An holistic approach to Sustainable Agriculture – Holistic Flexible Conservation Agriculture (ACFO)

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- **WE NEED SUSTAINABLE PROCESSES TO SURVIVE**

WHEN IS AN AGRICULTURAL PROCESS SUSTAINABLE?

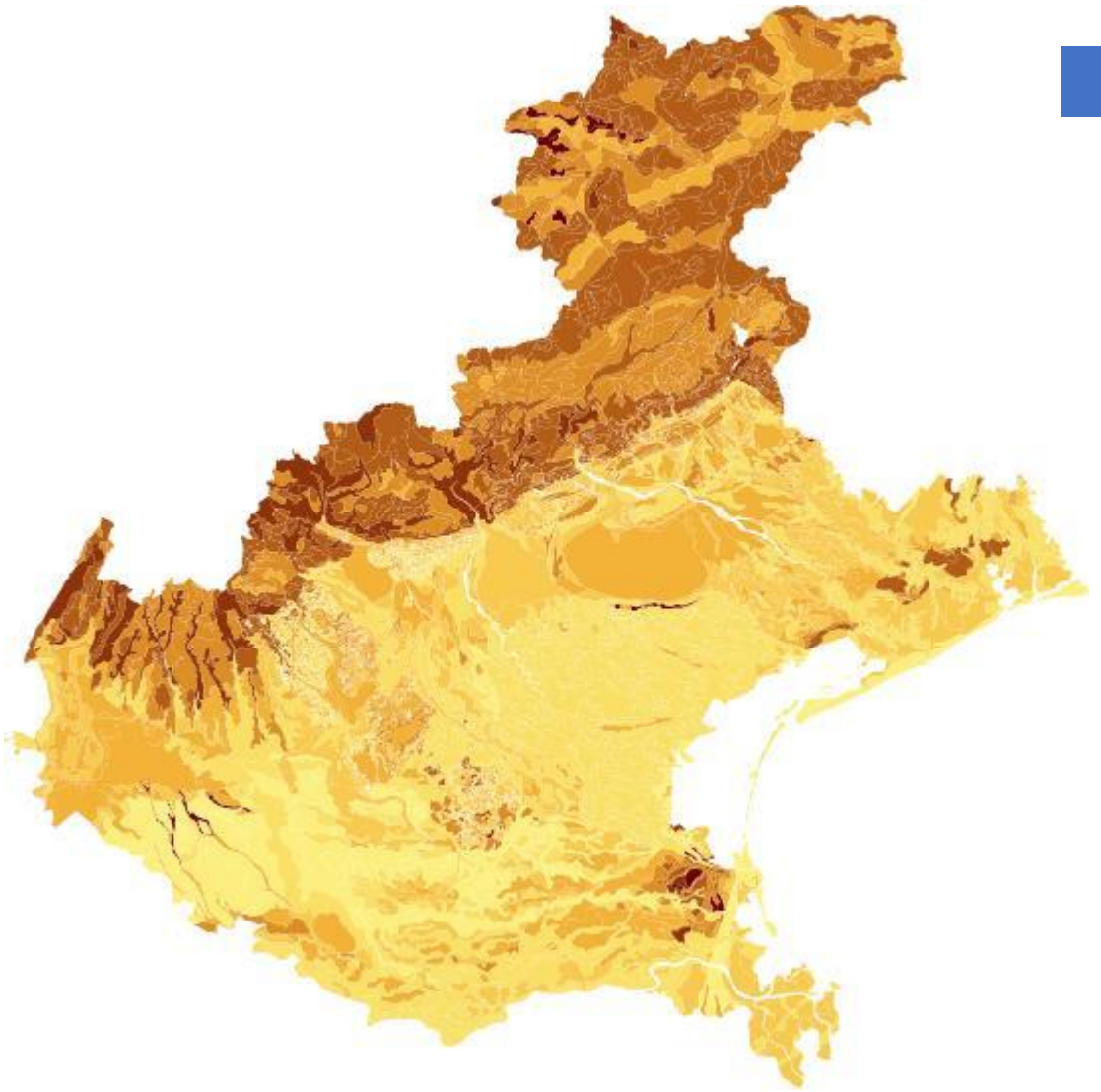
A sustainable agricultural production process enables farmers to exploit the potential of an agroecosystem to grow healthy, high-quality food and earn a living, while maintaining the land's productive potential and without causing (i.e. minimising) negative effects on humans and the environment.

IS THE CURRENT WIDESPREAD CONVENTIONAL AGRICULTURAL PROCESS SUSTAINABLE?

ACTUALLY TODAY

Organic carbon (%)

December 2022



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FUNDAMENTAL FACTOR OF SUSTAINABILITY
ORGANIC CARBON/ORGANIC MATTER

FUNDAMENTAL TRIGGER OF ECOSYSTEM PROCESSES

1. **IMPROVE SOIL STRUCTURE la performance delle piante**
2. **KEEP NUITRIENTS AND WATER, PROMOTE MICRORGANISM LIFE**
3. **INCREASE ECOSYSTEM COMPLEXITY/BIODIVERSITY**

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WHAT CHANGES CAN WE MAKE?

