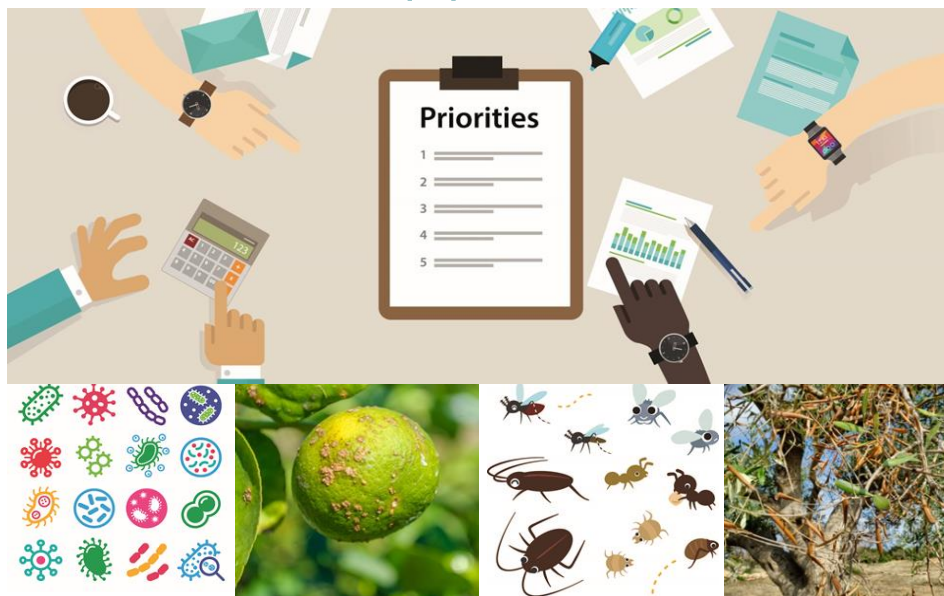# Agenda item #3: Consolidated version of the methodology for the identification of the Union quarantine pests qualifying as priority pests and its application to selected pilot pests
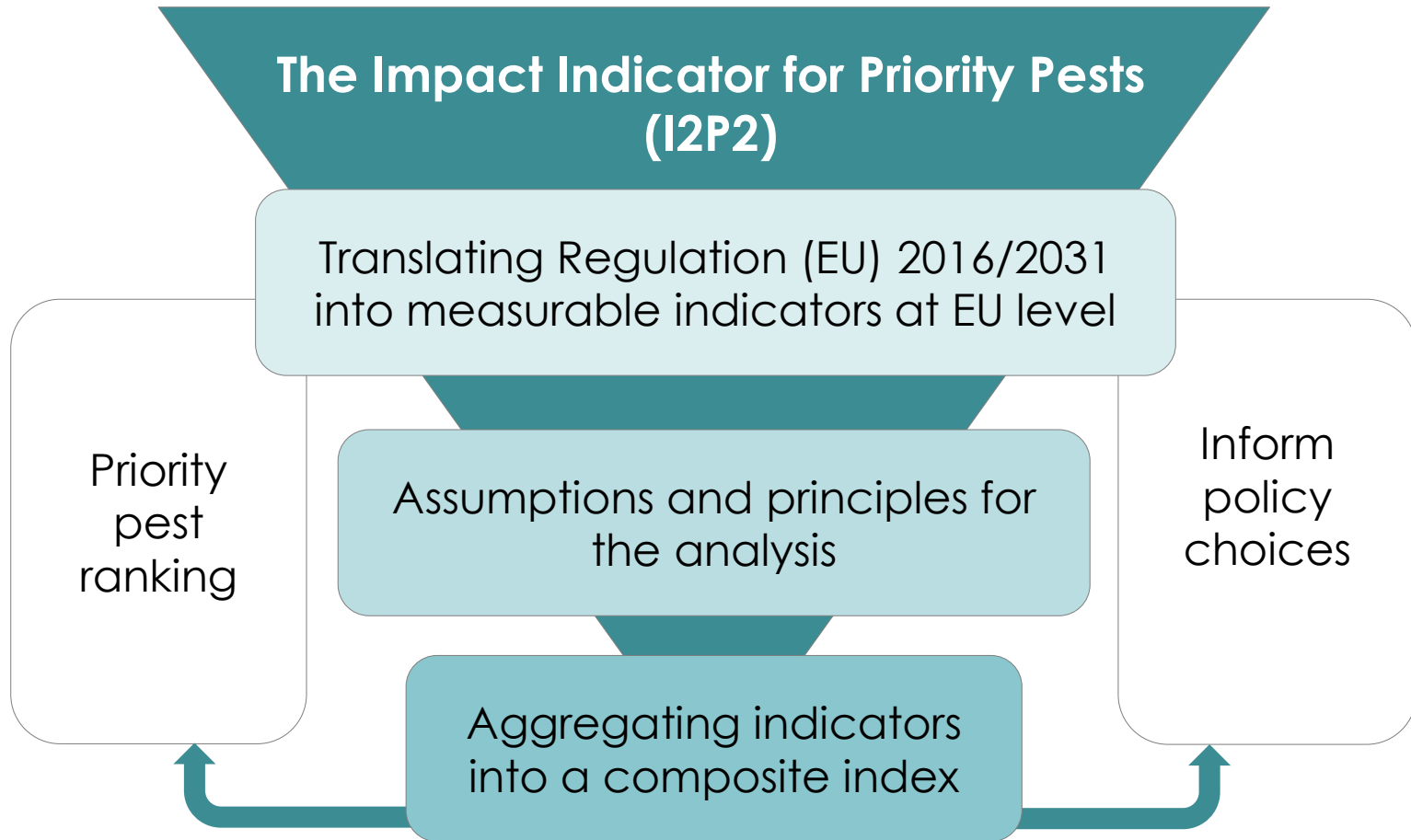
Berta Sánchez
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European Commission
Joint Research Centre (JRC)
Unit D.4 Economics of Agriculture

