THE ENVIRONMENT IN GALICIA IN YEAR 2000: AN OVERVIEW

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1. Preface

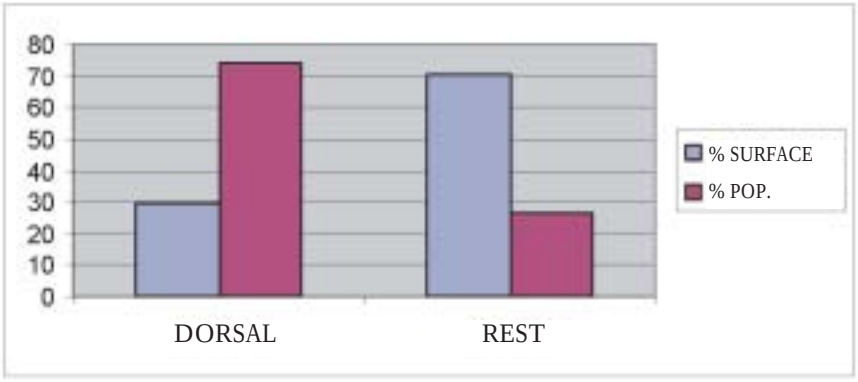
The objective of this work is to present a panoramic view of the environmental situation in Galicia today. A "panoramic view" because it will not go into very detailed analyses of the issues worthy of attention and, also, because it is only concerned with giving a global view of how our main challenges fit into the social and economic reality facing Galicia in the 21st century. "The environmental situation" because, this being our center of attention (that is, the troublesome relationship between human activities and the environment), we are only attempting to initiate a kind of stock take of problems rather than present proposals[1] or alternatives for their correction. Finally, "today", because the set of issues covered would be as removed from the Galicia of the 50s as they are crucial for the Galicia of

[1] This is the aim of the rest of the presentations at the seminar: to review tools for economic analysis and their use within the scope of the EU to define accurate diagnoses for alternatives in management, regulation and/or public intervention in environmental problems. Here, we only wish to identify the problems that are of higher priority in the Galician environmental "agenda".

the year 2000 or, put another way, because the relationship between activities and the environment in Galicia has changed radically during recent decades and is the basis for our current environmental problems.

Not only for the problems, but also for the achievements. Fifty years ago Galicia was a rural country with subsistence agriculture, with a very small urban population, with a non-existent industrial sector,... and with an income per capita (GDP) that would have placed us way below the 60th position in the world ranking and very far from the developed countries. Today, agriculture only accounts for less than 10% of production and is specialized in cattle, population is concentrated in the metropolitan areas on the coast[2] (graph 1), we have industrial activity with great specific weight within the Spanish context (energy, aluminum, timber, transport material etc.) (Prada, A. 1999: 77) and both the GDP and the HDI[3] place us within the international group of countries with high levels of wealth.

Graph 1
CURRENT IMBALANCE BETWEEN POPULATION AND LAND



Source: Drawn up by the authors from Consellería de Economía data 1999: 91 t. I

But this positive metamorphosis should not obscure the fact that, as in other countries, it has gone hand in hand with the appearance of impacts that demand an explanation in environmental terms. Impacts that sometimes have to do with threats to sustainability related to exhaustible

[2] That, in parallel with Central Europe, are collectively called the "Dorsal", running from Ferrol to Tui.
[3] Human Development Index, which includes the GDPpc but also includes education of the population and life expectancy (cfr. Prada, A. 1999: 14).

resources (natural resources, biodiversity, water, air quality, etc.) for future generations, and also with deterioration in our living conditions (congestion, noise, food quality, urbanism, etc.). Recognizing and quantifying the current magnitude of such impacts in Galicia seems like a good starting point for approaching correction without negatively affecting, as far as possible, the positive levels of economic development.

This need for correction, which in coming years is going to be considered as the most important objective for the Spanish and also Galician people (Fund Entorno 2000: 3), is taking shape in legislation[4] that has been created over recent years. The Galician Administration is not unaware of this sensitivity, for in the current Development Plan (CEF 1999: 37) some of our environmental weaknesses[5] are pointed out:

- Population dispersion
- Decline in traditional activities
- Urban growth
- Mining and coal burning activity
- Hydroelectric use
- Wind farms and the landscape

The quantification is introduced in the following three sections, which, it is hoped, will help to give order to the presentation; even though it is difficult to establish ordered arguments in these matters (for example, both agriculture and urban activities clearly affect water quality). However, it seemed a good idea to group, on the one hand, the situation in the rural world with that of agriculture, and then on the other, the situation of industrial activities and that of urban concentration on air and water, finally to take on the problems of both urban and industrial solid waste[6].

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4 Decree 442/1990 on Evaluation of Environmental Impact for Galicia. Decree 327/1991 on Evaluation of environmental effects for Galicia, Law 1/1995 on the Environmental protection of Galicia and Decree 154/1998 on the Waste Catalogue of Galicia. These are completed in the State framework by the Water Law (29/1985), Packaging and Packaging Waste Law (11/1997) and the Waste Law (10/1998).

5 And, at the same time, propose Environmental Priority Indicators (op. cit., p. 68) with 51 items (water, natural spaces, species, forests, urban solid waste, other waste and sea).

6 Again, here the presentation grouping should be done carefully as the relationship between the environmental management of air and water and their quality is immediate.

2. Agriculture and the urban world

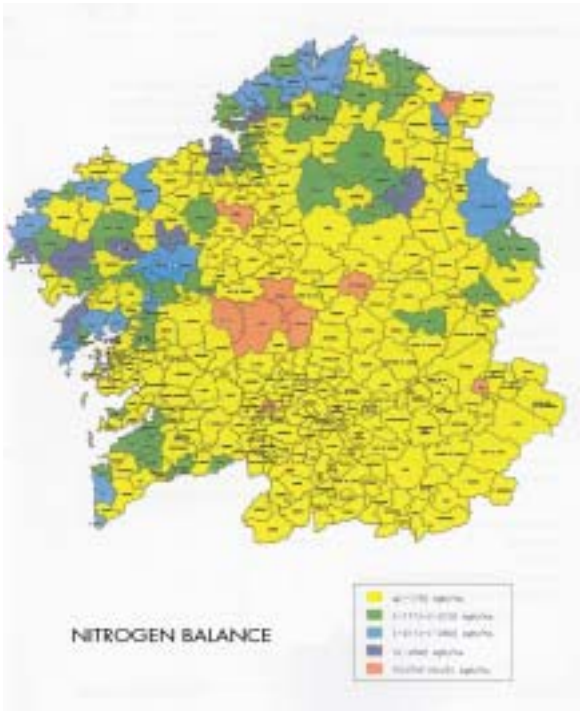
The environmental problems from current use of land in Galicia derive from abandonment and intensification (Surís and Varela 1995: 37). On the one hand, less productive land that loses its agricultural use joins the third of the country that is already covered by scrub or low land. In the more productive land, timber plantations become predominant (first pine, then eucalyptus, and often both mixed). On agricultural land, animal grazing pastures are the alternative benefited, often because of processes whereby a landowner's scattered plots are grouped together. areas (graph 2) there is an excessive production of Intensification, which is shown in the fact that with a small useful agricultural surface (UAS) Galicia generates a large part of Spain's cattle production (milk and meat) (Prada, A. 1999: 34), and some specific local areas (graph 2) there is an excessive production of manure that, together with chemical fertilisers, have an impact[7] on land and water. These effects are aggravated on those farms that have a UGM/ha. ratio higher than the advisable level (>1.5 to 3 according to Díaz-Fierros 1996a: 315 and 1996b: 41) and that do not have enough available arable land on which to spread the stored manure and achieve, in turn, a saving in chemical fertilisers.