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IMPLEMENTING SUSTAINABILITY

- CONTAIN/ZERO CARBON LOSSES
- INCORPORATE CARBON/CLOSE CARBON CYCLES
- RESTORE SOIL BIODIVERSITY

THAT MEANS: RESTORING SOIL FERTILITY

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ACCELERATION OF CARBON ACCUMULATION

- **AGROFORESTRY**
- **ORGANIC MATTER INPUTS (e.g. manure, digestate)**

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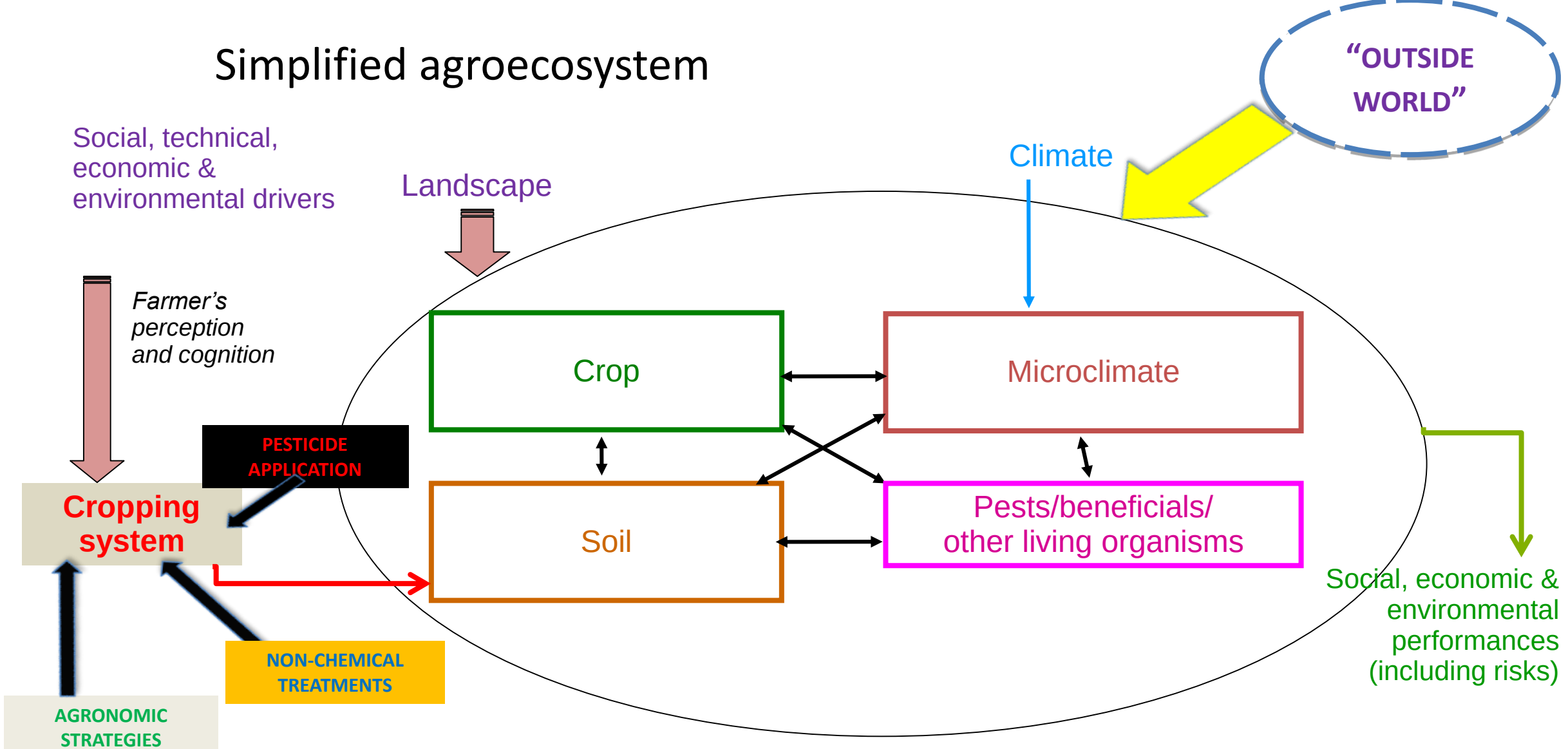
A HOLISTIC APPROACH

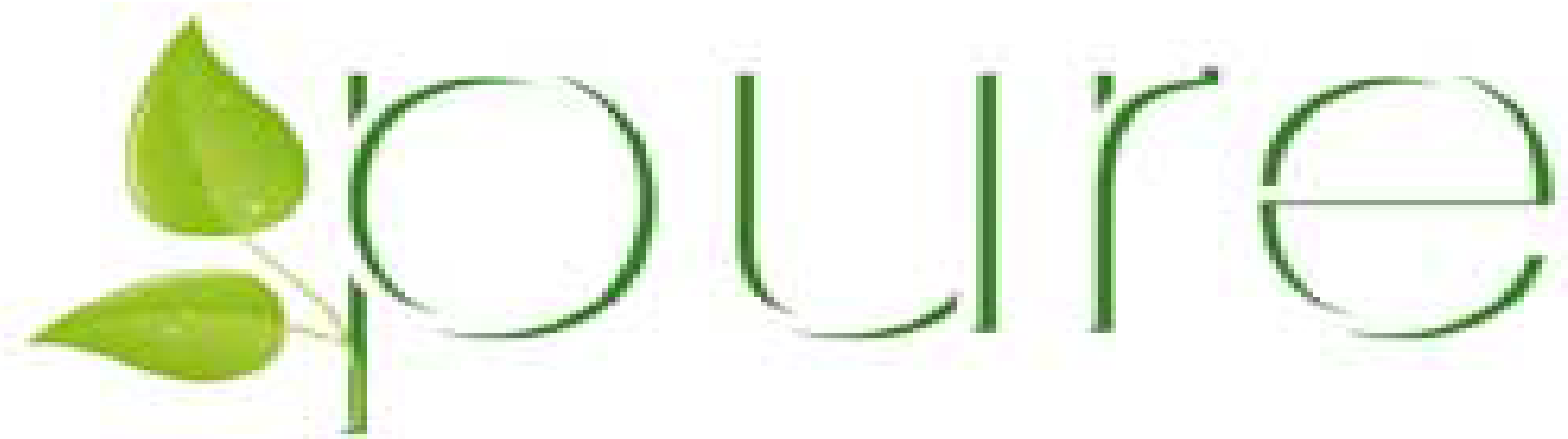
Simplified agroecosystem



Modified from Lescourret and Aubertot (2013)
PURE 2nd Annual Meeting, Riva del Garda, Italy

