GHG emissions and C sequestration in Mediterranean croplands: available information and gaps. (Preliminary results)

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GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN
Ciemat
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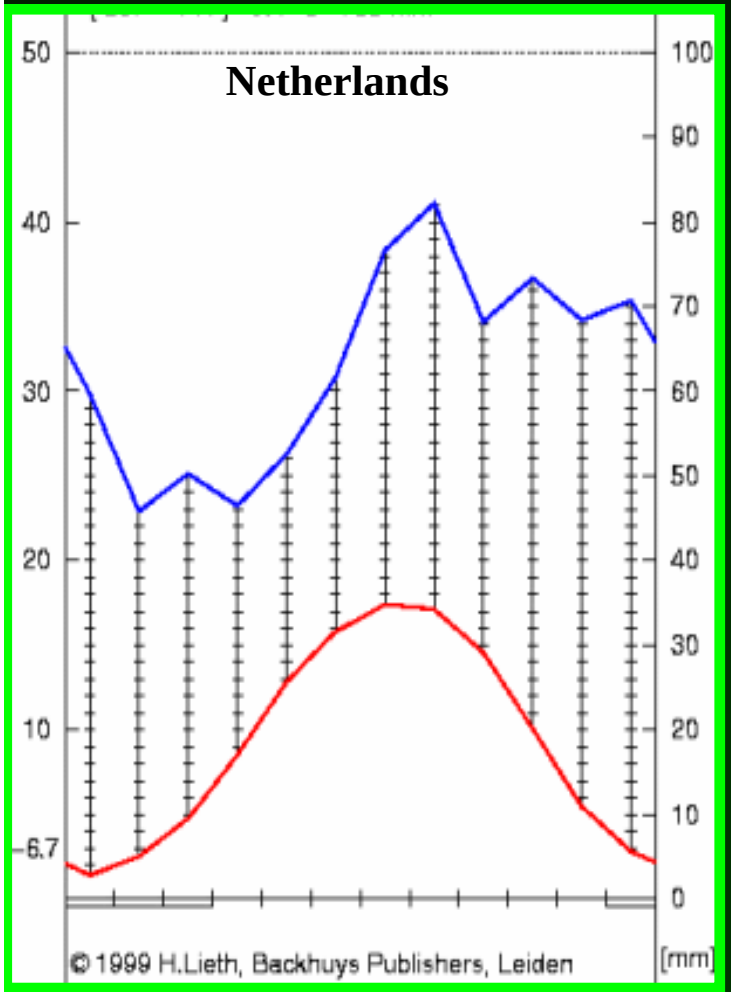
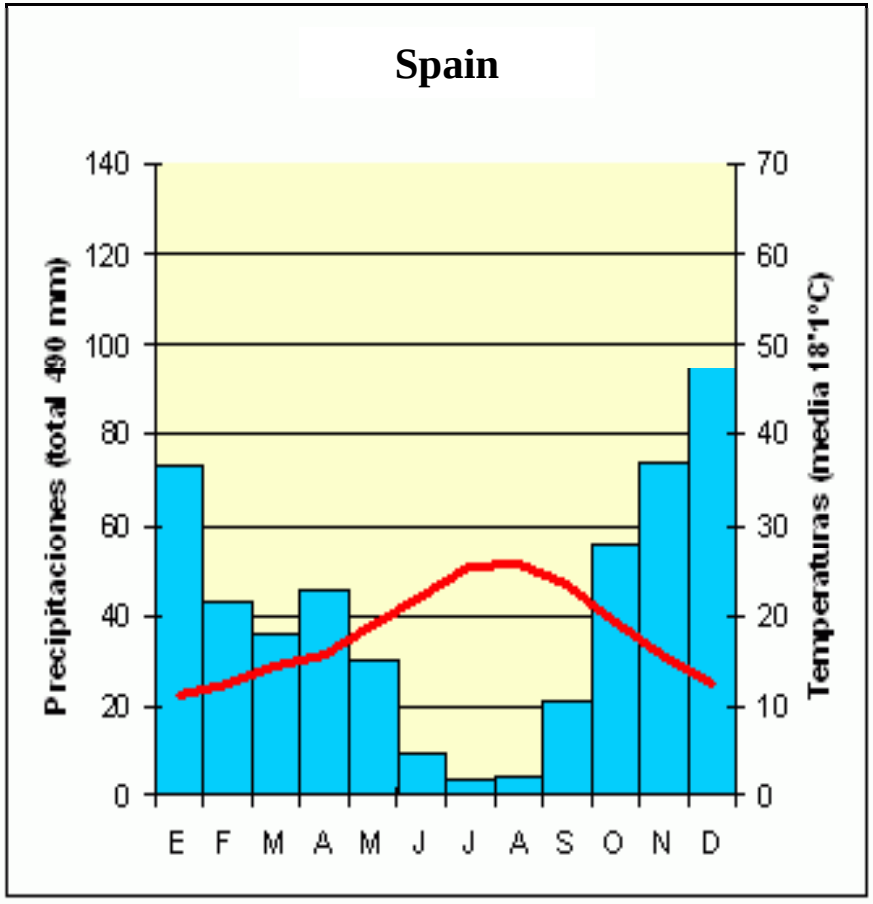
VNIVERSITAS COMPLVTENSIS MATRITENSIS