I2P2 a composite indicator to rank pests based on the socioeconomic and environmental impact

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Composite indicators including multiple criteria

The Impact Indicator for Priority Pests (I2P2)

Translating Regulation (EU) 2016/2031 into measurable indicators at EU level

Assumptions and principles for the analysis

Aggregating indicators into a composite index

Priority pest ranking

Inform policy choices

How to identify measurable indicators?
OECD and JRC-COIN steps!

We are here!

|	
Indicators selection	Quantitative or qualitative measures
Data selection	Measuring indicators based on available statistics and experts
Normalization	Allows comparing indicators with different scales; dimensions or units
Weighting	To aggregate indicators based on weights set by the Legislator(s)
Uncertainty of data	Probabilities and sensitivity analysis

APPLIYNG THE I2P2 TO SEVEN PILOT PESTS

3 pests affecting annual crops

Tilletia indica (Karnal bunt of wheat)
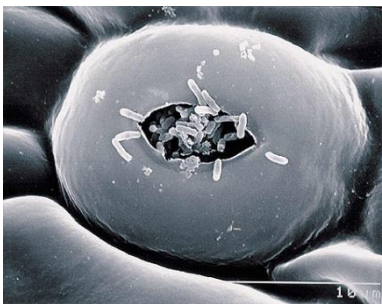
Synchytrium endobioticum (Wart disease of potato)
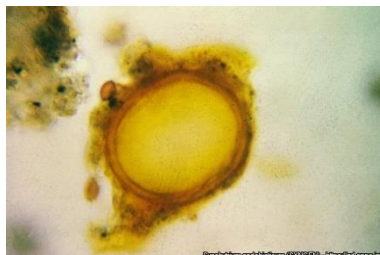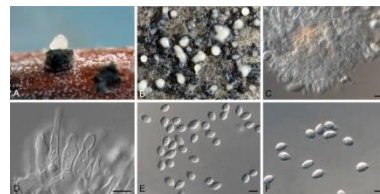
Clavibacter michiganensis (Bacterial ring rot of potato)

APPLIYNG THE I2P2 TO SEVEN PILOT PESTS

3 pests affecting perennial crops

Xanthomonas citri
(Citrus canker)

Phyllosticta citricarpa
(Black spot of citrus)

Candidatus libertibacter
(Citrus greening)

APPLIYNG THE I2P2 TO SEVEN PILOT PESTS

Agrilus anxius
(Bronze birch borer of Birch)

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Composite indicators including multiple criteria

The Impact Indicator for Priority Pests (I2P2)

Translating Regulation (EU) 2016/2031 into measurable indicators at EU level

Assumptions and principles for the analysis

Assumptions on reference scenario for impact assessment

Pest is **already present throughout the area of potential establishment** in the EU

