LCAFOOD 2010 – 7th Intl Conference on LCA in the Agri-food Sector
Bari, Italy - 23 Sept 2010

Life Cycle Assessment and Carbon Footprint in the Wine Supply-Chain

C. Pattara[*], A. Raggi[**], A. Cichelli[**]

[*] *Department of Sciences, "G. d'Annunzio" University, Pescara, Italy*

[**] *Department of Business, Statistical, Technological and Environmental Sciences, "G. d'Annunzio" University, Pescara, Italy*

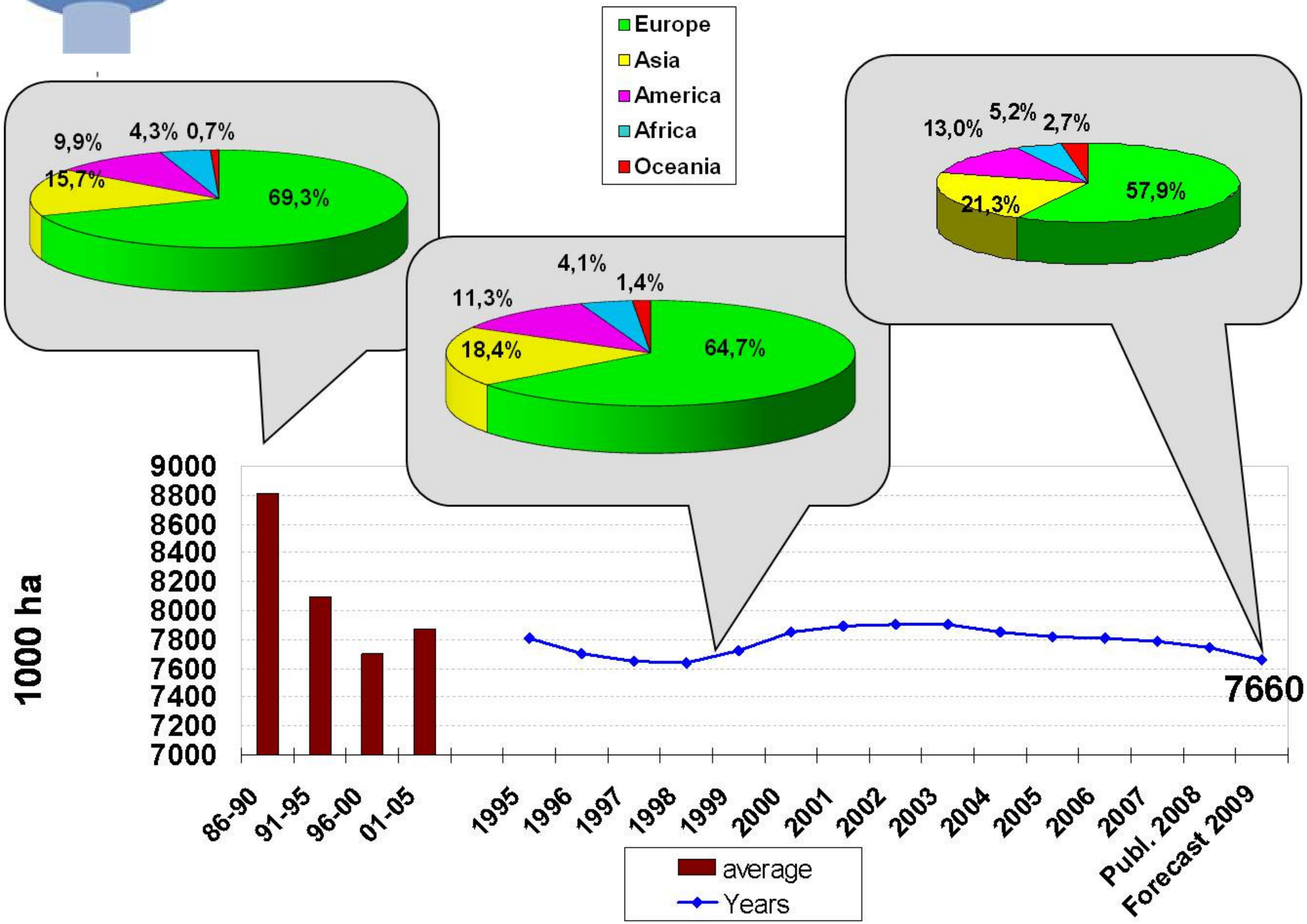
The wine industry

The wine industry is a “global” sector which represents a significant demand of world resources.

