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Integrated Water Resources Management in Peru – The Long Road Ahead

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LIMA - PERU

Objectives

- To discuss advances in IWRM in Peru presenting the Peruvian case as a case study
- To provide background information to understand the challenges and issues that need to be dealt with.

Organization of the presentation

- Introduction of Peru
- Water Resources, Population distribution.
- A note on economic growth and effect on consumption habits.
- Water Uses
- Progress on Main Crops WF estimation.

Organization of the presentation (2)

- GW cases
- Municipal Water and water and poverty in urban areas issues.
- Energy and Water
- Water and Environment
- Modernization of WRM

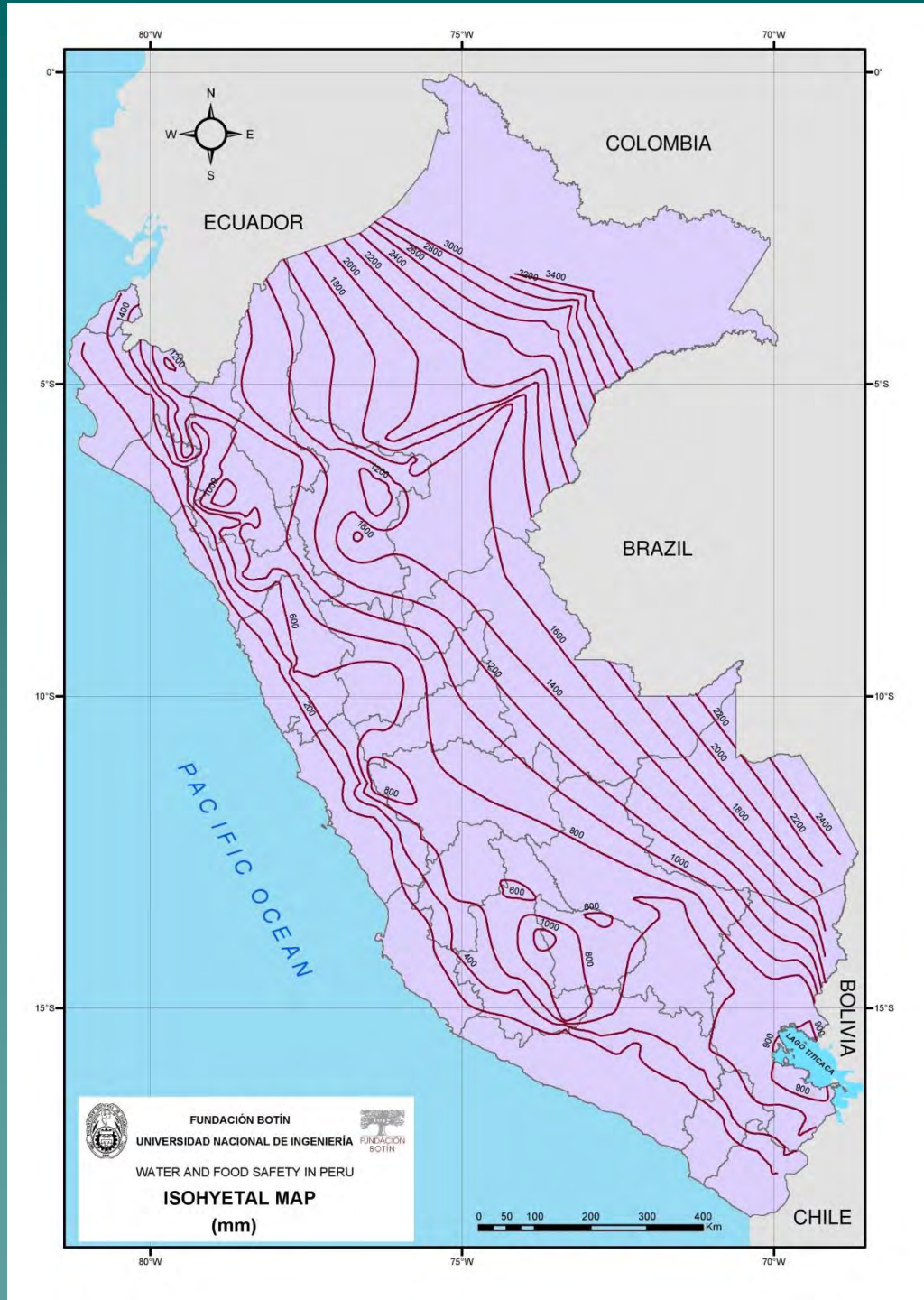
BACKGROUND

- Surface area : 1.285 million km^2. (Third largest country in South America, 20^{th} largest in the world)
- Population: 29.5 million as of 2010 (4^{th} most populated in South America)

Location of the study area

- Central Western South America.
- Between Parallels 0 and 18 S and Meridians 68 40 and 81 30 W.
- Three main hydrographic regions: Pacific, Amazon and Titicaca.

Mean Precipitation Distribution



Water availability in Peru´s three catchment areas

Basin	Area (1000 km^2)	Water Availability (MCM/yr)	% Water Availability	Population	% Population	Water availability (m3/inh/yr)
Pacific	279,7	37 363	1,8	18 315 276	65	2 040
Amazon	958,5	1 998 752	97,7	8 579 112	30	232 979
Titicaca	47,2	10 172	0,5	1 326 376	5	7 669
Total	1 285,2	2 046 268	100,0	28 220 764	100	72 510

Peru's Hydrographic Basins and Regions main features

Hydrographic Region	Area (km2)	Number of Basins	Average Annual Precipitation (mm)
Pacific	200517	53	274.3
Amazon	1046962	40	2060.8
Titicaca	37736	9	813.5

Natural Region	Altitude Range (m)	Annual Average Temperature (°C)	Annual Average Precipitation (mm)
Coast	0 - 500	18 - 20	40
Sierra	500 - 6780	8 - 11	600
Jungle	400 - 1000	24	3000 - 4000

Coast = Lower Reaches of the Pacific Basin

Peru's Natural Regions

- 3 Natural Regions: Coast, Sierra (Mountains) and Jungle.
- Studies make a point of addressing Geographic, Economic and Cultural differences
- Contribution to the GDP income is much higher along the Coast, particularly in Lima, the capital.

