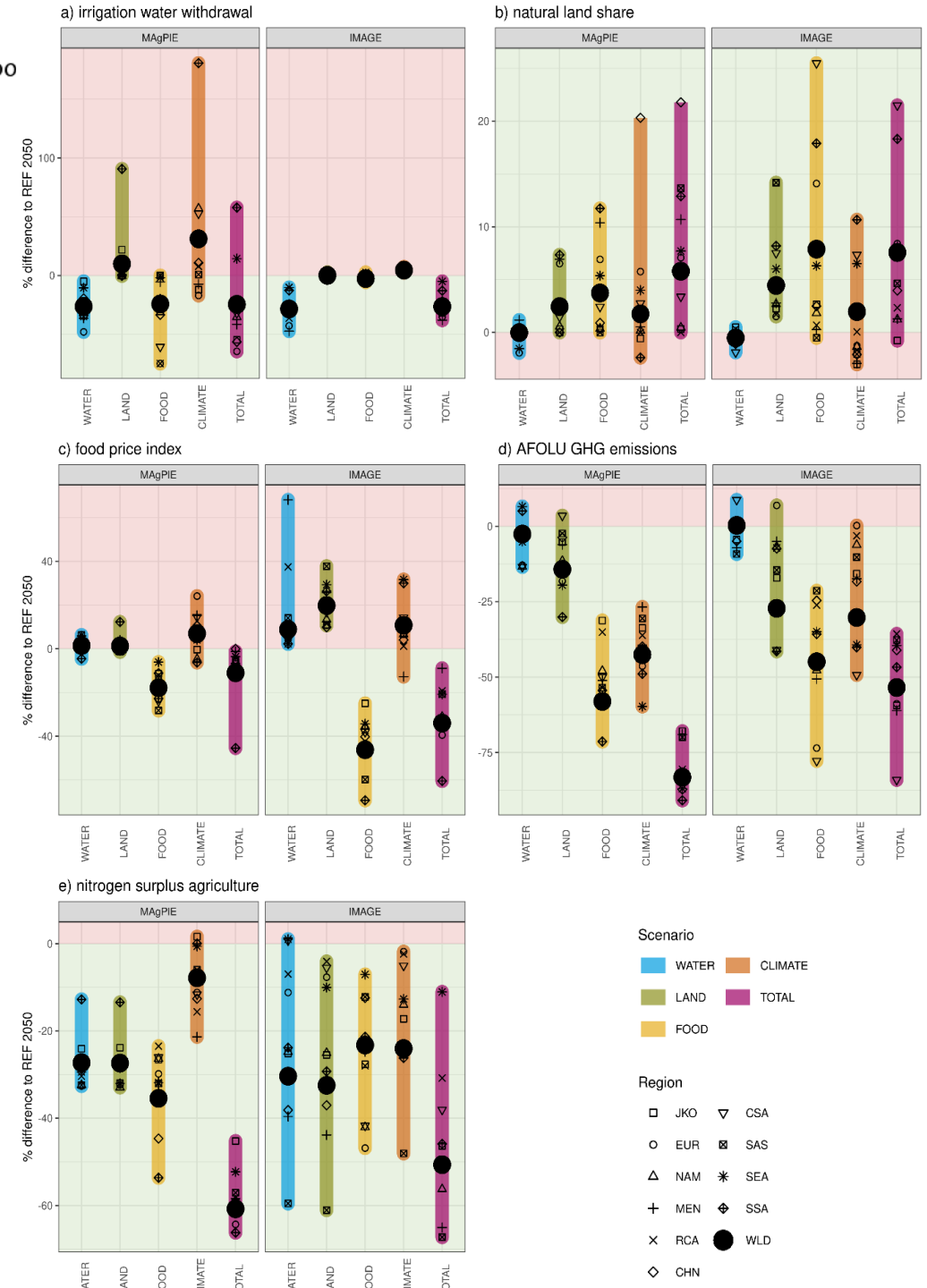
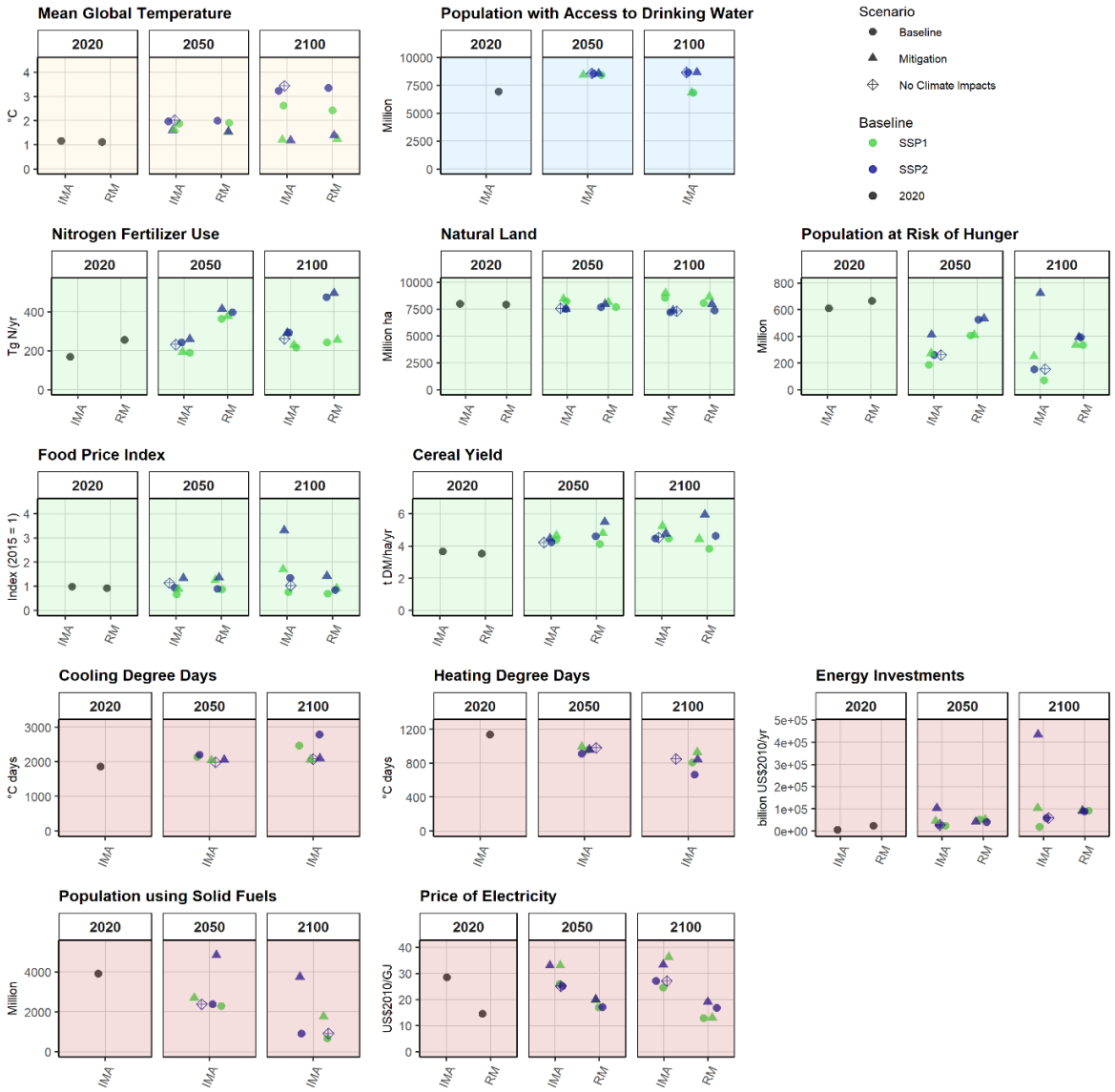
Model	MAgPIE					IMAGE				
Scenario	WATER	LAND	FOOD	CLIMATE	TOTAL	WATER	LAND	FOOD	CLIMATE	TOTAL
Water Withdrawal Irrigation	-26%	+10%	-24%	+31%	-25%	-28%	0%	-3%	+5%	-26%
Natural Land Area	0%	+2%	+4%	+2%	+6%	-1%	+4%	+8%	+2%	+8%
Nitrogen Surplus Agriculture	-27%	-27%	-35%	-8%	-61%	-30%	-32%	-23%	-24%	-51%
Food Price	+1%	+1%	-18%	+7%	-11%	+9%	+20%	-46%	+11%	-34%
AFOLU Emissions	-3%	-14%	-58%	-43%	-83%	0%	-27%	-45%	-30%	-53%

