EAAP
European Federation of Animal Science

75th EAAP Annual Meeting
Florence – Italy

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NextGenerationEU

Ministero dell'Università e della Ricerca

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PIANO NAZIONALE DI RIPRESA E RESILIENZA

agritech
National Center for Technology in Agriculture

Living labs for assessing the overall sustainability of livestock systems through Life Cycle Assessment

SOLSTICE

Birolo M., Petracci M., Lacetera N., Marco M., Di Iacovo F., Bonavolontà F., Verde M.T., Provolo G., Cartoni Mancinelli A., Sturaro E.

Agritech è l'hub nato per sviluppare nuove tecnologie al servizio di un'agricoltura più sostenibile. Lavoriamo sulla terra per difendere il futuro della Terra. Perchè cambiare è l'unico modo per crescere.

Index

Agritech

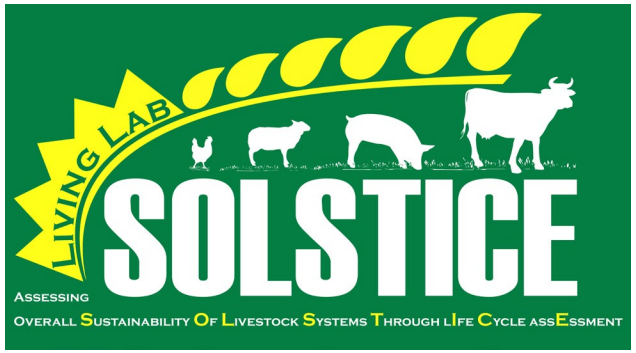
National Centre for Technologies in Agriculture

- ***SPOKE 5***

  Sustainable productivity and mitigation of environmental impact in livestock systems

  - ***Task 5.3.8***

    Living labs for assessing the overall sustainability of livestock systems through Life Cycle Assessment

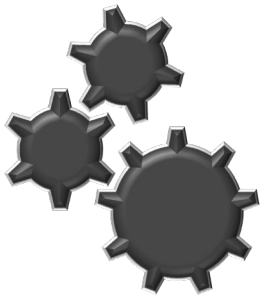


Index

Specific objectives

- ✓ To establish a collaboration between researchers, farmers, and other relevant stakeholders to develop and test innovative practices and technologies to improve the overall sustainability of livestock systems
- ✓ To test innovative management practices at livestock companies involved in the project to improve efficiency and reduce the environmental footprint of livestock farming systems
- ✓ To develop simplified software applications, with an intuitive interface, easy to manage by livestock companies, which will allow to assess the environmental performance of the production chain

Index



Methodology

1 - Participatory approaches

- ✓ To analyze issues and perspectives of different livestock farming systems and to define specific objectives
- ✓ To define methodologies and activities

2 - On field tests

- ✓ Innovative technologies
- ✓ Best management strategies
- ✓ On-farm surveys

3 - Data analysis

- ✓ Life Cycle Assessment
- ✓ Statistical analysis

4 - Dissemination

- ✓ To discuss about the results
- ✓ To share knowledge and innovations

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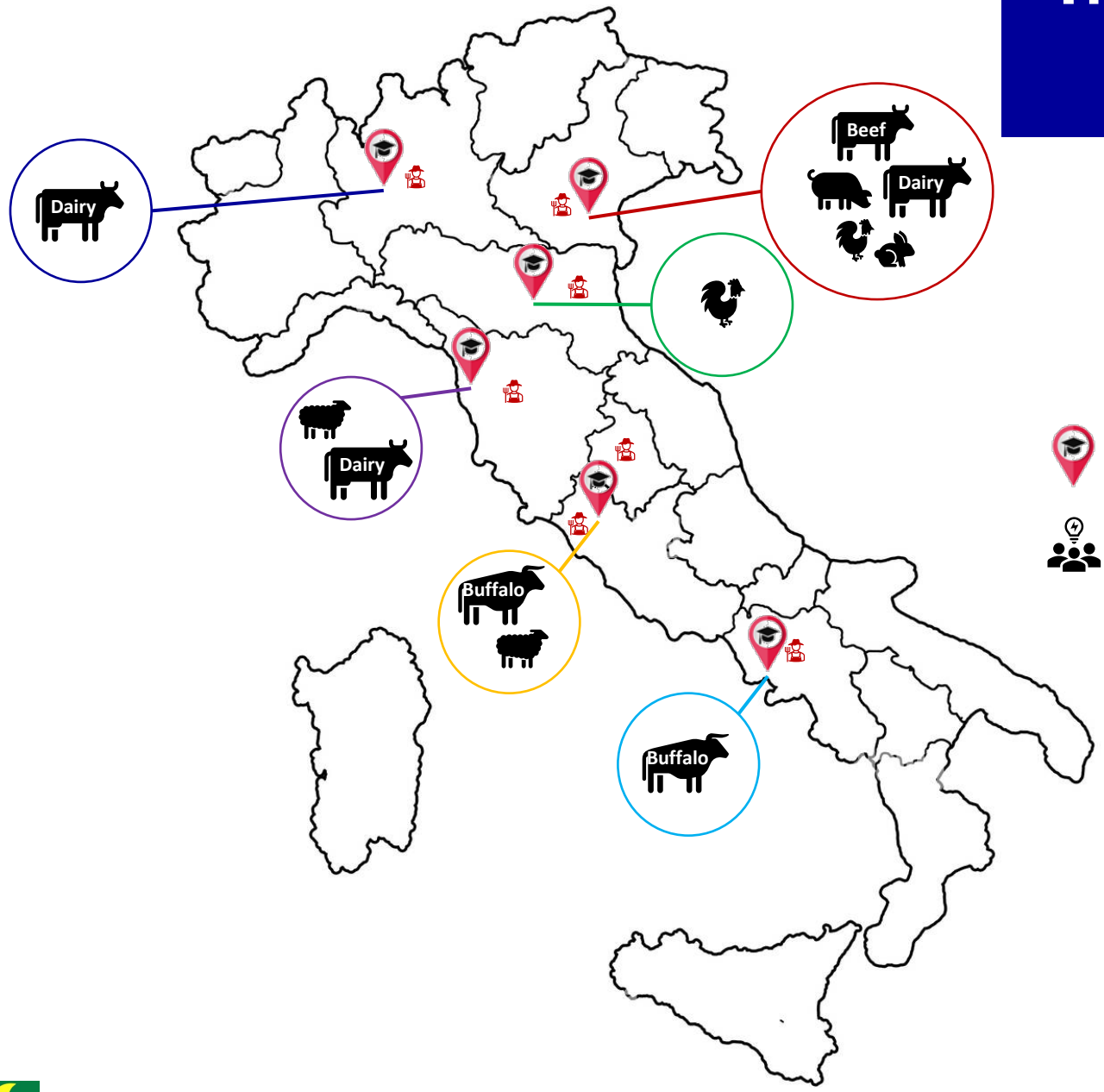
Index