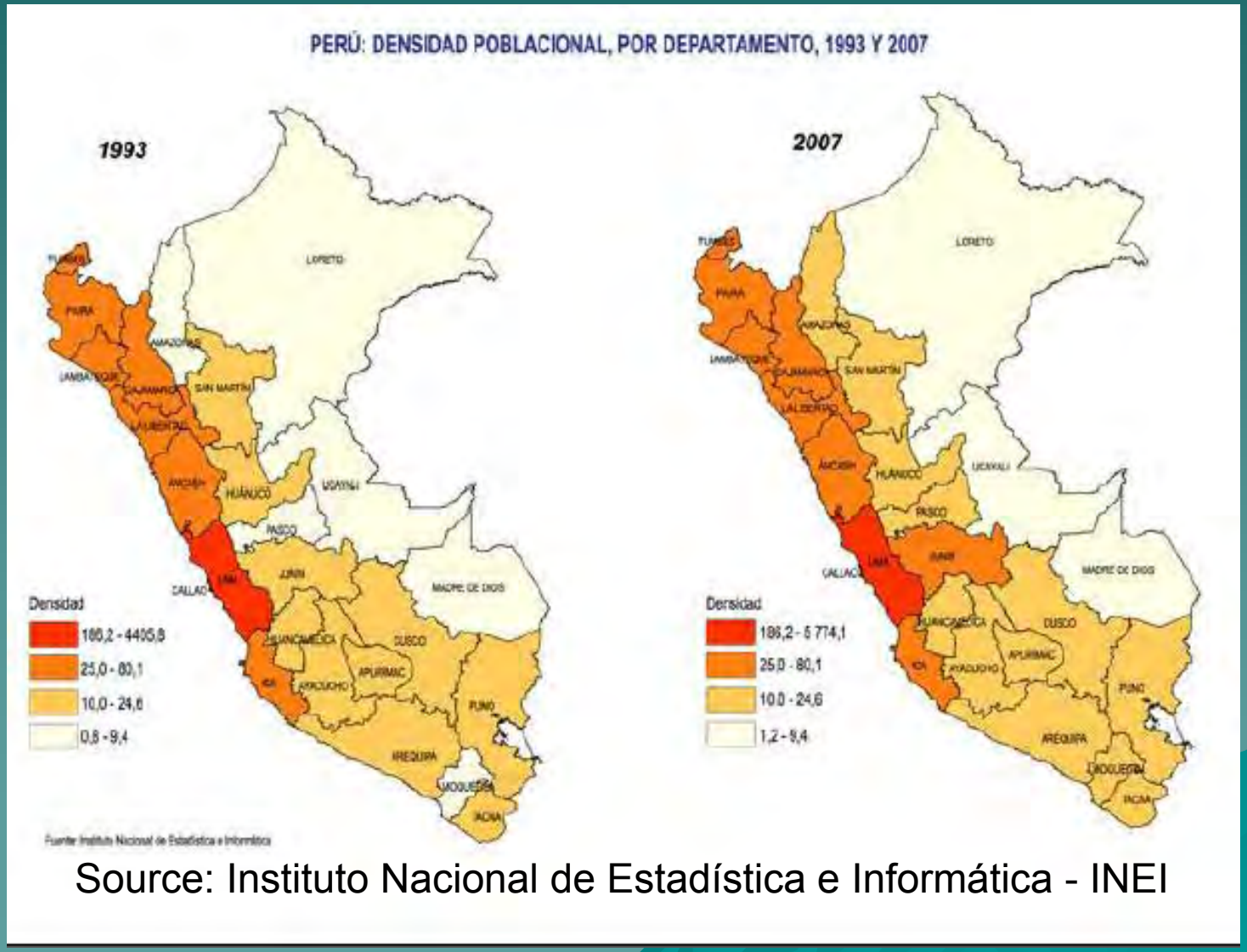
OGRAPHIC MAP OF PERU

logic Basin	Water	Pop.
Pacífic	1.8%	70%
Atlantic	97.7%	26%
Titicaca	0.5%	4%

And a little bit of history

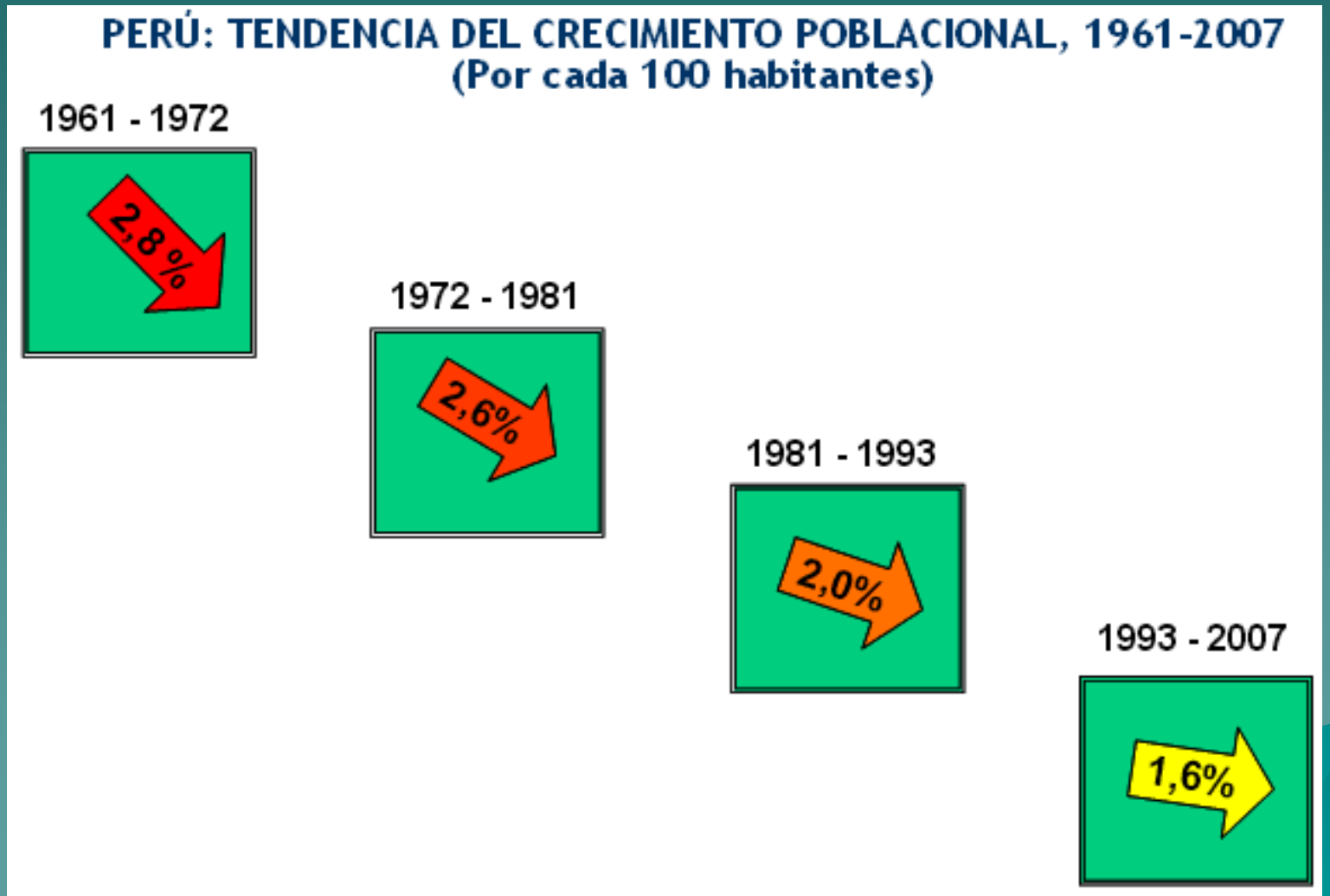
POPULATION DISTRIBUTION

Population density in Peru: 1993 and 2007



Source: Instituto Nacional de Estadística e Informática - INEI

Decaying National Population Growth Rates

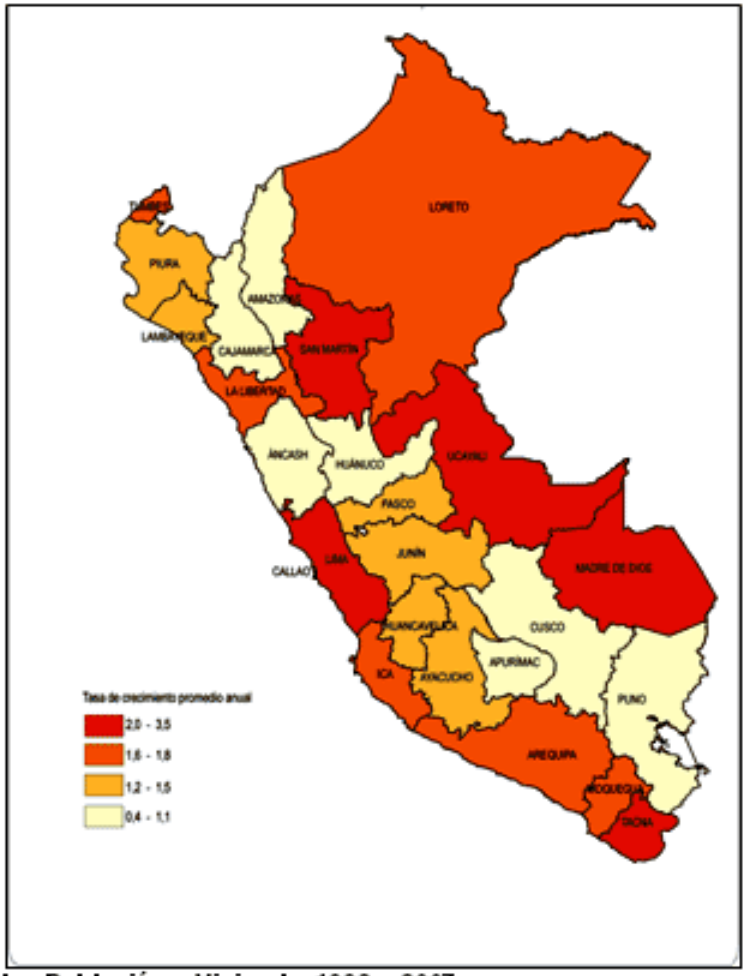


Regional Growth Rates

PERÚ: TASA DE CRECIMIENTO PROMEDIO ANUAL, 1993-2007
(Por cada 100 habitantes)

