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Energy turnaround in Germany -

Public perception of external effects of biogas technology

by German inhabitants in their roles as citizens, residents

and consumers under economic, ecologic and social viewpoints

- 1. Introduction**
- 2. Media analysis about the topic „biogas“**
- 3. Online survey about side effects of biogas plants**
- 4. List of references**

1. Introduction

2. Media analysis about the topic „biogas“

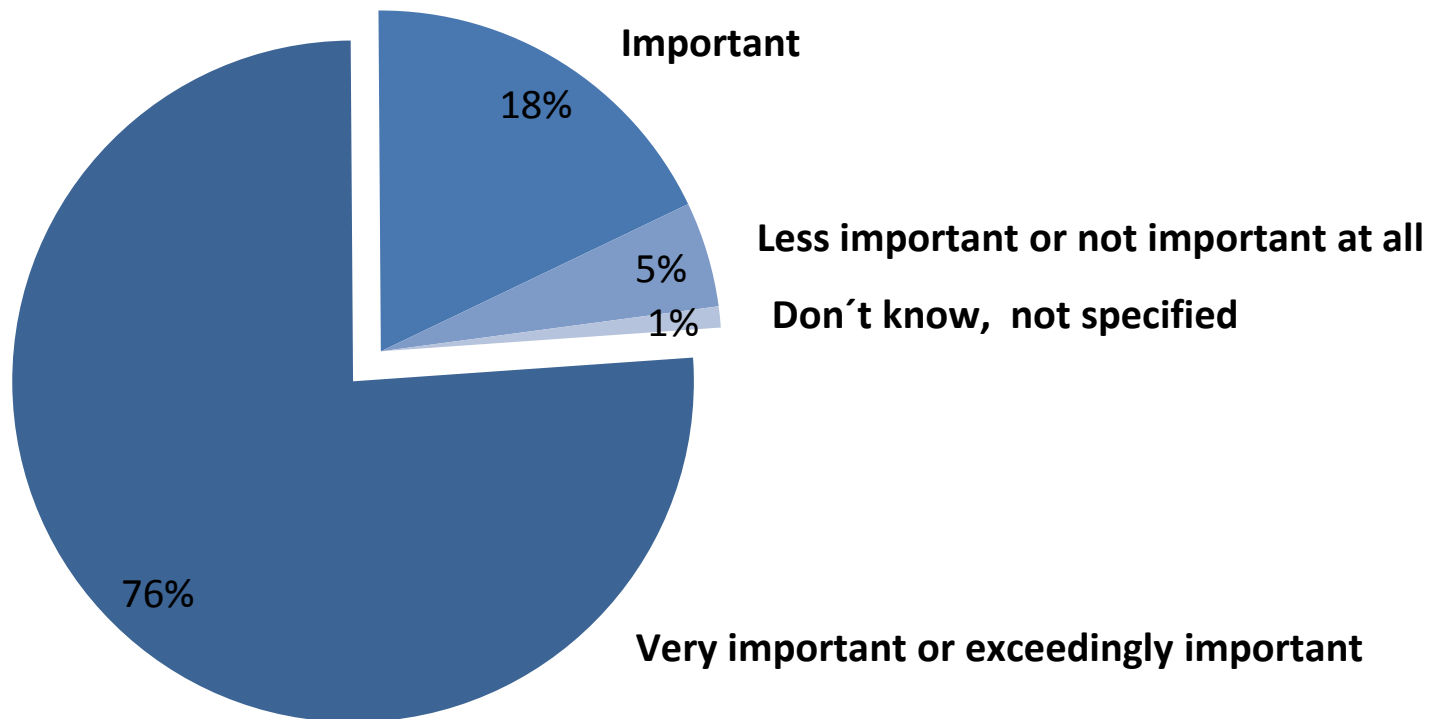
3. Online survey about side effects of biogas plants

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Energy turnaround in Germany:

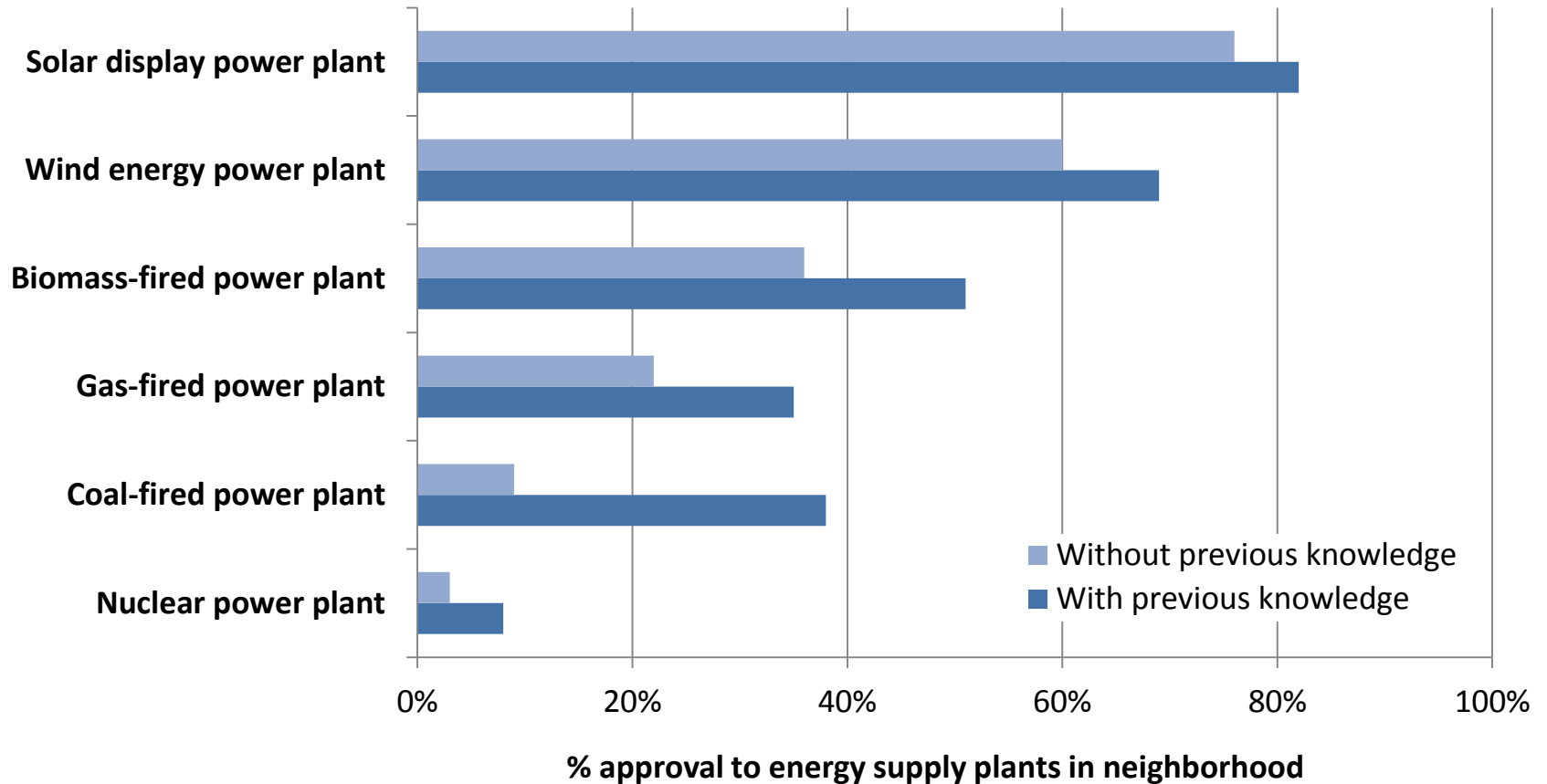
- March 11th 2011: Fukushima nuclear disaster → June 06th 2011: decision on **definitive nuclear phaseout** for Germany until 2022 → 7 shutdown plants stay shut down; 10 residual plants will be shut down successively until 2022
 - Simultaneously: expansion of renewable energies and electrical power supply lines PLUS increased saving of energy
- **2020:** coverage of **35 %** of German electric energy demand by renewables
2030: coverage of **50 %** of German electric energy demand by renewables
2040: coverage of **65 %** of German electric energy demand by renewables
2040: coverage of **80 %** of German electric energy demand by renewables

German citizens: „Use and development of renewable energies are...”



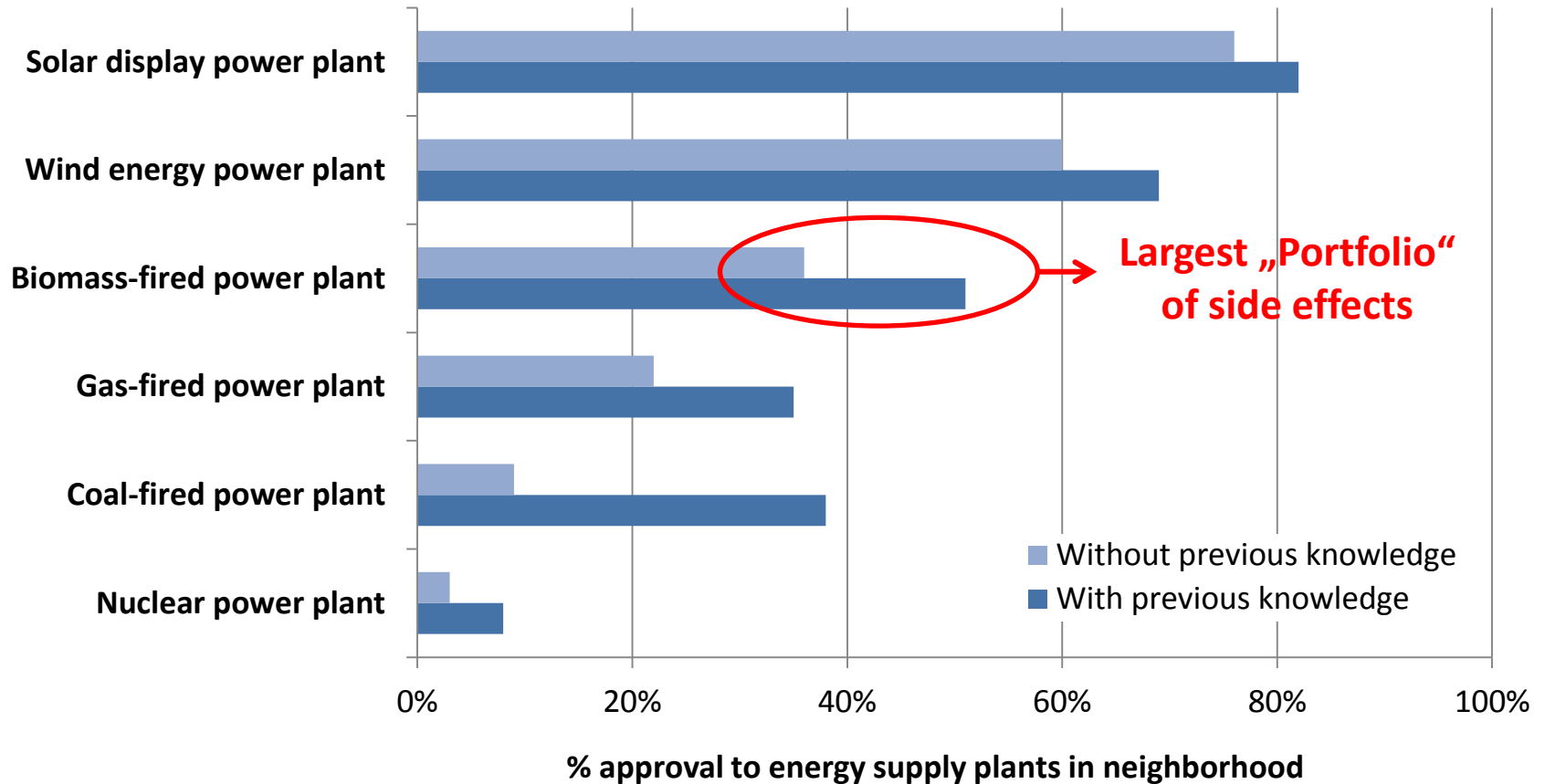
Own diagram, modified according to: Renewable Energies Agency (2011)

German citizens: Approval to energy supply plants in neighborhood



Own diagram, according to: Renewable Energies Agency (2011)

German citizens: Approval to energy supply plants in neighborhood



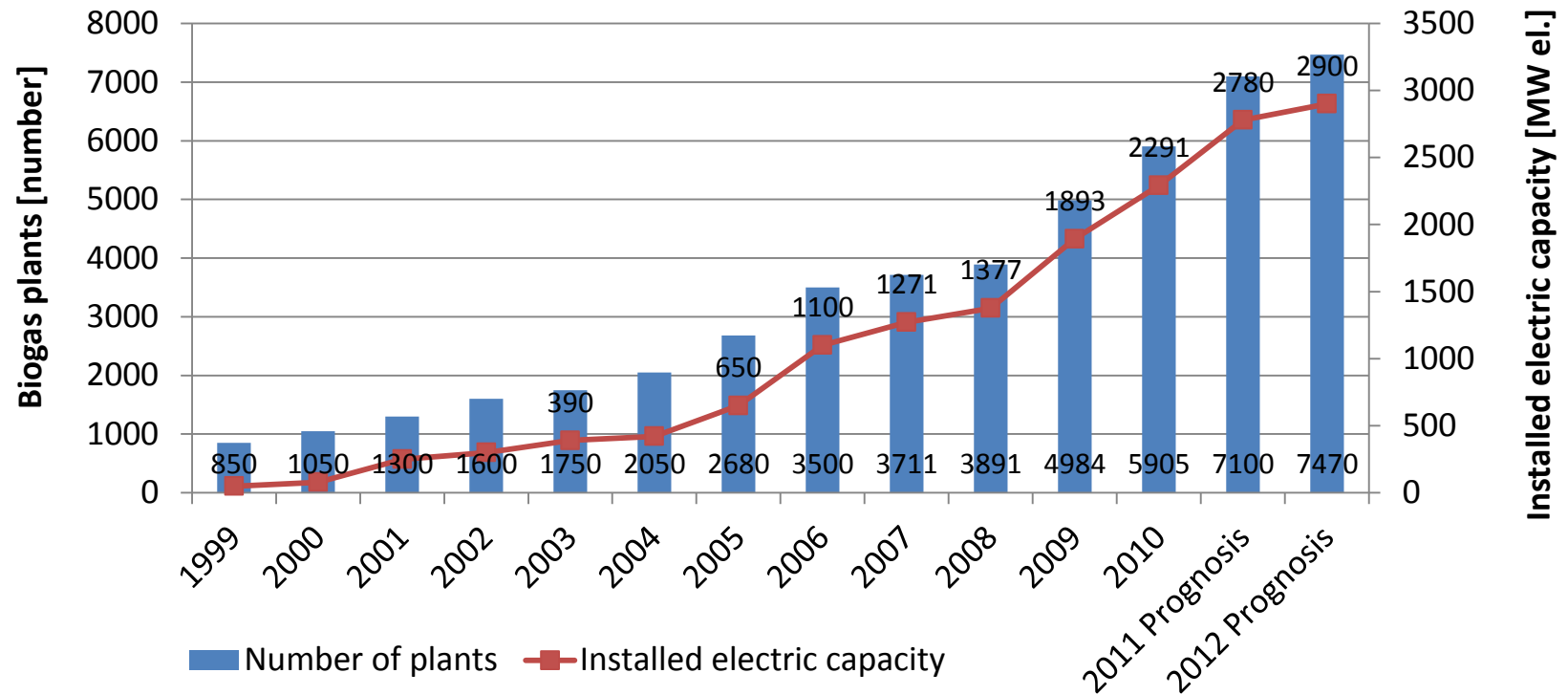
Own diagram, according to: Renewable Energies Agency (2011)

Impressions of biogas plants in Germany...



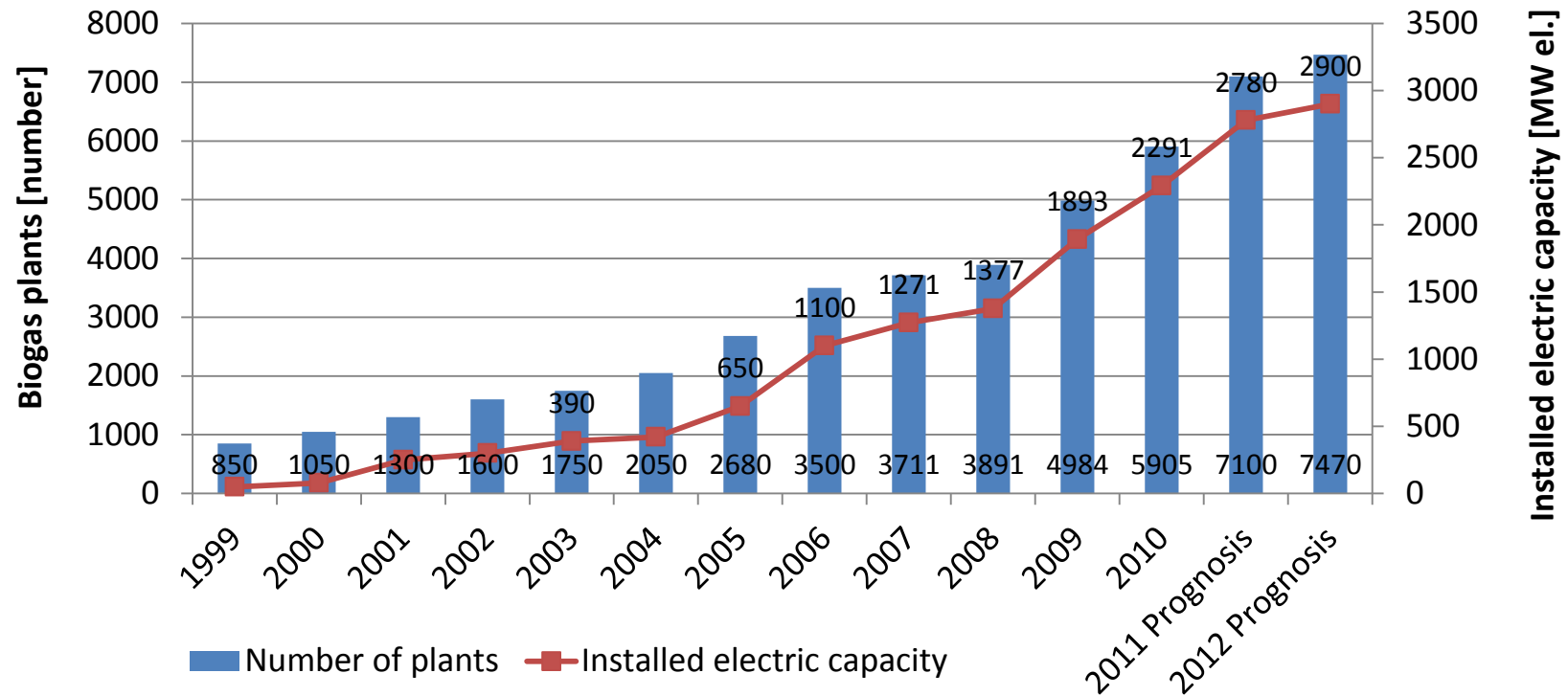
Own photographs (2011)

Number of biogas plants in Germany and installed electric capacity



E.ON AG (2012), German Biogas association (2012); Own diagram, according to: German Biogas Association (2012)

Number of biogas plants in Germany and installed electric capacity



- 1 single nuclear power plant „Isar II“: **11.62 Mio. MWh** in 2011;
- all German biogas plants together: **18.40 Mio. MWh** in 2011