The average impact of organic N/ha for UAS is 84 kg. above the average for countries such as Ireland and France or Autonomous Communities such as Asturias or the Basque Country (Xunta 1999: 29) (Díaz-Fierros 1996a: 314), with the most affected areas exceeding 200 kg. (Deza and Ordes).

At the same time, the spread of fertilizer use in Galicia during the last 30 years has lead to filtration of nitrate, ammonium, sulfate, potassium and phosphorus in surface and underground waters. The build up of these compounds in water, can cause negative effects in human health and affect the stability of aquatic ecosystems. Basically, the level of pollution will depend on the intensity of chemical fertilizer use, the soil type, and weather characteristics. This is why well over half of the springs and wells in rural Galicia show growing indices of sewage pollution and a lack of ideal drinking water conditions (Díaz-Fierros 1996a: 318). The Consellería de Agricultura itself notes as factors affecting water quality (Xunta 199b: 7): "the increase in intensive cattle farming, particularly farms "without land"

devoted to foul and swine production and those for veal, as well as the concentration in bovine cattle...".

Graph 2
NITROGEN BALANCE FOR CATTLE FARMING



Source: Xunta de Galicia (1999: 31) "Plan de Xestión de Residuos Agrarios de Galicia" (Galician Farm Waste Management Plan).)

This problem does not only derive from bacterial pollution from cattle manure but also from the lack of channeling and treatment of sewage in non-urban Galicia as, against a Galician average of 68.5% that has sewage drainage (IGE 1999: 12), in population centers of less than 15,000 inhabitants this figure comes to only 49% (CEF 1999: 38). These are impacts that, added to the forest fires that we will deal with below, would explain (Díaz-Fierros 1996b: 37-38) the gradual eutrophication that now extends to 67% of Galician reservoirs.

[7] Water nitrification, eutrophication with algae proliferation and heavy metal toxicity (Xunta 1999: 31) (MMA 1998b: 162 e 217)

Finally, in agriculture, we should not forget (Xunta de Galicia 1999: 21 and foll.) the often careless handling of plastics[8] used in farming and the annual one and a half million containers (plastic, card or paper) for fertilisers and the like.

At the same time, the abandoned lowlands, together with the growing tracts of single species timber crops (which certainly makes us the main producers of wood for pulp and chip for works within Spain, but means a simplification and impoverishment of the landscape and biodiversity) are the basis for forest fires as well as for the proliferation of infestations, etc. These tendencies lead to the passive recession and under-capitalization[9] of autochthonous woodlands and the scarce importance of protected natural areas (PNAs).

The incidence and environmental effects of forest fires in Galicia are well-known, being above the Spanish average at a figure of close to 200,000 ha burnt from 1990-2000, and accounting for 13% of the Spanish total. The map for these numbers (graph 3) shows that beyond the climatic factors in common with Southern Europe, there must be other structural factors coming together in the case of Galicia. The consequences for the conservation of the soil, flora and fauna, for water flows etc. greatly outweigh the losses of timber.

Graph 3
IMPACT OF FOREST FIRES
Annual average 1989-91

Source: MMA (1998: 563)

8 8,500 tonnes that with "... uncontrolled incineration give rise to the emission of hazardous compounds into the atmosphere, toxic for the environment and human health" (Xunta 1999: 37).

9 In uses of greater added value (parquet, outdoor carpentry, furniture, etc.) they are being replaced by imported timber or non-renewable resources such as aluminum.

We have a new environmental counterpoint in the case of the spread of protected natural spaces or areas (PNAs) which still do not account for 1% of geographical surface area (chart 1) against much higher percentages in both Spain and nearby Atlantic regions. In this respect it is good that a coverage of 324,000 has. has been defined recently (DOG de 9.11.99) for the Natura 2000 Network, which will take us to 11% of protected surface area.

Chart 1
CURRENT SITUATION OF PROTECTED NATURAL AREAS

	Average surface (av)	% Total surface
Asturias	5.780	10,21
Cantabria	7.156	6,77
Galicia	3.307	0,79
Basque Country	6.990	9,63
Spanish Average	5.551	5,77

Source: Authors, using MMA data 1998b: 66

But, besides the PNAs, perhaps the best indicator of the environmental quality of wooded areas in a country as a counterpoint to the deterioration caused by forestry intensification, single species crops and the introduction of exotic species (MMA 1998b: 75, 217, 224), is the state, importance and dynamics[10] of natural, semi-natural and traditional woodlands, of woods undergoing autochthonous regeneration and for genetic protection[11]. In this "stock" in Galicia, only 18% of woodland hectares are slow growing deciduous species (mainly oak and chestnut)[12]; but of equal or greater significance is the fact that most recent data[13] on forestation of agricultural land do not show any great changes in this balance for, in Galicia, replanting with deciduous trees, as opposed to forestry plantations, is very limited. (graph 4)

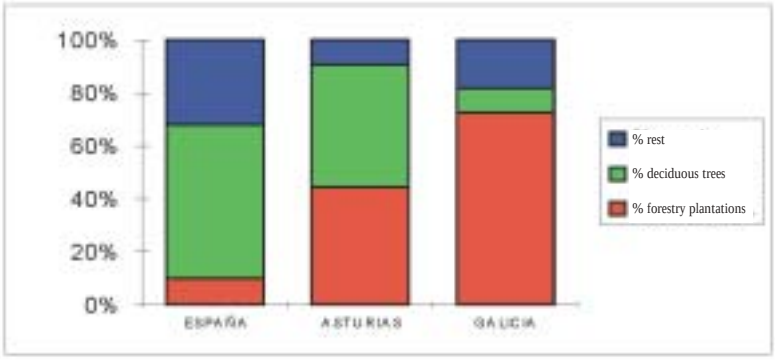
10 "... priority should be given to autochthonous species and local origins" (MMA 1998: 226).

11 Describers, respectively, of the indicators of biodiversity approved in the PEMCPF (Pan European Ministers Conference on Protection of Forests, "General Declaration, Resolutions and Annexes of the Third Conference") cfr. MMA-DGCONA 1999: 108 and Annex IX p. 94 and foll.

12 MAPA 1996: 41 in the "Encuesta sobre superficies y rendimientos" (surface and yield survey) Boletin Mensual de Estadistica, February, 1996.

13 MAPA-Dirección General de Desarrollo Rural (1998), data sent in by Autonomous Communities on 19.5.98 for the period 1993-1997.

Graph 4
STRUCTURE OF AGRICULTURAL LAND FORESTATION
1993-1997



Souce: Authors using MAPA data (Dirección General de Desarrollo Rural)

3. Industrial and Urban Polllution

As has already been stated in the preface, the Plan Estratéxico de Desenvolvemento Económico de Galicia (Strategic Economic Development Plan for Galicia), PEDEGA, (CEF 1999: volume IV, p 37) clearly outlines the main environmental problems present in Galicia.