AGROECOSYSTEM

+ COMPLEX = + STABLE



http://www.pure-ipm.eu/

(in red : cultural control ; in blue : genetic control; in green : physical control ; in orange : biological control)

Competitive crop

Variety(ies) of barley resistant to diseases and lodging / variety(ies) of peas resistant to lodging and frost. Mechanical weeding in autumn if possible, and spring

Ploughing

False seedbed

High sowing density. cultivar mixture, Tolerant to Phoma, including 10% of an earlier cultivar. Mechanical weeding in autumn and spring. Contans® if risk of sclerotinia.

Barley / pea intercrops

Oilseed rape

False seedbed

Late sowing, high sowing density. cultivar mixture, tolerant to diseases. Mechanical weeding in autumn if possible, and spring.

BIOCIDAL OVER CROP AND/OR BIOCIDAL DEFATTED SEED MEALS

Bread wheat

Cover crop

Ploughing

False seedbed

Soya (or sunflower)

Hardy crop (sunflower in case of high weed infestation)

2 strategies (soya): sowing with large space between rows or sowing in high density with close rows. Mechanical weeding, including hoeing. Contans® if risk of sclerotinia.

Bread wheat

Early sowing, large space between row. Resistant variety. Mechanical weeding in autumn if possible, and spring, including hoeing.

BIOCIDAL OVER CROP

MAIZE tilled before later intense hoeing

In case of high weed infestation, no cover crop and soil tillage to control them.

Crop less sensitive to pests than winter barley

Cultivar tolerant to diseases. Mechanical weeding.

Cover crop

Ploughing

False seedbed

POTATO

Competitive and hardy crop

Modified from Lescourret and Aubertot (2013)

PURE 2nd Annual meeting, Riva del Garda, Italy

Early autumn-sown crop

Late autumn-sown crop

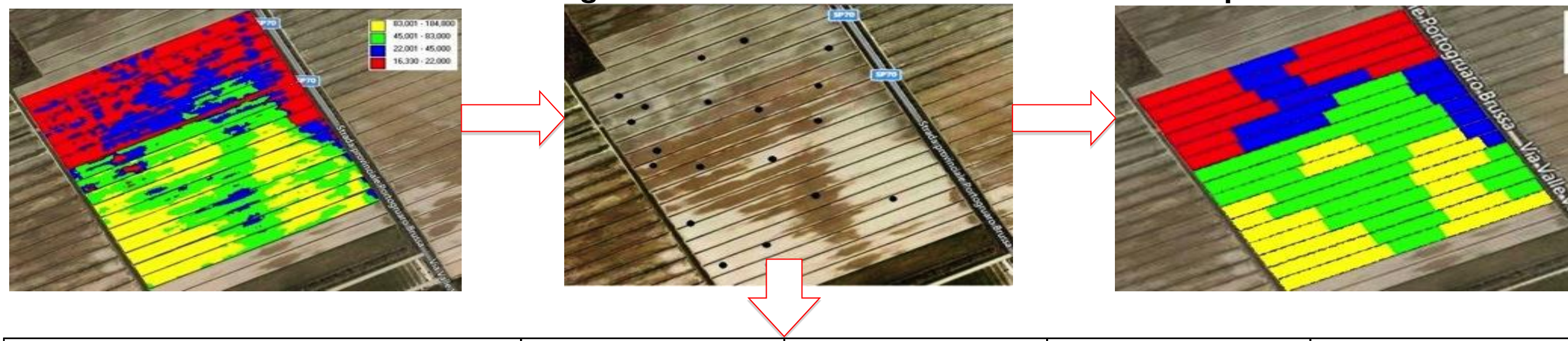
Early spring-sown crop

Late spring-sown crop

Harrowing of wheat sown in two twin-lines with an interrow of 25 cm

PRECISION FARMING

Definition of Homogeneous Areas - Basic and Online - Satellite Maps



TOTAL STATISTICS	ZONE A		ZONE B		ZONE C		ZONE D	
Electric conductivity (dS/m)	1.82	***aA***	2.01	***aAB***	2.26	***abAB***	2.39	***bB***
SAR index (Sodium Adsorption Ratio)	0.46	*ns*	0.50	*ns*	0.35	*ns*	0.32	*ns*
pH	7.25	***aA***	7.53	***bB***	7.54	***bB***	7.48	***bB***
Active limestone (%)	4.07	***aA***	3.83	***aB***	3.46	***bC***	3.48	***bC***
Total nitrogen (%)	0.06	***aA***	0.06	***bA***	0.08	***cB***	0.11	***dC***
Organic matter (%)	1.22	***aA***	1.23	***aA***	1.71	***bB***	2.38	***cC***
Assimilable phosphorus (mgP_2O_5/kg)	32.83	*ns*	30.00	*ns*	30.86	*ns*	29.5	*ns*
Exchangeable potassium (mgK_2O/kg)	115.83	***aA***	121.67	***aA***	151.00	***bB***	154.25	***bC***
Clay (% tf.)	15.17	***aA***	16.33	***aA***	22.14	***bB***	32	***cC***
Silt (% tf.)	25.33	***aA***	24.67	***aA***	36.14	***bB***	47.75	***cC***
Sand (% tf.)	59.50	***aA***	59.00	***aA***	41.71	***bB***	20.25	***cC***

