CPVO

Community Plant Variety Office

Impact of the Community Plant Variety Rights system on the European Union economy and the environment

UPOV Seminar on the role of plant breeding and plant variety protection in enabling agriculture to mitigate and adapt to climate change - Thematic session 5

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Outline

1. Description of the study on impact of the CPVR system
2. Chapter on Impact of CPVR system on EU Economy
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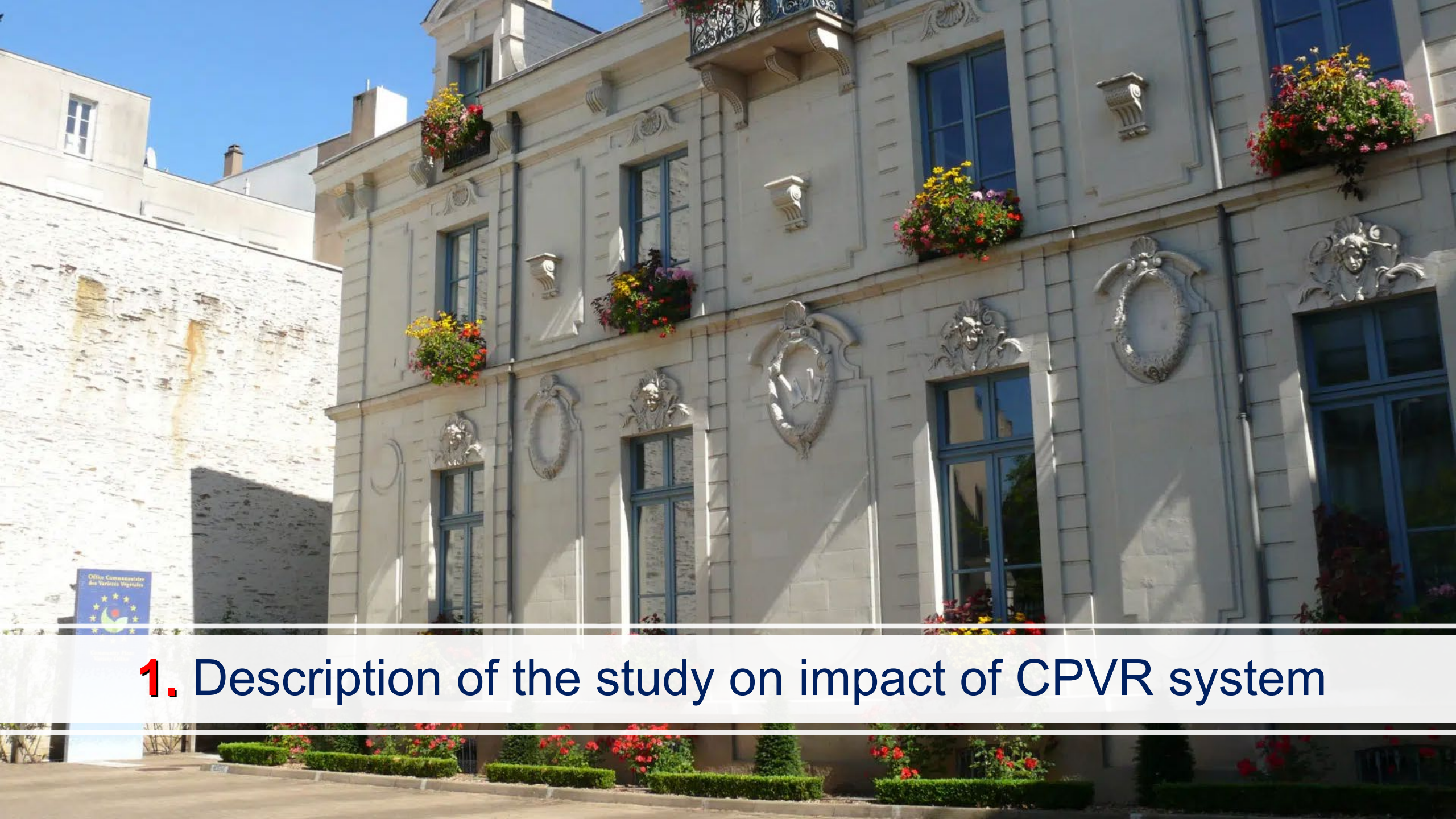
4. Final Considerations



1. Description of the study on impact of CPVR system

General remarks on the study

Published by European Observatory on Infringements of Intellectual Property Rights in cooperation with the CPVO

Released on 28 April in CPVO Policy seminar, under the French Presidency of the Council of the European Union

The study Quantifies the economic contribution in the European Union of the CPVR system

Structure of the study

1. Introductory chapter on CPVR and EU marketing
2. Literature review
3. Methodology and data
4. Quantitative results

Methodology used for the study

Impact on Economy

- Calculated using a computable equilibrium model
- Considers the impact of increased production on:
  - Prices
  - Farm incomes
  - Overall economic output (via multiplier effects)
  - Employment
  - Impact on EU's trade with the rest of the world

Impact on Environment

- Considers the impact of Increased productivity due to innovation
  - less imports from rest of the world
  - less land use in rest of the world
  - less water use
  - fewer greenhouse gas emissions
  - less biodiversity loss

Sources of Quantitative Data for the Study

CPVO Register
National PVR Registers

National listings
Common Catalogue

FRUMATIS

PLUTO (UPOV)

OECD Variety list query

FAOSTAT (production, value and trade in agricultural products)