Pest has reached **a stable spatial distribution / maximum potential abundance** based on the current environmental conditions and production practices

Yield/quality losses are evaluated in a **time frame long enough to take into account the temporal variation** in pest population dynamics

- We use the 50% value of the uncertainty distribution for yield loss, quality loss, spread rate and time to first detection

- For **polyphagous pests**, indicators aggregated for all pest-host pairing when cardinal data and using maximum value for shares or ratios

Indicator specific assumption (experts knowledge/data)

I.1 Maximum value of production losses:

A. Price assumptions for quality losses:

❑ Tilletia indica

    Wheat for feed use - **10% reduction on price**

❑ *Xanthomonas citri; Phyllosticta citricarpa; Synchytrium endobioticum; Clavibacter michiganensis ssp. Sepedonicus); Candidatus liberibacter*

    Citrus for food processing industries (juice) **70% reduction on price** (Source: Junta de Andalucía - Observatorio de Precios & Asociación de Industriales de Zumos de Cítricos)

    Potato for food processing industries (starch) **70% reduction on price** (Source: Eurostat)

Assumptions on some indicators (experts knowledge/data)

I.1 Maximum value of production losses:

B. Losses related to nurseries

❑ *Xanthomonas citri; Phyllosticta citricarpa; Candidatus liberibacter*

5 Euros per fruit plant (Source: ad hoc survey of citrus nurseries in Spain)

Number of fruit plants affected as reported by EFSA factsheet

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Forestry specific assumptions….

- ❑ **I.1 Maximum value of production losses:**

  - ❑ Reduced price to take into account quality losses is taken as that of the secondary use of wood (e.g. for betula spp. pulpwood is the 2nd quality price while roundwood is the 1st).

- ❑ **I.17 Share of other gainful activities:** All forestry species assumed to have a value of 100% due to the multifunctional nature of forests.

- ❑ **I.25 Area under area under sustainable management practices:** sum of Forestry Stewardship Commission (FSC) and Programme for Endorsement of Forestry Certification (PEFC) certified surface over total area (by genus)
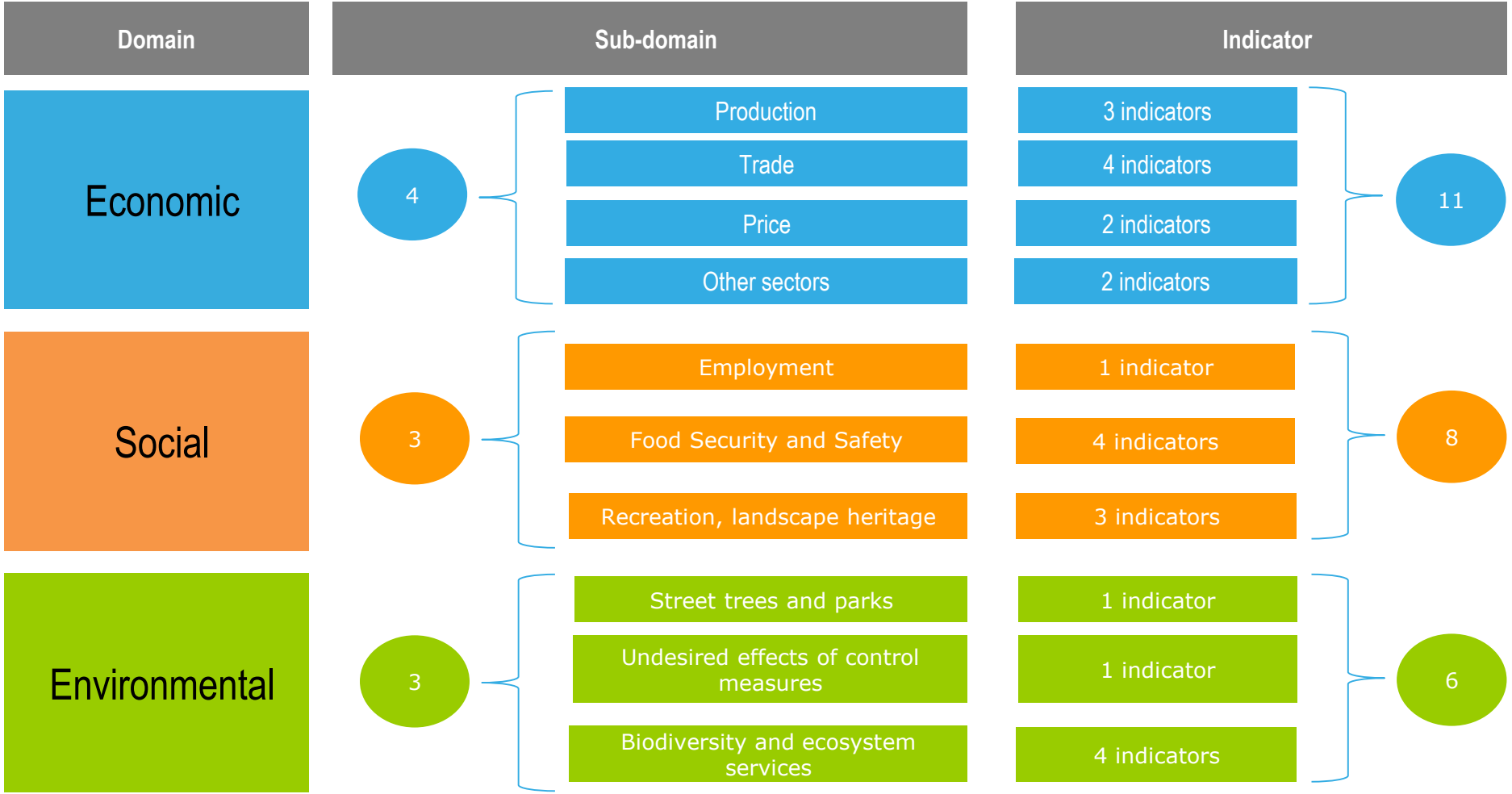
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Composite indicators including multiple criteria