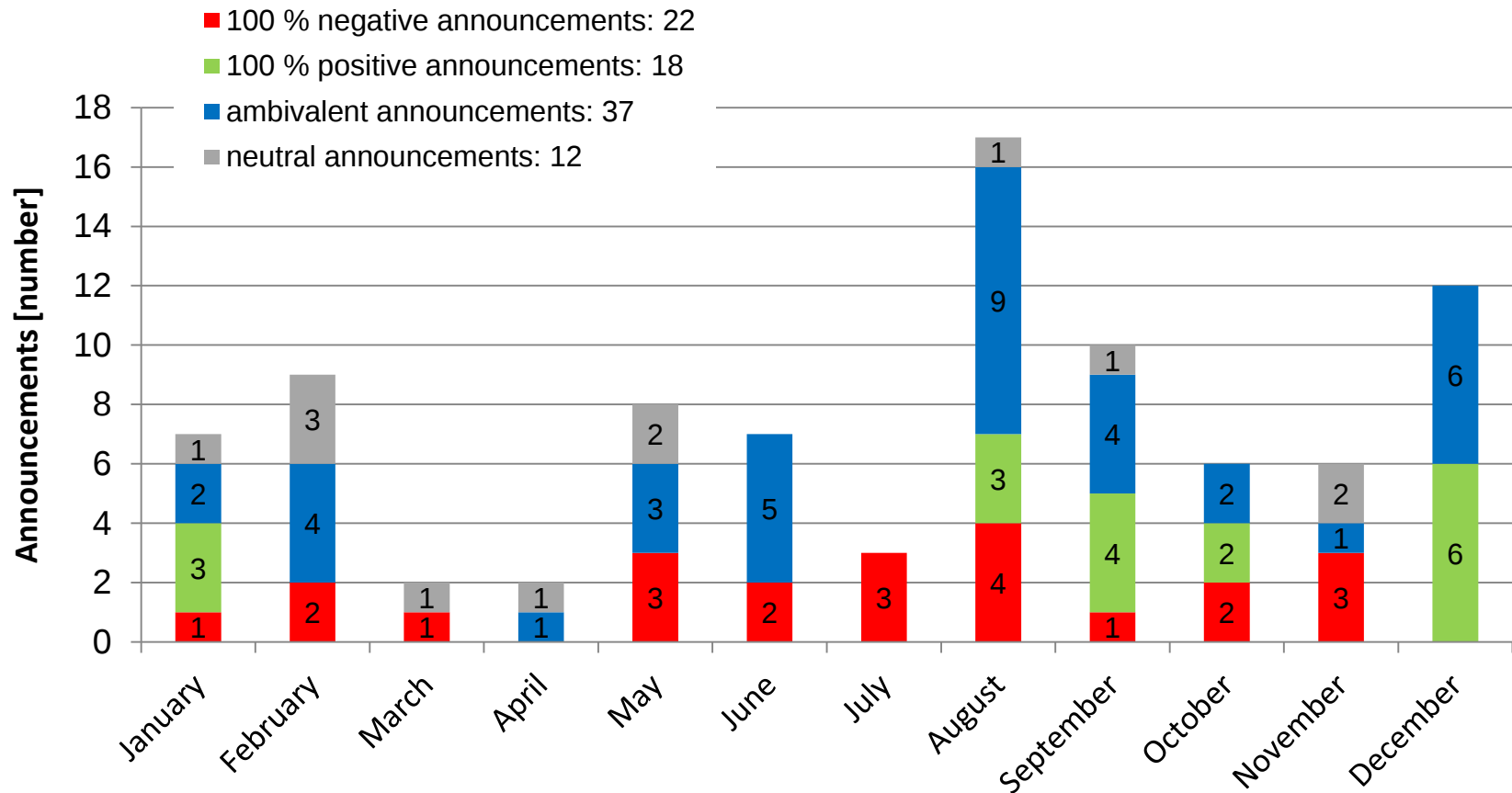
E.ON AG (2012), German Biogas association (2012); Own diagram, according to: German Biogas Association (2012)

1. Introduction
- 2. Media analysis about the topic „biogas“**
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Media analysis about the topic „biogas“ - approach:

1. Observation of german media concerning the topic „biogas“
(with help of german biogas association)
 2. Circuit of professional journals at Straubing Center of Science
 3. Frequent use of search engines
 4. Google alert „biogas“
 5. Different newsletters about the topic „renewable energies“
- ➔ **Collection of almost 400 general / widespread contributions about the topic „biogas“ in German media from 2004 - 2011**

89 announcements in 2011 - 7.5 articles monthly on average



Own source (2011)

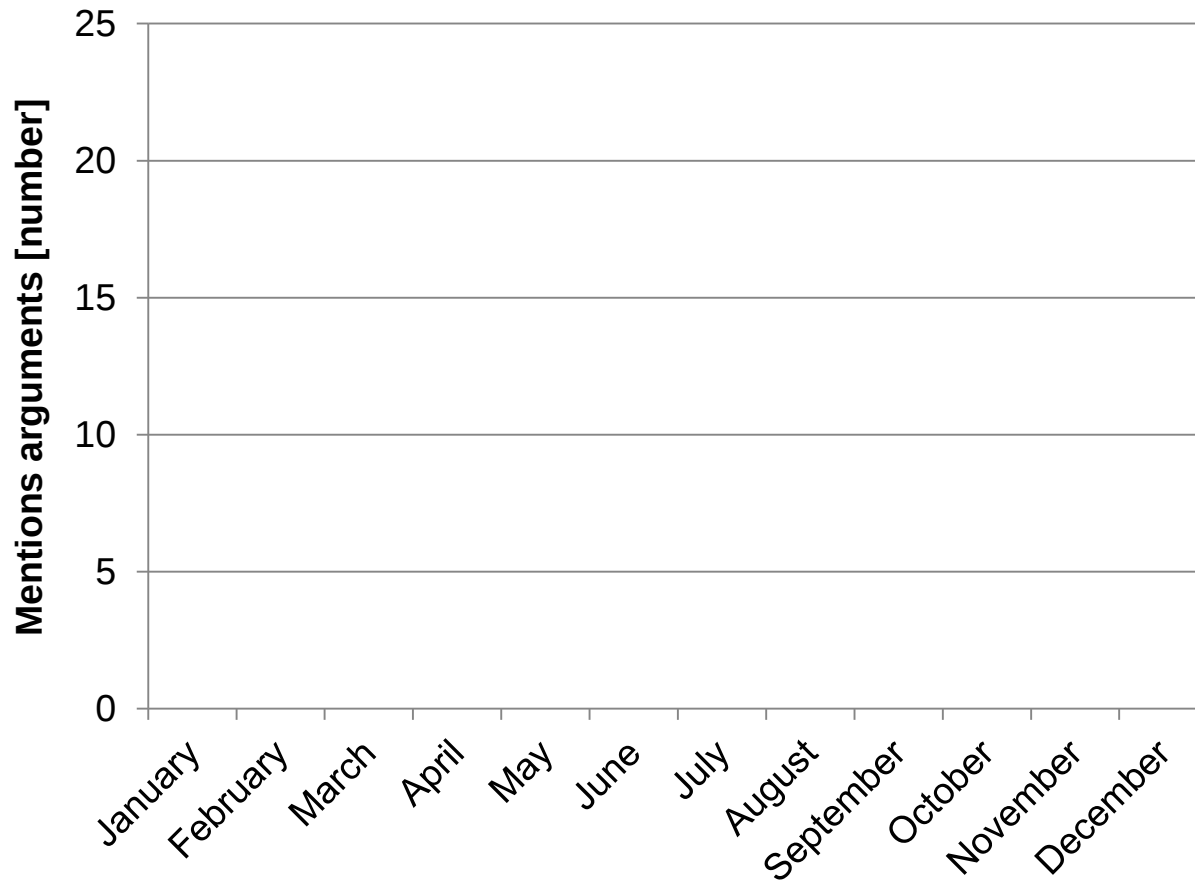
89 announcements in 2011 - 7.5 articles monthly on average

Within the 89 announcements in 2011 are:

→ 57 different arguments **CONTRA** biogas

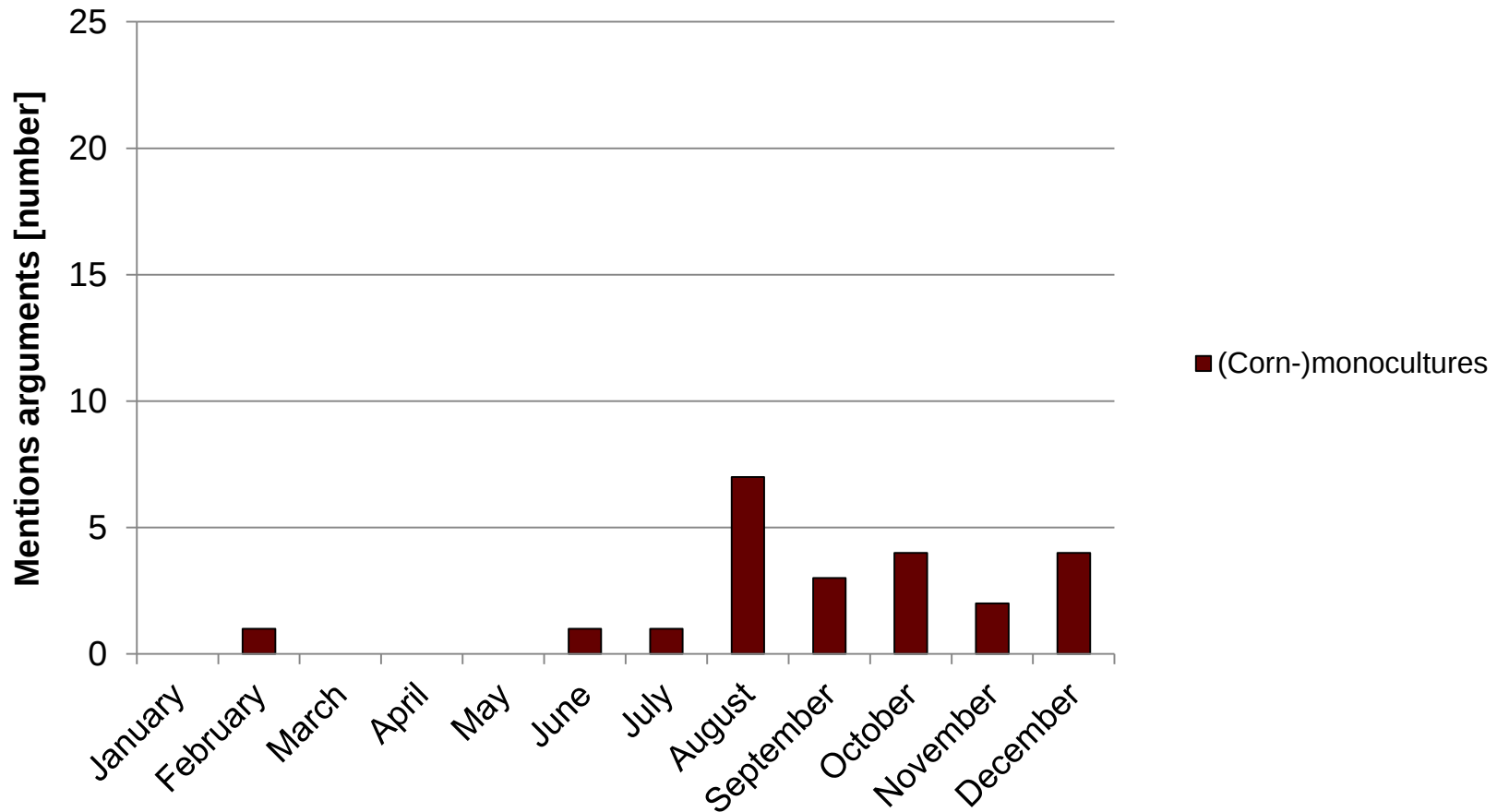
→ 55 different arguments **PRO** biogas

„TOP 10“ of arguments 2011



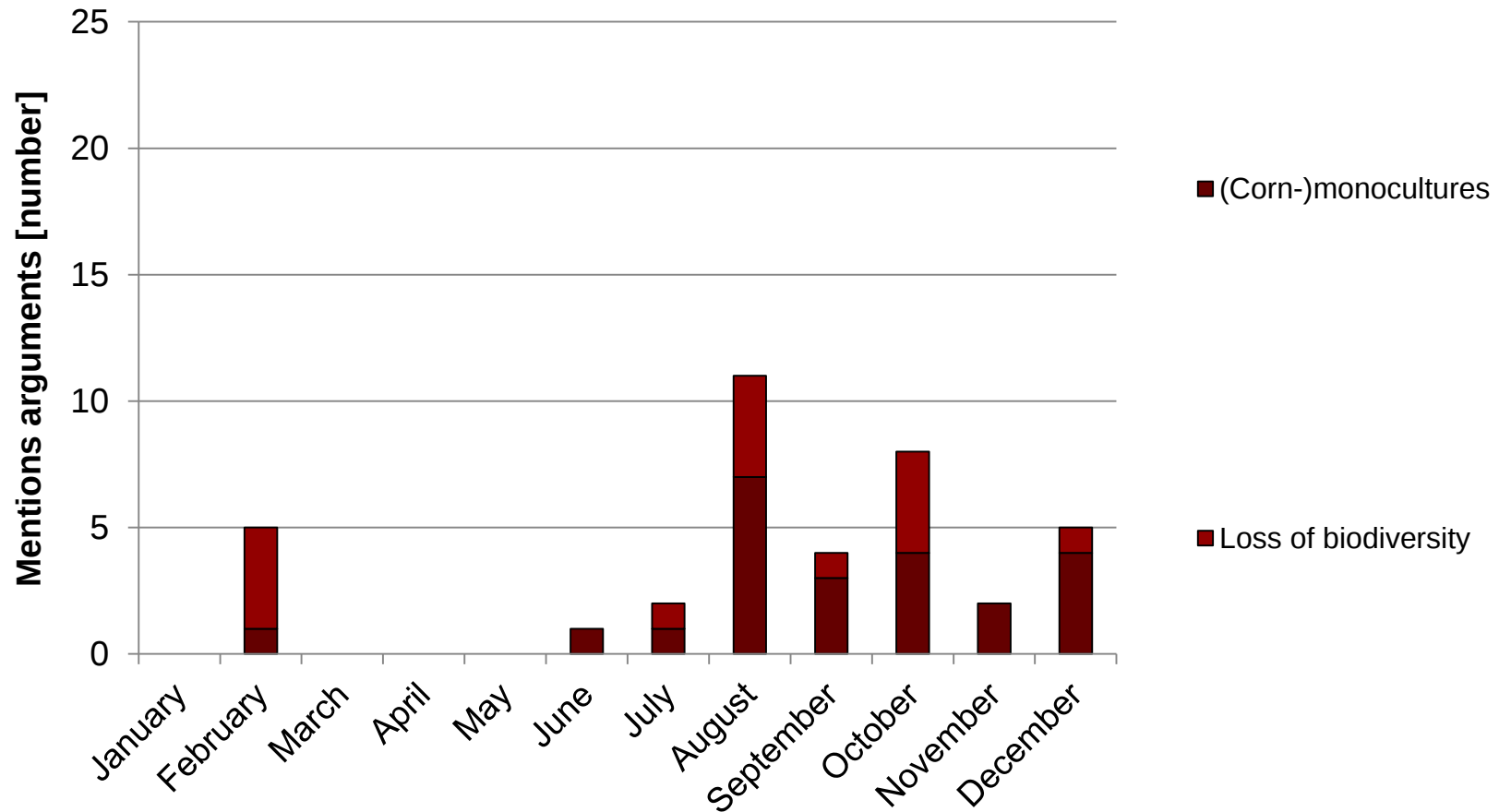
Own source (2011)

„TOP 10“ of arguments 2011 - rank 01. „(Corn-)monocultures“



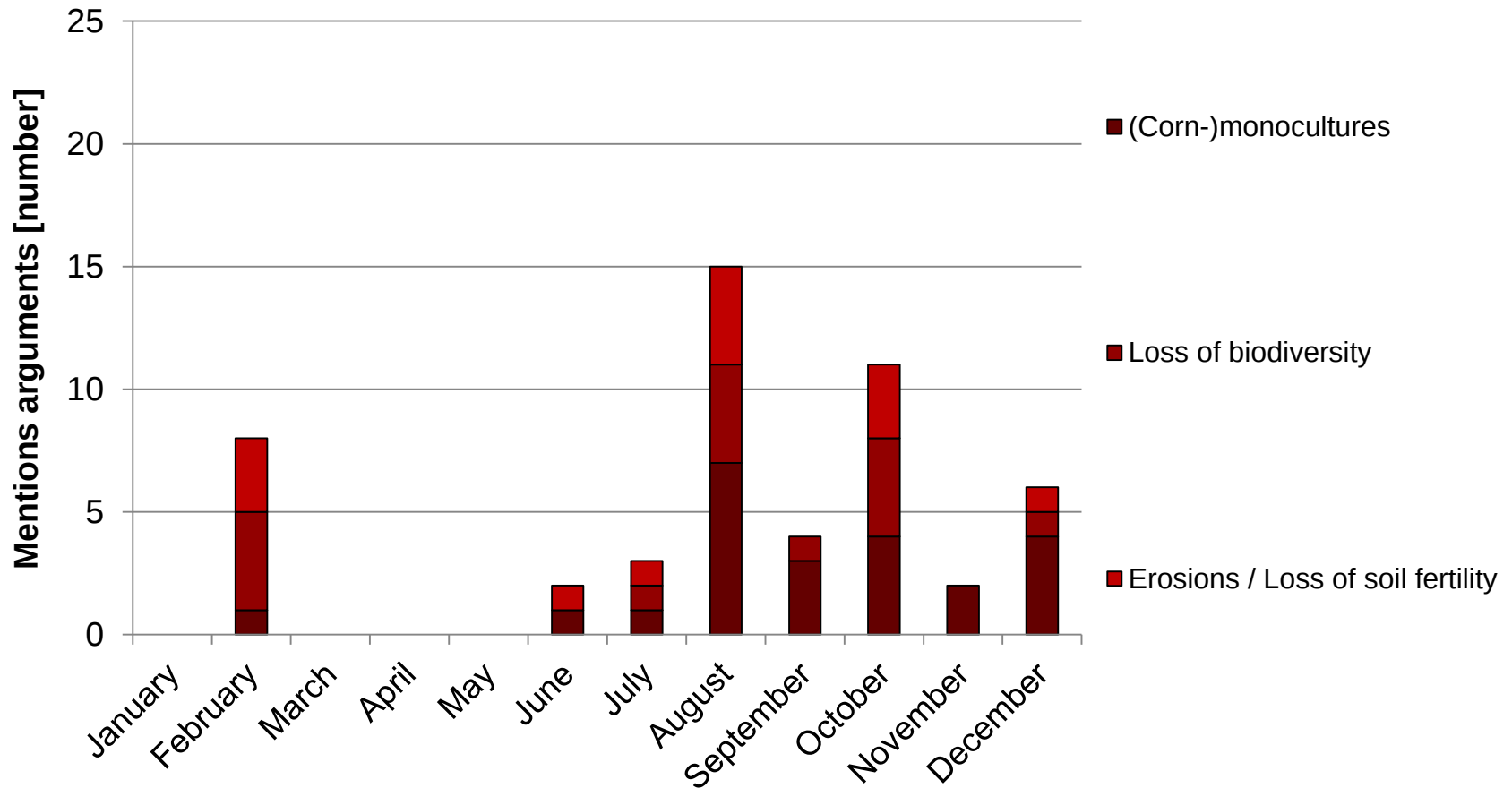
Own source (2011)