EUIPO registry and TMView

PATSTAT and PINTO databases

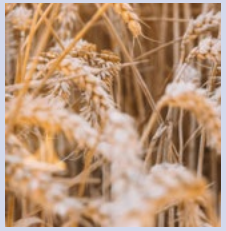
ORBIS (demographic and financial data on breeders)

EUROSTAT:

- Structural Business Statistics
- Economics Accounts for Agriculture
- Labour Force Survey

Scope of study: crops accounting for >80% of CPVRs

Agricultural	Fruit	Vegetables	Ornamentals
• Wheat • Corn • Barley • Other cereals • OSR • Sunflower • Other oilseeds • Sugar beet • Potato • Pulses • Ryegrass	• Peach • Strawberry • Apple • Wine/grape • Apricot • Blueberry • Raspberry • Plum • Cherry	• Lettuce • Tomato • Pepper • Melon • Bean • Pea • Cucumber • Cabbage • Onion • Spinach • Endive • Leek	Treated as one combined crop due to the large number of varieties



Indicators on impact of CPVR system

The fact that breeders do not protect varieties unlikely to be successful would confirm that the number of applications and titles are good indicators of the benefits of a PVP system.

[UPOV 2005 report on impact of PVP]

Breeders' perspective

Significant costs for breeders acceptable only if:

- Tangible market value

- Return in form of royalties

Growers' perspective

Choice: protected vs free varieties

- Payment of royalties acceptable only for superior varieties

2. CPVR Impact on Economy

Pic: © Wageningen

Impact if plant breeding progress had not occurred

Impact if plant breeding progress (1995-2019) had not occurred:

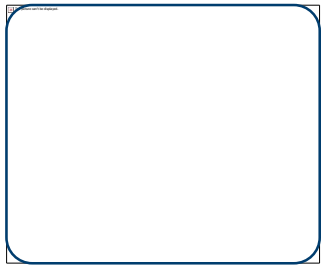
- the quantity of crops that would not have been produced
- the hypothetical missing volume attributable to protected varieties

Advantages of a PVP system are made visible by disadvantages of the absence of a PVP system!

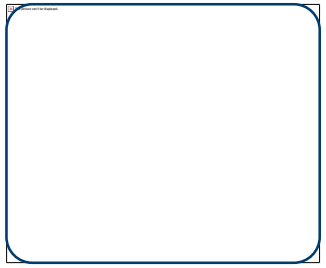
In the absence of the CPVR system, in 2020 the production in the EU would be:

- 6.4% lower for agricultural crops;
- 2.6% lower for fruits;
- 4.7% lower for vegetables;
- 15.1% lower for ornamentals.

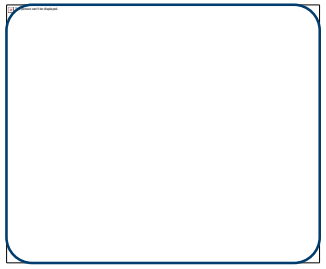
Key findings: economic contribution



The additional production brought about by EU-protected plant variety innovations is sufficient to feed (worldwide): an additional **57 million** people with arable crops, **38 million** with fruit crops, and **28 million** for vegetable crops