SOLSTICE Network

- ✓ 6 Universities
  (UNIPD, UNIBO, UNIMI, UNINA, UNIPI, UNITUS)
- ✓ 31 Stakeholders
  (Research organizations, Primary producers, Private companies, Public bodies)
  - Synergies with other Universities (UNIPG) and Spokes (Spoke 3 – Agritech)

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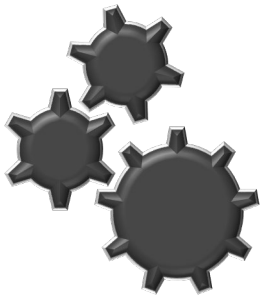
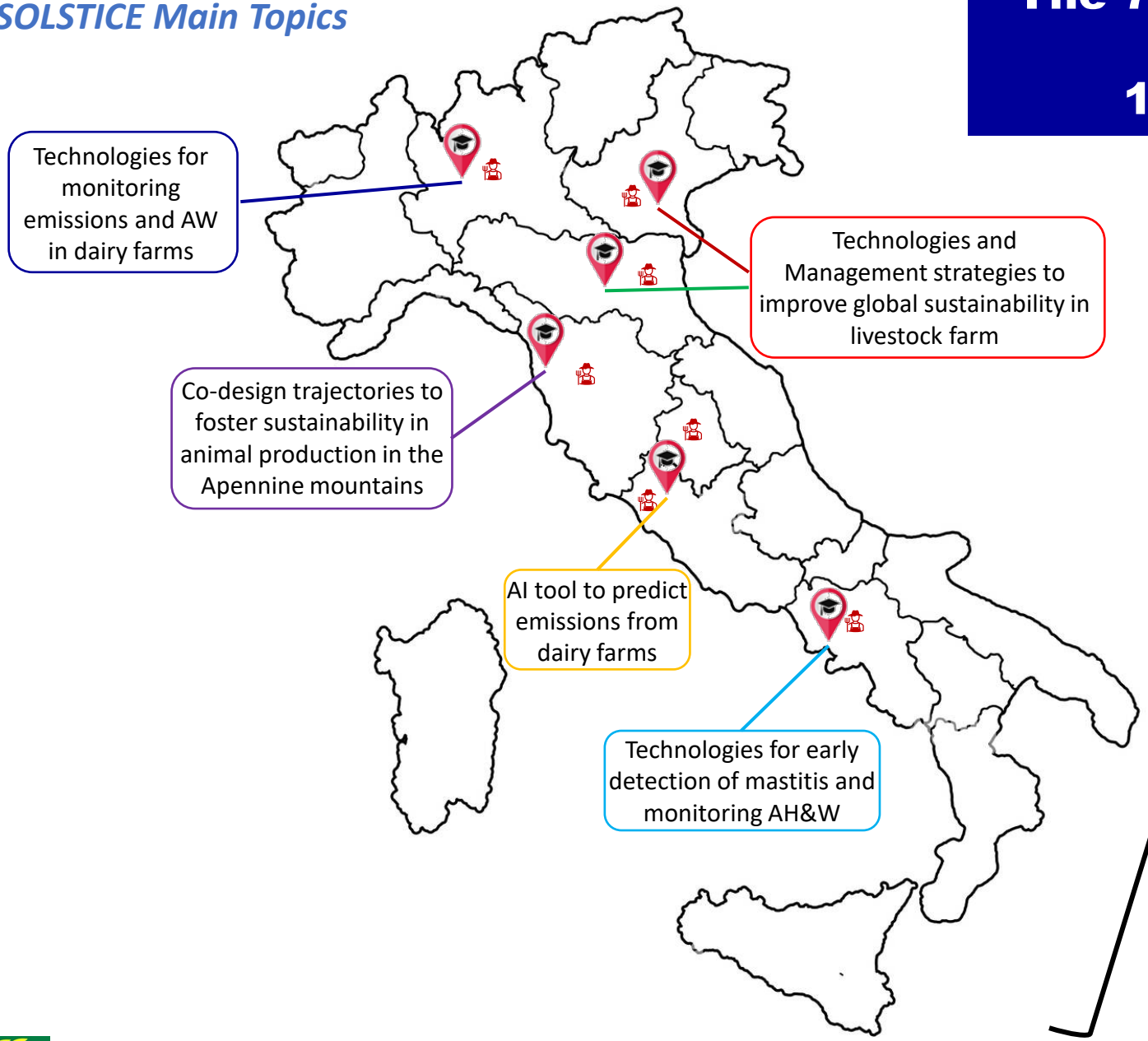
SOLSTICE Main Topics