> *Dispersion of population and activity, fragmentation of private property and the widespread incidence of this, the decrease in traditional activities and the still limited integration between environmental and economic planning summarises the main environmental weaknesses. Urban growth, the existence of impacts linked to specific activities (mining, coal-powered electricity generation and other industrial enclaves), the development of transport and energy infrastructures, constitute the most notable scope of the conflict.*

Galicia has – often on the basis of privileged natural resources – dynamic industrial sectors with important weight within Spain, as in the case of ornamental stone (40% of the Spanish total for granite and 80% for slate) (CEF 1999: 40), lignite fuel, hydroelectric power generation or, more recently, wind energy. The management of these activities often results in well-known

impacts (Suris and Varela 1995: 40). Lignite coal fields, quarries, gravelpits and sandpits cause a negative effect[14] on the landscape and river courses (MMA 1998b: 178); these, in turn, are affected by reservoirs that modify valleys, riverside woodlands and fish levels (Surís and Varela 1995: 42); it becomes necessary, sooner or later, to classify the many issues in play – always a work of artifice – into the two environmental problems (air and water) that citizens consider to be the main or priority ones (Fund. Entorno 2000: 3).

A) Air pollution

Air quality is a requirement for reaching a certain wellbeing and quality of life. It can affect our health[15] , the state of ecosystems and materials (damage to buildings[16] , vehicles and deterioration of historical heritage). Its effects depend on the height at which the pollutant is released[17] , the lie of the land and climate. Thus, the phenomenon can have a scope that is local (tens of kilometers), regional (hundreds of kilometers) or continental (thousands of kilometers). Concentrations also vary in time (daily, weekly and seasonally).

In Galicia there are (CEF 1999: 44) close to a hundred monitoring stations, sited in 40 municipalities, belonging to the Red de Vigilancia de la Contaminación Atmosférica (Atmospheric Pollution Monitoring Network) of the MMA. These stations are classified into two networks, the first linked to higher risk populations (38% of the total), corresponding to those located in cities[18] and are managed by the Dirección Xeral de Saúde (the Regional Health Authority), and the other related to large industrial centres[19], managed by the Consellería de Industria e Comercio (the Trade

14 Because of this it is planned to draw up "Rationalisation Plans for Extraction Works and Environmental Conditioning".

15 Especially discomfort and disturbance, reduced functioning of some organs (e.g. reduced lung capacity), morbidity and mortality. Effects can be acute (short-term and reversible) or chronic (long-term and irreversible). The respiratory system is the most affected by the presence of pollutants in the atmosphere although problems of a cardiovascular type can also be produced or aggravated (Bascom et al., 1996: 3-50).

16 Especially important in Galicia are the effects of acid deposits (SO2) on building made from granite, which was, and still is, one of the main construction materials (ECOTEC, 1992). At a European level this damage is estimated at around 10 billion ECUs.

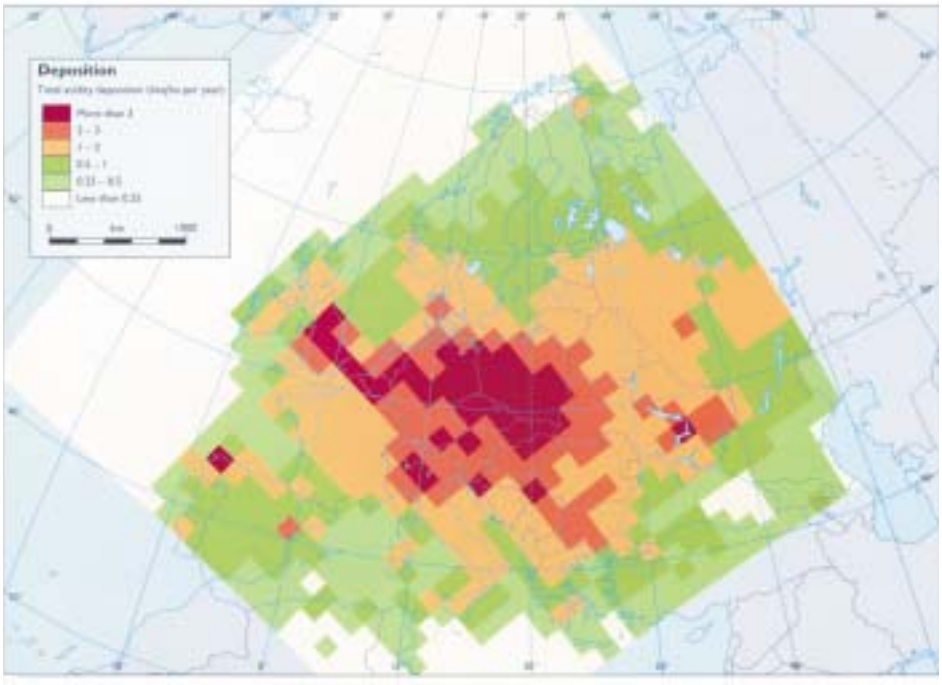
17 We differentiate between emissions derived from transport and those associated with power generation processes in oil- or coal-fired power stations.

18 There are monitoring stations in A Coruña, Ferrol, Santiago, Ordes, Lugo, Abadín, Guitiríz, Monforte, Xove, Ourense, O Barco, Pontevedra and Vigo.

19 Meirama, As Pontes, A Coruña, Cee, Dumbría, Santiago, Sarria, Xove, O Barco, Pontevedra and Vigo.

and Industry Department)[20]. Although PEDEGA (CEF 1999: 40) notes a reduction in emissions to the atmosphere from 685,000 t in 1987 to 382,000 t in 1991, there are still areas (AME, 1995: 50; Cuquejo, 1996: 21; Peña Castiñeira, 1987: 121-134) that exceed the limits and guideline values, particularly in urban areas during certain seasons, and in localized industrial areas as can be seen in aggregate form in Graph 5.

Graph 5
TOTAL ACID DEPOSITS



Source: European Environmental Agency, 1995: 41

It is well-known that there are three basic sources of urban atmospheric pollution: transport, heating and industrial activity. Save a few specific cases (the REPSOL refinery in A Coruña or ENCE-ELNOSA in Pontevedra), Galician cities do not have industrial activities with high levels of emissions.

[20] The management bodies for these stations, in the case of areas of influence of some companies, are the companies themselves, as is the case of the coal-fired power stations at Meirama (UEFSA), and As Pontes (Endesa), Alúmina-Aluminio and Celulosas de Pontevedra.

Likewise, the heating systems, mainly those that are oil fired, contribute to the aggravation of possible pollution problems but are not in themselves the cause of these. Therefore, the main cause of air pollution in our cities are the emissions derived from traffic.