SUSTAINABLE AGRICULTURE
=
HOLISTIC APPROACH
Synergic agricultural practices

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INTERACTING HOLISTIC CROPS/HARMFUL ORGANISMS/BENEFICIALS DEVELOPMENT MODELS CONSIDERING ALL THE ABIOTIC AND BIOTIC FACTORS AND THEIR INTERACTIONS

ALSO FED WITH MONITORING OUTPUTS

GIVING PERIODICAL PREDICTIONS WITH DIFFERENT SCENARIOS/FACTOR INPUT MODIFICATIONS

FOR ANY UNIFORM AREA

The largest long-term experiment on the future of Europe’s agriculture

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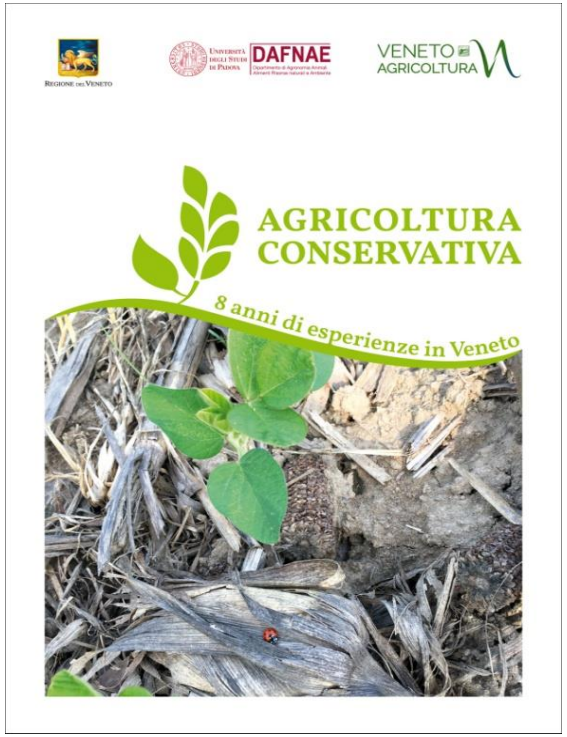
CULTIVATED LAND DIVIDED INTO TWO PARTS

HOLISTIC FLEXIBLE CONSERVATION * AGRICULTURE (HFCA)



VS

CONVENTIONAL AGRICULTURE

-

-* Technique: conservation agriculture - minimum tillage (MT)

- Technique: conservation agriculture - no-till (NT)

ACFO PACKAGE

1) PRECISION FARMING (WITH VARIABLE RATE) –
(all production factors including water)

2) SUITABLE ROTATION (as complex and diversified as possible)

3) NO PLOUGHING (Minimum or No Tillage)
(according to crop and actual soil conditions)

4) FREQUENT SOIL DECOMPACTATION

5) CONTINUOUS SOIL COVER - WITH COVER CROPS

6) ADVANCED IPM

7) CULTIVATION PRACTICES TO REDUCE THE RISK OF SOIL COMPACTATION
(E.G. LIGHT MACHINERY, SHORT-CYCLE VARIETIES-HYBRIDS)

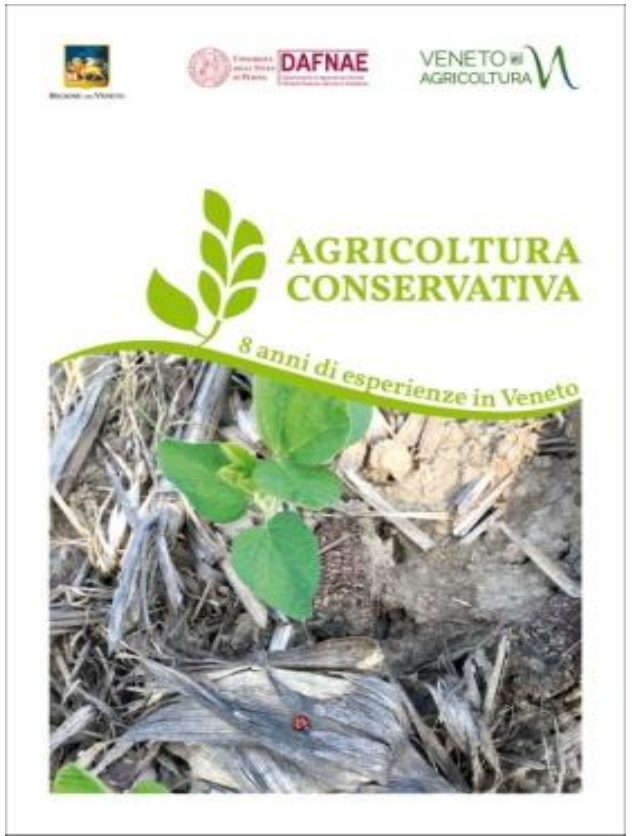
8) AGROFORESTRY

9) INNOVATION IN FERTILIZATION

PRIMI RISULTATI/INITIAL RESULTS

https://www.venetoagricoltura.org/2017/05/editoria/progetto-life-agricare-documentazione-tecnica-technical-document-2/