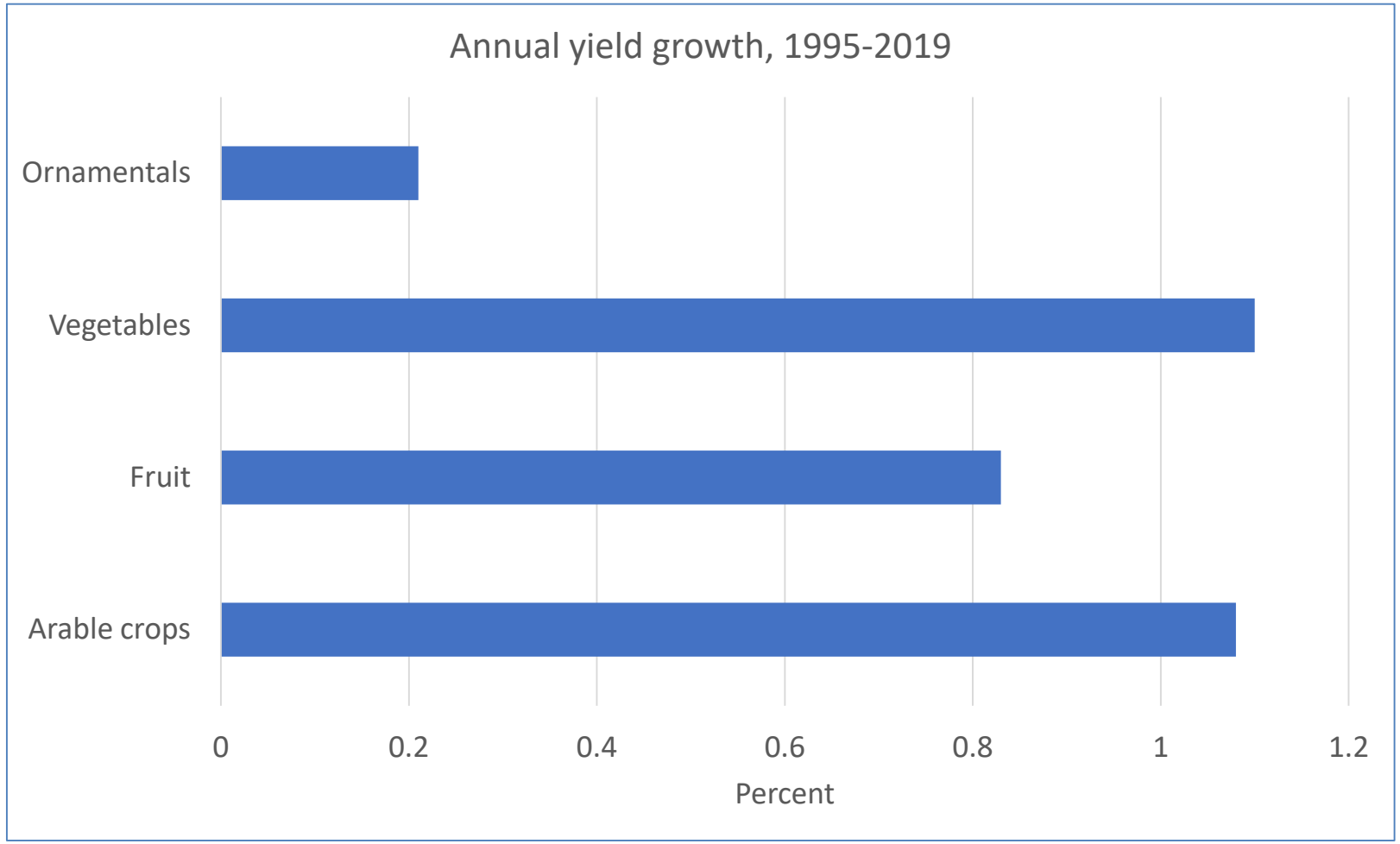


The additional added value (GDP contribution) generated by EU PVR-protected crops amounts to **13 billion EUR**



Additional production resulted in **higher employment rates** in the EU agriculture, and **better remunerated**

Annual yield growth for crops in the EU (1995-2019) (% per year)



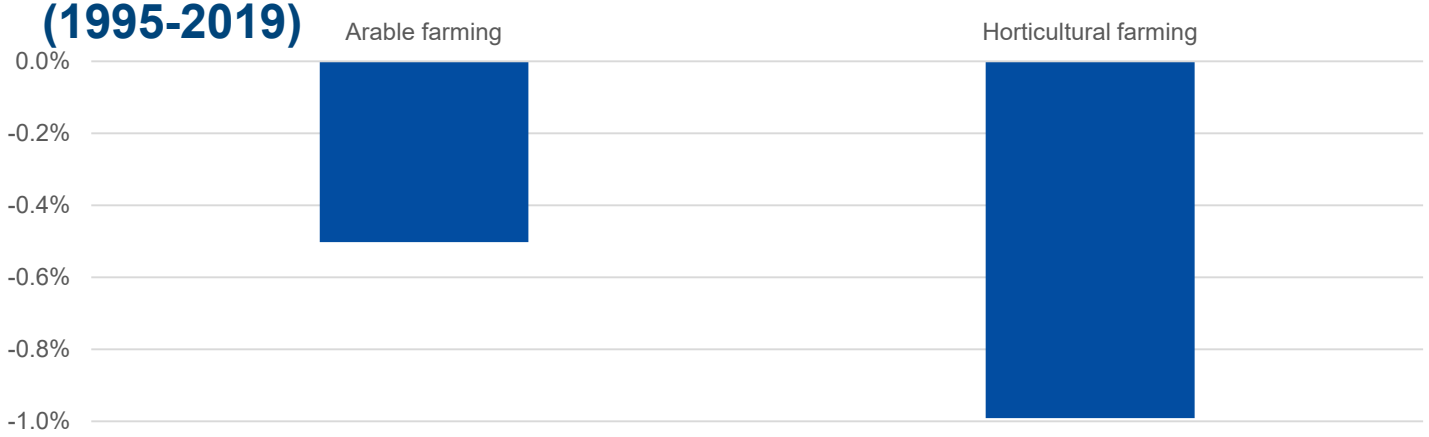
INPUT USE: DECLINING

Growth rates of input use (per hectare) for EU agricultural and horticultural farming (1995-2019) (% per year)

- **“Agricultural Intensification” is factored out (= increased input, e.g.: denser planting schemes, capital, labor etc.)**

FARMING	SEEDS	FERTILISERS	PPP	LABOUR	CAPITAL
Arable	-0.20	-0.07	-0.60	-0.60	-0.44
Horticultural	-0.60	-2.30	-1.40	-1.00	-0.92

Annual growth rates of the overall input use (excluding land) in agricultural and horticultural farming of the EU (1995-2019)



YIELD: INCREASING
Innovation-induced yield growth rates for crops in the EU (1995-2019) (% per year)

- **Subtracting the overall input use growth rate from statistically observable yield growth leads to crop-specific annual innovation-induced growth rate**

CROP	GROWTH RATE	CROP	GROWTH RATE	CROP	GROWTH RATE
Wheat	1.43	OSR	1.20	Potato	2.40
Corn	1.72	Sunflower	2.74	Pulses	0.94
Barley	1.57	Other oilseeds	0.79	Green maize	2.30
Other cereals	1.41	Sugar beet	2.63	Ryegrass	1.29
CROP	**GROWTH RATE**	**CROP**	**GROWTH RATE**	**CROP**	**GROWTH RATE**
Peach	2.20	Wine/Grape	1.59	Raspberry	1.57
Strawberry	2.22	Apricot	3.79	Plum	3.49
Apple	2.28	Blueberry	2.42	Cherry	1.48
CROP	**GROWTH RATE**	**CROP**	**GROWTH RATE**	**CROP**	**GROWTH RATE**
Lettuce	1.47	Bean	1.84	Onion	4.09
Tomato	3.16	Pea	0.91	Spinach	1.27
Pepper	3.90	Cucumber	4.71	Endive	2.31
Melon	2.14	Cabbage	1.51	Leek	1.71