„TOP 10“ of arguments 2011 - rank 02. „Loss of soil fertility“



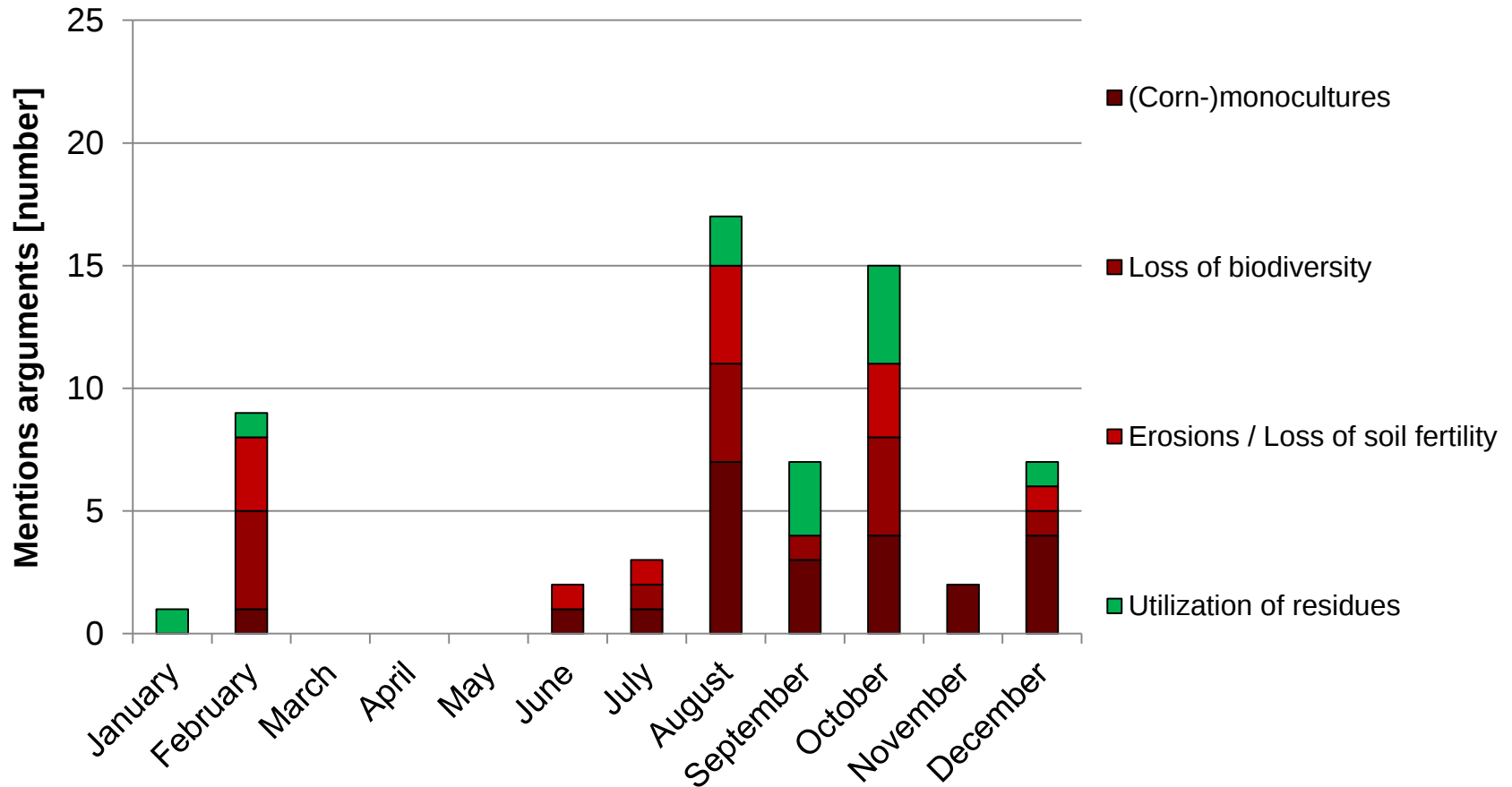
Own source (2011)

„TOP 10“ of arguments 2011 - rank 03. „Erosions / Loss of soil fertility“



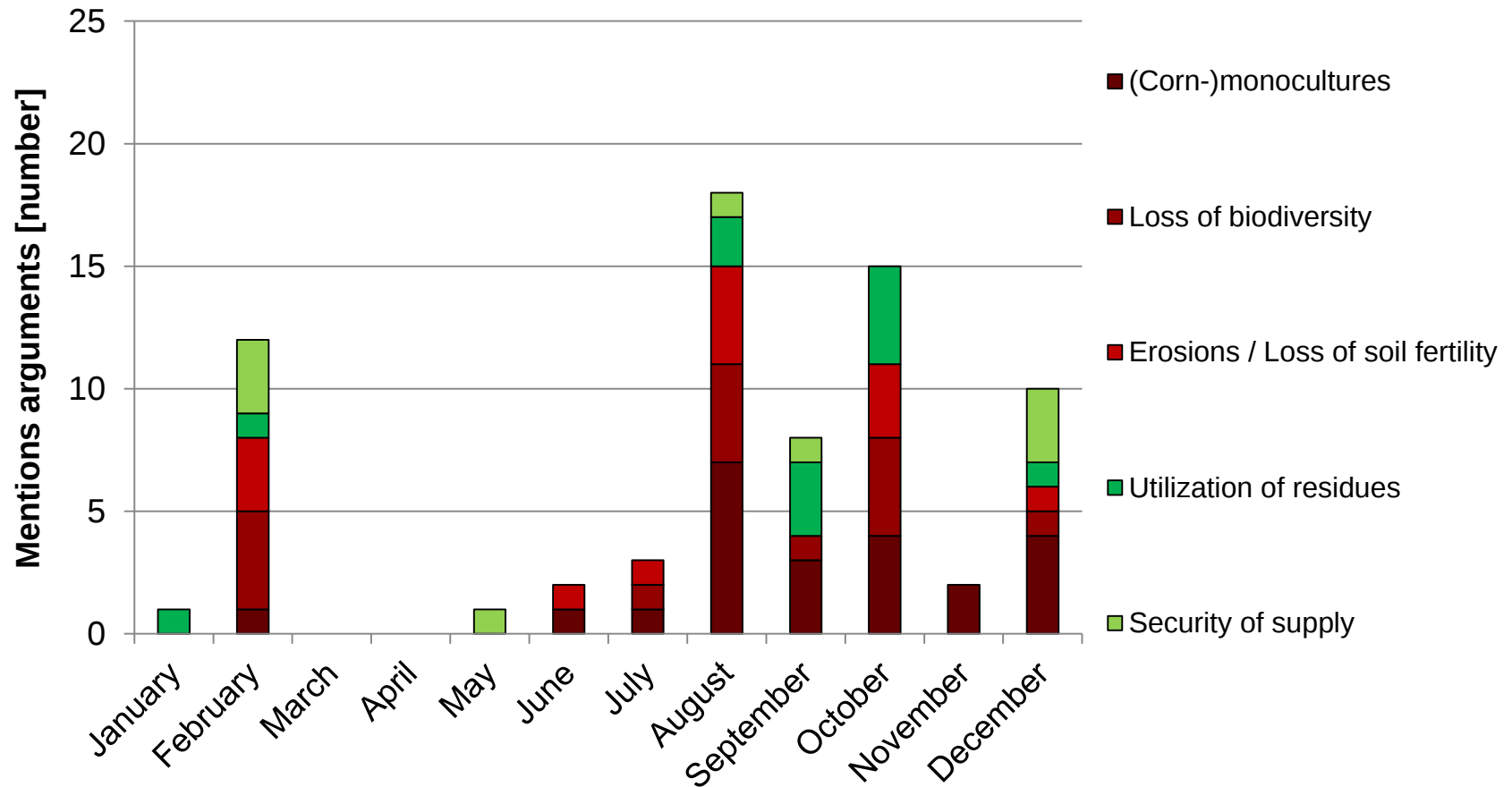
Own source (2011)

„TOP 10“ of arguments 2011 - rank 04. „Utilization of residues“



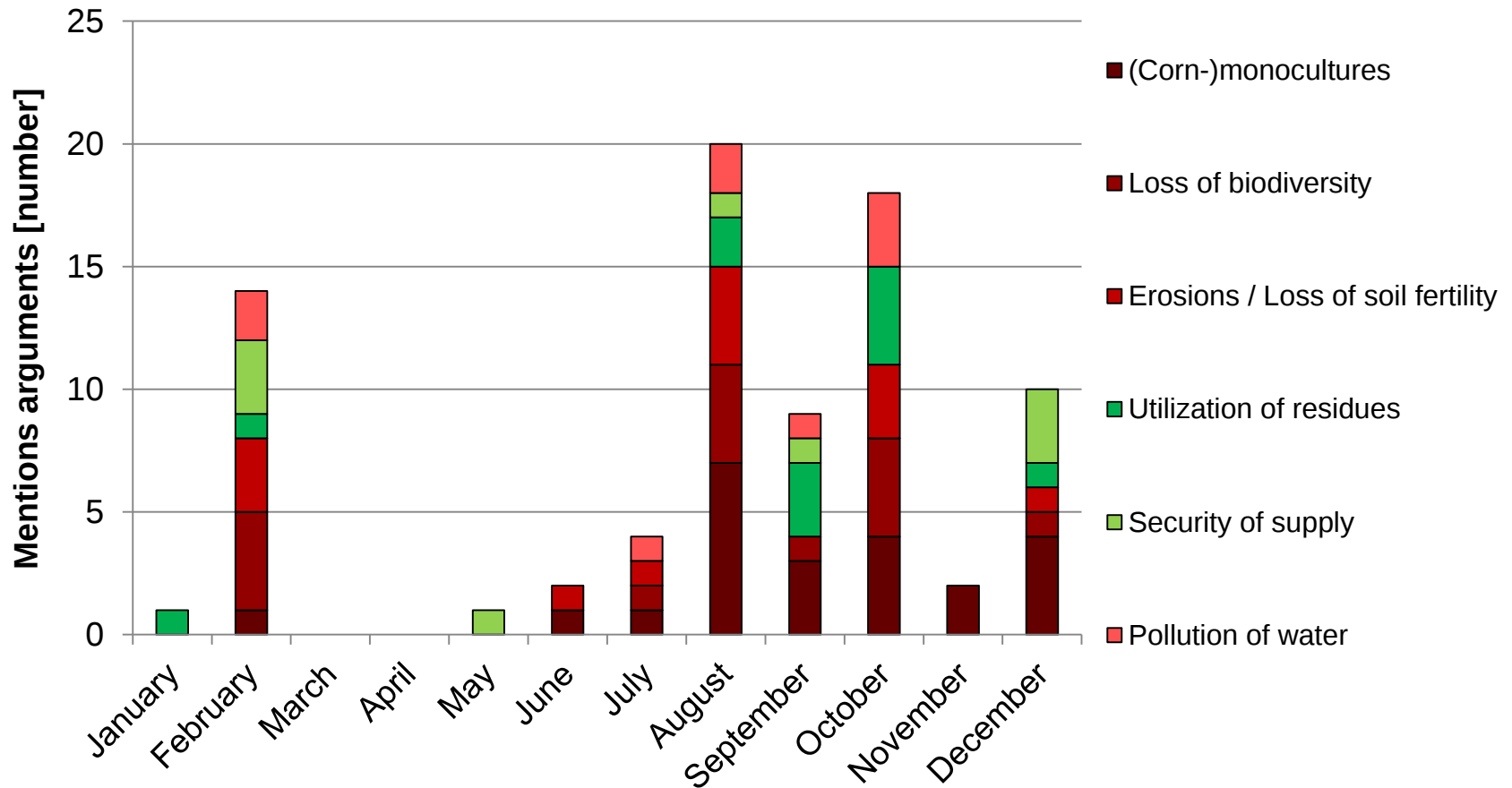
Own source (2011)

„TOP 10“ of arguments 2011 - rank 05. „Security of supply“

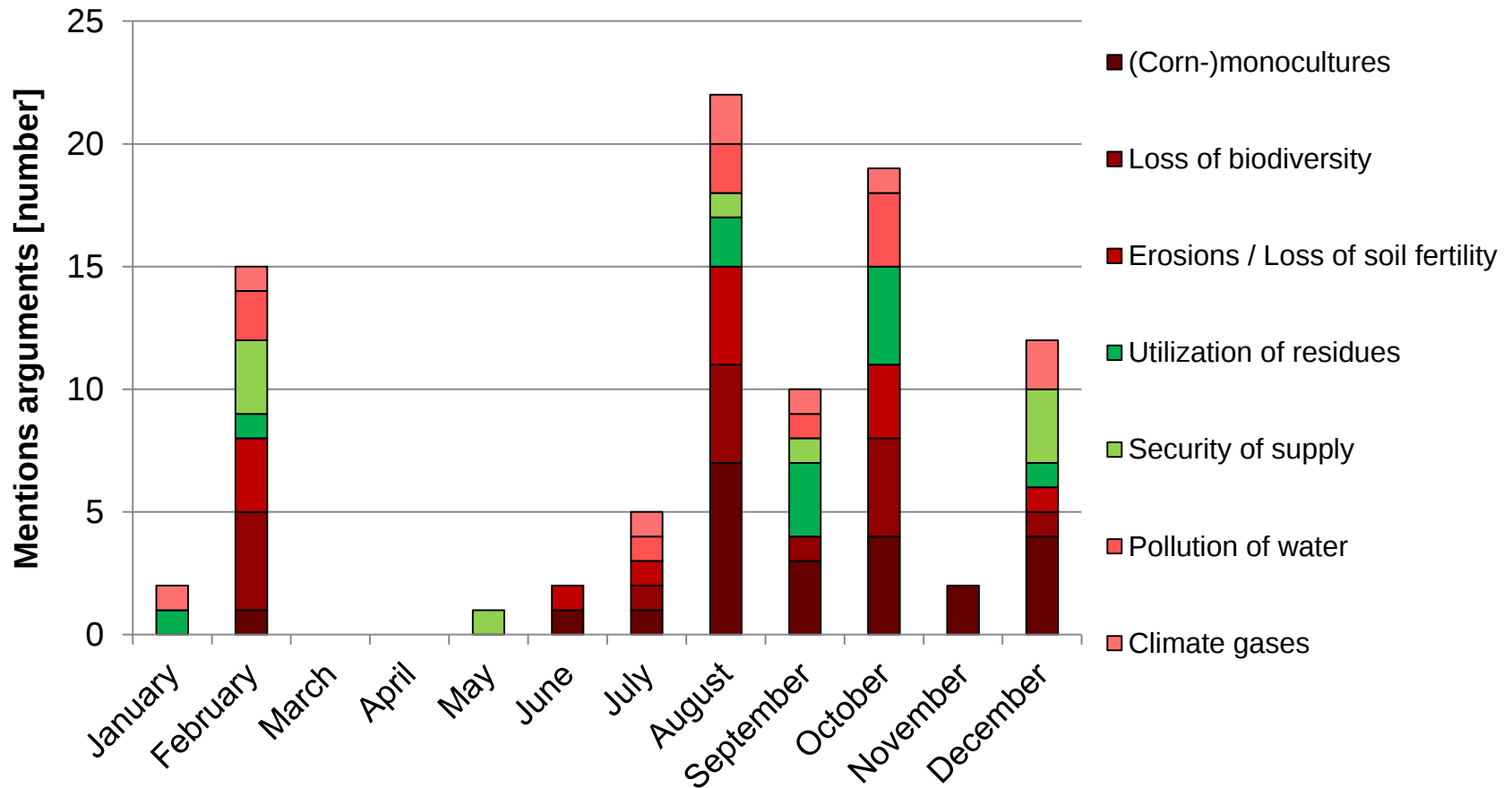


Own source (2011)

„TOP 10“ of arguments 2011 - rank 06. „Pollution of water“

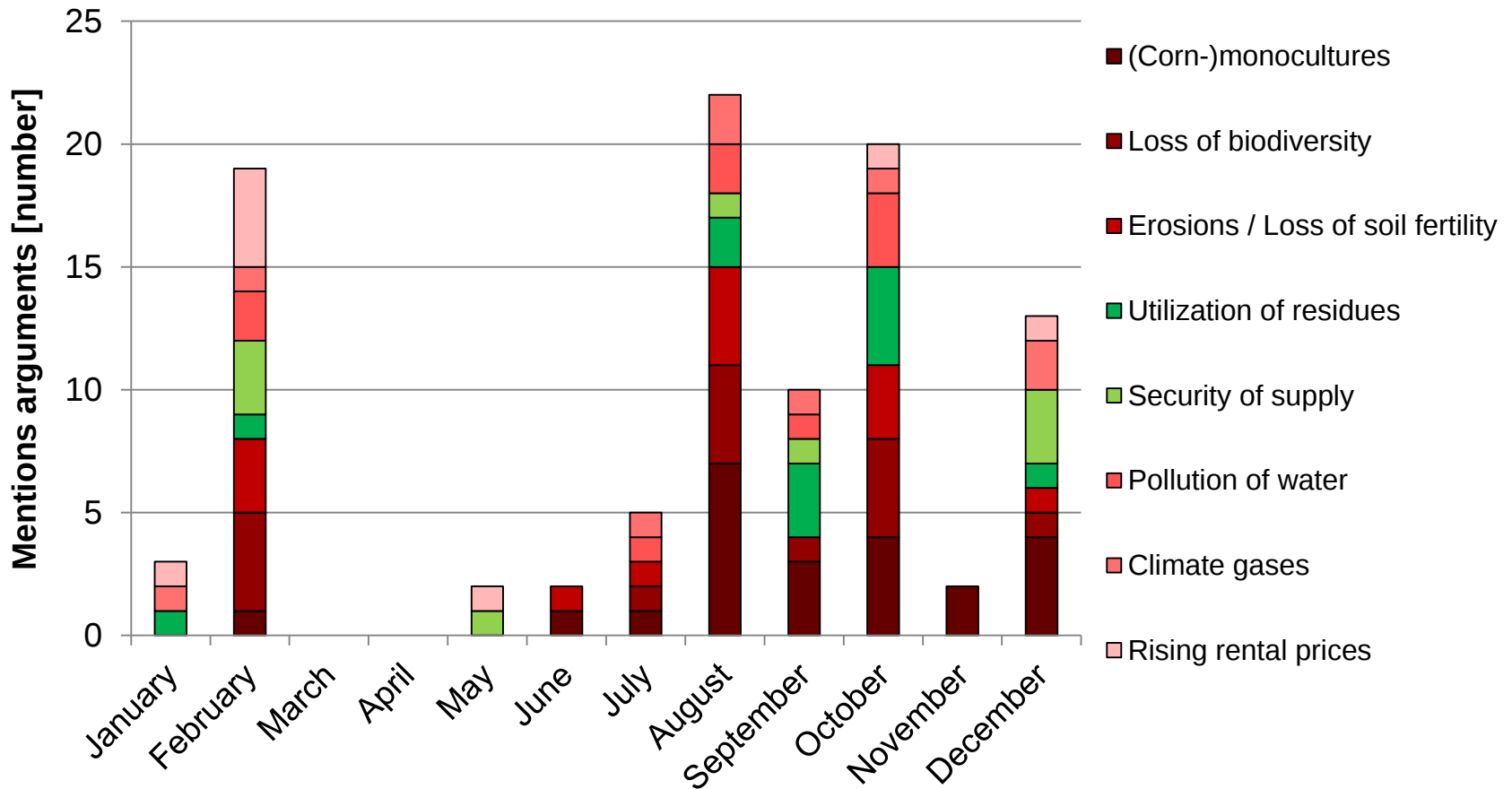


„TOP 10“ of arguments 2011 - rank 07. „Climate gases“

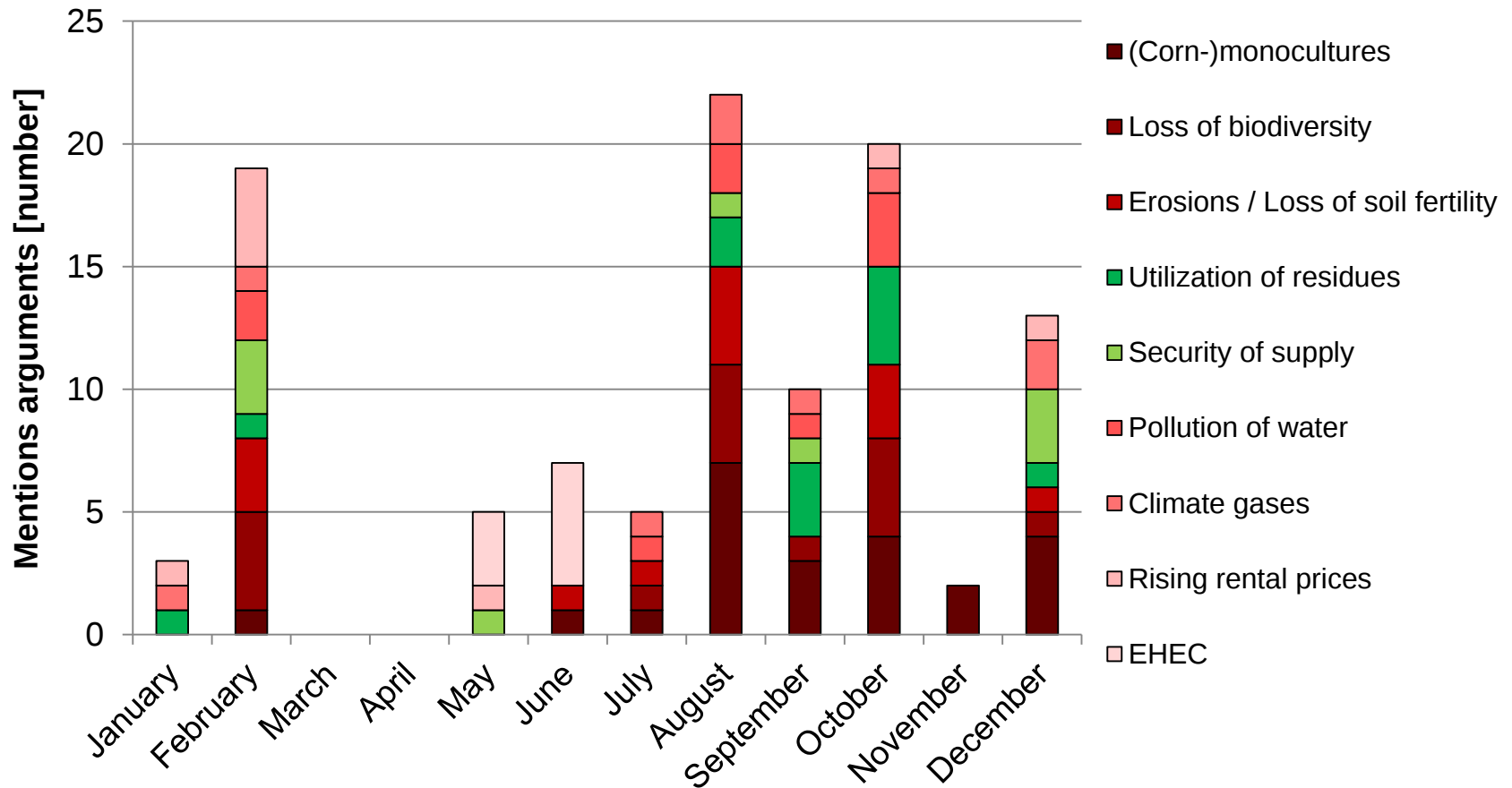


Own source (2011)