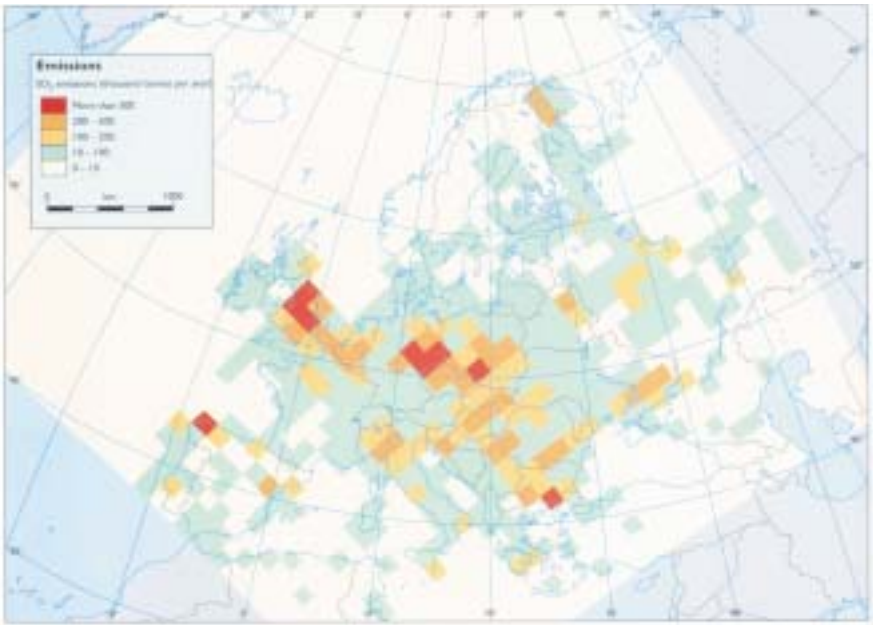
At present, every city has monitoring stations for concentrations of the main pollutants (managed either by the Dirección Xeral de Saúde or by the Municipal Laboratories of the Councils). Using data from these networks (Cuquejo, 1996: 21, 28 and data from the Consellería de Sanidade), we can conclude that the main urban pollutant is particulate matter rather than SO_2 levels or other pollutants (the exception seems to be the city of A Coruña with slightly higher levels of SO_2, due to the proximity of the REPSOL refinery). Increased problems are also observed during wintertime, due to a greater use of private transport, central heating and possible thermal inversion phenomena[21].

Of the seven main cities in Galicia, those that show the highest levels of atmospheric pollutants are Santiago and Vigo, exceeding the guideline values at certain heavy traffic points (Peña Castiñeira, 1987; Cuquejo, 1996: 21). Likewise, in these two cities the problem is aggravated by the particular geography of their areas, surrounded by elevations that impede the dispersing action of the wind. In general, and following the European trend, although emissions from new vehicles have decreased due to the incorporation of new technologies and greater energy efficiency, these improvements are counterbalanced by the increase in the number of vehicles and the distances covered per vehicle. The almost total absence of air pollution from lead over the last few years is prominent, a consequence of the progressive renovation of the fleet and the transition to vehicles running on diesel or unleaded petrol.

A large part of emissions to the atmosphere are produced outside the large urban centres, near to the location of industrial processes. Oil refineries and petrochemical industries, engineering industries, coal-fired power plants, the chemical industry (mainly fertilisers and pesticides) and paper pulp factories are the main emission points for this industrial pollution in Galicia. Air quality depends on the type of industry, the emission conditions (e.g. stack height) and the level of technology in both the process and emissions control.

[21] Data provided directly by the Consellería de Sanidad, Subdirección Xeral de Saúde Ambiental for the period 1990-95.

Graph 6
SO_2 EMISSIONS



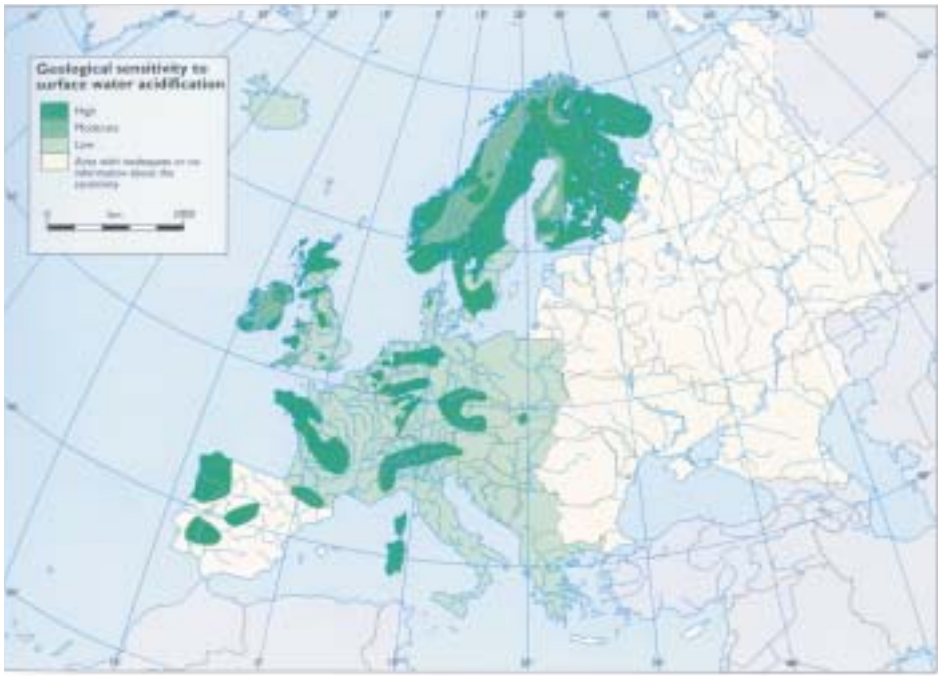
Source: European Environmental Agency 1995: 36

Although technology has allowed emission levels to decrease considerably over the last few decades, some effects, on nearby populations, crops (timber and agricultural) and vegetation, still persist. The most significant pollutant produced by industry is SO_2, which makes up 88% of total emissions (CEF 1999: 40), followed in importance by particulate matter and heavy metals. The province of Coruña accounts for 94% of total emissions (Graph 6). The main sources are, without doubt, the lignite coal-fired power stations[22] that emit ash with high sulfur contents into the atmosphere (MMA 1998b: 173); so much so that they will be economically and environmentally sustainable simply by mixing imported coal and, we hope, the contribution of gas.

It should also be pointed out (AME 1995: 97, 149) that despite the above, not all the impact derives from acid depositions but also from the characteristics of the receiving medium (land or water) and its reaction in the presence of sulfur and nitrogen compounds deposited by precipitation (dry, wet or clouds). Thus, the intrinsically acid characteristics of the soil in

Galicia constitutes a further element of sensitivity and vulnerability (Graph 7) as the geological sensitivity and surface water acidification will be greater.

Graph 7
ACIDIFICATION GEOLOGICAL SENSITIVITY AND WATER



Source: European Environmental Agency 1995: 36

B) Water pollution

Inland waters in Galicia are divided into two areas, with very different characteristics and problems. Thus, we can distinguish an area made up of all the hydrographic basins that flow wholly through Galicia (rivers between the Eo and the Miño) and over which the Galician Autonomous Community has

[22] The business structure of the Galician electricity subsector generates 20 million MW: 13 coal-fired and 7 hydraulic. Approximately half of the electrical energy produced in Galicia is produced by one company, ENDESA, at one coal-fired plant, As Pontes (Prada, 1999: 90-91). Alúmina alone consumes 38% of Galicia's total energy consumption.

had authority since 1990. The other area is made up of the "inter-autonomy" waters, which covers the basins of the Navia, Eo, Miño-Sil and all the basins to the south of the Miño. This is under the authority of the Confederación Hidrográfica do Norte.