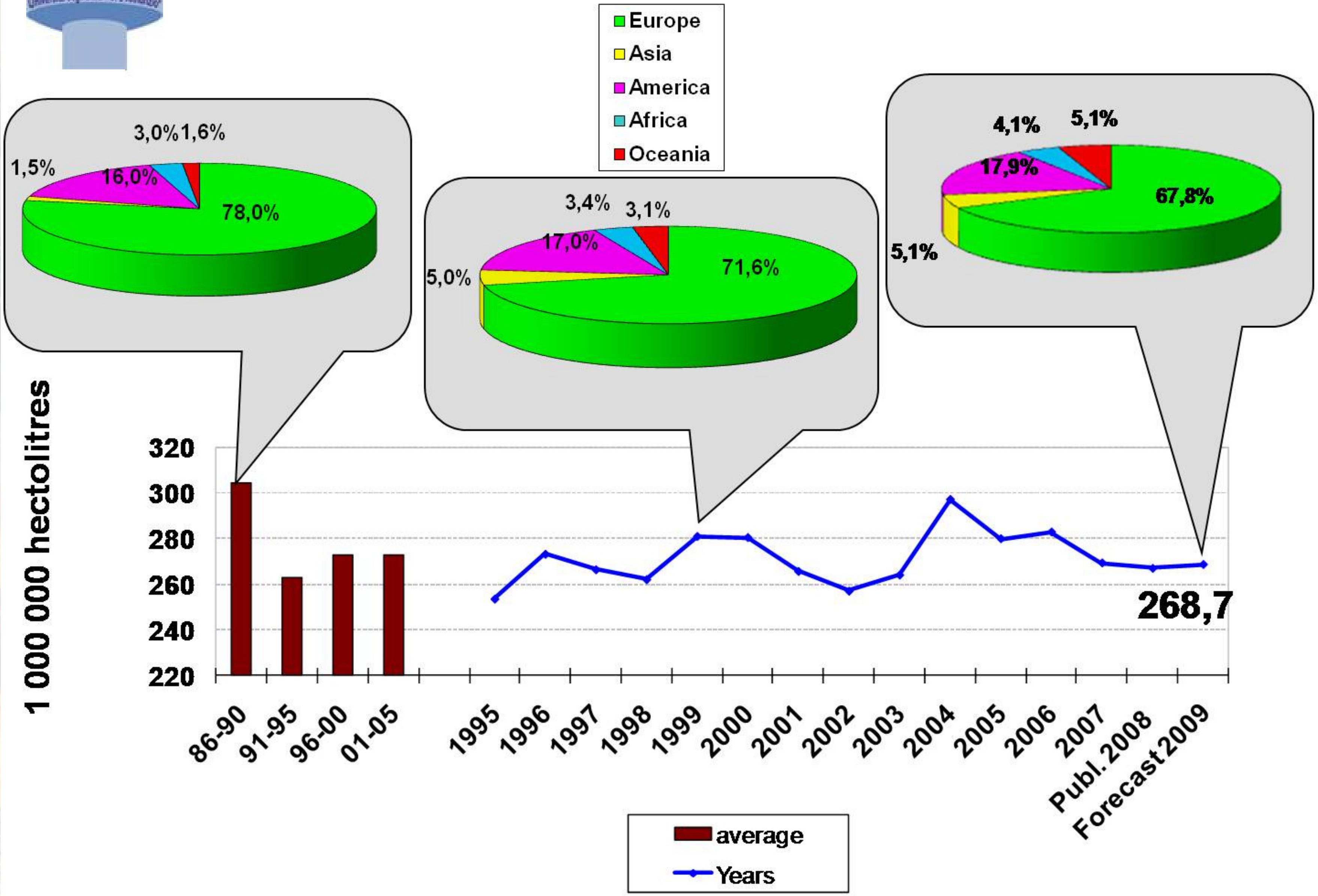
Worldwide, 8 million hectares are used for viticulture

Annual world production of wine is about 270 million hectolitres (OIV, 2006)