Madre de Dios	3,5
Ucayali	2,2
Callao	2,2
Tacna	2,0
Lima	2,0
San Martín	2,0

Loreto	1,8
Tumbes	1,8
La Libertad	1,7
Ica	1,6
Arequipa	1,6
Moquegua	1,6



Ayacucho	1,5
Pasco	1,5
Lambayeque	1,3
Piura	1,3
Junín	1,2
Huancavelica	1,2

Puno	1,1
Huánuco	1,1
Cusco	0,9
Amazonas	0,8
Áncash	0,8
Cajamarca	0,7
Apurímac	0,4

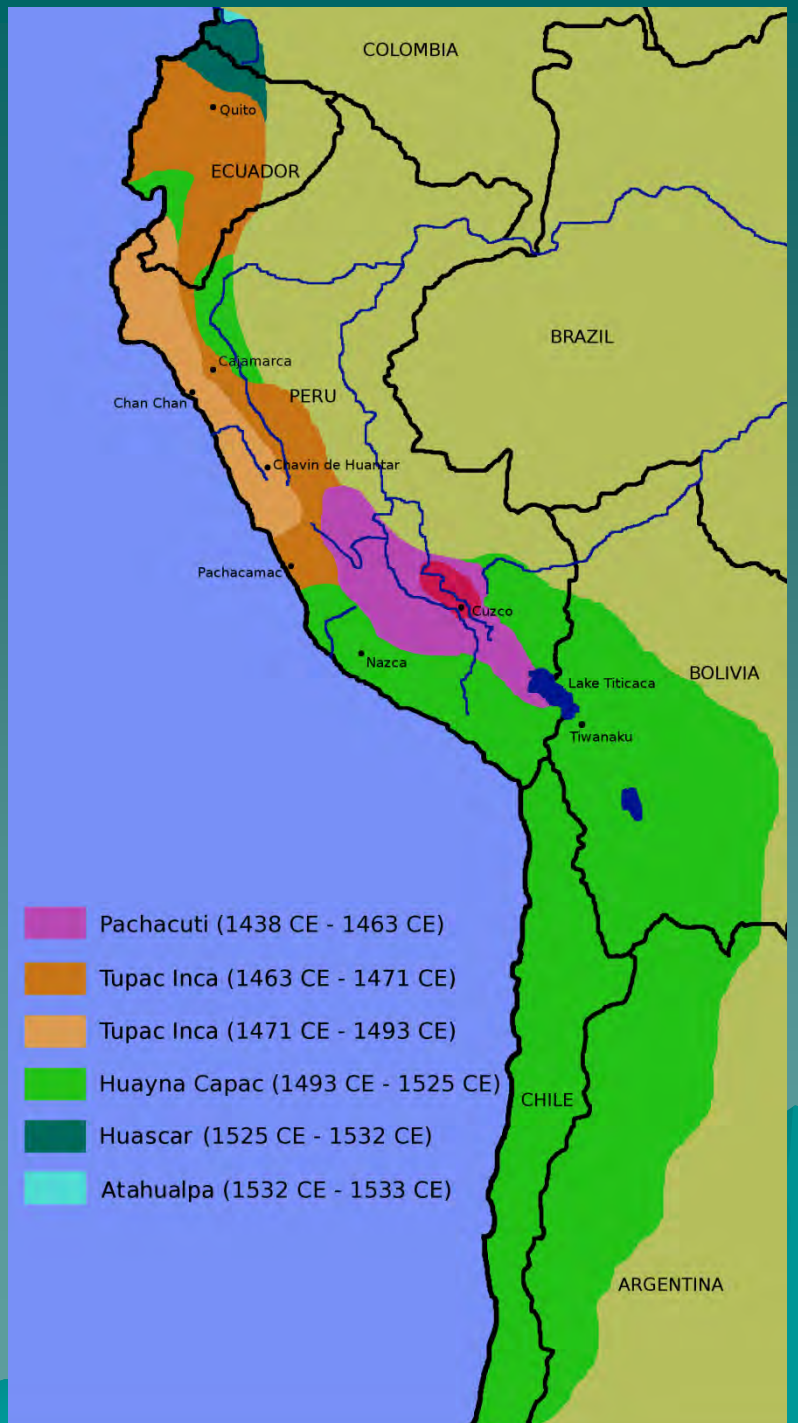
13

FUENTE: INEI – Censos Nacionales Población y Vivienda, 1993 y 2007.

CARAL,THE OLDEST CIVILIZATION OF AMERICA

Caral main center was near the coastline - 3000 B.C.

Occupation of the Inca Empire –the Jungle was “left alone” → Mainly the Coast, the Sierra and the Upple Jungle interested the rulers



Source: wikimedia – gegraphos.com

Lima, a city looking into the ocean

And an example of its effects

ECONOMIC GROWTH

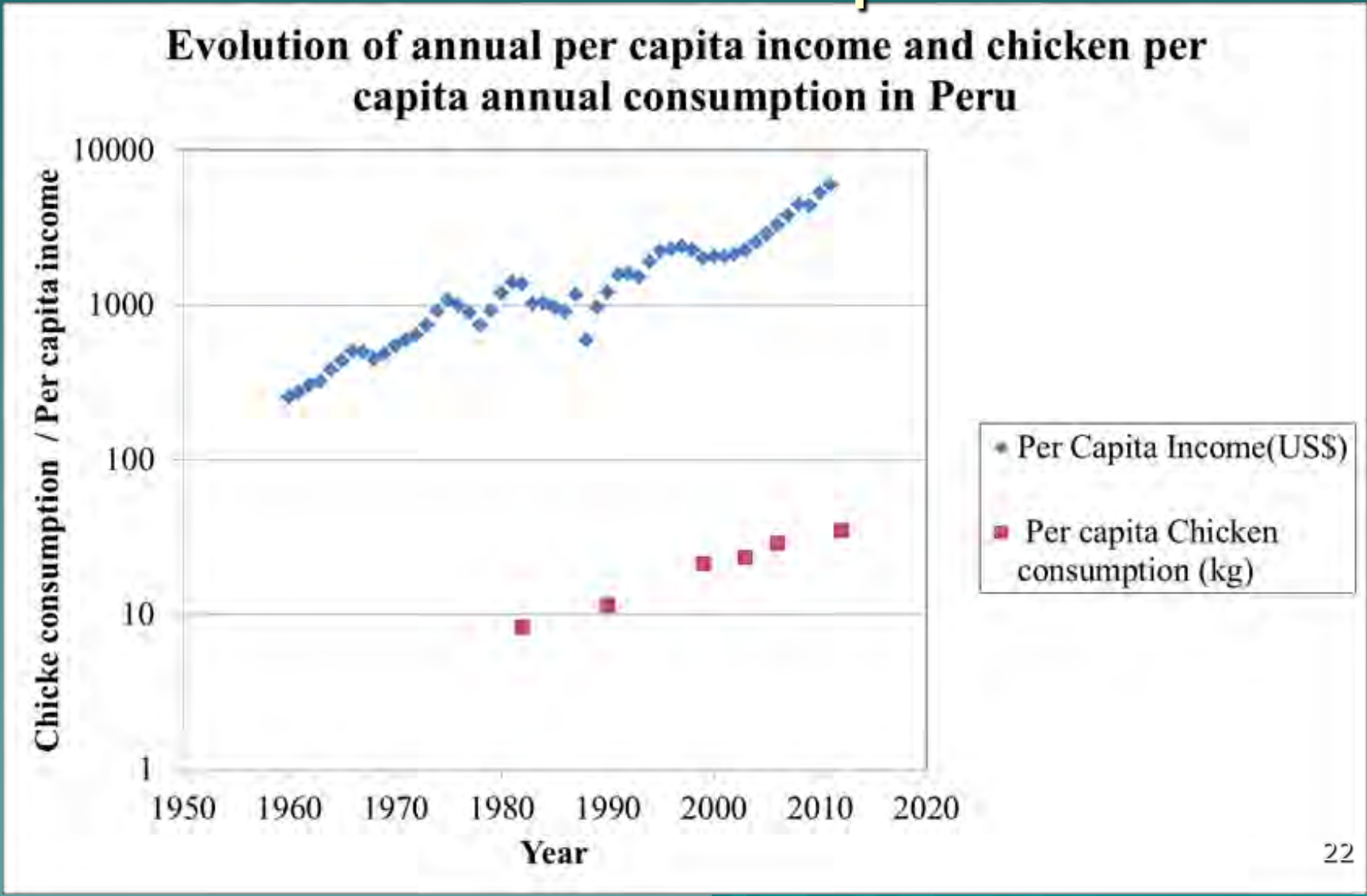
Contribution to Gross Domestic Product (GDP) by sectors

