
# LIFE15 ENV/IT/000392 LIFE VITISOM
# sustainable management of vineyard organic fertilization to reduce GHG emissions

**Isabella Ghiglieno** [1,a], *Ilaria Minardi* [2,b], *Luca Tezza* [3], *Andrea Pitacco* [3], *Leonardo Coppo* [2], *Federico Amari* [1], *Leonardo Valenti* [1]

[1] *Department of Agricultural and Environmental Sciences-Production, Landscape, Agroenergy, University of Milan, Italy;*

[2] *West Systems, Italy; ;*

[3] *Department of Agronomy, Food, Natural resources, Animals and Environment, University of Padova, Italy;*

[a] *Present address:* **Department of Civil, Environmental, Architectural Engineering and Mathematics, Agrofood Research Hub, University of Brescia, Italy;**

*b Present address: Ecol Studio S.p.A, Italy * Corresponding author: i.ghiglieno@unibs.it*

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**Coordinator**: **Università degli studi di Milano** (DISAA)

***Project Coordinator***: Leonardo Valenti

***Project Manager***: Isabella Ghiglieno

**Partners**:

**Casella Macchine Agricole s.r.l.** (G. Alario, P. Fermi in cooperation with **Gruppo Team** G. Bertuzzi, P. Dosso, B. Platè)

**Consorzio Italbiotec** (I. Re)

**Università degli Studi di Padova** (A. Pitacco)

**West Systems s.r.l** (G. Virgili, I. Minardi)

**Università degli Studi di Milano** (L. Valenti, F. Adani, D. Pessina, S. Corsi)

**Wine-growing companies**:

**Azienda Agraria degli Azzoni Avogadro Carradori** (MC)

**Guido Berlucchi & C. SpA** (BS)

**Castello Bonomi** Tenute in Franciacorta Societa Agricola a r.l. in cooperation with **Bosco del Merlo** (VE) e **Castelvecchi**(SI)

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# OBJECTIVES

**OB1**

**Development and demonstration of Variable-rate technology (VRT) for vineyard fertilization**

Implementation of the VRT in order to improve the organic fertilization distribution systems. Construction and testing of five prototypes adapted to 5 different pilot contexts, representatives of UE vineyard variability

**OB2**

**Increase sustainability improving the vineyard soil management**

Improve the quality of vineyard soils in terms of soil structure, organic matter content and biodiversity, monitoring different environmental and socio-economic aspects.

**DURATION:**

**Start** 01/07/2016 - **End:** 31/12/2019

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# ACTION C1: Monitoring of impacts

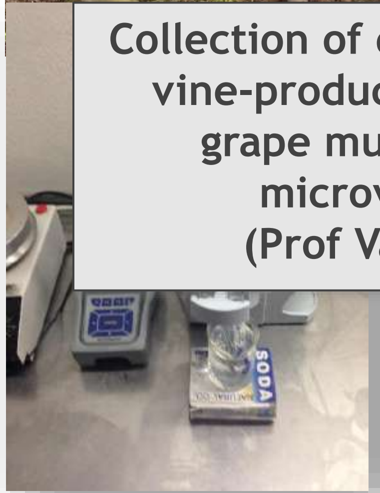
**Chemical analysis of soils**
***(Prof Adani UNIMI)***

**Analysis of Biological Quality of soils (QBS-Ar)**
***(Sata Studio Agronomico)***

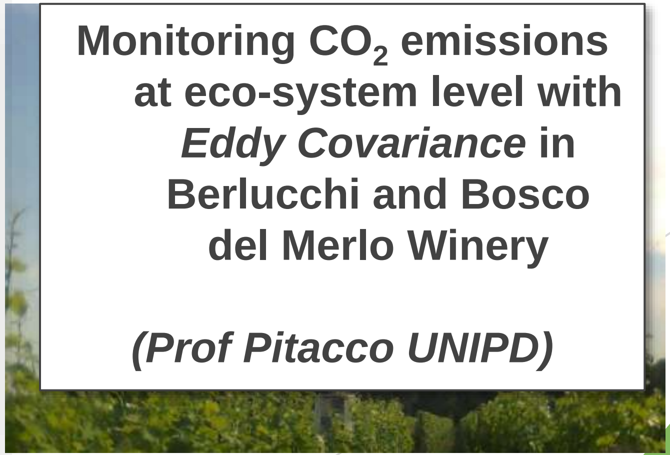
**Monitoring GHGs soil emissions in order to compare the different soil management, using IPNOA prototypes**