Planbureau voo




Mean Global Temperature
Population with Access to Drinking Water
Scenario
Baseline
Mitigation
No Climate Impacts
Baseline
SSP1
SSP2
2020
Nitrogen Fertilizer Use
Natural Land
Population at Risk of Hunger
Food Price Index
Cereal Yield
Cooling Degree Days
Heating Degree Days
Energy Investments
Population using Solid Fuels
Price of Electricity
2020
2050
2100
IMA
RM
°C
Million
Million ha
Tg N/yr
Index (2015 = 1)
t DM/ha/yr
°C days
billion US$2010/yr
US$2010/GJ

NAVIGATE – Nexus SDG requirements

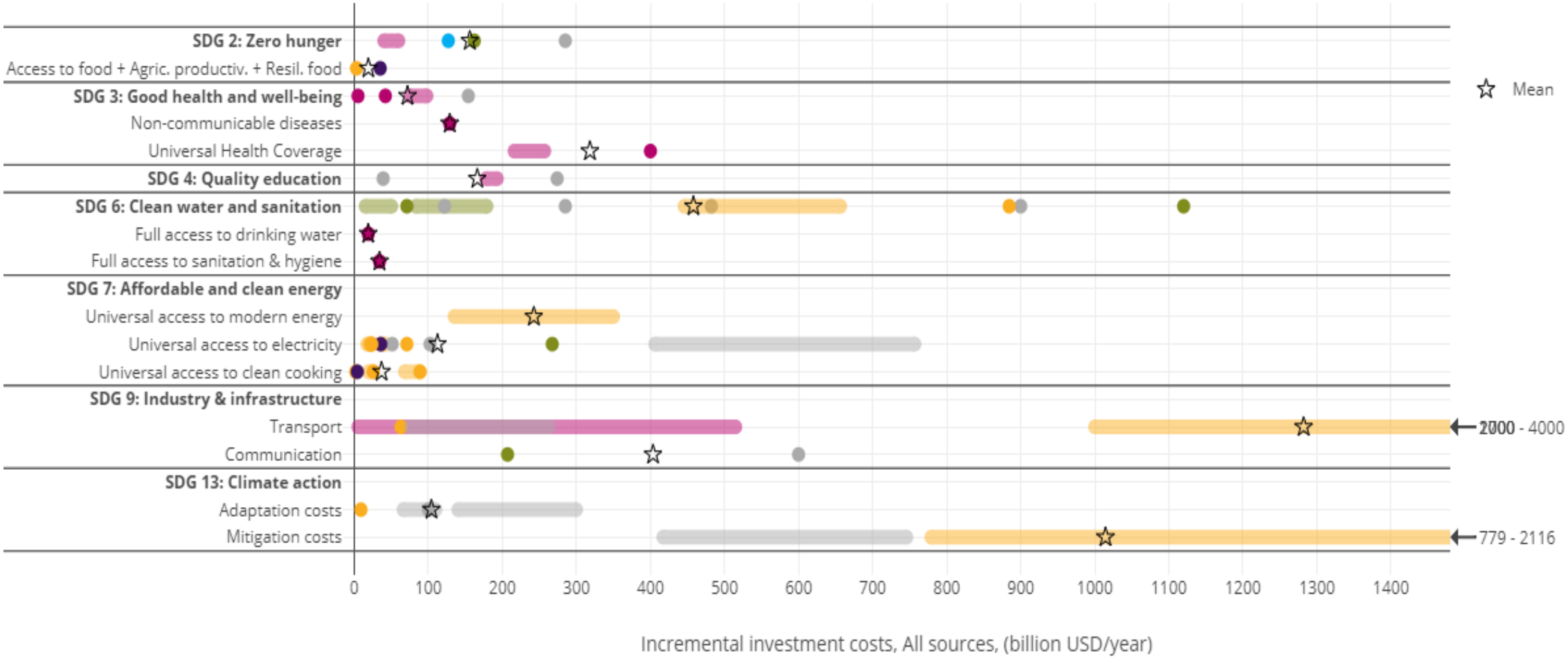
	Ref	SDG achievement
BL-no climate impact	1	3 (Energy/water/land targets reached)
BL-with climate impact	2	4 (Energy/water/land targets reached)
2.6 – with climate impact	5	6 (Energy/water/land targets reached)

Q 1: How can nexus SDGS be reached simultaneously? Can we say something on investment costs? (comparing 1 to 3)
Q 2: Role of climate impacts in reaching the nexus SDG goals? (comparing 3 to 4)
Q 3: Situation with added climate policy? (comparing 4 to 6)

Other possible research questions:

- How does near term action on SDGs help achieve long-term climate goals?
- Additional sectoral investment costs due to no climate mitigation?
- Assessment of single adaptation strategies

SDG goal	Target	Can be represented in model and how
SDG2 (Hunger)	End hunger and malnutrition in 2030	Allign with SHAPE (yield increase + diet change)
	Double agricultural productivity and income of small-scale food producers	
	Sustainable food production by 2030	
SDG6 (water)	Universal access to drinking water and sanitation by 2030	Increase water use efficiency
	Halving untreated wastewater by 2030	
	Increase water use efficiency/less water scarcity by 2030	
SDG7 (energy)	Universal access to modern energy (electricity + clean fuels) by 2030	Will be implemented
	Increase the share of renewables by 2030	
	Double the rate of improvement in energy efficiency by 2030	
SDG15 (Life on land)	Conservation of freshwater ecosystems by 2020	Based on SHAPE / Bending the trend (50% protection)
	Sustainable management of forests by 2020	
	Restore degraded land by 2030	
	Conservation of mountain ecosystems by 2030	
	Prevent the loss of biodiversity	


SDG 2: Zero hunger
Access to food + Agric. productiv. + Resil. food
SDG 3: Good health and well-being
Non-communicable diseases
Universal Health Coverage
SDG 4: Quality education
SDG 6: Clean water and sanitation
Full access to drinking water
Full access to sanitation & hygiene
SDG 7: Affordable and clean energy
Universal access to modern energy
Universal access to electricity
Universal access to clean cooking
SDG 9: Industry & infrastructure
Transport
Communication
SDG 13: Climate action
Adaptation costs
Mitigation costs
Mean
2000 - 4000
779 - 2116
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
Incremental investment costs, All sources, (billion USD/year)