Ornamental crop (as a whole): 1.20

Contribution of plant breeding to innovation-induced yield growth of EU crops (%)

CROP	SHARE	CROP	SHARE	CROP	SHARE
Wheat	67.3	OSR	73.8	Potato	62.1
Corn	69.2	Sunflower	71.5	Pulses	65.6
Barley	69.3	Other oilseeds	71.5	Green maize	65.8
Other cereals	72.3	Sugar beet	60.7	Ryegrass	53.5

Contribution by plant breeding to innovation-induced yield growth of arable crops in the EU (per cent)

GROUP OF CROPS	SHARE	GROUP OF CROPS	SHARE
Fruit	58.8	Vegetables	59.0

Contribution by plant breeding to innovation-induced yield growth of fruit and vegetables in the EU (per cent)

Ornamental crop (as a whole): Assumed to be 59 %

Plant breeding-induced yield growth rates for crops in the EU (1995-2019) (% per year)

- **Merging innovation-induced yield growth rates and plant breeding's shares in innovation-induced change**

CROP	GROWTH RATE	CROP	GROWTH RATE	CROP	GROWTH RATE
Wheat	0.96	OSR	0.89	Potato	1.49
Corn	1.19	Sunflower	1.96	Pulses	0.62
Barley	1.09	Other oilseeds	0.56	Green maize	1.51
Other cereals	1.02	Sugar beet	1.60	Ryegrass	0.69
CROP	**GROWTH RATE**	**CROP**	**GROWTH RATE**	**CROP**	**GROWTH RATE**
Peach	1.29	Wine/Grape	0.93	Raspberry	0.92
Strawberry	1.31	Apricot	2.23	Plum	2.05
Apple	1.34	Blueberry	1.42	Cherry	0.87
CROP	**GROWTH RATE**	**CROP**	**GROWTH RATE**	**CROP**	**GROWTH RATE**
Lettuce	0.87	Bean	1.09	Onion	2.41
Tomato	1.86	Pea	0.54	Spinach	0.75
Pepper	2.30	Cucumber	2.78	Endive	1.36
Melon	1.26	Cabbage	0.89	Leek	1.01

Ornamental crop (as a whole):
0.71

Share of protected agricultural varieties to account for the effects of the PVP system

CROP	REGISTERED VARIETIES	EU-LEVEL PVR VARIETIES	SHARE
Wheat	4 137	1 401	33.9 %
Corn/Green maize	10 942	2 537	23.2 %
Barley	2 109	650	30.8 %
Other cereals	2 502	593	23.7 %
OSR	2 431	884	36.4 %
Sunflower	3 037	686	22.6 %
Other oilseeds	1 875	370	29.7 %
Sugar beet	2 901	115	4.0 %
Potato	2 146	1 057	49.3 %
Pulses	1 075	167	15.5 %
Ryegrass	1 318	260	19.7 %

Therefore, 25.3 % of all registered varieties of the arable crops that are the focus of this study are varieties with an EU-level PVR.

Share of protected fruit varieties to account for the effects of the PVP system

CROP	REGISTERED VARIETIES	EU-LEVEL PVR VARIETIES	SHARE
Peach	3 333	640	19.2 %
Strawberry	1 868	418	22.4 %
Apple	6 748	345	5.1 %
Wine/Grape	2 444	243	9.9 %
Apricot	1 069	199	18.6 %
Blueberry	412	129	31.3 %
Raspberry	709	138	19.5 %
Plum	295	83	28.1 %
Cherry	1 731	99	5.7 %

12.3 % of all registered fruit varieties are varieties with an EU-level PVR.

Share of protected vegetable varieties to account for the effects of the PVP system

CROP	REGISTERED VARIETIES	EU-LEVEL PVR VARIETES	SHARE
Lettuce	3 314	1329	40.1 %
Tomato	5 740	922	16.1 %
Pepper	2 967	383	12.9 %
Melon	1 540	284	18.4 %
Bean	1 807	245	13.6 %
Pea	1 523	369	24.2 %
Cucumber	1 664	220	13.2 %
Cabbage	3 050	332	10.9 %
Onion	1 359	194	14.3 %
Spinach	584	105	18.0 %
Endive	461	88	19.1 %
Leek	299	84	28.1 %

18.7 % of all registered varieties of the vegetables that are the focus of this study are varieties with an EU-level PVR.

Share of protected ornamental varieties to account for the effects of the PVP system

CROP	REGISTERED VARIETIES	EU-LEVEL PVR VARIETES	SHARE
Ornamentals	15 588	15 094	96.8 %

Breeders' geographical origin in CPVRs

- 29.000+ CPVRs in force (beginning 2022)
- Largest share: EU countries (almost 77%)