„TOP 10“ of arguments 2011 - rank 08. „Rising rental prices“

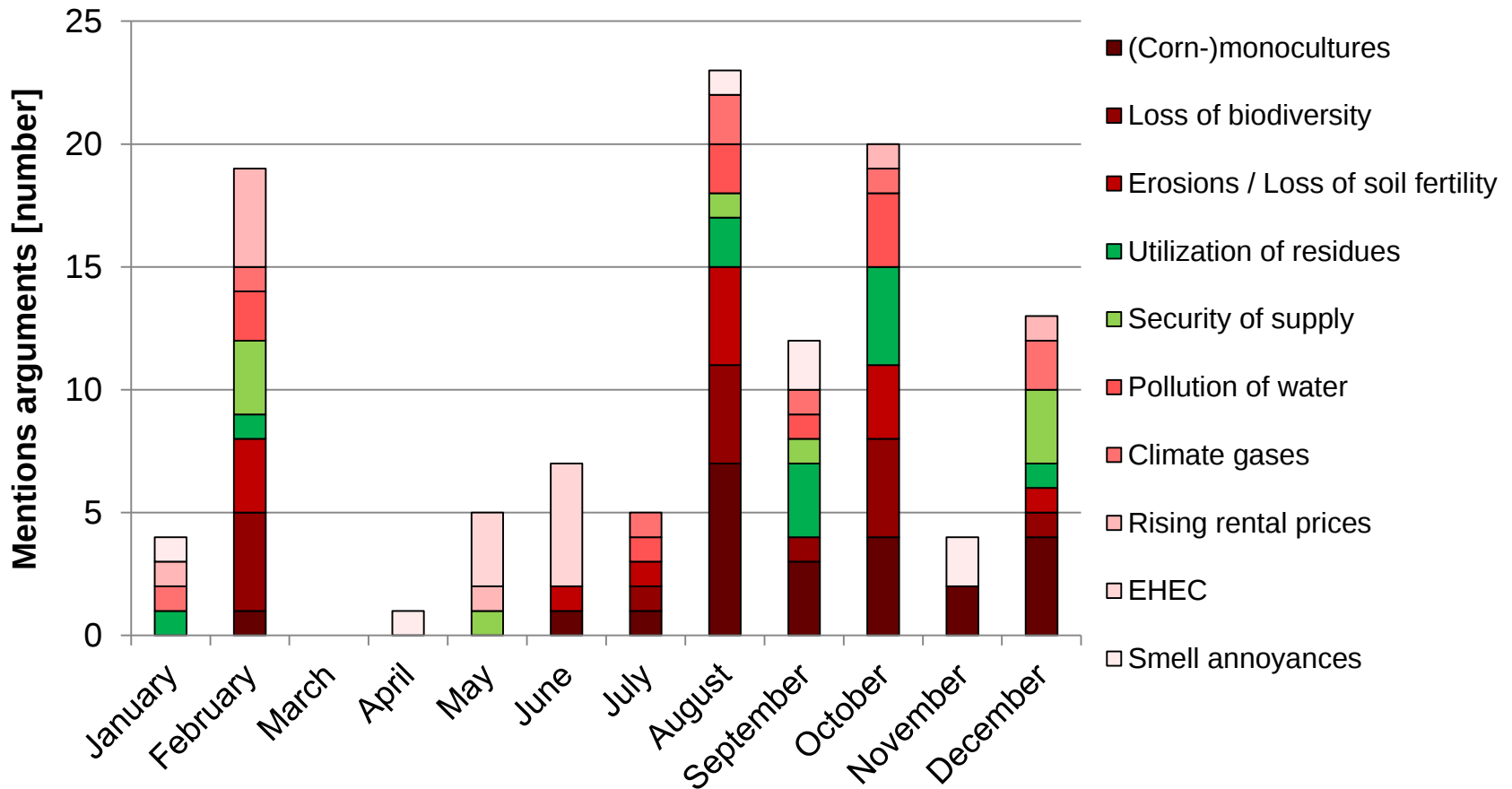


„TOP 10“ of arguments 2011 - rank 09. „EHEC“



Own source (2011)

„TOP 10“ of arguments 2011 - rank 10. „Smell annoyances“



Categories of arguments (≥ 10 mentions) in contributions from '04 bis '11

	Global Aspects/Motives	Regional Aspects/Motives	Local Aspects/Motives
Ecology			
Economy			
Social matters			

Own source (2011)

Categories of arguments (≥ 10 mentions) in contributions from '04 bis '11

	Global Aspects/Motives	Regional Aspects/Motives	Local Aspects/Motives
Ecology	Corn monocultures		
	Pollution of water through increased use of pesticides		
	Erosions and loss of soil fertility		
	Loss of biodiversity		
	Damage to climate through emissions		
	Climate protection		
Economy	Security of energy supply		
	Feed-in of biogas natural gas grid		
	Biogas as economic factor		
	Increasing rental prices		
	Biogas subsidies distort competition	Negative influence on tourism	
	Rising prices for food	Alternative for farmers	
Social matters	Concurrence to food	Health risks through bacteria	
	Biogas made of residuals	Incidents and accidents	
	Creation of jobs	Increasing traffic	
			Odour disturbances
			Noise disturbances

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Online survey about side effects of biogas plants - approach:

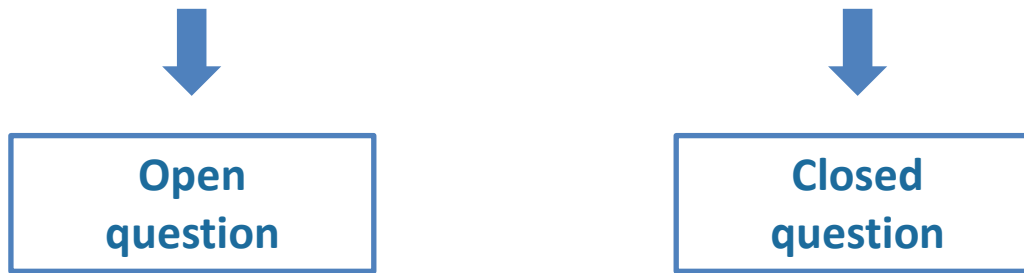
1. Detailed material collection, expert interviews, pre-tests
2. Realization with online survey tool „LimeSurvey“; distribution via Facebook, emails, professional web pages and press releases in regional newspapers („Straubinger Tagblatt“ and „Passauer Neue Presse“)
3. Duration: 70 days (27th of July 2011 - 04th of October 2011)

→ 274 data sets were evaluated

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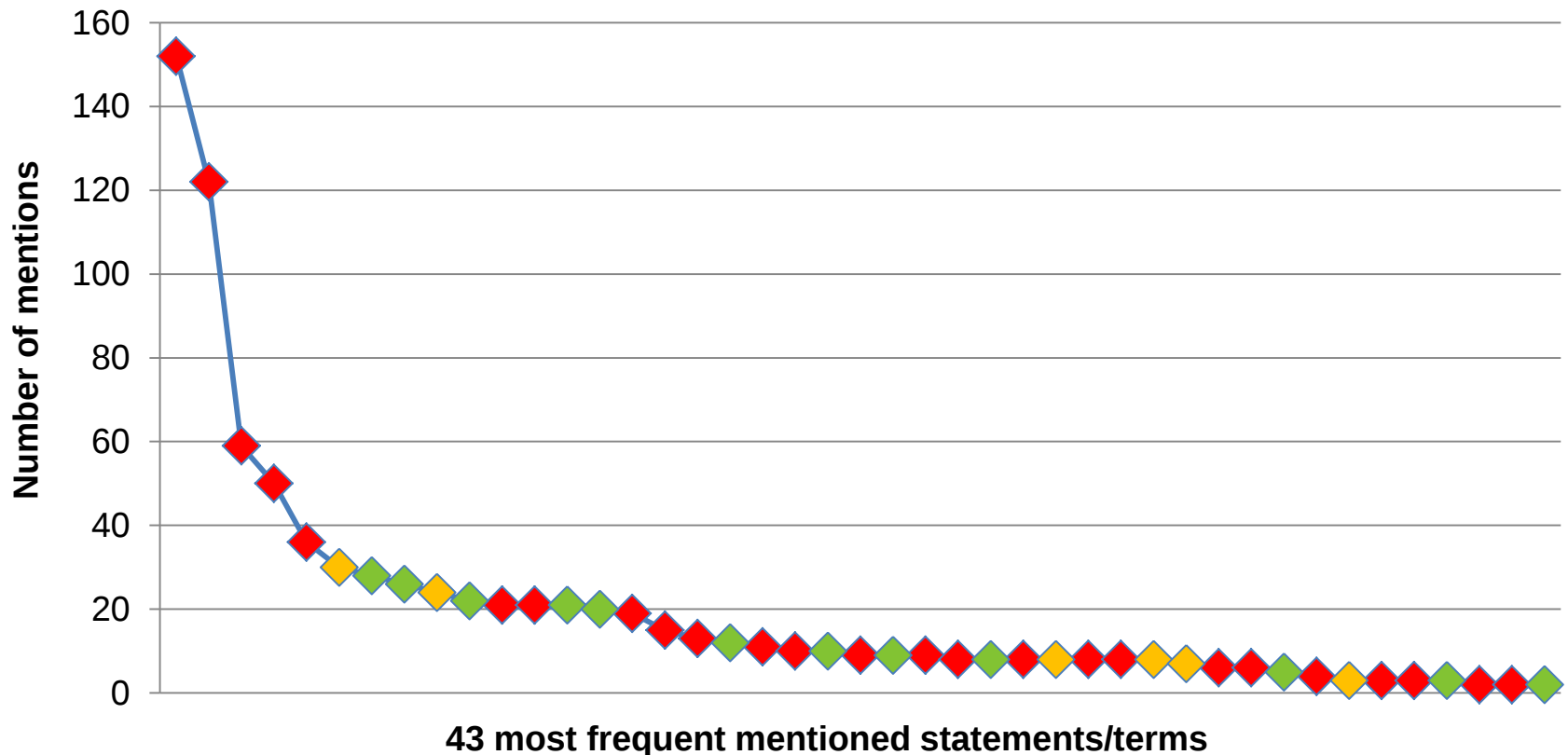


Open question: 274 data sets

*„Tell us five side effects of biogas plants
that come spontaneously in your mind!“*

Open question:

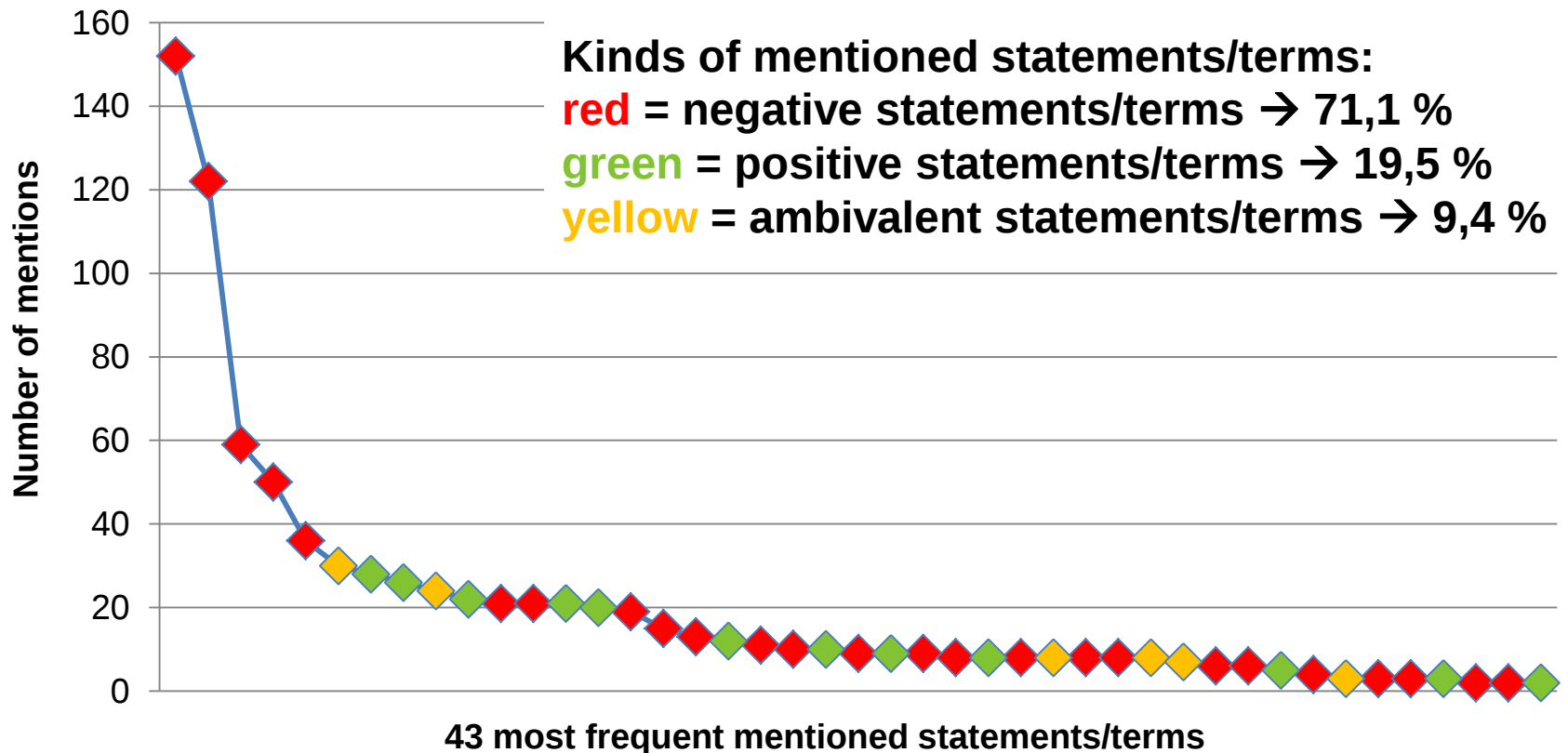
„Tell us five side effects of biogas plants that come spontaneously in your mind!“ (n=274) → **851 of 1.370 terms / associations**



Own source (2011)

Open question:

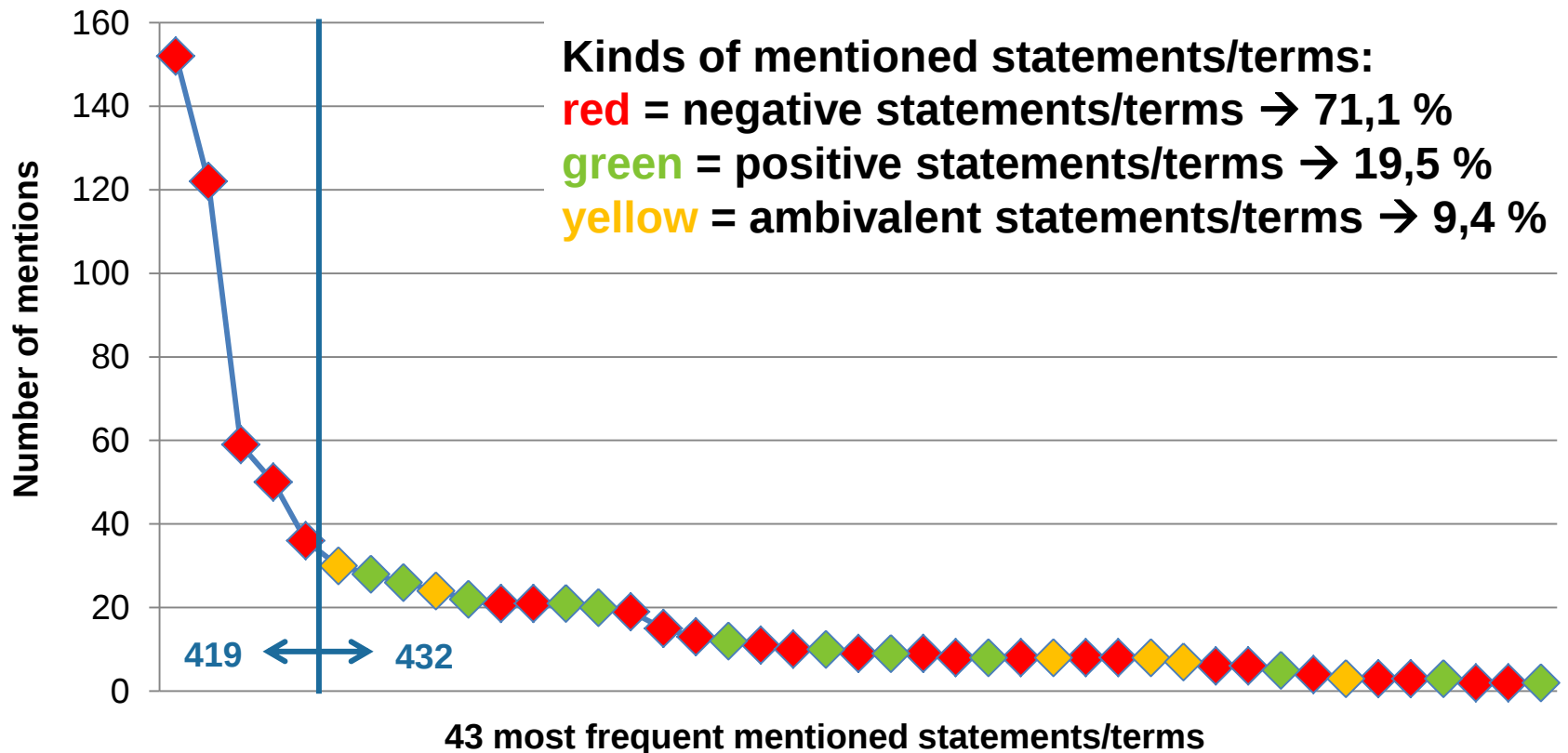
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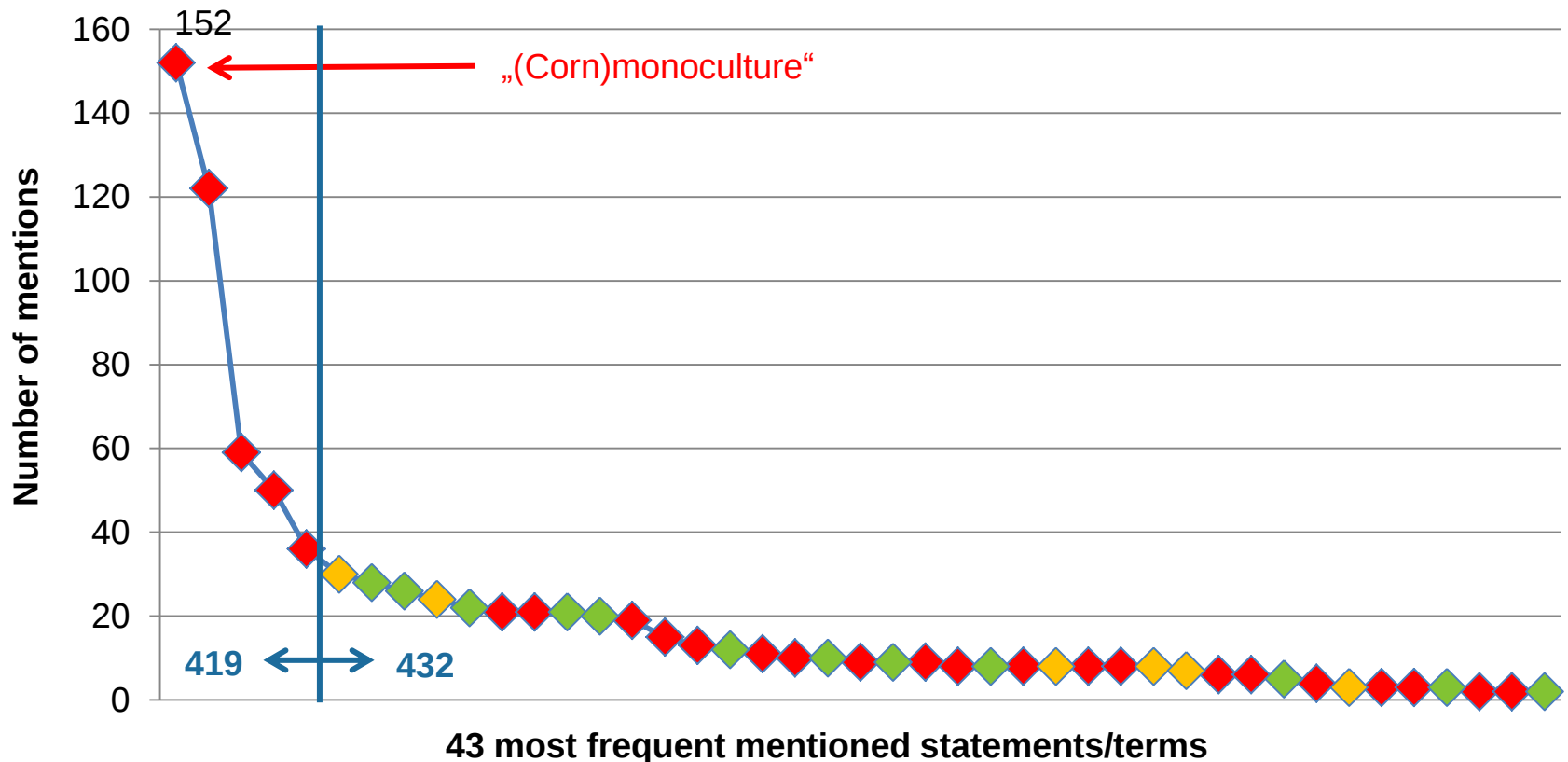
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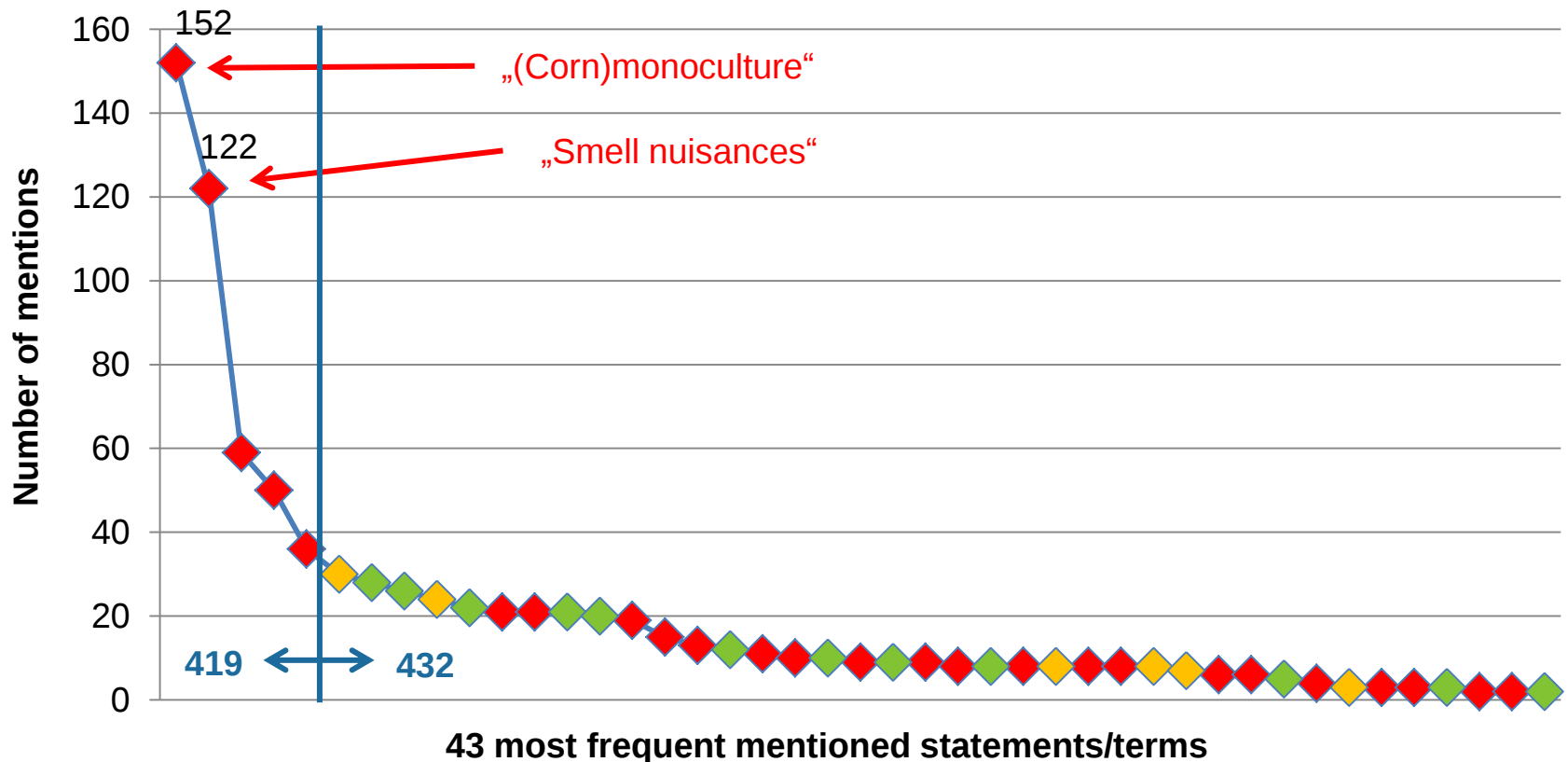
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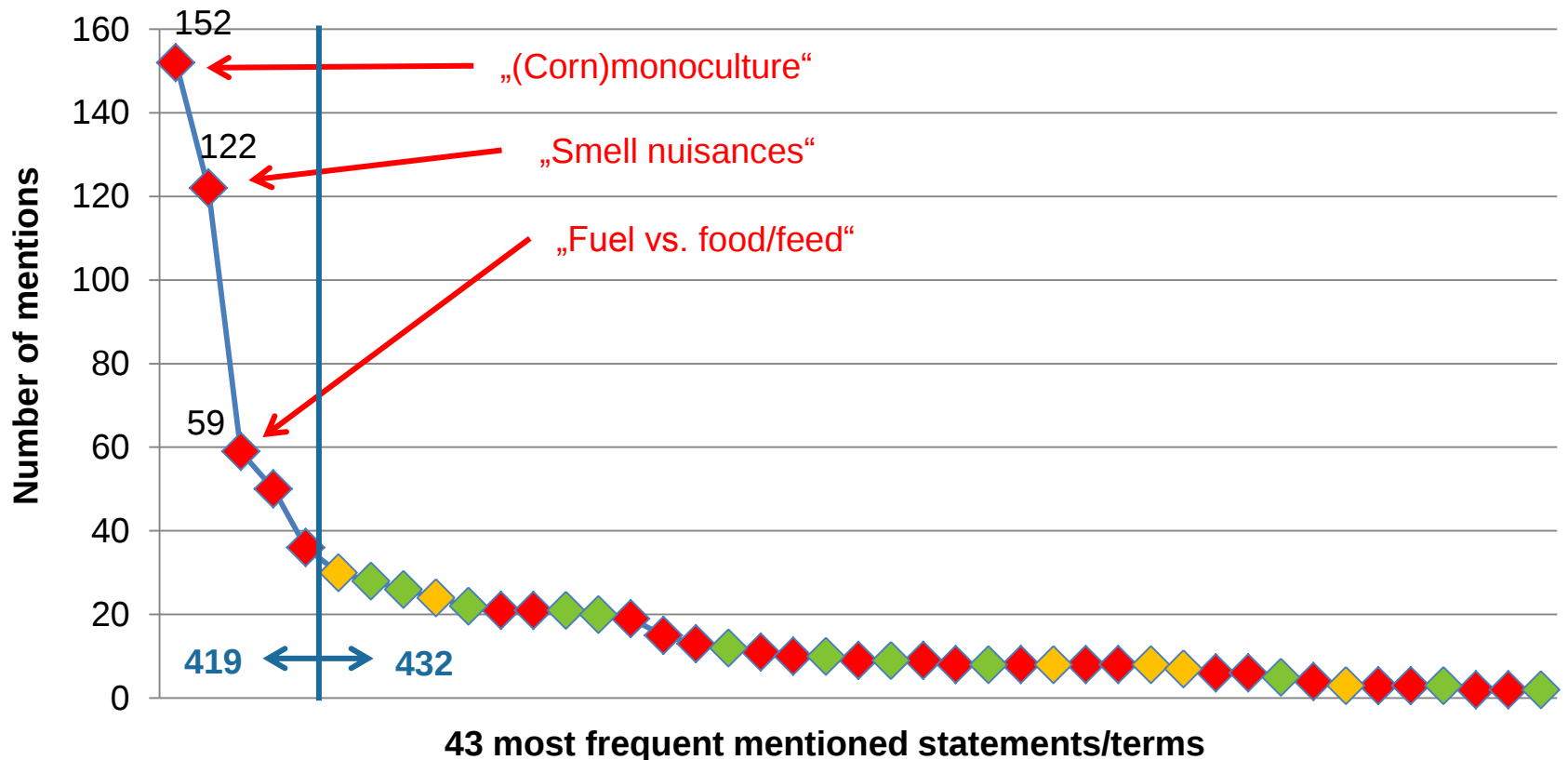
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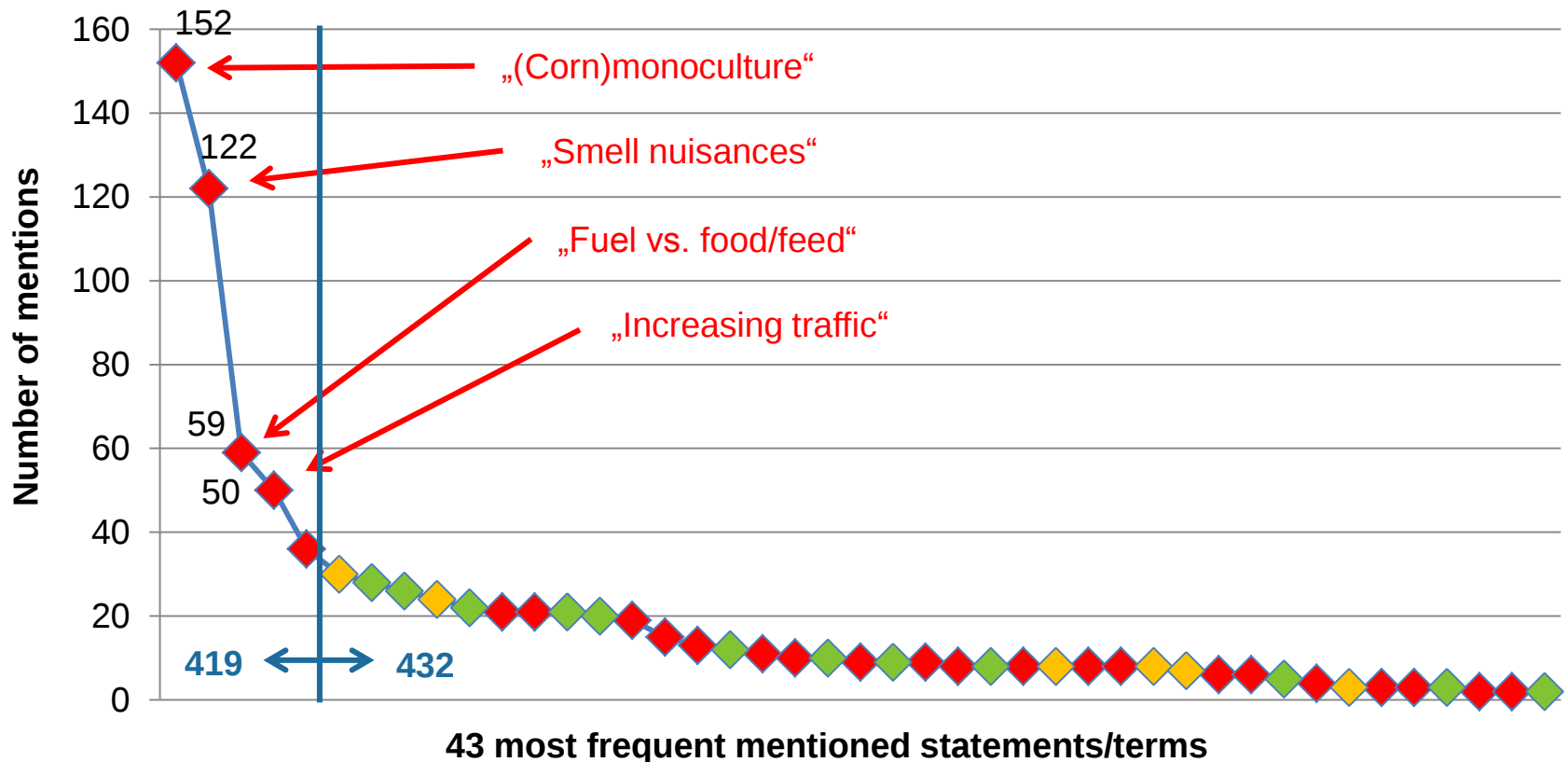
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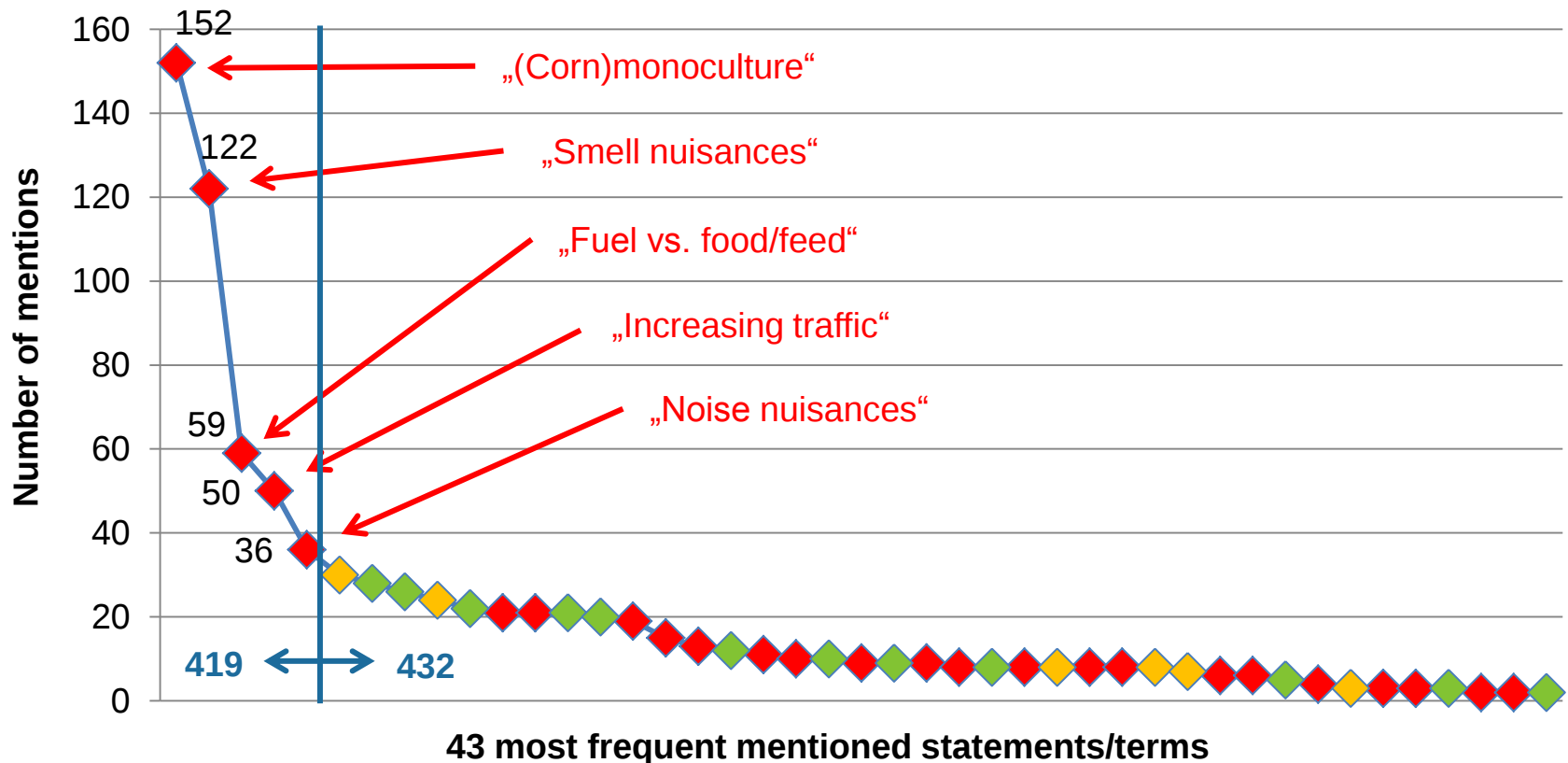
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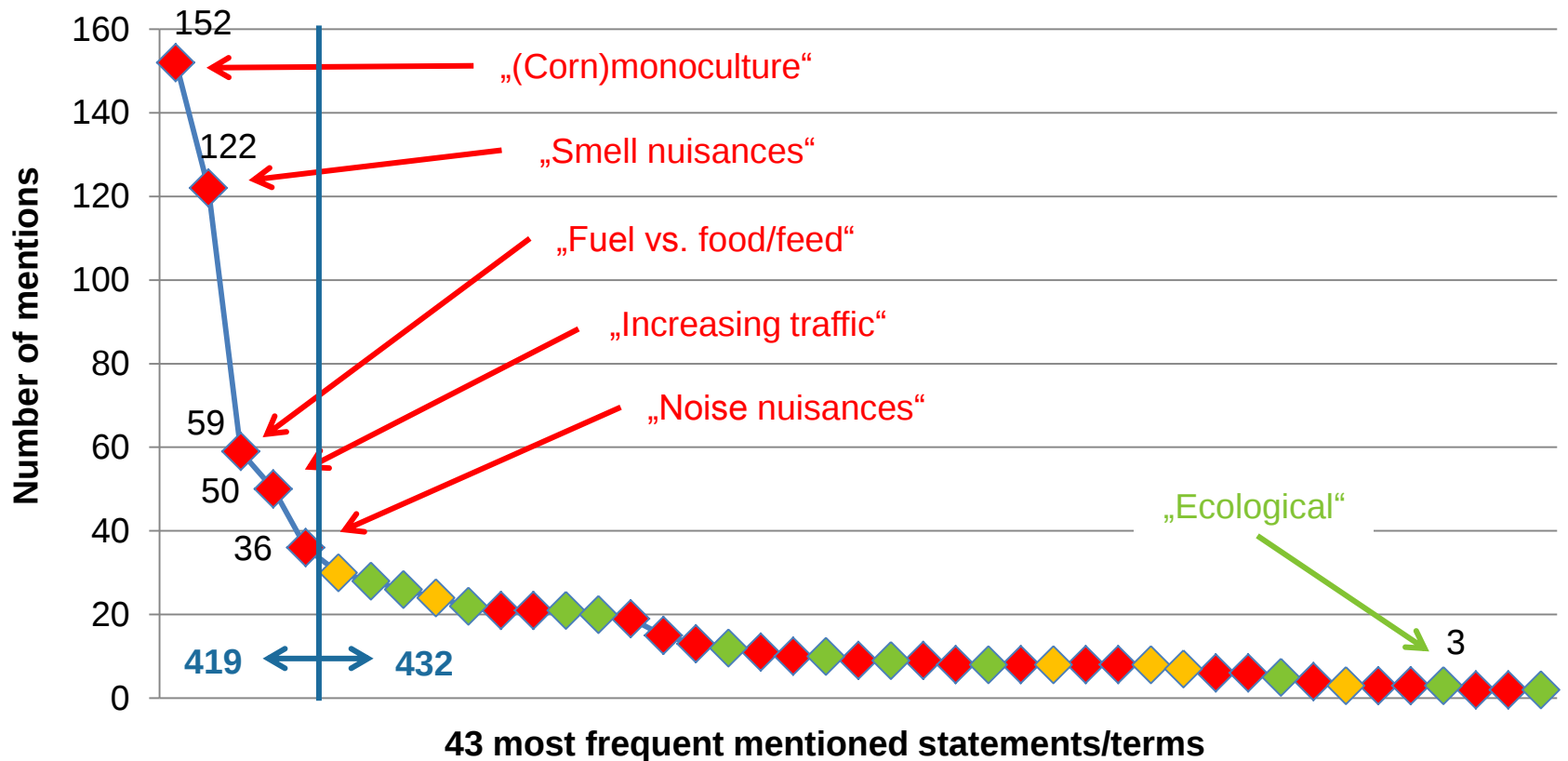
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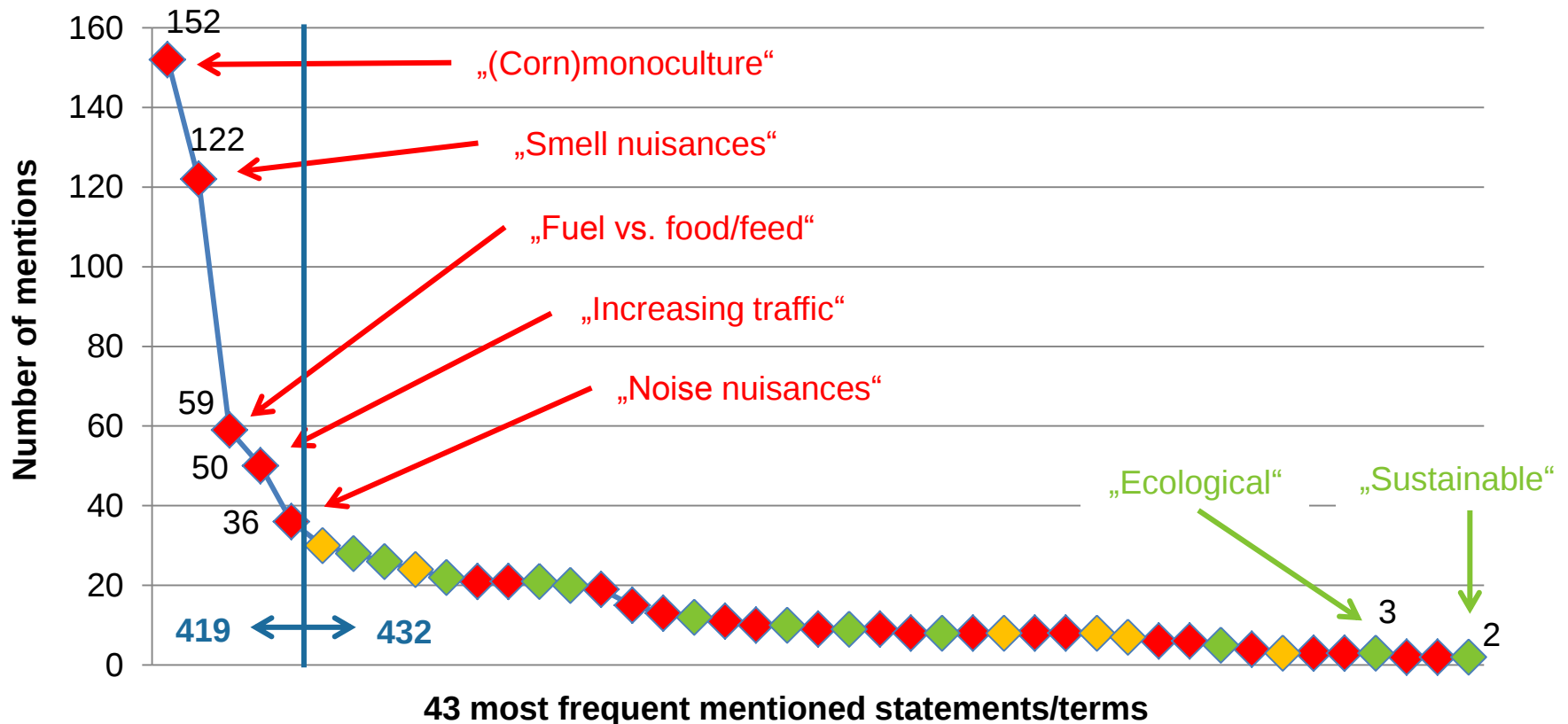
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Open question:

„Tell us five side effects of biogas plants that come spontaneously in your mind!“ (n=274) → **851 of 1.370 terms / associations**



Own source (2011)

Closed question: 236 data sets

*„Please evaluate the 32 subsequently
given characteristics / side effects
of biogas projects.“*

Closed question - approach:

„Please evaluate the 32 subsequently given characteristics / side effects of biogas projects.“ (n=236)

	Das finde ich...				Das ist mir...			
	negativ	neutral	positiv	egal	unwichtig	wichtig	ziemlich wichtig	ein großes Anliegen
Einbindung der Anwohner, Transparenz und Fairness bei Anlagenplanung von Anfang an	☐	☐	☐	☐	☐	☐	☐	☐
Nutzung von Reststoffen anstatt eigens angebauten Nachwachsenden Rohstoffen	☐	☐	☐	☐	☐	☐	☐	☐
Anbau gentechnisch veränderter Pflanzen	☐	☐	☐	☐	☐	☐	☐	☐
Einsatz von Pflanzenschutzmitteln (in Monokulturen)	☐	☐	☐	☐	☐	☐	☐	☐

Own source (2011)

Closed question - approach:

32 given statements about the 32 subsequently given characteristics / side effects of biogas plants (n=236)

	Das finde ich...				Das ist mir...			
	negativ	neutral	positiv	egal	unwichtig	wichtig	ziemlich wichtig	ein großes Anliegen
Einbindung der Anwohner, Transparenz und Fairness bei Anlagenplanung von Anfang an	☐	☐	☐	☐	☐	☐	☐	☐
Nutzung von Reststoffen anstatt eigens angebauten Nachwachsenden Rohstoffen	☐	☐	☐	☐	☐	☐	☐	☐
Anbau gentechnisch veränderter Pflanzen	☐	☐	☐	☐	☐	☐	☐	☐
Einsatz von Pflanzenschutzmitteln (in Monokulturen)	☐	☐	☐	☐	☐	☐	☐	☐

Own source (2011)

Closed question - approach:

32 given
statements

the 3
(n=23)

Classification 1:

„negative“

„neutral“

„positive“

ten characteristics / side effects of

Das finde ich...

Das ist mir...

negativ

neutral

positiv

egal

unwichtig

wichtig

ziemlich
wichtig

ein großes
Anliegen

Einbindung der Anwohner,
Transparenz und Fairness
bei Anlagenplanung von
Anfang an



Nutzung von Reststoffen
anstatt eigens angebauten
Nachwachsenden
Rohstoffen



Anbau gentechnisch
veränderter Pflanzen



Einsatz von
Pflanzenschutzmitteln (in
Monokulturen)



3. Online survey about side effects of biogas plants

Closed question - approach:

32 given statements

Classification 1:

„negative“

„neutral“

„positive“

Classification 2:

„don't care“

„unimportant“

„important“

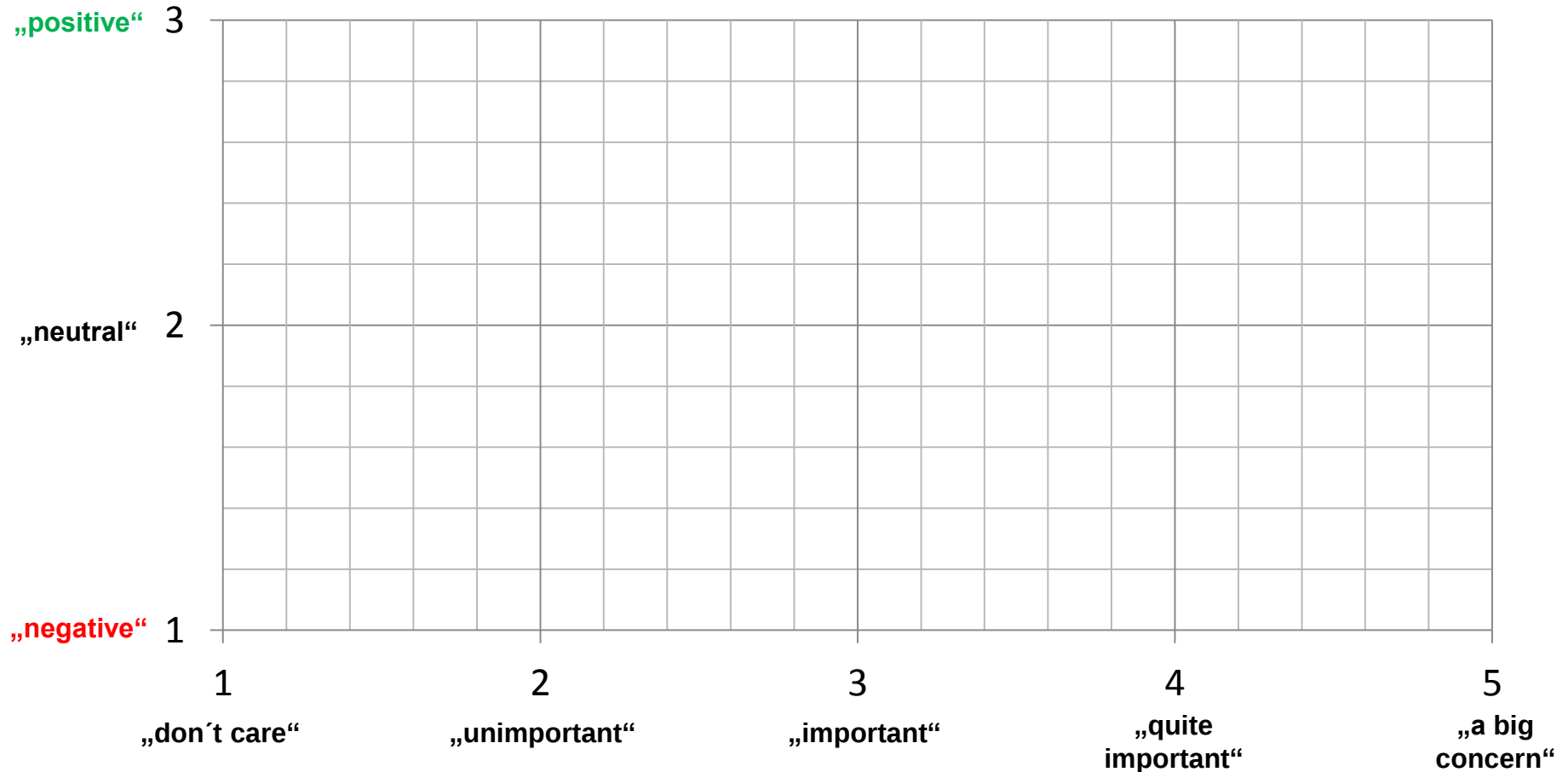
„quite important“

„a big concern“

	negativ	neutral	positiv	egal	unwichtig	wichtig	ziemlich wichtig	ein großes Anliegen
Einbindung der Anwohner, Transparenz und Fairness bei Anlagenplanung von Anfang an	☐	☐	☐	☐	☐	☐	☐	☐
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Einsatz von Pflanzenschutzmitteln (in Monokulturen)	☐	☐	☐	☐	☐	☐	☐	☐

Own source (2011)

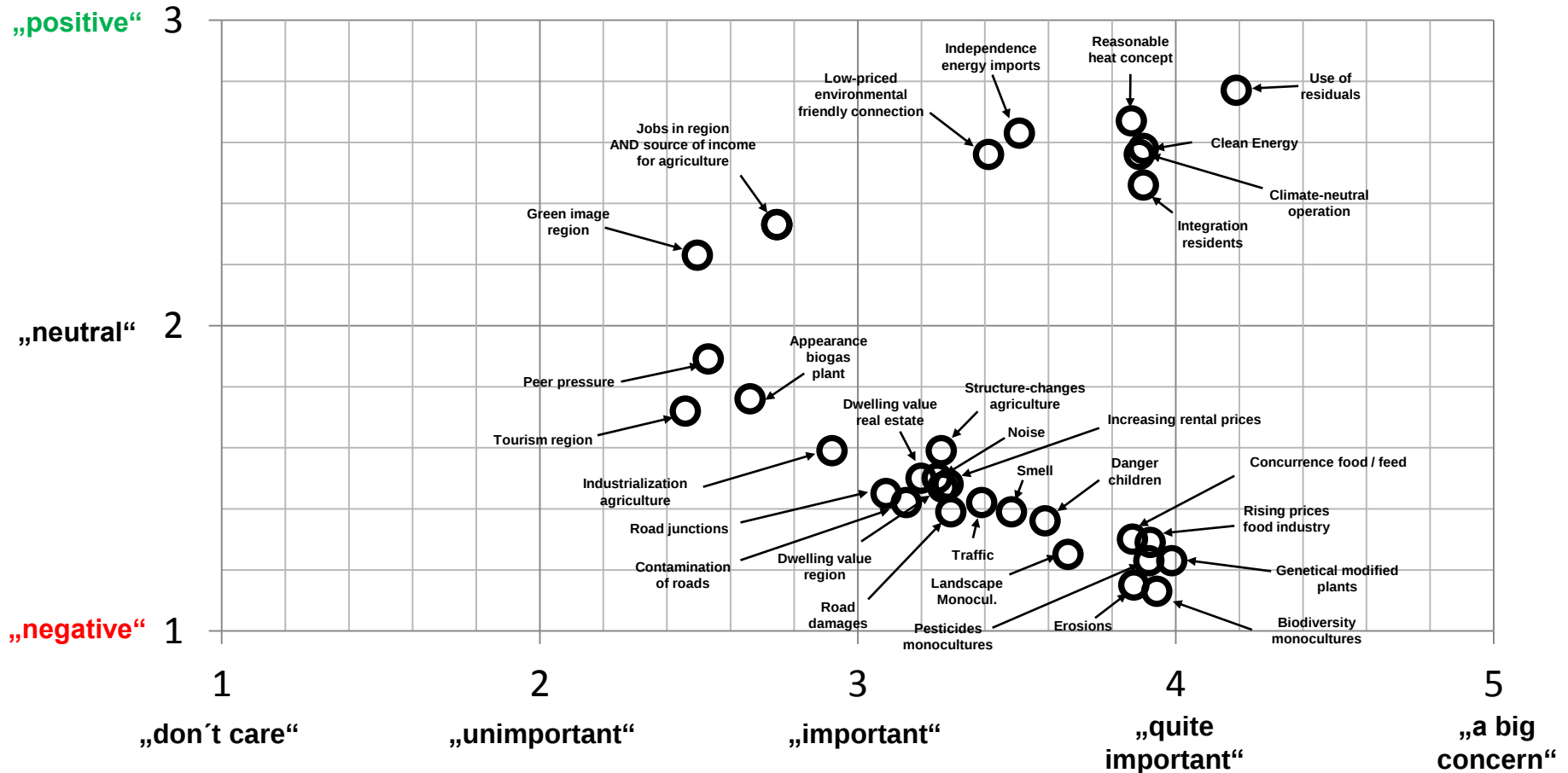
Placing of the 32 given characteristics / side effects - averages (n=236)



Own source (2011)

3. Online survey about side effects of biogas plants

Placing of the 32 given characteristics / side effects - averages (n=236)



Own source (2011)

Categories of arguments (≥ 10 mentions) in contributions from '04 bis '11

	Global Aspects/Motives	Regional Aspects/Motives	Local Aspects/Motives
Ecology	Category 1 „Land use“ - Corn monocultures - Pollution of water through increased use of pesticides - Erosions and loss of soil fertility - Loss of biodiversity		
	Category 2 „Climate protection / Future of energy supply“ - Damage to climate through emissions - Climate protection		
Economy	Category 2 „Climate protection / Future of energy supply“ - Security of energy supply - Feed-in of biogas natural gas grid - Biogas as economic factor		
	Category 3 „Fuel vs. Plate / Social matters“ - Increasing rental prices - Biogas subsidies distort competition - Rising prices for food - Creation of jobs		
Social matters	Category 4 „Personal disturbances“ - Negative influence on tourism - Alternative for farmers		
	Category 4 „Personal disturbances“ - Health risks through bacteria - Incidents and accidents - Increasing traffic - Odour disturbances - Noise disturbances		

Own source (2011)

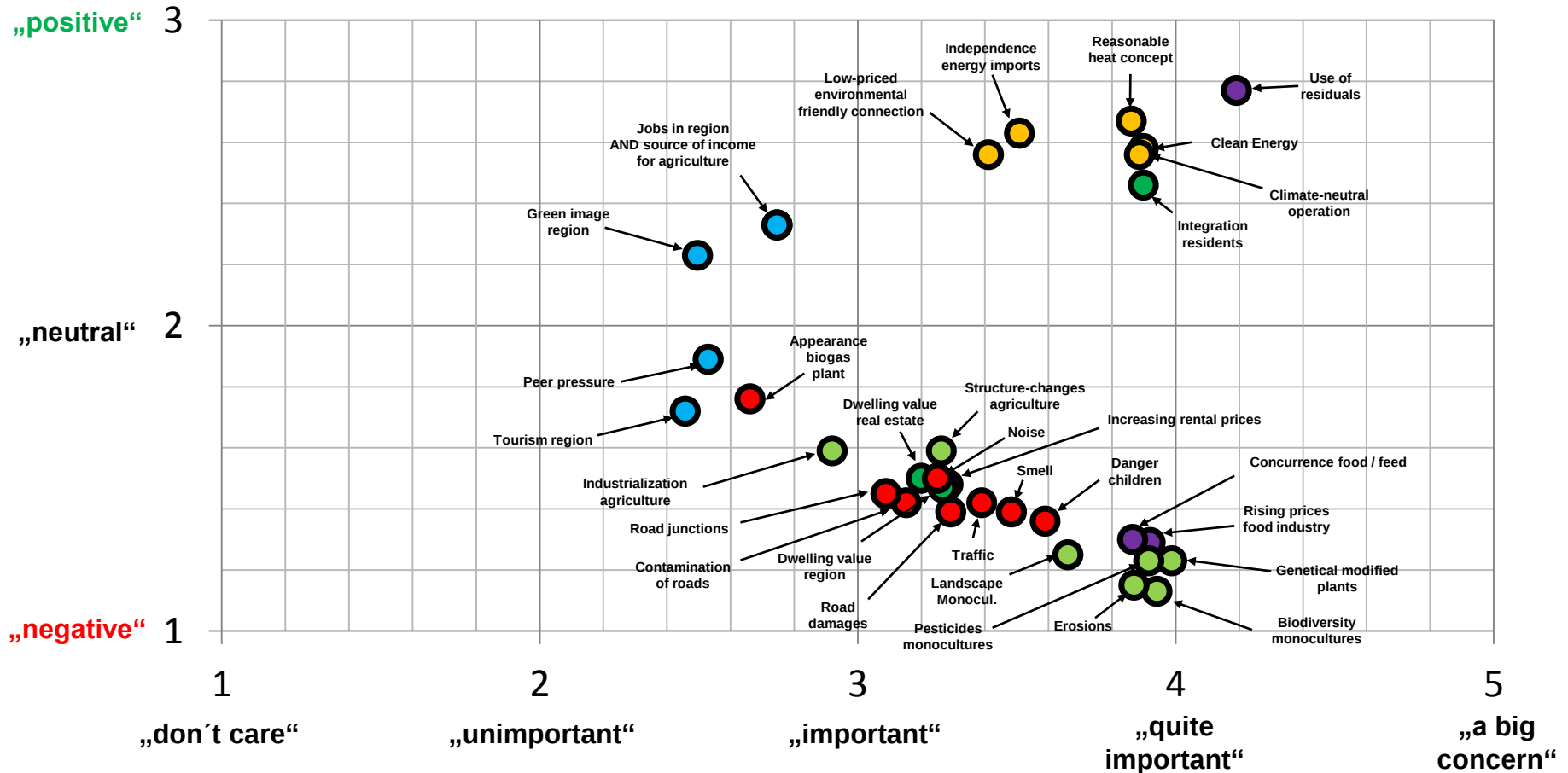
Closed question- Factor analysis

„Please evaluate the 32 subsequently given characteristics / side effects of biogas projects.“ (n=236)