The Impact Indicator for Priority Pests (I2P2)

Translating Regulation (EU) 2016/2031 into measurable indicators at EU level

Assumptions and principles for the analysis

Aggregating indicators into a composite index

Domain	Sub-domain		Indicator	
Economic	4	Production	3 indicators	11
		Trade	4 indicators	
		Price	2 indicators	
		Other sectors	2 indicators	
Social	3	Employment	1 indicator	8
		Food Security and Safety	4 indicators	
		Recreation, landscape heritage	3 indicators	
Environmental	3	Street trees and parks	1 indicator	6
		Undesired effects of control measures	1 indicator	
		Biodiversity and ecosystem services	4 indicators	

Domain	Sub-domain	Indicator	MAX	MIN
Economic impact	Production impacts	I.1 Maximum value of production losses (Mill €)	Agrilus	Tilletia
		I.2 Share of EU production affected (%)	Agrilus	Tilletia
		I.3 Difficulty of eradication (index)	Candidatus	Phyllosticta
	Trade impacts	I.4 Number of importing countries banning trade	Synchytrium	Agrilus
		I.5 Value of export losses (Mill €)	Tilletia	Agrilus
		I.6 Share of export losses over total production (%)	Tilletia	Agrilus
		I.7 Trade dispersion (index)	Synchytrium	Agrilus
	Price and market impacts	I.8 Change in domestic price (%)	Agrilus	Xanthomonas
		I.9 Change in domestic production over imports	Agrilus	Tilletia
	Impacts on other agents	I.10 Upstream effect (Mill €)	Agrilus	Tilletia
		I.11 Downstream effect (%)	Agrilus	Xanthomonas

Domain	Sub-domain	Indicator	MAX	MIN
Social impact	Impact on employment	I.12 Job losses (jobs/year)	Candidatus	Tilletia
	Impact on Food Security and Food safety	I.13 Share of caloric supply (%)	Tilletia	Agrilus
		I.14 Share of protein supply (%)	Tilletia	Agrilus
		I.15 Share of fat supply (%)	Tilletia	Agrilus
		I.16 Capacity to produce fungal toxins (yes-1/No-0)	All equal (no capacity)	
	Impact on recreation, landscape and cultural heritage	I.17 Share of holdings with other gainful activities (%)	Agrilus	Citrus pests
		I.18 Products covered by EU quality labels (nº labels)	Potato pests	Agrilus
		I.19 Presence of affected hosts on cultural heritage landmarks	Syncgytrium	Clavibacter