There are many publications on the quality of inland waters[23] and measurements from the Rede de Vixilancia (monitoring network) of the Dirección General de Obras Hidráulicas (MOPU), the Conferencia Hidrográfica del Norte de España and the Dirección Xeral de Calidade e Avaliación Ambiental. In one detailed study (Antelo and Arce 24 1996: 353-383) carried out in February 1993 in the "intra-community" basins, water quality was analyzed according to[24] physical and chemical parameters[25], with results being compared to values established by the community directives in force and quality indices being established. Results showed that the pouring of urban sewage together with industrial and mining effluent is causing most of the impact. Looking at the figures it can be stated that the water quality in the Galician inter-community basins is, in general, good, although there is a growing number of trouble spots where intervention would be recommendable.

In at least two cases the cause for the high levels of pollution found is mining (Antelo and Arce 1996: 382). Firstly, a notable case is that of the River Brandelos, tributary of the Ulla, which suffers heavy pollution due to runoffs from the slag heaps of the Rio Tinto mine at Touro that, although now disused, continues to provoke a major impact. This pollution can be important for flora and fauna on the river Ulla in its last stretch. Thus, Ponte Ledesma is considered to be heavily polluted (Antelo and Arce 1996: 382). From Ponte Cira on the effect decreases due to the arrival of waters from the Deza. Secondly, the study points out the high level of pollution in the River Eume after its passage through the installations at As Pontes (monitored at Ribadeume) compared to the values found at its source. After the Eume Reservoir the chemical quality of the water improves again.

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23 Cfr. 324 studies compiled in 1991 in the Base de Datos sobre Estudios Físico-Químicos de Augas Superficiales Gallegas database, University of Santiago de Compostela, 1991.

24 Work included in the book As augas de Galicia, published by the Consello da Cultura Galega, 1996.

25 pH, conductivity, chlorides, sulfates, silica, calcium, magnesium, alkalinity, nitrates, phosphates, organic material, heavy metals, copper, zinc, cadmium, nickel, iron etc.

In the comparison with community directives, the rivers Sar and Anllóns show the worst situation (Antelo and Arce 1996: 382). In both cases the problem is due to pollution from urban and industrial effluent from Santiago and Carballo, respectively. Also noteworthy is the pollution in the river Lagares as it flows through Vigo. Apart from those mentioned, the Xallas, Masma, Xubia, Mero, Umia, Deza, rivers in the Ferrol area, etc. should be cited. In these, there are quite important pollution black spots (Antelo and Arce 1996: 382) and monitoring should be undertaken in order to avoid their worsening.

With regard to the inter-autonomy basins, the available information comes from the Rede de Vixilancia (monitoring network) of the Dirección General de Obras Hidráulicas and from studies by the Chemistry and Physics Department of the University of Santiago de Compostela (1990 and 1993) (Antelo and Arce 1996: 383-422). All the data show that the basins of the Eo and the Navia have high quality levels, whilst the Limia basin only shows problems as it flows through Xinzo, due to urban sewage, a the Támega basin shows similar problems as it flows through Verín.

In the Miño, our main water course, the most important problems that have been suffered over the past few years have been caused, principally, by two large urban centres that dump their sewage directly into the river. The city of Lugo has a great effect on the water quality of the Miño as does, to a lesser extent, the city of Ourense. In Lugo there are also high levels of nitrites, nitrates and phosphates associated with the filtration of fertilisers and agricultural pesticides (Antelo and Arce 1996: 392-393). Likewise, the tributaries in Ourense, such as the Barbaña, are worthy of note as they flow in highly polluted from the San Cibrao industrial centre. Finally, the river Louro reaches the main river in the final stretch, after O Porriño, and carries high levels of both urban and industrial pollution which is present as far as Tui.

Finally, the River Sil is characterised by the great impact (Antelo and Arce 1996: 411) that its water quality suffers along the initial stretch, provoked by the waste pour off from the Ponferrada area. These cause a generalized and considerable increase in almost all the physical-chemical parameters and originate from domestic activity as well as mining and the slate industry.

If we move from inland to coastal waters, it is worth remembering that, in Spain, Galicia is the Autonomous Community with the most kilometres (1,659) of coastline, followed by the Canary Islands (1,583 Km) and the Balearic Islands (1,428 Km). Given the productive and tourist interest in our estuaries and their sensitivity to pollution, public intervention at all levels, municipal or regional, is vital in order to attain their sustainability. There is currently the Plan for Regulation of Fishing and Seafood Resources in Galicia, approved in 1993 (DOG no. 13 20.1.94), which includes the cleaning up of the estuaries, the setting up of a specialised centre (Centre for Marine Environment Monitoring and Quality), and three networks for monitoring molluscs and water quality.

The main impacts on the Galician coastal ecosystems have as their main cause the fact that development is increasingly taking place along the coast in Galicia (CEF 1999: 45), both in population and productive activities The most noteworthy problems are:

1. Strong human presence along the coast, with interference on natural processes.

2. Pollution in the estuaries of Ferrol, Coruña, South of Arousa, Pontevedra and Vigo, fundamentally associated with urban and industrial waste.

3. Growing over-exploitation of resources for mollusc farming[26].

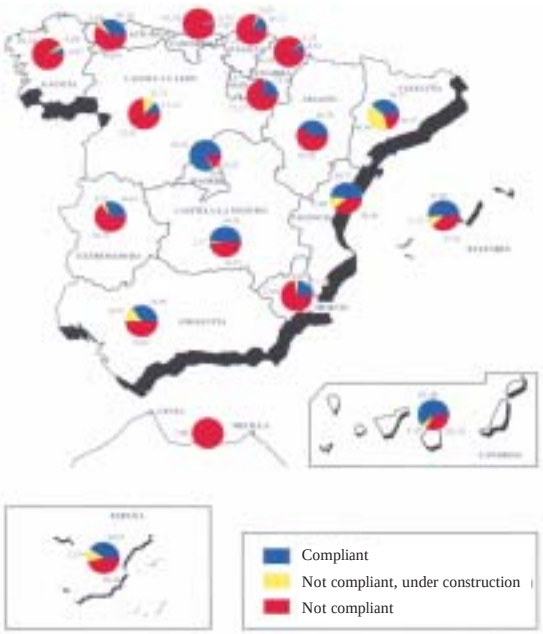
The fundamental cause for these pollution points along our coast is the dumping of waste waters from along the banks. This causes, in the first place, a reduction in coastal fishing and shellfish harvesting as the productivity in our estuaries is extremely sensitive to changes in temperature and the concentration of elements diluted in the water. Also of note is the impact on tourism (Peña Castiñeira 1998: 138) and revenues derived from this. Thus, the author (Peña Castiñeira 1998: 141) presents the results of the Galician Programme for Health Monitoring of Maritime Bathing Waters (running since 1983), Continental Bathing Waters (running since 1989). In this plan there are 744 maritime beaches in the census (409 in Coruña, 294

[26] In Galicia there are 3355 oyster beds and mollusc rafts and the surface area for marine farms is estimated to be 1,200,000 m2. Mussel farms cause local problems because of their excessive concentration (detritus and shadow effects).

in Pontevedra and 71 in Lugo), with a total length equivalent to 272 km. The measurements reveal that 93% of Galician beaches are fit for bathing and 7% are unfit. With regard to the areas surrounding the bathing areas, 46% show good conditions, 33% tolerable conditions and 12% poor conditions. At the same time, the inland waters present slightly worse figures, with 71% of areas being fit and 29% unfit. In this case, 53% of the surroundings for bathing areas show poor conditions, 33% tolerable conditions and only 14% are considered to be good quality.