Sector	% GDP
Agriculture	8
Fishing	1
Mining	6
Manufacturing	15
Construction	6
Commerce	15
Electricity	2
Taxes	10
Services	37

Investment made by private companies / consortiums

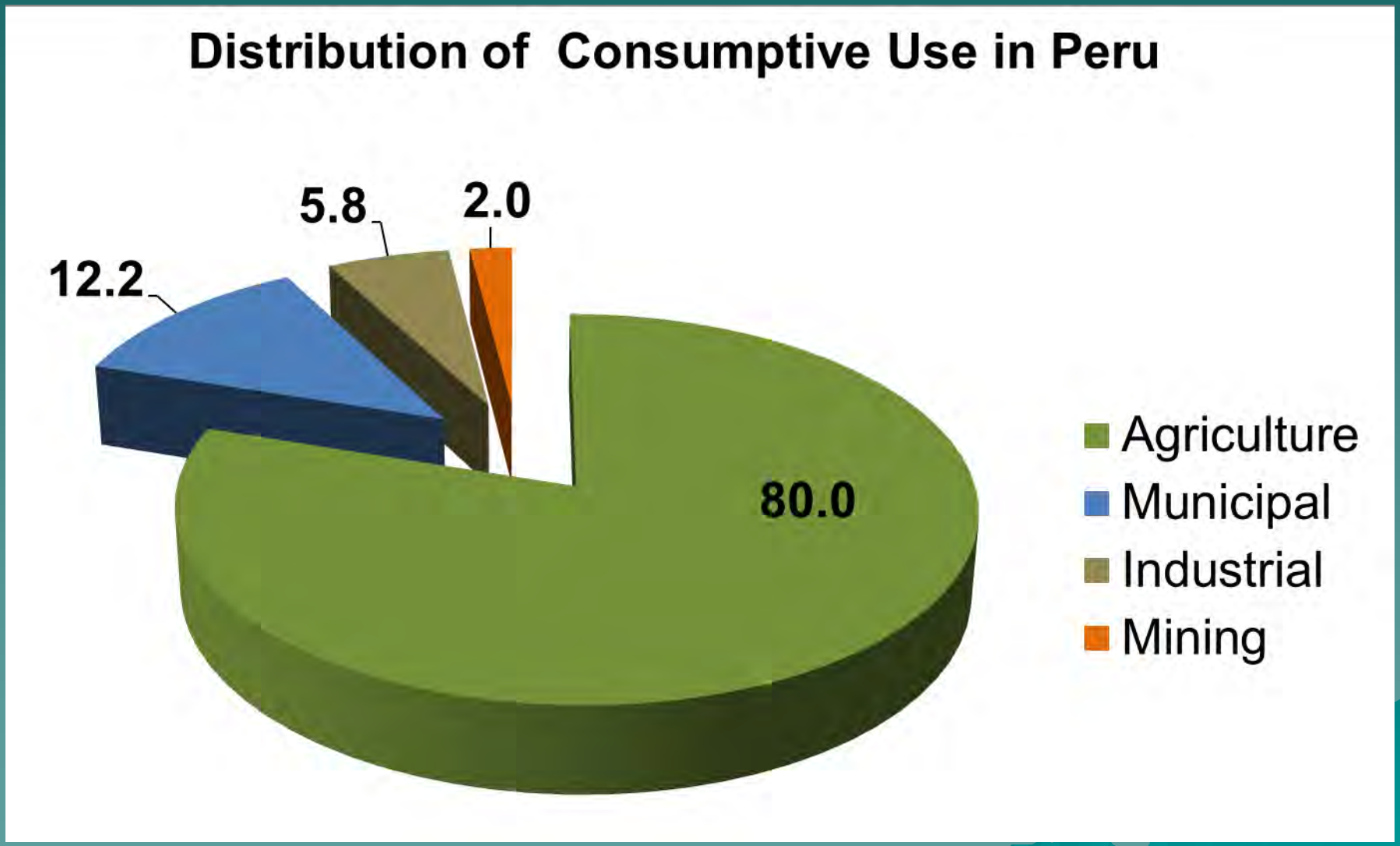
Economic Activity	Investment (Millions of US$)	Percentage of Private Investment
Agriculture	203	1.6%
Fishing	92	0.7%
Mining and Oil industries	5333	41.8%
Manufacturing	1523	11.9%
Electricity, gas and water	1513	11.9%
Construction and Infrastructure	2305	18.1%
Commerce	935	7.3%
Services	861	6.7%
Total (Millions US$)	12765	100.0%

Relation between income and food consumption



WATER USES

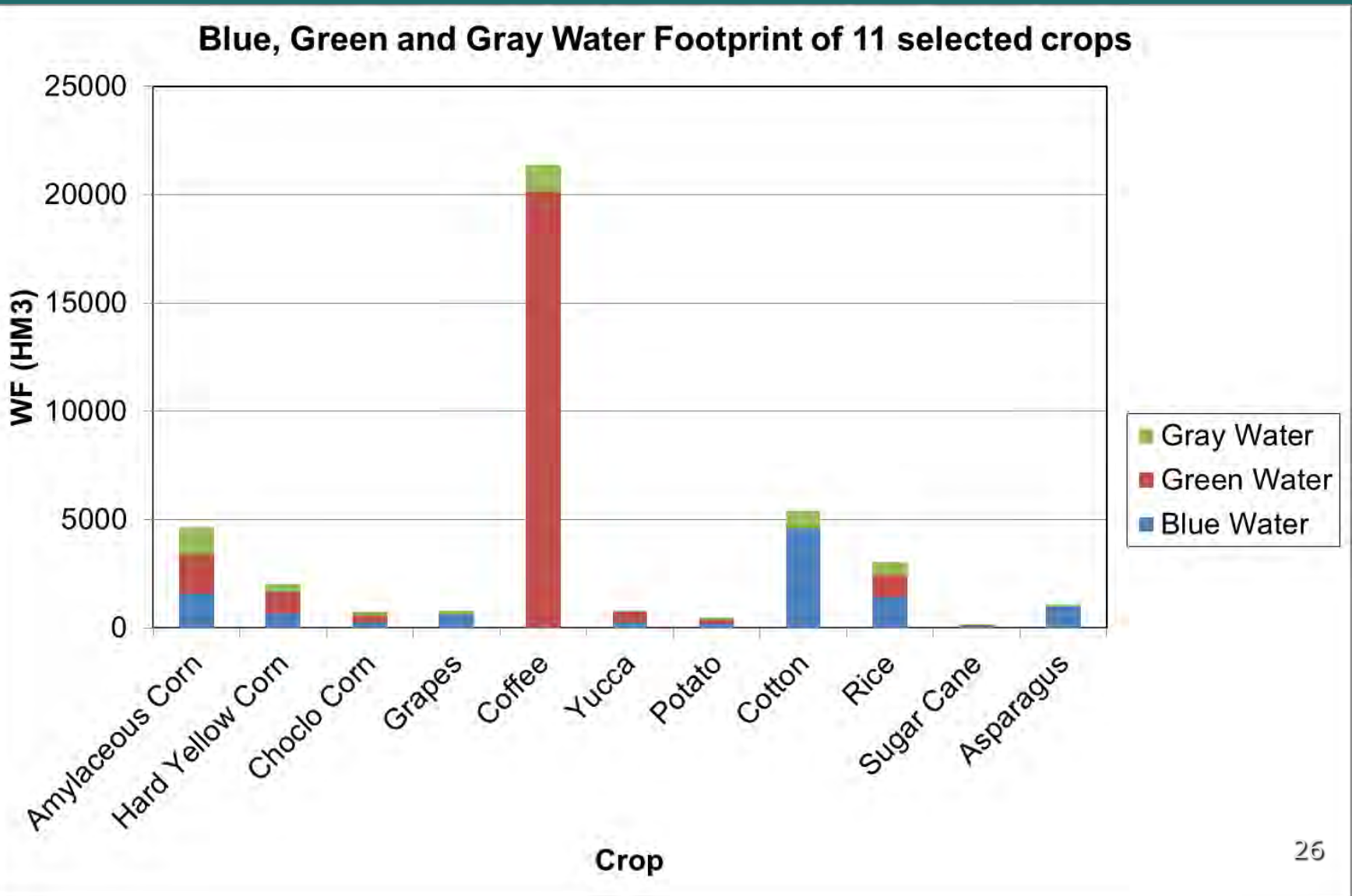
Water Uses


Distribution of Consumptive Use in Peru
5.8
2.0
12.2
80.0
Agriculture
Municipal
Industrial
Mining