Statement/Term	Factor					
	1	2	3	4	5	6
Contamination of roads	0,857	0,195	0,068	0,043	0,086	0,052
Road damages	0,851	0,169	0,053	-0,043	0,163	0,099
Traffic volume	0,799	0,212	-0,025	0,022	0,227	0,008
Danger for children through delivery traffic	0,737	0,106	0,091	0,056	0,239	0,098
Hardly visible road junctions through corn stock (hazard of road accidents)	0,73	0,129	-0,056	0,034	-0,011	0,187
Noise emissions	0,677	0,03	0,044	-0,052	0,45	0,003
Look of biogas plant in landscape	0,588	0,222	-0,031	0,188	0,087	0,026
Smell emissions	0,569	0,042	-0,035	0,07	0,521	0,091
Use of pesticides (in monocultures)	0,106	0,811	0,126	-0,016	0,163	0,075
Changes in biodiversity (through monocultures)	0,081	0,779	0,05	0,002	0,233	0,201
Erosions (through monocultures)	0,19	0,739	0,091	0,137	0,127	0,127
Growing of genetical modified plants	0,091	0,722	0,103	-0,034	0,042	0,056
Changes in landscape (through monocultures)	0,29	0,688	-0,039	0,058	0,057	0,195
„Industrialisation“ of agriculture	0,241	0,558	0,011	0,223	0,118	0,296
Structural changes in agriculture	0,254	0,54	-0,152	0,326	0,07	0,273
A meaningful heat concept of the plant	0,038	0,141	0,795	0,05	-0,05	0,155
A climate neutral operation of the plant	0,084	0,098	0,774	0,113	-0,005	0,172
Opportunity of a low priced and environmental friendly connection to the heat network of the plant	-0,066	-0,107	0,765	0,226	-0,008	-0,001
Production of „clean energy“ in terms of ecological heat, electricity or bio-natural gas	0,018	0,056	0,7	0,216	-0,097	-0,114
Independence of energy imports	0,004	0,026	0,666	0,145	0,167	-0,109
„Green image“ for region	-0,03	0,091	0,243	0,735	0,083	-0,085
Biogas for jobs in the region	-0,02	-0,001	0,363	0,704	-0,062	-0,066
Biogas as source of income for agriculture	-0,071	0,125	0,235	0,703	-0,044	0,005
Peer pressure effects (your entire street gets connected to the heat network of the biogas plant)	0,25	-0,006	0,118	0,563	0,017	0,217
Changes in regional tourism	0,213	0,11	-0,112	0,524	0,276	0,225
Changes in the (dwelling) value of your real estate	0,377	0,23	-0,022	-0,014	0,759	0,106
Changes in the dwelling value of your neighbourhood	0,344	0,215	-0,076	0,046	0,748	0,188
Involvement of residents, transparency and fairness at plant planning from the beginning	0,188	0,262	0,095	0,091	0,513	0,071
Increasing rental prices for arable land	0,104	0,199	0,012	0,205	-0,031	0,765
Increasing commodity prices for the food industry	0,126	0,263	-0,035	0,066	0,323	0,674
Acreage competition to production of food and feed	0,156	0,348	-0,033	-0,012	0,317	0,662
Utilisation of residues instead of especially cultivated renewable resources	0,038	0,217	0,368	-0,209	-0,028	0,526

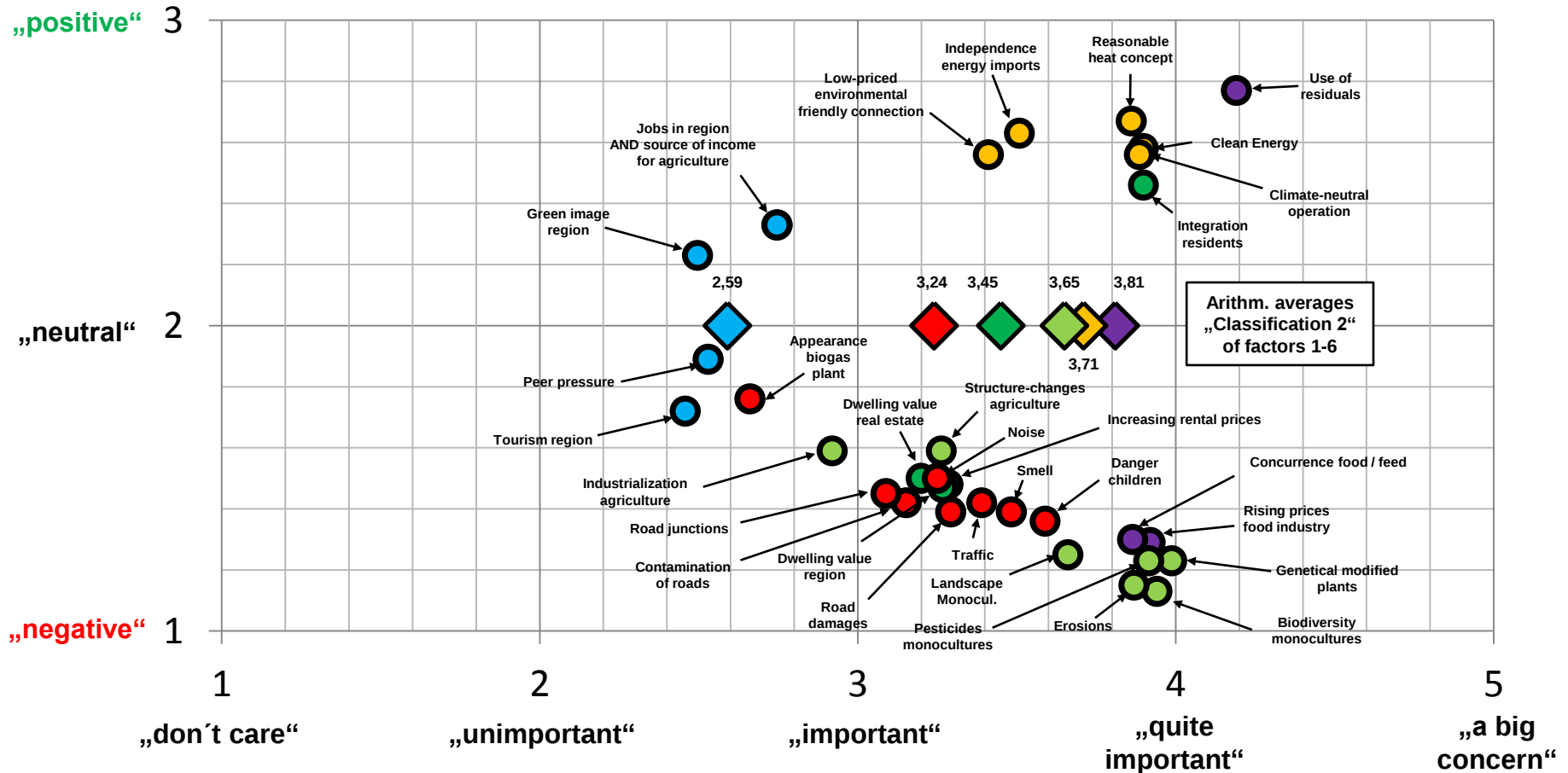
Own source (2011)

Placing of the 32 given characteristics / side effects - averages (n=236)



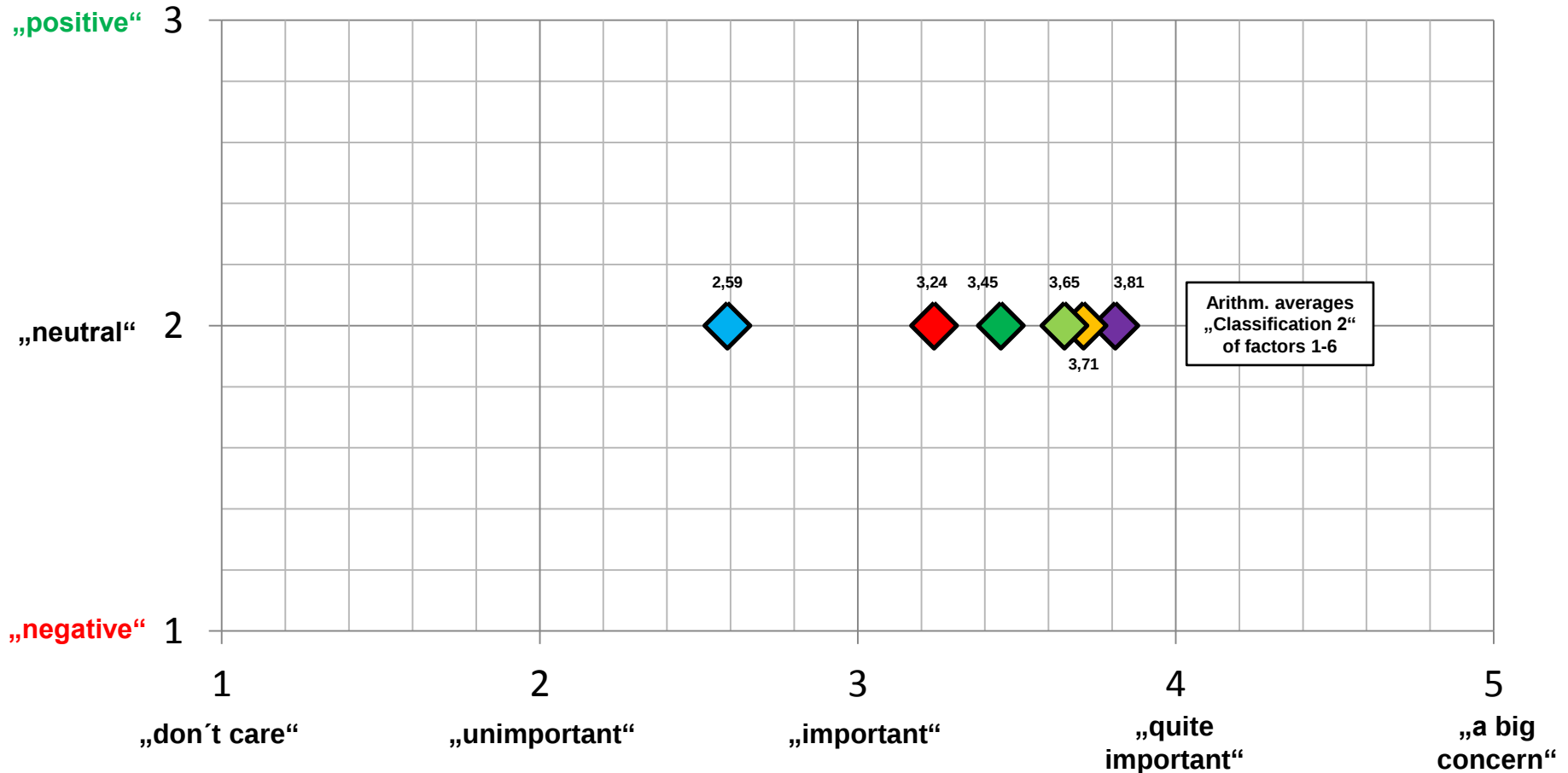
Own source (2011)

Placing of the 32 given characteristics / side effects - averages (n=236)

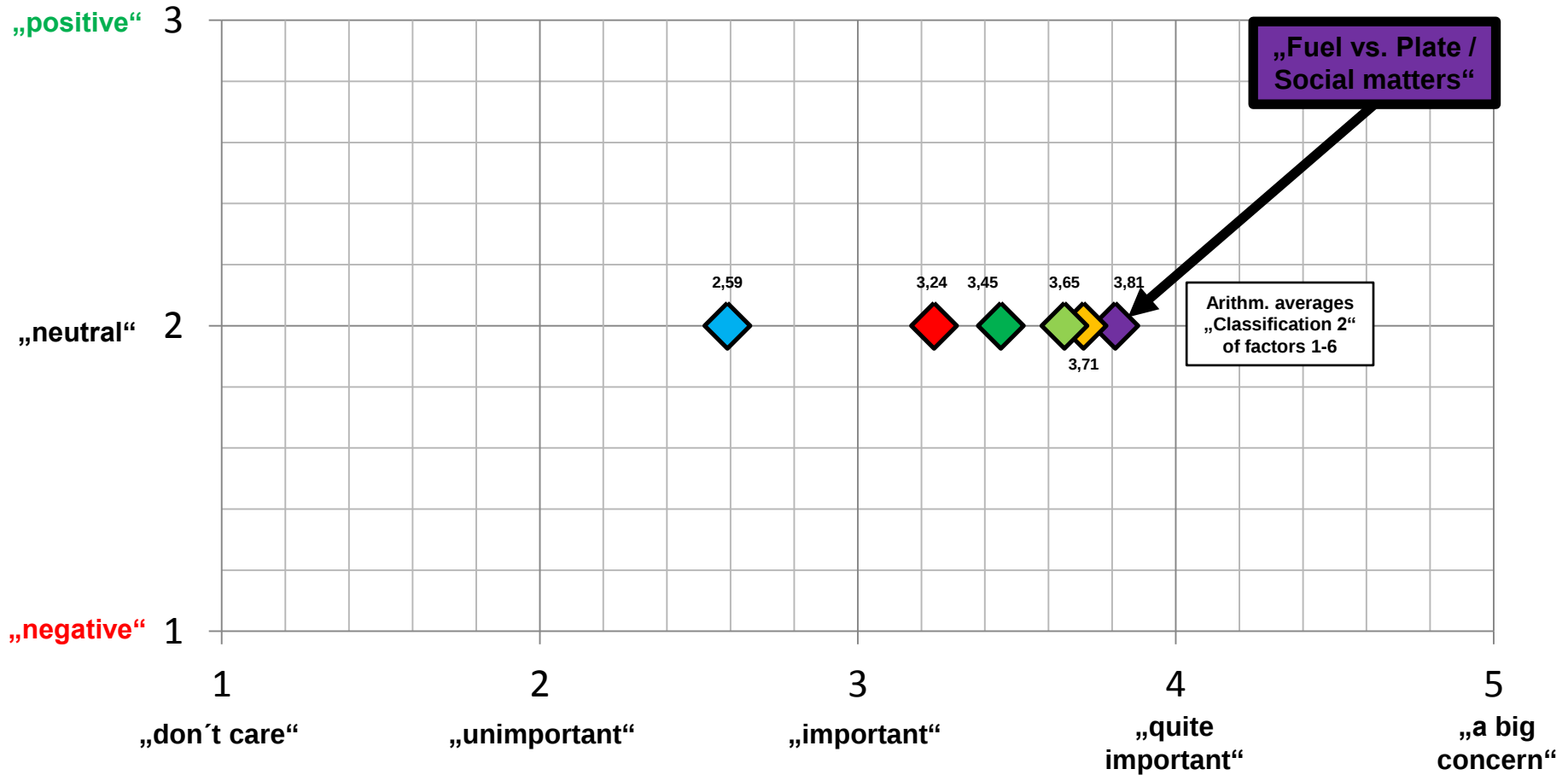


Own source (2011)

Placing of the 32 given characteristics / side effects - averages (n=236)

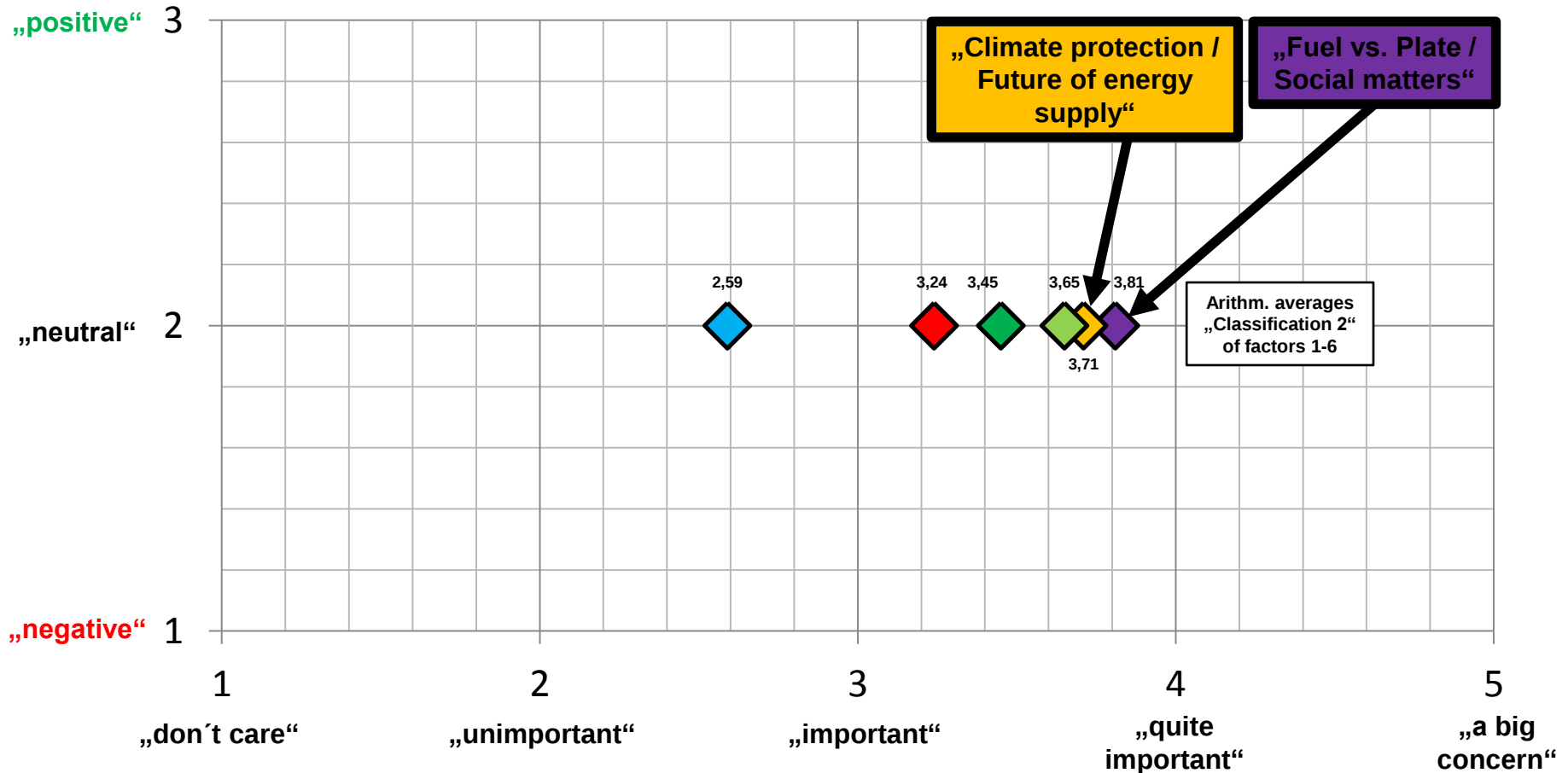


Placing of the 32 given characteristics / side effects - averages (n=236)