Mediterranean characteristics

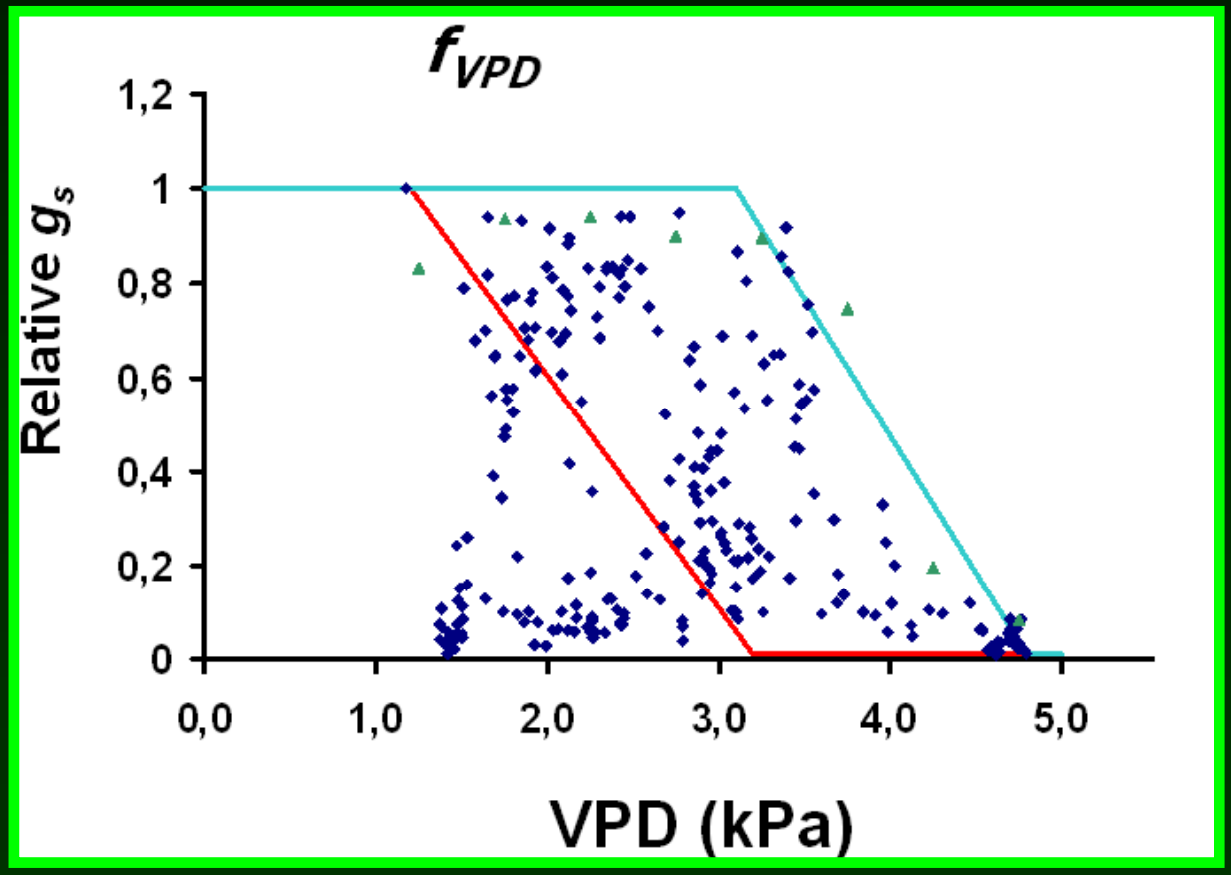
Temperate



Mediterranean

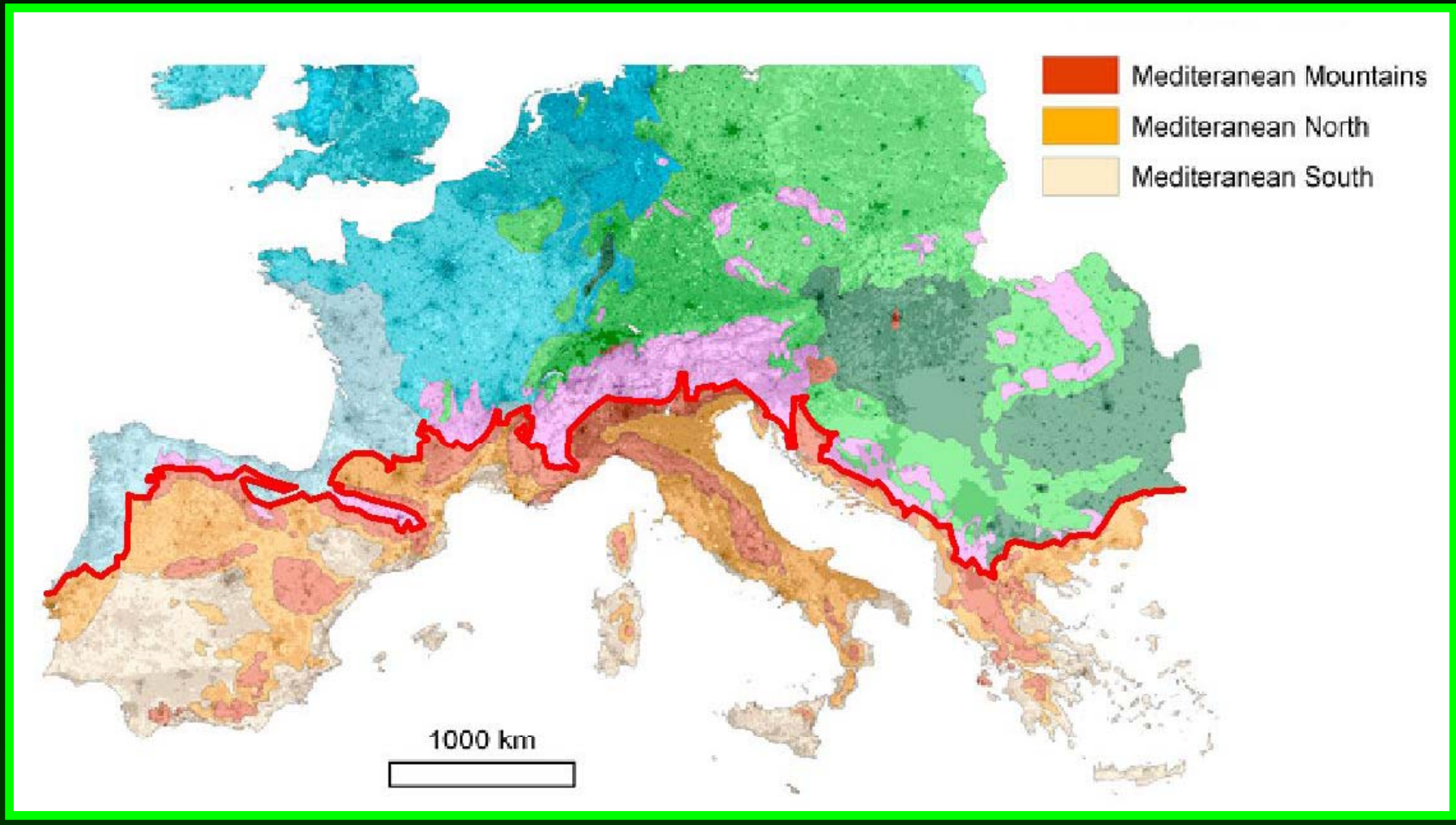


Mediterranean characteristics



González-Fernández et al. (2010)

Mediterranean climate in Europe



Metzer et al. 2010

Objective

The main objective is to review all the information and to summarize the main available data on the peer reviewed literature related to GHG emission and C sequestration in Mediterranean cropping systems, with a special focus on the comparison between organic and conventional management systems

LLC1

Methods

Review of the scientific literature (peer review) on the following subjects:

1) N_2O emission papers;

2) C sequestration papers (which measure soil carbon)

3) Integrated papers (which study more than one gas emitted from soil)

4) Indirect emission papers (fossil fuel)