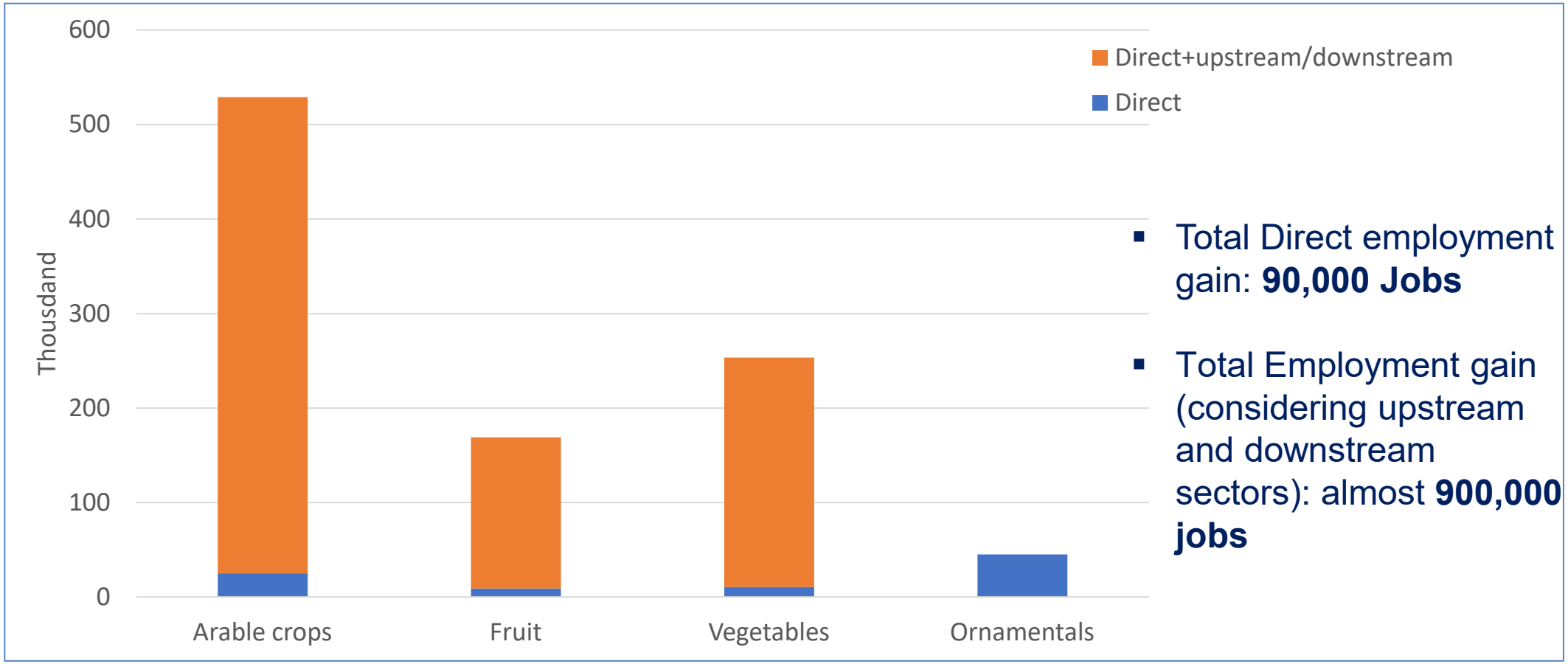
	Country	% CPVR	number CPVR
NL	Netherlands	34.8	9,919
FR	France	17.0	4,837
DE	Germany	14.0	3,985
US	United States	6.7	1,911
CH	Switzerland	5.3	1,523
DK	Denmark	3.2	906
UK	United Kingdom	3.1	872
IT	Italy	2.7	783
ES	Spain	2.4	681
BE	Belgium	2.2	615
EU27	**European Union**	**76.9**	**22,669**
	Third countries	**23.1**	5,845

Size of CPVR holders

- **93.5% of registrants of CPVRs are SMEs**
- **60% of CPVRs are owned by SMEs**
- **SMES own each around 10 CPVRs**

Size	% CPVR	% firms	Number of firms	CPVRs per firm
Physical persons	8.0	36.8	451	3.3
Micro firms	21.7	32.8	402	10.2
Small firms	11.5	15.5	190	11.4
Medium firms	18.8	8.5	104	34.2
Large firms	**40.0**	**6.5**	**80**	**94.8**
SME + Physical	**60.0**	**93.5**	**1 147**	**9.9**

Contribution to Employment of CPVR-protected varieties



- Total Direct employment gain: **90,000 Jobs**
- Total Employment gain (considering upstream and downstream sectors): almost **900,000 jobs**