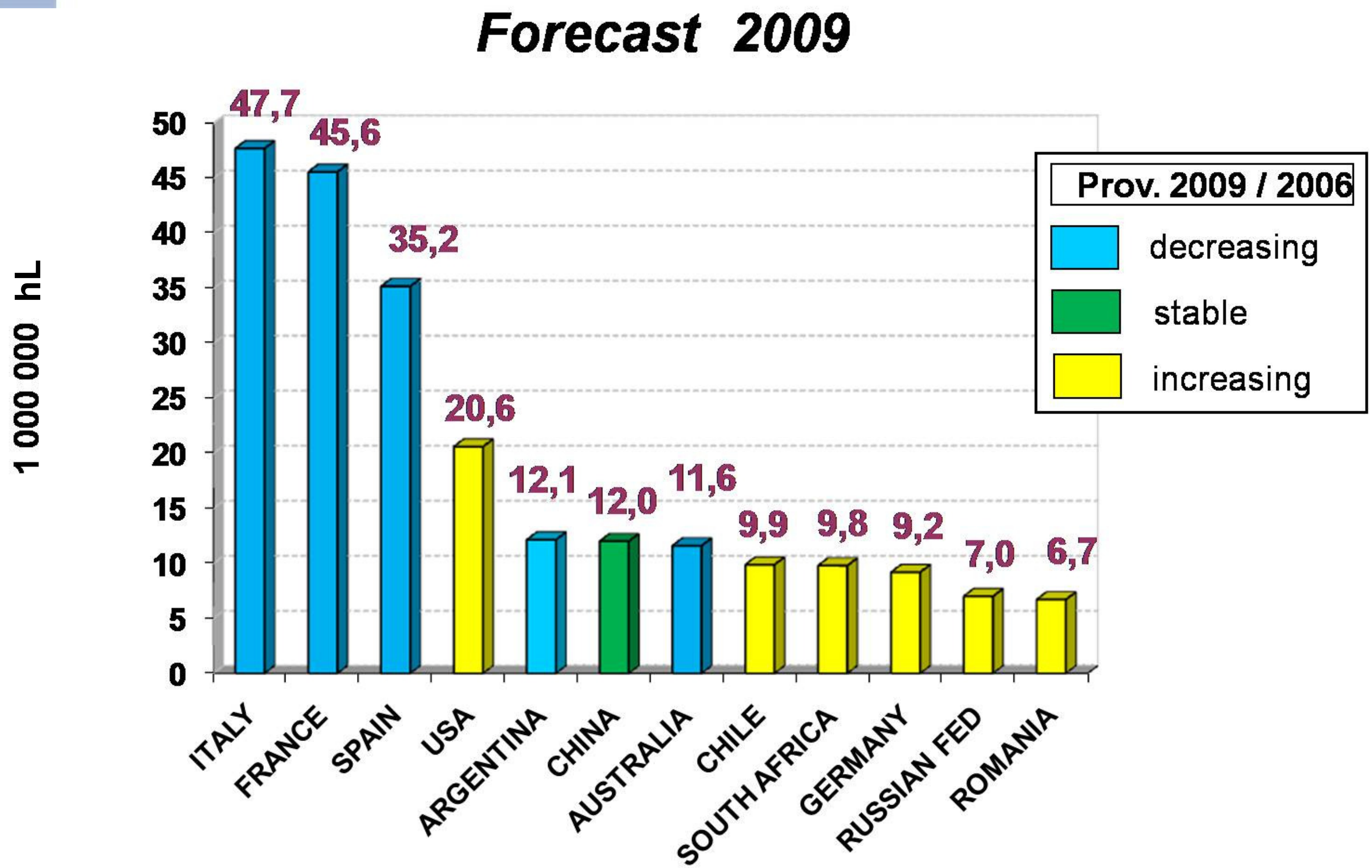
Surface area of vineyards worldwide

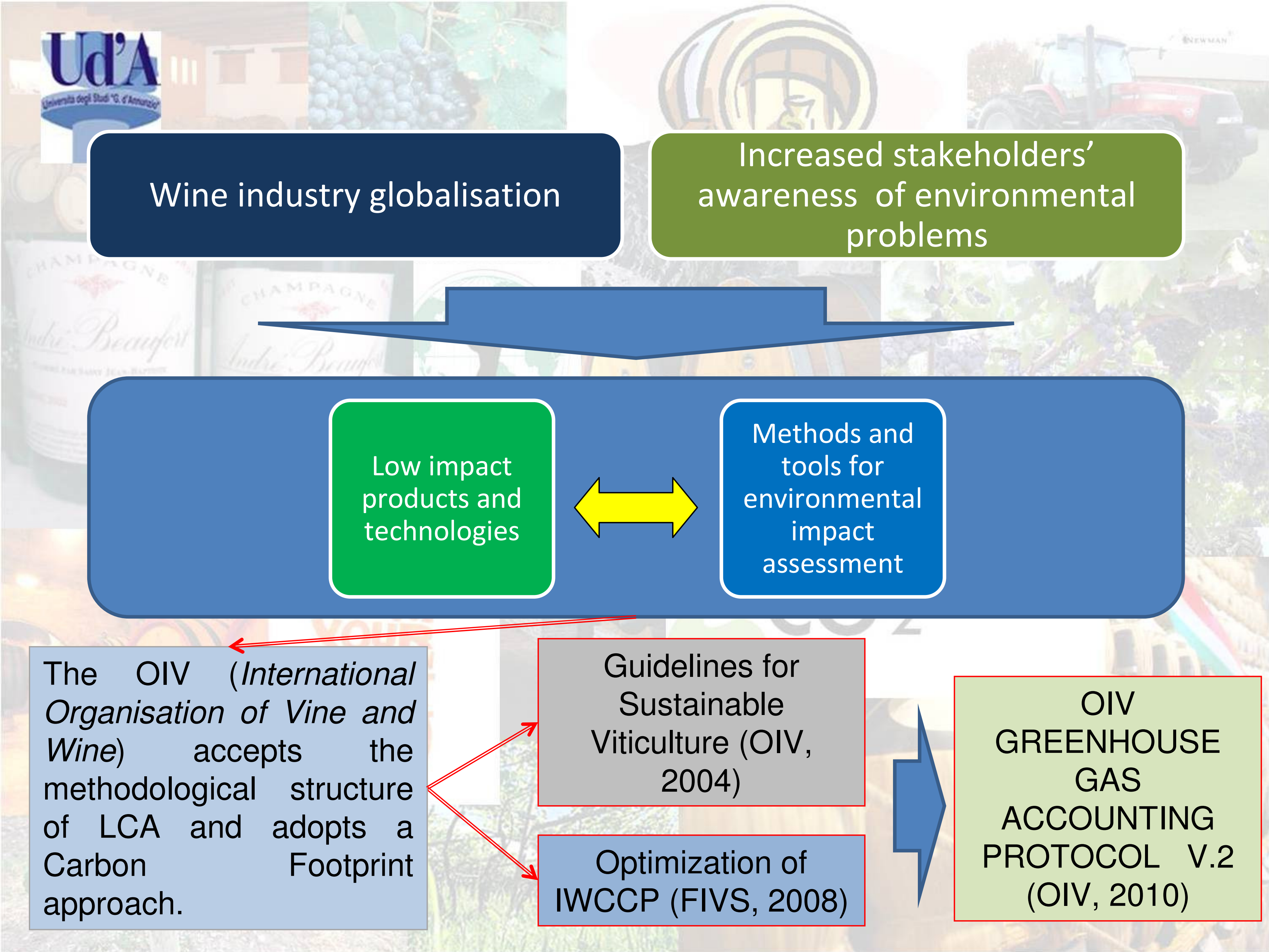


World production of wine

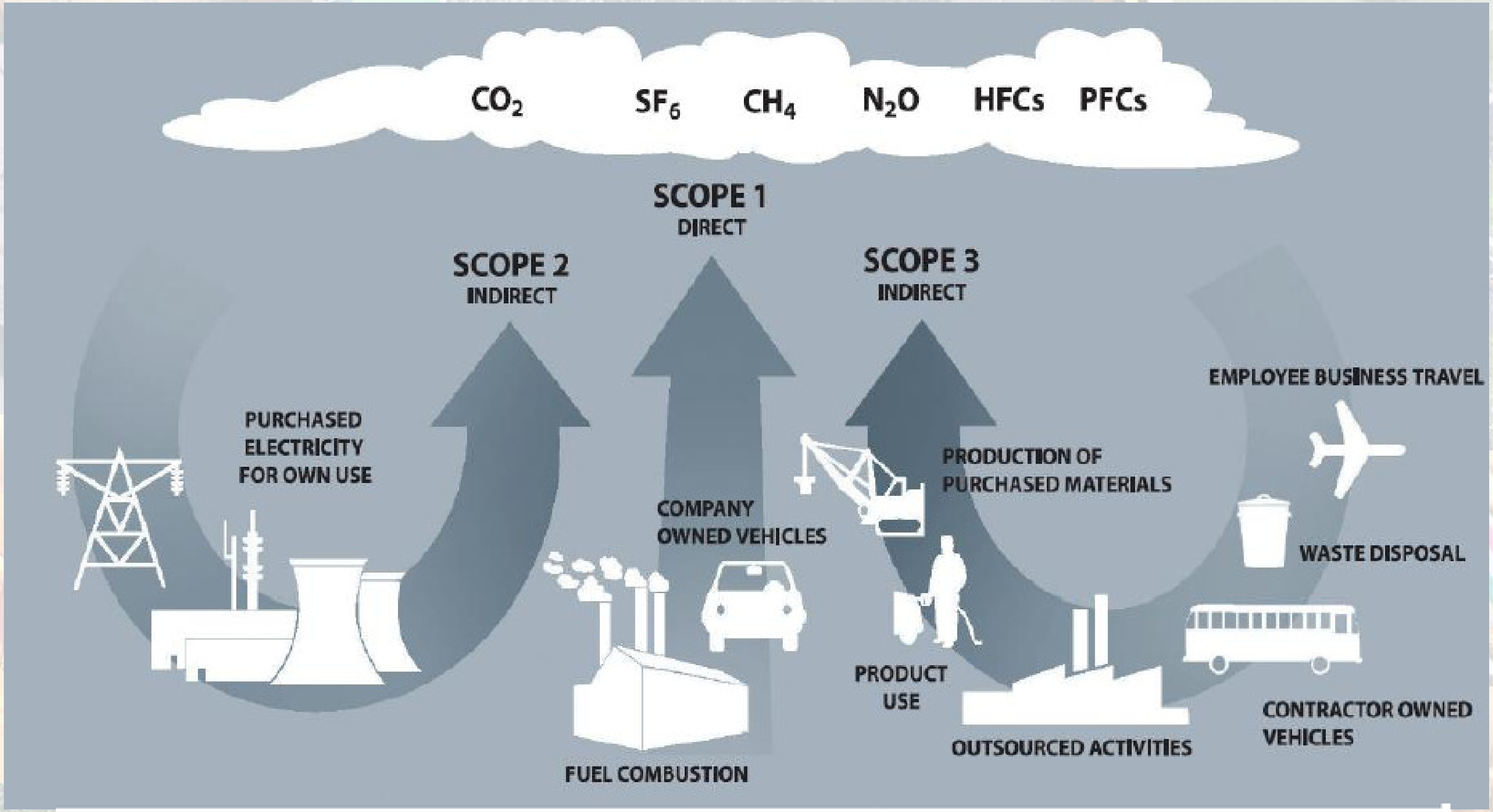


Production of wine of the 12 leading countries




Ud'A
Wine industry globalisation
Increased stakeholders' awareness of environmental problems
Low impact products and technologies
Methods and tools for environmental impact assessment
The OIV (*International Organisation of Vine and Wine*) accepts the methodological structure of LCA and adopts a Carbon Footprint approach.
Guidelines for Sustainable Viticulture (OIV, 2004)
Optimization of IWCCP (FIVS, 2008)
OIV GREENHOUSE GAS ACCOUNTING PROTOCOL V.2 (OIV, 2010)

IWCCP 3-scope framework



Pictorial Representation of Scope (World Resources Institue 2004)

