SNIS Conference 2018
23 November 2018, Parterre Rialto Basel, Switzerland

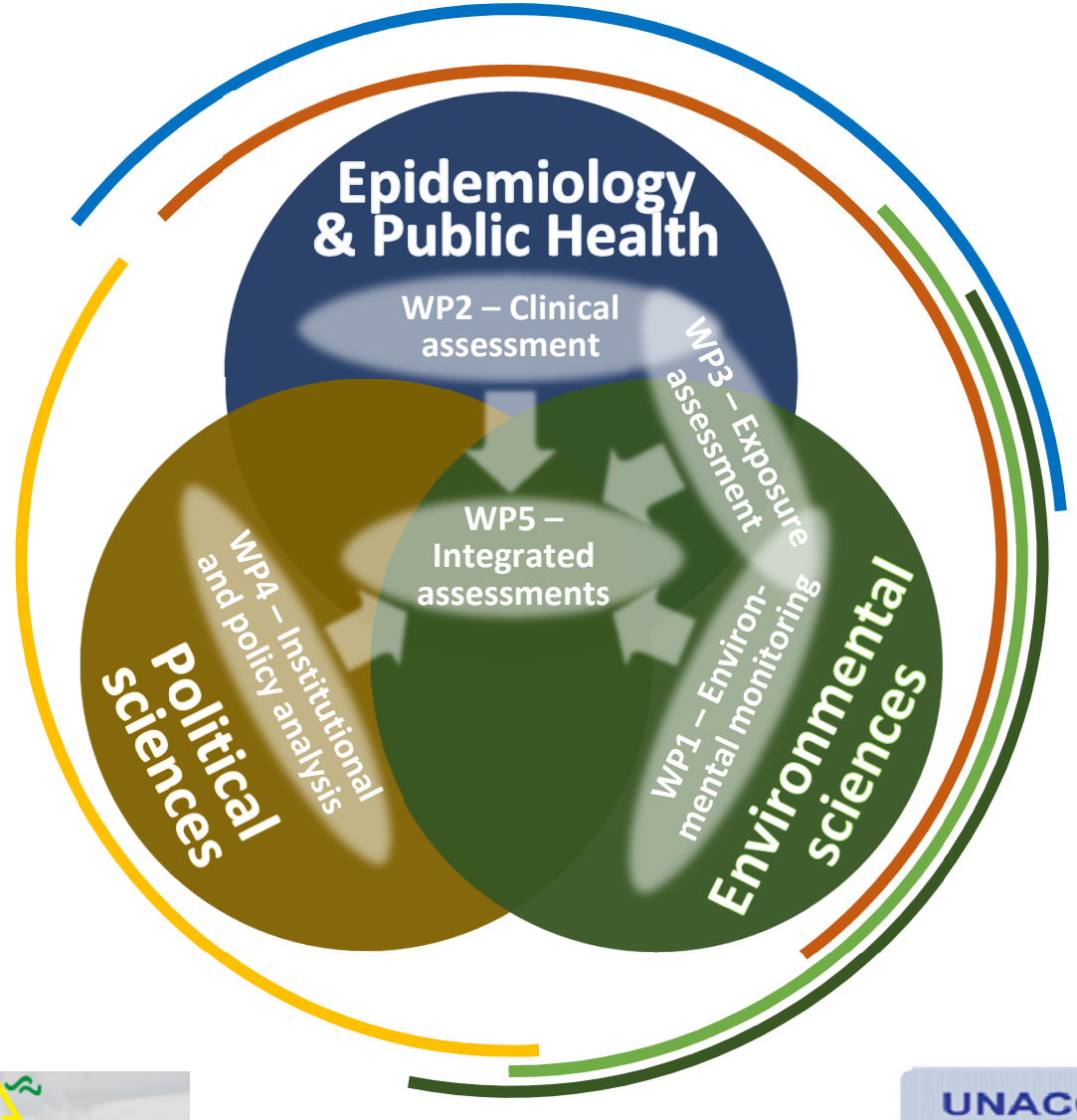
The PESTROP Project in the Context of the SDGs

Mirko Winkler, Philipp Staudacher, Samuel Fuhrimann, Frederik Weiss, Jonathan Lilje, Ruth Wiedemann, Damien Marti & Bernhard Fuhrer


PESTROP
Pesticide use in tropical settings

What are the interrelations between institutional determinants of pesticide use and associated human and environmental health effects?

Research approach and project consortium



Legend:

Swiss institutions

- **Swiss Tropical and Public Health Institute**
- **Swiss Federal Institute of Aquatic Science and Technology**
- **University of Bern**

International project partners

- **Universidad Nacional, Costa Rica**
- **Makerere University, Uganda**

Coopebrisas R.L. gente ayudando a la gente

CENTRO DE PRODUCCIÓN ORGÁNICA E INVERNADEROS

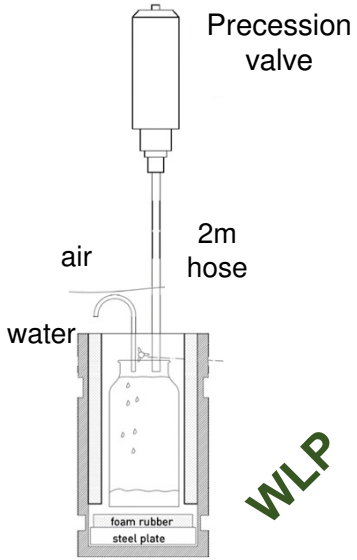
UNACOH "Health for All & By All"

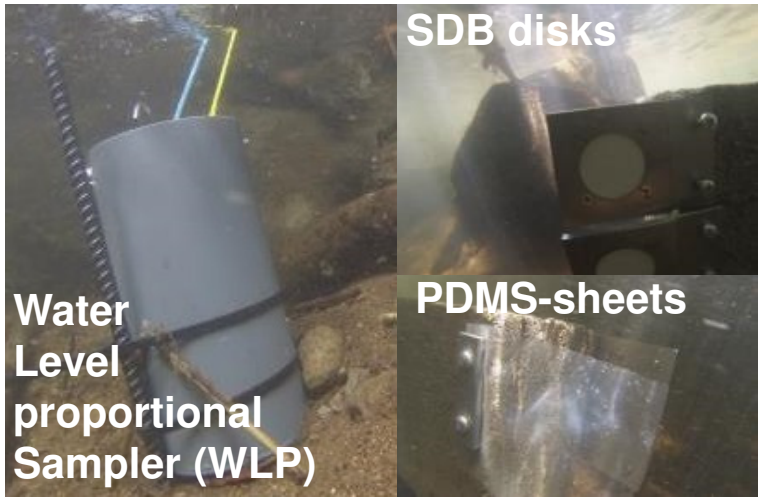
Uganda National Association of Community and Occupational Health

WP1 – Environmental monitoring

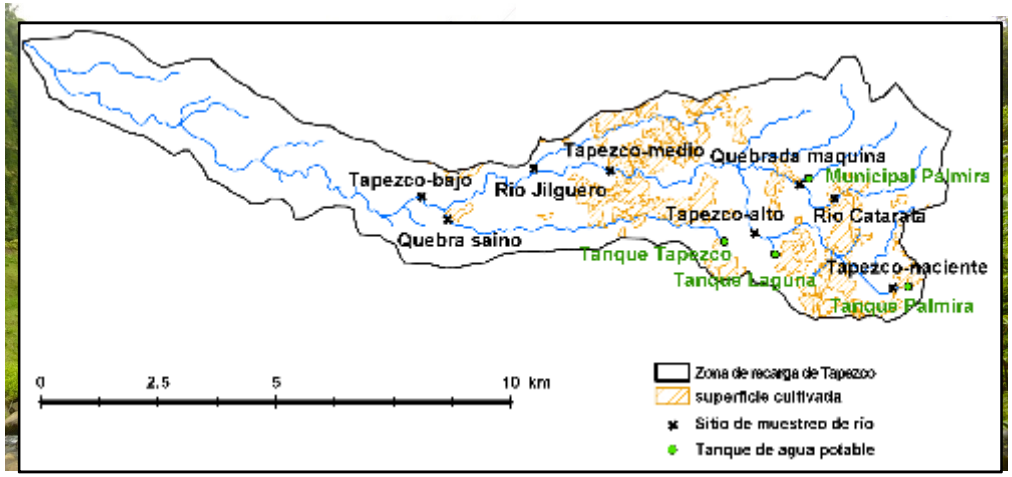
Water Monitoring in two tropical horticultural areas