Employment and Turnover rates of CPVR holders

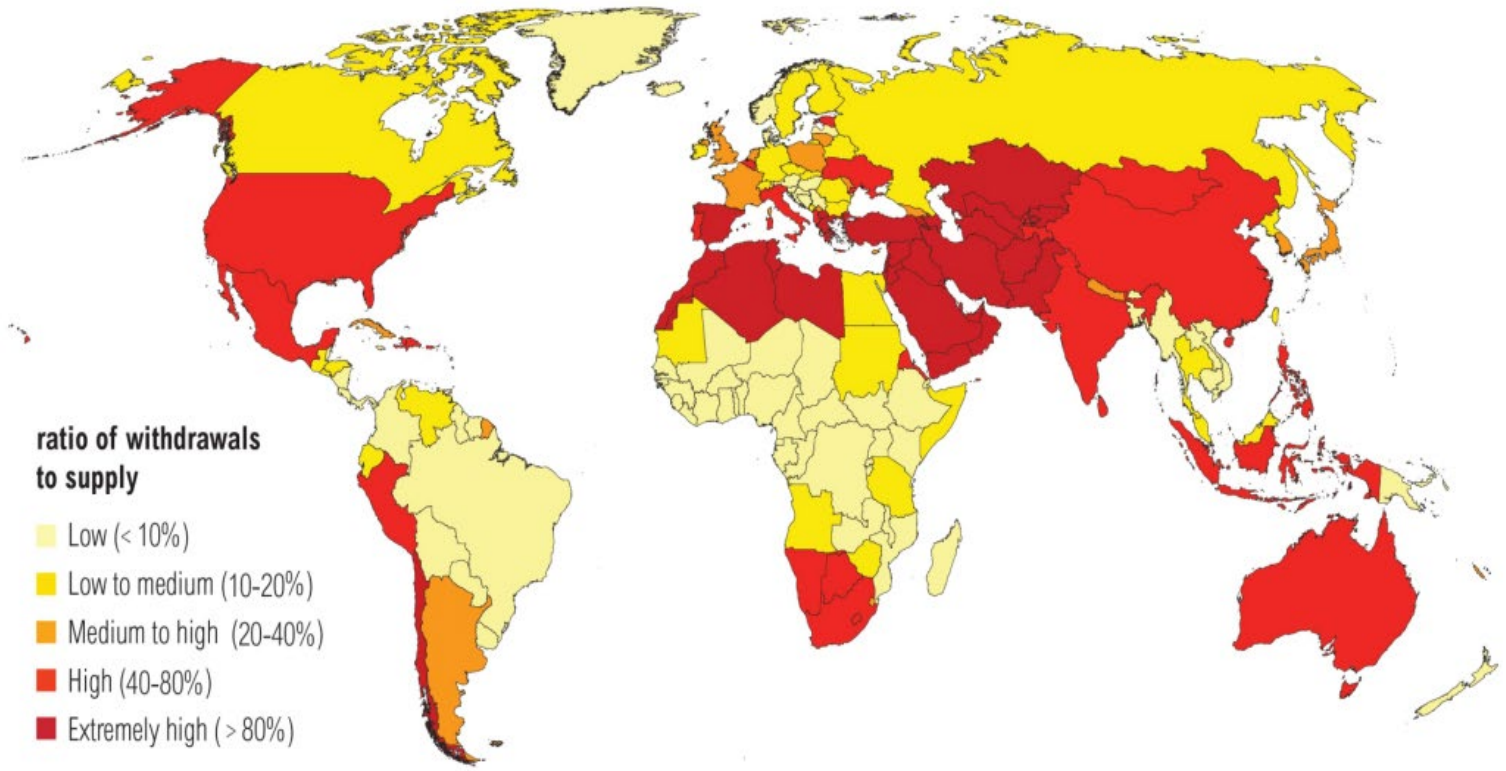
- **951 CPVR holders have plant breeding as primary activity**
- **CPVR holders employ more than 70.000 workers and have an annual turnover of EU**

sector	firms	employees	turnover (million €)
Agriculture (seed growing)	603	35,045	17,780
R&D (agricultural & biotechnology)	128	7,970	2,364
Royalties (PVR)	47	119	722
Wholesale (seeds)	173	27,590	14,552
Total	**951**	**70,725**	**35,418**

- **Positive impact on wages:**
  - **Agricultural crop sector: +12.6%**
  - **Horticultural sector: +11%**
- **Positive impact on EU's trade balance**
  - **Without CPVR-protected innovation, the EU would become a net importer of some crops for which it is an exporter today**

3. Impact of the CPVR system on Environment and Society

Water stress by country in 2040



NOTE: Projections are based on a business-as-usual scenario using SSP2 and RCP8.5.

For more: ow.ly/RiWop

WORLD RESOURCES INSTITUTE

Need for Climate change adaptation in EU agriculture

Coastal zones
Sea level rise
Intrusion of saltwater

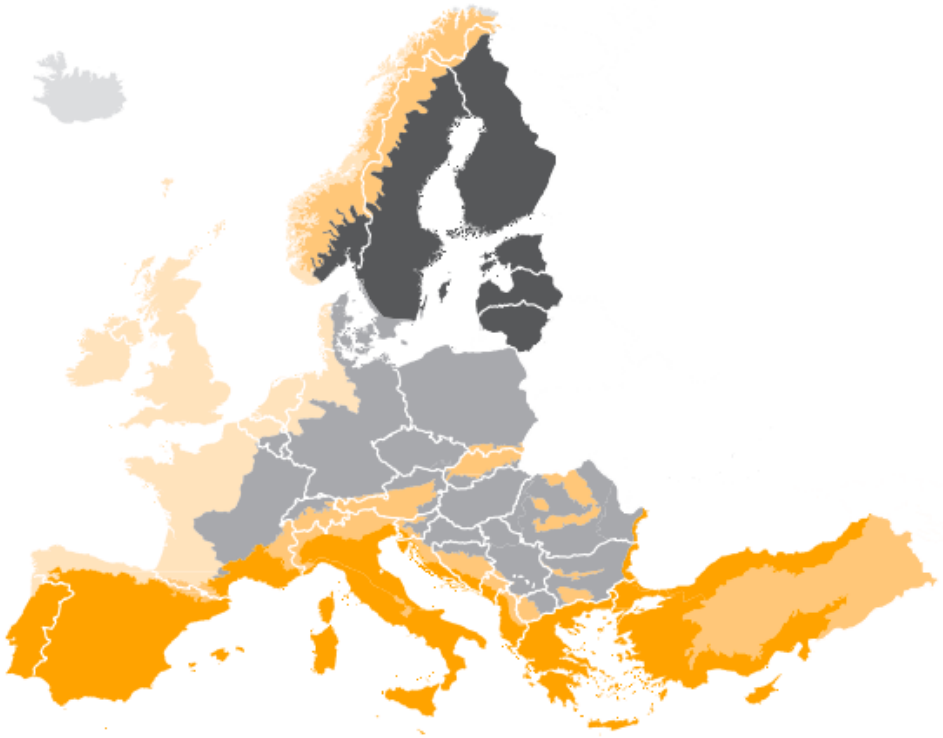
Mediterranean region
Large increase in heat extremes
Decrease in precipitation
Increasing risk of droughts
Increasing risk of biodiversity loss
Increasing water demand for agriculture
Decrease in crop yields
Increasing risks for livestock production
Agriculture negatively afected by spillover efects of climate change from outside Europe