On the state of effluent treatment in Galicia, it should be pointed out that Directive 91/271/CE on urban sewage treatment was published in the Official Diary of the European Communities on May 30, 1991, as a response to the resolution of 28 June 1988. This directive established the adoption by Member States of the measures needed to guarantee proper water treatment of urban sewage before its release. The Directive obliges Member States to deal with urban sewage in such a way that, by 2005, it would all be correctly treated before reaching the sea.

Graph 8
STATE OF WATER TREATMENT IN SPAIN AND GALICIA



Source: Plan Nacional de Saneamento e Depuración (BOE 12 May, 1995)

For the application of this directive[27] the National Plan for Cleaning and Treatment from the Ministerio de Medio Ambiente drew up an inventory of treatment plants (1992) and carried out a diagnosis of the water treatment situation in Spain (Graph 8). On the basis of this diagnosis, which placed the lacks existing in Galicia at the time in the open, it can easily be explained why, in 1997, the budget set aside for this matter came to 60% of total investment in hydraulic infrastructure (CEF 1999: 38).

With respect to sea pollution, dumping of oil and other substances originating from shipping, shipbuilding and repairs and accidents are of the most importance. When they happen, the spillage from catastrophes seriously affects marine harvests. For example, the case of the Urquiola petrol tanker, which forced the seafood harvest to be stopped at the farms in the A Coruña estuary and its surroundings; the case of the Aegean Sea, which also affected activity and marine farming areas as well as the raft farms and fish cages in the estuaries of A Coruña, Ares-Betanzos and Ferrol; and the case of the Erkowit, with the same result for over a year in the estuary of A Coruña (Peña Castiñeira, 1998: 136). Graph 9 shows how Europe's Atlantic coast, and the Galician north west in particular, is one of the areas with the highest number of recorded accidents.

Pollution derived from the cleaning of vessels should also be included here. This is despite the fact that waste generated in these processes is regulated by means of an agreement (RD 438/1994 of 11 March which includes the MARPOL 73/78 agreement), which establishes a network of authorised handlers to work in ports, and that 95% of port facilities in Galicia currently adhere to this agreement (CEF, 1999: 96).

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[27] Given in Law 29/1985 of August, on Waters and Law 22/1988 of July, on the Coast which establish various measures in order to achieve improved quality in inland and maritime waters, respectively, among which stand out the subjection to authorisation for activities susceptible to provoking pollution in public water areas or public land-maritime areas and, in particular, effluents. The Directive is carried out in Spain by means of Royal Decree Law 11/1995, of 28 December (BOE n.º 312 of 30, December, 1995), by which the norms applicable to sewage treatment are established. Enforcement of the legislation rests with the Autonomous Communities (by.virtue of the statutory competence awarded by article 148. 1. 9th of the Constitution). In 1996 Royal Decree 509/1996 of 15 March was passed with the aim of complementing the norms for collection, treatment and release of sewage and completing the incorporation of the Spanish law of the directive

Graph 9
OIL SPILLS IN MARITIME ACCIDENTS (greater than 10,000 barrels, since 1994)

Source European Environmental Agency (1995: 388)

4. Urban Solid Waste and Industrial Waste

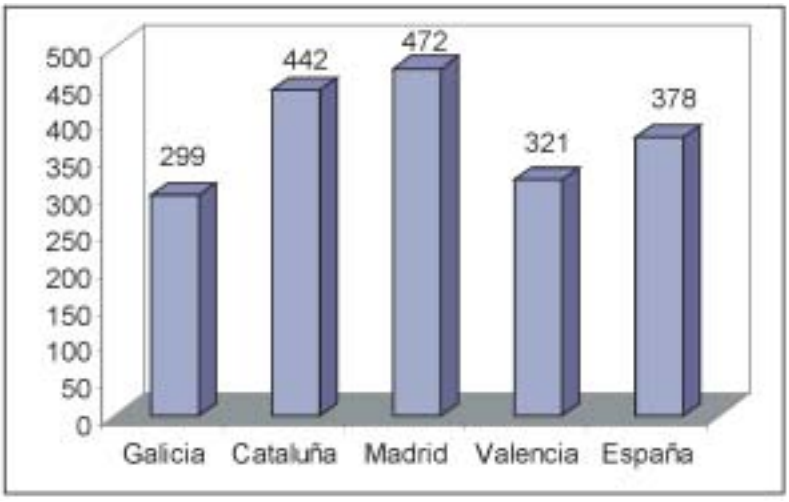
The Atlantic face of the Peninsula (which includes Galicia) shows high population density when compared with the inland area and the Mediterranean. This means high-speed and large-capacity communication routes become necessary (motorways, railways, etc.) as do all kinds of service infrastructures (solid waste and sewage treatment), and problems arise in quality of life associated with urban congestion (emissions, urbanism, noise, etc.).

The quantity of domestic urban waste is growing (as is family income) and this is complicated by a more difficult to manage, scattered production of waste on a smaller scale in outlying and rural areas. In both cases, collection, handling and treatment as well as reduction and recycling are issues that are still undecided. And whereas solid waste involves issues of natural resource savings and reductions in impacts on health and the environment, sewage involves issues to do with one of Galicia's prized riches:

the estuaries that provide leisure and produce of high quality[28]. As we have seen, this is due to pollution from urban and industrial activity in the final stretches of river (Ferrol, Coruña, Pontevedra and Vigo) (CEF 1999: 41).

In 1996, Galicia produced 814,000 tonnes of solid waste. That is on a par with other, similarly developed European countries at 300 kg/inhabitant/year (Iceland, Ireland, Portugal, Greece, etc.) but below Spanish Autonomous Communities with higher GDPpc (Graph 10) (MMA 1998: 347) (CMA 1998: 27).

Graph 10
SOLID URBAN WASTE INTENSITY (1996)
KG/INHABITANT/YEAR



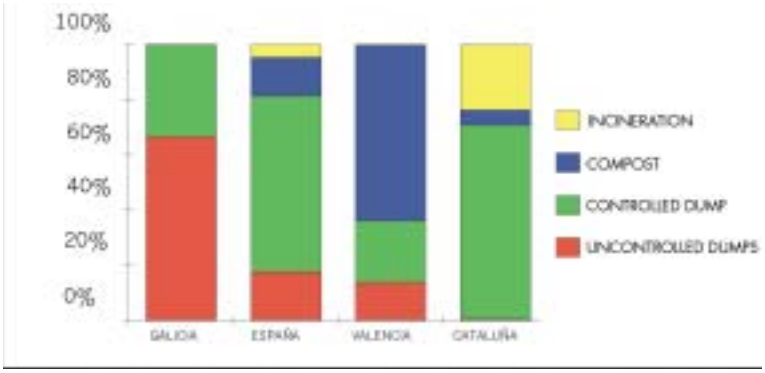
Source: Drawn up by the authors from MMA 1997 and CMA 1998 data.