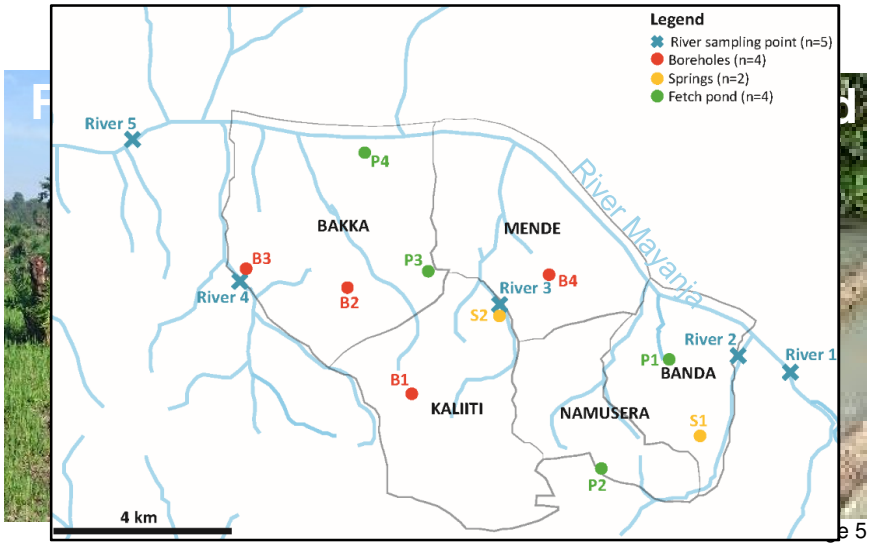
Sampling devices





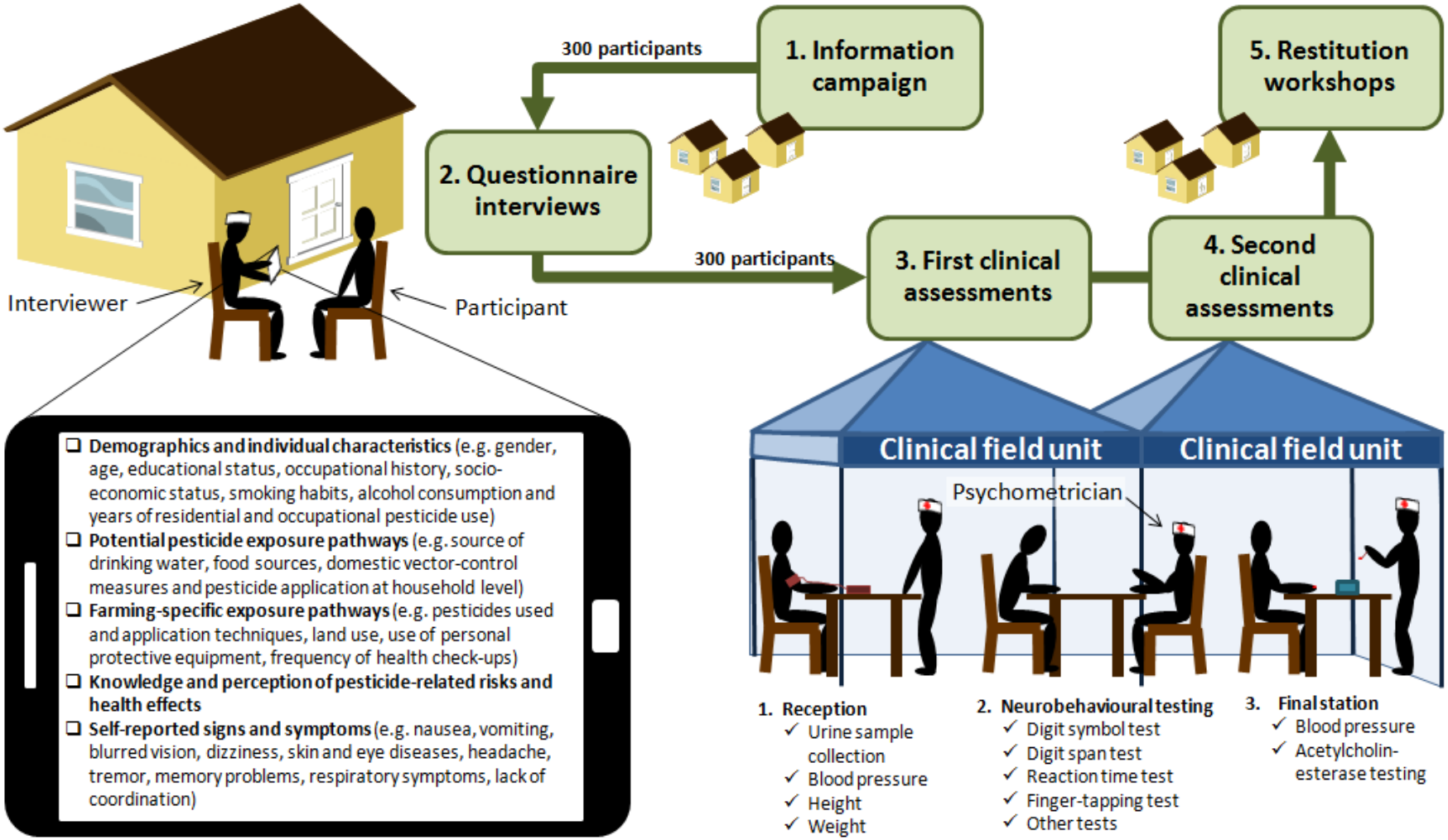
Catchments





WP2&3 – Cross-sectional epidemiological survey

Sample size: 150 agricultural workers from conventional farms and 150 agricultural workers from organic farms



Behavioural assessment (Psychology)

- **46 qualitative, ethnographic interviews**
- **309 structured, quantitative interviews**

Understanding PPE use & safe container disposal using the

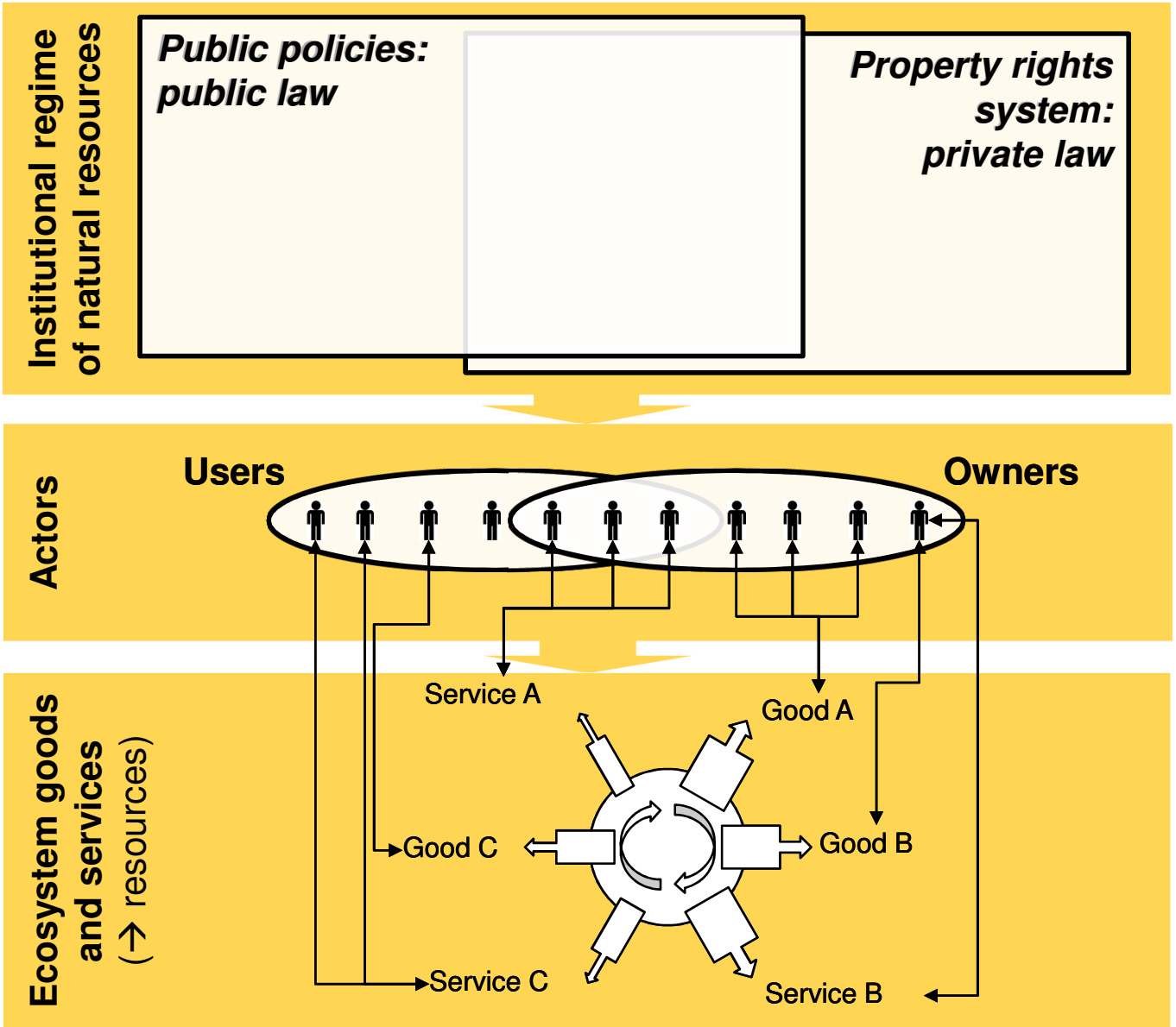
- Risk
- Attitudes
- Norms
- Abilities
- Self-regulation