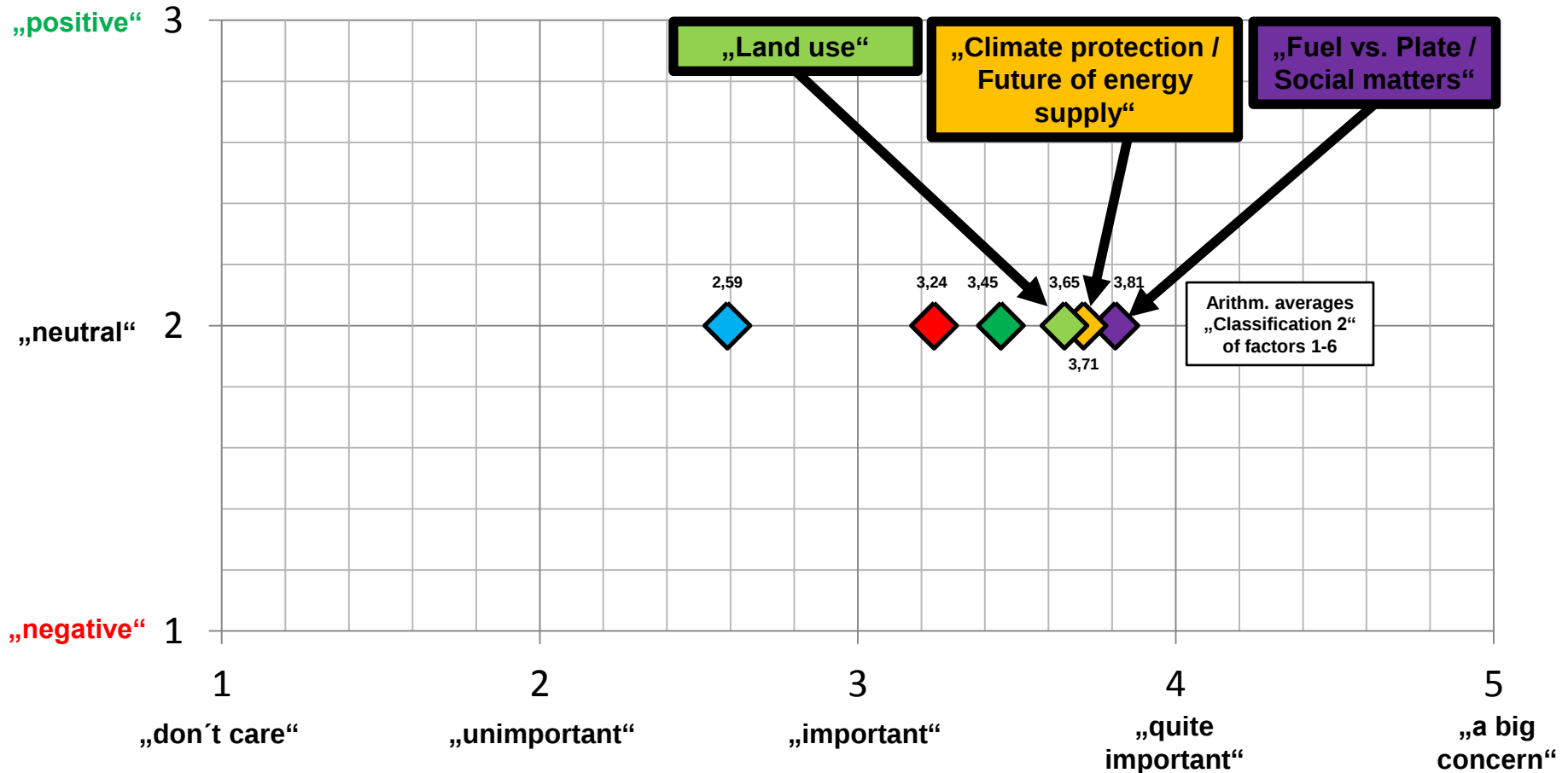
Own source (2011)

Placing of the 32 given characteristics / side effects - averages (n=236)



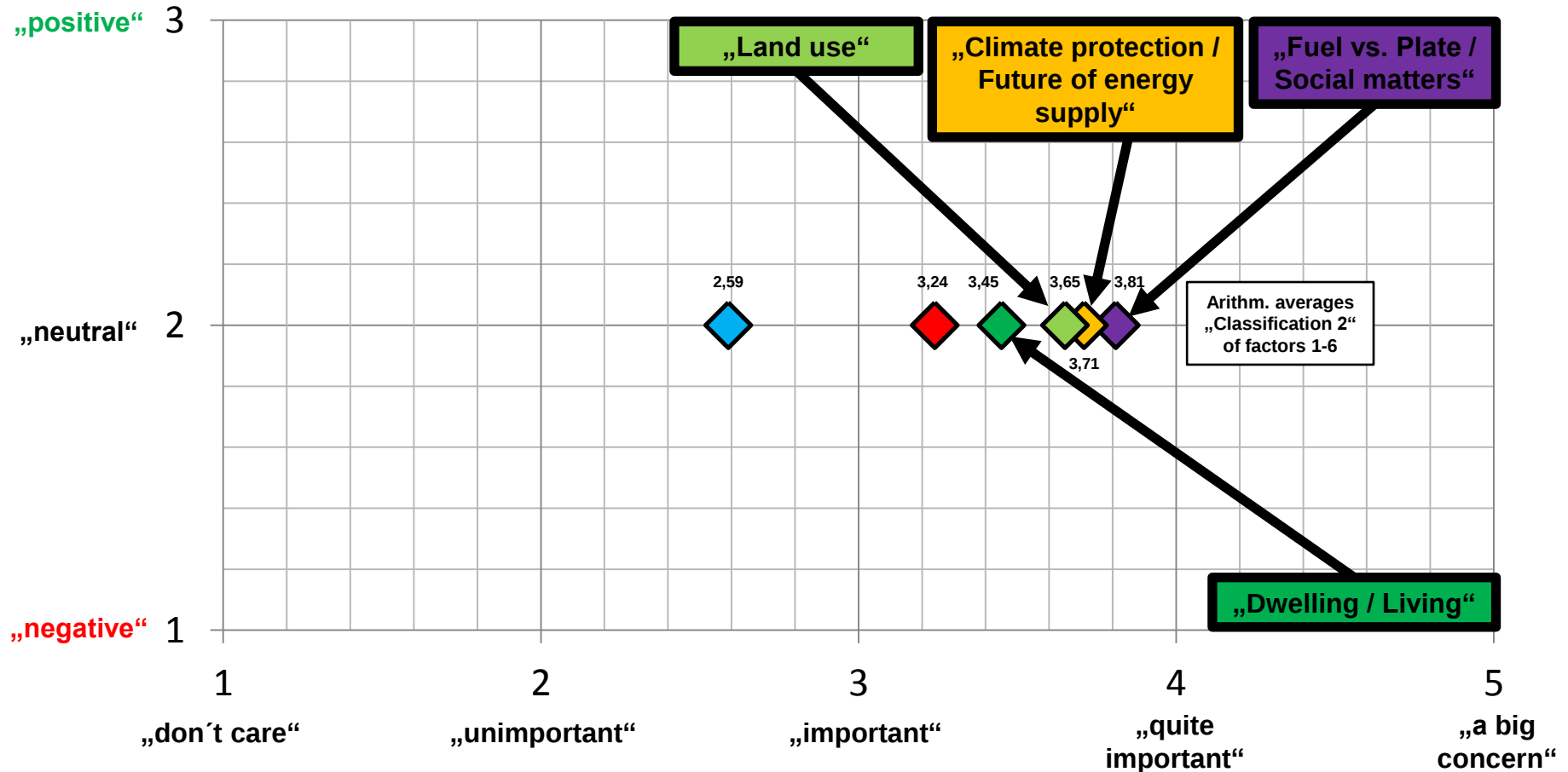
Own source (2011)

Placing of the 32 given characteristics / side effects - averages (n=236)



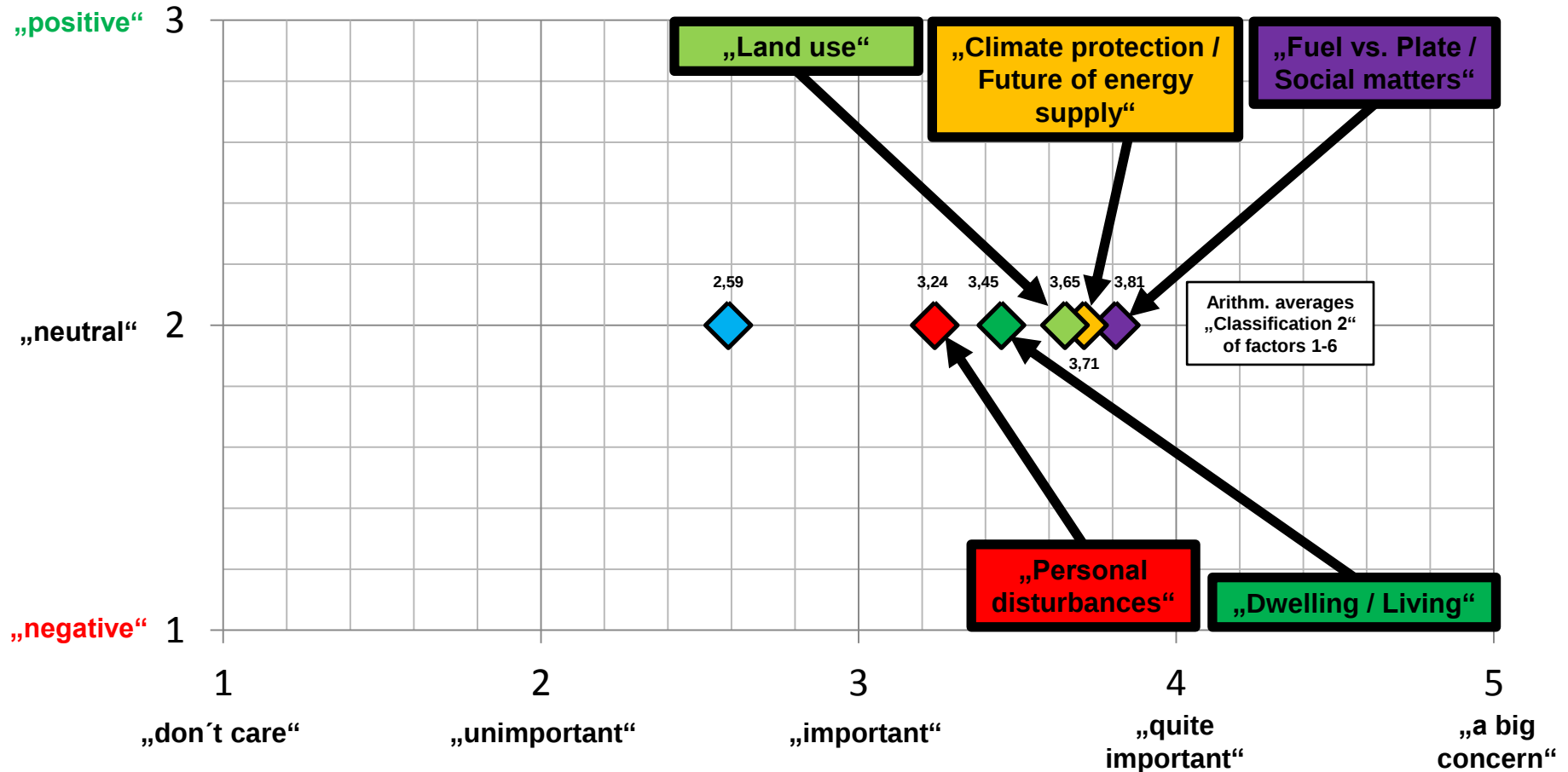
Own source (2011)

Placing of the 32 given characteristics / side effects - averages (n=236)



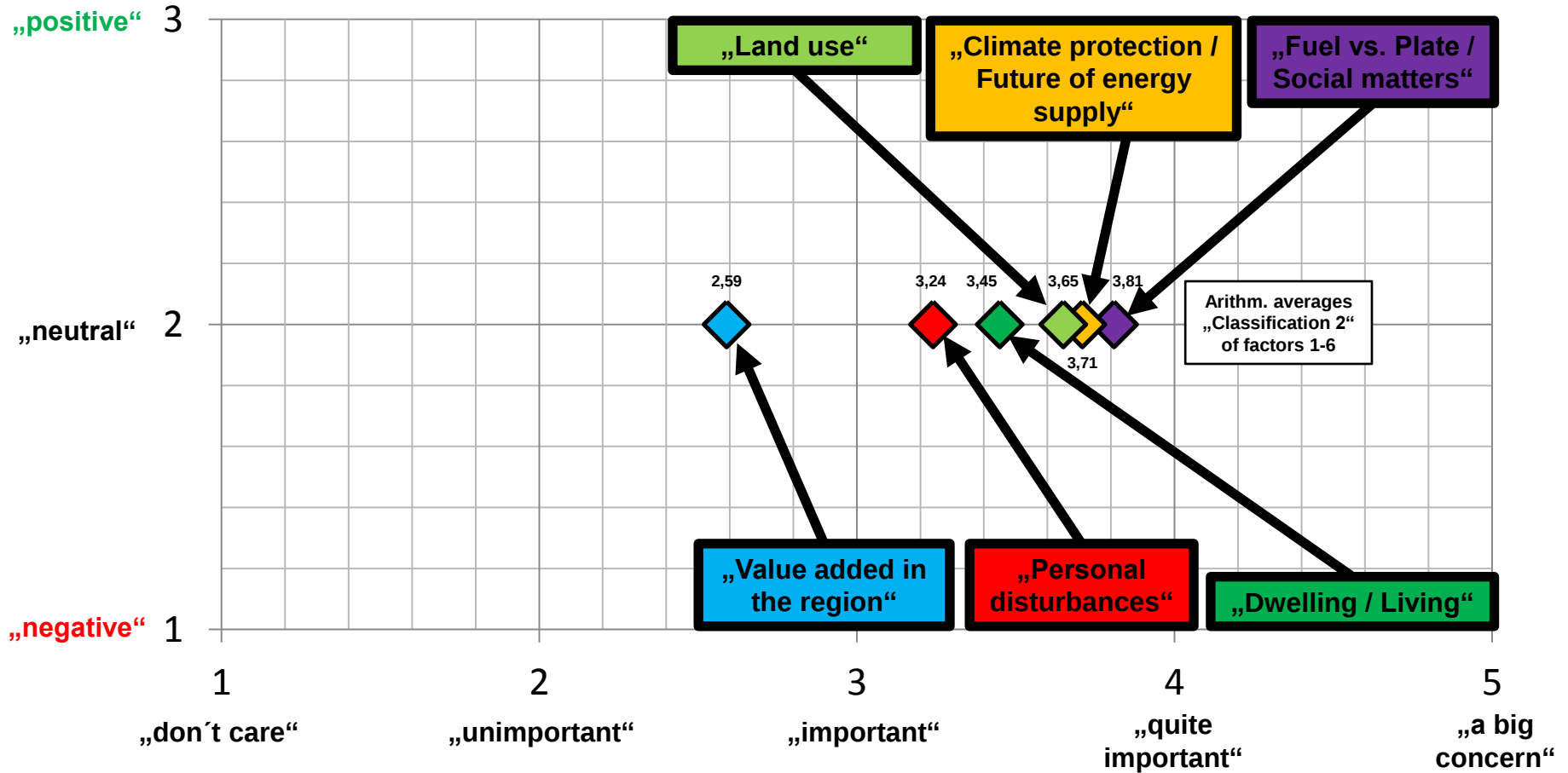
Own source (2011)

Placing of the 32 given characteristics / side effects - averages (n=236)



Own source (2011)

Placing of the 32 given characteristics / side effects - averages (n=236)



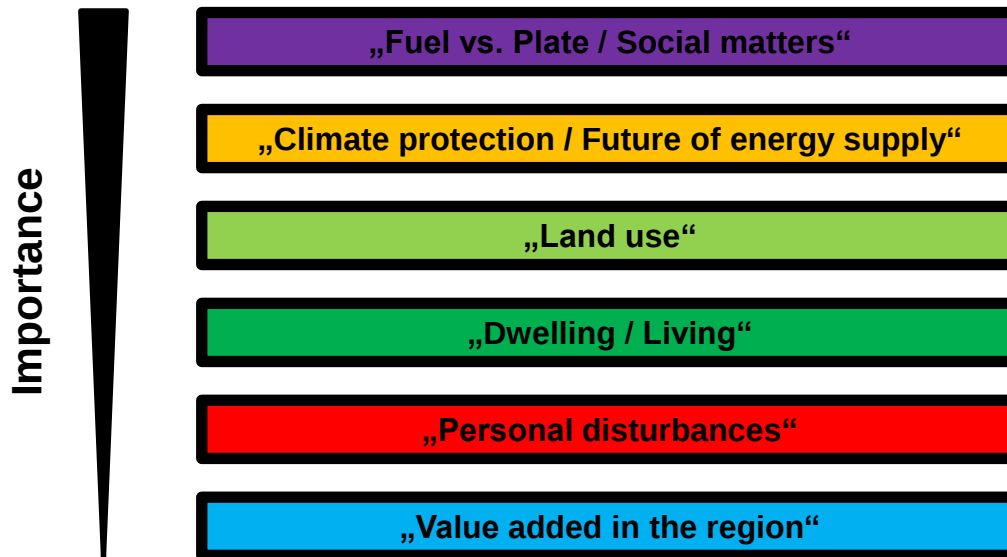
Own source (2011)

Conclusion

1. Energy turnaround in Germany brings massive changes; largest number of citizens as residents of power supply plants ever since
2. Large range of different side effects, according to renewable energy technologies; especially biogas plants have a large „portfolio“ of side effects, first of all negative ones
3. Superficial studies on social acceptance of renewable energy technologies / plants are very positive
4. In case of biogas plants: More than 70 % of the respondents have spontaneous associations of negative kind; 70 % of these negative spontaneous associations are represented by 5 single arguments

Conclusion

5. Four superior themes were found in the analysis of German media concerning the topic „biogas“ **plus** two more superior themes that were found in the online survey



Conclusion

6. The German government has set very ambitious targets concerning biogas plants until 2020: Substitution of 6 billion Nm³ of fossil natural gas through biogas per year

1. Introduction
2. Media analysis about the topic „biogas“
3. Online survey about side effects of biogas plants
- 4. List of references**

AG Energiebilanzen e.V. (2012):

Electricity data for the year 2011 (preliminary);

Online: http://www.ag-energiebilanzen.de/componenten/download.php?filedata=1324204440.pdf&filename=2011_Strom.pdf&mimetype=application/pdf (accessed: 29th July 2012)

E.ON AG (2012):

Ex-Post-Data according to generating units;

Online: <http://www.eon-schafft-transparenz.de/download/expost> (accessed: 06th August 2012)

German Biogas association (2012):

Branch key data 2011;

Online: [http://www.biogas.org/edcom/webfvb.nsf/id/DE_Branchenzahlen/\\$file/12-06-01_Biogas%20Branchenzahlen%202011-2012-2013.pdf](http://www.biogas.org/edcom/webfvb.nsf/id/DE_Branchenzahlen/$file/12-06-01_Biogas%20Branchenzahlen%202011-2012-2013.pdf) (accessed: 10th January 2012)

Michel, Jean-Baptiste; Shen, Yuan Kui; Aiden, Aviva Presser; Veres, Adrian; Gray, Matthew K.; Brockman, William; The Google Books Team, Pickett, Joseph P. ; Hoiberg, Dale; Clancy, Dan; Norvig, Peter; Orwant, Jon; Pinker, Steven; Nowak, Martin A. and Lieberman Aiden, Erez (2010):

Quantitative Analysis of Culture Using Millions of Digitized Books. Science 14 January 2011: 176-182. Published online 16 December 2010 [DOI: 10.1126/science. 1199644] (accessed: 07th February 2012)

Renewable Energies Agency (2011):

Survey by TNS Infratest 2011, 1002 Respondents, by order of the Renewable Energies Agency, Status: 07/2011;
Online: <http://www.unendlich-viel-energie.de/de/detailansicht/article/224/umfrage-buerger-befuerworten-energiewende-und-sind-bereit-die-kosten-dafuer-zu-tragen.html> (accessed: 09th October 2011)

The Federal Government (2011a):

Nuclear power plants on the test bench;

Online: <http://www.bundesregierung.de/Content/DE/Artikel/2011/03/2011-03-15-bund-laender-kkw-pruefungen.html> (accessed: 27th July 2012)

The Federal Government (2011b):

Pathway to the energy of the future;

Online: <http://www.bundesregierung.de/Content/DE/Artikel/2011/06/2011-06-06-energiewende-text-breg.html> (accessed: 29th July 2012)

Thank you for your attention!

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