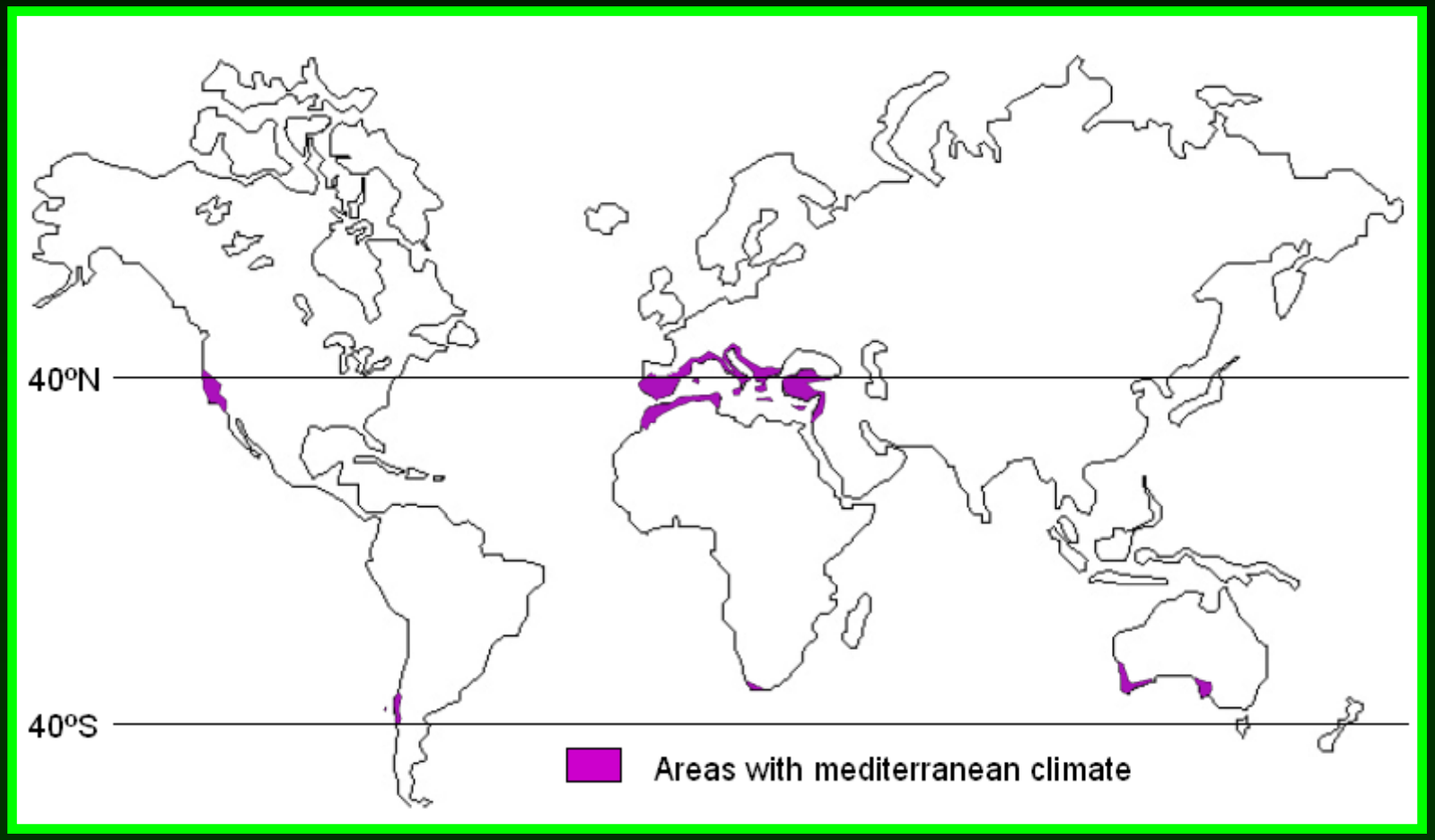
5) CH_4 emission papers.

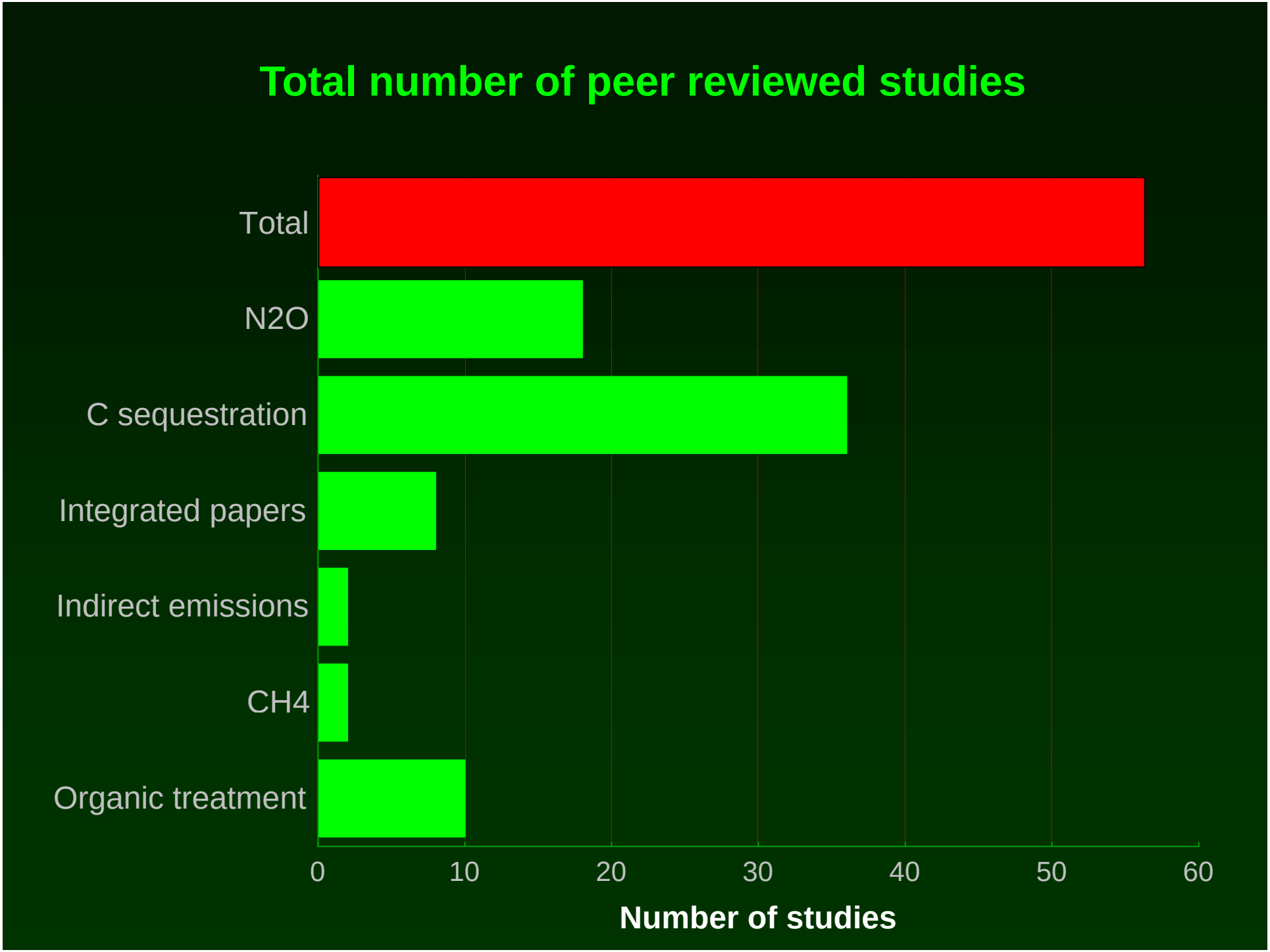
No articles on emissions from livestock farming have been found