Domain	Sub-domain	Indicator	MAX	MIN
Environmental impact	Impact on street trees and parks	I.20 Use of hosts as street trees and in parks (index; MS data request)	Agrilus	All others
	Undesired impacts of control measures	I.21 Undesired effects of control measures (index; EFSA scale)	Candidatus	Tilletia, Agrilus, Synchytrium
	Impact biodiversity and ecosystem services	I.22 Soil erosion	Agrilus	Citrus pests
		I.23 Number of protected species and habitats related to hosts	Agrilus	Potato pests
		I.24 Share of Natura 2000 area and sites affected	Agrilus	All others
		I.25 Share under sustainable management practices	Agrilus	Potato pests

Processing the data: normalization and aggregation

| Normalization |

$$I_n = \frac{X - X_{min}}{X_{max} - X_{min}}$$

❑ Avoid impact of different measurement units

❑ Allow taking into consideration difference between hosts groups

Two alternatives for normalization:

A. Use global maximum and minimum values for all pests

B. Use maximum of pests affecting specific host (forest, perennial crops and annual crops)

⚠ Not applicable yet for forestry as only one pest

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Processing the data: normalization and aggregation

Normalization

$$I_n = \frac{X - X_{min}}{X_{max} - X_{min}}$$

❑ Avoid impact of different measurement units

❑ Allow taking into consideration difference between hosts groups

Aggregation

❑ Hierarchical weighting to avoid giving more importance to domain or sub-domains with more indicators

❑ Starting point equal weighting for individual indicators, sub-domains and domains

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Structure of I2P2

$$I2P2 = W_1\left(\sum w_{1j} \times X_{1j}\right)_{j=1,4} + W_2\left(\sum w_{2j} \times X_{2j}\right)_{j=1,3} + W_3\left(\sum w_{3j} \times X_{3j}\right)_{j=1,4}$$

W_1 — 1. Economic impact

w_{1j}	X_{1j}
$w_{1.1}$	1.1 Production impacts
$w_{1.2}$	1.2 Price and market Impacts
$w_{1.3}$	1.3 Trade impacts
$w_{1.4}$	1.4 Impacts in other agents

W_2 — 2. Social impact

w_{2j}	X_{2j}
$w_{2.1}$	2.1 Employment impact
$w_{2.2}$	2.2 Food security / food safety impacts
$w_{2.3}$	2.3 Recreation, landscape cultural heritage impacts

$$\sum_{i=1}^{i=3} W_i = 100 \qquad \sum_{j=1}^{j=n} W_{ij} = 100 \; \forall \, i[1,3]$$

W_3 — 3. Environmental impact

w_{3j}	X_{3j}
$w_{3.1}$	3.1 Impact on street trees
$w_{3.2}$	3.2 Impact on spread pests
$w_{3.3}$	3.3 Impacts control measures
$w_{3.4}$	3.4 Impacts biodiversity or ecosystem services

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Results for the 7 Pilot pests

We conduct the analysis under 2 alternative approaches:

❑ Common normalization for all pests

  ❑ *Only one pest gets value "1" and "0" for each indicator*

❑ Normalization by host type

  ❑ *Three pests (one per host group) gets value "1" and "0" for each indicator*

We present 2 rankings:

❑ Ranking all pests together (for both normalization options)

❑ Ranking pest per host group (for the second normalization option)

Preliminary results: domains

Domain	Economic		
Normalization approach	All together		
1	Agrilus		
2	Tilletia		
3	Candidatus		
4	Clavibacter		
5	Synchytrium		
6	Phyllosticta		
7	Xanthomonas		

RANK

# of indicators & # of sub-domains

4   11

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Preliminary results: domains

Domain	Economic		
Normalization approach	**All together**	**By host type**	
RANK 1	Agrilus	Clavibacter	Candidatus	Agrilus
2	Tilletia	Synchytrium	Phyllosticta	
3	Candidatus	Tilletia	Xanthomonas	
4	Clavibacter			
5	Synchytrium			
6	Phyllosticta			
7	Xanthomonas			
# of indicators & # of sub-domains			