Index





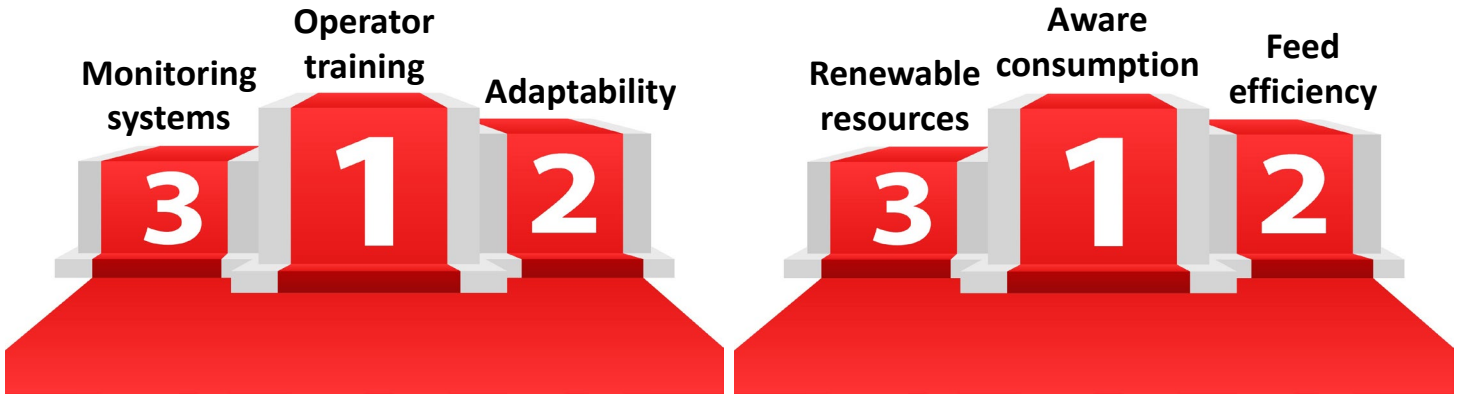
Simplified software applications to assess the environmental performance of livestock farms based on LCA

Index

Free-range and Organic Poultry Productions (UNIPD – UNIBO in collaboration with UNIPG)

Preparatory work

- Focus group with stakeholders to identify priorities



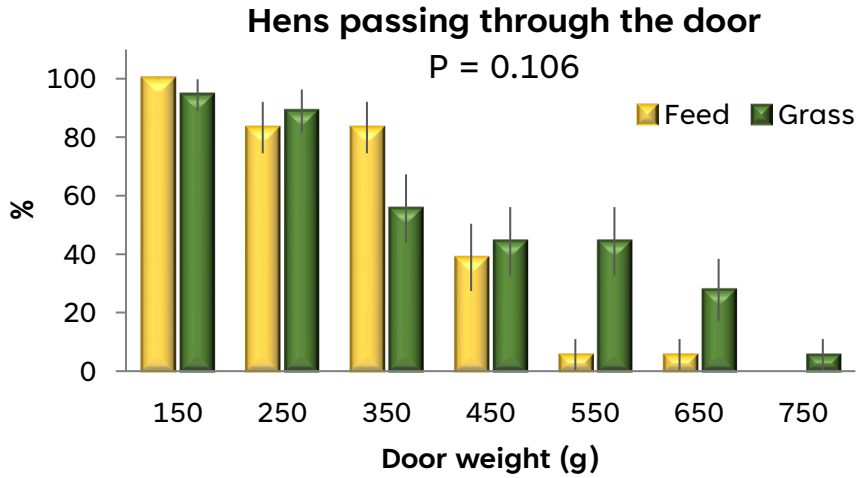
Birolo et al., 2024. Identifying priorities to improve the sustainability of poultry meat production in free-range farming systems through the Living Lab approach
Oral presentation at AGRITECH Workshop "*Living Labs in agriculture: What we know and what should we learn?*"
February 1st Padova, Italy

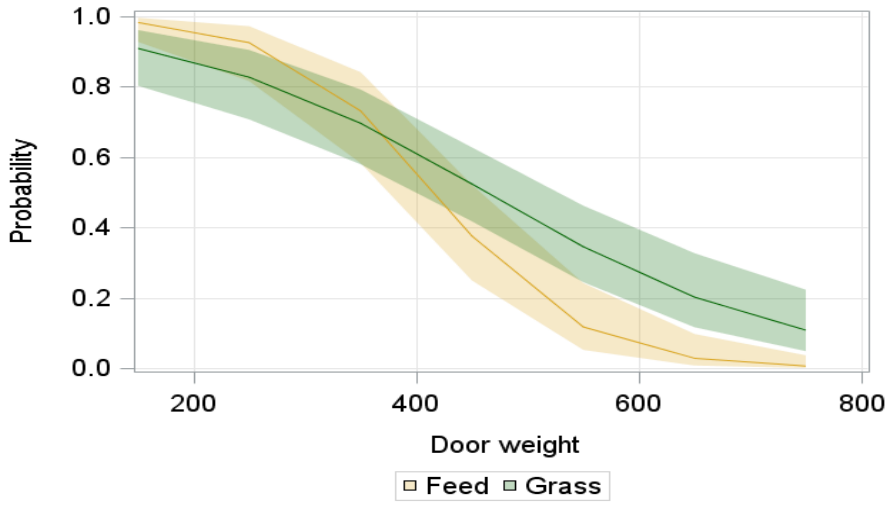
Index

Free-range and Organic Poultry Productions (UNIPD – UNIBO in collaboration with UNIPG)