Folie 6

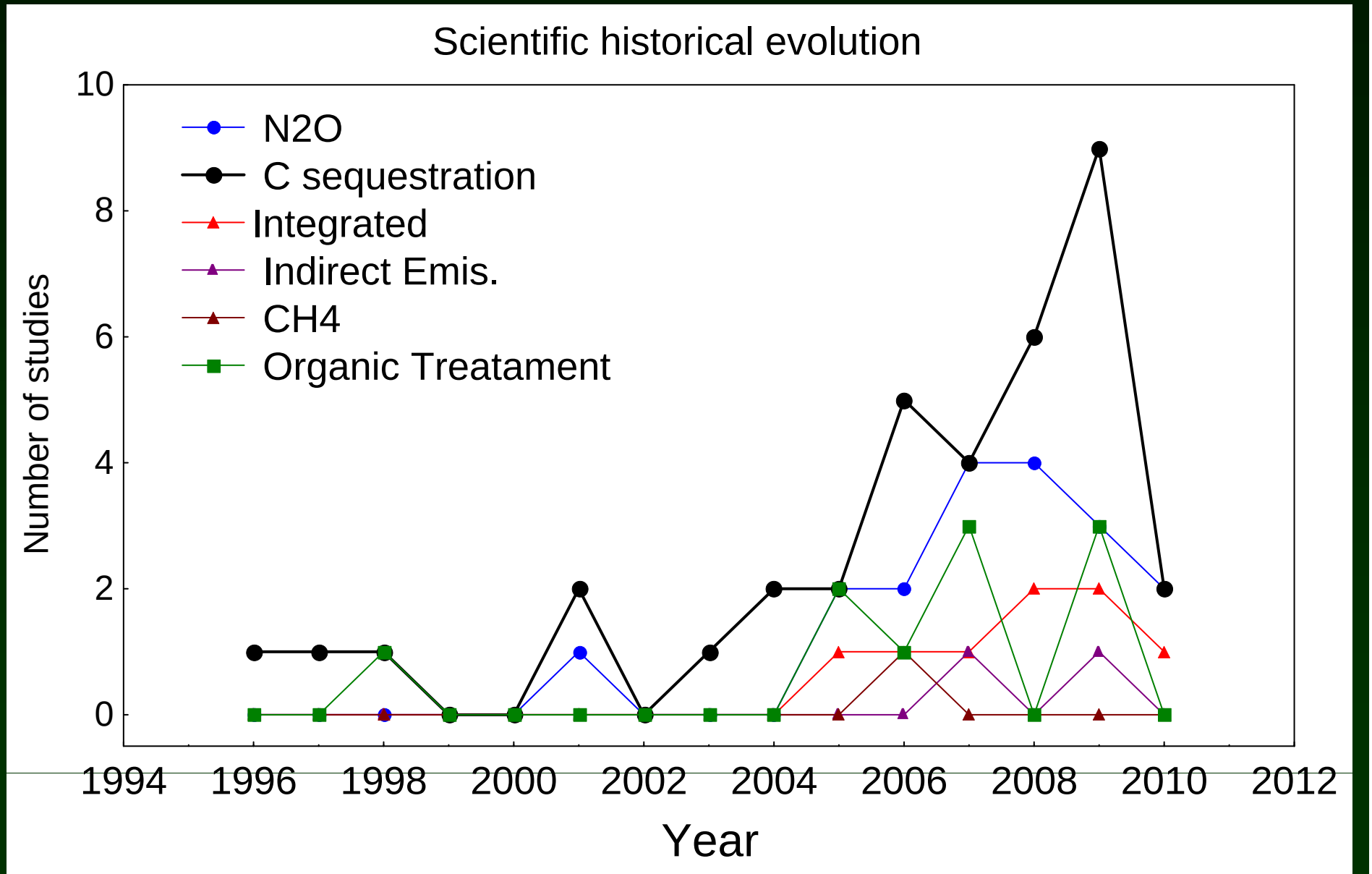
LLC1 Incluir comentario sobre periodo
Decir que algunos artículo solo dan soil carbon concentration as percentaje of soil mass
LLC; 05.05.2010