https://www.venetoagricoltura.org/catalogo-editoriale-agricoltura-sostenibile/



COVER CROPS

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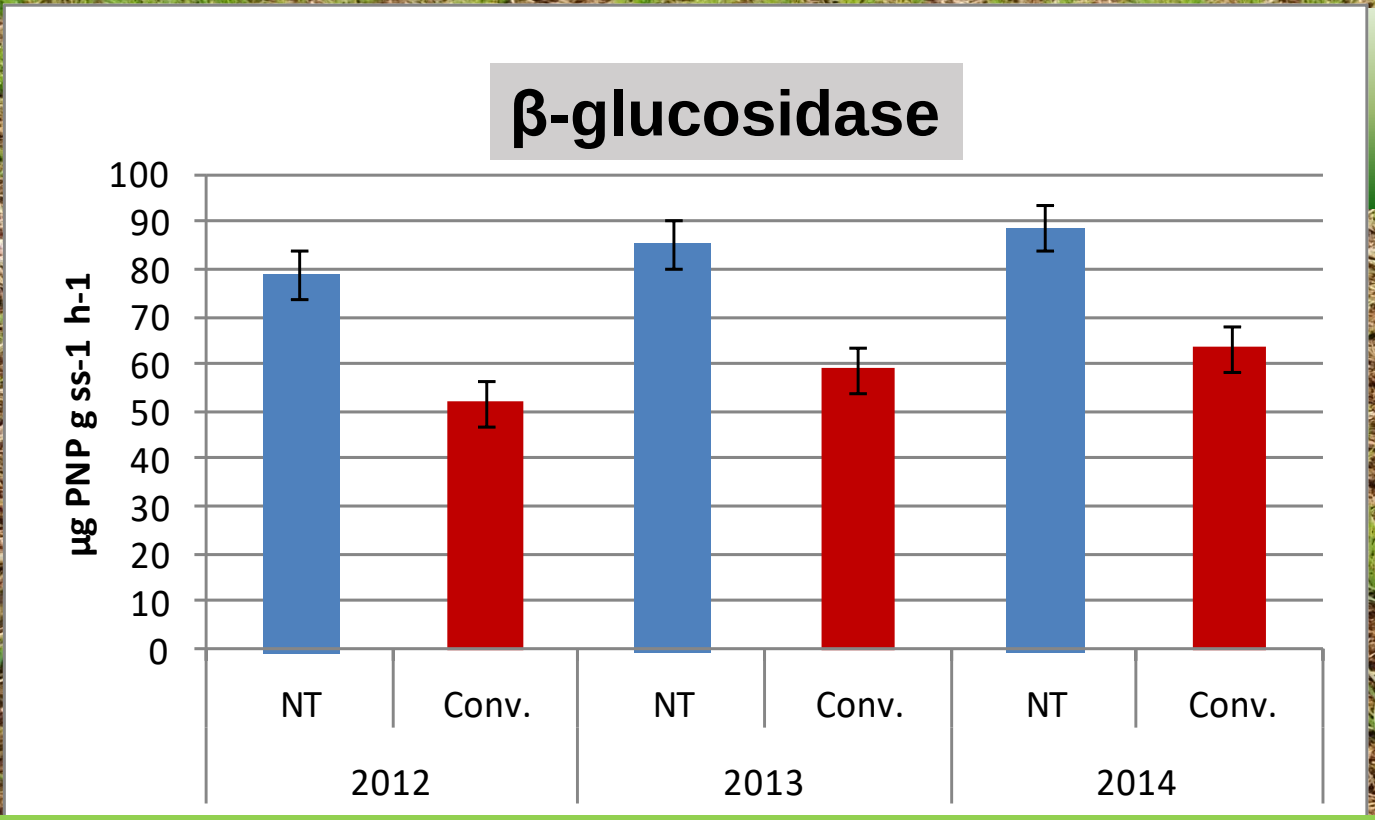

Improvement of soil enzymatic activities

Pittarello M, Chiarini F, Menta C, Furlan L, Carletti P. (2022) Changes in soil quality through conservation agriculture in North-Eastern Italy. Agriculture, 12, 1007. https://doi.org/10.3390/ agriculture1207100

Life HelpSoil

HFCA AGRICULTURE

- Soil Organic Matter (SOM) OXIDATION, + BIODIVERSITY, + SOM CONTENT

+ ARTHROPODS, + MICROBIAL/ENZYMATIC ACTIVITY

+ STABLE SOM, – CARBON DIOXIDE IN THE AIR

+ FERTILITY, + ABILITY TO CONTRAST CLIMATE CHANGE,
+ PROFITABILITY AND ECOSYSTEM SERVICES, – ENVIRONMENTAL IMPACT

ADVANCED IPM

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IPM OF SOIL PEST IN MAIZE

1) Risk analysis

Furlan L, Contiero B, Chiarini F, Colauzzi M, Sartori E, Benevegnù I, Giandon P (2016) Risk assessment of maize damage by wireworms (Coleoptera: Elateridae) as the first step in implementing IPM and in reducing the environmental impact of soil insecticides. Environ Sci Pollut Res, 24:236-251, DOI: 10.1007/s11356-016-7692-z