Preliminary test

- Motivation test to assess the importance of outdoor space and grass resources





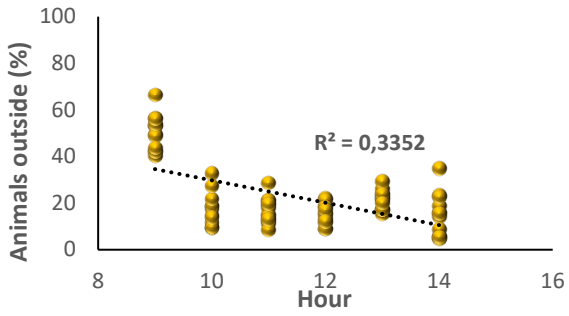
Birolo et al., 2024. Access to outdoor space for laying hens: evaluating motivation and behavior of the animals
Oral presentation at XVI European Poultry Conference – June 24th-27th Valencia, Spain

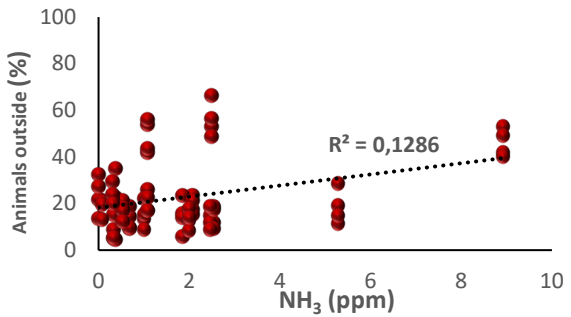
Index

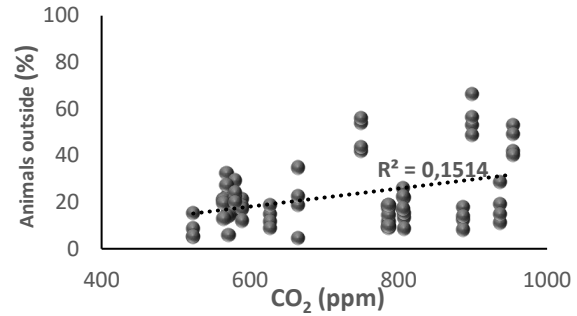
Free-range and Organic Poultry Productions (UNIPD – UNIBO in collaboration with UNIPG)

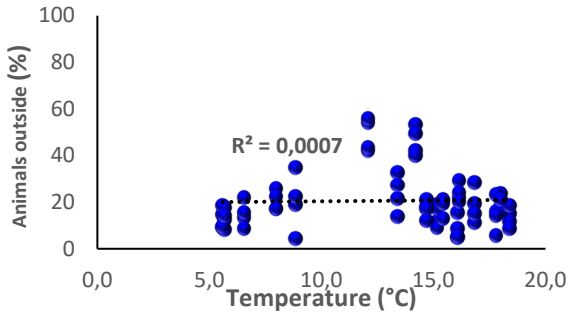
On-field test

- An on-field trial was carried out on a large set of broiler chickens reared in free-range conditions (collaboration with Amadori group)









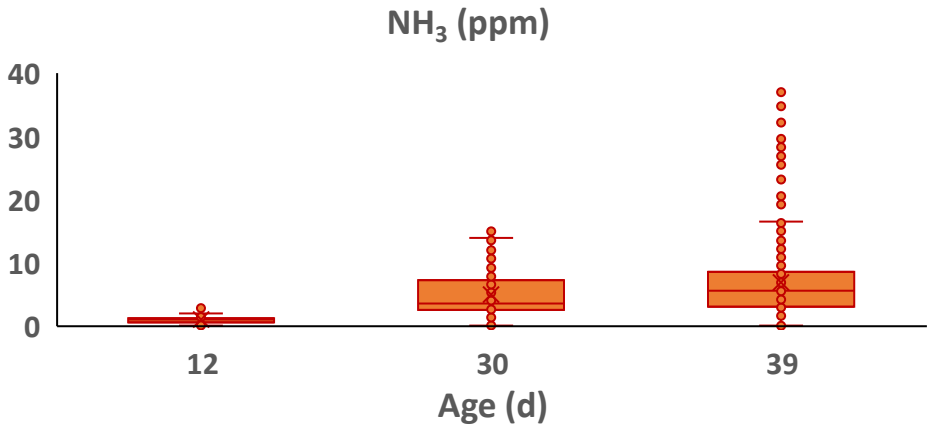
	Mean ± SD
Live weight at 61 d, g	2982 ± 39
Daily weight gain, g/d	48.0 ± 0.6
Daily feed intake, g/d	113.6 ± 2.37
Feed conversion	2.37 ± 0.09

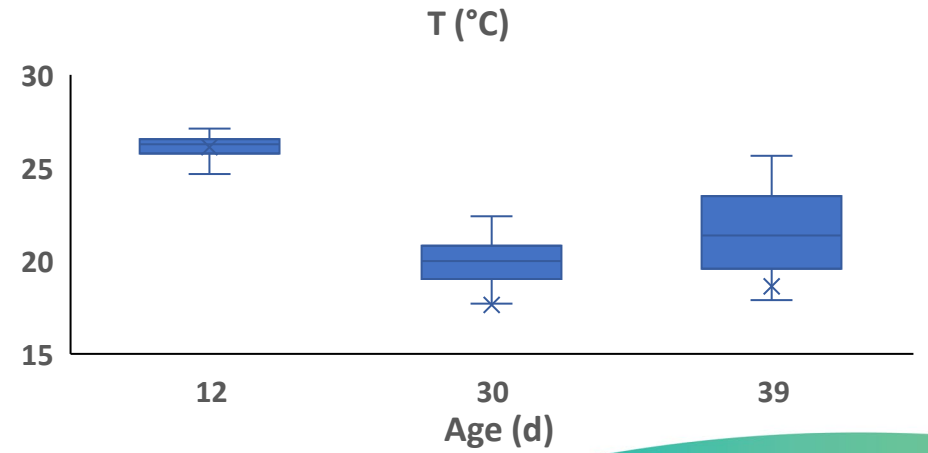
Index

Intensive Poultry Productions (UNIPD – UNIBO)