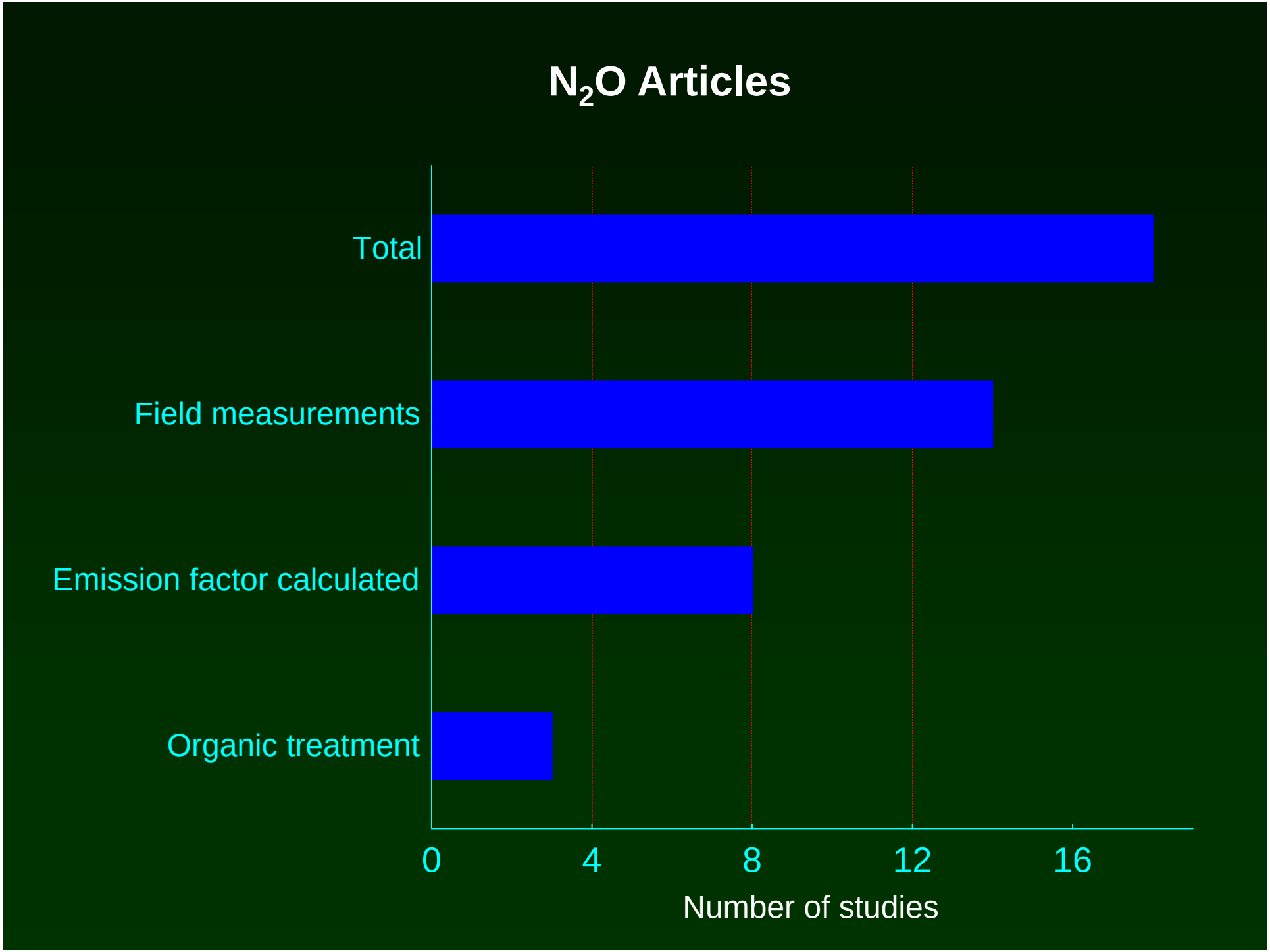
Mediterranean climate in the world

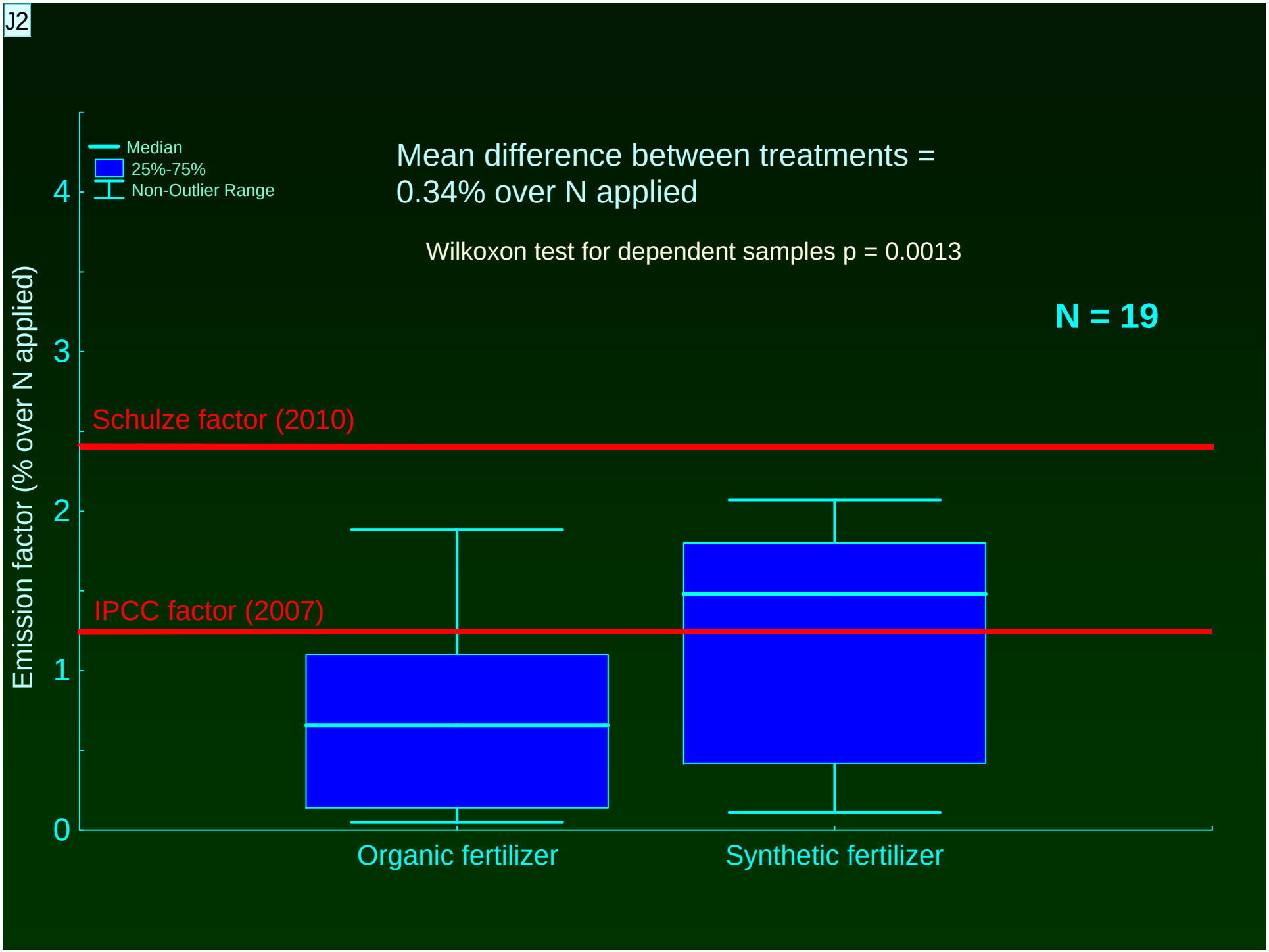



Total number of peer reviewed studies
Total
N2O
C sequestration
Integrated papers
Indirect emissions
CH4
Organic treatment
0
10
20
30
40
50
60
Number of studies

Historical evolution of publication

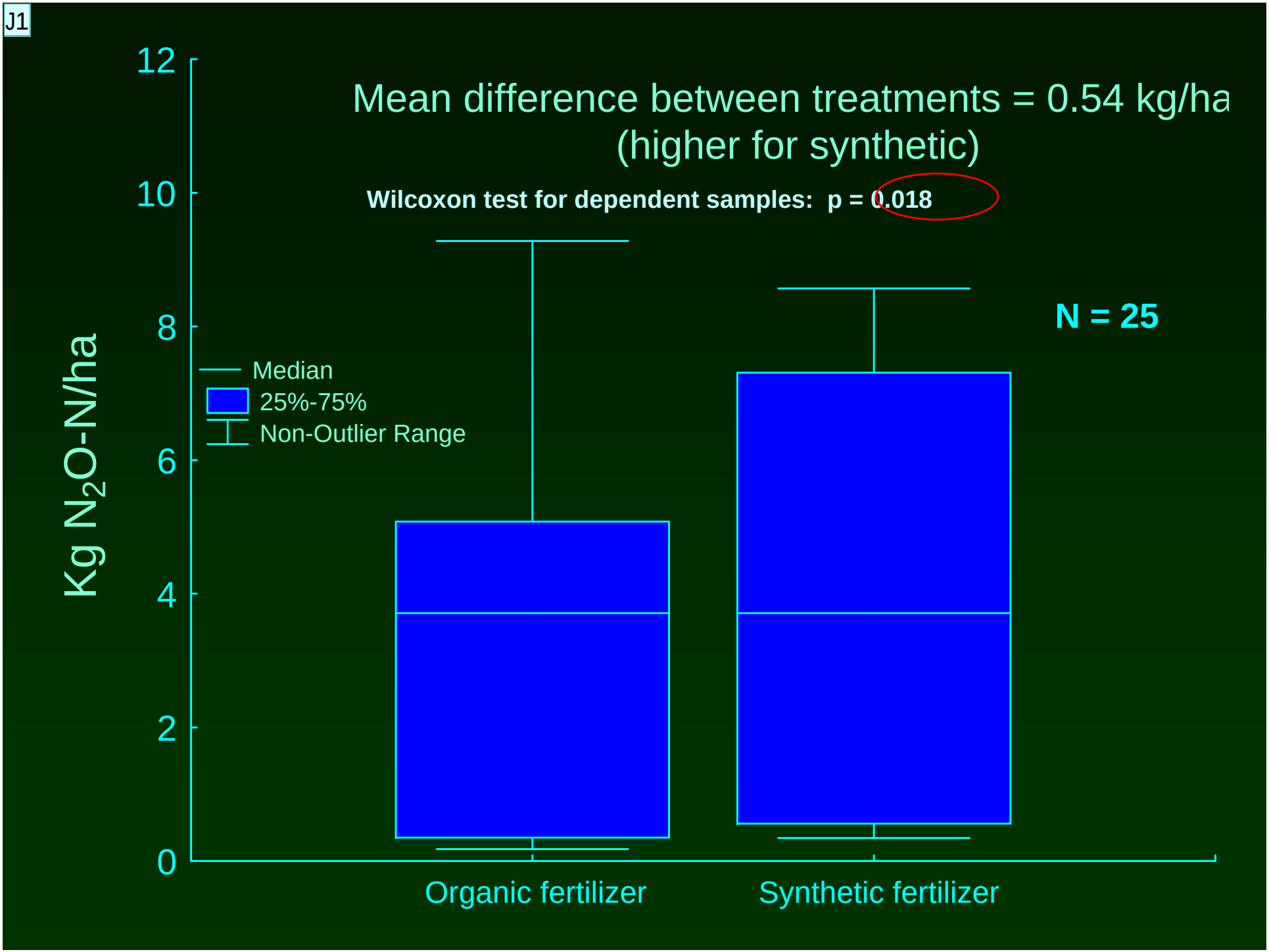



N_2O Articles
Total
Field measurements
Emission factor calculated
Organic treatment
0
4
8
12
16
Number of studies


J2
Median
25%-75%
Non-Outlier Range
Mean difference between treatments =
0.34% over N applied
Wilkoxon test for dependent samples p = 0.0013
N = 19
Emission factor (% over N applied)
4
3
2
1
0
Schulze factor (2010)
IPCC factor (2007)
Organic fertilizer
Synthetic fertilizer

J2 Todos riego menos unos

J; 06.05.2010


J1
Mean difference between treatments = 0.54 kg/ha
(higher for synthetic)
Wilcoxon test for dependent samples: p = 0.018
N = 25
Kg N2O-N/ha
12
10
8
6
4
2
0
Median
25%-75%
Non-Outlier Range
Organic fertilizer
Synthetic fertilizer