Model for systematic behavior change in developing contexts (Mosler, 2012)

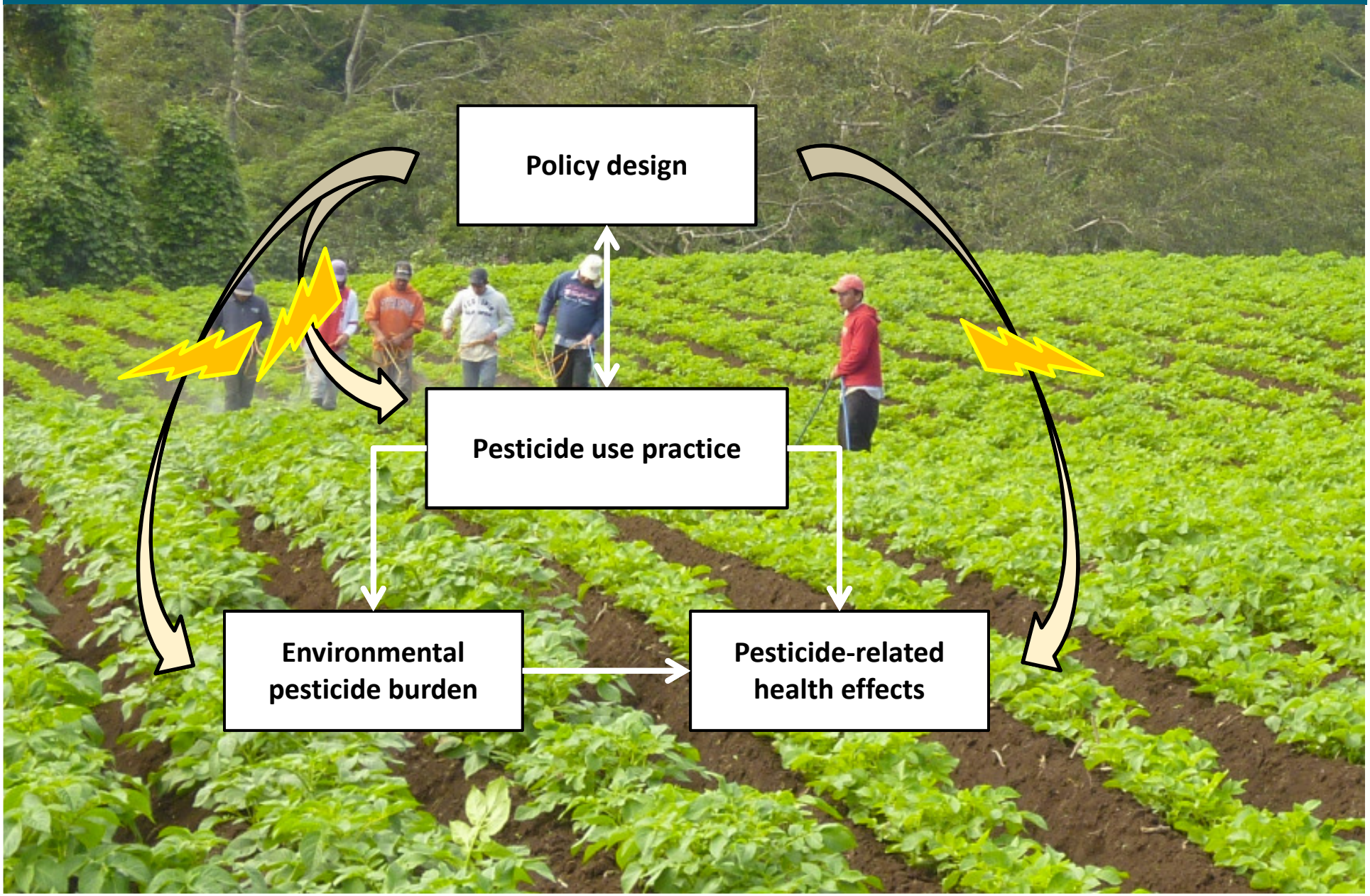
Multiple regression models reveal relevant psycho-social factors

WP4 – Institutional and policy analysis

Institutional resource regime
(Gerber et al., 2009)



WP5 – Integrated assessment



International project team

Senior project advisor and much more
Prof. Rik Eggen

Local project coordinator Costa Rica
Prof. Ana María Mora

Local project coordinator Uganda
Prof. Charles Niwagaba

Co-coordinator
Dr. Christian Stamm

Field work manager
Dr. Samuel Fuhrimann

Institutional assessment
Ruth Wiedemann

Behavioural assessment Uganda
Dr. Jonathan Lilje

Project leader beharioural assessment
Prof. Jennifer Inauen

Environmental monitoring Costa Rica
Frederik Weiss

Co-coordinator
Prof. Karin Ingold

Biostatistician
Dr. Andrea Farnhma

Environmental monitoring Uganda
Christelle Oltramare

Integrated assessments and much more
Philipp Staudacher

Coordinator
Dr. Mirko Winkler

Local project teams and study settings

Catchment of the Tapezco River drains

Local project teams and study settings

Wakiso district

SNIS 2018 documentary

swiss network for international studies

Pesticides and health – a story from Uganda

What are general characteristics of the small-scale farmers in Wakiso District?

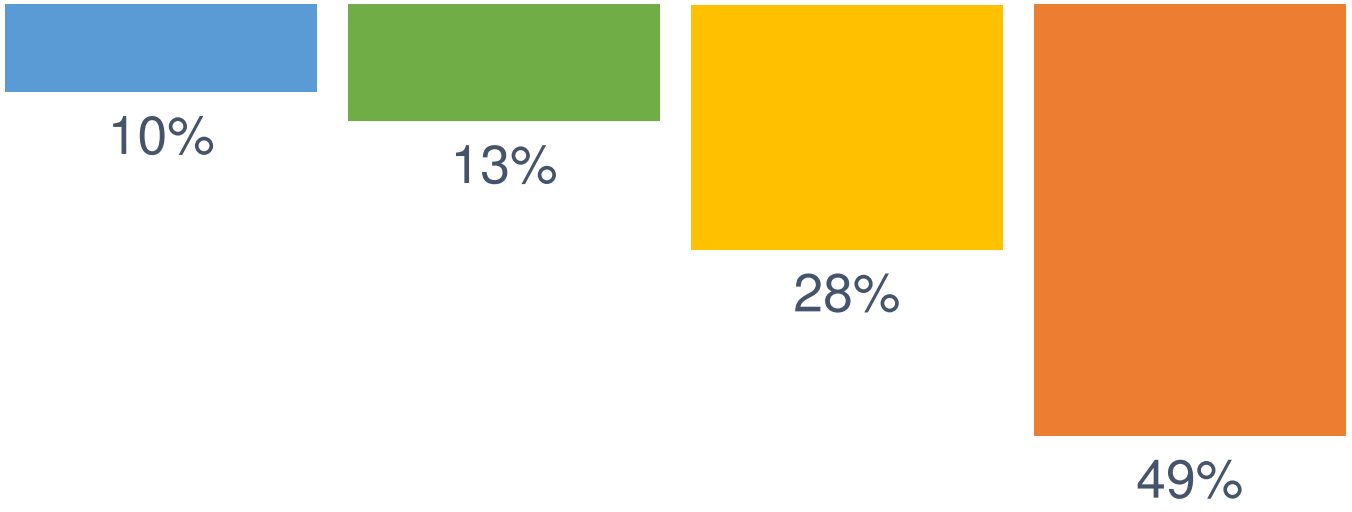

302 structured questionnaires
• Demographics
• Pesticide use
• Knowledge, Attitude and Practices

Socio-demographic characterisation

Farmer Classification and Sociodemographics

Pesticides used (n=302):

	Non-Applicator	Organic	Mixed	Conventional
Synthetic	NO	NO	YES	YES
Organic	NO	YES	YES	NO



2.3 (…) double the agricultural **productivity** and **incomes of small-scale** food producers, in particular women (…).
2.4 (…) ensure **sustainable food production systems** and implement resilient agricultural practices (…).