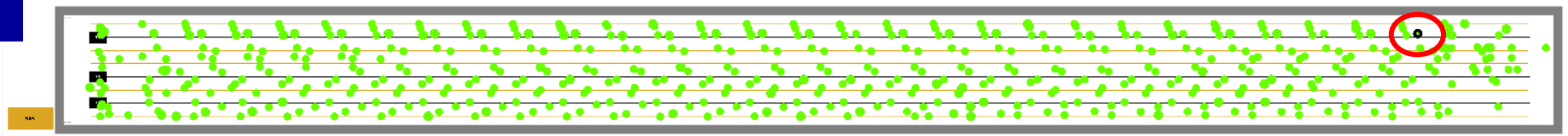
On-field test

- Applying new technologies to improve human and animal welfare
  - Robot for monitoring environmental parameters and scarifying litter

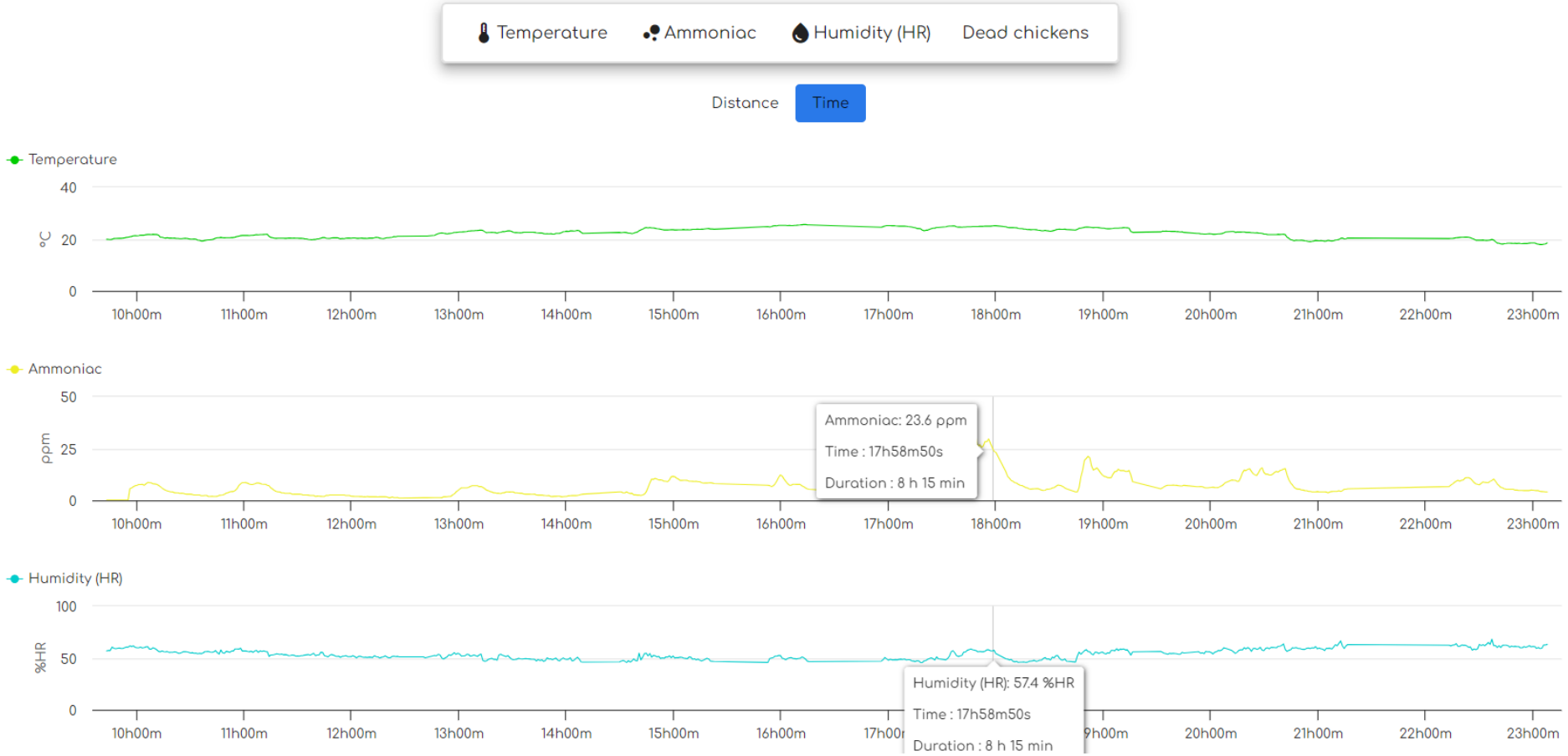




Index

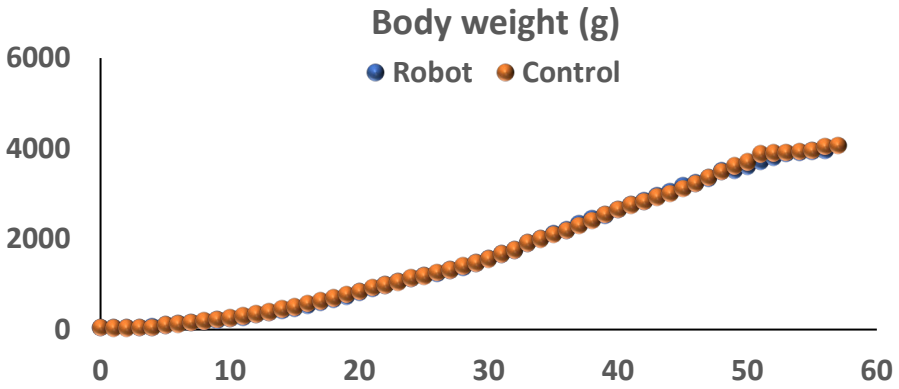


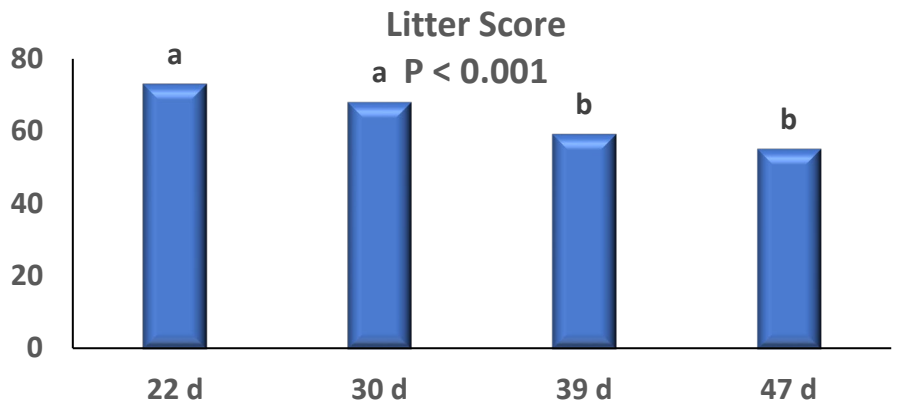