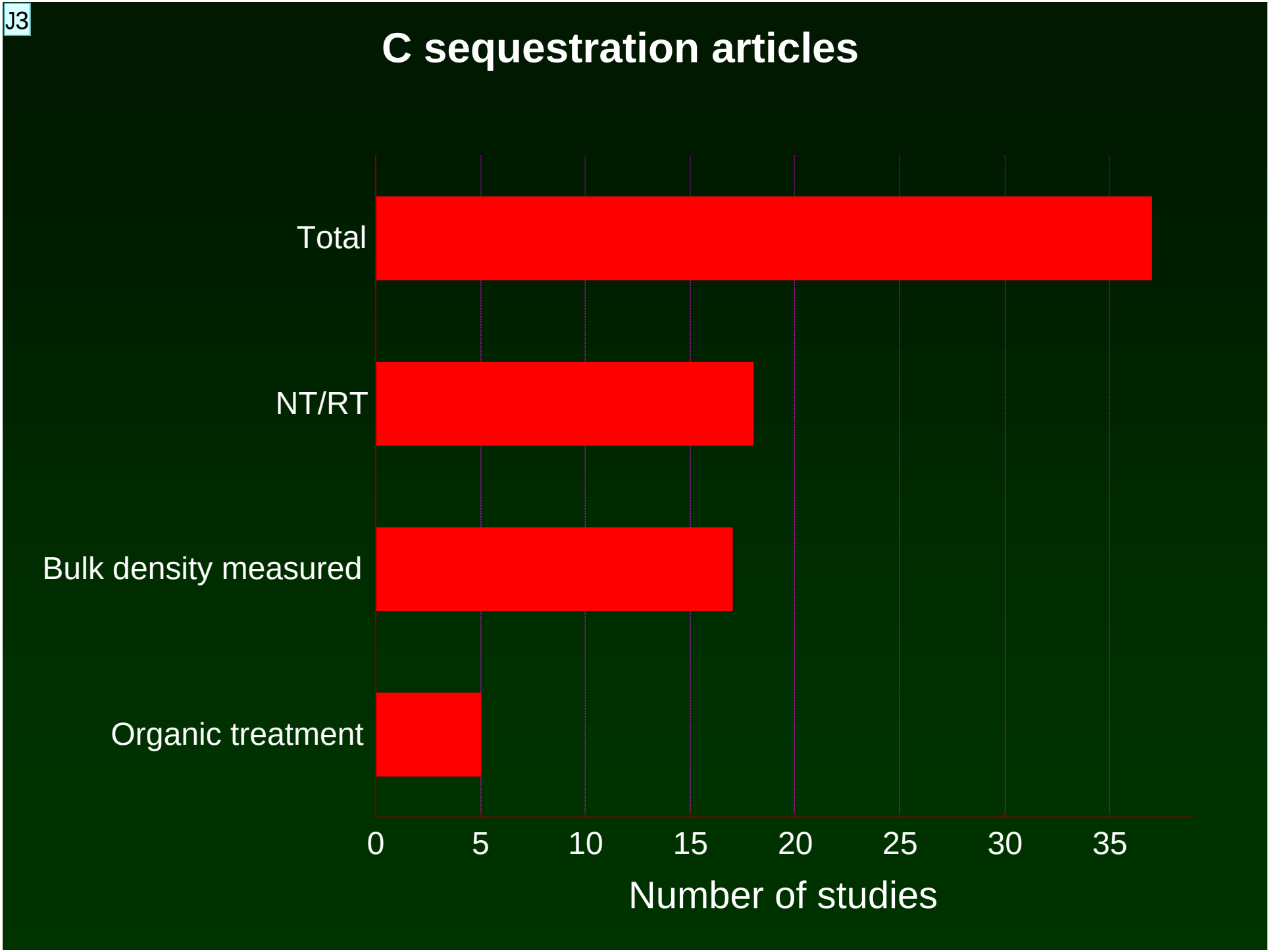
J1 El 80% de los casos emiten más los sintéticos

J; 06.05.2010

Main detected problems for N_2O emission assessment

1. Sampling period usually limited to crop growth season
2. Organic input does non mean organic management
3. No upstream emission data
4. Emission factor not always calculated.
5. Some difficulties to unify information
6. Absence of information on important crops