Boreal region
Increase in heavy precipitation events
Increase in precipitation
Increasing damage risk from winter storms
Increase in crop yields

Atlantic region
Increase in heavy precipitation events
Increasing risk of river and coastal flooding
Increasing damage risk from winter storms

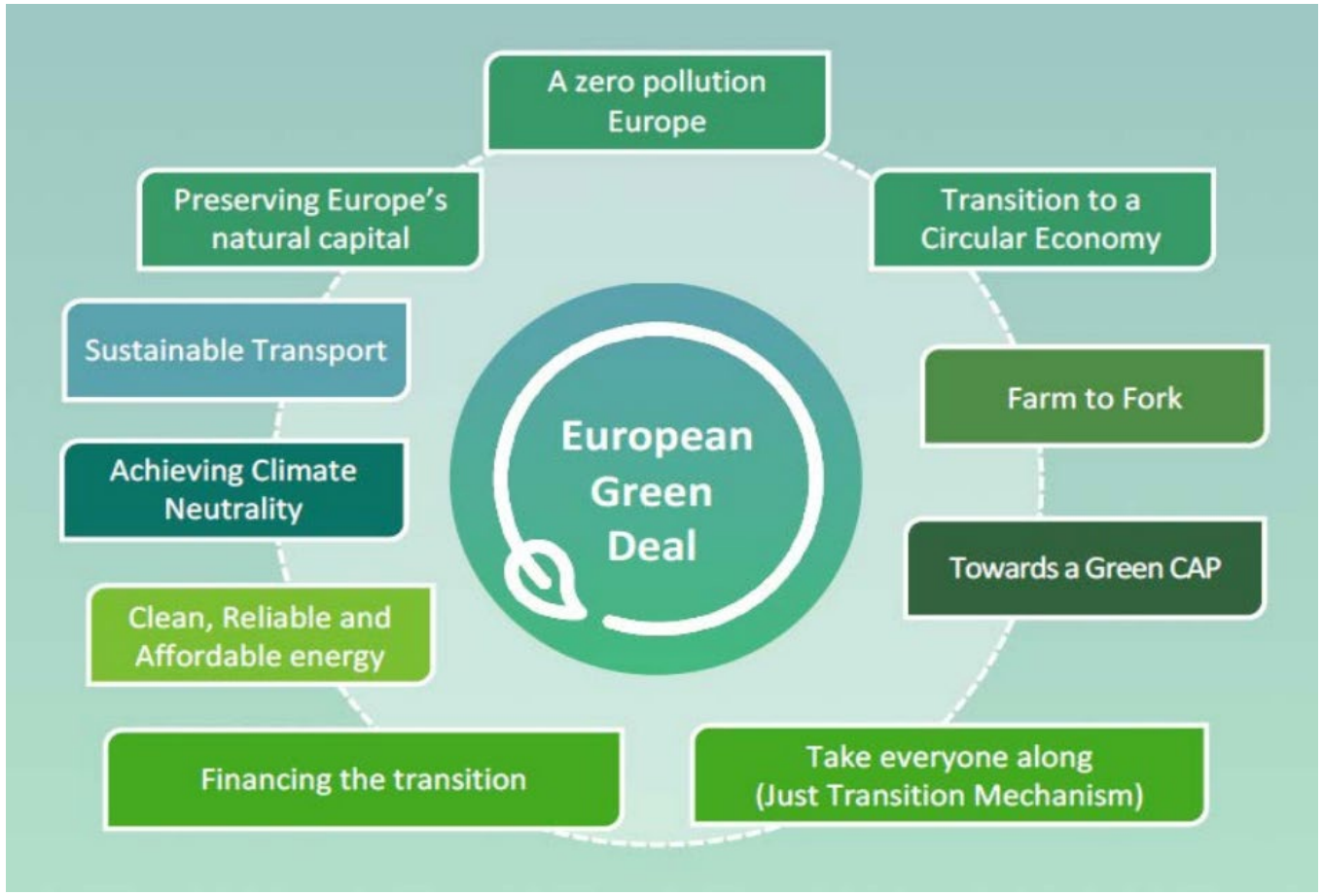
Continental region
Increase in heat extremes
Decrease in summer precipitation
Increasing risk of river floods

Mountain regions
Temperature rise larger than European average
Upward shift of plant and animal species
Risk of hail
Risk of frost
Increasing risk from rock falls and landslides