Aim of this work

Application of the Carbon Footprint to a winery in Abruzzo, Italy, where an LCA had been already carried out previously (Petti et al., 2005, 2006).

Analysis, in a context already known, of an instrument (CF) which is still being defined by the OIV .

Preliminary comparative considerations between the two tools considered (LCA and CF).

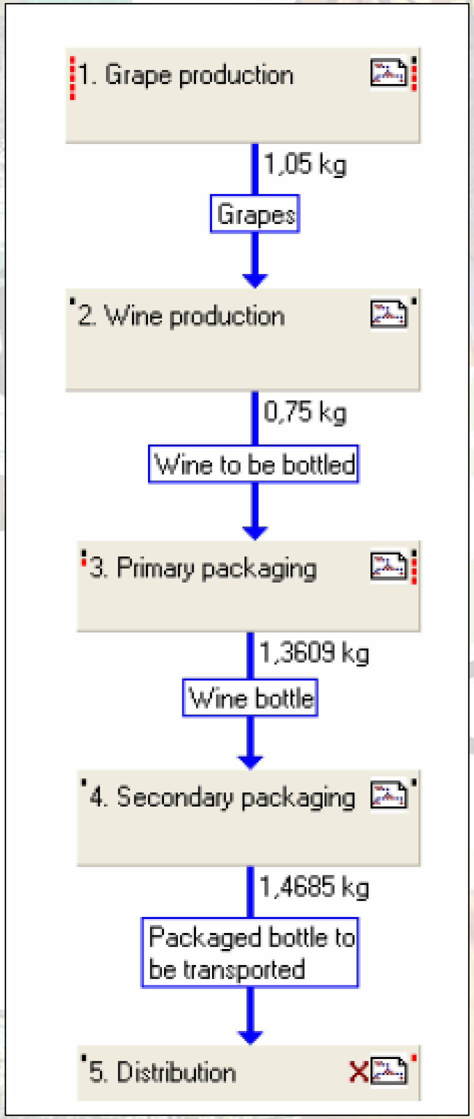
The functional unit chosen was a bottle (750 ml) of organic red wine (Montepulciano d'Abruzzo),

The farm analysed has 12 hectares of vineyard, 5 of which cultivated with Montepulciano d'Abruzzo grape.

The average yearly production of Montepulciano grapes is about 70 tonnes.

The yearly production of wine is about 50,000 litres, part of which (75%) is bottled, whilst the remaining is sold in bulk.