The waste is largely made up[29] of organic material, which accounts for almost half in weight (400,000 tonnes), followed by paper and cardboard (over 200,000) and to a lesser extent, in terms of weight, plastics (89,000) and glass (50,000). Treatment could be said to be going through a transition. In 1996 (Graph 11), mass collection (non-selective) mainly ended up at tips which did not meet minimum environmental standards (uncontrolled) and

[28] The exception, we hope, was the Bens tip (A Coruña) which collapsed into the sea.
[29] Our figures based on percentages from (MMA97: 153) or (CMA98: 32).

less than 300,000 tonnes were placed in adequate tips (MMA 1997). This was in contrast to the Spanish average which channeled, even then, most mass collection into controlled tips and the rest to either compost or uncontrolled dumps. Looking at individual Communities, Catalonia incinerated the waste that did not go to tips, and Valencia and Madrid used it for compost.

Gráfico 11
STRUCTURE OF URBAN SOLID WASTE TREATMENT
1996



Source: Drawn up by the authors from MMA 1997 data

The situation is currently being modified – in the SOGAMA plan – along three lines: sealing - the elimination of uncontrolled tips; progressively selective collection and recycling of glass and paper; and incineration. Although discussion about both compost and incineration is still underway, there seems to be consensus on the aim for separation at source, recycling and elimination of any untreated rubbish in controlled tips.

From our starting point, the waste management structure in the United Kingdom would appear to be the most plausible in the short term; although possible moves towards recycling (Denmark), compost or incineration (Germany) are open options[30], but always with decrease at origin, reduced use of tips and selective collection (chart 2). However, being prudent and realistic we should not forget where we live and that most recent data (IGE 1999: 12) shows that, whereas 90% of households have bulk collection, only 34% have selective collection - a necessary condition for any other option.

[30] On urban solid waste management cfr MMA 1998: 576 and foll.

Chart 2

URBAN SOLID WASTE IN EU COUNTRIES IN 2000 AND SOGAMA PLAN

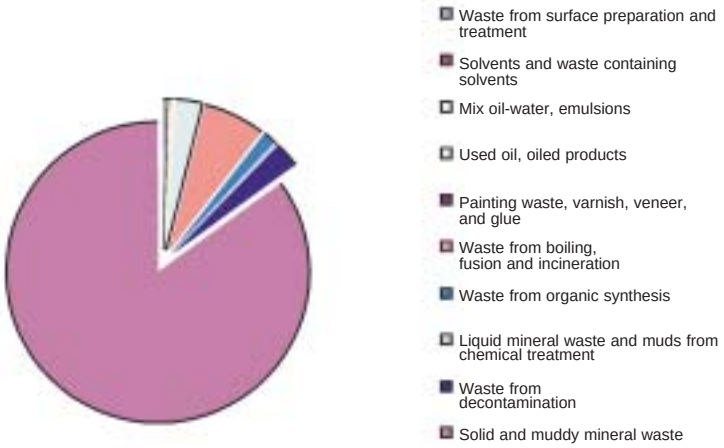
	Tip	Recycled	Compost	Incineration
Galicia	30	29	0	39
Denmark	21	44	10	25
Germany	14	20	26	40
United Kingdom	70	20	5	5

Source: Drawn up by the authors from (CMA1998: 75) and (EC 1997a: 34 chart 3.5.)

As far as industrial waste is concerned the Industrial Waste Treatment Centre at Somozas (A Coruña) has been working since 1994, managed by the Sociedade Galega de Residuos Industriais e Solos Contaminados de Galicia (1995-2000). About 3,700,000 tonnes/year of industrial waste are currently produced in Galicia, of which 555,000 tonnes/year are hazardous waste (CEF 1999: 39). Graph 12 shows the percentage distribution of hazardous waste in Galicia.

Graph 12

PERCENTAGE DISTRIBUTION OF HAZARDOUS WASTE GALICIA (1998)



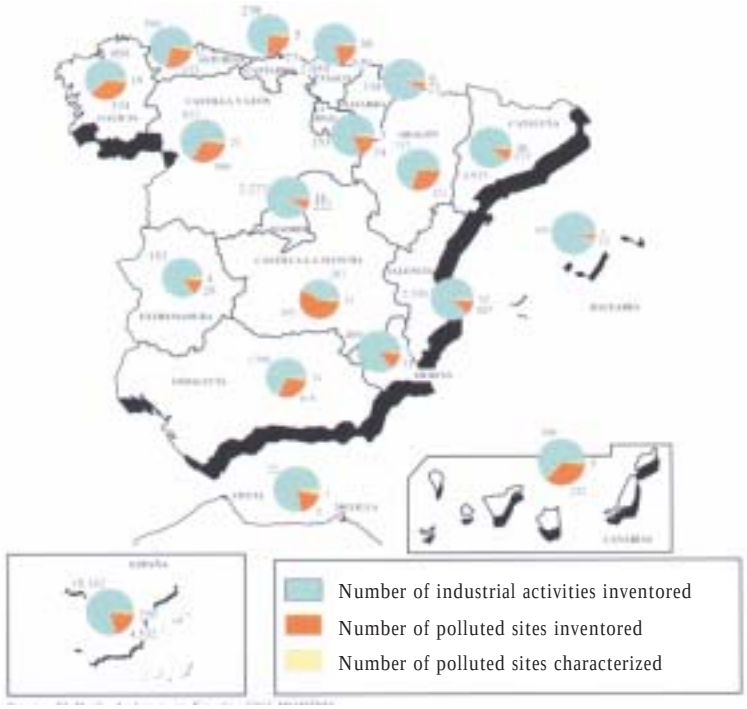
Source: Peña Castiñeira, 1998: 193

Although toxic and hazardous[31] waste is expected to go from 555,000 tonnes/year (85% is red mud from aluminium extraction which goes to a

[31] Special waste is not included: hospitals, batteries, vehicles, tyres, etc. An idea of the quantity of this is given in the ENVIROIL Galicia S.A. project – also at Somozas – to treat 18,000 tonnes/year of tyres and 22 million litres/year of oils (Voz de Galicia 22.3.00).

controlled depot) to 164,000 – in the medium term – (CEF 1999: 39), 30% currently ends up being reused, 47% is taken to tips and 22% goes to controlled depots. Since 1991, used oils and oil-filters have been collected by authorised vehicles for storage in transfer centres (A Coruña, Pontevedra and Ourense). After treatment, oils are used as fuel in the ceramics industry and oil and scrap are obtained from filters[32].

Graph 13
POLLUTED SOIL



Source: MOPTMA, 1993. El Medio Ambiente en España.

The National Plan for Hazardous Waste (1995-2000) (Resolution 28/04/95) compares the Galician situation with the other Communities in Spain with regard to hazardous waste production in 1994. Galicia is the fourth producer of such waste, after Catalonia, the Basque Country and Asturias.

[32] The applicable normative for the Autonomous Community is included in Law 10/97 on Urban Solid Waste Management, D 154/98 which presents a catalogue of waste for Galicia, D 260/98 which regulates authorisation for 30 urban solid waste management and D 263/98 on authorisation for production and management of Hazardous Waste.