Temperature	Humidity (HR)	Ammoniac	Dead chicken
25.2 °C	57 % HR	23.6 ppm	0

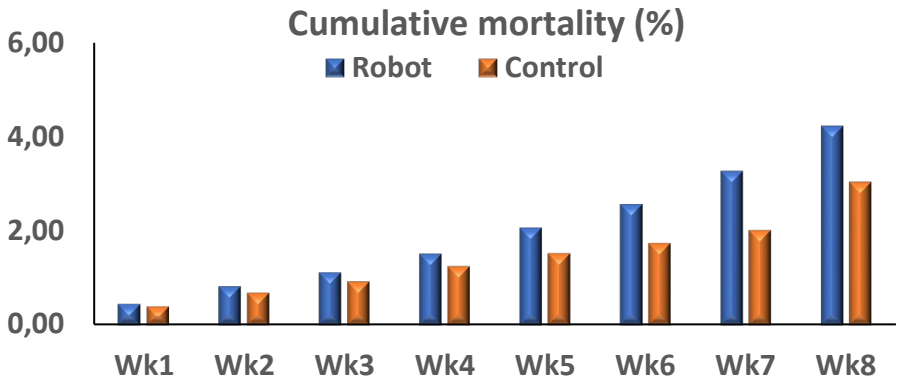


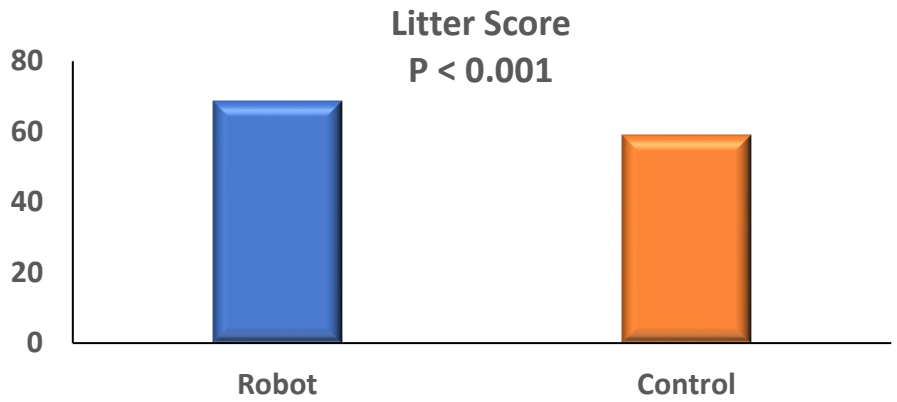
Index

Intensive Poultry Productions (UNIPD – UNIBO)









Index

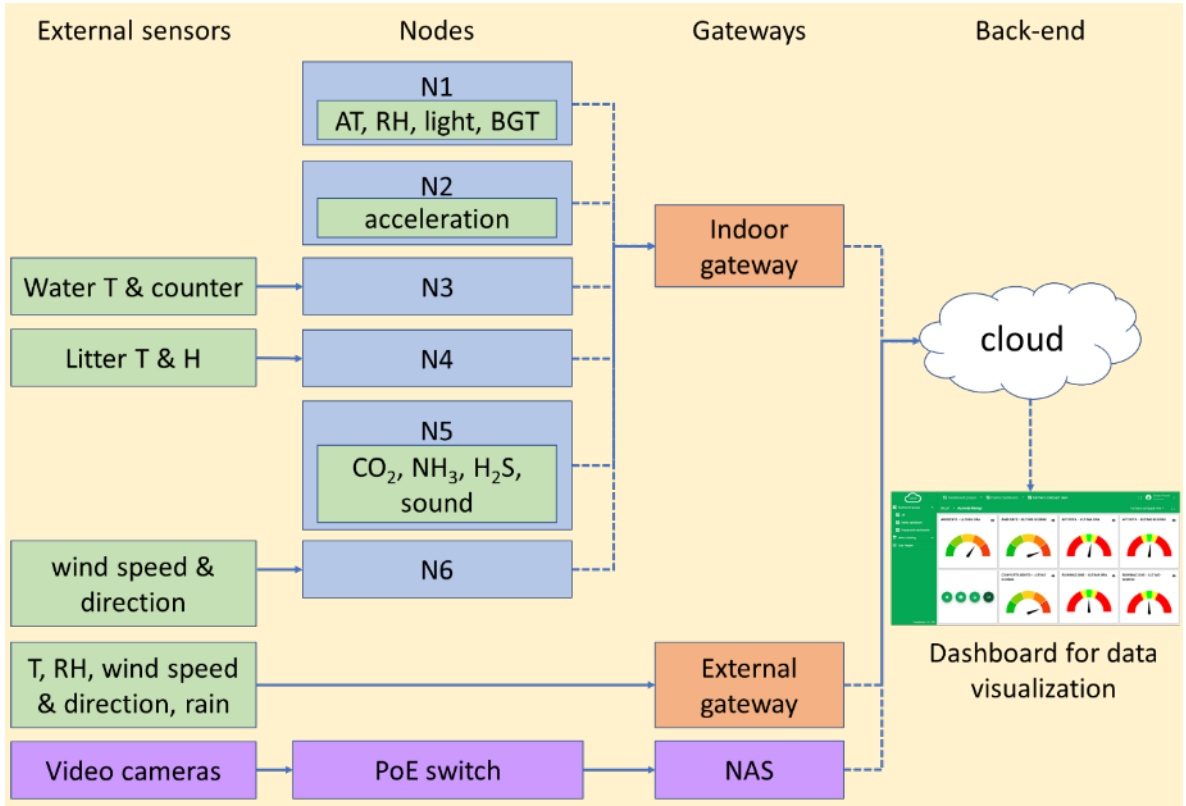
Intensive Poultry Productions (UNIPD – UNIBO)