4   11
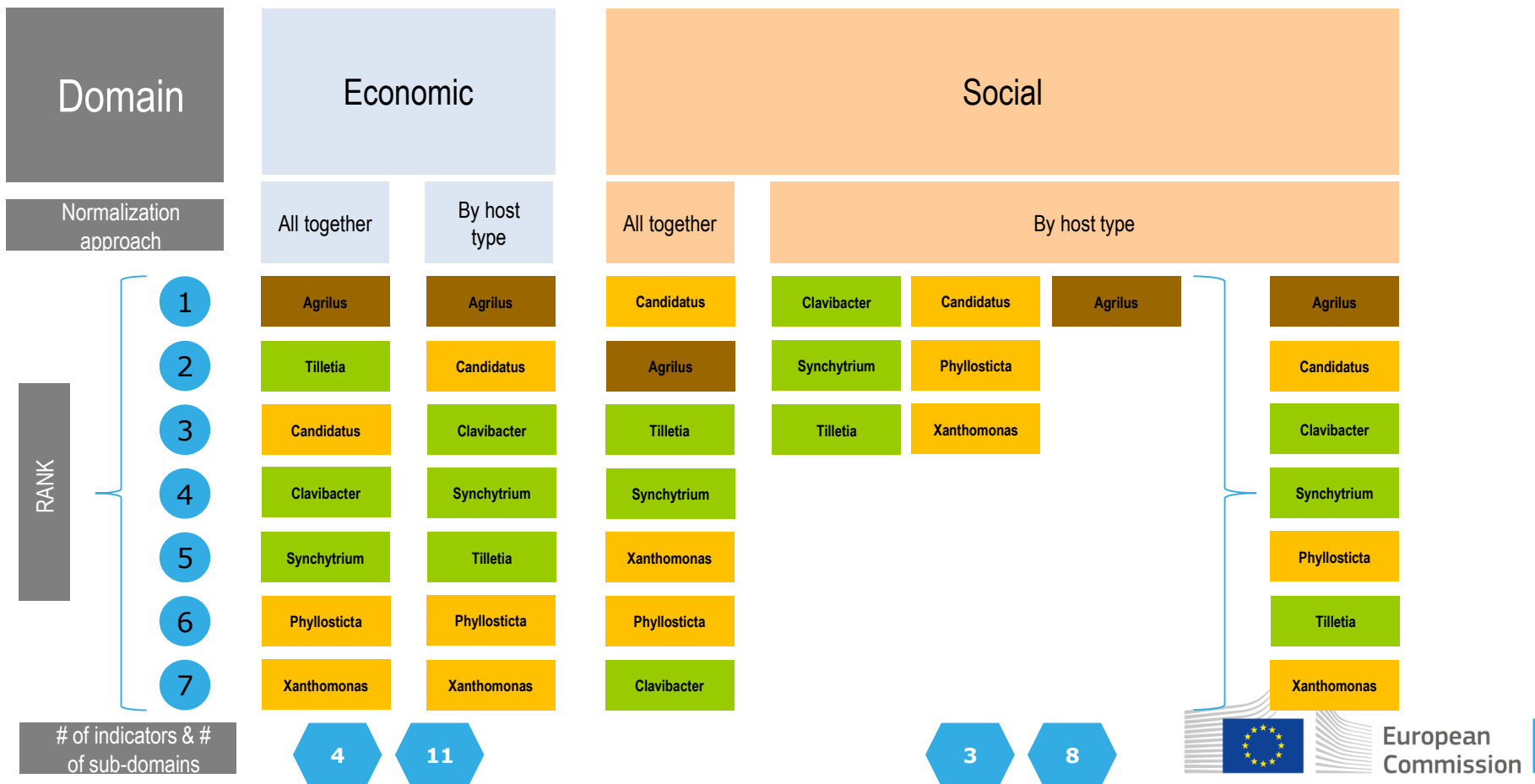
Preliminary results: domains

Preliminary results: domains
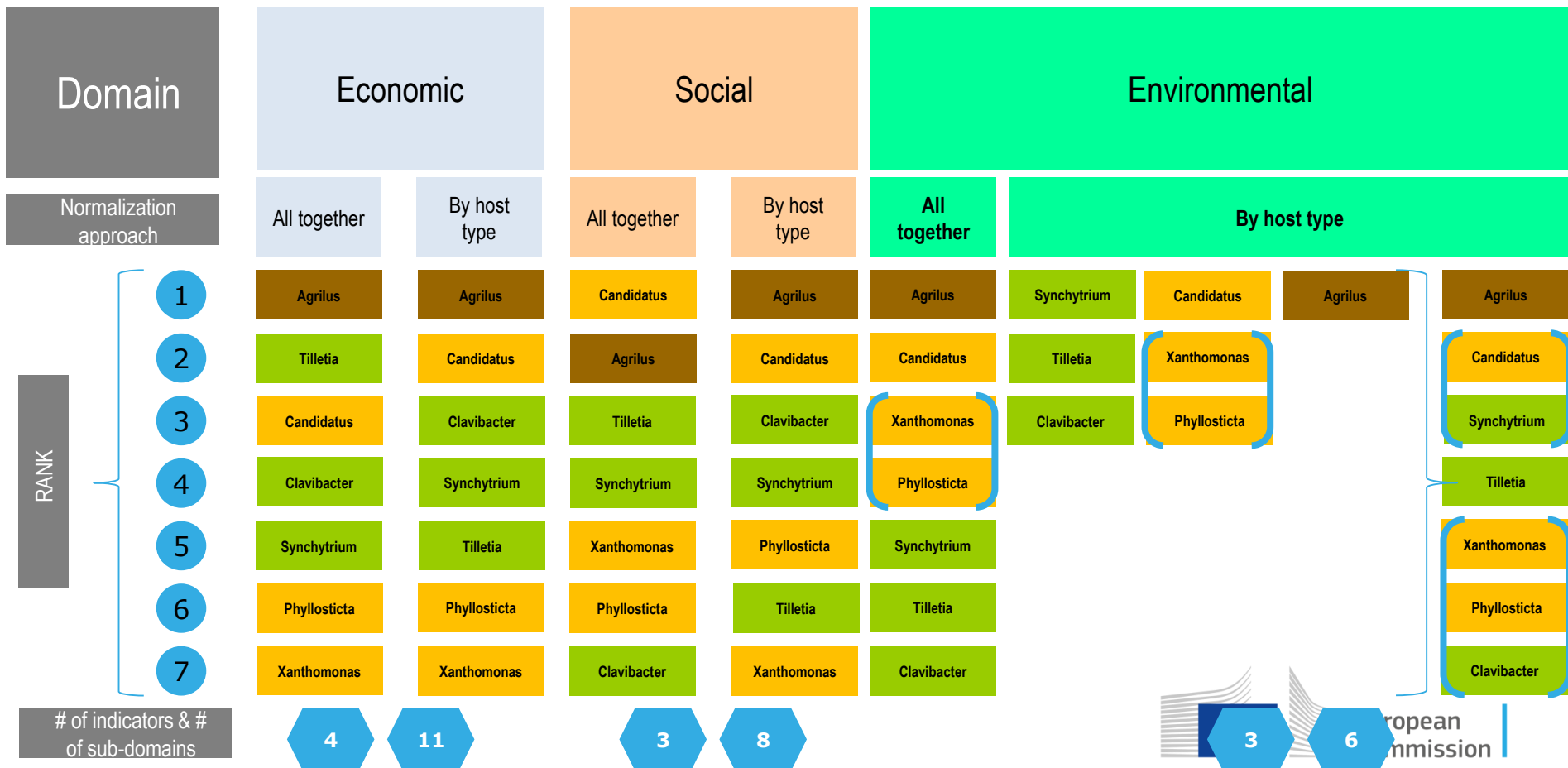
Domain	Economic		Social				
Normalization approach	All together	By host type	All together	By host type			
1	Agrilus	Agrilus	Candidatus	Clavibacter	Candidatus	Agrilus	Agrilus
2	Tilletia	Candidatus	Agrilus	Synchytrium	Phyllosticta		Candidatus
3	Candidatus	Clavibacter	Tilletia	Tilletia	Xanthomonas		Clavibacter
4	Clavibacter	Synchytrium	Synchytrium				Synchytrium
5	Synchytrium	Tilletia	Xanthomonas				Phyllosticta
6	Phyllosticta	Phyllosticta	Phyllosticta				Tilletia
7	Xanthomonas	Xanthomonas	Clavibacter				Xanthomonas
# of indicators & # of sub-domains	4	11		3	8		

RANK

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Preliminary results: domains