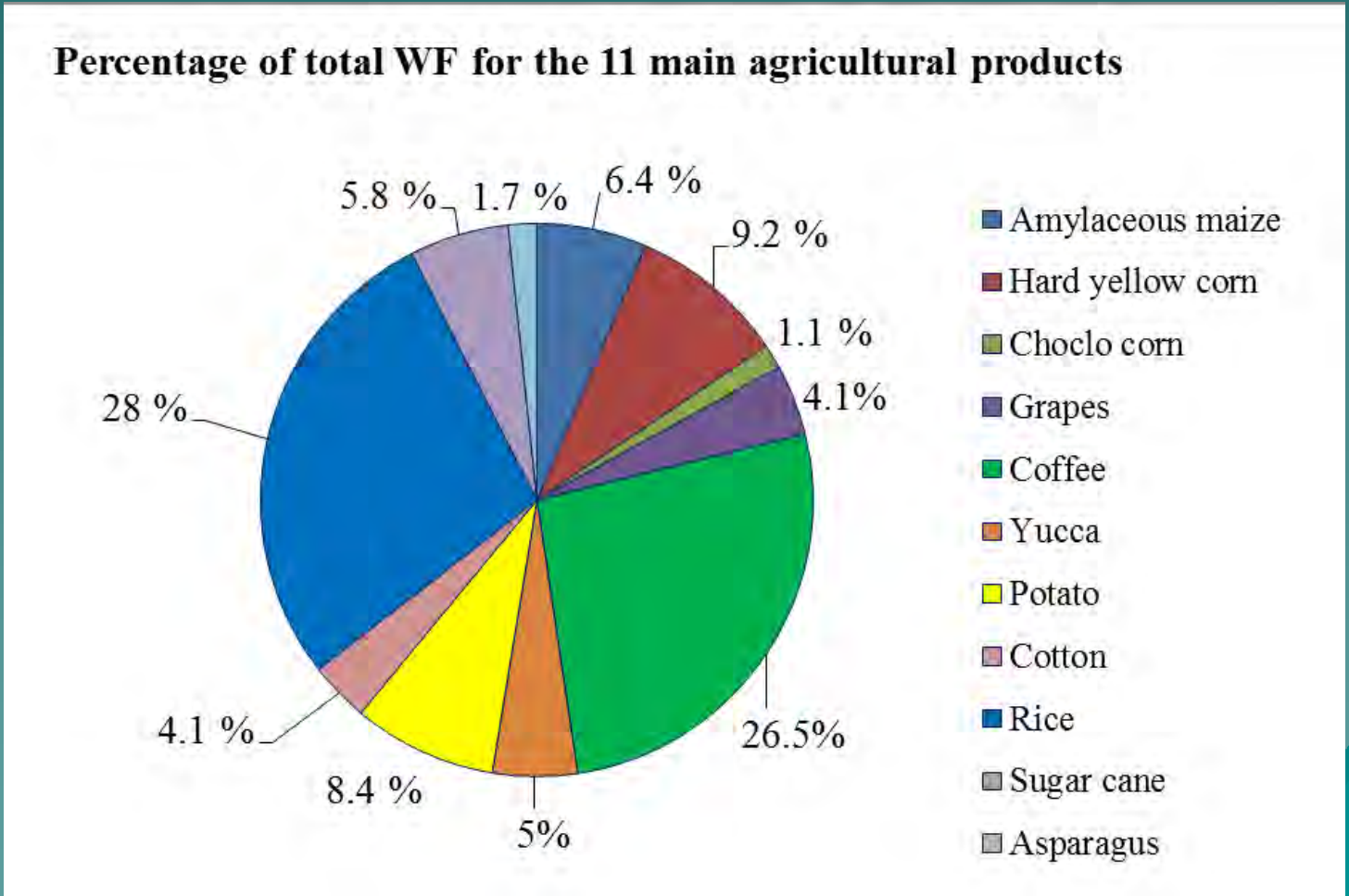
Consumptive and Non Consumptive Use in Peru

- More consumptive use by far → Pacific Basin

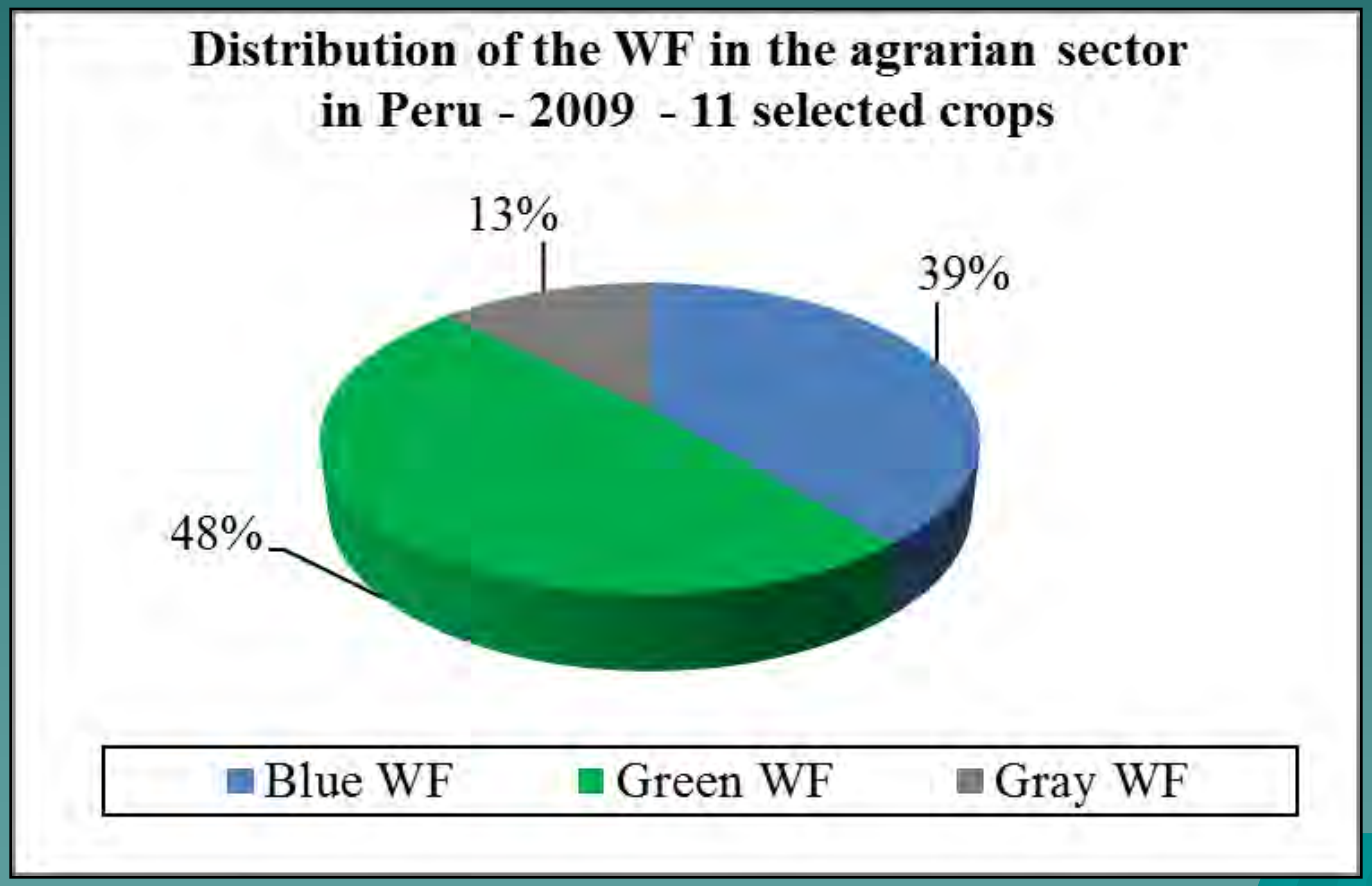
Drainage Basin	Consumptive Use (MCM/year)					Non consumptive use (MCM / year)	
	Municipal	Agriculture	Industrial	Mining	Total	Energy	Total
Pacific	2086	14051	1103	302	17542	4245	4245
Amazon	345	1946	49	97	2437	6881	6881
Titicaca	27	61	3	2	93	13	13
Total	2458	16058	1155	401	200072	11139	11139