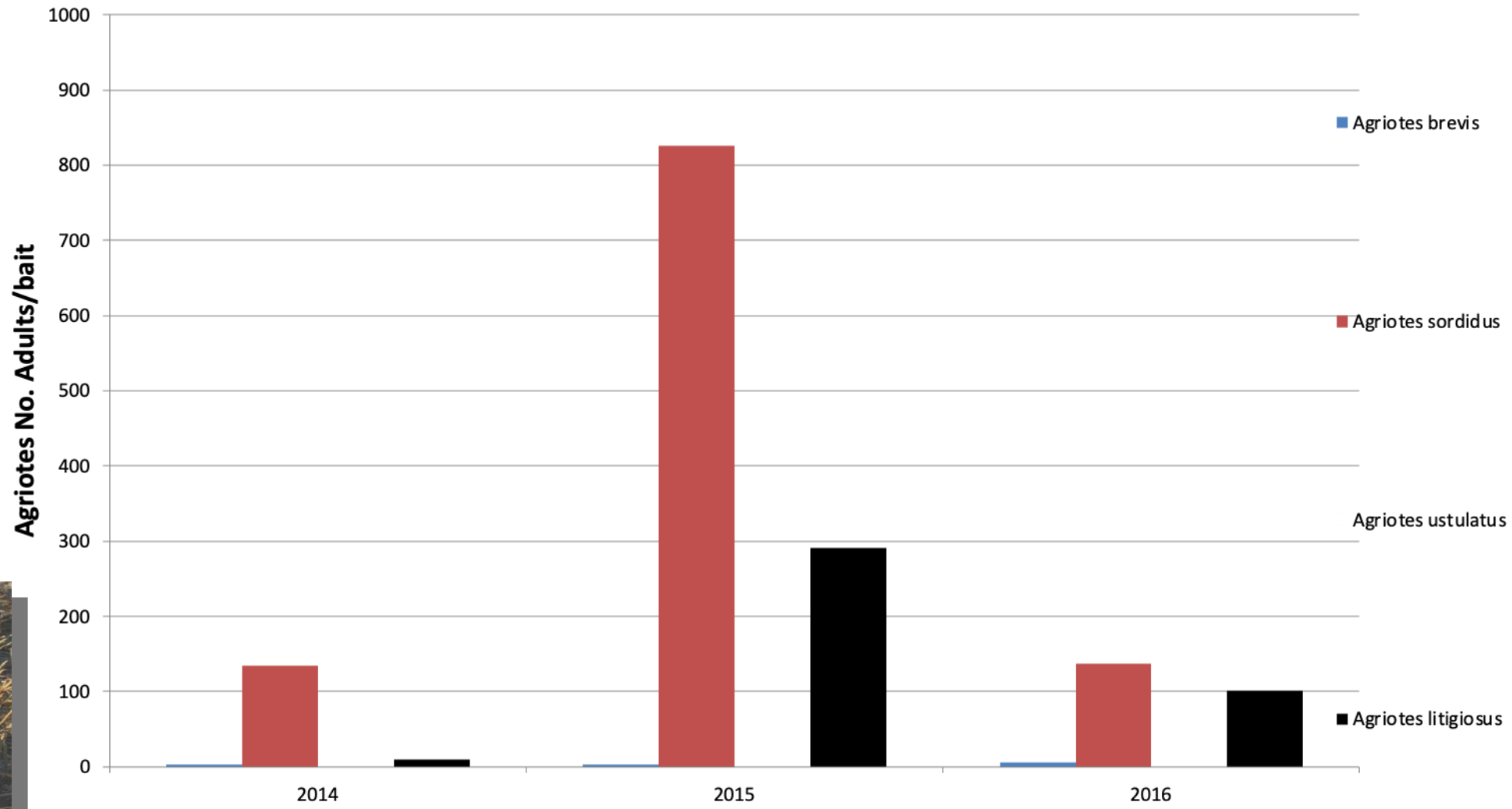
2) Accurate evaluation of the larval population level

Furlan, L. (2014) IPM thresholds for *Agriotes* wireworm species in maize in Southern Europe. J Pest Sci , DOI 10.1007/s10340-014-0583-5

3) Decision on need to apply pesticides when sowing

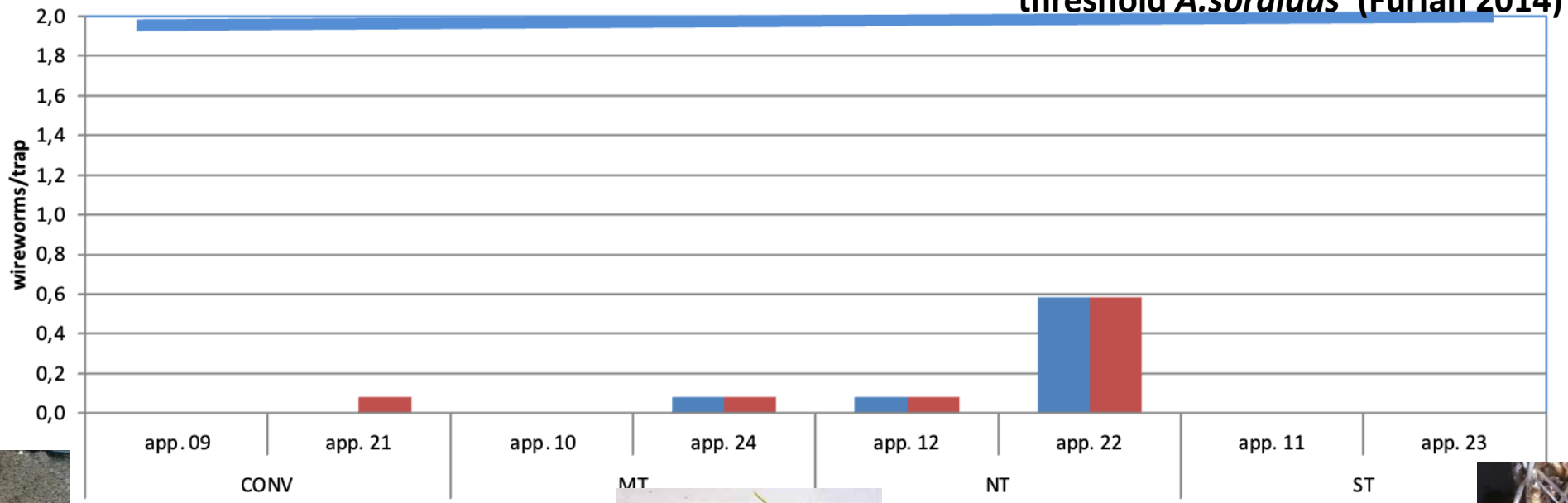
Furlan L, Vasileiadis VP, Chiarini F, Huiting H, Leskovšek R, Razinger J, Holbe JI, Sartori E, Urek G, Verschweleg A, Benevegnù I, Sattin M. (2016) Risk assessment of soil-pest damage to grain maize in Europe within the framework of Integrated Pest Management. Crop Protection, DOI 10.1016/j.cropro.2016.11.029