***WEST SYSTEMS SRL***

IPNOA
Improved flux Prototypes for $N_2O$ emission from Agriculture



Collection of data regarding both vine-productive parameters, grape musts quality and microvinifications
(Prof Valenti UNIMI)



**Monitoring $CO_2$ emissions at eco-system level with *Eddy Covariance* in Berlucchi and Bosco del Merlo Winery**

***(Prof Pitacco UNIPD)***

# Why Nitrous Oxide (N2O)

- One of the most important aspects in terms of environmental impact to be considered in the supply of organic and mineral fertilizers is the dispersion of Nitrous Oxide ($N_2O$) in the atmosphere;

- $N_2O$ has a Global Warming Potential (GWP) value, very high and equal to 265 (IPCC, 2014);

- It is estimated that about 1.975% of the nitrogen distributed through mineral fertilizer is dispersed in the form of this gas (Georget, 2009);

- $N_2O$ emissions are very variable depending on the environmental conditions (temperature and humidity), on the type of soil (availability of organic matter, pH, level of compaction and texture) and of the fertilizer distributed (Patak, 1999)

# Spatial monitoring of GHG


Mobile instrumentation, developed as part of a previous LIFE+ IPNOA project (LIFE11 ENV / IT / 000302), which consists of an electric tracked vehicle on which the analyzers of carbon dioxide, nitrous oxide, methane and carbon monoxide. The flows emitted from the soil are quantified using the methodology of the non-stationary static accumulation chamber

# Spatial monitoring experimental plan

| Type of organic fertilizer | Treatment | Location |
|---|---|---|
| **NT** | No-tillage | All |
| **NT** | Tillage | All |
| **Compost** | No-incorporation | All |
| **Compost** | Incorporation | All |
| **Solid fraction of digestate** | No-incorporation | All |
| **Solid fraction of digestate** | Incorporation | All |
| **Manure** | No-incorporation | All |
| **Manure** | Incorporation | All |
| **Urea** | No-incorporation | Bosco del Merlo |
| **Urea** | Incorporation | Bosco del Merlo |

# Sampling sites

# 4500 GHG measurements during LIFE15 ENV/IT/000392 - VITISOM LIFE

| SITE | 2017 | | | | 2018 | | | | 2019 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N. campaign | Month | Measurement/month | Measurement/year | N. campaign | Month | Measurement/month | Measurement/year | N. campaign | Month | Measurement/month | Measurement/year |
| CSV | 3 | January | 69 | 325 | 3 | June | 128 | 384 | 1 | April | 128 | 128 |
| | | March | 128 | | | September | 128 | | | | | |
| | | July | 128 | | | December | 128 | | | | | |
| CBON | 5 | January | 80 | 554 | 3 | May | 119 | 369 | - | | | - |
| | | March | 116 | | | August | 125 | | | | | |
| | | June | 120 | | | October | 125 | | | | | |
| | | September | 119 | | | | | | | | | |
| | | October | 119 | | | | | | | | | |
| BER | 4 | January | 101 | 485 | 2 | May | 127 | 271 | 1 | July | 133 | 133 |
| | | March | 128 | | | August | 144 | | | | | |
| | | June | 128 | | | | | | | | | |
| | | September | 128 | | | | | | | | | |
| CDA | 3 | March | 128 | 385 | 2 | May | 128 | 256 | 2 | March | 22 | 150 |
| | | June | 128 | | | July | 128 | | | July | 128 | |
| | | October | 129 | | | | | | | | | |
| BDM | 5 | January | 91 | 677 | 3 | May | 175 | 502 | - | | | - |
| | | March | 118 | | | July | 156 | | | | | |
| | | April | 156 | | | October | 171 | | | | | |
| | | June | 156 | | | | | | | | | |
| | | September | 156 | | | | | | | | | |