Blue, Green and Gray Water Footprint of 11 selected crops
WF (HM3)
25000
20000
15000
10000
5000
0
Amylaceous Corn
Hard Yellow Corn
Choclo Corn
Grapes
Coffee
Yucca
Potato
Cotton
Rice
Sugar Cane
Asparagus
Crop
Gray Water
Green Water
Blue Water

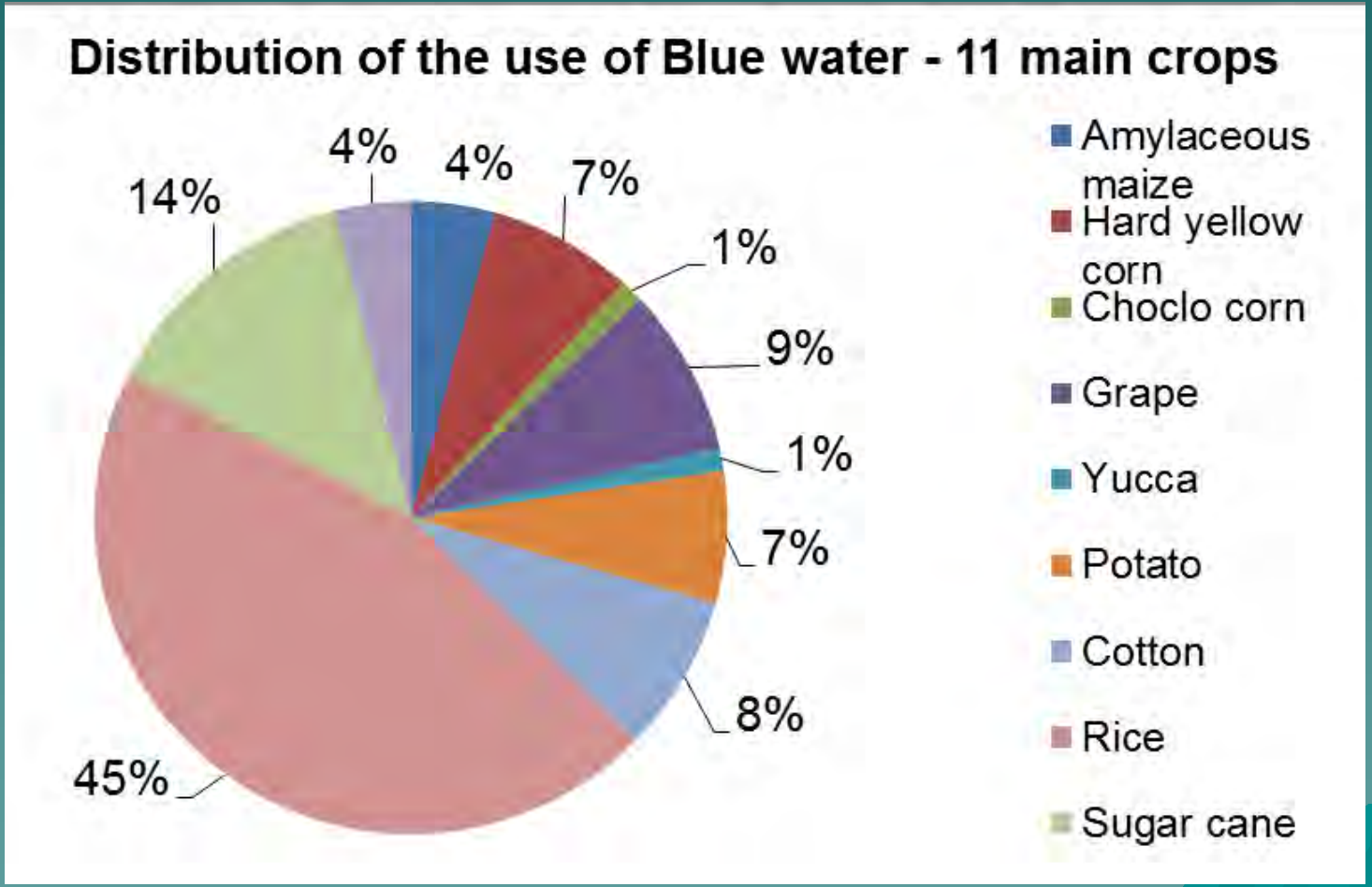
Distribution of WF – 11 selected crops



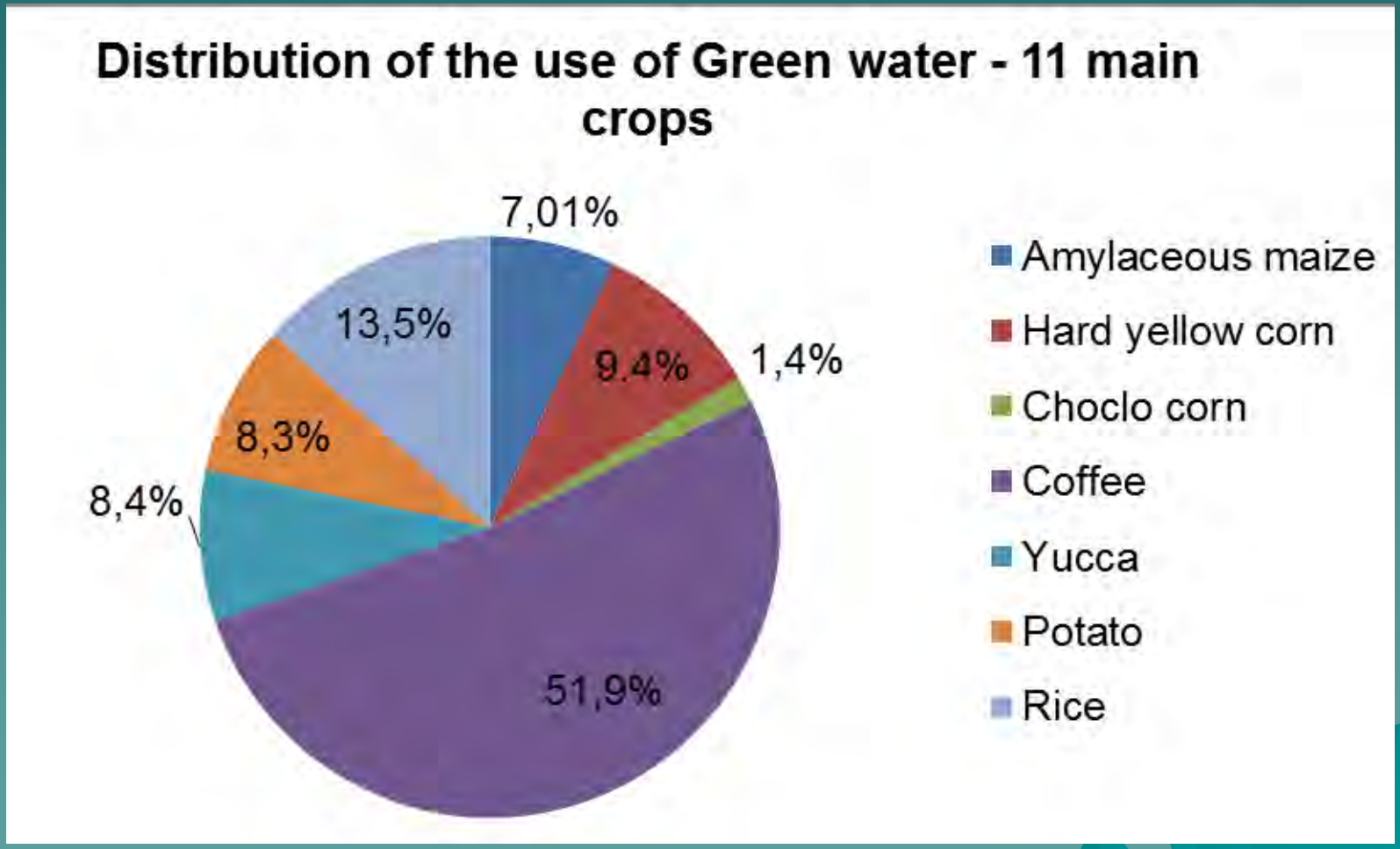
WF distribution -11 main crops



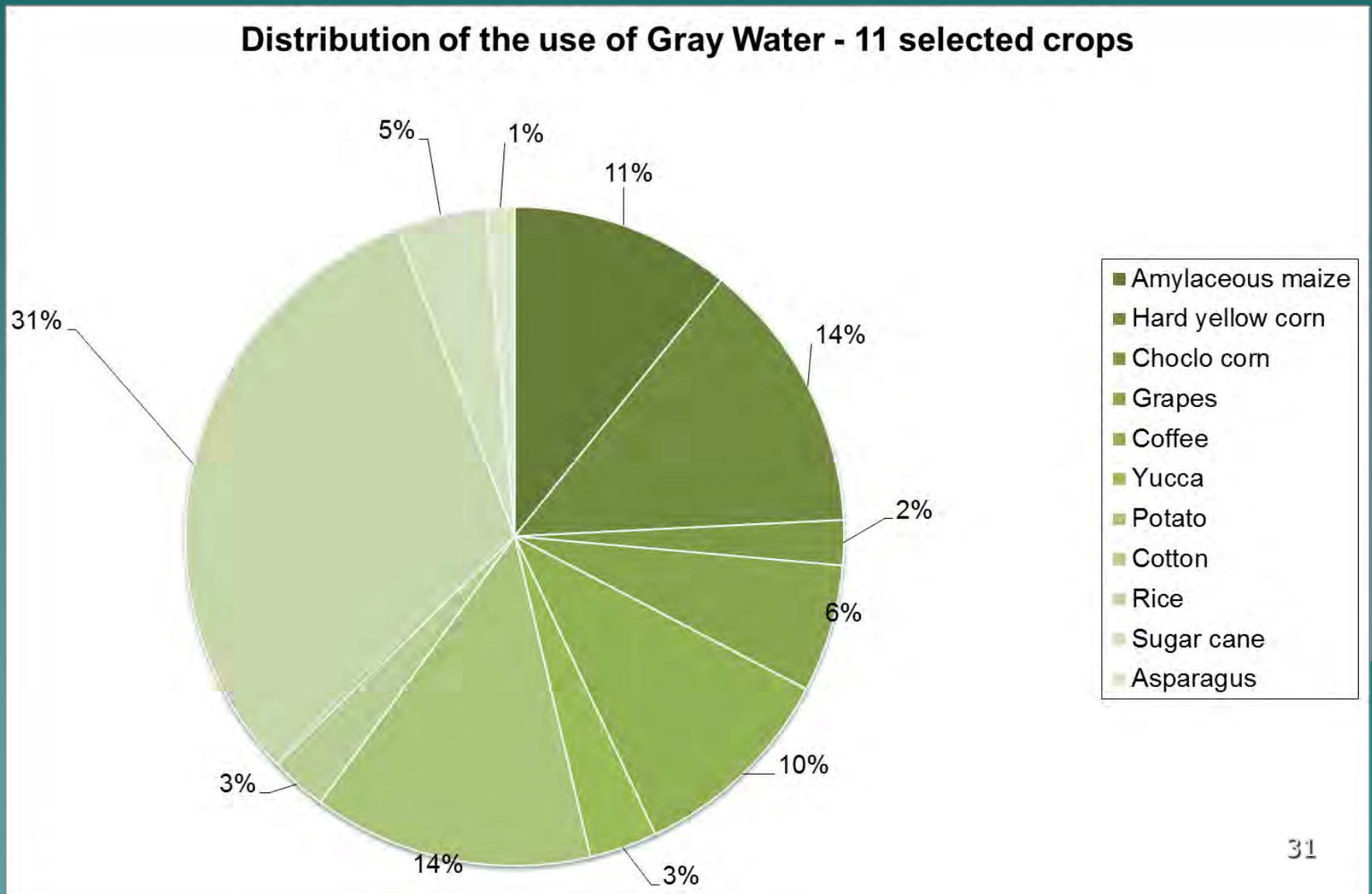