LCA Case-Study System Boundaries



Source: Petti et al., 2006

Welcome to the International Wine Carbon Calculator (IWCC)

Start AB32 Accounting

In order to select the familiar units and region specific emission factors, please select a region from the coloured maps below.

Start Carbon Footprint or Embodied Carbon Accounting

You have selected the following country and region: **South Africa** South Africa You have selected the following electrical grid: **South Africa**

Units Used Within the Model

	Volume	Energy	Mass	Mileage	Gas Units	Distance	Crush	Power	Sugar	Land Area
Australia	L	GJ	kg	L/100km	scM	km	Tonnes	kWh	Brix	ha
New Zealand	L	GJ	kg	L/100km	scM	km	Tonnes	kWh	Brix	ha
United States	Gal (US)	Therm	lb	mpg	scf	mil	ton (short)	kWh	Brix	Acre
South Africa	L	GJ	kg	L/100km	scM	km	Tonnes	kWh	Brix	ha
United Kingdom	Gal (imp)	Btu	lb	L/100km	scf	mil	ton (long)	Therm	Brix	ha

Introduction | General Summation | General Summation Bar Chart | General Summation Pie Chart | AB32 Summation | R1 AB32 Stationary Combu

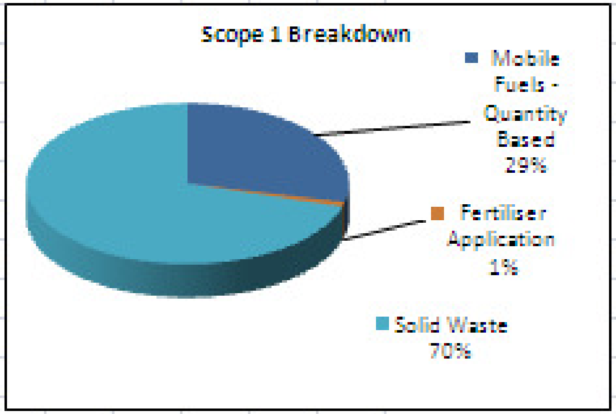
GHG Emissions Summary

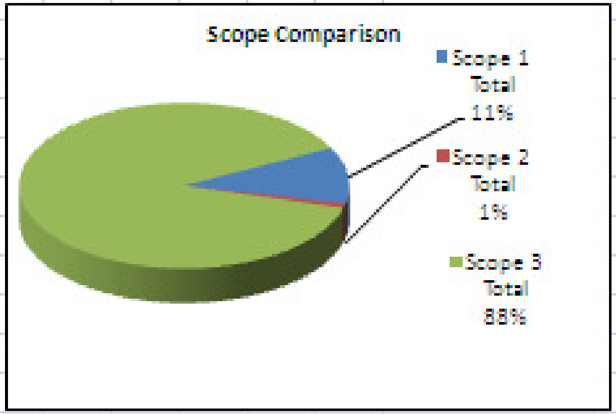
Print This Page

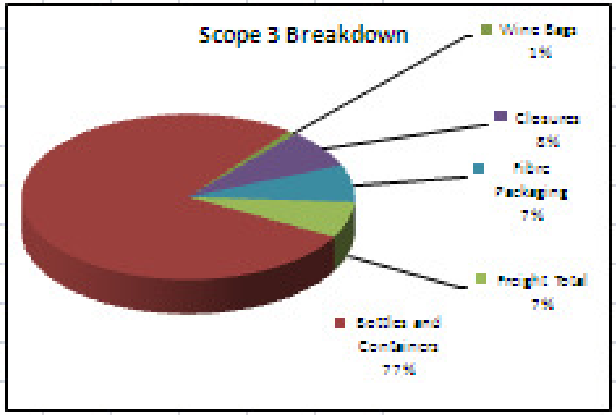
Scope 1		Tonnes CO_2e		CO_2e	Units
	Mobile Fuels - Quantity Based	2	1.00	2	Tonnes
	Mobile Fuels - Distance Based	0	1.00	0	Tonnes
	Stationary Fuels Combustion	0	1.00	0	Tonnes
	Fugitive Emissions	0	1.00	0	Tonnes
Winery Processing	Direct CO_2 Use in Wine Making	0	1.00	0	Tonnes
Vineyard Processing	Fertiliser Application	0	1.00	0	Tonnes
	Soil Emission (Tillage Practices)	NA	1.00	NA	Tonnes
	Row Cropping	NA	1.00	NA	Tonnes
	Permanent Structure Growth	NA	1.00	NA	Tonnes
	Soil Humus Addition from Prunings	NA	1.00	NA	Tonnes
Waste Treatment	Solid Waste	5	1.00	5	Tonnes
	Liquid Waste	0	1.00	0	Tonnes
	Scope 1 Total	[illegible]	1.00	[illegible]	Tonnes
	Scope 2 Total	1	1.00	1	Tonnes
	Scope 3 Total	61	1.00	61	Tonnes
Scope 3					
Power Use	Transmission and Distribution Losses	0	1.00	0	Tonnes
Packaging	Bottles and Containers	47	1.00	47	Tonnes
	Wine Bags	1	1.00	1	Tonnes
	Closures	5	1.00	5	Tonnes
	Fibre Packaging	4	1.00	4	Tonnes
	Wooden Products	0	1.00	0	Tonnes
Contract Machinery	Helicopter	0	1.00	0	Tonnes
	Tractor Based	0	1.00	0	Tonnes
Transportation / Freight	Freight Total	4	1.00	4	Tonnes
Purchased Wine Products	Total	NA	1.00	NA	Tonnes
Scope 3 Waste Treatment	Solid	0	1.00	0	Tonnes
	Liquid Waste	0	1.00	0	Tonnes

Short-term Carbon Cycle

Biomass Conversion	Biomass Photosynthesis	-13	1.00	-13	Tonnes
	Wine Making Practices	4	1.00	4	Tonnes







Implementation of the CFP
Scope 1

Mobile equipment: the carbon calculator allows the user to select the fuel type, but not the kind of equipment (tractor, lorries, etc); thus, fuel-specific CO_2 default emission factors were used in calculations, irrespective of the piece of equipment actually used.