# Spatial monitoring - Main results

Incorporation (yellow highlight):

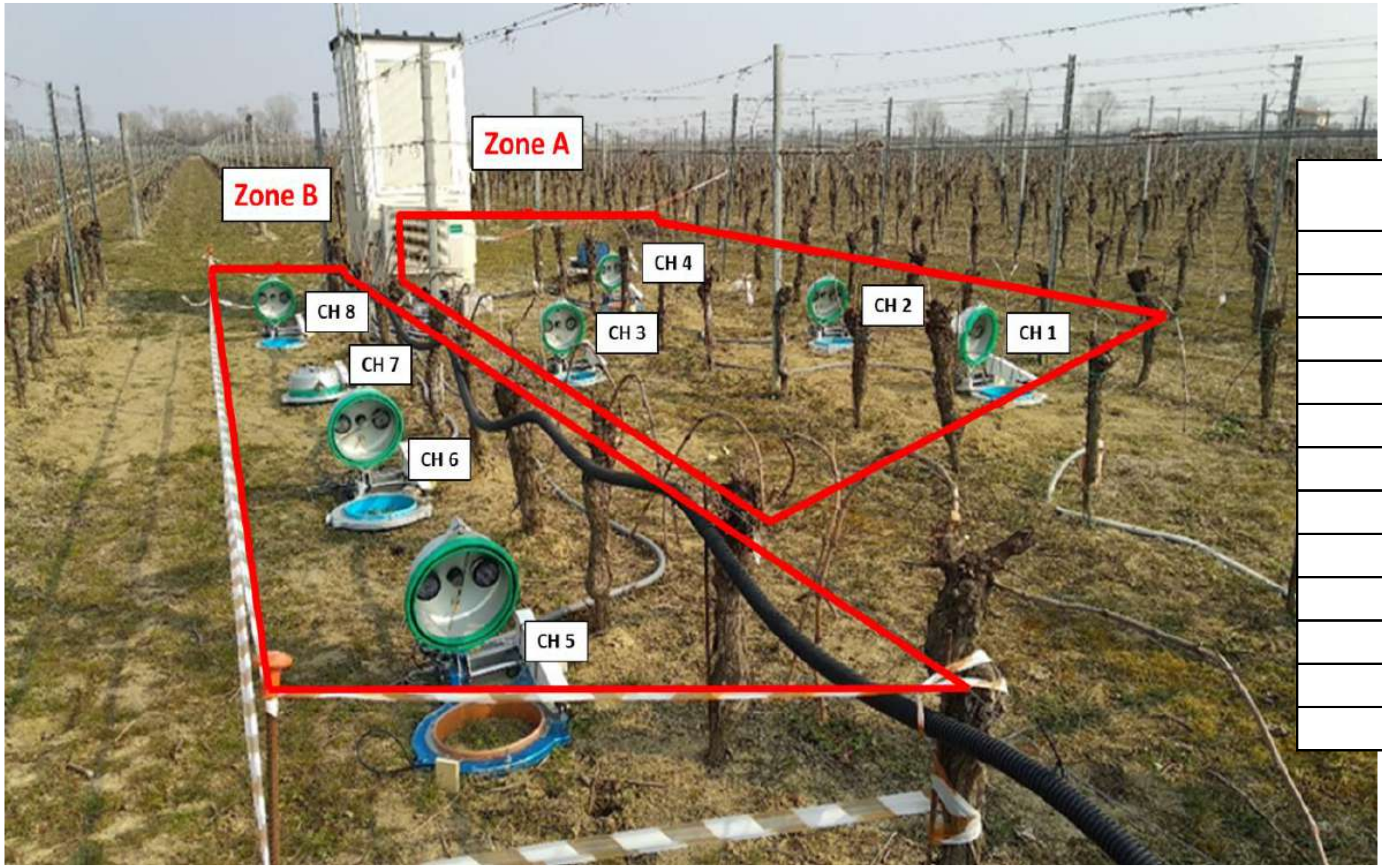
- The emissions in the incorporated plots are generally, but not always, higher