	Group		Age		P-Value		
	Control	Robot	39 d	47 d	Group	Age	Group*Age
Dust bathing, %	0.00	0.17	0.17	0.00	0.139	0.139	0.139
Grooming, %	**4.85**	**8.46**	5.08	8.23	**0.004**	0.01	0.936
Exploring, %	**1.98**	**3.98**	3.25	2.71	**0.008**	0.433	0.101
Stretching, %	4.42	5.50	6.58	3.33	0.156	0.002	0.287
Interactions, %	0.83	1.21	0.58	1.46	0.999	0.081	0.081
Panting, %	0.00	0.75	0.75	0.00	0.069	0.069	0.069
Resting, %	94.1	92.3	92.0	94.4	0.169	0.063	0.319
Injured, n	0.63	0.75	1.00	0.38	0.900	0.185	0.416
Dirty, %	**18.00**	**9.38**	5.63	21.75	**0.036**	0.019	0.040

Index

Intensive Dairy Productions (UNIMI)

- Data integration in dairy farm and ammonia emissions estimate based on continuous environmental measurement of gas concentrations



→ Behavioural and environmental data to support farmers in the management of the herd

→ Environmental data to feed LCA

→ Concentrations of gases like ammonia to estimate emissions from the barn

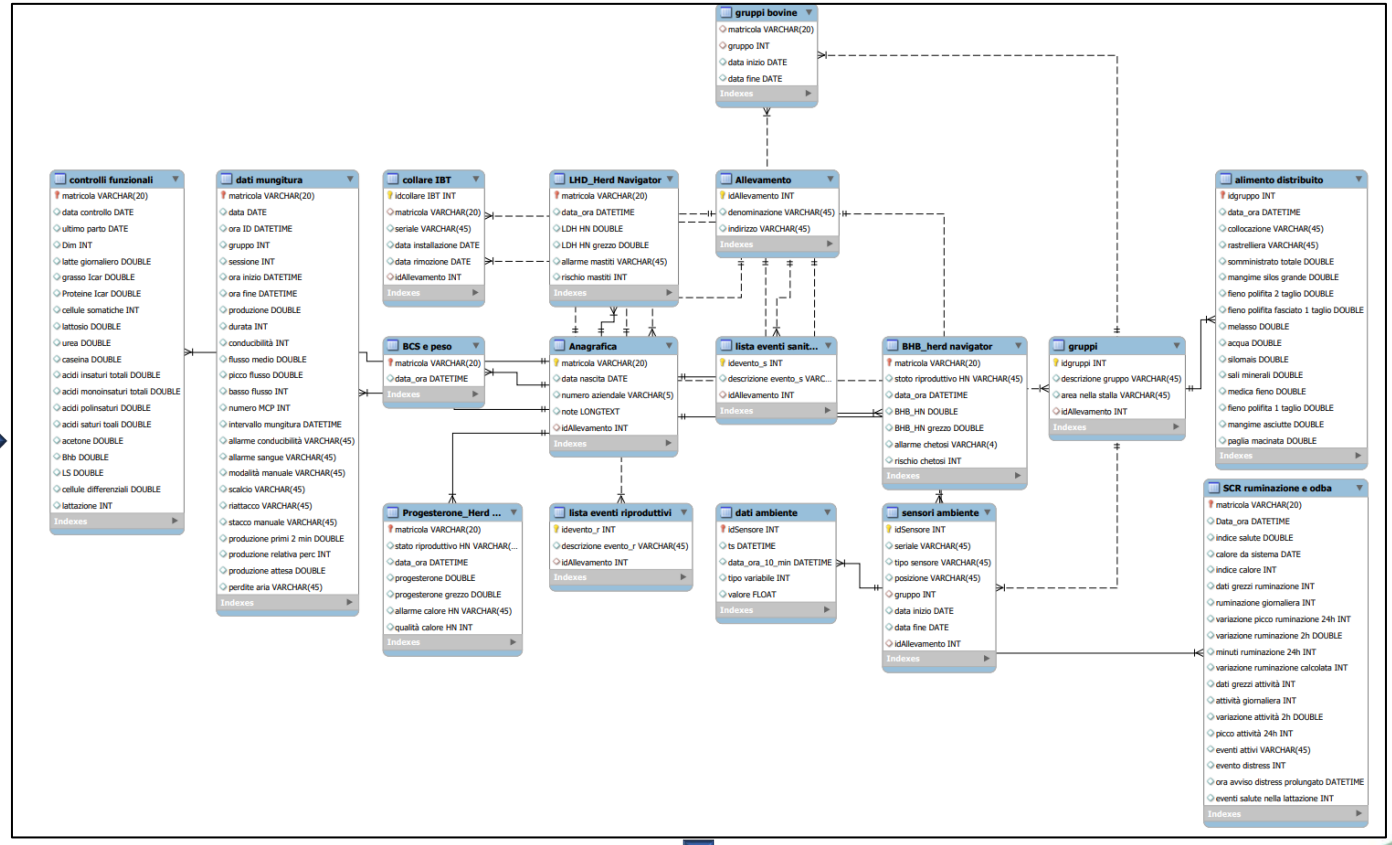
Milking parlour/robot

Wearable devices (behaviour, health)