Blue Water -11 main crops



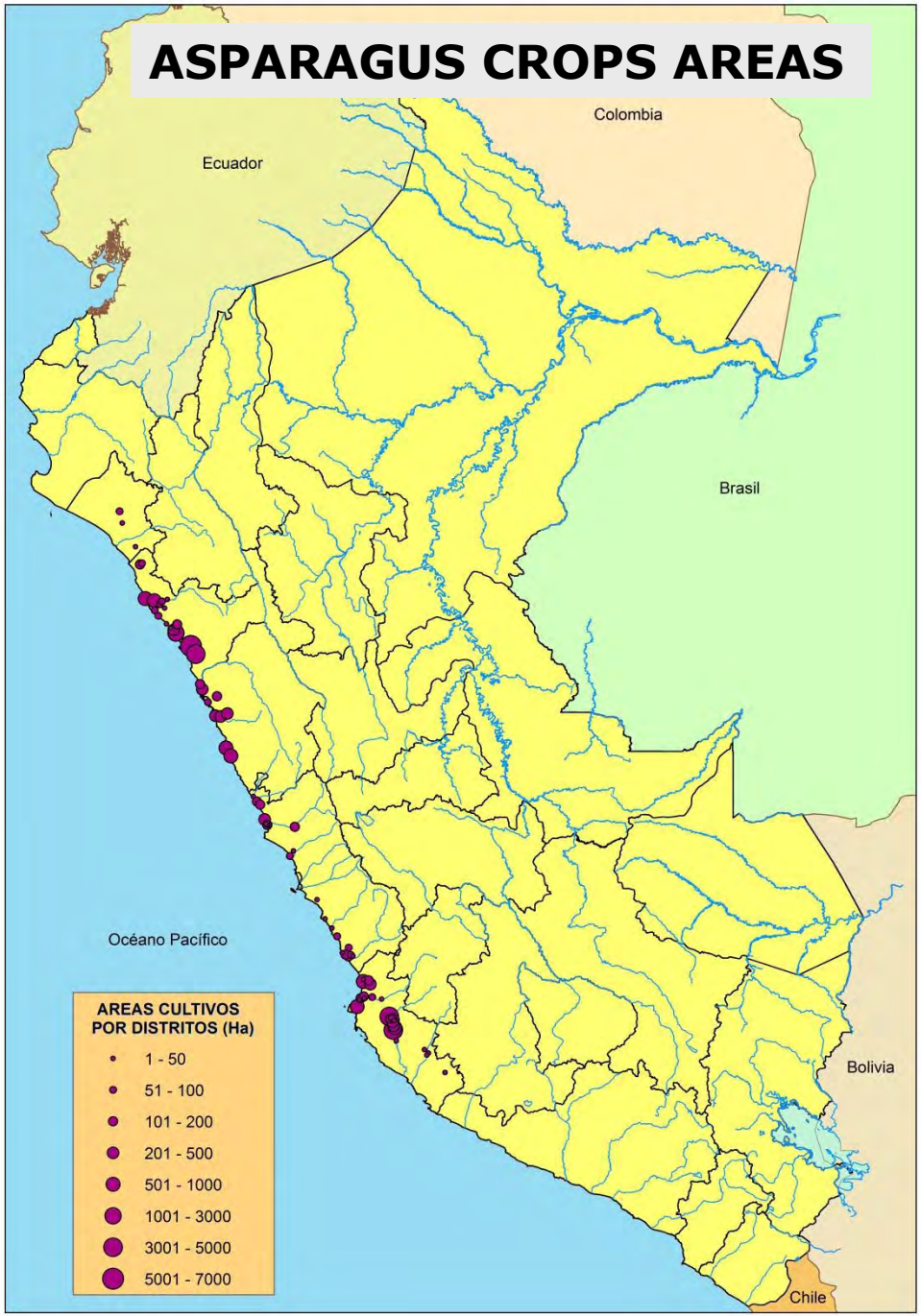
Green Water -11 main crops



Gray WF

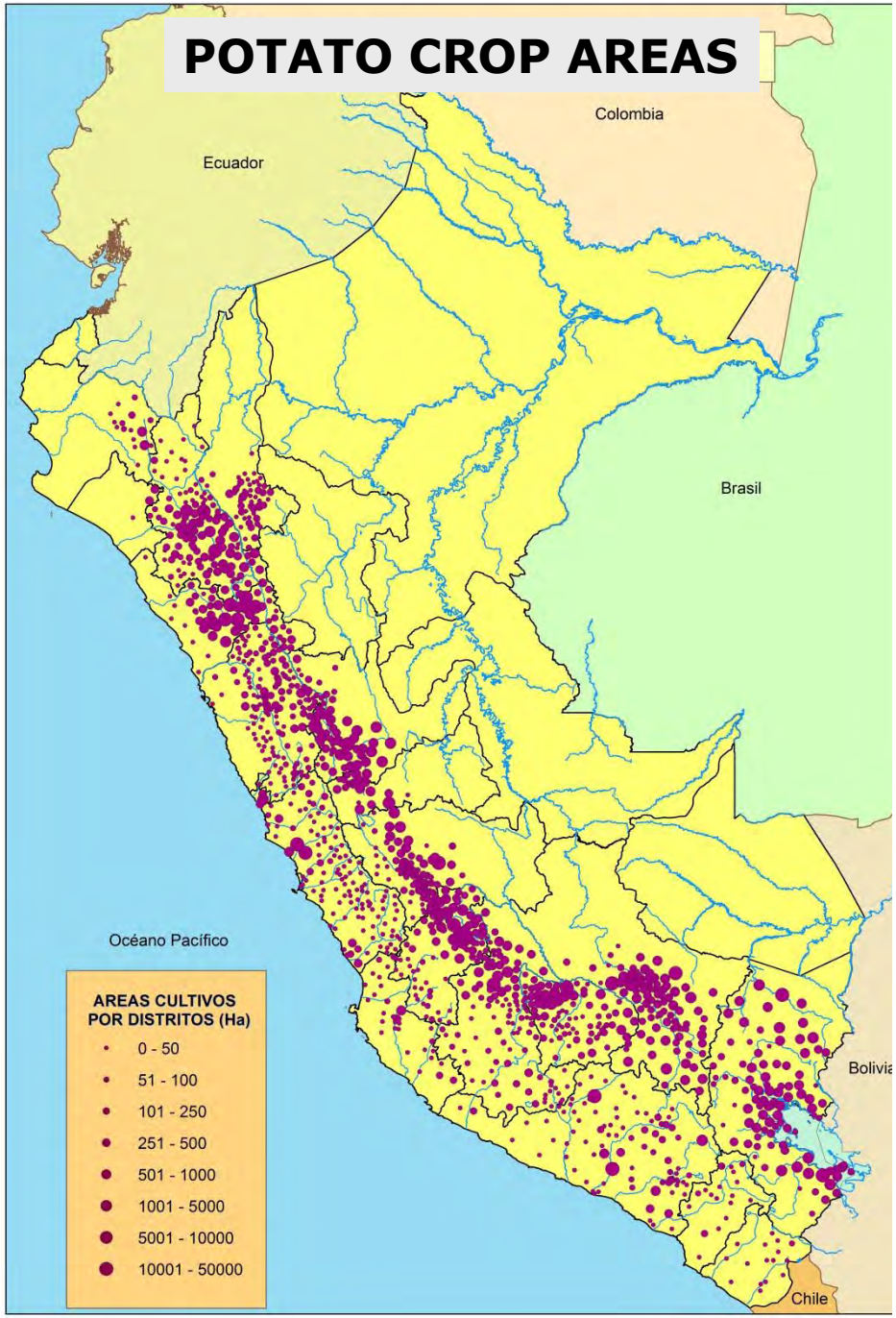

Distribution of the use of Gray Water - 11 selected crops
5%
1%
11%
14%
2%
6%
10%
3%
14%
3%
31%
Amylaceous maize
Hard yellow corn
Choclo corn
Grapes
Coffee
Yucca
Potato
Cotton
Rice
Sugar cane
Asparagus

ASPARAGUS CROPS AREAS

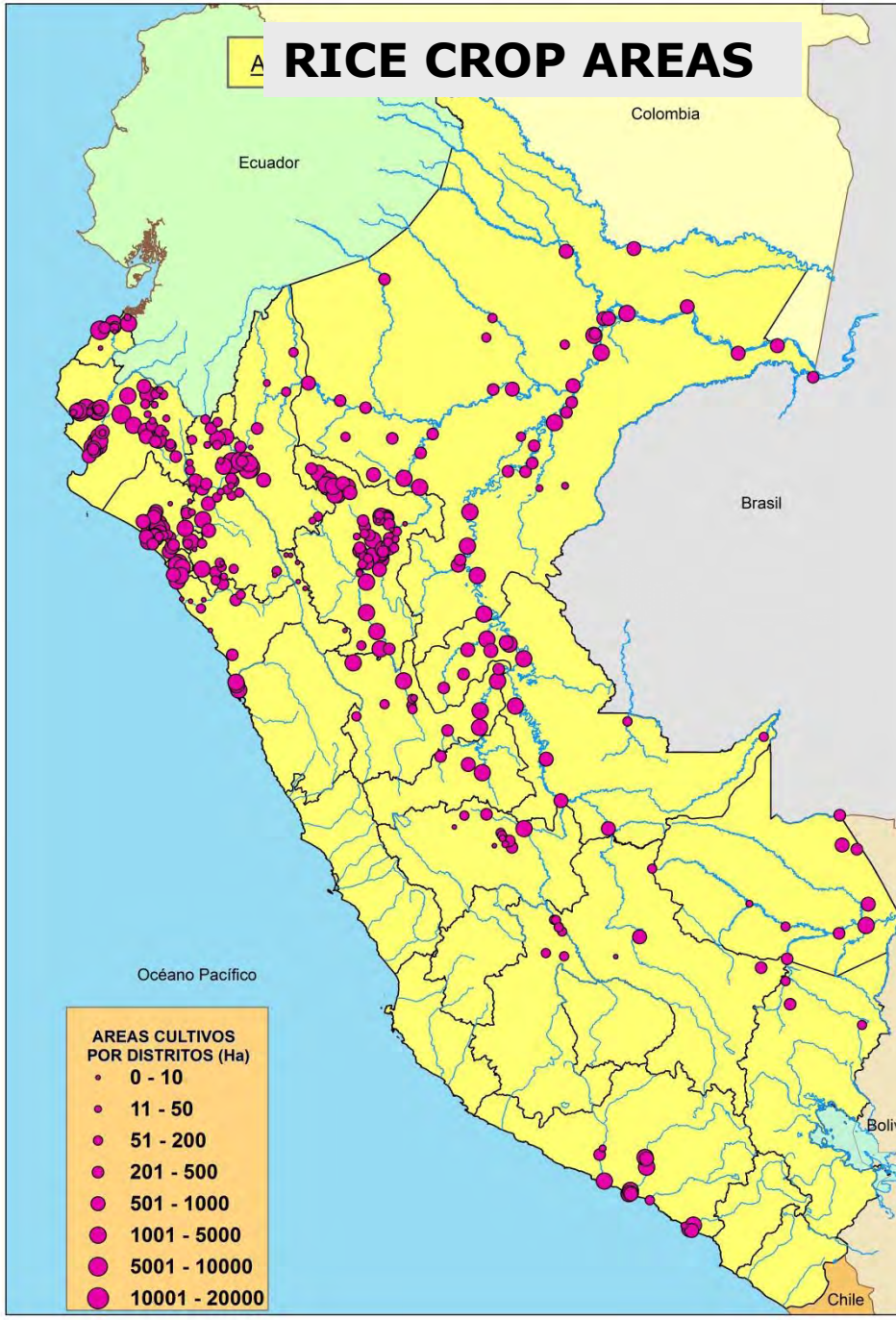


VINES CROP AREAS

POTATO CROP AREAS



RICE CROP AREAS



Potato Water Footprint

	2008	2009	2010	2011
Huella Hídrica Azul (mm)	329.26	341.85	370.37	325.73
Huella Hídrica Verde (mm)	178.15	161.27	136.55	175.64
Huella Hídrica Azul (Mm^3)	530.52	614.96	660.46	393.70
Huella Hídrica Verde (Mm^3)	406.93	483.95	563.02	484.59
Blue WF (m3/Ton)	223.51	232.27	223.23	229.49
Green WF (m3/Ton)	242.66	222.65	244.25	222.45