Type of fertilizer (red text):

- Castelvecchi: the highest emission factor is that of incorporated digestate
- Bosco del Merlo: the higher coefficient is associated with not incorporated compost
- Bonomi: the highest emission factor is that of digestate incorporated
- Berlucchi: the highest emission factor is that of digestate not incorporated
- Conte degli Azzoni: very high emission factor for digestate which differs from the average of the other observations

| | FE [mg $N_2O$/gr N giorno] | | | | |
|---|---|---|---|---|---|
| | Castelvecchi | Bosco del Merlo | Bonomi | Berlucchi | Conti degli Azzoni |
| CL | 0,00042 | 0.084 | 0.029 | 0.053 | 0.060 |
| CNL | 0.015 | 0.176 | 0.032 | 0.027 | 0.083 |
| DL | 0.043 | 0.121 | 0.057 | 0.064 | 0.319 |
| DNL | 0.028 | 0.098 | 0.024 | 0.135 | 0.229 |
| LL | 0.037 | 0.149 | 0.018 | 0.063 | 0.077 |
| LNL | 0.028 | 0.029 | 0.048 | 0.050 | 0.031 |

# Continuous monitoring of GHG

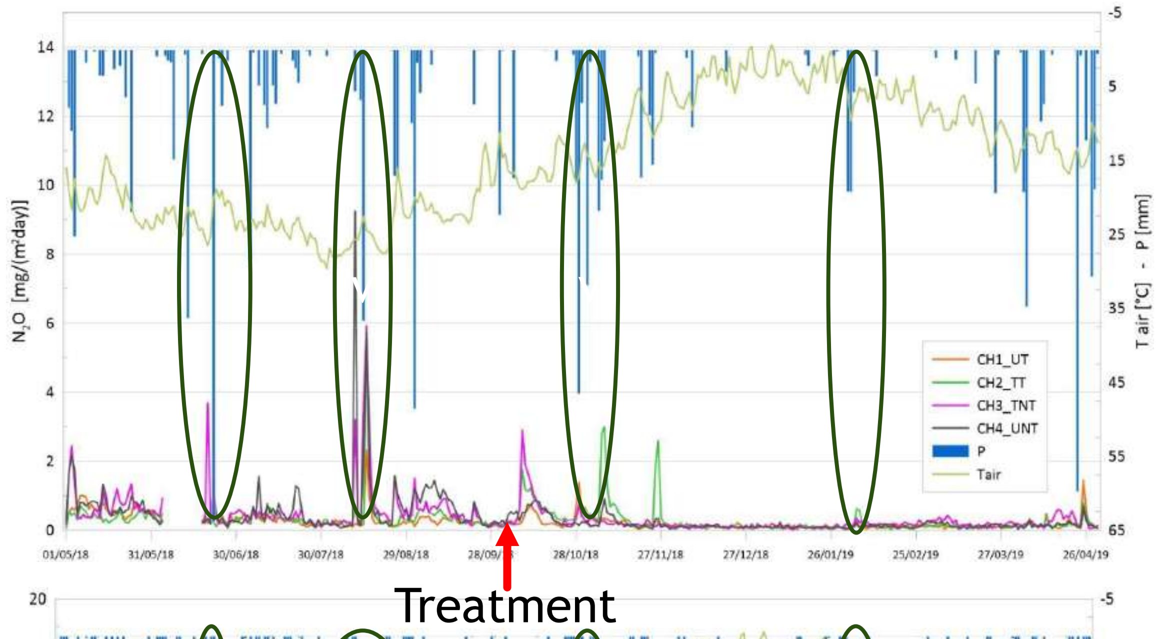