Causes of soil pollution are to be found in both industrial waste and agricultural filtration (Graph 12). Effects depend fundamentally on pollutant type, duration and soil type, and can cause losses in land productivity or in its capacity to satisfy uses for agriculture, housing or leisure. Surface and underground water pollution can also be generated, which can affect the food chain. Because of these impacts, MOPTMA (1993) determines the Water, Waste and Land volumes needing treatment (Graph 13). There are 19 enclaves in the Plan for Toxic and Hazardous Waste and Polluted Soil in Galicia (1995-2000). Some specific problems[33] are worth of note, such as pollution from fertiliser production processes at O Porriño.

5. Conclusions

Galicia has undergone large-scale economic change over the last 40 years and, at the same time, change in environmental conditions with clear signs of imbalance (as other areas, but with its own profile). Necessary adjustment does not lie solely in directly productive activity, but also in institutions. Norms and conduct of public managers change with social and economic factors, and play an important role in the adjustment process.

Impacts derived from development have two fronts from the perspective of environmental economics. Firstly, sustainability problems (loss of biodiversity and natural balance) and, secondly, problems to do with quality of life (also affected by water and air quality, noise, congestion, etc.).

The combination of economic differentiation and environmental incidence leads us to separate three major areas:

Problems in agriculture and the rural world

The most obvious economic cause derives from a combination of abandonment of rural areas (less profitable uses and locations) and intensification (most noticeable in timber plantations and pastures), but also in forms of activity. Some consequences worth noting are the effects of

[33] CMA 1999 "Action Areas within the Research Framework for Soils Polluted by Lindane in the Torneiros Industrial Estate, O Porriño, Pontevedra" and "Report – summary of works carried out related to detailed research into "HCH" pollution in the Torneiros industrial estate area, O Porriño, Pontevedra".

manure and chemical fertilisers on soil and water, linked to abandonment and single-species crops, which lead to the production of a fire promoting base (for forest fires) and specific infestations.

Economic losses are not directly productive, but rather, deterioration in soil and water quality and losses in flora and fauna also lead to, as a consequence, a loss in tourism and leisure activities. Recourse to protected natural areas still seems to be partially developed.

Industry and the urban world

The most harmful impacts can be found through urban growth (spatial imbalance and distribution of people and activities) and the acquired or created needs in infrastructure, transport and energy. Certain productive activities also have heavy localised impact (mining, coal-fired power generation, etc.).

Environmental impacts, besides alterations in landscapes and historical or cultural heritage, can be detected in atmospheric and water quality. We find water impacts in both river basins and the coast, which suffers particularly from increased population flow and economic activity which contribute to pollution and overexploitation of resources.

Here too, losses are not exclusively in products but also in possibilities for tourism and those derived from impacts on the environment and natural productivity.

Finally, we specifically separate the generation of *urban solid waste and industrial waste.* What can mainly be seen here is similar to other comparably developed areas and, of course, vary according to population centre size.

The problems are quite typified and are being dealt with but, clearly, available treatment options are susceptible to discussion in terms of their value as environmental solutions and economic management.

By way of conclusion, Galician economic and demographic evolution over recent decades has generated associated environmental problems, as in most other western countries. The current stage is, or should be, to use technical

tools available from a scientific and economic standpoint to carry out a proper diagnosis and try to reform growth patterns with the aim of reaching sustainable development, that is, according to the first paragraphs of the Agenda 21 document: development which "manages to satisfy the needs of the current generation without compromising the options of future generations to satisfy their own needs" (United Nations Conference on Environment and Development, Rio de Janeiro, June 1992).

6. Bibliografía

Agencia Medioambiental Europea (1995): *Medio Ambiente en Europa. El Informe Dobris*. Copenhague.

Bascom, R. *et al*. (1996): "Health Effects of Outdoor Air Pollution". *American Respiratory and Critical Care Medicine*, vol. 153, pp. 3-50.

Consellería de Economía e Facenda (CEF) (1999): *Plan Estratéxico de Desenvolvemento Económico de Galicia 2000-2006*. Santiago de Compostela.

Consellería do Medio Ambiente (CMA) (1998): *Adaptación do Plan de Xestión de RSU de Galicia. Ano 1998*. Santiago de Compostela.

Consellería do Medio Ambiente (CMA) (1998): *Plan de Xestión de RSU de Galicia*. Secretaría Xeral / Resolución de 28.10.98.

Consello da Cultura Galega (1996): *As augas de Galicia*, Santiago de Compostela.

Cuquejo Taboada, E. (1996): *Contaminación Atmosférica en Vigo. Período 1990-1995*. Concello de Vigo.

Díaz-Fierros, F. e Nuñez, A. (1996a): "La contaminación de las aguas en España con origen en actividades ganaderas". *En Prácticas agrarias compatibles con el medio natural*, MAPA, Madrid.

Díaz-Fierros, F. (1996b): "Problemática ambiental y sanitaria de las explotaciones ganaderas" en *Residuos ganaderos y medio ambiente*, Fund. Semana Verde, Silleda.

ECOTEC (1992): A *Cost-Benefit Analysis of Reduced Acid Deposition: a Revised Appoach for Evaluating Buildings and Building Materials*. Birmingham.

European Commission (EC) (1997): *Cost-benefit analysis of the different municipal solid waste management systems*. Luxemboug.

Fundación Entorno (2000): *Hábitos de consumo y medio ambiente en España*. En http://www.fundacion-entorno.org.

Instituto Galego de Estatística (IGE) (1999): *Enquisa das condicións de vida das familias*. Santiago de Compostela.

Ministerio de Medio Ambiente (MMA) (1997): *Medio Ambiente en España*, 1996. Madrid.

Ministerio de Medio Ambiente (MMA) (1998): *Medio Ambiente en Europa: Informe Dobris*. Madrid.

Ministerio de Medio Ambiente (1998b): *Estrategia española para la conservación de la biodiversidad biológica*. Madrid.

Ministerio de Medio Ambiente (MMA) (1998c): *Medio Ambiente en España, 1997*. Madrid.

Ministerio de Medio Ambiente – Dirección General Conservación Naturaleza (1999): *Estrategia Forestal Española*. Madrid.

Ministerio de Medio Ambiente (MMA) (1999b): *Medio Ambiente en España*, 1998. Madrid.

Ministerio de Obras Públicas, Transporte y Medio Ambiente, MOPTMA (1993): *Medio Ambiente en España*, 1993. Madrid.

Peña Castiñeira, F. J. (1987): *Contribución al Diagnóstico de Salud Ambiental de Santiago de Compostela en Relación con la Contaminación del Aire, del Agua y del Suelo*. Tese de doutoramento. Departamento de Hixiene e Sanidade Ambiental, Facultade de Farmacia. Universidade de Santiago de Compostela.

Peña Castiñeira, F. J. (1998): *Medio Ambiente y Salud*. Compostela, Ediciones El Correo Gallego.

Prada, A. (1999): *Economía de Galicia*. Vigo. Edic. Xerais de Galicia.

Surís, J. C. e Varela, M. M. (1995): *Introducción a la Economía de los Recursos Naturales*. Madrid. Edit. Civitas.

Xunta de Galicia (1999) *Plan de Xestión de Residuos Agrarios de Galicia*. Santiago de Compostela.

Xunta de Galicia (1996b): *Código galego de boas prácticas agrarias*.