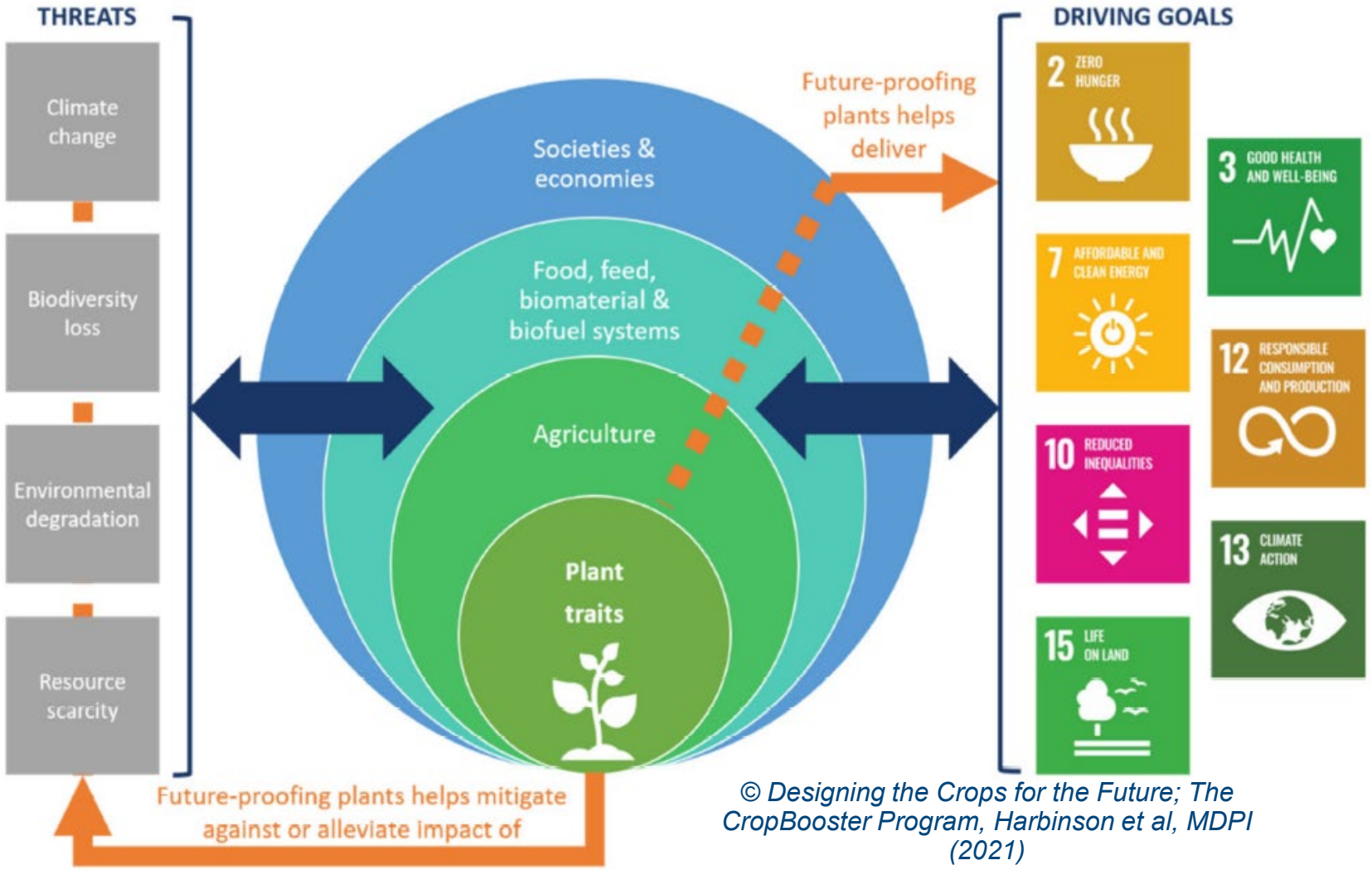
Commission's EU Green Deal

EU to become climate-neutral by 2050



Biodiversity Strategy & Farm to Fork Strategy

Plant variety innovation is part of the solution!



© Designing the Crops for the Future; The CropBooster Program, Harbinson et al, MDPI (2021)

Contribution of the EU PVR system to SDGs

SDG 1

POVERTY REDUCTION

- Increased farm incomes
- More affordable food

SDG 2

ZERO HUNGER

- Increased food production

SDG 8

JOBS & GROWTH

- More jobs in agriculture & horticulture + in upstream & downstream industries

SDG 12

SUSTAINABLE PRODUCTION AND CONSUMPTION

- Growth in yields with less resource input

SDG 13

CLIMATE ACTION

- Reduced resource use and GHG emissions

SDG 15

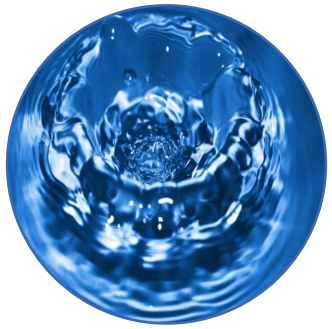
LIFE ON LAND

- Release of new adapted varieties
- Preservation of land thanks to yield growth

Key findings: environmental objectives

Annual Greenhouse Gas (GHG) emissions from agriculture and horticulture: reduced by **62 million tons** per year

= total **Portugal**'s GHG footprint



Water use in agriculture and horticulture: reduced by more than **14 billion m3**

= 1/3 of **Lake Constance's** volume

Land use and biodiversity: prevention of conversion of **6.5 million hectares of grassland** and natural habitats in the world

= size of **Ireland's** territory

4. Final Considerations

Key findings: farmers, breeders, SMEs

Farmers/growers across the EU benefit from the innovations protected by the CPVR system

R&D by Breeders leads to innovations, employment and economic growth

SMEs and physical persons account hold 60% of CPVRs currently in force

Final Considerations

Plant variety innovation must support low-input agriculture and better environmental protection

Varieties should not only produce higher yields but also be adapted to biotic and abiotic stresses

In the context of Climate Change: draught-resistance and less-water-input traits

Legislation must drive innovation to accelerate transition to sustainable inclusive food systems from primary production to consumption

EU legislative reforms foreseen:

- **CPVR system**
- **Plant Reproductive Material marketing**
- **Gene-Editing Regulatory framework**

CPVO

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