On farm equipment (feeding systems, etc)

Farm environmental monitoring

software to make the data uniform and compatible in order to feed the database



Data processing and dashboard feeding

Index

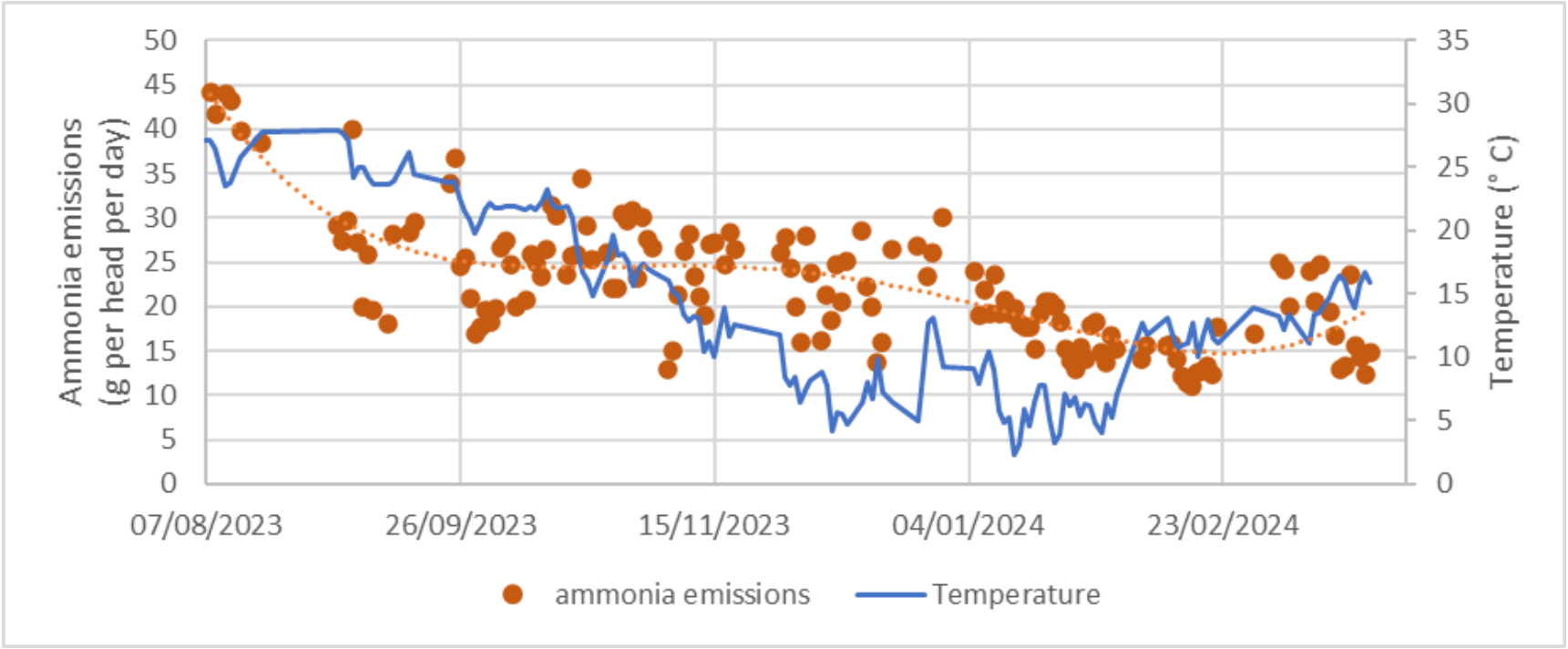
Intensive Dairy Productions (UNIMI)

- To be effectively useful for farmers, data acquired with sensors and devices must be processed and presented to the farmer showing the information they require

Index

Intensive Dairy Productions (UNIMI)

➢ Daily values of ammonia emissions and temperature in a dairy cow barn



$$E_{NH3} = P_{CO2}\ x\ \frac{[C_{NH3}]barn - [C_{NH3}]outside}{[C_{CO2}]barn - [C_{CO2}]outside}$$

Index

SOLSTICE – Potentialities and Perspectives

- ✓ The SOLSTICE network offers a reliable representation of the main livestock production chains in Italy, including dairy and meat cattle, sheep, dairy buffalo, pigs, and poultry. It encompasses diverse environmental and production conditions and involves all relevant stakeholders
- ✓ The Living Lab approach has proven to be highly effective in providing a multi-perspective analysis of priorities and solutions to enhance global sustainability across various livestock production chains
- ✓ As part of the Agritech project, the final deliverable from SOLSTICE will be a simplified LCA application to monitor the sustainability of livestock farms
- ✓ SOLSTICE is an ideal candidate for co-designing, developing, and testing innovative technologies and solutions in other ongoing and future projects aimed at improving resilience and sustainability in the livestock sector amidst a continuously changing and challenging global environment

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Thank you for your attention

Task leader: enrico.sturaro@unipd.it – marco.birolo@unipd.it

Acknowledgment

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