Socio-demographic characterisation

Farmer Classification and Sociodemographics

Pesticides used (n=302):

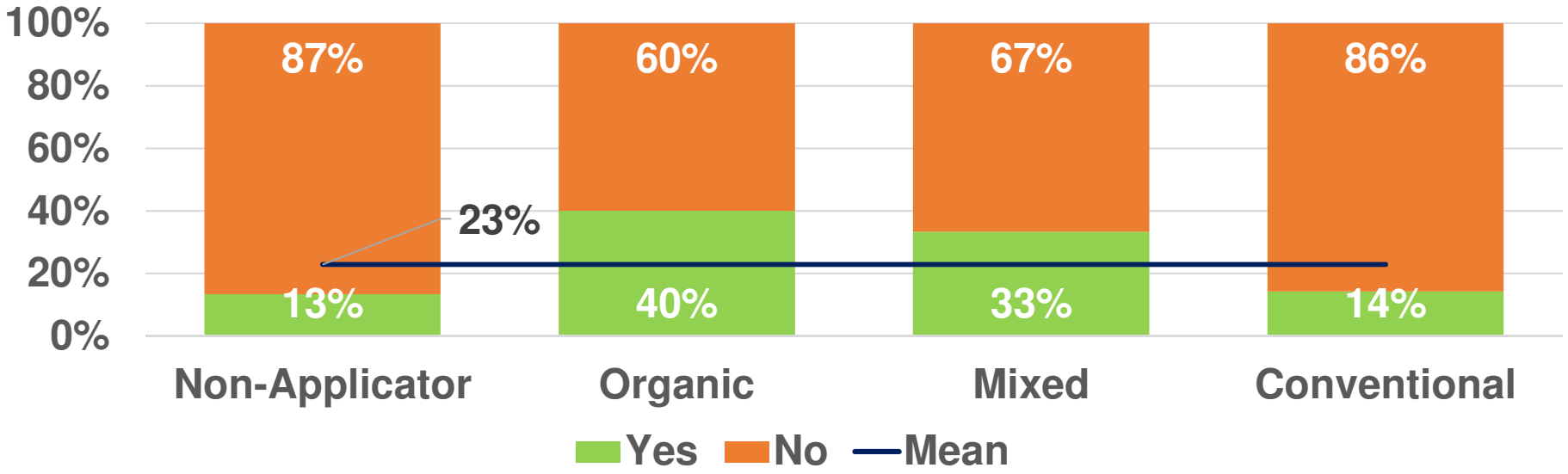
	Non-Applicator	Organic	Mixed	Conventional
Synthetic	**NO**	**NO**	**YES**	**YES**
Organic	**NO**	**YES**	**YES**	**NO**

Age (mean)	**57.1**	49.6	49.7	**44.7**
Women	**76.7%**	**77.5%**	40.5%	**25%**
Education (years)	7.3	**8.9**	**9.3**	7.2

2.3 (…) double the agricultural **productivity** and **incomes of small-scale** food producers, in particular women (…).
2.4 (…) ensure **sustainable food production systems** and implement resilient agricultural practices (…).

Socio-demographic characterisation

Are Farmers Trained in Pesticide Use?



Training provided by:

NGOs (64%)

Government (11%)

Friends and Family (7%)

Schools and University (6%)

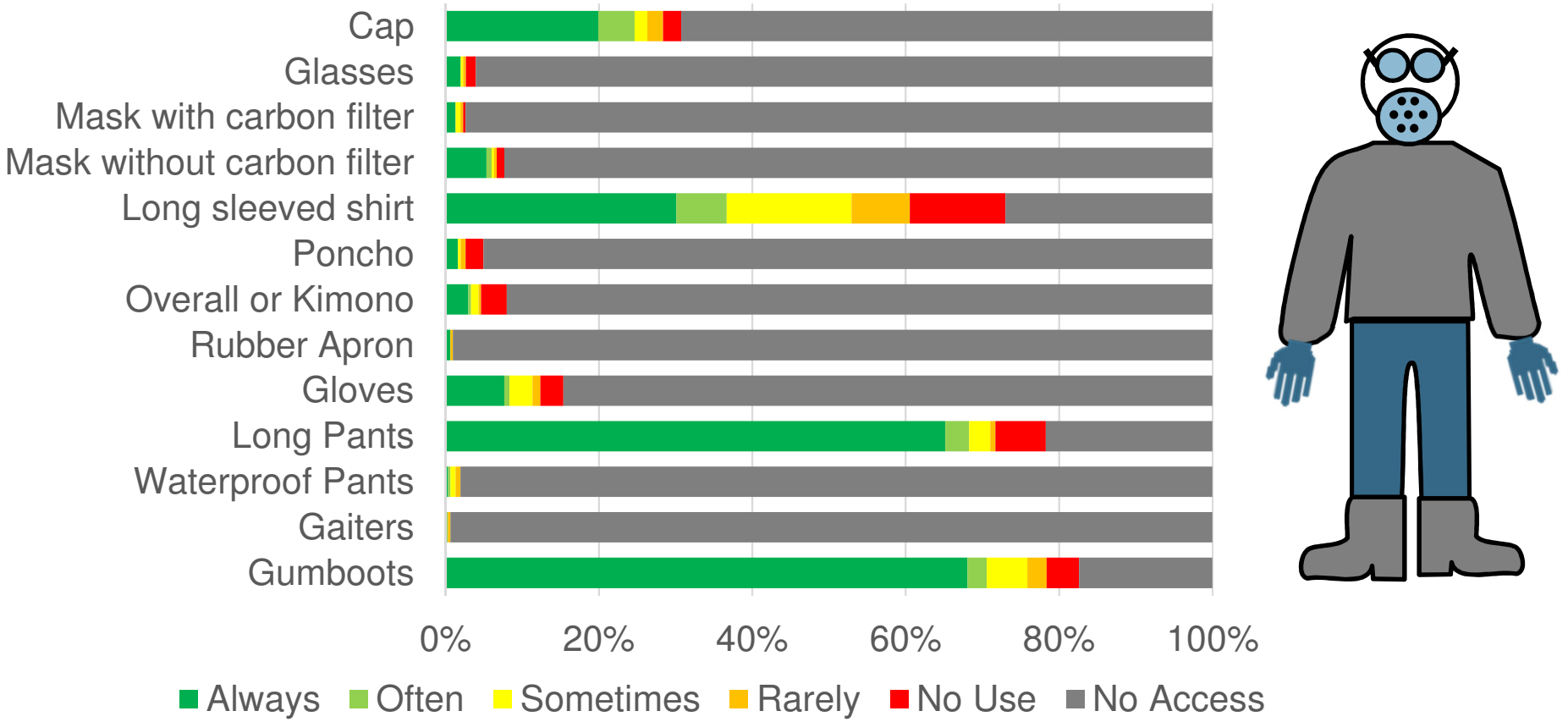
Other (Agrobusiness, Media, etc.) (14%)

4.7 (…) all learners acquire the **knowledge and skills** needed to promote **sustainable development** (…)

4 QUALITY EDUCATION

Socio-demographic characterisation

Personal Protective Equipment Access and Use



3.9 (…) reduce the **number of deaths and illnesses from hazardous chemicals** and air, water and soil pollution and contamination

How does the observed practice impact on the health of farmers?