Domain	Economic		Social		Environmental				
Normalization approach	All together	By host type	All together	By host type	**All together**	**By host type**			
1	Agrilus	Agrilus	Candidatus	Agrilus	Agrilus	Synchytrium	Candidatus	Agrilus	Agrilus
2	Tilletia	Candidatus	Agrilus	Candidatus	Candidatus	Tilletia	Xanthomonas		Candidatus
3	Candidatus	Clavibacter	Tilletia	Clavibacter	Xanthomonas	Clavibacter	Phyllosticta		Synchytrium
4	Clavibacter	Synchytrium	Synchytrium	Synchytrium	Phyllosticta				Tilletia
5	Synchytrium	Tilletia	Xanthomonas	Phyllosticta	Synchytrium				Xanthomonas
6	Phyllosticta	Phyllosticta	Phyllosticta	Tilletia	Tilletia				Phyllosticta
7	Xanthomonas	Xanthomonas	Clavibacter	Xanthomonas	Clavibacter				Clavibacter
# of indicators & # of sub-domains	4	11	3	8				3	6

RANK

Preliminary results: I2P2

Preliminary results: I2P2 – what to prioritize?

Assuming we want 3 priority pests

I2P2

Normalization approach	All together	By host type
1	Agrilus	Agrilus
2	Candidatus	Candidatus
3	Tilletia	Clavibacter
4	Synchytrium	Synchytrium
5	Xanthomonas	Tilletia
6	Phyllosticta	Phyllosticta
7	Clavibacter	Xanthomonas

RANK

Option A1: common normalization and all pests considered together: *Agrilus, Candidatus and Tilletia*

Option A2: common normalization and 1st pest per host type: *Agrilus, Candidatus and Tilletia*

Option B: normalization per host type and all pests considered together: *Agrilus, Candidatus and Clavibacter*

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Pending tasks

- Extend the analysis to all 28 pests

- Validate the I2P2 (correlation matrix) and discard redundant indicators

- Uncertainty analysis for ranking using 25% and 75% cut off points from EFSA provided uncertainty distributions

- Choose approach to select priority pests

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Thanks for your attention

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Preliminary results: economic subdomains

Preliminary results: economic subdomains

Preliminary results: economic subdomains

Sub-domain	Production impacts		Trade impacts		Price and Markets impacts	
Normalization approach	All together	By host type	All together	By host type	All together	By host type
1	Agrilus	Agrilus	Tilletia	Agrilus	Candidatus	Agrilus
2	Candidatus	Candidatus	Synchytrium	Phyllosticta	Tilletia	Candidatus
3	Tilletia	Clavibacter	Clavibacter	Candidatus	Agrilus	Tilletia
4	Xanthomonas	Tilletia	Phyllosticta	Tilletia	Phyllosticta	Clavibacter
5	Phyllosticta	Synchytrium	Candidatus	Clavibacter	Clavibacter	Phyllosticta
6	Clavibacter	Xanthomonas	Xanthomonas	Synchytrium	Synchytrium	Synchytrium
7	Synchytrium	Phyllosticta	Agrilus	Xanthomonas	Xanthomonas	Xanthomonas

RANK

| # of indicators | 3 | 4 | 2 |

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Preliminary results: economic subdomains

Sub-domain	Production impacts		Trade impacts		Price and Markets impacts		Impacts on other agents	
Normalization approach	All together	By host type	All together	By host type	All together	By host type	All together	By host type
1	Agrilus	Agrilus	Tilletia	Agrilus	Candidatus	Agrilus	Agrilus	Agrilus
2	Candidatus	Candidatus	Synchytrium	Phyllosticta	Tilletia	Candidatus	Clavibacter	Clavibacter
3	Tilletia	Clavibacter	Clavibacter	Candidatus	Agrilus	Tilletia	Synchytrium	Synchytrium
4	Xanthomonas	Tilletia	Phyllosticta	Tilletia	Phyllosticta	Clavibacter	Tilletia	Candidatus
5	Phyllosticta	Synchytrium	Candidatus	Clavibacter	Clavibacter	Phyllosticta	Candidatus	Xanthomonas
6	Clavibacter	Xanthomonas	Xanthomonas	Synchytrium	Synchytrium	Synchytrium	Xanthomonas	Phyllosticta
7	Synchytrium	Phyllosticta	Agrilus	Xanthomonas	Xanthomonas	Xanthomonas	Phyllosticta	Tilletia
# of indicators	3		4		2		2	

Preliminary results: social subdomains

Preliminary results: social subdomains

Preliminary results: social subdomains

Preliminary results: environmental subdomains

Preliminary results: environmental subdomains

Preliminary results: environmental subdomains