Waste disposed of on-site: the amount of shredded grape stalks spread on fields and buried as a soil improver were entered in the “landfilled grape marc, pommace, grape stalks and stems” item.

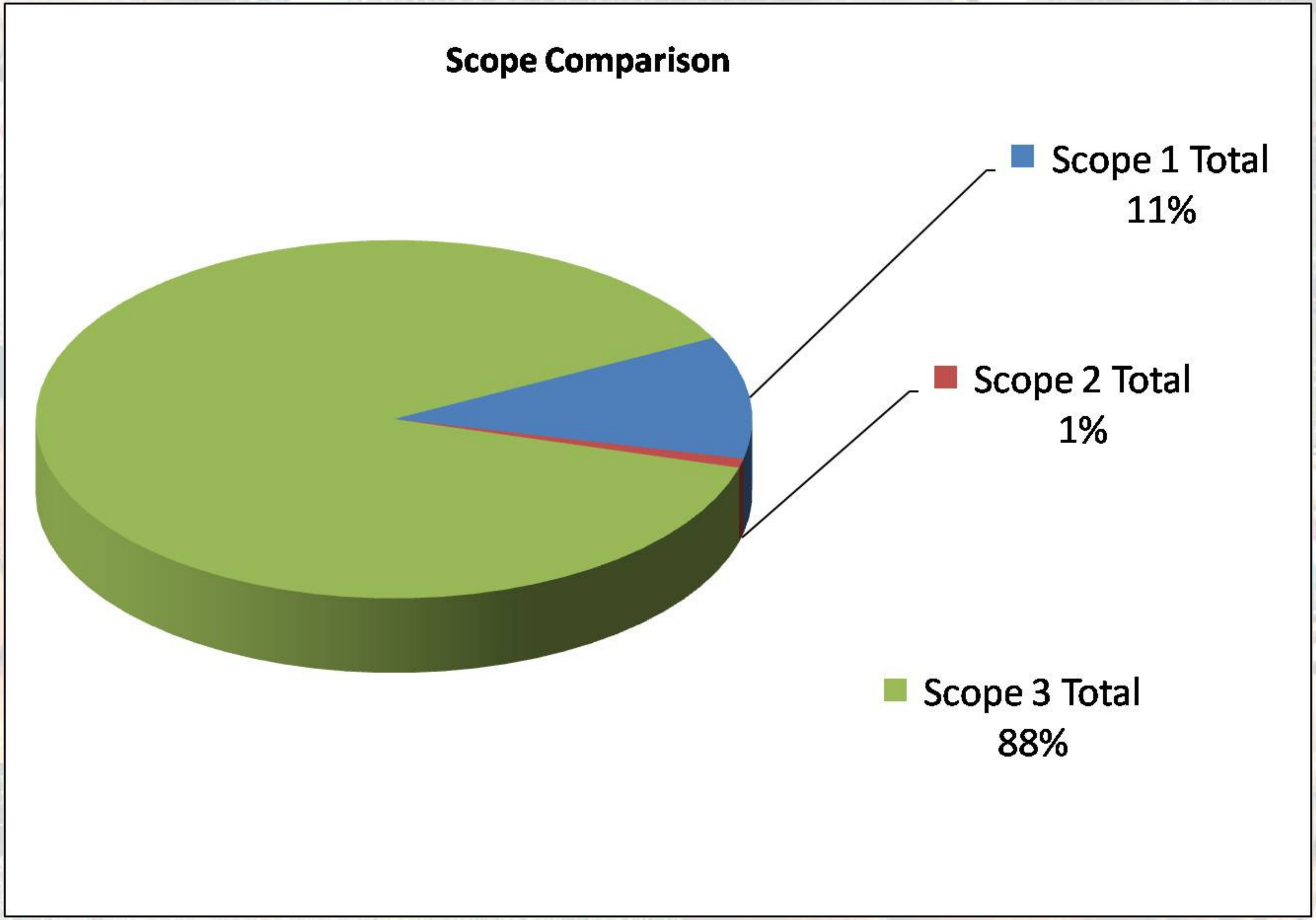
Implementation of the CFP
Scope 2

- CO_2 emission factor for power generation: it was adapted to the Italian power mix (source: ELCD).
- No specific correction factor for power transmission and distribution losses was entered in the relevant field of the IWCC.