Clinical assessment

- Acetylcholine esterase level
- Blood pressure
- Neurobehavioral assessments

Exposure assessment

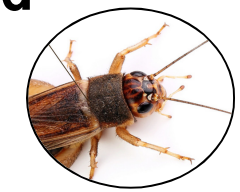
- Urine samples
- Hair and toenail sample
- Exposure scores

Exposure assessment

Pesticide biomarkers in farmer's urine

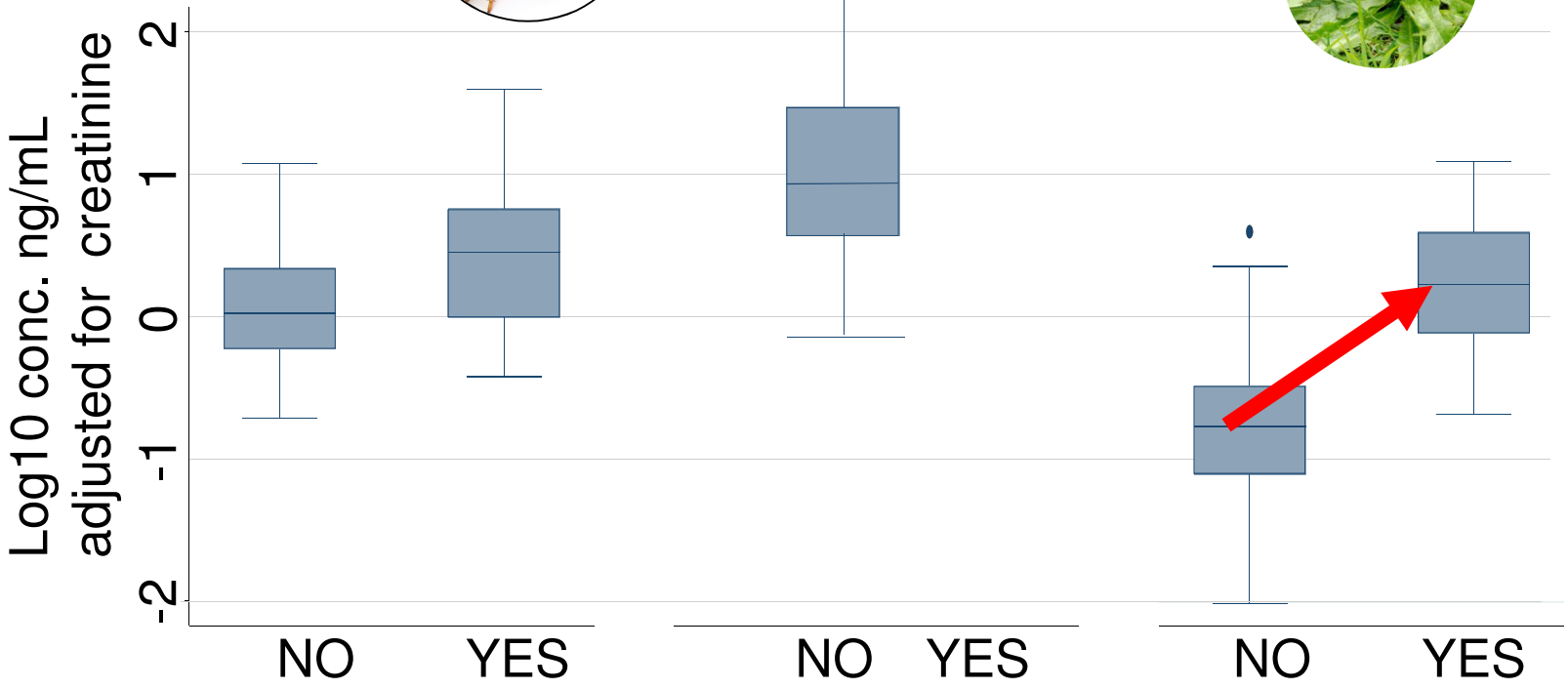
100 urine samples

Pyrethroid



Chlorpyriphos (Organophosphate)

Glyphosate



3.9 (…) reduce the **number of deaths and illnesses from hazardous chemicals** and air, water and soil pollution and contamination

3 GOOD HEALTH AND WELL-BEING

Clinical assessment

Neurobehavioural tests

3.9 (…) reduce the **number of deaths and illnesses from hazardous chemicals** and air, water and soil pollution and contamination

Clinical assessment

Neurobehavioural tests

Test	PESTROP Mean (SD)		Other studies Mean (SD)	Reference
Benton Visual Retention Test	5.82 (2.17)	<	6.98 (1.87)	Zhang et al. (2016)
		<	6.0 (2.10)	Holtman (2013)
		<	6.87 (2.02)	London et al. (1997)
Digit Span Forward	4.16 (1.60)	<	10.73 (2.84)	Zhang et al. (2016)
		<	6.1 (2.2)	Holtman (2013)
Digit Span Backward	3.92 (1.76)	<	6.35 (2.45)	Zhang et al. (2016)
		<	4.92 (1.14)	Stephens et al. (2004)
		<	4.87 (1.22)	Mackenzie et al. (2011)
Finger Tapping Test				
Dominant	46.78 (8.64)		53.6 (9.6)	Starks et al. (2011)
Non-dominant	43.77 (8.34)	<	91.67 (2.82)	Rothlein et al. (2006)
Perdue Pegboard Test				
Dominant	11.42 (2.05)		14.9 (1.7)	Butler-Dawson (2015)
Non-dominant	10.64 (1.99)	<	14.3 (1.6)	Butler-Dawson (2015)

Why!?

Neurobehavioral test scores of the Ugandan farmers are consistently lower compared to farmers in Costa Rica or other studies

3.9 (…) reduce the **number of deaths and illnesses from hazardous chemicals** and air, water and soil pollution and contamination

Clinical assessment

Neurobehavioural tests

Test	PESTROP	Other studies	Reference
Non-dominant	10.04 (1.99)	14.5 (1.6)	Butler-Dawson (2015)

Neurobehavioral test scores of the Ugandan farmers are consistently lower compared to farmers in Costa Rica or other studies

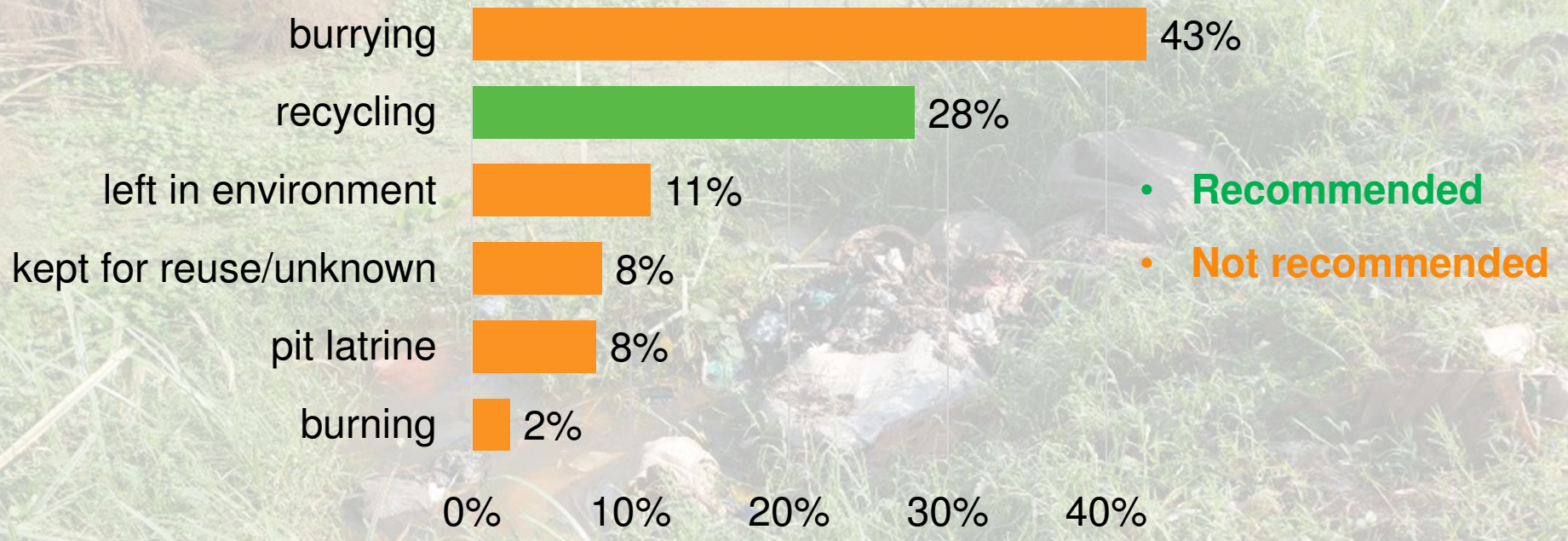
3.9 (…) reduce the **number of deaths and illnesses from hazardous chemicals** and air, water and soil pollution and contamination

3 GOOD HEALTH AND WELL-BEING

How is environmental health affected by the observed practice?