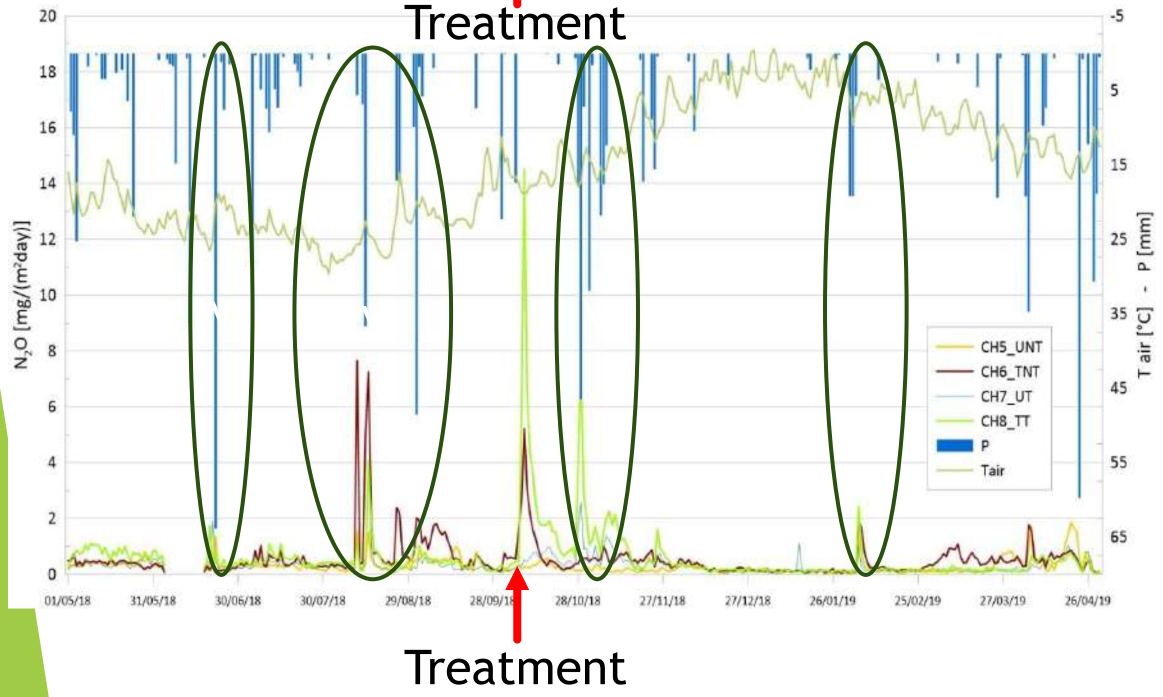

| Period | Measurements per Chamber |
|---|---|
| November -Decembre 2017 | 732 |
| January – February 2018 | 622 |
| March – April 2018 | 732 |
| May – June 2018 | 556 |
| July – August 2018 | 744 |
| September – October 2018 | 740 |
| November – December 2018 | 732 |
| January – February 2019 | 708 |
| March – April 2019 | 732 |
| till 17° May 2019 | 196 |
| **Toatal per Chamber** | **6494** |
| **Total measurements** | **51952** |

| Zona A | Zona B | Treatment |
|---|---|---|
| CH4 | CH5 | UNT (no fertilisation + no tillage) |
| CH1 | CH7 | UT (no fertilisation + tillage) |
| CH3 | CH6 | TNT (compost + no incorporation) |
| CH2 | CH8 | TT (compost + incorporation) |

Multi-chamber system developed during the IPNOA project (LIFE+ IPNOA, LIFE11 ENV/IT/000302), methodology of automated closed dynamic accumulation chamber (a non-steady-state through-flow system