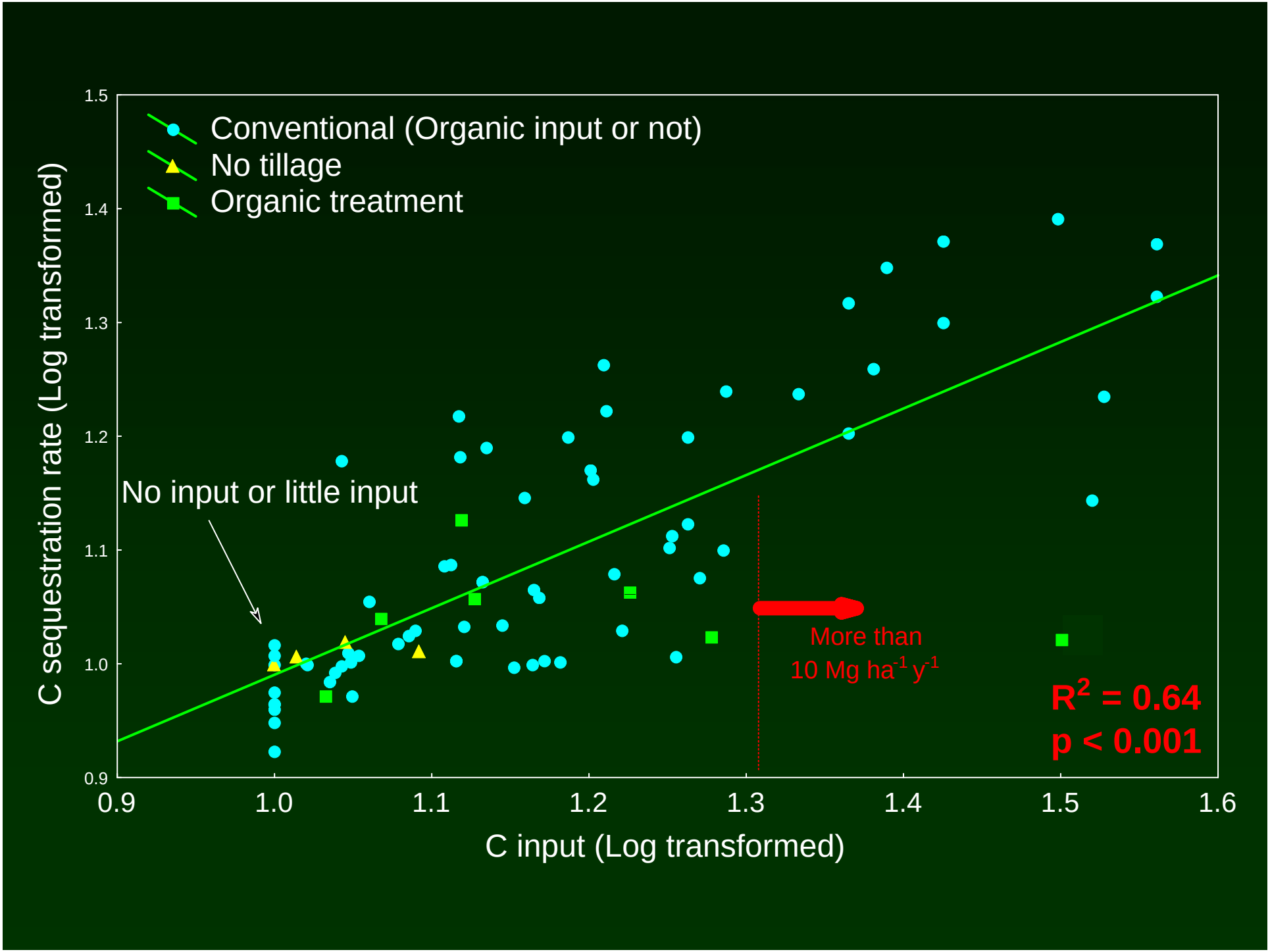
J3

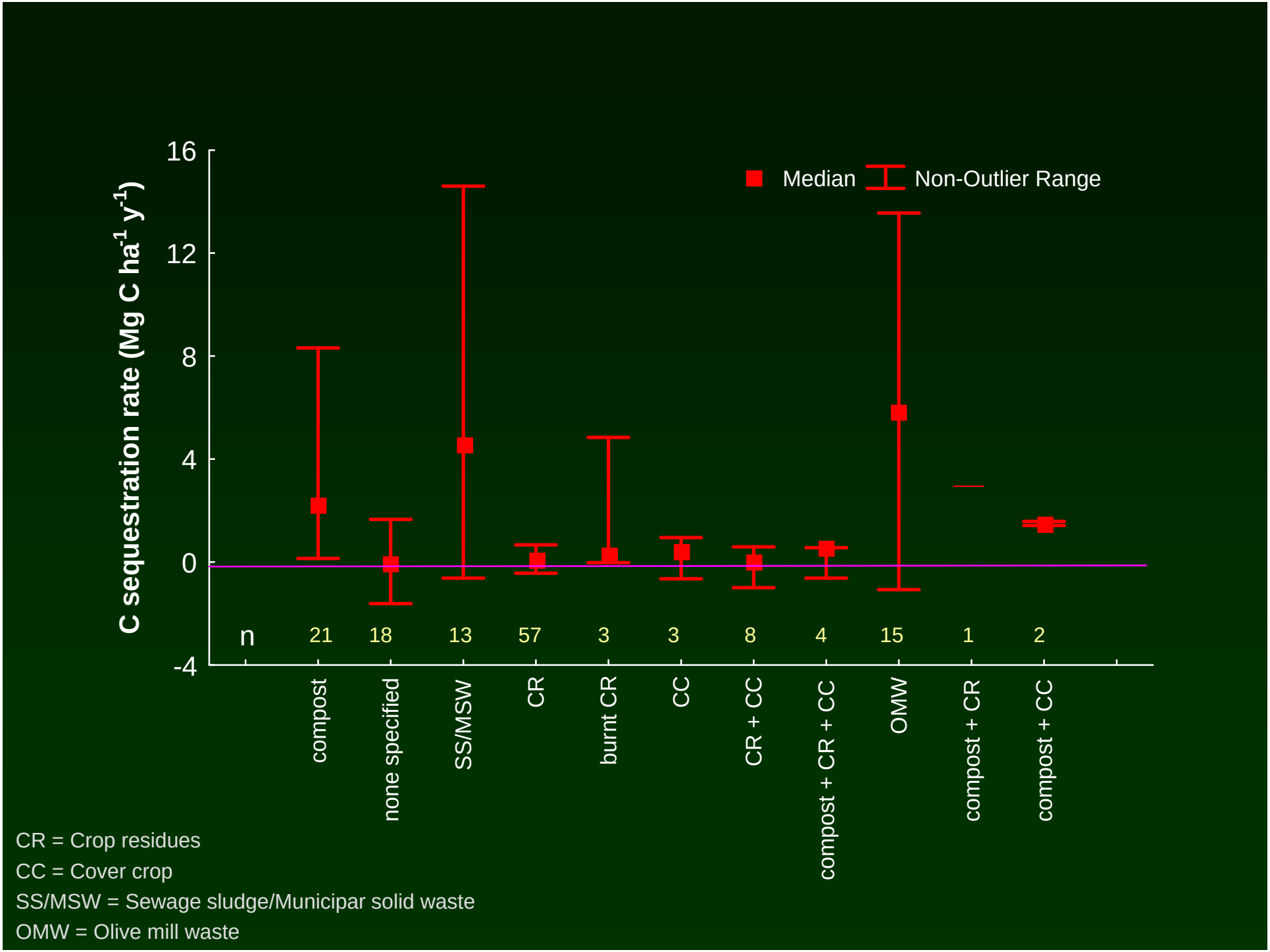

C sequestration articles
Total
NT/RT
Bulk density measured
Organic treatment
0
5
10
15
20
25
30
35
Number of studies