Implementation of the CFP
Scope 3

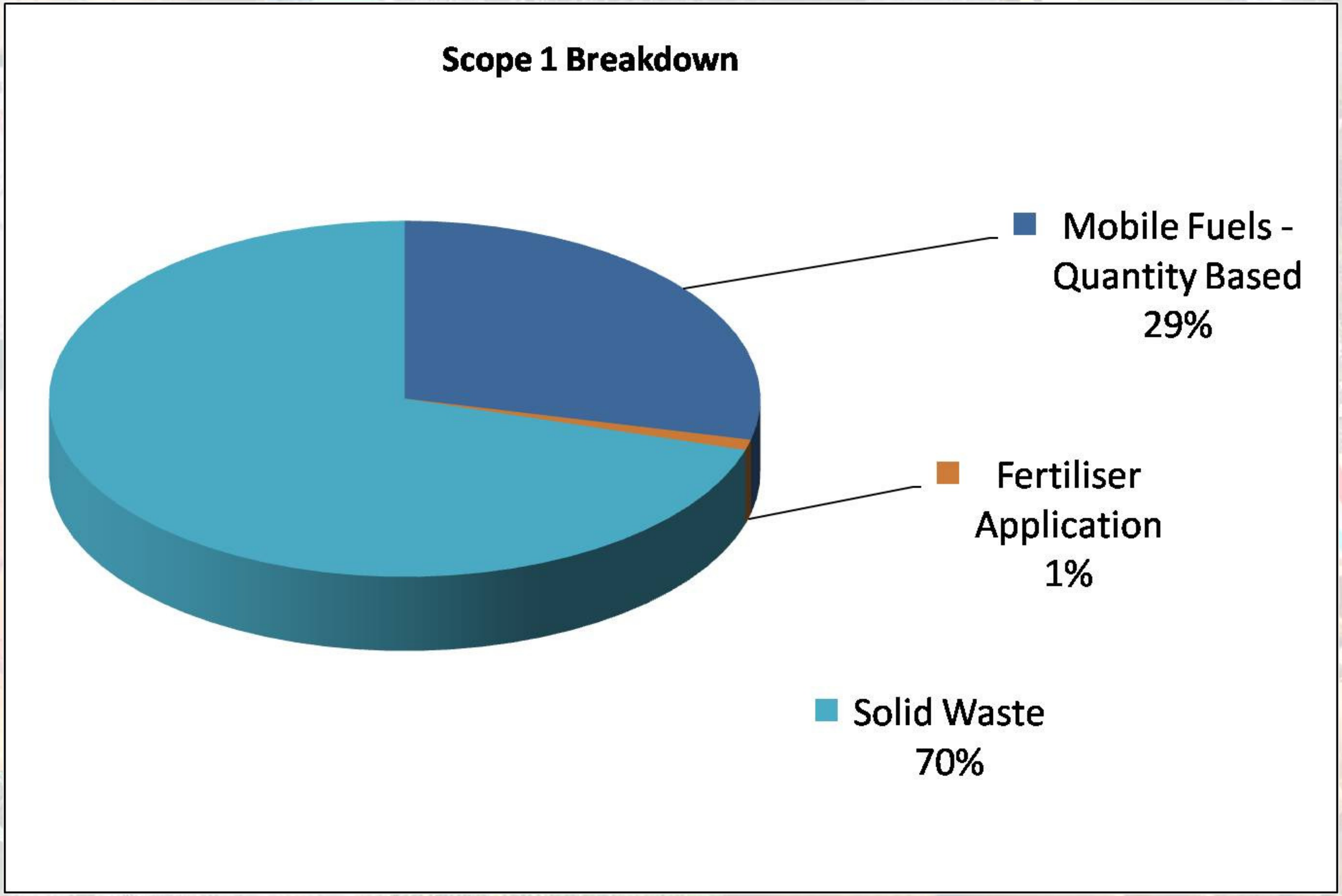
- Packaging: no specific data field was found for the bottle paper labels.
- Transports: overall amount of kilometres travelled by the different types of vehicles used for product distribution were calculated.
- Wine related products: “bentonite” the only one for which a corresponding entry was found.
- No relevant entries were found for: potassium metabisulphite, yeast, albumin, chemicals and other inputs used in the bottling process (sodium hydroxide, nitrogen), as well as in agricultural practices (copper hydroxide, micronized sulphur, *Bacillus thuringiensis* bacteria, milk, glucose).
- Waste: marc and lees are delivered to a distillery for further processing. It was decided not to enter any data within these items. Indeed, a more accurate modelling would require an allocation process (or alternative approaches) to deal with the environmental burden shared by the main product and by-products; no allocation (or alternative option) seems to be possible in the IWCC.

Results



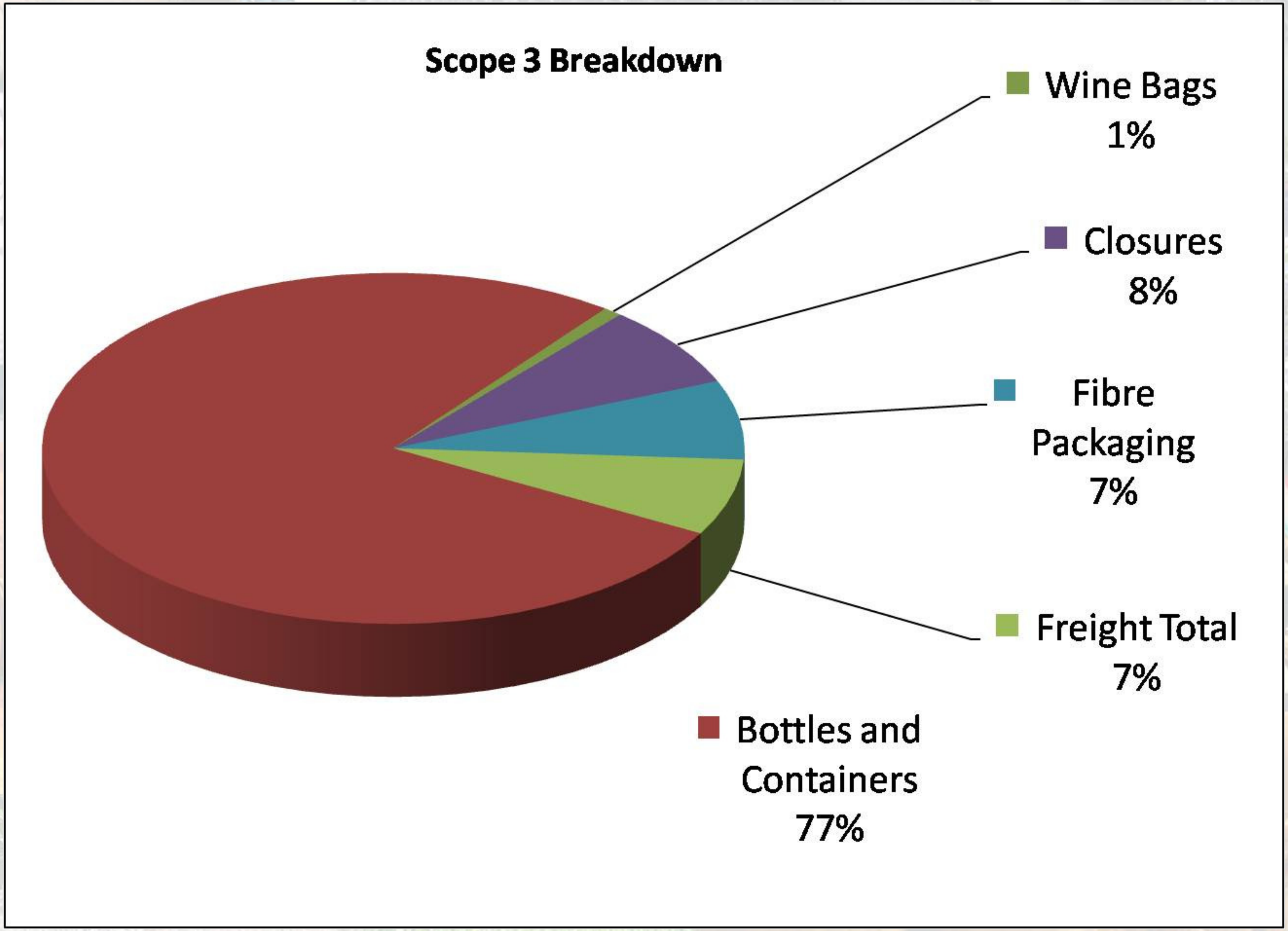
Scope Comparison
Scope 1 Total
11%
Scope 2 Total
1%
Scope 3 Total
88%