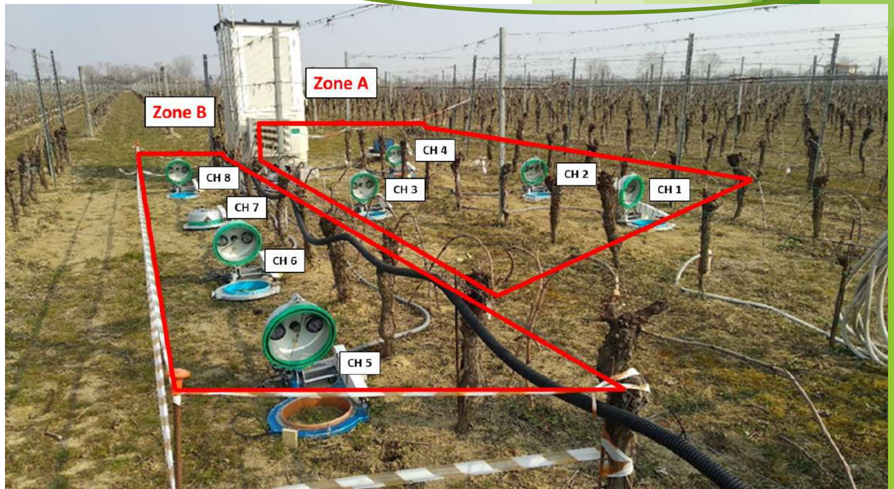
# Continuous monitoring of $N_2O$ - Main results




| Zone | Treatment | g $N_2O$ $m^{-2}$ $year^{-1}$ | g $N_2O$ - N $m^{-2}$ $year^{-1}$ | EF (g $N_2O$ - N g $N^{-1}$) |
|---|---|---|---|---|
| Zone A | Ch 3 _TNT | 0.136 | 0.087 | 0.005 |
| Zone A | Ch 2 _TT | 0.109 | 0.070 | 0.004 |
| Zone B | Ch 6 _TNT | 0.190 | 0.121 | 0.007 |
| Zone B | Ch 8 _TT | 0.217 | 0.139 | 0.008 |

| Zone | Treatment | g $N_2O$ $m^{-2}$ $year^{-1}$ | g $N_2O$ - N $m^{-2}$ $year^{-1}$ | EF (g $N_2O$ - N g $N^{-1}$) |
|---|---|---|---|---|
| Zone A | TNT Ch3- UNT Ch4 | 0.005 | 0.0032 | 0.0002 |
| Zone A | TT Ch2- UT Ch1 | 0.024 | 0.0153 | 0.0009 |
| Zone B | TNT Ch6 - UNT Ch5 | 0.086 | 0.0547 | 0.0031 |
| Zone B | TT Ch8 - UT Ch7 | 0.103 | 0.0658 | 0.0037 |



# Main conclusions

- Spatial $N_2O$ monitoring:
  - a tendency can be observed in the emission factors to increase in the case of incorporation of fertilizers and in case of the use of digestate;
  - a non-negligible variability is observed between one site and another;
  - investigate more deeply about the possible interactions between the meteorological and pedological conditions of each site and the results obtained.
- Continuous $N_2O$ monitoring:
  - a relationship between meteorology and $N_2O$ emissions: emissions peak was observed, both in treated and untreated sites, in correspondence of heavy rainfall events through the entire year;
  - the $N_2O$ EF has been calculated according to the IPCC procedure, both considering the emissions due to soil and fertilizer, and excluding the background contribution from the soil;
  - considering Emission Factor for N2O emissions related only to fertilizer application, excluding the background contribution from the soil, an effect of fertilizer incorporation can be observed;
  - the maximum $N_2O$ fluxes are measured in fertilizer plots, where high emissions occurred during the first 6-7 days after treatment, followed by a decrease in $N_2O$ fluxes;
  - the area (Zone B) with a major content of carbon and nitrogen in the soil shows a greater emission peak related to the fertilization, both for tilled and not tilled plots.

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# Thank you for your attention

**Isabella Ghiglieno**
**Univerity of Brescia - DICATAM - Agrofood Research Hub**

- **The LIFE website and the new LIFE programming period 2021-2027**

https://cinea.ec.europa.eu/life_en

- **The new LIFE call for proposals 2022**

https://cinea.ec.europa.eu/life/life-calls-proposals_en

- **Access to the LIFE project database**

https://webgate.ec.europa.eu/life/publicWebsite/search

- **The new LIFEis30 website**

https://www.lifeis30.eu/

- **Get in touch with your National Contact Points**

https://cinea.ec.europa.eu/programmes/life/about-life/life-contacts/european-national-contact-points_en

30 years of bringing green ideas to LIFE

# Thank You!!!

Contact us here: cinea-life-enquiries@ec.europa.eu

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