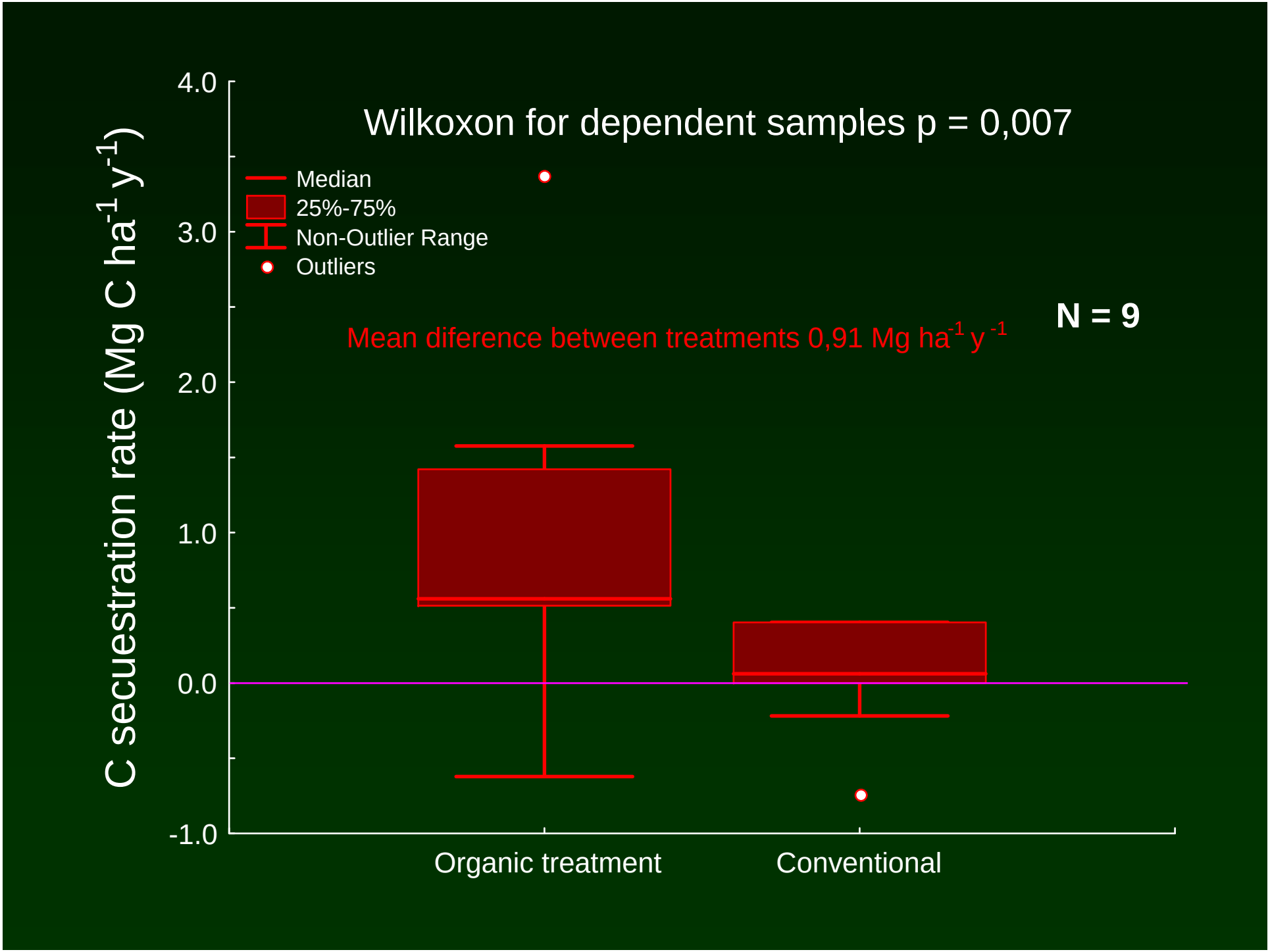
J3

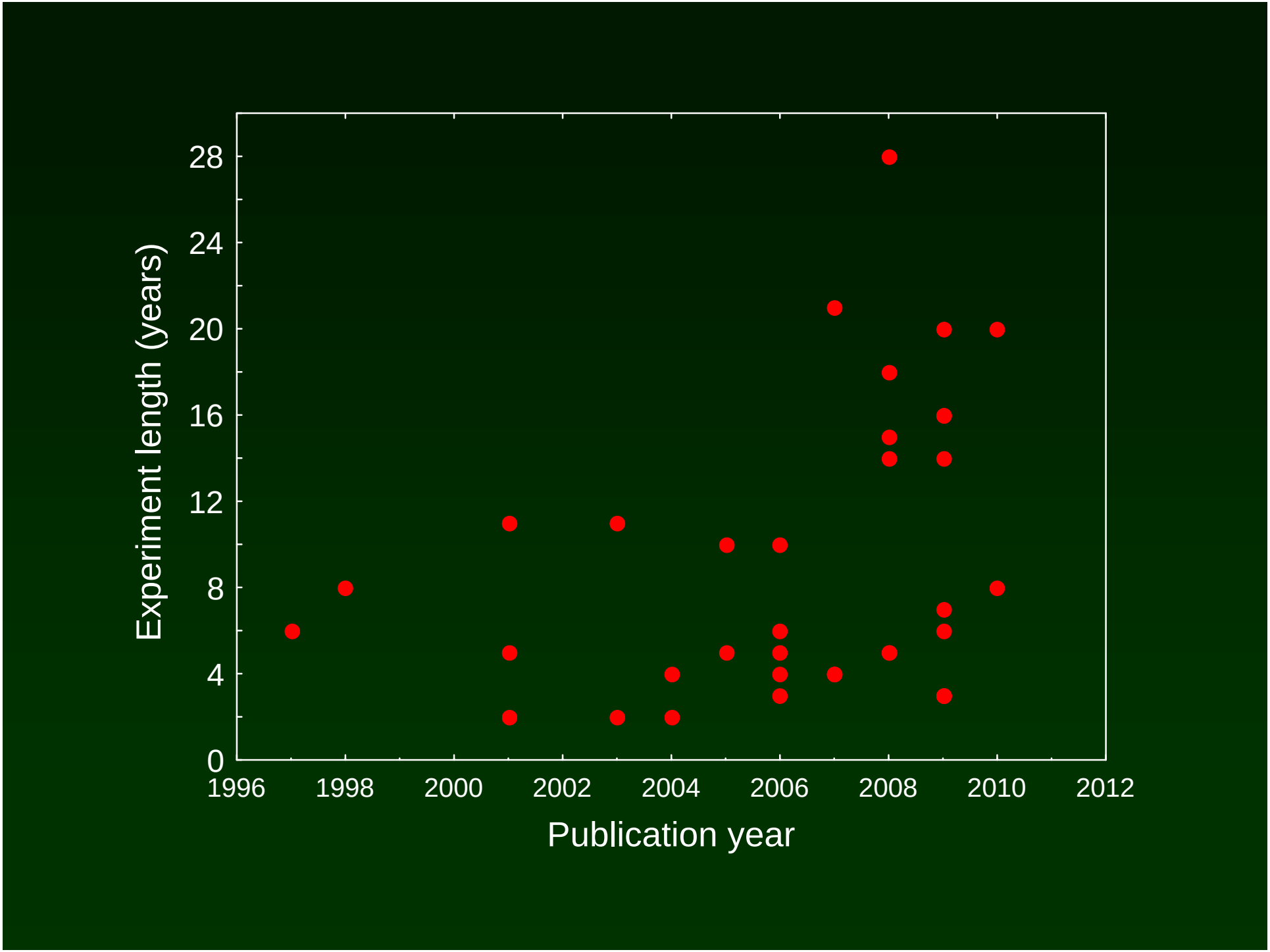
Los que dan el Input completo solamente 2
Calculada la tasa 11

Soil carbon concentration expressed as % of the soil mass o rin concentration
J; 06.05.2010


Conventional (Organic input or not)
No tillage
Organic treatment
No input or little input
More than
10 Mg ha-1 y-1
R2 = 0.64
p < 0.001
C sequestration rate (Log transformed)
C input (Log transformed)
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6


C sequestration rate (Mg C ha-1 y-1)
16
12
8
4
0
-4
Median
Non-Outlier Range
n
21
18
13
57
3
3
8
4
15
1
2
compost
none specified
SS/MSW
CR
burnt CR
CC
CR + CC
compost + CR + CC
OMW
compost + CR
compost + CC
CR = Crop residues
CC = Cover crop
SS/MSW = Sewage sludge/Municipar solid waste
OMW = Olive mill waste


Wilkoxon for dependent samples p = 0,007
Median
25%-75%
Non-Outlier Range
Outliers
N = 9
Mean diference between treatments 0,91 Mg ha-1 y -1
C secuestration rate (Mg C ha-1 y-1)
4.0
3.0
2.0
1.0
0.0
-1.0
Organic treatment
Conventional


Experiment length (years)
0
4
8
12
16
20
24
28
1996
1998
2000
2002
2004
2006
2008
2010
2012
Publication year

Main detected problems for C sequestration assessment

1) C sequestration estimation is not the objective of many of the papers here reviewed
2) The articles usually include different information: bulk density or SOC density or C concentration
3) > 2 mm fraction is not usually considered
4) Estimation of bulk density using SOC concentration can be inaccurate
5) C input quantity data is only provided in 50% of the papers, and usually it is incomplete
6) Many studies deal with unrealistic C inputs
7) Many treatments use organic inputs with conventional management
8) Only 5 studies have a real organic treatment
9) Differences in soil depth difficult the comparisons.

Integrated papers

- 8 papers, but only one of them measures the 3 GHG gases fluxes
- None of them provide data on SOC change over time
- None of them study indirect emissions

Indirect Emissions

- 2 papers
- Emissions related to fuel consumption only
- Organic systems emit less than conventional ones

Methane

- 2 papers
- Synthetic fertilizer reduce methane sequestration

Conclusions

1) Clear lack of scientific information in the Mediterranean context

2) Only 10 articles include a proper organic treatment

3) Preliminary results suggest a lower N_2O emission factor for organic fertilizers than for conventional ones and also than the factor proposed by IPCC. There is a very scarce information on dry land conditions

4) Preliminary results suggest a higher C sequestration rate for organic treatments. Nonetheless, most of the information is hardly comparable

5) There is a need of studies on CH_4, indirect emissions and specially of fully integrated assessments

Although the sectorial available information suggests that organic agriculture on Mediterranean zones has a lower GWP, we have not enough scientific evidence to make this conclusion sound

Thank you very much

Jáuregui, 2009

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