The way how pesticides applied and empty containers are discarded can lead to adverse effects on the environmental health

Fate of empty pesticide containers

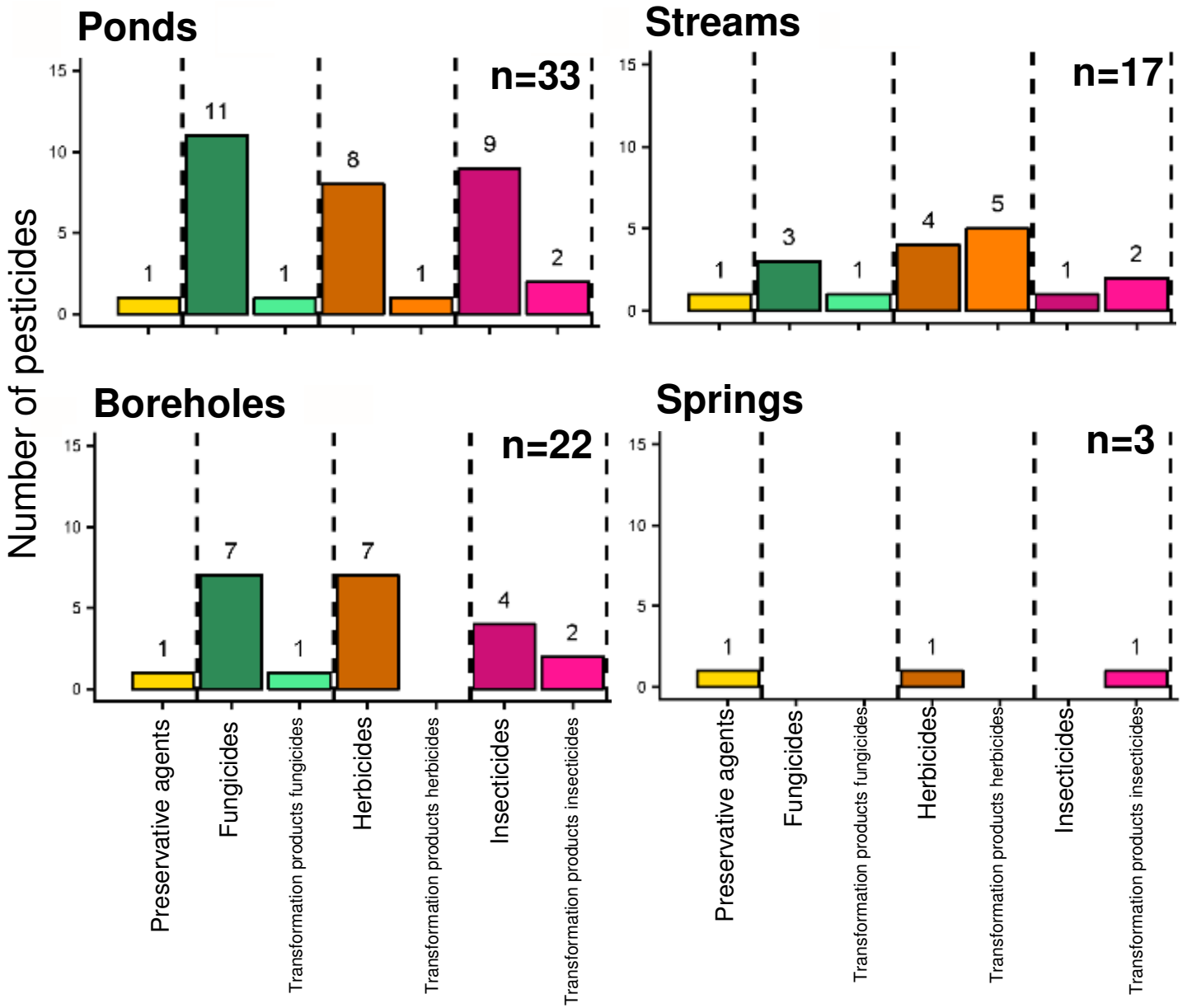


12.2	(…) achieve the **sustainable management** and **efficient use** of **natural resources.**
12.4	(…) achieve the **environmentally sound management of chemicals** (…)
12.5	(…) **reduce waste generation** through prevention, reduction, recycling (…)

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Environmental monitoring

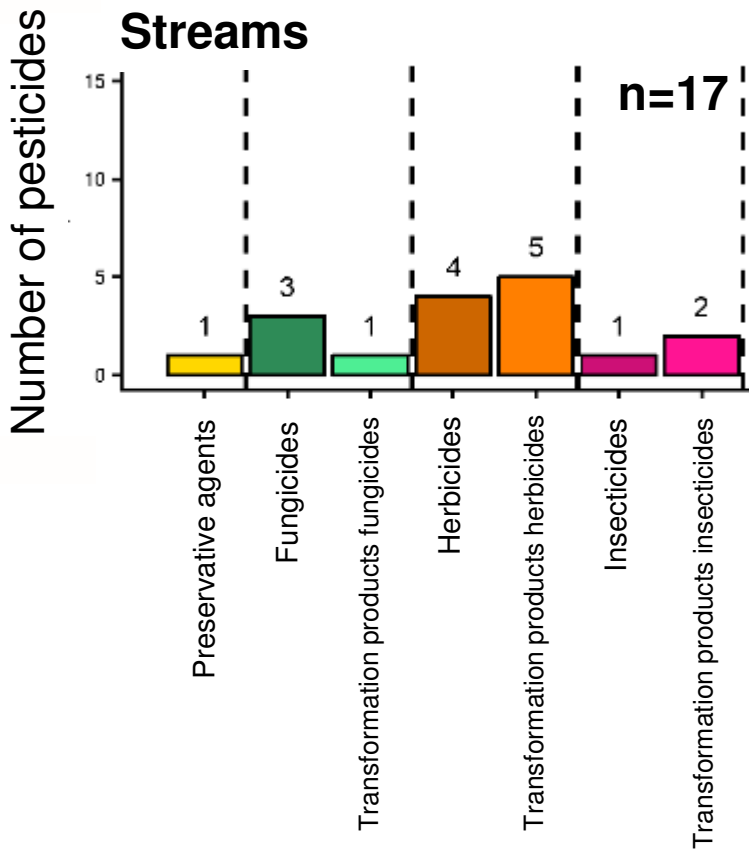
Amount of detected pesticides detected



- **45 compounds** were detected in total
- **Ponds:** most of the compounds were detected here
- **Springs:** Only 3 compounds were found
- **Pesticide concentrations:**

Ponds
Rivers
Boreholes
Springs

Environmental monitoring
Pesticides in streams

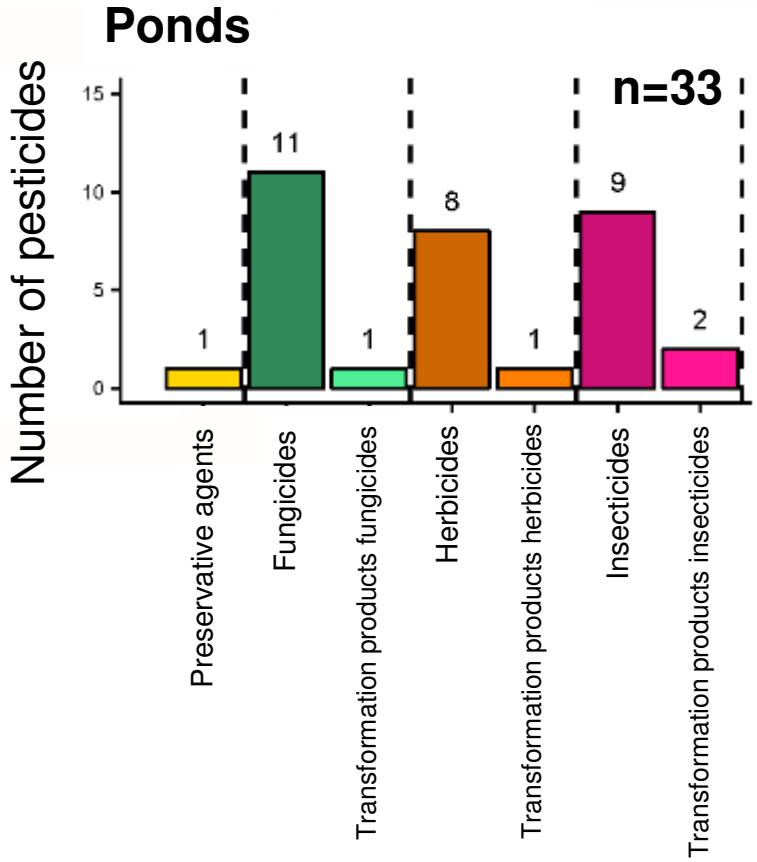


- **17** detected **pesticides**
- **Chronic Environmental Quality Standard (EQS) of 2,4-D exceeded**
- At **river sampling site 4 – highest environmental concentrations** and **risks** especially for plants and algae
- Obsolete pesticides could not be analysed

15.1	(…) ensure the **conservation** (…) and **sustainable use** of **terrestrial** and **inland freshwater ecosystems** (…)
15.5	(…) take action **to reduce the degradation of natural habitats, halt the loss of biodiversity** (…)

15 LIFE ON LAND

Environmental monitoring
Pesticides in ponds



- Pond water is used for domestic purposes (**drinking water, cleaning, preparing food**)
- **Recommendation:** pond water should not be used for domestic purposes
- High concentrations of **2,4-D (3 µg/L)** and **Carbendazim (1.7 µg/L)**
- Swiss critical value of pesticides in drinking water **0.1 µg/L**

6.1	(…) achieve **access to safe and affordable drinking water** for all.
6.3	(…) **improve water quality by reducing pollution** (…)
6.6	(…) **protect** and restore **water related ecosystems** (…)

6 CLEAN WATER AND SANITATION

Why are farmers behaving the way they do and what can be done about it?