1) MAIZE IPM - Monitoring of *Agriotes* adults (click beetles)
Plot 12 Vallevecchia 2014-2016



2) MAIZE IPM - Wireworm (*Agriotes* larvae) monitoring pre-sowing
Plot 12 Vallevecchia 2016

threshold *A.sordidus* (Furlan 2014)



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IPM OF SOIL PESTS IN MAIZE

1) RISK ANALYSIS AND 2) POPULATION ANALYSIS

BELOW THE DAMAGE THRESHOLD FOR THE ENTIRE AREA PLANTED WITH MAIZE (2015-2016)

3) NO SOIL PEST TREATMENT, NO PESTICIDES APPLIED AT SOWING

LOW LEVEL OF SOIL PEST ATTACK - NO PHYTOTOXICITY
EXCELLENT STAND - NO NEGATIVE IMPACT ON THE SOIL AND ENVIRONMENT
IN GENERAL - LOWER COSTS, INCLUDING ENERGY COSTS, LESS CO_2 RELEASE

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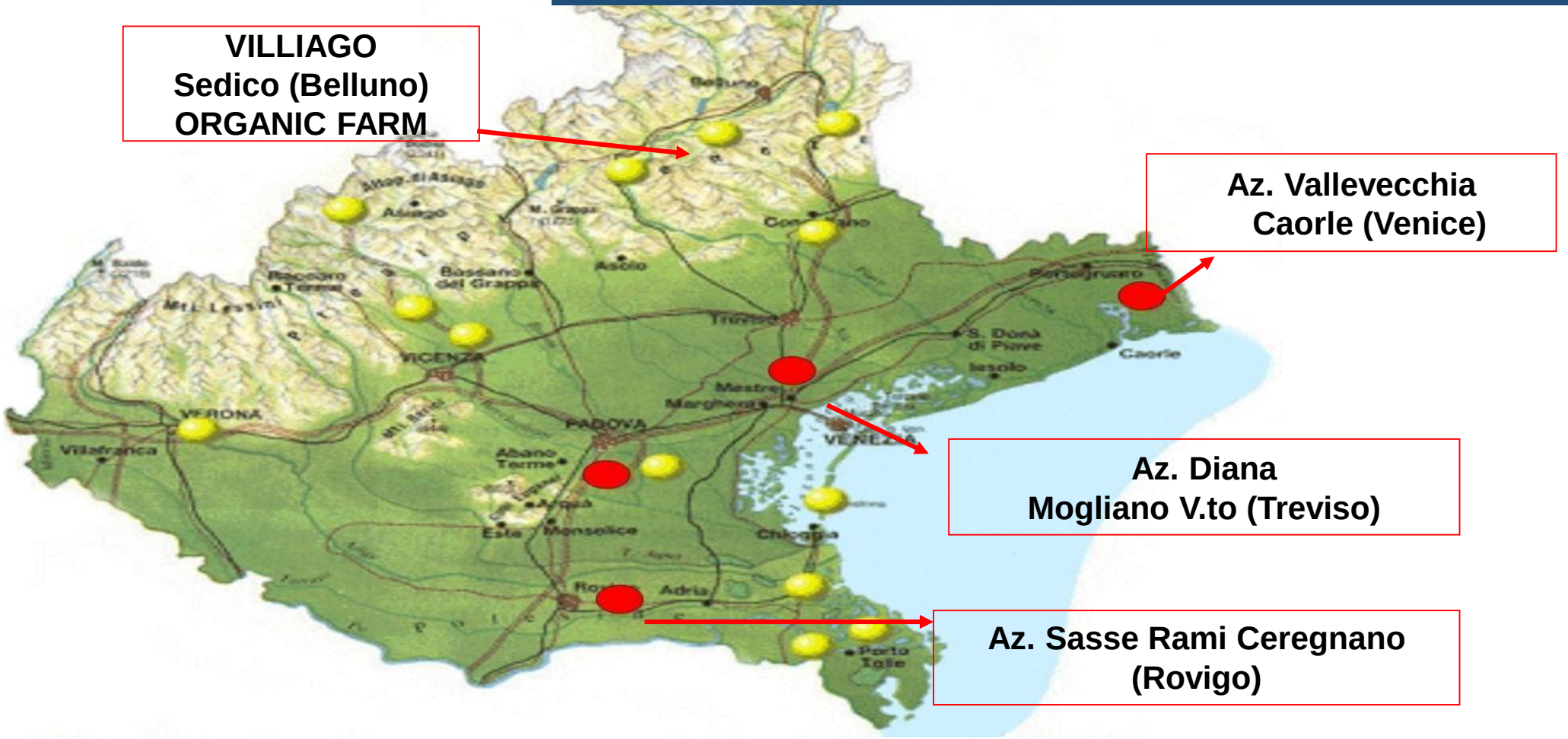
OPEN FARMS -
OPEN PROTOCOLS

2009 – 2024

No soil insecticides – IPM implementation
(600 ha of land farmed for 16 years
> 2400 ha of maize farmed over 16 years
NO severe damage (NO impact on yield) by soil insects



ADVANCED INTEGRATED PEST MANAGEMENT (IPM)

A LEGAL REQUIREMENT AND A FUNDAMENTAL FACTOR IN ACHIEVING THE DECLARED OBJECTIVES OF CONSERVATION AGRICULTURE AND PRECISION AGRICULTURE

The “Herbaceous Crops Bulletin”

(www.venetoagricoltura.org/bollettino-colture-erbacee/)

WHY IS VALLEVECCHIA PARTICULARLY SUITABLE FOR THE BIG FIELD EXPERIMENT?