Results



Scope 1 Breakdown
Mobile Fuels - Quantity Based 29%
Fertiliser Application 1%
Solid Waste 70%

Results



Scope 3 Breakdown
Wine Bags 1%
Closures 8%
Fibre Packaging 7%
Freight Total 7%
Bottles and Containers 77%

LCA ⇔ CFP

- Good agreement. In LCA case-study the major contribution in terms of GWP (more than 70%) comes from packaging (in particular: the glass bottle), followed by the product distribution and the agricultural operations.

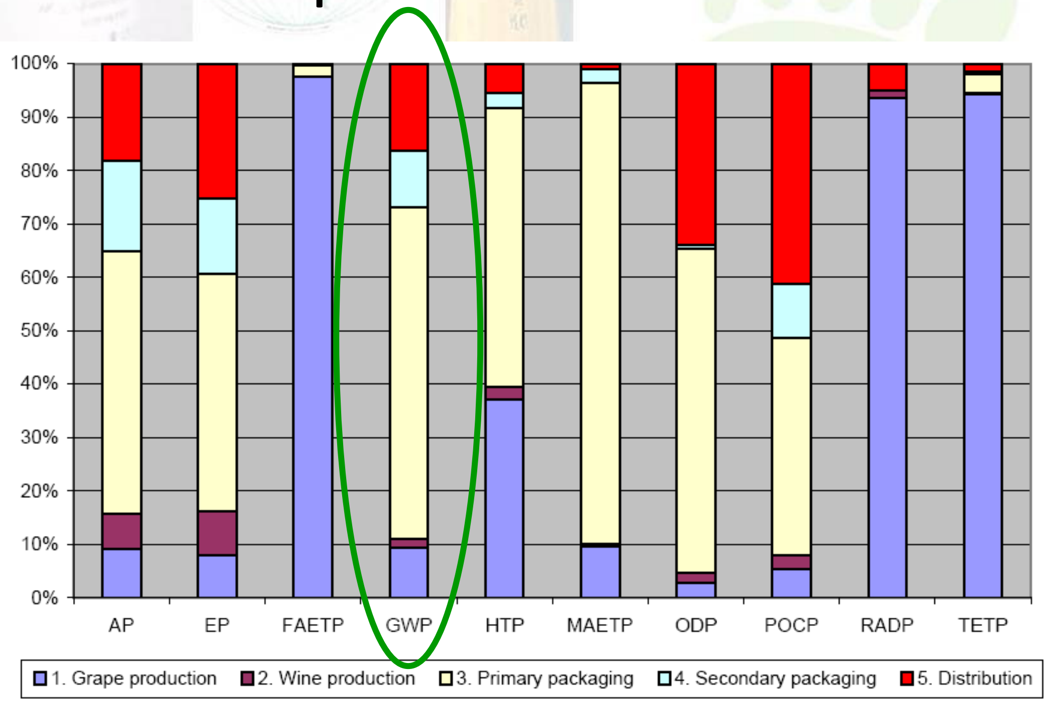


Fig 2. LCIA: Characterisation results

Source: Petti et al, 2006

IWCC limitations

- Most default model parameters and assumptions are closely related to specific Countries/Regions
- The list of products and inputs available is limited to just a few wine related products
- Specific modelling options for co-products are lacking (allocation, system expansion) (marc, lees, wine; bottled and bulk wine)
- The same applies for recovered waste (avoided impacts) (grape stalks)
- Burden/impact shifting issues

Conclusions

- The wine industry has been increasingly impelled by market and regulatory drivers to assess and reduce carbon emissions
- As expected, despite a few differences in framework and modelling, results concerning global warming are rather consistent
- About the CF tool, the lack of accurate baseline data was confirmed and the need of further improvement and adaptation to additional contexts was highlighted
- The calculator carries out an accurate assessment of emissions as it contains effective tools capable of providing concise information analysing all phases of wine production
- LCA seems to be more effective in avoiding environmental burdens and impacts to be shifted from one life-cycle step to another, or from one environmental concern to another.
- On the other hand CF seems to be more suitable as a marketing tool

Thank you!

For more information:

a.raggi@unich.it

claudiopattara1@libero.it