46 in-depth, qualitative interviews
309 structured, quantitative interviews

Behavioural assessment
Qualitative findings

“Yes those pesticides are poisonous, they….because already by the time they can kill the pest then how about myself, they will also affect me. “

“No. Other than wearing gumboots, I do not have a mask….. I do not have anything else.”

“When I am spraying, I have to make sure I am all covered very well right from the head, the nose everywhere such that I cannot get any contact with the pesticide.”

Behavioural assessment

Quantitative findings

Factor	Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	-.215	.573		-.376	.708
Perceived vulnerability	.211	.103	.115	2.044	.042
Pride using PPE	-.003	.082	-.002	-.032	.974
Personal importance	.367	.113	.205	3.245	.001
Exposure paths known	.009	.029	.017	.317	.751
PPE knowledge	.911	.325	.153	2.805	.005
Label knowledge	.003	.022	.007	.123	.902
Self-efficacy	.059	.115	.033	.515	.607
Gender	.520	.136	.196	3.816	.000
Education	.007	.004	.094	1.806	.072
Household wealth	.046	.025	.096	1.821	.070
Training received	.346	.141	.135	2.459	.015
Association member	-.175	.127	-.076	-1.382	.168

5.a (…) give **women equal rights to economic resources**, as well as **access to ownership** and control over land and other forms of property,(…)

Behavioural assessment
Creating interventions…

→ **Targeting identified psycho-social factors using specific Behavior Change Techniques**

→ **i.e. Informing about personal risk using demonstration techniques**

4.4 (…) substantially increase the number of youth and adults who have **relevant skills, including technical and vocational skills** (…)

4 QUALITY EDUCATION

What policy changes are needed to reduce human and environmental exposure to pesticides?

In-depth **document analysis** of official documents

Interviews with key stakeholders of public agencies, industry and non-governmental organizations

Policy analysis

Key findings in the context of the SDGs

Pesticide use as a **challenge** for drinking water protection

Most policies address **quantity of drinking water rather than its quality**

Mostly **strict and mandatory requirements** from the state towards polluters

- *Lack of **drinking water standards***
- *Farmers not directly addressed as **target group** to be affecting drinking water quality through pesticide use*

6.1 (…) universal and equitable **access to safe** and affordable **drinking water**
6.b. (…) support and strengthen the **participation of local communities** (…)

6 CLEAN WATER AND SANITATION

Policy analysis
Key findings in the context of the SDGs

No specific regulator present

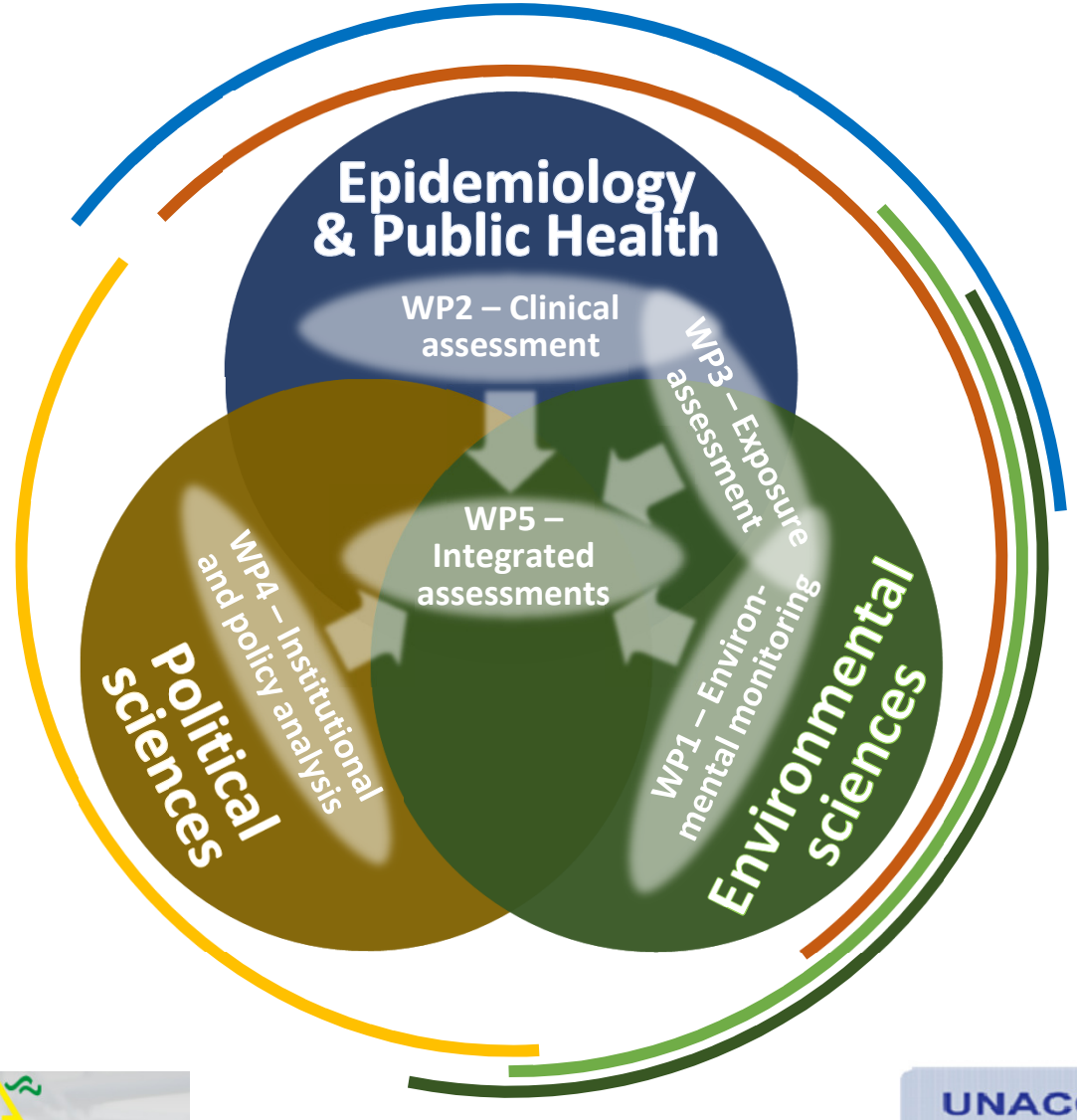
Weak monitoring of drinking water quality

- ***Decentralization of decision making*** *(local ordinances) is needed to directly address pesticide contamination*
- ***Persuasive instruments*** *to tapp into the conscience of the consumers*

16.6 Develop **effective, accountable and transparent institutions** (…)
16.7 (…) ensure responsive, **participatory** and **representative decision making**

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

Research approach and project consortium



Legend:

Swiss institutions

- **Swiss Tropical and Public Health Institute**
- **Swiss Federal Institute of Aquatic Science and Technology**
- **University of Bern**