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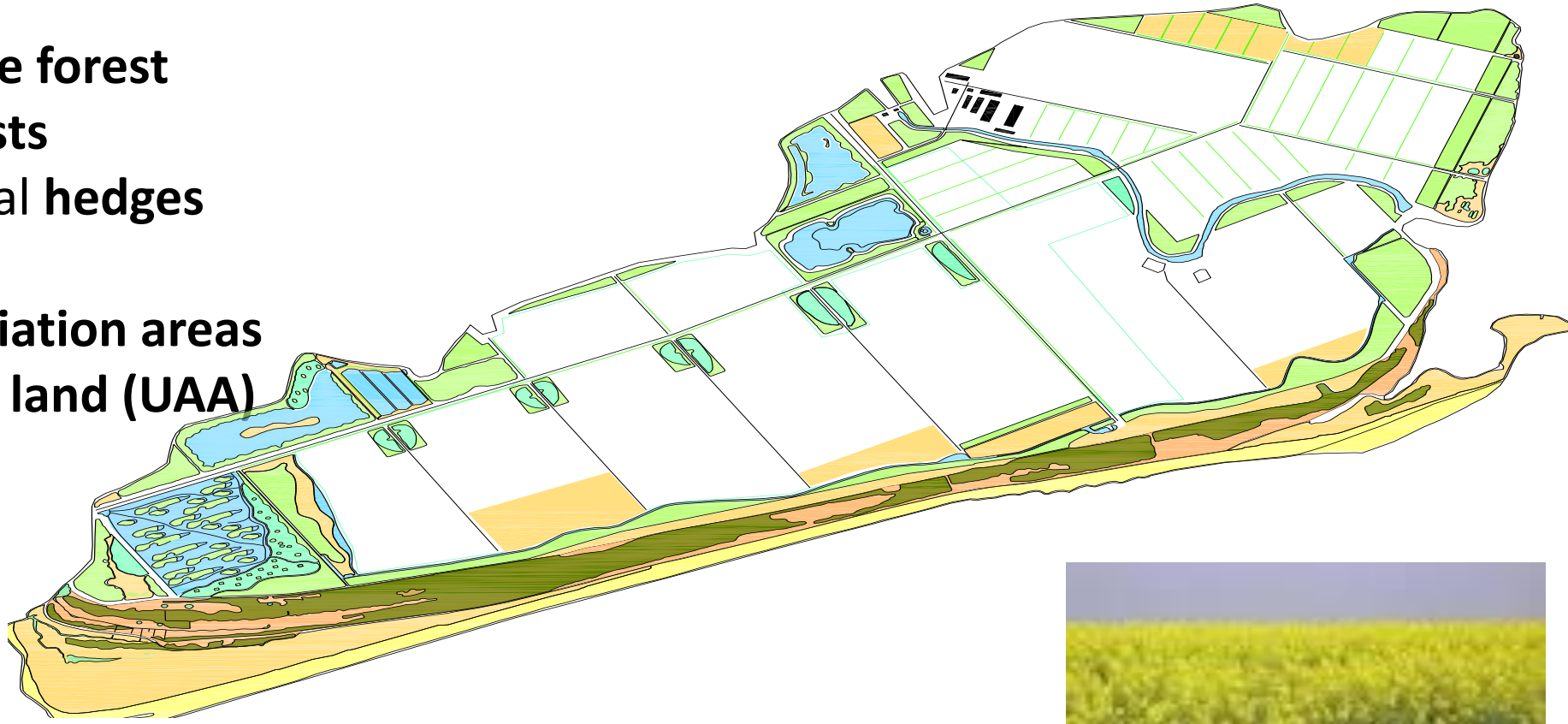
Approx. 60 ha coastal **pine forest**
Approx. 100 ha plain **forests**
Approx. 15 ha (24 km) rural **hedges**
Approx. 70 ha **wetlands**
Approx. 9 ha **phytoremediation areas**
Approx. 380 ha **cultivated land (UAA)**



HIGH BIODIVERSITY
Site of Community Importance *(IT3250033)* and **Zone of Special Protection** (IT3250041) for the Community Directives “Habitat” and “Birds”.

Main rotation

Winter-wheat/maize/soybean
Winter-wheat/soybean/maize-sorghum
Winter-wheat/canola/soybean/maize
alfalfa

A MOSAIC OF DIVERSE ADJACENT HABITATS = AN UNEQUALLED LEVEL OF BIODIVERSITY

250 bird species (50% of Italy's avifauna species)
44 species listed in Dir. 79/409/EEC Annex I (species that may not be hunted and for which special habitat conservation measures must be provided)
42 species listed in Dir. 79/409/EEC Annex II/2

Lepidoptera: 640 species, 9 are new for Italy and 4 are new for science

Orthoptera: 29 species (2 endemic to the Northern Adriatic coastal zone)

Odonates: 13 species

Amphibians: 6 species of frog and toad and 2 of newt

Reptiles: 13 species

THE MAIN CHALLENGE FOR VALLEVECCHIA

IS IT POSSIBLE TO HAVE HIGH-QUALITY, PROFITABLE, HI-TECH FARMING that is in harmony with the NATURAL ENVIRONMENT and mitigates/contrasts CLIMATE CHANGE?

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PER ISCRIVERSI AL BCE – BOLLETTINO COLTURE ERBACEE
SUBSCRIBE TO THE HERBACEOUS CROPS BULLETIN

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