International project partners

- **Universidad Nacional, Costa Rica**
- **Makerere University, Uganda**

Coopebrisas R.L. gente ayudando a la gente

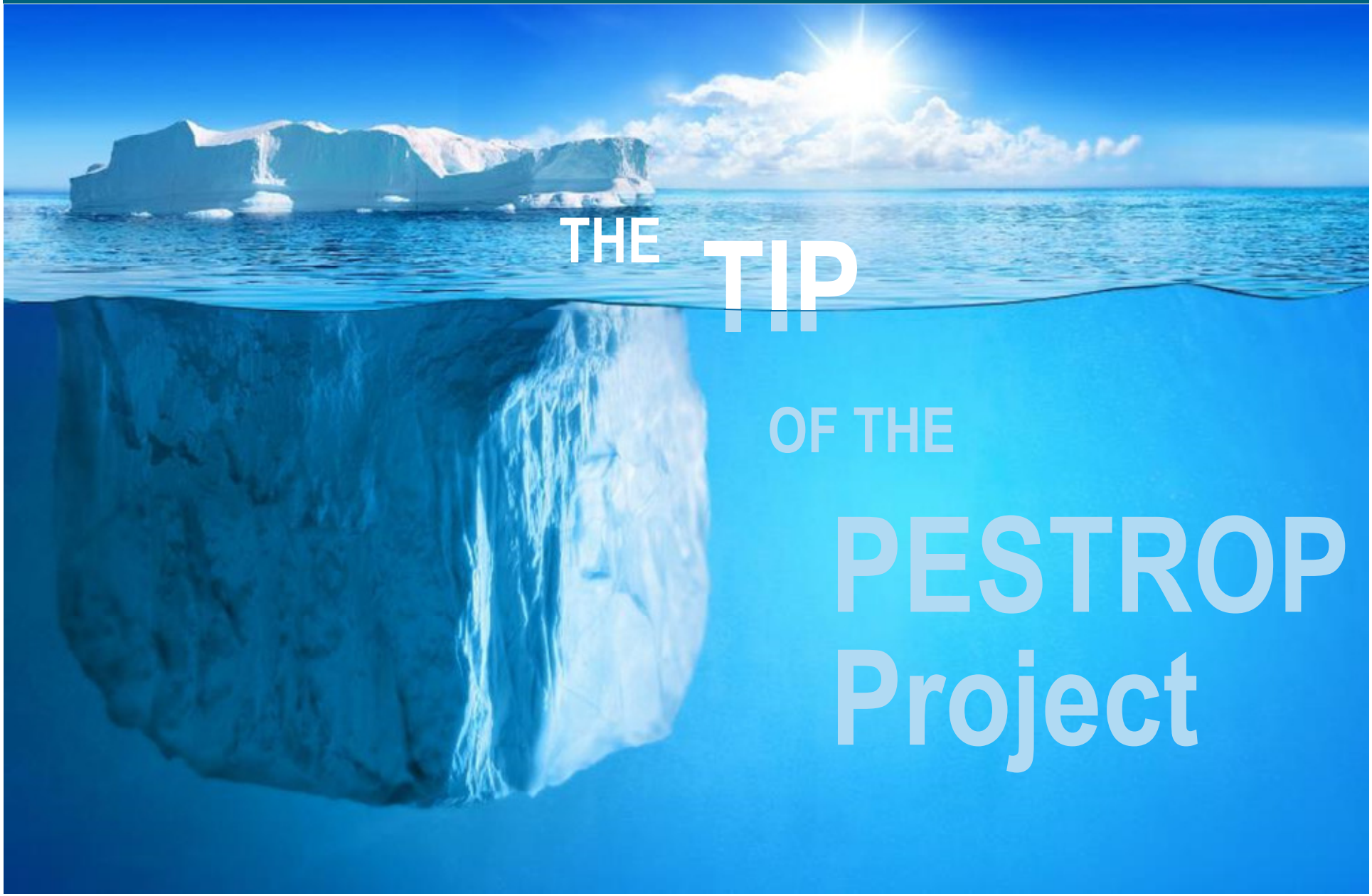
CENTRO DE PRODUCCIÓN ORGÁNICA E INVERNADEROS

UNACOH "Health for All & By All"

Uganda National Association of Community and Occupational Health

Concluding remarks

Concluding remarks – Findings

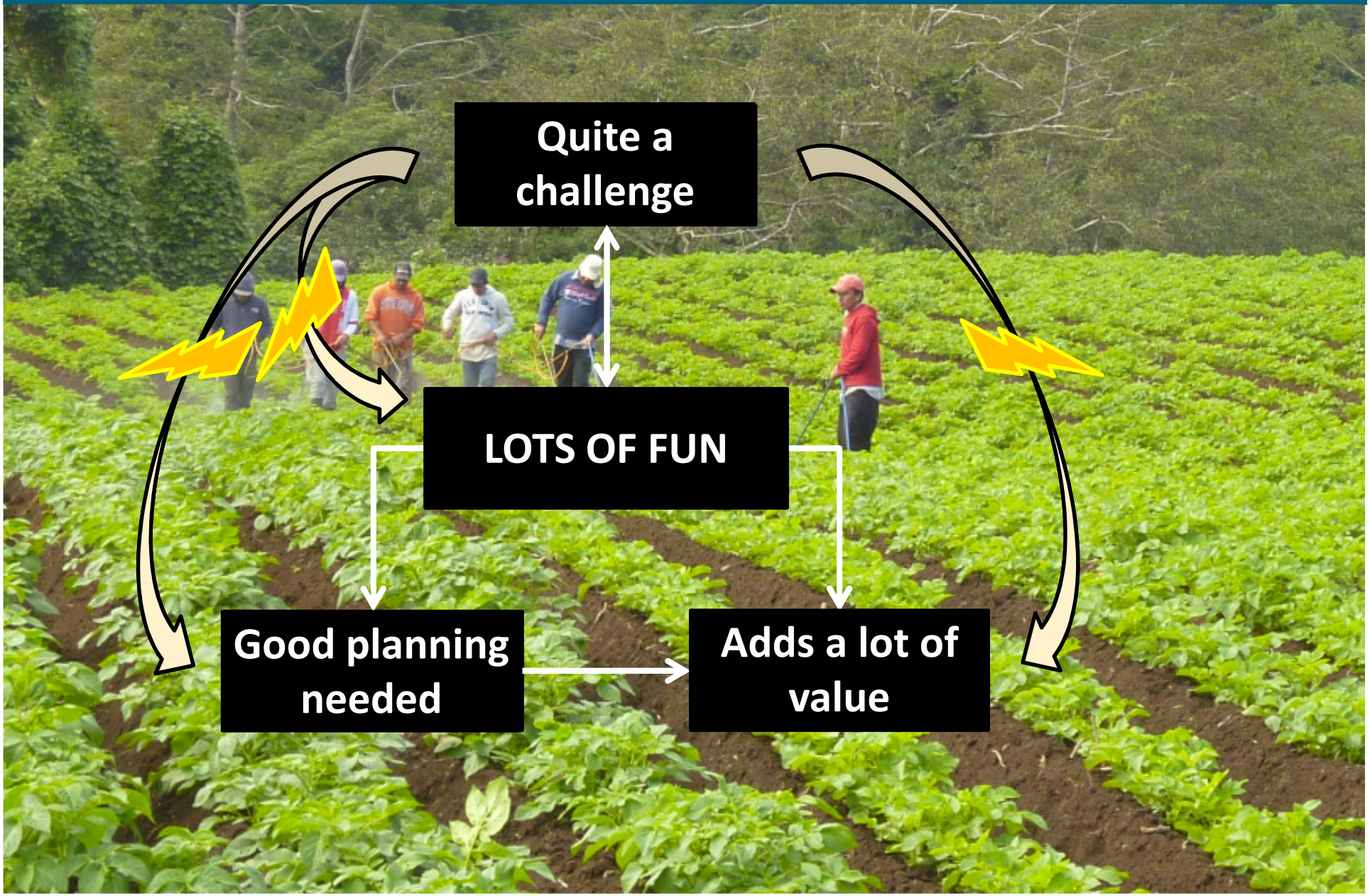


Concluding remarks – SDGs

Which SDG target indicators (n=169) are affected by pesticide use? (→ informed by our results)

	Total #target indicators (accounted for doublicates)	Environmental monitoring	Clinical assessments	Institutional assessment	Integrated assessment
Sustainable Developmenrt Goals (SDGs)	63	13	7	19	45
SDG1 No Poverty	5	1	1	2	4
SDG2 Zero Hunger	7	1	0	1	7
SDG3 Good Health and Well-being	6	1	5	2	2
SDG4 Quality Education	2	0	0	0	3
SDG5 Gender Equality	1	0	0	0	1
SDG6 Clean Water & Sanitation	5	4	0	2	1
SDG7 Affordable & Clean Energy	0	0	0	0	0
SDG8 Decent Work & Economic Growth	6	1	1	2	4
SDG9 Industry, Innovation & Infrastructure	3	0	0	0	3
SDG10 Reduced Inequalities	3	0	0	0	3
SDG11 Sustainable Cities & Communities	1	1	0	1	0
SDG12 Responsible Consumption & Production	10	1	0	1	9
SDG13 Climate Action	0	0	0	0	0
SDG14 Life Below Water	0	0	0	0	0
SDG15 Life on Land	5	3	0	2	2
SDG16 Peace, Justice & Strong Institutions	3	0	0	2	1
SDG17 Partnerships for the Goals	6	0	0	4	5

Concluding remarks – Integrated assessment




Thank you!
swiss
network for
international
studies